Fish and Game Commission
Meeting Binder

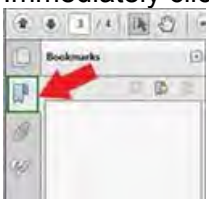
August 24-25, 2016

Commission Meeting

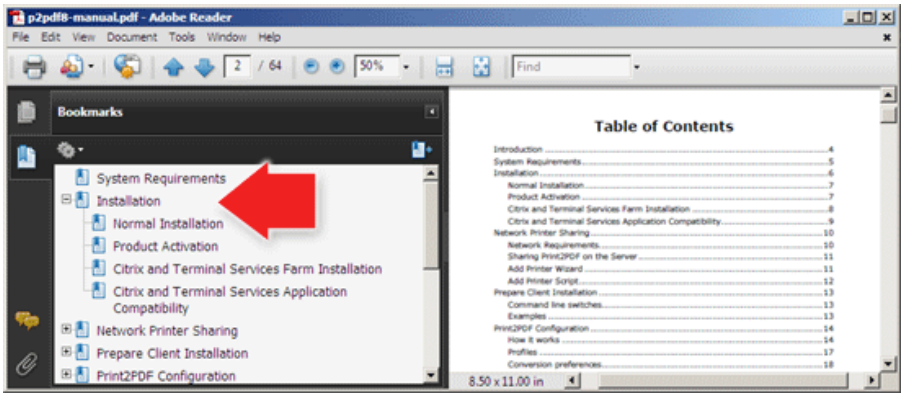
EASY GUIDE TO THE BINDER

1. Download and open the binder document using your Adobe Acrobat program/application.

2. Immediately click/tap on the “bookmark symbol” located near the top left-hand corner.



3. A bookmark panel should appear on either the top or the left-hand side of the screen. To make adjustments, simply use the Page Display option in the View tab. If done correctly, you should see something like:



4. We suggest leaving open the bookmark panel to help you move efficiently among the staff summaries and supporting documents included in the binder. It’s helpful to think of these bookmarks as a table of contents which allows you to go to specific points in the binder without having to scroll through hundreds of pages.

5. Resize the bars by placing the icon in the dark, vertical line located between the text boxes and using a long click/tap to move ↔ in either direction. You may also adjust the sizing of the documents by adjusting the sizing preferences located on the Page Display icons found in the top toolbar or in the View tab.

6. Upon locating a staff summary for an agenda item that interests you, notice that you can get more information by double-clicking/tapping on any item underlined in blue.

7. Return to the staff summary by simply re-clicking/tapping on the item in the bookmark panel.

OVERVIEW OF FISH AND GAME COMMISSION BUSINESS MEETING

- This is the 146th year of continuous operation of the Fish and Game Commission (Commission) in partnership with the Department of Fish and Wildlife (Department). Our goal is the preservation of our heritage and conservation of our natural resources through informed decision making. These meetings are vital in achieving that goal. In that spirit, we provide the following information to be as effective and efficient toward that end. Welcome and please let us know if you have any questions.

- We are operating under Bagley-Keene Open Meeting Act and these proceedings are being recorded and broadcast via Cal-Span.

- In the unlikely event of an emergency, please note the location of the nearest emergency exits. Additionally, the restrooms are located _____.

- Items may be heard in any order pursuant to the determination of the Commission President.

- The amount of time for each agenda item may be adjusted based on time available and the number of speakers.

- Speaker cards need to be filled out **legibly** and turned in to the staff **before** we start the agenda item. Please make sure to list the agenda items you wish to speak to on the speaker card.

- We will be calling the names of several speakers at a time so please line up behind the speakers' podium when your name is called. If you are not in the room when your name is called you may forfeit your opportunity to speak on the item.

- When you speak, please state your name and any affiliation. Please be respectful. Disruptions from the audience will not be tolerated. Time is precious so please be concise.

- To receive meeting agendas and regulatory notices about those subjects of interest to you, please visit the Commission's website, www.fgc.ca.gov, and sign up for our electronic mailing lists.

- All petitions for regulation change must be submitted in writing on the authorized petition form, FGC 1 Petition to the California Fish and Game Commission for Regulation Change, available athttp://www.fgc.ca.gov/public/information/petitionforregulatorychange.aspx.

- **Reminder!** Please silence your mobile devices and computers to avoid interruptions.

- **Warning**! The use of a laser pointer by someone other than a speaker doing a presentation may result in arrest.

INTRODUCTIONS FOR FISH AND GAME COMMISSION COMMISSION MEETINGS

FISH AND GAME COMMISSIONERS

Eric Sklar	President (Saint Helena)
Jacque Hostler-Carmesin	Vice-President (McKinleyville)
Anthony Williams	Member (Huntington Beach)
Russell Burns	Member (Napa)
Peter Silva	Member (Chula Vista)

COMMISSION STAFF

Valerie Termini	Executive Director
Susan Ashcraft	Acting Deputy Executive Director/Marine Advisor
Mike Yaun	Legal Counsel
Erin Chappell	Wildlife Advisor
Elizabeth Pope	Acting Marine Advisor
Mary Brittain	Administrative Assistant
Sherrie Fonbuena	Analyst
Caren Woodson	Analyst

DEPARTMENT OF FISH AND WILDLIFE - *Directorate*

Chuck Bonham	Director
Wendy Bogdan	General Counsel
Jordan Traverso	Deputy Director for Communications
David Bess	Deputy Director and Chief, Law Enforcement Division
Stafford Lehr	Deputy Director, Wildlife and Fisheries Division
Rick Mayfield	Acting Wildlife Branch Chief

I would also like to acknowledge special guests who are present:
(i.e., elected officials, tribal chairpersons, other special guests)

_____

_____

_____

_____

Commissioners
Eric Sklar, President
Saint Helena
Jacque Hostler-Carmesin, Vice President
McKinleyville
Anthony C. Williams, Member
Huntington Beach
Russell E. Burns, Member
Napa
Peter S. Silva, Member
Chula Vista

STATE OF CALIFORNIA
Edmund G. Brown Jr., Governor

Fish and Game Commission

Wildlife Heritage and Conservation
Since 1870

Valerie Termini, Executive Director
1416 Ninth Street, Room 1320
Sacramento, CA 95814
(916) 653-4899
www.fgc.ca.gov

REVISED* MEETING AGENDA
August 24-25, 2016

Lake Natoma Inn Hotel & Conference Center
702 Gold Lake Drive, Folsom

The meeting will be live streamed at www.cal-span.org

NOTE: * Agenda Items 4, 14, 22, 23, 25, and 38 have been revised; revisions are in bold font. See important meeting deadlines and procedures at the end of the agenda.

DAY 1 – AUGUST 24, 2016, 8:30 A.M.

Call to order/roll call to establish quorum

1. Approve agenda and order of items

2. Public forum for items not on agenda
   The Commission **may not** discuss or take action on any matter raised during this item, except to decide whether to place the matter on the agenda of a future meeting. (Sections 11125, 11125.7(a), Government Code)

3. Commission recognition of former Executive Director Sonke Mastrup for his commitment and service to the California Fish and Game Commission

CONSENT ITEMS

4. Approve request from Neushul Mariculture to transfer state water bottom lease No. M-654-03 to **PharmerSea**, LLC

5. Approve request from Grassy Bar Oyster Company to transfer state water bottom lease Nos. M-614-01 and M-614-02 to Grassy Bar Oyster Company, Inc.

6. Authorize publication of notice of intent to amend recreational groundfish regulations (Sections 27.25, 27.30, 27.35, 27.40, 27.45, 27.50, 28.27, 28.49 and 28.55, Subsections 27.20(a) and 27.20(b), and add section 28.47, Title 14,CCR)

7. Adopt proposed changes to commercial hagfish trap regulations (Subsection 180.6(b), Title 14, CCR)

8. Marine Resources Committee

   (A) July 21, 2016, meeting summary
      I. Receive and adopt recommendations
   (B) Work plan development
      I. Update on work plan and draft timeline
      II. Discuss and approve new topics

9. Tribal Committee

   (A) Work plan development
      I. Update on work plan and draft timeline
      II. Discuss and approve new topics
   (B) Participation in California Native American Day

10. Master Plan for Marine Protected Areas

   (A) Discuss and approve text related to traditional ecological knowledge
   (B) Adopt proposed final Master Plan for Marine Protected Areas and the Marine Life Protection Program pursuant to the Marine Life Protection Act (Pursuant to Section 2850, et seq., Fish and Game Code)

11. Authorize publication of notice of intent to amend regulations concerning tribal take in marine protected areas
(Section 632, Title 14, CCR)

12. Announce results from Executive Session

13. Marine items of interest from previous meetings

   (A) Update on lessons learned from the Dungeness and rock crab emergency closures and planning for future harmful algal blooms
   (B) Other

14. Marine petitions for regulation change and non-regulatory requests from previous meetings

   (A) Action on petitions for regulation change
   (B) Action on non-regulatory requests
   (C) Update **and possible action** on pending petitions and requests referred to staff and the Department for review

15. Other informational items

   (A) Staff report
   (B) Legislative update and possible action
      I. Proposition 67 – A referendum to overturn the statewide ban on single-use plastic bags
   (C) Federal agencies report
   (D) Other

16. Department informational items

    (A) Director's report
    (B) Wildlife and Fisheries Division, and Ecosystem Conservation Division
    (C) Law Enforcement Division
    (D) Marine Region
    (E) Other

17. Discuss and act on future Commission meeting items

    (A) Adopt proposed meeting dates and locations for 2017
    (B) Next meetings
    (C) Rulemaking calendar updates
    (D) New business
    (E) Other

Recess

DAY 2 – AUGUST 25, 2016, 8:00 A.M.

Call to order/roll call to establish quorum

18. Public forum for items not on agenda
    The Commission may not discuss or take action on any matter raised during this item, except to decide whether to place the matter on the agenda of a future meeting. (Sections 11125, 11125.7(a), Government Code)

19. Commission recognition of former Commissioner Jim Kellogg for his commitment and service to the California Fish and Game Commission

20. Commission recognition of newly inducted members to California Waterfowler's Hall of Fame

CONSENT ITEM

21. Approve Department's request for a 30-day extension of time to complete its evaluation of the petition to list coast yellow leptosiphon (*Leptosiphon croceus*) as an endangered species under the California Endangered Species Act (Pursuant to Section 2073.5, Fish and Game Code)

22. Approve amendment to Private Lands Wildlife Habitat Enhancement and Management Area (PLM) **five-year license for 2016-2021**, and seasons, harvests and habitat improvements for 2016-2017 for:
    (Pursuant to Section 601, Title 14, CCR)

    (A) DeFrancesco & Eaton Ranch (Merced County)

CONSENT ITEM

23. Approve initial five-year PLM license for **2016**-2021, and seasons, harvests and habitat improvements for 2016-2017 for:
(Pursuant to Section 601, Title 14, CCR)

    (A) Clover Creek Ranch (Shasta County)
    (B) Kramer Ranch (Lassen County)

24. Approve annual PLM seasons, harvests and habitat improvements for 2016-2017 for:
(Pursuant to Section 601, Title 14, CCR)

    (A) Bardin Ranch (Monterey County)
    (B) Basin View Ranch (Modoc County)
    (C) Bell Ranch (Tehama County)
    (D) Big Morongo Springs Ranch (San Bernardino County)
    (E) Bird Haven Ranch (Glenn County)
    (F) Black Ranch (Shasta County)
    (G) Clarks Valley Ranch (Lassen County)
    (H) Deseret Farms – Ballard Unit (Butte County)
    (I) Deseret Farms – Wilson Unit (Butte County)
    (J) Duncan Creek Ranch (Shasta County)
    (K) Five Dot Ranch - Avila (Lassen County)
    (L) Five Dot Ranch – School Section (Lassen County)
    (M) Hathaway Oak Run Ranch (Shasta County)
    (N) M&T Chico Ranch (Butte County)
    (O) Ordway Ranch (Calaveras County)
    (P) Pacheco Ranch (Santa Clara County)
    (Q) Rock Creek (Butte and Tehama counties)
    (R) Santa Catalina Island (Los Angeles County)
    (S) Sopher-Wheeler (Butte County)
    (T) Spurlock Ranch (Glenn County)
    (U) Sugarloaf – Bangor Ranch (Yuba County)

25. Approve five-year renewal of PLM license for **2016**-2021, and seasons, harvests and habitat improvements for 2016-2017 for:
(Pursuant to Section 601, Title 14, CCR)

    (A) Coon Creek Ranch (Santa Clara County)
    (B) Little Dry Creek Ranch (Tehama County)
    (C) Mendiboure Cold Springs Ranch (Lassen County)
    (D) R Wild Horse Ranch (Tehama County)
    (E) Roaring River Ranch (Shasta County)

26. Wildlife Resources Committee

    (A) Work plan development
        I. Update on work plan and draft timeline
        II. Discuss and approve new topics

27. Consider the petition, Department's evaluation report, and comments received to determine whether listing the northern spotted owl (*Strix occidentalis caurina*) as a threatened or endangered species is warranted
(Pursuant to Sections 2075 and 2075.5, Fish and Game Code)
Note: Findings will be adopted at a future meeting

28. Consider the petition, Department's evaluation report, and comments received to determine whether listing the Townsend's big-eared bat (*Corynorhinus townsendii*) as a threatened or endangered species is warranted
(Pursuant to Sections 2075 and 2075.5, Fish and Game Code)
Note: Findings will be adopted at a future meeting

29. Consider the petition, Department's evaluation report, and comments received to determine whether listing the Livermore tarplant (*Deinandra bacigalupii*) as a threatened or endangered species is warranted
(Pursuant to Sections 2075 and 2075.5, Fish and Game Code)
Note: Findings will be adopted at a future meeting

30. Authorize publication of notice of intent to amend sport fishing regulations
(Sections 1.74, 5.05, 5.40, 5.60, 7.00, and 7.50, and subsections 29.45(a)(1), 43(c), 671(c)(3), and 671(c)(7), Title 14, CCR)

31. Authorize publication of notice of intent to amend falconry regulations
(Section 670, Title 14, CCR)

32. Authorize publication of notice of intent to adopt regulations concerning enhanced penalties for illegal take of game
(Add Section 748.6, Title 14, CCR)

33. Discuss proposed regulations to establish an upland game bird special hunt drawing and fee
(Section 702 and add Section 715, Title 14, CCR)

34. Adopt proposed changes to Department Lands Pass Program and lands public uses regulations, and certify the addendum to the final 2012 environmental document
(Sections 550, 550.5, 551, 552, 630 and 702., Title 14, CCR)

35. Adopt proposed changes to definitions for tidal waters and finfish gear restrictions in San Francisco and San Pablo bays
(Sections 1.53 and 27.00, and subsection 28.65(a), Title 14, CCR)

36. Adopt proposed changes to upland game bird hunting regulations
(Sections 300, 311, and 745.5, Title 14, CCR)

37. Non-marine items of interest from previous meetings

38. Non-marine petitions for regulation change and non-regulatory requests from previous meetings

(A) Action on petitions for regulation change
(B) Action on non-regulatory requests
(C) Update **and possible action** on pending petitions and requests referred to staff and the Department for review

Adjournment

EXECUTIVE SESSION
(Not Open to Public)

Pursuant to the authority of Government Code Section 11126(a)(1) and (e)(1), and Section 309 of the Fish and Game Code, the Commission will meet in closed Executive Session. The purpose of this Executive Session is to consider:

(A) Pending litigation to which the Commission is a Party

I. Big Creek Lumber Company and Central Coast Forest Assoc. v. California Fish and Game Commission (Coho listing, south of San Francisco)

II. James Bunn and John Gibbs v. California Fish and Game Commission (squid permits)

III. Center for Biological Diversity and Earth Island Institute v. California Fish and Game Commission (black-backed woodpecker)

IV. Dennis Sturgell v. California Fish and Game Commission, California Department of Fish and Wildlife, and Office of Administrative Hearings (revocation of Dungeness crab vessel permit No. CT0544-T1)

V. Kele Young v. California Fish and Game Commission, et al. (restricted species inspection fee waiver)

VI. Public Interest Coalition v. California Fish and Game Commission (California Environmental Quality Act)

(B) Possible litigation involving the Commission

(C) Staffing

(D) Deliberation and act on license and permit items

I. Approve a renewal request for a Pacific Herring Gillnet Permit, which is the subject of a settlement agreement between Mr. Steven Kramer and California Department of Fish and Wildlife

II. Approve Office of Administrative Hearing's proposed decision for Exotic Feline Breeding Compound, Inc.'s appeal.

FISH AND GAME COMMISSION
2016 MEETING SCHEDULE
www.fgc.ca.gov

MEETING DATE	COMMISSION MEETING	COMMITTEE MEETING	OTHER MEETINGS
September 21		**Wildlife Resources** Woodland Public Library Leake Center Community Room 250 First Street Woodland, CA 95695	
September 28			**Predator Policy Workgroup** Department of Fish and Wildlife - Yolo Bypass Wildlife Area Conference Room 45211 County Road 32b Davis, CA 95618
October 18		**Tribal** Red Lion Inn 1929 4th Street Eureka, CA 95501	
October 19-20	Red Lion Inn 1929 4th Street Eureka, CA 95501		
November 1			**Predator Policy Workgroup** Department of Parks and Recreation Redwood Room 1416 Ninth Street, 14th Floor Sacramento, CA 95814
November 17		**Marine Resources** Sacramento	
December 7-8	Portofino Inn & Suites 3805 Murphy Canyon Road San Diego, CA 92123		

OTHER MEETINGS OF INTEREST

Pacific Fishery Management Council

- September 12-20, Boise, ID
- November 16-21, Garden Grove, CA

Pacific Flyway Council

- September 30, Sun Valley, ID

Wildlife Conservation Board

- August 30, Sacramento
- November 16, Sacramento

IMPORTANT COMMISSION MEETING PROCEDURES INFORMATION

WELCOME TO A MEETING OF THE CALIFORNIA FISH AND GAME COMMISSION
This is the 146th year of operation of the Commission in partnership with the California Department of Fish and Wildlife. Our goal is the preservation of our heritage and conservation of our natural resources through informed decision making; Commission meetings are vital in achieving that goal. In that spirit, we provide the following information to be as effective and efficient toward that end. Welcome and please let us know if you have any questions.

PERSONS WITH DISABILITIES
Persons with disabilities needing reasonable accommodation to participate in public meetings or other Commission activities are invited to contact the Reasonable Accommodation Coordinator at (916) 651-1214. Requests for facility and/or meeting accessibility should be received at least 10 working days prior to the meeting to ensure the request can be accommodated.

STAY INFORMED
To receive meeting agendas and regulatory notices about those subjects of interest to you, please visit the Commission's website, www.fgc.ca.gov, and sign up on our electronic mailing lists.

SUBMITTING WRITTEN COMMENTS
The public is encouraged to comment on any agenda item. Submit written comments by one of the following methods: **Email** to fgc@fgc.ca.gov**; delivery** to Fish and Game Commission, 1416 Ninth Street, Room 1320, Sacramento, CA 95814; or **hand-deliver to a Commission meeting.**

Comment Deadlines: Written comments received at the Commission office by **5:00 p.m. on August 11** will be made available to Commissioners prior to the meeting. Comments received by **12 noon on August 19** will be marked late and made available to Commissioners at the meeting. Otherwise, 10 copies of written comments must be brought to the meeting. All materials provided to the Commission may be made available to the general public.

NON-REGULATORY REQUESTS
All non-regulatory requests will follow a two-meeting cycle to ensure proper review and thorough consideration of each item. All requests submitted by **12 noon on August 19** (or heard during public forum at the meeting) will be scheduled for receipt at this meeting, and scheduled for consideration at the next business meeting.

PETITIONS FOR REGULATORY CHANGE
Any person requesting that the Commission adopt, amend, or repeal a regulation must complete and submit form FGC 1, titled Petition to the California Fish and Game Commission for Regulation Change (as required by Section 662, Title 14, CCR). The form is available at http://www.fgc.ca.gov/public/information/petitionforregulatorychange.aspx. To be received by the Commission at this meeting, petition forms must have been delivered by **12 noon on August 19** (or delivered during public forum at the meeting) and will be scheduled for consideration at the next business meeting, unless the petition is rejected under staff review of petition pursuant to subsection 662(b), Title 14, CCR.

VISUAL PRESENTATIONS/MATERIALS
All electronic presentations must be submitted by **12 noon on August 19** and approved by the Commission executive director before the meeting.

1. Electronic presentations must be provided by email or delivered to the Commission on a USB flash drive by the written materials deadline.
2. All electronic formats must be Windows PC compatible.
3. It is recommended that a print copy of any electronic presentation be submitted in case of technical difficulties.
4. A data projector, laptop and presentation mouse will be available for use at the meeting.

CONSENT CALENDAR
A summary of all items will be available for review at the meeting. Items on the consent calendar are generally non-controversial items for which no opposition has been received and will be voted upon under single action without discussion. Any item may be removed from the consent calendar by the Commission upon request of a Commissioner, the Department, or member of the public who wishes to speak to that item, to allow for discussion and separate action.

LASER POINTERS may only be used by a speaker during a presentation; use at any other time may result in arrest.

SPEAKING AT THE MEETING
To speak on an agenda item, please complete a “Speaker Card" and give it to the designated staff member before the agenda item is announced. Cards will be available near the entrance of the meeting room. Only one speaker card is necessary for speaking to multiple items.

1. Speakers will be called in groups; please line up when your name is called.
2. When addressing the Commission, give your name and the name of any organization you represent, and provide your comments on the item under consideration.
3. Each speaker has up to three minutes to address the Commission as determined by the presiding commissioner. If there are several speakers with the same concerns, please appoint a spokesperson and avoid repetitive testimony.
4. Speakers may cede their time to an individual spokesperson, but only under the following conditions:
    a. Individuals ceding time forfeit their right to speak to the agenda item; and
    b. The minimum number of individuals required to cede time to a spokesperson and the amount of time allocated are *arranged in advance* with the presiding commissioner.
5. If you are presenting handouts/written material to the Commission at the meeting, please provide 10 copies to the designated staff member just prior to speaking.

STAFF SUMMARY FOR AUGUST 24-25, 2016

2. PUBLIC FORUM (DAY 1)

Today's Item **Information** ☒ **Action** ☐

Receipt of public comments and requests for regulatory and non-regulatory actions.

Summary of Previous/Future Actions

- **Today's receipt of requests and comments** **Aug 24-25, 2016; Folsom**
- Direction to grant, deny, or refer requests Oct 19-20, 2016; Eureka

Background

This agenda item is primarily to provide the public an opportunity to address FGC on topics not on the agenda. Staff also delivers written materials and comments received prior to the meeting for FGC receipt as exhibits in the meeting binder (if received by comment deadline), or as late comments at the meeting (if received by late comment deadline).

Public comments are generally categorized in three types under public forum: 1) Requests for regulatory action; 2) requests for non-regulatory action; and 3) informational–only comments. Under the Bagley-Keene Open Meeting Act, FGC cannot discuss any matter not included on the agenda, other than to schedule issues raised by the public for consideration at future meetings. Thus, regulatory and non-regulatory requests generally follow a two-meeting cycle (receipt and direction): FGC will determine the outcome of the regulatory and non-regulatory requests received at this meeting (Aug 2016) at the next FGC meeting (Oct 2016) following staff evaluation.

As required by the Administrative Procedure Act (APA), regulatory requests will be either denied or granted and notice made of that determination. Action on requests received at previous meetings is scheduled under a separate agenda item called "Petitions for regulation change and non-regulatory requests from previous meetings."

Significant Public Comments

1. See summary table of regulatory petitions in Exhibit 1, followed by the individual petitions.
2. See summary table of non-regulatory requests in Exhibit 2, followed by individual requests.
3. Informational-only comments are provided in exhibits.

Recommendation

Consider whether any new future agenda items are needed to address issues that are raised and within the FGC's authority.

Exhibits

1. Table containing a summary of new petitions for regulation change received by Aug 11 at 5:00 p.m., the comment deadline for meeting binder (individual petitions listed below)
2. Table containing a summary of new non-regulatory requests received by Aug 11 at 5:00 p.m., the comment deadline for the meeting binder (individual requests included below)
3. Petition #2016-014 (Falcons) (summarized in Exhibit 1 table)
4. Petition #2016-017 (Hedgehogs) (summarized in Exhibit 1 table)

5-7 Individual non-regulatory requests for action that are summarized in Exhibit 2 table

8-9 Informational items; staff will not take further action unless otherwise directed by FGC.

Motion/Direction (N/A)

STAFF SUMMARY FOR AUGUST 24-25, 2016

3. COMMISSION RECOGNITION OF SONKE MASTRUP

Today's Item **Information** ☐ **Action** ☒

Recognition of former Executive Director Sonke Mastrup for his commitment and service to FGC and the State of California.

Summary of Previous/Future Actions

• Direct staff to begin planning for recognition	Feb 10-11, 2016; Sacramento
• Further direction and schedule for recognition	Mar 15, 2016; Teleconference
• **Honor Sonke Mastrup**	**Aug 24-25, 2016; Folsom**

Background

Traditionally, FGC has recognized outgoing Executive Directors for the service they perform.

Sonke Mastrup served as executive director of FGC from July 8, 2011 until December 31, 2015 as part of his 33 years of work in the natural resources field. Before joining FGC he worked for the Department of Fish and Game (now DFW), the last ten years of which were as deputy director for the Wildlife and Fisheries Division under four directors and three governors. He left FGC in Dec 2015 to take a management position with DFW's Marine Region.

FGC discussed recognizing him for his performance as Executive Director and decided that the cost of the gift would be borne by the Commissioners in their individual capacity, as State funds could not be used to purchase gifts.

Significant Public Comments (N/A)

Recommendation

FGC staff recommends formally recognizing the work done by former Executive Director by adoption of a resolution and presentation of a gift.

Exhibits (N/A)

Motion/Direction (N/A)

4. NEUSHUL MARICULTURE LEASE TRANSFER

Today's Item **Information** ☐ **Action** ☒

Approve request to transfer state water bottom lease No. M-654-03 from Neushul Mariculture to PharmerSea, LLC.

Summary of Previous/Future Actions

- Renew 15 year lease — Oct 7, 2015; Los Angeles
- Receive request to transfer lease — Jun 22-23, 2016; Bakersfield
- **Today approve request** — **Aug 23-24, 2016; Sacramento**

Background

FGC has the authority to lease state water bottoms that grant exclusive privilege to any person for conducting aquaculture pursuant to Fish and Game Code sections 15400 and 15405. Leases shall not be assigned or transferred without the prior approval of FGC (Fish and Game Code Section 15412).

Mrs. Devon Harger, Neushul Mariculture, Inc., holds state water bottom lease No. M-654-03. The lease is comprised of two parcels covering 25 acres along the Santa Barbara coastline to cultivate marine algae for research purposes (Exhibit 1). FGC approved renewal of the lease in Oct 2015 for a period of 15 years and is subject to the revised 2011 FGC lease terms. However, at the time of this writing, efforts to complete and execute the 15-year renewed lease are still under way.

In Jan 2016, Mrs. Harger submitted a request to transfer the lease to Mr. Daniel Marquez, PharmerSea, LLC (Exhibit 2). Mr. Marquez has submitted the necessary application and filing fee, and confirmed that there are no changes proposed to lease-approved culture methods or species (Exhibit 3). If granted, the lease would transfer to Mr. Marzquez for the remainder of the lease period under the same terms and conditions, including responsibility for conditions of the lease area; new financial guarantees would be established as required in the lease terms.

DFW has reviewed the current lease and request for transfer (Exhibit 2). No changes to lease provisions or operations are proposed and, as a result, DFW has determined that the proposed project is subject to a categorical exemption from CEQA (Exhibit 3).

Significant Public Comments (N/A)

Recommendation

***FGC Staff*:** Under a motion to adopt the consent calendar, determine that the transfer is exempt from CEQA pursuant to CEQA Guidelines Section 15301, based on the record, and approve the lease transfer contingent on execution of the lease renewal with Neushul Mariculture.

***DFW Staff*:** Approve the request to transfer state water bottom lease M-654-03.

Exhibits

1. Lease M-654-03 map and legal description
2. Letter from Devon Harger, Neushul Mariculture, Inc., dated Jan 2016
3. Application and fee for lease of state water bottom from Mr. Daniel Marquez, received Aug 3, 2016
4. DFW memo, received Aug 2, 2016

Motion/Direction

A. Moved by _____ and seconded by _____ that the Commission adopts the consent calendar, items 4-7.

5. GRASSY BAR

Today's Item **Information** ☐ **Action** ☒

Approve request from Grassy Bar Mariculture to transfer state water bottom lease Nos. M-614-01, Parcel 1 and M-614-02, to lessee's incorporated business, Grassy Bar Oyster Company, Inc. Summary of Previous/Future Actions

- Receive request to transfer leases Feb 10-11. 2016; Sacramento
- **Today approve request** **Aug 23-24, 2016; Sacramento**

Background

FGC has the authority to lease state water bottoms that grant exclusive privilege to any person for conducting aquaculture pursuant to Fish and Game Code sections 15400 and 15405. Leases shall not be assigned or transferred without the prior approval of FGC (Fish and Game Code Section 15412).

Grassy Bar Oyster Company has held two state water bottom leases (Nos. M-614-01-Parcel 1 and M-614-02) since 2009 for purposes of aquaculture in Morro Bay, San Luis Obispo County under the sole proprietorship of Mr. George Trevelyan (Exhibit 1). In Jan 2016, Mr. Trevelyan notified FGC that he filed articles of incorporation in Dec 2015 for a new corporation called Grassy Bar Oyster Company, Inc., and requests the transfer of both leases to the new business (Exhibit 2).

DFW has reviewed the current lease and request for transfer (Exhibit 3). No changes to lease provisions or operations are proposed and, as a result, DFW has determined that the proposed project is subject to a categorical exemption from CEQA (Exhibit 4).

Significant Public Comments (N/A)

Recommendation

FGC Staff: Under a motion to adopt the consent calendar, determine that the transfers are exempt from CEQA pursuant to CEQA Guidelines in Section 15301, based on the record, and approve the transfer of both leases as recommended by DFW under a motion to adopt the consent calendar.

DFW Staff: Approve the request to transfer state water bottom lease Nos. M-14-01, Parcel 1 and M-614-02.

Exhibits

1. State Water Bottom Lease No. M-614-01, Parcel 1, maps and legal descriptions
2. State Water Bottom Lease No. M-614-02 maps and legal descriptions
3. Letter from Grassy Bar Oyster Company requesting transfers, received Jan 7, 2016
4. Grassy Bar Oyster Company, Inc. Articles of Incorporation and other business documentation, received Jan 11, 2016

5. Application for lease of state water bottom from Mr. George Trevelyan, Grassy Bar Oyster Company, Inc., received Aug 3, 2016
6. DFW memo, received Aug 2, 2016

Motion/Direction

A. Moved by _____ and seconded by _____ that the Commission adopts the consent calendar, items 4-7.

STAFF SUMMARY FOR AUGUST 24-25, 2016

6. GROUNDFISH (CONSENT)

Today's Item **Information** ☐ **Action** ☒

Authorize publication of notice of intent to change recreational groundfish regulations.

Summary of Previous/Future Actions

- **Today's Notice hearing** Aug 24-25, 2016; Folsom
- Discussion hearing Oct 19-20, 2016; Eureka
- Adoption hearing Dec 7-8, 2016; San Diego

Background

On Jun 27, 2016, the Pacific Fishery Management Council recommended changes to federal rules for recreational groundfish fishing off California for 2017 and 2018 which are expected to go into effect on or around Jan 1, 2017. DFW is proposing regulatory changes that would make regulations for State waters consistent with these new federal regulations.

The proposed regulatory changes will extend the season length in the Northern and Mendocino Management Areas by two and one-half months; increase the allowable depth in the Northern, San Francisco and Central Management Areas by 10 fathoms; allow for the take of all species with no depth restrictions Nov 1 through Dec 31 in the Northern and Mendocino Management Areas; increase the bag limit for canary rockfish from zero to one fish; decrease the bag limit for black rockfish from five to three fish; eliminate the three fish sub-bag limit for bocaccio; decrease the bag limit for lingcod from three to two fish; allow petrale sole and starry flounder to be retained year round at all depths; and make other change for clarity and consistency.

Significant Public Comments (N/A)

Recommendation

FGC staff: Authorize publication of the notice with proposed regulations as reflected in Exhibit 2 under a motion adopting the consent calendar.

Exhibits

1. DFW memo received Jul 27, 2016
2. ISOR

Motion/Direction

Moved by _____ and seconded by _____ that the Commission adopts the consent calendar, items 4-7.

STAFF SUMMARY FOR AUGUST 24-25, 2016

7. HAGFISH (CONSENT)

Today's Item **Information** ☐ **Action** ☒

Adopt proposed changes to commercial hagfish trap regulations.

Summary of Previous/Future Actions

- Notice hearing Jun 22-23, 2016; Bakersfield
- **Today's Adoption hearing** Aug 24-25, 2016; Folsom

Background

Under existing law, hagfish may be commercially taken in 40-gallon barrel traps if attached to a ground line. Permittees may fish up to 25 barrel traps spread over a maximum of three ground lines.

DFW is proposing to amend Section 180.6, Title 14, to replace the 40-gallon requirement for barrel traps with a maximum total trap length of 45 inches and maximum outside diameter of 25 inches to provide flexibility to fishermen to locate compliant gear based on gear availability. Additional language is proposed to enact the same restrictions that are in place for other hagfish traps: 1) no take of finfish other than hagfish; and 2) no possession of any other hagfish trap type when using or in possession of barrels.

Significant Public Comments (N/A)

Recommendation

FGC staff: Adopt proposed regulations as reflected in Exhibit 1 under a motion adopting the consent calendar.

Exhibits

1. ISOR
2. DFW email message received Aug 10, 2016

Motion/Direction

Moved by _____ and seconded by _____ that the Commission adopts the consent calendar, items 4-7.

STAFF SUMMARY FOR AUGUST 24-25, 2016

8. MRC

Today's Item **Information** ☐ **Action** ☒

This is a standing item to receive MRC reports and recommendations, including a summary from the Jul 21, 2016 meeting.

Summary of Previous/Future Actions

- Most recent MRC meeting — Jul 21, 2016; MRC Petaluma
- **Today approve March MRC recommendations** — **Aug 24-25, 2016; Folsom**
- Next MRC meeting — Nov 17, 2016; TBD

Background

The MRC continues to work under FGC direction to accomplish its current work plan (Exhibit 1). The MRC generally meets three times per year to discuss topics referred by FGC, and provides a summary and recommendation to FGC after each MRC meeting. The MRC met on Jul 21; a meeting summary will be provided at the meeting. Based on work referred to MRC for its Jul 21, 2016 meeting (Exhibit 2), MRC has the following recommendations for FGC consideration:

1) California's Fishing Communities: Continue seeking public input through regionally-focused FGC-hosted scoping discussions as follow-up to the statewide public meeting hosted by FGC and attended by President Sklar on Jul 20 in Petaluma.

2) Fisheries Bycatch Workgroup (BWG): Continue to support the efforts of the BWG through a work plan that emphasizes a review of the bycatch section of the Master Plan for Fisheries, and developing recommendations for potential updates to the bycatch section, including bycatch language and definitions, and/or action items within FGC authority.

3) Pier and Jetty Fishing: Request an update on pier fishing issues in Southern California be provided to the MRC in Nov.

4) Marine Debris and Plastic Pollution: Issue a public statement of support in favor of voting "yes" on Proposition 67 to uphold the statewide ban on plastic bags as a means to reduce ocean debris and protect marine life (Note: This topic will be discussed under Agenda Item 15(B)I.).

New Agenda Topics*:* Current topics already referred to MRC are shown in Exhibit 1. The MRC did not identify any potential new agenda topics to recommend to FGC for referral.

Significant Public Comments (N/A)

Recommendation

Approve MRC recommendations 1, 2, and 3, and consider recommendation number 4 under Agenda Item 15(B)I., "Other Informational Items – Legislative update and possible action".

Exhibits

1. MRC 2016 Work Plan, updated Aug 24, 2016
2. MRC meeting agenda from July 21, 2016 meeting

Motion/Direction

Moved by _____ and seconded by _____ that the Commission approves recommendations 1, 2 and 3 from the July 2016 MRC meeting.

9. TRIBAL COMMITTEE

Today's Item **Information** ☒ **Action** ☐

Discuss and provide direction regarding agenda topics for the October 18, 2016 Tribal Committee (TC) meeting in Eureka. Receive update on TC work plan and draft timeline. Discuss and approve new topics for TC review.

Summary of Previous/Future Actions

• Most recent TC meeting	Jun 21, 2016; Tribal, Bakersfield
• TC recommendations approved	Jun 22-23, 2016; Bakersfield
• **Receive update and approve agenda topics**	**August 24-25, 2016; Folsom**
• Next TC meeting	Oct 18, 2016; Tribal, Eureka

Background

Updates: In Jun, FGC approved several TC recommendations. Updates on these recommendations include: (1) to encourage Ocean Protection Council (OPC) to seek tribal government representation on the Marine Protected Area (MPA) Statewide Leadership Team (SLT); and (2) to explore legislation to formalize the TC; and (3) to work on co-management definitions and strategies through a workgroup.

(1) In regard to the MPA SLT, OPC staff has worked with the SLT on a letter to send to tribes inviting tribal government representation on the SLT; the draft letter is nearly finalized for distribution.

(2) A workgroup meeting was scheduled for Aug 23 in Sacramento. Updates on topics for discussion include:

a. Discuss next steps to formalize the Tribal Committee in Statute:

FGC staff is developing a budget change proposal (BCP) for a tribal advisor and to statutorialy create the tribal committee in law.

b. Discuss steps to define co-management and to work toward possible co-management agreements between DFW and tribes:

FGC, DFW staff, and tribal leaders to discuss defintiions and concerns with the tribes on co-management and a process to move forward.

Potential Oct 18, 2016 agenda items:

- Elk management
  - Update on elk management plan
  - Status of AB 1792 Elk tags: federally recognized indian tribes
- Co-management definitions and strategies: Workgroup progress update
- Legislation to formalize Tribal Committee: Update on progress

Significant Public Comments (N/A)

Recommendation

FGC staff: Receive report on the Aug 23 workgroup meeting and approve any recommendations from that meeting; approve list of draft agenda topics for Oct TC.

Exhibits (N/A)

Motion/Direction

Moved by _____and seconded by _____ that the Commission approves the agenda topic(s) _____ for the October 24-15, 2016 Tribal Committee meeting.

10. MASTER PLAN FOR MARINE PROTECTED AREAS

Today's Item **Information** ☐ **Action** ☒

Approve text related to traditional ecological knowledge (TEK); and adopt proposed final master plan for marine protected areas (MPAs) and the Marine Life Protection Program, pursuant to the Marine Life Protection Act (MLPA)

Summary of Previous/Future Actions

• Receive draft proposed final master plan	Dec 9-10, 2015; San Diego
• Discuss proposed final master plan	Feb 10-11, 2016; Sacramento
• Discuss final master plan; close comment except TEK	Apr 13-14, 2016; Santa Rosa
• Tribal Committee review of draft TEK language	Jun 21, 2016; TC, Bakersfield
• Discuss adoption of master plan	Jun 22-23, 2016; Bakersfield
• **Today adopt final master plan**	**Aug 24-25, 2016; Sacramento**

Background

The MLPA directs DFW to prepare, and FGC to adopt, a "master plan" to guide design, implementation, and management of a redesigned network of MPAs in California (Fish and Game Code Section 2855). FGC adopted a draft master plan in 2008, with the intent to adopt an updated final master plan at the conclusion of regional MPA planning efforts. A FGC review of the proposed final master plan has been underway since Dec 2015. Adoption of the 2016 final master plan would formally enact the Marine Life Protection Program pursuant to MLPA (Fish and Game Code Section 2850, et seq.).

At the Apr 2016 meeting, FGC closed all comments on the final draft plan, except to allow additional time for Tribal input regarding traditional ecological knowledge (TEK). At the Jun 2016 FGC meeting, adoption of the master plan was continued to the Aug 2016 FGC meeting. This provided Tribes with additional time to review and respond to proposed TEK text developed by DFW in response to Tribal input received at the FGC Tribal Committee meeting on Jun 21, 2016. A letter sent from FGC Executive Director Valerie Termini to all Tribes provided the draft language and response deadline set by FGC for Jul 29 (Exhibit 1).

Comment letters responding to the draft TEK text were received from three tribes: the Yurok Tribe, the Cher-Ae Heights Indian Community of the Trinidad Rancheria, and the Tolowa Dee-ni' Nation (exhibits 2-4). DFW has integrated the input from the Tribes' comments into the proposed TEK text and provided it for FGC consideration and adoption with the 2016 master plan today (Exhibit 5).

Significant Public Comments

1. Comments on draft TEK language from the Yurok Tribe (offering specific wording suggestions and definitions); the Cher-Ae Heights Indian Community of the Trinidad Rancheria (with specific wording suggestions); and the Tolowa Dee-ni' Nation (with comments relevant to the topic without specific changes proposed) (exhibits 2-4).
2. Two multi-stakeholder letters in support of adoption of the 2016 master plan, from the co-chairs of 14 MPA Collaborative Network collaboratives, and from 25 former MLPA Regional Stakeholder Group (RSG) members from all regions (exhibits 6-7).

Recommendation

FGC Staff: Adopt the 2016 final master plan for MPAs as modified by the revised TEK text proposed by DFW in exhibit 5.

DFW Staff: Adopt and include the revised proposed TEK text and adopt the 2016 proposed final master plan for MPAs.

Exhibits

1. Letter from FGC to Tribes including draft TEK text, dated Jul 19, 2016
2. Yurok Tribe comment letter, dated Jul 19, 2016
3. Cher-Ae Heights Indian Community of the Trinidad Rancheria comment letter, received Aug 3, 2016
4. Tolowa Dee-ni' Nation comment letter, received Aug 4, 2016
5. DFW Transmittal memo and revised draft TEK text, dated Aug 8, 2016
6. Letter from 14 MPA Collaboratives, dated Aug 11, 2016
7. Letter from 25 former RSG members, dated Aug 11, 2016

Motion/Direction

(A) Moved by _____ and seconded by _____ that the Commission approves the text related to traditional ecological knowledge as proposed in Exhibit 5.

and

(B) Moved by _____ and seconded by _____ that the Commission approves and adopts the final 2016 Master Plan for Marine Protected Areas and the Marine Life Protection Program pursuant to Section 2850, et Seq. of the Fish and Game Code.

11. TRIBAL TAKE IN MPAS

Today's Item **Information** ☐ **Action** ☒

Authorize publication of notice of intent to change regulations regarding tribal take in marine protected areas (MPAs).

Summary of Previous/Future Actions

- FGC direction to initiate rulemaking — Apr 13-14, 2016; Sacramento
- **Today's Notice hearing** — **Aug 24-25, 2016; Folsom**
- Discussion hearing — Oct 19-20, 2016; Eureka
- Adoption hearing — Dec 7-8, 2016; San Diego

Background

Existing regulations in Section 632, Title 14, provide definitions, and site-specific area classifications, boundary descriptions, commercial and recreational take restrictions, and other restricted/allowed uses, including tribal take allowances within select MPAs in recognition of traditional tribal uses in the north coast region.

The originally proposed language of the 2012 MPA rulemaking included the Cher-Ae Heights Indian Community of the Trinidad Rancheria and Resighini Rancheria in the list of tribes exempt from the area and take regulations for Reading Rock State Marine Conservation Area (SMCA) based on their submitted factual records (exhibits 2 and 3). However, FGC ultimately adopted the no-change alternative concerning these tribes in this area and listed the Yurok Tribe as the only federally-recognized tribe exempt from regulations within the SMCA.

Following the adoption of the 2012 regulations, Cher-Ae Heights Indian Community of the Trinidad Rancheria and Resighini Rancheria requested that FGC reconsider adding an exemption for their respective Tribes in the Reading Rock SMCA, based on their status as independent federally recognized Sovereign Tribal Nations and their fulfillment of FGC's requirement for documentation of historic or current uses of the area through a factual record (exhibits 4-6).

After vetting in the Tribal Committee and before FGC in 2014 and 2015, FGC provided direction to staff in Apr 2016 to begin to prepare a rulemaking package that would add Cher-Ae Heights Indian Community of the Trinidad Rancheria and Resighini Rancheria to the list of tribes exempt from the area and take regulations for Reading Rock SMCA (subsection 632(b)(6)).

In addition, FGC directed staff to update MPAs that include an exemption for Smith River Rancheria. The tribe notified FGC that in 2015 Smith River Rancheria changed its name to Tolowa Dee-ni' Nation and requested that the regualtions be updated to reflect the change. The regulatory text in subsections 632(b)(1) and 632(b)(2) is proposed to be updated to reflect Smith River Rancheria's name change to Tolowa Dee-Ni' Nation. Other changes are proposed for clarity and consistency (Exhibit 1).

In Jun 2016, the Yurok Tribe submitted a comment letter (Exhibit 7) requesting formal consultation before action is considered. FGC Executive Director Valerie Termini sent a letter responsive to the request to the Yurok Tribe, as well as letters to Cher-Ae Heights Indian Community of the Trinidad

Rancheria and Resighini Rancheria offering similar opportunities for consultation, and offered to schedule the consultations in Oct (adjacent to Oct FGC meeting).

Significant Public Comments

1. Letter from Yurok Tribe opposing the change at Reading Rock and requesting formal consultation between FGC and the Yurok Tribe before any action is taken on the requests from Cher-Ae Heights Indian Community of the Trinidad Rancheria and Resighini Rancheria (Exhibit 7).

Recommendation

FGC staff: The proposed changes have been discussed before FGC for several years. As such, staff recommends going to notice at this meeting while concurrently engaging in consultation with the Yurok, Cher-Ae Heights Indian Community of Trinidad Rancheria and Resighini Rancheria.

Exhibits

1. Executive Director memo and draft proposed regulatory language, dated Aug 16, 2016
2. Factual Record of Current and Historical Uses by the Cher-Ae Heights Indian Community of the Trinidad Rancheria, dated Aug 29, 2011
3. Letter and Factual Record from Resighini Rancheria, received Oct 31, 2011
4. Letter from Resighini Rancheria, received Aug 20, 2012
5. Letter from Cher-Ae Heights Indian Community of the Trinidad Rancheria, dated Apr 10, 2012
6. Letters from Cher-Ae Heights Indian Community of the Trinidad Rancheria, received Aug 14, 2013
7. Letter from Yurok Tribe, received Jun 30, 2016

Motion/Direction

Moved by _____ and seconded by _____ that the Commission authorizes publication of a notice of its intent to amend Section 632, Title 14, California Code of Regulations, related to tribal take in marine protected areas.

12. EXECUTIVE SESSION

Today's Item **Information** ☐ **Action** ☒

(A) Pending litigation to which FGC is a party: See agenda for complete list of litigation.
(B) Possible litigation involving FGC: None to report at the time the binder was prepared.
(C) Staffing
(D) Deliberation on license and permit items: Review and take action on Kramer appeal and Exotic Feline Breeding Compound, Inc. appeal

Summary of Previous/Future Actions (N/A)

Background

(A) The agenda lists pending civil litigation to which FGC is a party.

(B) N/A

(C) N/A

(D) Mr. Steven Kramer applied to DFW to renew an expired license. DFW denied the request and Mr. Kramer appealed to FGC. DFW and Mr. Kramer subsequently entered into an agreement to attempt to resolve the appeal (Exhibit 1), but FGC has sole authority to decide whether to grant Mr. Kramer's renewal request. Exhibit 2 is a FGC decision document that would be consistent with the Fish and Game Code and the agreed position of Mr. Kramer and DFW.

Exotic Feline Breeding Compound, Inc. (EFBC) requested a fee waiver from DFW. DFW denied the request and EFBC appealed to FGC. The appeal was referred to the Office of Administrative Hearings, who conducted a hearing and ultimately filed a Proposed Decision (Exhibit 3) that found EFBC did not justify the requested fee waiver. Exhibit 4 is an unsigned FGC decision document that would adopt adopting the proposed decision.

Recommendation

(D) ***FGC staff:*** Formally adopt a decision in the appeal of Mr. Steven Kramer; and formally adopt the proposed decision in the EFBC appeal consistent with the recommendation of the OAH administrative law judge.

Exhibits

1. Settlement Agreement between the Department and Steven Kramer
2. [Unsigned] FGC Decision In the Matter of Steven Kramer
3. Proposed Decision In the Matter of Exotic Feline Breeding Compound, Inc., from the Office of Administrative Hearings
4. [Unsigned] FGC Decision In the Matter of Exotic Feline Breeding Compound, Inc.

Motion/Direction

Moved by _____ and seconded by _____ that the Commission adopts the drafted decisions In the Matter of Steven Kramer and In the Matter of Exotic Feline Breeding Compound, Inc.

13. ITEMS OF INTEREST FROM PREVIOUS MEETINGS (MARINE)

Today's Item **Information** ☒ **Action** ☐

This is a standing agenda item to provide FGC with updates on items of interest from previous meetings. For this meeting:

(A) Update on lessons learned from Dungeness and rock crab emergency
(B) Update on Harmful Algal Bloom (HAB) and state agencies

Summary of Previous/Future Actions

(A)

• Adopt emergency crab regulations	Nov 5, 2015; Emergency Teleconference
• Re-adopt emergency crab regulations	Apr 13-14, 2016; Santa Rosa
• Adopt emergency razor clam regulations	Apr 25, 2016; Emergency Teleconference
• Update on domoic acid levels	Jun 22-23, 2016; Bakersfield
• Re-adopt emergency crab regulations	Jul 19, 2016; Emergency Teleconference
• **Today's update on domoic acid levels**	**Aug 22-23, 2016; Sacramento**
• Re-adopt emergency razor clam regulations (if needed)	Oct 19-20, 2016; Eureka

Background

This item is an opportunity for staff to provide any follow-up information on marine topics previously before FGC.

(A) Due to elevated levels of domoic acid and a public health advisory from the Office of Environmental Health Hazard Assessment (OEHHA) and the Department of Public Health (CDPH), FGC took emergency action on Nov 2015 to close Dungeness, and rock crab recreational fisheries. Testing for domoic acid continued with DFW, and CDPH providing results to FGC to help inform the extent of emergency action. Ninety day emergency closure regulations were re-adopted by FGC in Apr and Jun 2016. Waters were opened along traditional management boundaries as the risk to public health was reduced to meet public health standards; however, rock crab caught in state waters north of Pigeon Point in San Mateo County (Latitude 37° 11′ N) remains closed (see Exhibit A1 for additional background). The emergency closure for recreational razor clam in Humboldt and Del Norte Counties also remains in effect due to persistent elevated levels.

Recently, a hearing of the Joint Committee on Fisheries and Aquaculture was held on Aug 10, where Vice-President Hostler-Carmesin participated as an invited panelist to offer lessons learned from a FGC perspective. (Exhibit A2).

(B) Update on HAB and state agency efforts: Today Deborah Halberstadt, Deputy Secretary for Oceans at California Natural Resources Agency and Executive Director for Ocean Protection Council (OPC), will attend to speak to FGC on the efforts of the inter-agency HAB Task Force convened by OPC, and the work of the OPC science team in undertaking a scope of work identified by the HAB Task Force.

As part of these efforts, on Jul 27, 2016 the California Ocean Science Trust (OST) released a document titled "*Frequently Asked Questions: Harmful Algal Blooms and California Fisheries, Developed in Response to the 2015-16 Domoic Acid Event*". The FAQ (Exhibit B1) is designed to serve as a resource to build common understanding across all engaged in this issue, and provide clarity on the State's current practices (through July 2016) to harmful algal bloom (HAB) monitoring and management, and seafood toxin sampling and testing protocols.

Exhibits

A1. Staff Summary from Jul 19, 2016, Crab Emergency Teleconference
A2. Talking Points
B1. OST FAQ sheet, dated Aug 2016

Motion/Direction (N/A)

14. MARINE PETITIONS AND NON-REGULATORY REQUESTS FROM PREVIOUS MEETINGS

Today's Item **Information** ☒ **Action** ☐

This is a standing agenda item for FGC to act on regulatory petitions and non-regulatory requests from the public that are marine in nature. For this meeting:

(A) Action on petitions for regulation change received at the Jun 2016 meeting.

(B) Action on requests for non-regulatory requests received at the Jun 2016 meeting.

(C) Update on pending petitions and non-regulatory requests referred to staff or DFW for review.

Summary of Previous/Future Actions

(A-B)

- FGC receipt of new petitions and requests — Jun 22-23, 2016; Bakersfield
- **Today FGC action on petitions and requests from Jun — Aug 24-25, 2016; Folsom**

(C)

- **Today update and possible action on previous referrals — Aug 24-25, 2016; Folsom**

Background

FGC provides direction regarding requests from the public received by mail and email and during public forum at the previous FGC meeting. Public petitions for regulatory change or requests for non-regulatory action follow a two-meeting cycle to ensure proper review and consideration. Petitions for regulatory change or requests for non-regulatory action scheduled for consideration today were received at the Jun 2016 meeting in three ways: (1) submitted by the comment deadline and published as tables in the meeting binder; (2) submitted by the late comment deadline and delivered at the meeting; or (3) received during public forum.

The public request logs provided in exhibits A1 and B1 capture the regulatory and non-regulatory requests received at the last meeting that are scheduled for FGC action today. The exhibits contain staff recommendations for each request.

(A) Petitions for regulatory change: As of Oct 1, 2015, Section 662, Title 14, requires that any request for FGC to adopt, amend, or repeal a regulation must be submitted on form "FGC 1, Petition to the California Fish and Game Commission for Regulation Change". Petitions received at the previous meeting are scheduled for consideration at the next business meeting, unless the petition is rejected under 10-day staff review as prescribed in subsection 662(b).

One marine petition received in Jun 2016 is scheduled for action at this meeting (See summary table in Exhibit A1 and individual petition in Exhibit A2).

(B) Non-regulatory requests: Requests for non-regulatory action received at the previous meeting are scheduled for consideration today.

Four non-regulatory requests received in Jun are scheduled for action at this meeting (See summary table in Exhibit B1 and individual requests in exhibits B2-B4).

(D) Pending petitions and non-regulatory requests: This item is an opportunity for staff to provide an evaluation and recommendation on items previously referred by FGC to DFW or FGC staff for review. FGC may act on any staff recommendations made today.

No previously referred items are scheduled for discussion today.

Significant Public Comments (N/A)

Recommendation

(A-B) Adopt staff recommendations for the regulatory and non-regulatory requests to (1) deny the request, (2) grant the request, or (3) refer the request to committee, DFW staff, or FGC staff for further evaluation or information gathering. See exhibits A1 and B1 for specific staff recommendations for each request.

(C) N/A

Exhibits

A1. FGC table of marine requests for regulatory change received through Jun 23, 2016
A2. Petition #2016-013 from The Sportfishing Conservancy concerning use of cast nets, received Jun 22, 2016
B1. FGC table of marine requests for non-regulatory change received through Jun 23, 2016
B2-B4. Individual written requests for non-regulatory change that are summarized in Exhibit B1

Motion/Direction

(A-B) Moved by _____ and seconded by _____ that the Commission adopts the staff recommendations for actions on June 2016 regulatory and non-regulatory requests.

OR

Moved by _____ and seconded by _____ that the Commission adopts the staff recommendations for actions on June 2016 regulatory and non-regulatory requests, except for item(s) _____ for which the action is _____.

15A. OTHER INFORMATIONAL ITEMS – STAFF REPORT

Today's Item **Information** ☒ **Action** ☐

Receive the staff report, including staff time allocations and previous meeting outcomes.

Summary of Previous/Future Actions (N/A)

Background

Staffing update. The deputy executive director job announcement (Exhibit A1) has been posted to the FGC website (www.fgc.ca.gov), the state jobs website (www.jobs.ca.gov), Capitol Daybook (www.capitoldaybook.com), and Seven Seas Travel Magazine (www.sevenseastravelmagazine.com). Additionally, the announcement was released through the International Union for Conservation of Nature weekly newsletter and jobs posting. Applications must be postmarked, personally delivered, or received via inter-office mail by Aug 31, 2016.

California Native American Day at the State Capital. FGC has been invited to participate in the 49th annual California Native American Day, being held on Sep 23 at the State Capital. FGC will co-host a table with DFW to engage with members of California's tribes and the public about FGC and its activities (Exhibit A2).

Staff time allocations. In an effort to help keep FGC current on its staffing and where staff is expending its time, staff has developed a report that shows the allocation of time in general categories for the previous two months, as well as highlights some of the specific activities for the previous months (Exhibit A3).

Previous meeting outcomes. Staff has prepared a summary of meeting outcomes for the most recent FGC meetings held Jun 22-23 and Jul 19 (exhibits A4 and A5).

Significant Public Comments (N/A)

Recommendation (N/A)

Exhibits

A1. Job posting for FGC deputy executive director
A2. Invitation to 49th annual Native American Day
A3. Staff Report on Staff Time Allocation, dated Aug 12, 2016
A4. Jun 22-23, 2016 FGC meeting outcomes
A5. Jul 19, 2016 FGC emergency teleconference meeting outcomes

Motion/Direction (N/A)

15B. OTHER ITEMS – LEGISLATIVE UPDATE

Today's Item **Information** ☒ **Action** ☒

Review and discuss legislation of interest, and provide staff direction. Receive and possibly take action on the Marine Resources Committee's (MRC) recommendation concerning a statement reflecting FGC support for voting "yes" on statewide ballot referendum Prop. 67.

Summary of Previous/Future Actions

- Brief legislative update — Jun 22-23, 2016; Bakersfield
- **Today's update and possible action** — **Aug 24-25, 2016; Folsom**

Background

FGC staff has prepared a list of legislative bills (Exhibit 1) that may be of interest to FGC, which includes a brief synopsis and current bill status. Items highlighted in yellow indicate legislation of particular interest or that may impact FGC's resources and workload.

This is an opportunity for FGC to provide direction to staff concerning any proposed legislation. At any meeting FGC may direct staff to provide information or share concerns with bill authors. FGC members also have the option to take positions on bills at the same meeting an update is provided.

The Legislature reconvened on Aug 1 and will recess again on Aug 31. As the session nears conclusion, there are some important deadlines to note: Aug 12 was the last day for fiscal committees to meet and report bills. Aug 19 was the final day to amend bills on the floor. Aug 31 is the last day for each house to pass bills. Sep 30 is the last day for the Governor to sign or veto bill passed by the legislature.

I. **Proposition 67 – Referendum to overturn ban on single use plastic bags**
A referendum on the Nov 8, 2016, statewide ballot challenges a State law previously approved by the Legislature and the Governor which prohibits grocery and certain other retail stores from providing single-use bags but permits sale of recycled paper bags and reusable bags statewide.

A "yes" vote is a vote in favor of upholding or ratifying the contested legislation banning plastic bags that was enacted by the California State Legislature under the name Senate Bill 270. A "no" vote is a vote in favor of overturning Senate Bill 270. A thorough overview of the referendum is available via Ballotpedia at https://ballotpedia.org/California_Plastic_Bag_Ban_Referendum,_Proposition_67_(2016)#cite_note-4

At its Jul 21, 2016, meeting in Petaluma, the MRC recommended FGC issue a public statement of support in favor of voting "yes" on Proposition 67 to uphold the ban on plastic bags as a means to reduce ocean debris and protect marine life.

Updates on New/Pending Legislation

AB 1792 (Wood) Elk tags for tribes – Would require DFW, upon request, to meet with individual federally recognized Indian tribes in California to discuss elk-related issues for elk located within the territory of the individual tribe. The bill would require DFW to work collaboratively, and in good faith, with that tribe to identify possible science-based solutions. Passed in the Assembly, passed Sen. Cmte. on Natural Resources and Water, referred to Sen. Cmte on Appropriations' suspense file.

AB 1844 (Baker) License fees veterans – This bill would require DFW to reduce the fee required to obtain the lifetime hunting and fishing licenses by 25% for honorably discharged resident veterans. Passed in the Assembly, passed in Sen. Cmte. on Natural Resources and Water, and referred to Sen. Cmte. on Appropriations' suspense file.

AB 2549 (Water, Parks and Wildlife) – This bill extends the procedures outlined in CESA indefinitely, extends the authority to DFW concerning dreissenid mussles to Jan 2020, and other provisions. Passed in the Assembly, passed in Sen. Cmte. on Natural Resources and Water, referred to Consent Calendar.

ACR 148 (Chau) Law Revision Commission – This bill would grant approval to the Law Revision Commission (LRC) to continue its study of designated topics that the Legislature previously authorized or directed it to study, and authorizes LRC to study, report on, and prepare recommended legislation as soon as possible concerning the revision of the portions of the Government Code relating to public records that would accomplish specified goals, including, among other things, reducing the length and complexity of current sections and clearly expressing legislative intent without any change in the substantive provisions. Passed in Assembly, referred to Sen. Cmte. on Appropriations, and ordered to third reading.

SB 345 (Berryhill) Sport Fishing Stimulus Act – This bill would (1) authorize charitable organizations to possess fish taken under a sport fishing license in excess of a possession under certain provisions; (2) require FGC to adopt regulations to clarify when a possession limit is not violated by processing into food lawfully taken sport fish; (3) make annual fishing licenses valid for a full 12 months; and (4) create a junior fishing license. Passed in Asm. Cmte. on Water, Parks and Wildlife, and placed on Asm. Cme. on Appropriations' suspense file.

SB 1235 (DeLeon) – Ammunition – This bill would, if the Safety for All Act of 2016 is enacted by voters, amend the act to instead allow ammunition to be sold only to a person whose information matches an entry in the Automated Firearms System and who is eligible to possess ammunition, to a person who has a current certificate of eligibility issued by the department, or to a person who purchases or transfers the ammunition in a single ammunition transaction, as specified. Approved by the Governor on Jul 1, 2016.

SB 1287 (McGuire) – Fishing – This bill would (1) expand the authority of DFW to order the closure of any waters or restricting the taking of any species of fish if state health agencies determine that the fish is likely to pose a human health risk from high levels of toxins, (2) require the Director to notify the FGC and request that FGC schedule a public discussion of the closure or restriction at its next scheduled full meeting, and (3) remove the requirement

that the closure or restriction be adopted by emergency regulation (by DFW or FGC) and would instead exempt a closure or restriction from the Administrative Procedure Act. Passed in Sen. Cmte. on Water, Parks, and Wildlife, and placed on Asm. Cmte. on Appropriations' suspense file.

SB 1363 (Monning) – OPC: Ocean Acidification and Hypoxia Reduction Program – This bill would require OPC, in consultation with the State Coastal Conservancy and other relevant entities, to establish and administer the Ocean Acidification and Hypoxia Reduction Program for the purposes of achieving specified goals. The bill would authorize moneys in the trust fund to be expended for grants or loans for projects or activities that further public purposes consistent with the Ocean Acidification and Hypoxia Reduction Program. Passed in Asm. Cmte. on Natural Resources, placed on Asm. Cmte. on Appropriations' suspense file.

SB 1473 (Committee on Natural Resources) Fish and Game Commission procedures – This bill would clarify that those procedures apply generally to any FGC regulation that governs the take or possession of any bird, mammal, fish, amphibian, or reptile, except as provided. The bill would conform certain FGC rulemaking procedures to the rulemaking procedures of the Administrative Procedure Act. The bill would delete obsolete and superfluous provisions, make organizational changes, delete obsolete cross references, and make other conforming changes. Passed in the Senate, passed in Asm. Cmtes. on Water, Parks and Wildlife, and on Natural Resources, and on Appropriations, and ordered to third reading.

Significant Public Comments (N/A)

Recommendation

MRC: *Issue a public statement of support in favor of voting "yes" on Proposition 67 to uphold the statewide ban on plastic bags approved under SB 270 (2014) as a means to reduce ocean debris and protect marine life.*

Exhibits

B1. FGC legislative tracking log, as of Aug 11, 2016
B2. DFW legislative report, as of Aug 10, 2016
B3. Prop 67 full text

Motion/Direction

Moved by _____ and seconded by _____ that the Commission directs staff to prepare a public statement of support in favor of voting "yes" on Proposition 67 to uphold the statewide ban on plastic bags as a means to reduce ocean debris and protect marine life.

15C. OTHER INFORMATIONAL ITEMS – FEDERAL AGENCIES REPORT

Today's Item **Information** ☒ **Action** ☐

Standing agenda item to receive reports on any recent federal agency activities of interest not otherwise addressed under other agenda items.

Summary of Previous/Future Actions (N/A)

Background

National Oceanic and Atmospheric Administration (NOAA): NOAA's National Marine Fisheries Service (NMFS) has recommended 17 coastal and marine habitat restoration projects, including three in California, for its 2016 Community-Based Restoration Program (Exhibit C1). NMFS also announced the availability of approximately $10 million for projects focused on sustainable fisheries and coastal fishing communities, with pre-proposals due Sep 20 (Exhibit C2).

Significant Public Comments (N/A)

Recommendation (N/A)

Exhibits

C1. NOAA news release: *Projects selected for $9 million in community-based habitat restoration funding*, dated Jul 20, 2016

C2. NOAA news release: *Approximately $10 million available for fisheries projects,* dated Jul 22, 2016

Motion/Direction (N/A)

STAFF SUMMARY FOR AUGUST 24-25, 2016

15D. OTHER INFORMATIONAL ITEMS – OTHER

Today's Item **Information** ☒ **Action** ☐

An opportunity for staff to identify any additional items that arise after binder production is complete.

Summary of Previous/Future Actions (N/A)

Background (N/A)

Significant Public Comments (N/A)

Recommendation (N/A)

Exhibits (N/A)

Motion/Direction (N/A)

STAFF SUMMARY FOR AUGUST 24-25, 2016

16. DEPARTMENT INFORMATIONAL ITEMS

Today's Item **Information** ☒ **Action** ☐

Standing agenda item to receive and discuss informational updates from DFW:

(A) Director's Report
(B) Wildlife and Fisheries Division, and Ecosystem Conservation Division
(C) Law Enforcement Division
(D) Marine Region
(E) Other

Summary of Previous/Future Actions (N/A)

Background

(A)-(D) Verbal reports are expected at the meeting. Related to Item (C), DFW's Law Enforcement Division distributes a monthly report; included with this summary are links to the May 2016 and Jun 2016 reports (exhibits C1 and C2).

(E) Other items of potential interest include:

1. Nonlead Ammunition Implementation - Phase 2 of implementation began on Jul 1, with additional requirements to use nonlead shot with a shotgun when taking upland game birds, small game mammals, furbearing mammals, nongame mammals, nongame birds, and any wildlife for depredation purposes (Exhibit E1).
2. *Big Game Grants Program:* DFW has awarded $1.1. million in grants for big game conservation projects that meet a series of criteria, including dedication to conservation and management, and increased hunting opportunities. The projects are selected and budgets approved by a public advisory committee (Exhibit E2).

Significant Public Comments (N/A)

Recommendation (N/A)

Exhibits

C1. *Law Enforcement Division Monthly Report*, May 2016, received Jun 27, 2016
C2. *Law Enforcement Division Monthly Report*, Jun 2016, received Aug 4, 2016
E1. *Nonlead Ammunition Implementation Phase 2 Starts July 1*, June 28, 2016
E2. *Big Game Grants Program Awards $1.1 Million for WIldlife*, July 8, 2016

Motion/Direction (N/A)

STAFF SUMMARY FOR AUGUST 24-25, 2016

17A. FUTURE MEETINGS – ADOPT MEETING DATES AND LOCATIONS 2017

Today's Item **Information** ☒ **Action** ☒

Approve FGC meeting dates and locations for 2017

Summary of Previous/Future Actions

- Discuss draft 2017 meeting dates and locations — June 22-23, 2016; Bakersfield
- **Approve 2017 meeting dates and locations** — **Aug 24-25, 2016; Folsom**

Background

FGC conducts its annual business during eight meetings per year consisting of six two-day meetings (Feb, Apr, Jun, Aug, Oct, and Dec) and two one-day teleconferences (Mar and Apr). Committees each holds three half- to full-day meetings per year, either staggered between FGC business meetings (WRC, MRC), or the afternoon before the first day of each 2-day FGC meeting (TC). Adequate meeting facilities have become more difficult to obtain and advanced-planning increases the likelihood of locating available venues. Thus, in order to ensure that staff has adequate time to identify and secure venue options that meet FGC's requirements related to cost, information technology and security conditions, and State-mandated bids, contracting conditions, and timelines, it is important for meeting dates and locations to be identified well in advance. As such, in Jun 2016 staff proposed draft meeting dates and locations for 2017. Staff considered State holidays, other relevant meeting schedules, and regulatory deadlines, and attempted to avoid high-cost areas such as San Luis Obispo, Palm Desert, Palm Springs and Santa Barbara, where meeting and lodging costs are usually prohibitive relative to approved rates for State business.

Based on guidance from FGC and committee chairs, staff has updated the proposed list of meeting dates and locations for FGC adoption at this meeting (see Table 1 on next page). FGC meetings are proposed for Wednesdays and Thursdays, WRC meetings are proposed for Wednesdays, MRC meetings for Thursdays, and Tribal Committee meetings the day before FGC meetings. As a reminder, in Jun, staff provided a recommendation to alternate which day marine-or non-marine related agenda items are scheduled on an annual basis. As such, for 2017 the wildlife (non-marine) related items would be scheduled the first day and marine-related items on the second day.

Table 1. Proposed 2017 FGC and Committee meeting dates and locations

Proposed Dates	Meeting	Proposed Location
January 18*	WRC	Redding
February 7*	Tribal	Santa Rosa
February 8-9*	FGC	Santa Rosa
March 15	Teleconference	Sacramento and DFW Offices
March 23	MRC	San Clemente/Oceanside
April 13	Teleconference	Sacramento and DFW Offices
April 26-27	FGC	Los Angeles
May 24*	WRC	Sacramento
June 20	Tribal	Fortuna
June 21-22	FGC	Fortuna
July 20	MRC	Petaluma
August 16-17	FGC	Sacramento
September 13*	WRC	Riverside
October 10	Tribal	Ventura
October 11-12	FGC	Ventura
November 9*	MRC	Marina
December 6-7	FGC	San Diego

* Revised from Jun 2016 version of proposed meeting dates based on FGC direction to staff.

Other Relevant 2017 Meetings

- Western Association of Fish and Wildlife Agencies: January 5-8 and July 6-11
- Pacific Fishery Management Council: March 7-14, April 6-12, June 7-14, September 11-18, November 13-20
- Wildlife Conservation Board: Dates unknown at this time

Significant Public Comments (N/A)

Recommendation

Approve 2017 meeting dates as proposed in Table 1. Approve the staff recommendation for marine and non-marine days to be rotated between day 1 and day 2 of FGC meetings on an annual basis.

Exhibits (N/A)

Motion/Direction

The Commission directs staff to secure meeting facilities for the identified meeting dates and locations for 2017 and approves the staff recommendation to rotate scheduling of marine and non-marine days between day 1 and day 2 of FGC meetings for 2017.

STAFF SUMMARY FOR AUGUST 24-25, 2016

17B. FUTURE MEETINGS- NEXT MEETING

Today's Item **Information** ☐ **Action** ☒

This is a standing item to review logistics and approve draft agenda items for the next and future FGC meetings.

Summary of Previous/Future Actions (N/A)

Background

This item is generally scheduled for Day 2 of the meeting, to ensure additional changes to the next meeting agenda identified during the existing meeting are captured. Due to concerns about timing constraints, this item is scheduled on Day 1.

Significant Public Comments (N/A)

Recommendation

Approve draft agenda topics for the Oct 2016 meeting. Any revisions identified later in the meeting should include a motion to amend the approved agenda accordingly.

Exhibits

1. Potengial agenda items for Oct 2016 FGC meeting

Motion/Direction

Move by _____ and seconded by _____ that the Commission approves the draft agenda items for the October 19-20, 2016 meeting, as amended.

STAFF SUMMARY FOR AUGUST 24-25, 2016

17C. FUTURE MEETINGS – REGULATIONS PERPETUAL TIMETABLE

Today's Item **Information** ☐ **Action** ☒

Review and acknowledge requested changes to the perpetual timetable for anticipated regulatory actions.

Summary of Previous/Future Actions (N/A)

Background

FGC maintains a perpetual timetable for anticipated FGC regulatory actions. At each FGC meeting, staff provides the latest approved timetable along with any requests for changes (Exhibit C1).

DFW and FGC staff generally submits memos to FGC requesting changes to the FGC timetable for anticipated regulatory actions; requested changes to the rulemaking calendar identified by DFW are included in Exhibit C2.

This item is generally is scheduled for Day 2 of the meeting to ensure additional rulemaking schedule changes identified during the existing meeting are captured. Due to concerns about timing constraints, this item is scheduled on Day 1.

Recommendation

Provide direction on the scheduling of any proposed rulemaking schedule changes identified by staff verbally during the meeting. Any revisions identified later in the meeting should include a motion to amend the approved rulemaking schedule accordingly. .

Exhibits

C1. Amended timetable for anticipated regulatory actions, updated Aug 10, 2016

C2. DFW memo request for change to FGC timetable, received Aug 10, 2016

Motion/Direction

Moved by _____and seconded by _____ that the Commission approves the proposed amendments to the rulemaking calendar.

17D-E. FUTURE MEETINGS – NEW BUSINESS, OTHER

Today's Item **Information** ☒ **Action** ☐

This is an opportunity for Commissioners to bring new items of business to FGC (Agenda Item 17D), or to raise any other topics related to future meetings (Agenda Item 17E).

Summary of Previous/Future Actions (N/A)

Background (N/A)

Significant Public Comments (N/A)

Recommendation (N/A)

Exhibits (N/A)

Motion/Direction (N/A)

18. PUBLIC FORUM

Today's Item **Information** ☒ **Action** ☐

Receipt of public comments and requests for regulatory and non-regulatory actions.

Summary of Previous/Future Actions

- **Today's receipt of requests and comments** **Aug 24-25, 2016; Folsom**
- Direction to grant, deny, or refer requests Oct 19-20, 2016; Eureka

Background

This agenda item is primarily to provide the public an opportunity to address FGC on topics not on the agenda. Staff also delivers written materials and comments received prior to the meeting comment deadline for FGC receipt as exhibits in the meeting binder (under Day 1 Public Forum), or as late comments at the meeting (if received by late comment deadline).

Public comments on topics not scheduled on the current agenda are generally categorized in three types under public forum: 1) Requests for regulatory action; 2) requests for non-regulatory action; and 3) informational–only topics. Under the Bagley-Keene Open Meeting Act, FGC cannot act on any matter not included on the agenda, other than to schedule issues raised by the public for consideration at future meetings. Regulatory and non-regulatory requests generally follow a two-meeting cycle (receipt and direction): FGC will determine the outcome of the regulatory and non-regulatory requests received at this meeting (Aug 2016) at the next FGC meeting (Oct 2016) following staff evaluation.

As required by the Administrative Procedure Act (APA), regulatory requests will be either denied or granted and notice made of that determination. Action on requests received at previous meetings is scheduled under a separate agenda item called "Petitions for regulation change and non-regulatory requests from previous meetings".

Significant Public Comments

All written comments were summarized and provided as exhibits under Day 1 Public Forum, Agenda Item 2.

Recommendation

Consider whether any new future agenda items are needed to address issues that are raised and within the FGC's authority.

Exhibits

See exhibits for Agenda Item 2.

Motion/Direction (N/A)

19. COMMISSION RECOGNITION OF JIM KELLOGG

Today's Item **Information** ☐ **Action** ☒

Recognition of former Commissioner Jim Kellogg for his commitment and service to FGC.

Summary of Previous/Future Actions

• Direct staff to begin planning for recognition	Feb 10-11, 2016; Sacramento
• Further direction and schedule for recognition	Mar 15, 2016; Teleconference
• **Honor Jim Kellogg**	**Aug 24-25, 2016; Folsom**

Background

Traditionally, FGC has recognized out-going Commissioners for the work those individuals performed during the term they served.

Jim Kellogg was appointed to FGC on January 31, 2002 by Governor Davis. He was reappointed by Governors Schwarzenegger and Brown. During his tenure, he served as President and Vice President of FGC as well as Co-chair for the Wildlife Resources Committee. He served for nearly 13 years, ending in December 2015.

FGC discussed recognizing him for his performance as a Commissioner and decided that the cost of a gift would be borne by the Commissioners in their individual capacity, as State funds could not be used to purchase gifts.

Significant Public Comments (N/A)

Recommendation

FGC staff recommends formally recognizing the work done by former Commissioner Jim Kellogg by adoption of a resolution and presentation of a gift.

Exhibits (N/A)

Motion/Direction (N/A)

20. WATERFOWLERS HALL OF FAME

Today's Item **Information** ☐ **Action** ☒

Recognize newly inducted members of the Calfiornia Waterfowler's Hall of Fame.

Summary of Previous/Future Actions

FGC has annually recognized inductees into the California Waterfowler's Hall of Fame through the presentation of signed FGC resolutions.

Background

This year's inductees will be presented with certificates by the California Waterfowl Association: the inductees are Howard Ellman, Bill Pinches, Thomas Seeno, John Takekawa and Jeff Thomson.

Significant Public Comments (N/A)

Recommendation (N/A)

Exhibits

1. Resolution honoring Howard N. Ellman
2. Resolution honoring Bill Pinches
3. Resolution honoring Thomas A. Seeno
4. Resolution honoring Dr. John Y. Takekawa
5. Resolution honoring C Jeff Thomson

Motion/Direction

Moved by _____ and seconded by _____ that the Commission recognizes Howard Ellman, Bill Pinches, Thomas Seeno, John Takekawa and Jeff Thomson members of the California Waterfowler's Hall of Fame.

21. COAST YELLOW LEPTOSIPHON

Today's Item **Information** ☐ **Action** ☒

Approve DFW request for an extension of 30 days to evaluate the petition to list coast yellow leptosiphon as endangered.

Summary of Previous/Future Actions

- Receive petition — May 25, 2016
- FGC transmits petition to DFW — May 27, 2016
- Publish notice of receipt of petition — Jun 10, 2016
- **Today act on DFW request for 30-day extension** — Aug 24-25, 2016; Folsom

Background

A petition to list coast yellow leptosiphon, *Leptosiphon croceus*, was submitted by California Native Plant Society on May 25, 2016. California Fish and Game Code Section 2073.5 requires that, within 90 days of receiving a petition, DFW shall evaluate the petition and submit to FGC a written evaluation with a recommendation; under this section the director of DFW may also request an extension of up to 30 days to complete the evaluation. The requested extension would change the due date for DFW's evaluation from 90 days, due on Aug 25, 2016, to 120 days, due on Sep 24, 2016.

Significant Public Comments

This meeting is not intended for FGC discussion as the law requires the public to have 30 days to review the petition and public release of the evaluation report; however, under Bagley-Keene, FGC must allow public comment on this item if requested.

Recommendation

FGC staff: Approve DFW's request for an extension of 30 days under a motion to adopt the consent calendar.

Exhibits

1. DFW memo, dated Jul 25, 2016
2. Petition to list coast yellow leptosiphon as an endangered species

Motion/Direction

Moved by _____ and seconded by _____that the Commission adopts the Consent Calendar, items 21-25.

STAFF SUMMARY FOR August 24-25, 2016

22. APPROVE AMENDMENT TO PLM SEASONS HARVEST PROGRAMS

Today's Item **Information** ☐ **Action** ☒

Approve amendment to Private Lands Wildlife Habitat Enhancement and Management Area (PLM) five-year license for 2016-2021, and annual seasons, harvests, and habitat improvements for DeFrancesco & Eaton Ranch.

Summary of Previous/Future Actions

- Approve proposed 5-year PLM license — Jun 22-23, 2016; Bakersfield
- **Today amend approved 5-year PLM license — Aug 24-25, 2016; Folsom**

Background

Incorrect numbers for authorized seasons and harvests for deer and elk were included in the table adopted by FGC in Jun 2016. DFW has submitted the corrections for FGC approval (exhibits 1 and 2). Tables with highlighted errors and corrections are provided in Exhibit 2.

Significant Public Comments (N/A)

Recommendation

FGC Staff: Support DFW recommendation and approve under a motion to adopt consent calendar.

DFW: Approve the amended wildlife management plan for DeFrancesco & Eaton Ranch,

Exhibits:

1. DFW Memo, received July 21, 2016
2. Tables of PLM area license season, harvests, and habitat improvements with errors and proposed corrections highlighted.

Motion/Direction

Moved by _____and seconded by_____ that the Commission adopts the consent calendar, items 21-25.

STAFF SUMMARY FOR August 24-25, 2016

23. INITIAL PLM HARVEST PROGRAMS

Today's Item **Information** ☐ **Action** ☒

Approve initial five-year Private Lands Wildlife Habitat Enhancement and Management (PLM) Area license 2016-2021 and seasons, harvest and habitat improvements for two properties.

Summary of Previous/Future Actions (N/A)

Background

Fish and Game Code Sections 3400-3409, and Title 14 Section 601 prescribes conditions for a PLM program that provides incentives for landholders to manage their property for the benefit of fish and wildlife in exchange for access to increased recreational opportunities, such as hunting tags or extended seasons. In return for a harvest program, the landholder must prepare a biologically-sound wildlife management plan and complete specific wildlife habitat improvements on the PLM property. There are three types of PLM Program plans with conditions unique to each participant's property: an *initial 5-year PLM license*, an *annual list of PLM seasons, harvests, and habitat improvements*, and a *five-year PLM license renewal,* all.

Proposed 5-year wildlife management plans and **seasons, harvest and habitat improvements** for the two properties have been reviewed by DFW and found to be in compliance with FGC regulations and policies for PLMs; applicants have identified location where records will be kept and made available for inspection (Exhibit 1).

Significant Public Comments (N/A)

Recommendation

FGC Staff: Approve initial five-year PLM license and annual seasons, harvests, and habitat improvements as recommended by DFW under a motion to adopt consent calendar.

DFW: Approve the specified wildlife management plans, initial five-year PLM license for 2016-2021, and annual seasons, harvests, and habitat improvements for 2016-2017 for three properties, under the conditions specified in (Exhibit 2) under a motion to adopt the consent calendar.

Exhibits

1. DFW Memo, received July 21, 2016
2. PLM proposed annual details

Motion/Direction

Moved by _____and seconded by_____ that the Commission adopts the consent calendar, items 21-25.

STAFF SUMMARY FOR August 24-25, 2016

24. ANNUAL PLM HARVEST PROGRAMS

Today's Item **Information** ☐ **Action** ☒

Approve the annual Private Lands Wildlife Habitat Enhancement and Management (PLM) Area seasons, harvests and habitat improvements for 2016-2017 on 21 properties.

Summary of Previous/Future Actions (N/A)

Background

Fish and Game Code Sections 3400-3409, and Title 14 Section 601 prescribes conditions for a PLM program that provides incentives for landholders to manage their property for the benefit of fish and wildlife in exchange for access to increased recreational opportunities, such as hunting tags or extended seasons. In return for a harvest program, the landholder must prepare a biologically-sound wildlife management plan and complete specific wildlife habitat improvements on the PLM property. There are three types of actions associated with the PLM Program: an *initial 5-year PLM license*, an *annual list of PLM seasons, harvests, and habitat improvements*, and a *five-year PLM license renewal,* with conditions unique to each participant's property.

Proposed annual seasons, harvests, and habitat improvements for the 21 PLM properties have been reviewed by DFW and found to be in compliance with FGC regulations and policies for PLMs; applicants have identified location where records will be kept and made available for inspection (Exhibit 1).

Significant Public Comments (N/A)

Recommendation

FGC Staff: Approve annual seasons, harvests, and habitat improvements for 21 PLM properties as recommended by DFW, under a motion to adopt the consent calendar.

DFW: Approve annual seasons, harvests, and habitat improvements for 21 properties, under the conditions specified in Exhibit 2.

Exhibits

1. DFW Memo, received July 21, 2016
2. PLM proposed annual details

Motion/Direction

Moved by _____and seconded by_____ that the Commission adopts the consent calendar, items 21-25.

STAFF SUMMARY FOR August 24-25, 2016

25. FIVE YEAR PLM HARVEST PROGRAMS

Today's Item **Information** ☐ **Action** ☒

Approve the five-year renewal of Private Lands Wildlife Habitat Enhancement and Management (PLM) Area licenses for 2016-2021 and seasons, harvests and habitat improvements for 2016-2017 on five properties.

Summary of Previous/Future Actions (N/A)

Background

Fish and Game Code Sections 3400-3409, and Title 14 Section 601 prescribes conditions for a PLM program that provides incentives for landholders to manage their property for the benefit of fish and wildlife in exchange for access to increased recreational opportunities, such as hunting tags or extended seasons. In return for a harvest program, the landholder must prepare a biologically-sound wildlife management plan and complete specific wildlife habitat improvements on the PLM property. There are three types of actions associated with the PLM Program: an *initial 5-year PLM license*, an *annual list of PLM seasons, harvests, and habitat improvements*, and a *five-year PLM license renewal,* with conditions unique to each participant's property.

Proposed wildlife management plans and annual seasons, harvests, and habitat improvements for the five properties have been reviewed by DFW and found to be in compliance with FGC regulations and policies for PLMs; applicants have identified location where records will be kept and made available for inspection (Exhibit 1).

Significant Public Comments (N/A)

Recommendation

FGC Staff: Approve five-year renewal of PLM license, and annual seasons, harvests, and habitat improvements as recommended by DFW, under a motion to adopt the consent calendar.

DFW: Approve the specified wildlife management plans, five-year PLM license renewals for 2016-2021 and seasons, harvests, and habitat improvements for 2016-2017 for five properties, under the conditions specified in Exhibit 2.

Exhibits

1. DFW Memo, received July 21, 2016
2. PLM proposed annual details

Motion/Direction

Moved by _____and seconded by_____ that the Commission adopts the consent calendar, items 21-25.

26. WILDLIFE RESOURCES COMMITTEE

Today's Item **Information** ☐ **Action** ☒

Review tasks referred to the Wildlife Resources Committee (WRC), review potential agenda topics for Sep 21, 2016 WRC meeting, and consider new potential topics for WRC review. Provide an update on the Predator Policy Workgroup (PPWG).

Summary of Previous/Future Actions

- Most recent WRC — May 18, 2016; WRC, West Sacramento
- Most recent PPWG meeting — Jul 12, 2016; WRC-PPWG, Sacramento
- **Today, approve draft Sep WRC topics — Aug 24-25, 2016; Folsom**
- Next WRC meeting — Sep 21, 2016; WRC, Woodland
- Next PPWG meeting — Sep 28, 2016; WRC-PPWG, Sacramento

Background

WRC Work Plan and Draft Timeline

FGC directs committee work. Current topics already referred to WRC are shown in Exhibit 2 and include two new topics referred by FGC in Jun 2016 (falconry regulations, and the Hatchery and Inland Fisheries Fund). A discussion of the falconry regulations and the Hatchery and Inland Fisheries Fund are tentatively scheduled for Jan 2017 and May 2017, respectively.

Draft agenda topics for the Sep WRC meeting are shown in the Sep column of the WRC work plan (Exhibit 1) for FGC review and consideration today. Topics include discussion and recommendations on four annual rulemaking packages: mammals; waterfowl; Central Valley salmon; and Klamath River sport fish. Also proposed are continued discussion on wild pig management and a PPWG update.

Predator Policy Workgroup

The WRC's PPWG met in Jul 2016 to review existing predator policies and identify the management issues to address in a predator policy. The meeting summary is available on the FGC website. The next meeting is scheduled for Sep 28, 2016 in Davis.

Discuss and Approve New WRC Topics

No new topics are proposed at this time.

Significant Public Comments

1. Letter received from California Legislature Outdoor Sporting Caucus requesting DFW present a detailed analysis of revenues and expenditures for the Hatchery and Inland Fisheries Fund for the fiscal years 2013-2014, 2014-2015, and 2015-2016 at the Sep 2016 WRC meeting (Exhibit 2).

Recommendations

Approve draft agenda topics for the May 2016 WRC meeting:

- *Proposals for annual rulemaking*
  - *Mammals for 2017-18*
  - *Waterfowl for 2017-18*
  - *Central Valley Salmon for 2017*
  - *Klamath River Sportfish for 2017*
- *Special project updates:*
  - *Wild pig management discussion*
  - *PPWG update*

Exhibits

1. WRC work plan and draft agenda topics for Sep 21, 2016 WRC meeting
2. Letter from California Legislature Outdoor Sporting Caucus concerning the Hatchery and Inland Fisheries Fund, received Aug 11, 2016

Motion/Direction

Moved by _____ and seconded by _____ that the Commission approves the draft agenda topics for the Sep 2016 Wildlife Resources Committee meeting.

27. NORTHERN SPOTTED OWL

Today's Item **Information** ☐ **Action** ☒

Consider whether to add the northern spotted owl (NSO) to the list of endangered species and, if FGC determines that listing may be warranted, authorize staff to publish notice of its intent to amend Section 670.5, Title 14, CCR.

Summary of Previous/Future Actions

• Received petition	Sept 7, 2012
• FGC transmits petition to DFW	Sept 10, 2012
• Published notice of receipt of petition	Oct 5, 2012
• Approved DFW request for 30-day extension	Dec 12, 2012; San Diego
• Received DFW's evaluation and recommendation	Mar 6, 2013; Mount Shasta
• Postponed whether petitioned action may be warranted	Apr 17, 2013; Santa Rosa
• Accepted petition for candidacy	Aug 7, 2013; San Luis Obispo
• Approved DFW request for six month extension	Dec 3, 2014; Van Nuys
• Received DFW status review report	Feb 10-11, 2016; Sacramento
• Discussion; deferred action to Jun 2016 meeting	April 13-14, 2016; Santa Rosa
• Deferred to Aug 2016 meeting	Jun 22-23, 2016; Bakersfield
• **Today's action to determine if listing is warranted**	**Aug 24-25, 2016; Folsom**

Background

A petition to list NSO was received in Sep 2012 (Exhibit 1). DFW submitted a status review report to FGC at the Feb 2016 meeting (Exhibit 2).

At the Apr 14, 2016 meeting, FGC delayed action on the petition, continued this item to the Jun 23, 2016 meeting, and set a deadline of May 2 for submittal of supplemental information relevant to the action. Five submittals with supplemental information were submitted by the May 2, 2016 deadline (see Significant Public Comments below and exhibits 5-9). In Jun, DFW requested that action on the petition be deferred to the Aug meeting to allow time to finish reviewing and responding to the new supplemental information.

DFW has provided a report that comprehensively reviews and evaluates supplemental information received by the deadline, and responds to comments received concerning the DFW NSO status review report (see Exhibit 3). Also at the request of FGC, DFW has submitted a draft barred owl working group structure and general communication framework (see Exhibit 5). Note that additional comments received after the deadline are not included in the DFW report but are provided in exhibits 11-12.

Significant Public Comments

1. The Environmental Protection and Information Center (EPIC) commented that it does not believe that creation of a NSO Stakeholder Working Group can or should be used

as a basis to avoid CESA listing, or for DFW to otherwise fail to discharge its statutory duties as the trustee agency for wildlife in California (Exhibit 6).

2. Bill Snyder, retired Deputy Director of the Department of Forestry and Fire Protection, challenges nearly every aspect of DFW's status review and provided supportive documents regarding DFW "Staff Report Findings Regarding the Potential for Take of NSO Attributable to Timber Harvesting on Non-federal Ownerships" (Exhibit 7). DFW had obtained the documents attached to Mr. Snyder's letter while preparing the status review; therefore, the documents do not represent new information available to DFW.
3. California Forestry Association (Calforests) provided three new studies relating to NSO and the association with barred owl presence and timberlands (Exhibit 8). These are well-represented in the DFW status report.
4. Emails received from Matt Green, registered professional forester; Lisa Weger, Wenger Ranch; Craig Blencowe, registered professional forester; Peter Bradford, Bradford Ranch; and Claire McAdams, Forest Landowners of California and The Buckeye Conservancy; requesting to ensure that small non-industrial private forest landowners ("NIPFs") be included in the decision-making for rules which will implement the listing, and transmitting The Buckeye Conservancy's suggestions for NSO habitat management (see Exhibit 9).
5. EPIC submitted an independent report (Exhibit 10) that covers the "Status and Trends [of NSO] in California" and analyzes four primary potential threats to NSO: timber harvesting (Ch. 2), wildfires (Ch. 3), barred owls (Ch. 4), and outdoor marijuana cultivation (Ch. 5), and provides a brief list of management recommendations.
6. EPIC submitted peer review comments on its independent report (Exhibit 11) that overall it is a very thorough review.
7. Letter received on Aug 11, 2016, from Noelle Cremers, California Farm Bureau Federation, representing members that would be impacted by listing the NSO under CESA (Exhibit 12)

Recommendation

FGC: Staff agrees with DFW findings and supports DFW recommendation to list as a threatened species under the CESA.

DFW: Following review of supplemental information, DFW maintains its recommendation to list the NSO as a threatened species under the CESA.

Exhibits

1. Petition
2. DFW's NSO status review report (available at http://www.fgc.ca.gov/CESA/index.aspx#nso)
3. DFW memo - review and evaluation of the supplemental materials and comments received by May 2, 2016, dated Aug 8, 2016
4. DFW presentation on the status review (for reference; provided Apr 2016)
5. DFW presentation on draft barred owl team concept
6. Email from Rob DiPerna, EPIC, received Apr 19, 2016
7. Email from Bill Snyder, received May 2, 2016

8. Email from George Gentry, Calforests, received May 3, 2016
9. Email from Claire McAdams, Forest Landowners of California and The Buckeye Conservancy, received Jun 16, 2016
10. EPIC independent report, dated May 7, 2015
11. EPIC peer review comments, dated Jul 3, 2015
12. Letter from Noelle Cremers, received Aug 11, 2016

Motion/Direction

1a. Moved by _____ and seconded by _____ that the Commission, pursuant to Section 2075.5 of the Fish and Game Code, finds the information contained in the petition to list the northern spotted owl (*Strix occidentalis caurina),* and the other information in the record before the Commission **warrants** listing the northern spotted owl as a threatened species under the California Endangered Species Act. (Note: Findings will be adopted at a future meeting.)

AND

1b. Moved by _____ and seconded by _____ that the Commission, authorizes publication of its intent to amend Section 670.5, Title 14, CCR, to add the northern spotted owl to the list of animals of California declared to be threatened.

OR

2. Moved by _____ and seconded by _____ that the Commission, pursuant to Section 2075.5 of the Fish and Game Code, finds that the information contained in the petition and other information before the Commission **does not warrant** listing the northern spotted owl as an endangered or threatened species under the California Endangered Species Act. (Note: Findings will be adopted at a future meeting.)

28. TOWNSEND'S BIG-EARED BAT PETITION

Today's Item **Information** ☐ **Action** ☒

Consider whether to add Townsend's big-eared bat to the list of threatened or endangered species and, if FGC determines that listing may be warranted, authorize staff to publish notice of its intent to amend Section 670.5, Title 14, CCR.

Summary of Previous/Future Actions

• Received petition	Nov 1, 2012
• FGC transmits petition to DFW	Nov 9, 2012
• Published notice of receipt of petition	Nov 30, 2012
• Approved DFW request for 30-day extension	Dec 12, 2012; San Diego
• Received DFW's evaluation and recommendation	May 22, 2013; Los Angeles
• Accepted petition for candidacy	Jun 26, 2013; Sacramento
• Approved DFW request for six month extension	Dec 3, 2014; Van Nuys
• Receive DFW's status review report	Jun 22-23, 2016; Bakersfield
• **Today take action to determine if listing is warranted**	**Aug 24-25, 2016; Folsom**

Background

A petition to list Townsend's big eared bat was received in Nov 2012 (Exhibit 1). DFW submitted a status review report to FGC at the Jun 2016 meeting (Exhibit 2). The status report represents DFW's final written review of the status of the Townsend's big-eared bat and is based upon the best scientific information available to DFW.

Significant Public Comments

1. Keith A. Hamm, representing Green Diamond Resource Company (Green Diamond), supports DFW's recommendation that listing the Townsend's big-eared bat as a threatened or endangered species is not warranted. Green Diamond believes that its current practices implemented through state timber harvesting plans protect potential roosting habitat, reduce risk of take and prevent significant adverse impacts to the Townsend's big-eared bat.

Recommendation

FGC staff: Staff agrees with DFW findings and supports DFW recommendation to not list the Townsend's big-eared bat as a threatened or endangered species.

DFW: DFW recommends that listing of Townsend's big-eared bat as threatened or endangered is not warranted.

Exhibits

1. Petition
2. DFW's status review report (see: http://www.fgc.ca.gov/CESA/index.aspx#tbeb)

3. Email from Green Diamond, received Aug 11, 2016
4. DFW presentation

Motion/Direction

1a. Moved by _____ and seconded by _____ that the Commission, pursuant to Section 2075.5 of the Fish and Game Code, finds the information contained in the petition to list Townsend's big-eared bat (*Corynorhinus townsendii),* and the other information in the record before the Commission **warrants** listing Townsend's big-eared bat as a threatened or endangered species under the California Endangered Species Act. (Note: Findings will be adopted at a future meeting.)

AND

1b. Moved by _____ and seconded by _____ that the Commission, authorizes publication of its intent to amend Section 670.5, Title 14, CCR, to add Townsend's big-eared bat to the list of animals of California declared to be threatened or endangered.

OR

2. Moved by _____ and seconded by _____ that the Commission, pursuant to Section 2075.5 of the Fish and Game Code, finds that the information contained in the petition and other information before the Commission **does not warrant** listing Townsend's big-eared bat as an endangered or threatened species under the California Endangered Species Act. (Note: Findings will be adopted at a future meeting.)

29. LIVERMORE TARPLANT PETITION

Today's Item **Information** ☐ **Action** ☒

Consider whether to add Livermore tarplant to the list of endangered species and, if FGC determines that listing may be warranted, authorize staff to publish notice of its intent to amend Section 670.2, Title 14, CCR.

Summary of Previous/Future Actions

• Received petition	Aug 26, 2014
• FGC transmits petition to DFW	Aug 28, 2014
• Published notice of receipt of petition	Sep 12, 2014
• DFW requested 30-day extension for evaluation	Nov 24, 2014
• Received DFW's evaluation and recommendation	Feb 11-12, 2015; Sacramento
• Accepted petition for candidacy	Apr 8-9, 2015; Santa Rosa
• Received DFW's status review report	Jun 22-23, 2016; Bakersfield
• **Today take action to determine if listing is warranted**	**Aug 24-25, 2016; Folsom**

Background

A petition to list Livermore tarplant was received in Aug 2014 (Exhibit 1). DFW submitted a status review report to FGC at the Jun 2016 meeting (Exhibit 2). The status report represents DFW's final written review of the status of the Livermore tarplant and is based upon the best scientific information available to DFW.

Significant Public Comments (N/A)

Recommendation

FGC staff: Staff agrees with DFW findings and supports DFW recommendation to list as an endangered species under the CESA.

DFW: DFW recommends that listing Livermore tarplant as endangered is warranted.

Exhibits

1. Petition
2. DFW's status review report
   (see: http://www.fgc.ca.gov/CESA/Livermore_Tarplant/lt_status_review.pdf?DocumentID=126117)
3. DFW presentation

Motion/Direction

1a. Moved by _____ and seconded by _____ that the Commission, pursuant to Section 2075.5 of the Fish and Game Code, finds the information contained in the petition to list Livermore taplant (*Deinandra bacigalupii),* and the other information in the

record before the Commission **warrants** listing Livermore tarplant as an endangered species under the California Endangered Species Act. (Note: Findings will be adopted at a future meeting.)

AND

1b. Moved by _____ and seconded by _____ that the Commission, authorizes publication of its intent to amend Section 670.2, Title 14, CCR, to add Livermore tarplant to the list of plants of California declared to be endangered.

OR

2. Moved by _____ and seconded by _____ that the Commission, pursuant to Section 2075.5 of the Fish and Game Code, finds that the information contained in the petition and other information before the Commission **does not warrant** listing Livermore tarplant as an endangered species under the California Endangered Species Act. (Note: Findings will be adopted at a future meeting.)

30. SPORT FISH

Today's Item **Information** ☐ **Action** ☒

Authorize publication of notice of intent to amend sport fishing regulations.

Summary of Previous/Future Actions

• MRC vetting	Mar 21, 2016; MRC, Los Alamitos
• WRC vetting	May18, 2016; WRC, West Sacramento
• **Today's Notice hearing**	Aug 24-25, 2016; Folsom
• Discussion hearing	Oct 19-20, 2016; Eureka
• Adoption hearing	Dec 7-8, 2016; San Diego

Background

Proposed regulation changes for the 2017 sport fishing season include both DFW and public recommendations in the following changes to current regulations:

Inland

- Sport Fishing Report Card Requirements – Update and clarify;
- Eastman Lake - Removal of existing closures to open the lake to fishing year-round;
- Reptile and Amphibian Nomenclature Updates;
- District General Regulations and Special Fishing Regulations - Updated for clarity;
- San Clemente Lake - Remove special regulation;
- Los Padres Reservoir - Prohibition on take of rainbow trout to reduce take of listed steelhead;
- Las Garzas Creek Tributaries – Make consistent with other regulations in Carmel River watershed;
- Increase Fishing Opportunity for Landlocked (Kokanee) Salmon;
- Clarify New Regulation for Landlocked (Kokanee) Salmon; and
- Minor Editorial Corrections for Clarity.

Marine

- Razor Clam Fishery in Humboldt County – Restore the original management boundary.

Significant Public Comments (N/A)

Recommendation

FGC staff: Support DFW recommendation to authorize publication of notice as proposed.

Committee: The WRC and MRC recommended inclusion of the items identified under "Inland" and "Marine", respectively.

DFW: Authorize publication of notice as proposed.

Exhibits

1. ISOR Inland Sport Fish
2. ISOR Marine Sport Fish
3. DFW memo, received July 22, 2016

Motion/Direction

Moved by _____and seconded by _____ that the Commission authorizes publication of a notice of its intent to amend Sections 1.74, 5.05, 5.40, 5.60, 7.00 and 7.50, and subsections 29.45(a)(1), 43(c), 671(c)(3) and 671(c)(7), Title 14, CCR regarding sport fishing regulations.

31. FALCONRY

Today's Item **Information** ☐ **Action** ☒

Authorize staff to publish notice of intent to amend falconry regulations.

Summary of Previous/Future Actions

- Original Notice hearing — Jun 22-23, 2016; Bakersfield
- **Today's Notice hearing** — **Aug 24-25, 2016; Folsom**
- Discussion hearing — Oct 19-20, 2016; Eureka
- Adoption hearing — Dec 7-8, 2016; San Diego

Background

The falconry regulations were last amended in 2013 to comply with revised to federal regulations which provided a means for states to adopt their own rules governing falconry and allow those states to be delegated authority by the U.S. Fish and Wildlife Service. At that time, it was understood by FGC, DFW, falconers, and the public that the new California regulations would need to be reviewed and updated. Consistent with that understanding, DFW prepared amendments that included numerous changes to bring the regulations more in line with the current practice of falconry in California, to conform to federal guidelines; and issues that were raised by the public in 2013, but due to timing or relevance were delayed until additional analysis could be conducted. In addition, editorial changes are needed for clarity and consistency. Those proposed changes fall into the following categories:

- Changes to bring the regulations in line with current federal guidelines;
- Changes in reporting requirements to require reporting only to the state, rather than both the state and federal agencies;
- Minor amendments suggested by licensed falconers and the public; and
- Numerous editorial corrections, renumbering and referencing

At the Commission's Jun 2016 meeting in Bakersfield, FGC requested five additional changes be considered by DFW for inclusion in an updated ISOR to be presented at the Aug 2016 meeting for a rescheduled Notice hearing. The five additional changes to be considered include:

- Confining inspections to "facilities" instead of "premises";
- Requiring a reasonable attempt to contact the permittee when conducting inspections;
- Providing more specificity about what documentation is required while in the field;
- Clarifying how violations relate to the timing of permit revocation; and
- Clarifying unauthorized/Incidental take of threatened, endangered, candidate, or fully protected species with more specific language.

The changes currently proposed for inclusion are enumerated in the table of proposed changes in Exhibit 1. The table provides the current section or subsection to be amended, the new subsection (renumbered), and the general subject to be changed, edited, or made more

specific and rationale (please refer to the regulatory text attached to the end of Exhibit 1for proposed language and context).

Significant Public Comments

Public comments from falconer representatives were made at the Jun 2016 meeting. No new comments were received following the Jun meeting.

Recommendation

FGC Staff: Staff recommends moving forward with the current suite of proposed changes as they relate to clean-up, including editorial changes and federal conformance issues, consistent with FGC direction in Mar 2013, and the edits as proposed by DFW responding to FGC concerns identified at the Jun 2016 meeting.

DFW: DFW recommends going to notice with changes as proposed in the updated ISOR, which is dated Jul 26, 2016.

Exhibits

1. ISOR, dated Jul 26, 2016
2. DFW memo, received Jul 29, 2016

Motion/Direction

Moved by _____and seconded by _____ that the Commission authorizes publication of a notice of its intent to amend Section 670 regarding falconry regulations.

STAFF SUMMARY FOR AUGUST 24-25, 2016

32. Enhanced Penalties

Today's Item **Information** ☐ **Action** ☒

Authorize publication of notice to establish enhanced penalties for illegal take of game with defined characteristics.

Summary of Previous/Future Actions

- **Today's Notice hearing** **Aug 24-25, 2016; Folsom**
- Adoption hearing Dec 7-8, 2016; San Diego

Background

Fish and Game Code requires FGC to adopt definitions to establish a trophy designation and monetary value based on the size or related characteristics of deer, elk, antelope, bighorn sheep, and wild turkey. Defining trophy characteristics and allowing for imposition of a range of fines commensurate with the egregious nature of the violation, or violations, will potentially provide a deterrent to would be poachers, when informed of a court's new authority to increase the fines and penalties.

Current violations of the Fish and Game Code or Title 14 are predominantly misdemeanors with a penalty of a six month sentence in county jail and up to a $1,000 fine. The courts rarely sentence a convicted poacher to a jail term and are left with no significant authority to assess a greater penalty for many of the most egregious poaching violations. The courts need the authority to assess a penalty for an egregious violation, or multiple violations, compared to other violations that may be spur-of-the-moment bad decisions made by a hunter with no previous poaching convictions.

DFW developed the proposed designations after researching similar standards of nine western states. Interested user groups and non-governmental organizations associated with hunting and wildlife management provided input on the proposed standards. No state has a trophy size designation for wild turkey, therefore, if adopted, California would be the first.

Significant Public Comments (N/A)

Recommendation

FGC staff: Authorize publication of the notice as recommended by DFW.
DFW: Authorize publication of the notice.

Exhibits

1. DFW Memo, received Jul 19, 2016
2. ISOR, received Jul 19, 2016
3. DFW presentation

Motion/Direction

Moved by _____and seconded by _____ that the Commission authorizes publication of a notice of its intent to add Section 748.6, concerning enhancing the penalty for illegal take of game with defined characteristics.

33. UPLAND GAME BIRD DRAWING

Today's Item **Information** ☒ **Action** ☐

Discuss proposed changes to establish an upland game bird special hunt drawing and fee.

Summary of Previous/Future Actions

- Notice hearing Jun 22-23, 2016; Bakersfield
- **Today's Discussion hearing** **Aug 24-25, 2016; Folsom**
- Adoption hearing Oct 19-20, 2016; Crescent City

Background

At this time, big game and waterfowl hunt drawings are conducted through the Automated License Data System (ALDS), which was implemented to centralize all data relating to hunting, fishing, commercial and other licenses and permits, and to collect related fees. Unfortunately, the drawing for Upland Game Bird Special Hunt is still conducted by DFW's Wildlife Branch staff. The proposed regulation establishes an electronic random drawing for Upland Game Bird Special Hunt reservations in the ALDS to provide the public with an up-to-date method to apply for wild bird hunting opportunities.

In addition, an application fee of $5.00 will be established to recover all reasonable administrative and implementation costs of DFW relating to the drawing in accordance with Section 1050, Fish and Game Code. All licenses, tags, permits, reservations or other entitlements purchased via ALDS are subject to a three percent nonrefundable application fee in accordance with existing regulations. The fee is also subject to an annual adjustment in accordance with Section 713, Fish and Game Code.

Notice was published on Jul 15, 2016.

Significant Public Comments (N/A)

Recommendation (N/A)

Exhibits

1. DFW memo (for reference)
2. ISOR (for reference)

Motion/Direction (N/A)

34. DFW LANDS PASS

Today's Item **Information** ☐ **Action** ☒

Certify Addendum to the Final Environmental Document, and adopt proposed changes to amend DFW lands pass regulations.

Summary of Previous/Future Actions

- Notice hearing — Apr 13-14, 2016; Santa Rosa
- Discussion hearing — Jun 22-23, 2016; Bakersfield
- **Today's Adoption hearing — Aug 24-25, 2016; Folsom**

Background

Currently, most funds used to manage lands under the jurisdiction of DFW are derived from a combination of revenue sources generated by the sale of licenses, stamps, passes, and taxes on equipment for hunting, fishing and trapping. Visitors who engage in wildlife or wildflower viewing, recreational hiking, photography, or similar pursuits are required to contribute through the purchase of a Lands Pass for entry on seven DFW properties that participate in the Lands Pass Program. The existing program requires each visitor who is 16 years of age or older, and who does not possess a valid hunting, fishing or trapping license, to purchase a day or annual pass to enter certain DFW properties. School and organized youth groups are exempt from the pass requirement.

In 2012, Section 1745 of the Fish and Game Code was added, which requires DFW to offer purchase of an entry permit for non-consumptive uses of DFW-managed lands if the DFW finds that it is "practical and would be cost effective" to do so. DFW finds that it would be practical and cost effective to add certain wildlife areas and ecological reserves to the properties which require a Lands Pass for visitor entry. This assumes that the benchmark for being "cost effective" is that, at the very least, the program does not cost more to implement than the revenue that it generates.

DFW proposes the following changes to the Lands Pass program:

1. Expansion of the Lands Pass Program;
2. Implementation of recent changes to the Fish and Game Code regarding nonlead ammunition, the age for possessing a junior hunting license, and trail access at Magnesia Springs Ecological Reserve;
3. Improved consistency with federal regulations for the National Wildlife Refuges that are also designated as state wildlife areas;
4. Improved enforceability by rewording the charging sections; and
5. Minor changes to improve clarity and consistency of the regulations for DFW lands.

Since publication of the Notice on May 6, 2016, a small but substantive change was identified as necessary for capture in the Final Statement of Reasons (exhibits 1 and 2). The proposed regulation added Napa-Sonoma Marshes Wildlife Area to the list of properties where a lands pass would be required; however, DFW intended only to include one unit of the property, the

Green Island Unit, in the program. This Unit is proposed to open to public use now that restoration of the site has been completed, and a public access trail has opened. Staff will prepare the required 15-day notice contingent on adoption. An Addendum to the 2012 Final Environmental Document to comply with CEQA is provided for certification today (Exhibit 3).

Significant Public Comments

1. Comment by Newport Bay Conservancy opposing the fee for entry into the Upper Newport Bay Ecological Reserve (UNBER) because the reserve is surrounded by multiple entry points with no marked boundaries, there are shared contributions from the community which provide upkeep and management, and lack of staffing at visitor center.
2. Comment by City of Newport Beach opposing the access fee for UNBER because the location is not conducive for collecting a fee, and the partnership among the Department, City, and County does not warrant such action.

Recommendation

FGC staff: **First, adopt the addendum. Second, adopt the regulatory text with the modification to the reference to Napa-Sonoma Marshes Wildlife Area, which will require an additional 15-day notice.**

Exhibits

1. DFW Memo, received Aug 15, 2016
2. PSOR, received Aug 15, 2016
3. Addendum to the Final Environmental Document, dated Aug 5, 2016
4. Email from Newport Bay Conservancy, received Jun 20, 2016
5. Email from City of Newport Beach, received Jun 29, 2016

Motion/Direction

Moved by_____ and seconded by _____ that based on the record and the findings articulated in the Exhibit 3, the Commission certifies the Addendum to the 2012 Final Environmental Document as indicating the Commission's independent judgment and analysis,

and

Moved by_____ and seconded by _____ that the Commission adopts proposed changes to Section 550 et al., related to Department Lands Pass Program and Land Uses, as recommended by staff.

35. TIDAL WATERS

Today's Item **Information** ☐ **Action** ☒

Adopt proposed changes to definitions for tidal waters and finfish gear restrictions in San Francisco and San Pablo bays.

Summary of Previous/Future Actions

- Notice hearing — Apr 13-14, 2016; Santa Rosa
- Discussion hearing — June 22-23, 2016; Bakersfield
- **Today's Adoption hearing** — **Aug 24-25, 2016; Folsom**

Background

In Dec 2015, FGC adopted changes to sport fish regulations, including a general clean-up to clarify San Francisco and San Pablo bay tidal boundaries. Since adoption, DFW has identified that the regulation change resulted in some unintended consequences related to the definition of San Francisco and San Pablo Bays. The proposed amendment will clarify the meaning of "inland waters" versus "Ocean and San Francisco Bay District" in order to facilitate compliance and enforcement of the gear restrictions and seasons that apply in those waters.

Significant Public Comments (N/A)

No comments have been received.

Recommendation

FGC staff: Accept DFW's recommendations to adopt the proposed regulations.

DFW: Adopt the proposed regulation changes as presented in the ISOR.

Exhibits

1. ISOR

Motion/Direction

Moved by _____ and seconded by _____ that the Commission finds the proposed regulation is consistent with what was initially intended by the 2015 sport fish regulations and therefore determines subsequent CEQA review is not needed beyond the Negative Declaration certified by the Commission on December 10, 2015.

and

Moved by _____ and seconded by _____ that the Commission adopts the proposed regulations regarding sections 1.53 and 27.00, and subsection 28.65(a) as they relate to tidal waters, sloughs and finfish gear restriction for San Francisco and San Pablo bays.

36. UPLAND GAME BIRD HUNTING

Today's Item **Information** ☐ **Action** ☒

Adopt proposed changes to amend upland game bird hunting regulations for the 2016-2017 season.

Summary of Previous/Future Actions

- Notice hearing — Apr 13-14, 2016; Santa Rosa
- Discussion hearing — Jun 22-23, 2016; Bakersfield
- **Today's Adoption hearing — Aug 24-25, 2016; Folsom**

Background

FGC annually adopts regulations to set limits on upland game bird hunting. Five changes are proposed for the 2016-2017 season:

1. Ranges for sage grouse: DFW recommends *no change to permit numbers for sage grouse* in 2016 to allow populations in both Lassen zones and the South Mono Zone more time to recover from habitat loss and drought. Therefore, sage grouse permits would remain at 2015 levels.
2. Delete the current white-tailed ptarmigan hunting zone description and adds a new statewide area allowing ptarmigan to be taken anywhere they are found in California in accordance with the authorized season, bag limit, and possession limit.
3. Require the use of broad head blades which will not pass through a hole seven-eighths inch in diameter on hunting arrows and crossbow bolts for the take of wild turkey.
4. Authorize possession of a firearm during archery-only seasons by hunters authorized to carry concealable firearms via a Carry Concealed Weapon (CCW) permit or peace officer endorsement. Use of a firearm to hunt during archery only seasons is a violation.
5. Suspension or revocation of hunting or fishing privileges for any violation of Section 311 (method of take).

Significant Public Comments

1. Letter from California Bowman Hunters/State Archery Association (CBHSAA) supporting proposed changes for take of turkey, carry of concealed weapons, and revocation or suspension privileges (Exhibit 5).
2. Letter from Center for Biological Diversity opposing proposed ranges for sage grouse hunting and encouraging FGC to adopt zero permits in each of the four zones (Exhibit 6).
3. Over 2,000 form letters opposing sage grouse hunting and encourages FGC to adopt zero permits in each of the four zones (Exhibit 7).

Recommendation

FGC Staff: Adopt the regulations as recommended by DFW

DFW: Adopt the regulations as proposed, including no change to sage grouse permits.

Exhibits

1. PSOR memo, received Aug 15, 2016
2. PSOR, received Aug 15, 2016
3. Negative declaration (CEQA)
4. Email from California Bowman Hunters, received May 26, 2016
5. Email from Center for Biological Diversity, received Aug 3, 2016
6. Form email (Sample), received Aug 2, 2016

Motion/Direction

Moved by _____and seconded by _____ that that based on the record and the findings articulated in the Exhibit 3, the Commission certifies the Negative declaration.

and

Moved by _____and seconded by _____ that the Commission adopts the proposed changes to amend Section 300 et al., concerning upland game bird hunting regulations for the 2016-2017 season.

37. ITEMS OF INTEREST FROM PREVIOUS MEETINGS (NON-MARINE)

Today's Item **Information** ☒ **Action** ☐

This is a standing agenda item to provide FGC with updates on items of interest from previous meetings.

Summary of Previous/Future Actions (N/A)

Background

This item is an opportunity for staff to provide any follow-up information on non-marine topics previously before FGC.

There are no items identified for discussion today.

Significant Public Comments (N/A)

Recommendation (N/A)

Exhibits (N/A)

Motion/Direction (N/A)

38. NON-MARINE PETITIONS AND NON-REGULATORY REQUESTS FROM PREVIOUS MEETINGS

Today's Item **Information** ☐ **Action** ☒

This is a standing agenda item for FGC to act on regulatory petitions and non-regulatory requests from the public that are non-marine in nature. For this meeting:

(A) Action on petitions for regulation change received at the Jun 2016 meeting.
(B) Action on requests for non-regulatory requests received at the Jun 2016 meeting.
(C) Update on pending petitions and non-regulatory requests referred to staff or DFW for review.

Summary of Previous/Future Actions

(A-B)

- FGC receipt of new petitions and requests — Jun 22-23, 2016; Bakersfield
- **Today FGC action on petitions and requests from Jun — Aug 24-25, 2016; Folsom**

(C)

- **Today update and possible action on previous referrals — Aug 24-25, 2016; Folsom**

Background

FGC provides direction regarding requests from the public received by mail and email and during public forum at the previous FGC meeting. Public petitions for regulatory change or requests for non-regulatory action follow a two-meeting cycle to ensure proper review and consideration.

Petitions for regulatory change or requests for non-regulatory action scheduled for consideration today were received at the Jun 2016 meeting in three ways: (1) submitted by the comment deadline and published as tables in the meeting binder; (2) submitted by the late comment deadline and delivered at the meeting; or (3) received during public forum.

A log of public requests, provided in exhibits A1 and B1, capture the regulatory and non-regulatory requests received through the last meeting that are scheduled for FGC action today. The exhibits contain staff recommendations for each request.

(A) Petitions for regulatory change: As of Oct 1, 2015, Section 662, Title 14, requires that any request for FGC to adopt, amend, or repeal a regulation must be submitted on form "FGC 1, Petition to the California Fish and Game Commission for Regulation Change". Petitions received at the previous meeting are scheduled for consideration at the next business meeting, unless the petition is rejected under 10-day staff review as prescribed in subsection 662(b).

Six non-marine petitions received in Jun 2016 are scheduled for FGC action at this meeting (See summary table in Exhibit A1 and individual petitions in Exhibit A2-A7).

(B) Non-regulatory requests: Requests for non-regulatory action received at the previous meeting are scheduled for consideration today.

Five non-regulatory requests received in Jun 2016 are scheduled for action at this meeting (See summary table in Exhibit B1, and individual requests in exhibits B2-B4).

(C) Update on pending petitions and non-regulatory requests: This item is an opportunity for staff to provide an evaluation and recommendation on items previously referred by FGC to DFW or FGC staff for review. FGC may act on any staff recommendations made today.

In Feb 2016 FGC referred a regulatory petition (#2015-004) from Mr. James McCabe, requesting a change to the commercial take, sale, transport, export or import of native reptiles, to DFW for evaluation and recommendation. DFW completed their review and recommends scheduling it for rulemaking in 2017.

Significant Public Comments

1. Petition #2016-008 (Ferrets): A number of comments were received including a petition containing 1376 signatures in support of the regulatory petition to remove domestic ferrets from the prohibited species list. A summary table and examples of the comments received are included as Exhibit A8.
2. Petition #2016-011 (Striped and Black Bass): This petition generated a large number of public comments.

   Opposition to petition: Allied Fishing Groups submitted four documents providing the basis for their opposition to the regulatory petition to change the bag and size limits for striped and black bass in the Sacramento-San Joaquin Delta (Exhibit A9). Exhibits A10, A11, and A12 contain additional information provided by other organizations in opposition to the petition. In addition, nearly 3500 comments were received in opposition to this petition by the public comment deadline. A summary table and examples of those comments are included as ExhibitA15.

   Support for petition: Oakdale Irrigation District and South San Joaquin Irrigation District submitted letters in support of the petition (exhibits A13 andA14) along with four other letters from the public.

Recommendation

(A-B) Adopt staff recommendations for regulatory and non-regulatory requests to (1) deny the request, (2) grant the request, or (3) refer the request to committee, DFW staff, or FGC staff for further evaluation or information gathering. See exhibits A1 and B1 for specific staff recommendations for each request.

(C) Approve DFW recommendation to schedule regulatory petition #2015-004 for the 2017 regulatory calendar.

Exhibits

A1. FGC table of non-marine requests for regulatory change received through Jun 23
A2. Petition #2016-006 from Dennis Haussler, concerning fresh water spearfishing, received Apr 18, 2016
A3. Petition #2016-007 from Michael Newdow concerning take of fish for display, received Apr 29, 2016
A4. Petition #2016-008 from Pat Wright concerning domestic ferrets, received May 26, 2016
A5. Petition #2016-010 from J.D. Mostoufi concerning sage grouse preference points, received Jun 8, 2016

A6. Petition #2016-011 from Coalition for a Sustainable Delta and others concerning black bass and striped bass size and bag limits, received Jun 10, 2016
A7. Petition #2016-012 from American Falconry Conservancy concerning unannounced inspections in falconry regulations, received Jun 17, 2016
A8. Comment summary table and examples of comments received for Petition #2016-008
A9. Documents submitted by Allied Fishing Groups in opposition to Petition #2016-011, received Aug 3, 2016
A10. Letter from Brian Sak in opposition to Petition #2016-11, received Aug 10, 2016
A11. Joint letter from American Sportfishing Association, B.A.S.S., California Sportfishing League, Coastal Conservation Association-California, and others in opposition to Petition #2016-011, received Aug 11, 2016
A12. Public comment letter, list of organizations and individuals opposed to petition and supportive of coalition's alternate plan, and a summary of the Golden Gate Association's 53 Project alternate plan from the Striper, Bass, and Salmon Coalition, received Aug 10, 2016
A13. Two letters, one to FGC and one to Governor Brown, from Oakdale Irrigation District in support of Petition #2016-011, received Jul 29, 2016
A14. Letter from South San Joaquin Irrigation District in support of Petition #2016-011, received Aug 11, 2016
A15. Comment summary table and examples of comments received for Petition #2016-011
B1. FGC table of non-marine requests for non-regulatory action received through Jun 23
B2-B4. Individual requests for non-regulatory action that are summarized in Exhibit B1

Motion/Direction

(A-B) Moved by _____ and seconded by _____ that the Commission adopts the staff recommendations for actions on June 2016 regulatory and non-regulatory requests and approve adding petition 2015-004 on the 2017 regulatory calendar.

OR

Moved by _____ and seconded by _____ that the Commission adopts the staff recommendations for actions on June 2016 regulatory and non-regulatory requests, except for item(s) _____ for which the action is _____, and approve adding petition 2015-004 to the 2017 regulatory calendar.

CALIFORNIA FISH AND GAME COMMISSION
RECEIPT LIST FOR REGULATORY REQUESTS: RECEIVED BY 5 PM ON AUG 11, 2016
Revised 08-12-2016

FGC - California Fish and Game Commission **DFW** - California Department of Fish and Wildlife **WRC** - Wildlife Resources Committee **MRC** - Marine Resources Committee

Tracking No.	Date Received	Response Due (10 work days)	Response Letter to Petitioner	Accept or Reject	Name of Petitioner	Subject of Request	Code or Title 14 Section Number	Short Description	FGC Decision
2016-014	6/29/2016	7/14/2016	7/7/2016	A	Douglas Alton	Falcon and raptor rehabilitation	679(f)(4)	Add falconers and raptor breeders to list of legal recipients for non-releasable birds from rehabilitation facilities.	**Receipt scheduled 8/24-25/2016 Action scheduled 10/19-20/2016**
2016-015	7/11/2016	7/25/2016	8/12/2016	R	Ted Souza	Use of roe; fishing on Smith River		Ban the use of roe for fishing salmon and steelhead. Close Smith River to all fishing.	Rejected under staff review for failure to identify authority.
2016-016	6/27/2016	7/11/2016	7/14/2016	R	Kerry Kriger	American bullfrog	671	Prohibition on importation, transportaion, ales and possession of live American bullfrogs.	Rejected under staff review for failure to identify authority.
2016-017	7/20/2016	8/3/2016	7/25/2016	A	Megan Clenney	Hedgehogs	671	Legalize hedgehogs.	**Receipt scheduled 8/24-25/2016 Action scheduled 10/19-20/2016**

CALIFORNIA FISH AND GAME COMMISSION
RECEIPT LIST FOR NON-REGULATORY REQUESTS: RECEIVED BY 5 PM ON AUGUST 11, 2016
Revised 08-15-2016

FGC - California Fish and Game Commission **DFW** - California Department of Fish and Wildlife **WRC** - Wildlife Resources Committee **MRC** - Marine Resources Committee

Date Received	Name of Petitioner	Subject of Request	Short Description	FGC Decision
7/1/2016	Eric Mills Action for Animals	Live animal food markets	Request to place ban on importation of frogs and turtles for the live animal food market on the FGC agenda for discussion and action.	**Receipt scheduled 8/24-25/2016** **Action scheduled 10/19-20/2016**
7/19/2016	Thomas O'Rourke Yurok Tribal Chairman	Commissioner Hostler-Carmesin conflict	Requests FGC address concerns regarding Commissioner Hostler-Carmesin's compliance with the FGC Code of Conduct policy.	**Receipt scheduled 8/24-25/2016** **Action scheduled 10/19-20/2016**
7/21/2016	Inyo County Board of Supervisors	Fish planting in Eastern Sierra	Urges DFW to increase the number and size of fish planted in the Eastern Sierra.	**Receipt scheduled 8/24-25/2016** **Action scheduled 10/19-20/2016**

Tracking Number: (2016-014)

To request a change to regulations under the authority of the California Fish and Game Commission (Commission), you are required to submit this completed form to: California Fish and Game Commission, 1416 Ninth Street, Suite 1320, Sacramento, CA 95814 or via email to FGC@fgc.ca.gov. Note: This form is not intended for listing petitions for threatened or endangered species (see Section 670.1 of Title 14).

Incomplete forms will not be accepted. A petition is incomplete if it is not submitted on this form or fails to contain necessary information in each of the required categories listed on this form (Section I). A petition will be rejected if it does not pertain to issues under the Commission's authority. A petition may be denied if any petition requesting a functionally equivalent regulation change was considered within the previous 12 months and no information or data is being submitted beyond what was previously submitted. If you need help with this form, please contact Commission staff at (916) 653-4899 or FGC@fgc.ca.gov.

SECTION I: Required Information.

Please be succinct. Responses for Section I should not exceed five pages

1. **Person or organization requesting the change (Required)**
   Name of primary contact person: Douglas R Alton
   [redacted]

2. **Rulemaking Authority (Required)** - Reference to the statutory or constitutional authority of the Commission to take the action requested: Fish and Game Code Section 200

3. **Overview (Required)** - Summarize the proposed changes to regulations: Add Falconers and raptor breeders to the list of legal recipients for non-releasable birds from rehab facilities.

4. **Rationale (Required)** - Describe the problem and the reason for the proposed change: presently not allowed to the detriment of the birds and the falconers, breeders.

SECTION II: Optional Information

5. **Date of Petition: June 28, 2016**

6. **Category of Proposed Change**
   ☐ Sport Fishing
   ☐ Commercial Fishing
   ☐ Hunting
   ☒ Other, please specify: Falconry / Rehab.

7. **The proposal is to:** (*To determine section number(s), see current year regulation booklet or https://govt.westlaw.com/calregs*)
   ☒ Amend Title 14 Section(s):679.(f) (4) Possession of Wildlife and Wildlife Rehabilitation
   ☐ Add New Title 14 Section(s): Click here to enter text.
   ☐ Repeal Title 14 Section(s): Click here to enter text.

8. **If the proposal is related to a previously submitted petition that was rejected, specify the tracking number of the previously submitted petition** Click here to enter text.
   Or ☒ Not applicable.

9. **Effective date**: If applicable, identify the desired effective date of the regulation.
   If the proposed change requires immediate implementation, explain the nature of the emergency: Within reason

10. **Supporting documentation:** Identify and attach to the petition any information supporting the proposal including data, reports and other documents: Click here to enter text.

11. **Economic or Fiscal Impacts:** Identify any known impacts of the proposed regulation change on revenues to the California Department of Fish and Wildlife, individuals, businesses, jobs, other state agencies, local agencies, schools, or housing: None

12. **Forms:** If applicable, list any forms to be created, amended or repealed:
    Click here to enter text.

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SECTION 3: FGC Staff Only

Date received: July 5, 2016

FGC staff action:
☒ Accept - complete
☐ Reject - incomplete
☐ Reject - outside scope of FGC authority

Date petitioner was notified of receipt of petition and pending action: July 6, 2016
Tracking Number

Meeting date for FGC consideration: August 24-25, 2016

FGC action:
☐ Denied by FGC
☐ Denied - same as petition _____
Tracking Number
☐ Granted for consideration of regulation change

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~~2016 JUN 35 PM 12: 33~~

2016-017

Tracking Number: (~~Click here to enter~~ text.)

To request a change to regulations under the authority of the California Fish and Game Commission (Commission), you are required to submit this completed form to: California Fish and Game Commission, 1416 Ninth Street, Suite 1320, Sacramento, CA 95814 or via email to FGC@fgc.ca.gov. Note: This form is not intended for listing petitions for threatened or endangered species (see Section 670.1 of Title 14).

Incomplete forms will not be accepted. A petition is incomplete if it is not submitted on this form or fails to contain necessary information in each of the required categories listed on this form (Section I). A petition will be rejected if it does not pertain to issues under the Commission's authority. A petition may be denied if any petition requesting a functionally equivalent regulation change was considered within the previous 12 months and no information or data is being submitted beyond what was previously submitted. If you need help with this form, please contact Commission staff at (916) 653-4899 or FGC@fgc.ca.gov.

SECTION I: Required Information.

Please be succinct. Responses for Section I should not exceed five pages

1. **Person or organization requesting the change (Required)**
   Name of primary contact person: Megan Clenney
   [redacted]

2. **Rulemaking Authority (Required) -** Reference to the statutory or constitutional authority of the Commission to take the action requested: Section 2118 of Fish and Game Code included all species of the order insectivora (shrews, moles, hedgehogs, etc.) illegal to import, transport, posses, or release alive into this state, except under a revocable, nontransferable, permit. The problem is The Department of Fish and Wildlife is authorized to issue permits only to qualified individuals or institutions for limited purposes such as research, public exhibition, or shelter. So there is no way you are legally allowed to own a hedgehog in California as a pet.

3. **Overview (Required) -** Summarize the proposed changes to regulations: Make it legal to have a hedgehog as a California citizen for pet purposes.

4. **Rationale (Required) -** Describe the problem and the reason for the proposed change: The problem is that the current rules make it impossible to own a hedgehog as a pet in California because hedgehogs are not legal to own or posses and permits are not issued for pet purposes. I'd like to change this and make hedgehogs legal so that I and other responsible pet owners will be able to own a hedgehog as a household pet. I understand you are worried about them escaping and becoming pests and breeding, but rats, mice, hamsters, and chinchillas are all allowed and have been considered "pests" by many before. Even if a hedgehog did find a way to escape it would never survive long enough to find a opposite gender hedgehog, breed, and make it through the gestation period of 35 days with California's natural hot climate and predators such as cats, dogs, owls, mountain lions, hawks, ect. They also wouldn't stand a chance against our man-made machines that we use everyday like cars, trucks, motorcycles, buses, etc. They wouldn't even survive long enough to pass on any diseases. Unlike what some people say hedgehogs are not mean and even if they wanted to hurt you they couldn't considering

that unlike the porcupine- which they aren't related to- they have soft flexible quills. They do have teeth but if they did bit they would only cause as much damage as a rat or hamster. If you're still worried about hedgehogs escaping or giving away diseases, then make qualified individuals who want a hedgehog have to get a permit before they are allowed to own one.

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SECTION II: Optional Information

5. **Date of Petition: 7/14/16**

6. **Category of Proposed Change**
   ☐ Sport Fishing
   ☐ Commercial Fishing
   ☐ Hunting
   X Other, please specify: Hedgehogs

7. **The proposal is to:** (*To determine section number(s), see current year regulation booklet or https://govt.westlaw.com/calregs*)
   X Amend Title 14 Section(s): 671
   ☐ Add New Title 14 Section(s): Click here to enter text.
   ☐ Repeal Title 14 Section(s): Click here to enter text.

8. **If the proposal is related to a previously submitted petition that was rejected, specify the tracking number of the previously submitted petition** Click here to enter text.
   Or X Not applicable.

9. **Effective date**: If applicable, identify the desired effective date of the regulation.
   If the proposed change requires immediate implementation, explain the nature of the emergency: Click here to enter text.

10. **Supporting documentation:** Identify and attach to the petition any information supporting the proposal including data, reports and other documents: Click here to enter text.

11. **Economic or Fiscal Impacts:** Identify any known impacts of the proposed regulation change on revenues to the California Department of Fish and Wildlife, individuals, businesses, jobs, other state agencies, local agencies, schools, or housing: If the hedgehog became legal to own and breed in California, legal professional breeders would recognize the consequences that accidentally releasing hedgehogs into the wild would start up. They would start breeding businesses by giving the hedgehogs a safe environment to be raised and sold in, making sure that each hedgehog is getting an educated owner, and decreasing their rate of escape. They would also bring money to the state with this new, legitimate source of revenue.

12. **Forms:** If applicable, list any forms to be created, amended or repealed:

    Click here to enter text.

SECTION 3: FGC Staff Only

Date received: Click here to enter text.

FGC staff action:

- ☒ Accept - complete
- ☐ Reject - incomplete
- ☐ Reject - outside scope of FGC authority

Tracking Number

Date petitioner was notified of receipt of petition and pending action: July 25, 2016

Meeting date for FGC consideration: August 24-25, 2016

FGC action:

- ☐ Denied by FGC
- ☐ Denied - same as petition _____
  Tracking Number
- ☐ Granted for consideration of regulation change

From:	afa@mcn.org
To:	FGC
Cc:	CNRA Office of the Secretary; Wildlife DIRECTOR
Subject:	LIVE ANIMAL FOOD MARKETS
Date:	Friday, July 01, 2016 3:16:41 PM
Attachments:	STATEMENT OF ERIC MILLS.docx

July 1, 2016

Greetings -

LIVE ANIMAL FOOD MARKETS (see attached)

While organizing some materials today, I ran across the attached from 2010.

Since the new commissioners and the Exec. Director are, I presume, relatively unfamiliar with the live animal food markets issue, would you please forward this attachment to them?

And I DO hope that the matter will soon be re-agendized. As you may recall, former Resources Secretary Huey Johnson wrote twice in support of a ban on the importation of non-native frogs and turtles for human consumption, as did more than 3,000 other organizations, legislators and members of a concerned public. Surely the Department has the authority to stop these harmful imports. (That's why they're called "permits," right?)

Cheers,

Eric Mills, coordinator
ACTION FOR ANIMALS

STATEMENT OF ERIC MILLS, COORDINATOR, ACTION FOR ANIMALS TO THE STATE FISH & GAME COMMISSION RE THE PROPOSED BAN ON THE IMPORTATION AND/OR SALE OF LIVE FROGS AND TURTLES FOR THE LIVE ANIMAL FOOD MRKETS - FEBRUARY 3, 2010

Good morning, Commissioners.

Thank you for this opportunity to again address the Commission on the pressing need for a ban on the importation of live frogs and turtles for human consumption, an issue which has been before this body for nearly 15 years now. Indeed, the Commission in 2006 instructed the Department to go to notice, but the Department failed to act. It's way past time for action.

As has been well documented, these non-native animals are often bought and released into California waters, where they pose major problems for our native wildlife. On a personal note, on New Year's Day I was walking around Oakland's Lake Merritt, the nation's first in-city wildlife refuge, when I spotted a dead red-eared slider floating in the water. It was very likely the result of a religious "animal liberation" ceremony, an ongoing problem there and elsewhere, as described to in a January 12, 2010 letter sent to the Commission by Dr. Richard Bailey, Director of the Lake Merritt Institute. Dr. Bailey also favors the proposed ban.

Some 25 necropsies on turtles and frogs purchased from markets in Sacramento, Oakland, San Francisco and Los Angeles have shown these animals to be seriously diseased and/or parasitized. It is **illegal** to sell such products for human consumption, yet the practice continues unabated. DFG and health codes require that diseased or parasitized animals be destroyed at the border, or returned to the point of origin, yet are seldom if ever enforced.

Back in 1996, the Department's Steve Taylor (now retired), who issued the market permits for many years, told me that he administratively selected the red-eared sliders and the spiny soft-shells as the two turtle species for which the Department would issue permits. (Was this even legal?) It should be just as easy to administratively ban the importation, no?

Adding a sense of urgency to the matter is a scientific study which appeared in the January 2009 journal, BIOLOGICAL DIVERSITY, entitled, "Magnitude of the US trade in amphibians and presence of *Batrachochytrium dendrobatidis* and ranavirus infection in imported North American bullfrogs (*Rana catesbeiana).* (Abstract attached. I have submitted this study to the Commission previously.) The five researchers involved (one from USFWS here in Sacramento, another from UC Santa Cruz) documented that some TWO MILLION American bullfrogs are imported annually into California for the live markets. **OF THE FROGS NECROPSIED, 62% TESTED POSITIVE FOR THE DREADED CHYTRID FUNGUS, A PRIME SUSPECT IN THE**

EXTINCTIONS OF DOZENS OF AMPHIBIAN SPECIES AROUND THE WORLD IN THE PAST 15 YEARS. That fact alone should be enough reason to stop this commercial trade.

As is well known, the non-natives displace and prey upon our native wildlife. Threatened species such as the red-legged frog and the western pond turtle are put at great risk by the exotics. Bullfrogs are known to eat baby ducks and the fry of gamefish, which should concern all sporting organizations, as well as the environmental community. Both Oregon and Washington have either banned or severely restricted these species, and Florida only last year stopped the commercial trade in softshell turtles, in light of local depletions. California should follow suit.

I've seen the January 13, 2010 letter which the Commission sent to the Governor regarding the untenable furloughs thrust upon our beleaguered game wardens, and I share your concerns. That said, I hope you will not use the state budget as an excuse NOT to adopt the needed regulations to ban the turtle/frog importation and sales. According to the Governor's office, the furloughs are scheduled to end in June. It's critical that the regulatory ban be put in place as soon as possible. If we delay until all the human problems are resolved, all the animals will be extinct, the environment uninhabitable. I'm convinced that a total ban will not only resolve the problem, but will actually EASE the wardens' workload, not add to. The recent letter sent to the Commission by the California Fish and Game Wardens' Association seems to concur.

In sum, the mandate of the Commission and the Department of Fish and Game is to protect the state's natural resources, irreplaceable treasures belonging to all Californians. Please, no further delay--the issue is urgent. There's consensus that only a ban on the importation and sale of these non-native species will resolve the problem.

Thank you for your consideration.

Sincerely,

Eric Mills, coordinator

attachments

YUROK TRIBE

190 Klamath Boulevard • Post Office Box 1027 • Klamath, CA 95548

Sent via electronic mail

July 19, 2016

President Eric Sklar
California Fish and Game Commission
P.O. Box 944209
Sacramento, CA 94244-2090

Re: Tribal Committee Chair Jacque Hostler-Carmesin

Aiy-ye-kwee' President Sklar and Commissioners,

The purpose of this letter is to continue the conversation regarding the Yurok Tribe's concerns about the California Fish and Game Commission's ("Commission") Tribal Committee Chair, Commissioner Jacque Hostler-Carmesin.

On June 22, 2016, I presented to you a summary of the Yurok Tribe's concerns regarding the Tribal Committee Chair. Although the Commission made a point to clarify that they are not able to ask questions for items presented during the public forum, members of the commission did provide limited response to our genuine concerns. You, President Sklar, said that you thought our concerns were "inappropriate."

To be clear, the Yurok Tribe raised concerns Commissioner Hostler-Carmesin's work on the Commission with respect to the Commission's Code of Conduct – which is separate and distinct from the Commission's Conflict of Interest Code. As you know, the Commission adopted a Code of Conduct Policy in March of 2013 which states, in part, that "a Commissioner shall conduct his or her affairs in an open, objective, and impartial manner, free of undue influence and the abuse of power and authority." Once again, the Yurok Tribe respectfully requests that the Commission address our concerns pursuant to relevant Code of Conduct grievance and investigation processes. Yurok Tribal Council, unfortunately, has continuing concerns about the current Committee Chair's ability to practice unbiased leadership. The Yurok Tribe recognizes the value of having someone with tribal experience fill the Tribal Committee Chair position. However, there have been actions taken by Commissioner Hostler-Carmesin when the Yurok Tribe has felt excluded from the Commission's business related to matters that impact the Tribe.

We appreciate your consideration of our request. If you have any questions, please contact the Office of Tribal Attorney at 707-482-1350.

Sincerely,

Thomas P. O'Rourke, Sr.
Chairman

Cc: Valerie Termini, Executive Director California Fish and Game Commission

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BOARD OF SUPERVISORS
COUNTY OF INYO

P. O. DRAWER N • INDEPENDENCE, CALIFORNIA 93526
TELEPHONE (760) 878-0373
e-mail: kcarunchio@inyocounty.us

MLS

July 13, 2016

Charlton Bonham, Director
California Department of Fish and Wildlife
1416 9th Street, 12th Floor
Sacramento, CA 95814
director@wildlife.ca.gov

California Fish and Game Commission
P. O. Box 944209
Sacramento, CA 95814
fgc@fgc.ca.gov

The Honorable Jerry Brown
Governor, State of California
State Capitol, First Floor
Sacramento, CA 95814

Gentlemen:

The Inyo County Board of Supervisors strongly urges the California Department of Fish and Wildlife to increase the number and size of fish planted in the Eastern Sierra. Over the past several years the region has seen a decrease in the numbers and size of fish planted which has directly impacted the fishing opportunities available to our visiting anglers.

As a tourist-based economy, Inyo County depends heavily on our fishing resources for our economic wellbeing. Department statistic show that in the past 10 years sales of resident fishing licenses have declined from 1,245,007 to 985,986, which correlates to a significant reduction in State revenues. In addition to the diminishing numbers of fish, the size of the fish planted have also continued to be smaller. The competition with other States for California fresh water anglers' tourist dollars is becoming more and more diverse as other States look to the millions of California residents to improve their economies. It is important to ensure that our fresh water angling opportunities maintain the necessary ingredients to keep our fishing opportunities viable and competitive. The only way to do this is to improve the numbers and size of fish available. Inyo County is a tourist destination for millions of southern California residents, as well as visitors from around the globe. As a primary fishing destination for many of our visitors, it is imperative that those who pay for a State fishing license see a compensatory result for their purchase.

While the County recognizes the challenges of running an efficient department within the constraints of diminishing revenues, it is imperative for the Department to protect its fresh water fishing industry which has had a proven positive fiscal impact for our State. Without immediate action to protect this industry, we believe that this vital economic industry for our State and most especially for our small rural county will become non-existent in the future.

Your recognition of the importance of Inyo County's fishing resources to our economic well-being is greatly appreciated and we look forward to improved local hatchery operations and in the size and numbers of fish planted in the Eastern Sierra in the very in the near future.

Sincerely,

Jeff Griffiths, Chairperson
Inyo County Board of Supervisors

MEMBERS OF THE BOARD • DAN TOTHEROH • JEFF GRIFFITHS • RICK PUCCI • MARK TILLEMANS • MATT KINGSLEY
KEVIN D. CARUNCHIO • *Clerk of the Board*

Cassidy Hurabiell Trader
[redacted]

3-19-16

Fish and Game Commission,

We understand that you are reluctant to allow hedgehogs as legal pets in the state of California because past events show that hedgehogs can be involved in the destruction of native species. However, with certain restrictions and regulations, hedgehogs can be responsibly managed, if in the right care and environment. Hedgehogs are only harmful to protected or native animals when exposed to the outside world, and hedgehogs are pets meant to be kept away from the outdoors. If hedgehogs are never outside they can't be harming natural species. Having the owner sign a paper, agreeing to keep their hedgehog inside to the fullest of their abilities, can ensure strict rules. If the hedgehog does get out, then the owner has to pay a certain amount of money to the government of California, or Fish and Game Commission. If Fish and Game Commission is not entirely involved with the legality of hedgehogs, then please contact me, and let me know if there are any other organizations that we should talk to.

Sincerely, Cassidy

[redacted]

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THE SPORTFISHING CONSERVANCY

July 6, 2016

Eric Sklar, President
California Fish and Game Commission
1416 Ninth Street, Suite 1320
Sacramento, CA 95814

President Sklar and Commissioners:

The Sportfishing Conservancy (TSC) is deeply concerned about the status of California's natural resources. In most instances the deciding factor in the health of these resources can be traced back to how they are managed. Accordingly, TSC makes it a point to stay informed and closely monitors not only the California Fish and Game Commission meetings, but its Marine Resource Committee, Wildlife Resource Committee and the newly formed Tribal Committee meetings as well.

At this past Commission meeting in Bakersfield, during testimony at the public forum, one person pointedly suggested that Commissioner Hostler-Carmesin showed a conflict of interest while serving in her capacity on the Commission. I want to be quite specific in saying that in all of our extensive experience both at Commission meetings and at Committee meetings, nothing could be further from the truth. Commissioner Hostler-Carmesin has gone to great lengths at being prepared and in hearing all sides of each issue before her. Importantly, in all of our experience at no time have we witnessed any action that might unduly influence the outcome of proceedings in front of her. At all times she has conducted herself above board and has presented a model of fairness and objectivity. Commissioner Hostler-Carmesin has done a stellar job and on behalf of The Sportfishing Conservancy, I am happy to point that out.

Sincerely,

Tom Raftis

President

119 N. Milpas Street, Suite C
Santa Barbara, CA 93103

200 Nieto Avenue, Suite 207
Long Beach, CA 90803
(805) 895-3000 or (714) 686-6548

1365 Glen Haven Drive
Merritt Island, FL 32952

State Water Bottom Lease M-654-03 Legal Description

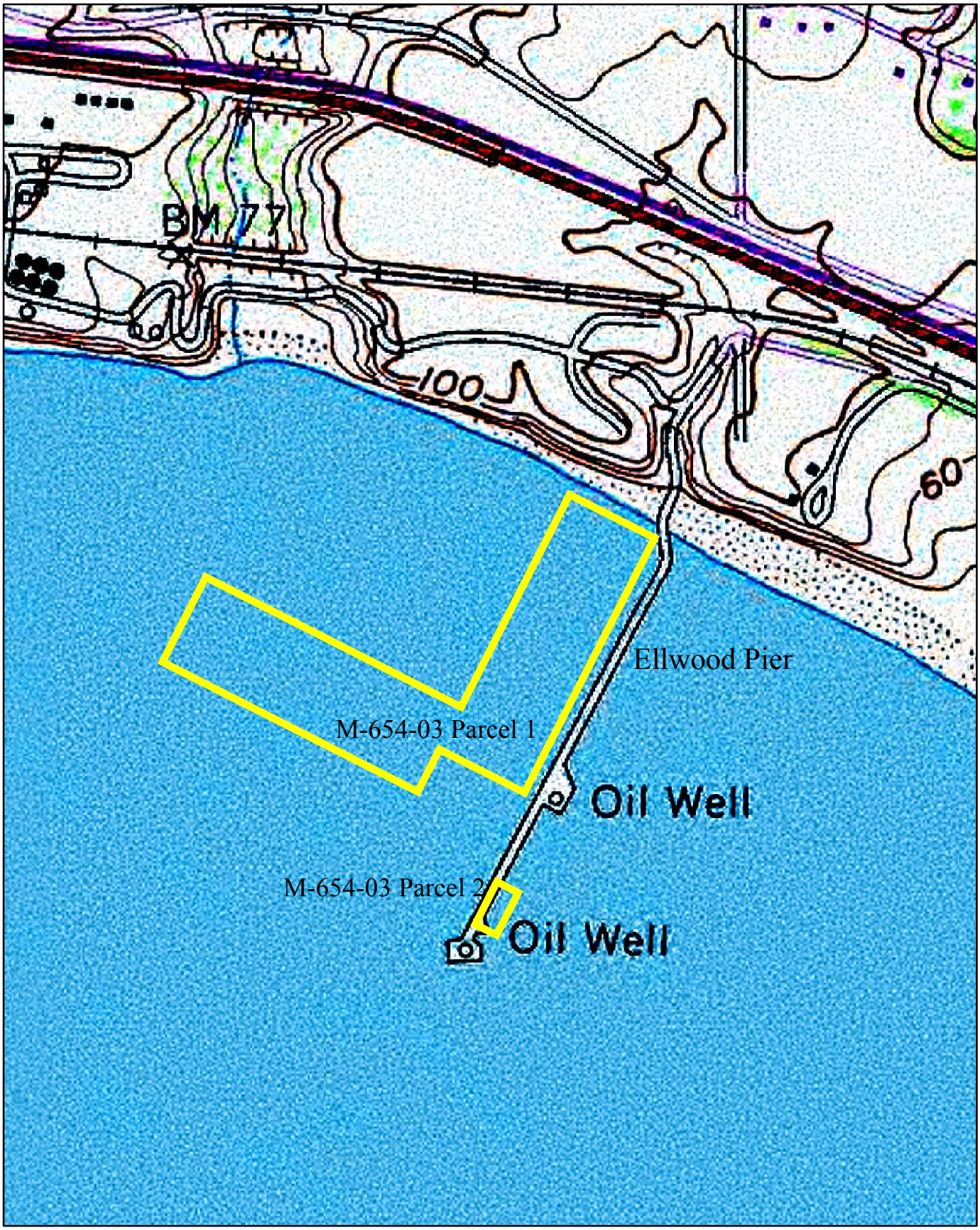
All that area of state water bottoms lying within the Santa Barbara Channel (Santa Barbara County), State of California, consisting of two (2) parcels of water bottom lying adjacent to the Ellwood Pier near Ellwood, Santa Barbara County, as shown on the Dos Pueblos Canyon Quadrangle, California, 7-1/2 minute series (topographic) United States Department of Interior, Geological Survey, ranging in depth from 3.05-10.6 meters (10-35 feet), and being more particularly described as follows:

Parcel 1 (of two parcels)
Beginning at a point 1,617 feet from the base, which is the new end of Ellwood Pier, located at approximately 34° 25' 56" North Latitude, 119° 55' 27" West Longitude; thence N 61° 50' W 418 feet, thence South 28° 10' West 209 feet, thence North 61° 51' West 1,254 feet; thence North 28°10' East 418 feet; thence South 61° 50' East 1,254 feet; thence North 28° 10' East 1,045 feet; thence South 61° 50' East 418 feet; thence South 28° 10' West 1,254 feet along the alignment of and contiguous to, the Ellwood Pier to the point of beginning, containing twenty-four (24) acres more or less.

Parcel 2 (of two parcels)
Beginning at a point which is approximately 393 feet southwesterly from the end of the Ellwood Pier located at approximately 34°25' North Latitude, 119° 55' 23" West Latitude along the old pier alignment South 28° 10' West 209 feet, thence South 61° 50' East 104.5 feet, thence North 28° 10' East 209 feet, thence North 61° 50' West 104.5 to the point of beginning, containing one (1) acre more or less. All bearings true.

These parcels (1 and 2), containing 25 acres more or less, together comprise Aquaculture Lease M-654-03 (Exhibit 1).

State Water Bottom Lease M-654-03
Santa Barbara, CA



N

0 0.1 0.2 0.4 Miles

CA Dept. Fish and Game

Coordinate system:
NAD 1983 California Teale Albers
Coordinates displayed in Decimal Degrees

January, 2016

Fish and Game Commission

P. O. Box 944209

Sacramento, CA 94244-2090

Cc: Kirsten.ramey@wildlife.ca.gov

RE: Neushul Mariculture, Inc. Lease site M-654-03

Dear Fish and Game Commission,

I would like to transfer Lease site M-654-3 to Daniel Marquez's company, Pharmasea, LLC. Would you please add this item to the agenda for consideration at the next Commisson meeting.

Sincerely,

Devon Harger

Neushul Mariculture, Inc.

[redacted]

FORM A

State Of California Department Of Fish And Game Application For Lease Of State Water Bottoms For Aquaculture

Applicant Name: Daniel E Marquez

Phone No. [redacted]

Address: [redacted]

Aquaculture Registration No _____

Expiration Date _____

Species of plant or animals to be cultured:

To whom it may concern,

Please refer to M-654-03 aquaculture lease. This is for name transfer of above lease from Neushul Mariculture Inc to PharmerSea LLC. I also agree to negotiate escrow conditions.

Thank You

Application is hereby made to the Fish and Game Commission of the State of California for a lease of State water bottoms in the area described in the attached exhibit entitled "Exhibit A-Legal Description", and as shown on the map attached hereto marked "Exhibit B". Each exhibit bears the name of this applicant. Such lease will be for the purpose of aquaculture involving the species designated above. In support of this application, the applicant hereby submits the following explanation of the type of operation and cultural practices to be employed:

A. Purpose of operation - research and development or production

B. Plan of development and proposed production schedule – 5 year plan

C. Type of cultural method(s) to be employed: bottom, long line, buoyed habitats, etc.

D. Department of Health Services growing water classification: approved, conditionally approved, prohibited, restricted or unclassified

(Attach additional sheets for detailed explanation)

Date: 8-2-16

Signed: [signature]

Print Name: Daniel E. Marquez

(See instructions on the back)

State of California – Department of Fish and Wildlife
2016 AQUACULTURE REGISTRATION APPLICATION
DFW 750 (REV. 10/30/15)

VALID JANUARY 1, 2016 THROUGH DECEMBER 31, 2016. If issued after January 1, valid on date issued.
(Fee includes a nonrefundable three percent (3%) application fee, not to exceed $7.50)

- [x] NEW – FEE $827.50
- [ ] NEW – ADDITIONAL FACILITY (NO FEE)
- [ ] RENEWAL – FEE $520.00 + $622.50 SURCHARGE FEE IF APPLICABLE
- [ ] RENEWAL – ADDITIONAL FACILITY (NO FEE)
- [ ] CHECK HERE IF MAILING OR FACILITY ADDRESS CHANGED

CDFW USE ONLY
REGISTRATION NUMBER

SEE INSTRUCTIONS ON REVERSE. TYPE OR PRINT CLEARLY.

OWNER'S FIRST NAME	M.I	LAST NAME	[redacted] ROM ALDS ISSUED LICENSE)
Daniel	E	Marquez	

BUSINESS NAME	FACILITY NAME *(if different from business name)*	DATE OF BIRTH
PharmerSea LLC		[redacted]

[redacted]	BUSINESS TELEPHONE [redacted]	STATE LEASE NUMBER M-654-03

CITY	STATE	ZIP CODE	COUNTY	E-MAIL ADDRESS *(Voluntary)*
Goleta	CA	93117	Santa Barbara	[redacted]

FACILITY ADDRESS/LOCATION	CITY	STATE	ZIP CODE
Santa Barbara Channel (Santa Barbara County)	Goleta	CA	93117

ATTENTION APPLICANTS [x] Check here if you wish the Department to include your business name, business address, and business telephone number on the list of aquaculturists released to the public.

BUSINESS CONDUCTED AT YOUR FACILITY *(Circle the letter for each type.)*

- [ ] A – REARS TROUT FOR SALE
- [ ] B – REARS WARM WATER FISH FOR SALE
- [ ] C – REARS MINNOWS FOR SALE
- [ ] D – REARS FROGS FOR SALE
- [ ] E – ALLOWS TROUT FISHING BY CUSTOMERS
- [ ] F – ALLOWS WARM WATER FISHING BY CUSTOMERS
- [ ] G – ALLOWS TAKING OF FROGS BY CUSTOMER
- [ ] H – PRIVATE; NON COMMERCIAL
- [ ] I – REARS INVERTEBRATES FOR SALE
- [ ] J – RESEARCH AND DEVELOPMENT
- [ ] K – CONSULTANT
- [x] L – REARS AQUATIC PLANTS
- [ ] M – REARS SALMON/STEELHEAD FOR SALE
- [ ] N – LIVE HAULER
- [ ] O – PROCESSOR
- [ ] P – REARS MARINE FIN FISH FOR SALE

SPECIES REQUESTED: (Check each species.) * Hybrid bass is limited to the specific geographic area defined in Section 204(h), Title 14, of the CCR.

- [ ] Abalone, red (*Haliotis rufescens*)
- [ ] Abalone, green (*Haliotis fulgens*)
- [ ] Bass, smallmouth (*Micropterus dolomieu*)
- [ ] Bass, striped (*Marone saxatilis*)
- [ ] Bass, (hybrids) (*Morone saxatilis*)* Specify strain_____
- [ ] Bass, largemouth (*Micropterus salmoides*)
- [ ] Bluegill (*Lepomis macrochirus*)
- [ ] Bullfrog (*Lithobates catesbeianus*)
- [ ] Catfish, brown bullhead (*Ameiurus nebulosus*)
- [ ] Catfish, channel (*Ictalurus punctatus*)
- [ ] Clam, Pacific geoduck (*Panopea generosa*)
- [ ] Clam, Manila (*Venerupis philippinarum*)
- [ ] Crappie, black (*Pomoxis nigromaculatus*)
- [ ] Crappie, white (*Pomoxis annularis*)
- [ ] Crayfish, signal (*Pacifastacus leniusculus*)
- [ ] Crayfish, red swamp (*Procambarus clarkii*)
- [ ] Croaker, orgmth corvine (*Cynoscion xanthulus*)
- [ ] Drum red (*Sciaenops ocellatus*)
- [ ] Halibut, California (*Paralichthys californicus*)
- [ ] Minnow, Sac blackfish (*Orthodon microlepidotus*)
- [ ] Minnow, carp (*Cyprinus carpio*)
- [ ] Minnow, koi carp (*Cyprinus carpio*)
- [ ] Minnow, fathead (*Pimephales promelas*)
- [ ] Minnow, goldfish (*Carassius auratus*)
- [ ] Minnow, goldfish x carp hybrid (*all spp.*)
- [ ] Minnow golden shiner (Notemigorus cry soleucas)
- [ ] Mosquitofish (*Gambusia spp.*)
- [ ] Mosquitofish, western (*Gambusia affinis*)
- [ ] Mussel, Mediterranean (*Mytilus galloprovincialis*)
- [ ] Oyster, Pacific (*Crassostrea gigas*)
- [ ] Oyster, Kumamoto (*Crassostrea sikamea*)
- [ ] Oyster, Other _____
- [ ] Perch, Sacramento (*Archoplites interruptus*)
- [ ] Prawn, giant freshwater (*Macrobrachium rosenbergii*)
- [ ] Scallop, purple-hinge rock (*Crassodoma gigantea*)
- [ ] Shrimp, Pacific white (*Peneaus vannamei*)
- [ ] Sturgeon, white (*Acipensertransmontanus*)
- [ ] Sunfish, green (*Lepomis cyanellus*)
- [ ] Sunfish, redear (*Lepomis microlophus*)
- Tilapia – specify species: [ ] (*hornorum*) [ ] (*mossambica*)
- [ ] Trout, brook (*salvelinus fontinalis*)
- [ ] Trout, brown (*Oncrhynchus trutta*)
- [ ] Trout, rainbow (*Oncorhynchus mykiss*)
- [x] Algae- specify species Macrocystis pyrifera, Gelidium spp

OTHER SPECIES REQUESTED *(PLEASE PRINT CLEARLY THE COMMON AND GENUS AND SPECIES NAMES AS SHOWN ABOVE.)*

M. Angustifoila, Mintergnigoila and Pelagophycus spp. No longer need Euchema uncinatum (male plants). This was for a graduate student's research paper.

FOR FRESH WATER AQUACULTURE FACILITIES (Complete the following information.)

NEAREST TOWN	ROAD OR HIGHWAY	
TOWNSHIP	RANGE	SECTION

NAME AND DESCRIBE FULLY THE SOURCE FROM WHICH WATER IS OBTAINED AND THE LOCATION AND TYPE OF DIVERSION.

ON THE REVERSE SIDE, DRAW A MAP SHOWING ARRANGEMENT OF PONDS AND POINTS AT WHICH INLET AND OUTLET ARE SCREENED. IF YOU NEED MORE SPACE, ATTACH A SEPARATE SHEET.

FOR SALTWATER AQUACULTURE FACILITIES *(Provide cultivation area location information and indicate whether state-leased or private.)*

BAY OR AREA	LOT NUMBERS OR DESCRIPTION
Santa Barbara Channel	M-654-03

FOR RENEWALS ONLY:

IF YOU MARK B BELOW, PLEASE INCLUDE PAYMENT OF THE REQUIRED SURCHARGE FEE IN ADDITION TO THE REGISTRATION FEE.

I certify under penalty of perjury that my total gross sales of aquaculture products during 2015 were: [x] A. LESS THAN $25,000 [ ] B. AT LEAST $25,000

In the past year, have there been any changes to locations of premises, source of water, or screening of outlet or inlets of the ponds? [ ] YES [x] NO

If you answered yes, describe the changes below:

I certify that I have read, understand, and agree to abide by, all conditions of this registration, the applicable provisions of the FGC, and the regulations promulgated thereto. I certify that I am not currently under any Fish and Wildlife license or permit revocation or suspension, and that there are no other legal or administrative proceedings pending that would disqualify me from obtaining this registration. I agree that if I make any false statement as to any fact required as a prerequisite to the issuance of this registration, the registration is void and will be surrendered where purchased, and I understand that I may be subject to prosecution pursuant to FGC Section 1054 or to other administrative actions pursuant to Section 746, Title 14, of the CCR.

SIGNATURE	TITLE	DATE
x [signature]	COO	8-2-16

FOR DEPARTMENT OF FISH AND WILDLIFE USE ONLY

FACILITY INSPECTED/APPROVED BY	DATE	REGION	LRB ROUTED TO: [ ] FPB [ ] MRD [ ] REGION	ROUTED BY/DATE
REVIEWED BY/DATE	TRANSACTION#	LATE FEE [ ] $153.75	TRANSACTION#	ISSUED BY/DATE

NEW APPLICATION MUST INCLUDE A COPY OF YOUR IDENTIFICATION WITH THIS APPLICATION

PHARMERSEA LLC
[redacted]

1005
16-24/1220 4589
7920704405

DATE 8-3-16

PAY TO THE ORDER OF California Dept. Fish & Wildlife $ 827.50

Eight Hundred Twenty Seven 50/100 DOLLARS

WELLS FARGO
Wells Fargo Bank, N.A.
California
wellsfargo.com

FOR 2016 Aquaculture Registration Application

⑈000000 1005⑈ [redacted]

RECEIVED
AUG 11 2016
Fisheries Branch
CA Dept. of Fish and Wildlife

PHARMERSEA LLC
[redacted]

1004
16-24/1220 4589
7920704405

DATE 8-3-16

PAY TO THE ORDER OF California Dept. Fish & Wildlife $ 500.—

Five Hundred + 00/100 DOLLARS

WELLS FARGO
Wells Fargo Bank, N.A.
California
wellsfargo.com

FOR Lease Application

⑈000000 1004⑈ [redacted]

State of California
Department of Fish and Wildlife

RECEIVED
CALIFORNIA
FISH AND GAME
COMMISSION

2016 AUG -2 PM 2:59

Memorandum

Date: July 27, 2016

To: Valerie Termini
Executive Director
Fish and Wildlife Commission

From: Charlton H. Bonham
Director

Subject: **Agenda Item for the August 24-25, 2016, Fish and Game Commission Meeting Regarding Proposed Transfer of State Water Bottom Lease, M-654-03, Neushul Mariculture, Inc., Santa Barbara**

The Department of Fish and Wildlife (Department) is providing the following comments in regard to a request by Mrs. Devon Harger, Neushul Mariculture, Inc., for Fish and Game Commission (Commission) approval to transfer state water bottom lease M-654-03. The existing lease encompasses 25 acres of state water bottoms along the Santa Barbara coastline and was recently renewed by the Commission on October 7, 2015, for a period of 15 years.

The lease was created in 1980 with the expressed intent to cultivate marine algae for research purposes and has been used for this purpose by Neushul Mariculture, Inc. since its inception. Mrs. Harger is planning her retirement and in January, 2016, submitted written notification to the Commission requesting to transfer the title of lease M-654-03 to Mr. Daniel Marquez, Pharmasea, LLC. There are no proposed changes in the culture methods or species currently approved by the Commission for the lease.

Upon staff review, it was determined that the proposed project is subject to the "Class 1" or "Existing Facilities" categorical exemption pursuant to CEQA Guidelines section 15301 (Cal. Code Regs., tit. 14, § 15301). In general, the Class 1 exemption consists of the leasing of existing facilities, involving negligible or no expansion of use beyond that existing at the time of the lead agency's determination. All provisions of the lease are identical to the original lease, with the only exception being a new lessee. This transfer does not increase, decrease, or change existing operations in any way or allow for any new activities by the new lessee.

The Department recommends approval of the request to transfer state water bottom lease M-654-03, Neushul Mariculture, Inc., to Mr. Daniel Marquez, Pharmasea, LLC.

If you have any questions regarding this item, please contact Dr. Craig Shuman, Regional Manager of the Department's Marine Region, at (805) 568-1246.

Attachments

ec: Department of Fish and Wildlife

Stafford Lehr, Deputy Director
Wildlife and Fisheries Division
Stafford.Lehr@wildlife.ca.gov

Craig Shuman, D.Env., Regional Manager
Marine Region (7)
Craig.Shuman@wildlife.ca.gov

Kirsten Ramey, Senior Environmental
Scientist Supervisor
Marine Region (7)
Kirsten.Ramey@wildlife.ca.gov

Randy Lovell, State Aquaculture
Coordinator
Randy.Lovell@wildlife.ca.gov

RECORDING REQUESTED BY AND)
WHEN RECORDED MAIL TO:)
)
State of California)
Fish and Game State)
1416 Ninth Street, 13th Floor)
Sacramento, CA 95814)

RECEIVED
CALIFORNIA
FISH AND GAME
COMMISSION

2012 AUG -3 PM 1:50

Space Above Line for Recorder's Use Only

LEASE GRANTING THE EXCLUSIVE PRIVILEGE OF CONDUCTING AQUACULTURE AT STATE WATER BOTTOM NO. M-614-01, PARCEL 1

THIS LEASE GRANTING THE EXCLUSIVE PRIVILEGE OF CONDUCTING AQUACULTURE AT STATE WATER BOTTOM NO. M-614-01, Parcel 1 ("Lease") is made and entered into as of the 21 ST day of JUNE, 2012, by and between Grassy Bar Oyster Company, ("Tenant") and the California Fish and Game Commission ("State") with reference to the following facts:

RECITALS

Tenant wishes to lease a State Water Bottom for the purpose of propagating, cultivating, maintaining and harvesting aquatic plants and/or animals in marine waters of the state.

Fish and Game Code section 15400 authorizes the State to lease to any person the exclusive privilege to conduct aquaculture in any designated State Water Bottom if it determines that such lease is in the public interest.

On August 3, 2011, the State authorized renewal of the Lease for State Water Bottom No. M-614-01, Parcel 1 to Tenant.

TERMS AND CONDITIONS

1. **LEASE.** The State hereby grants to Tenant the exclusive privilege to conduct aquaculture upon State Water Bottom No. M-614-01, Parcel 1, subject to the terms and conditions of this Lease.

2. **DESCRIPTION.** This Lease covers that area comprising approximately 143 acres designated as State Water Bottom No. M-614-01, Parcel 1 and shown on the Map and Description attached as **Exhibit A**, which is made a part of this Lease by this reference.

3. **TERM.** This Lease is for a period of 15 years commencing on July 1, 2012 and ending on July 1, 2027, unless renewed or sooner terminated in accordance with its terms.

4. **ANNUAL RENT.** The base rent for the Lease area is $50.00 per acre, calculated to recover Tenant's share of the State's operational costs of the aquaculture

bottom leasing program attributable to shellfish cultivation. The base rent shall be annually adjusted in the following manner:

> The Department of Fish and Game shall determine the change in the "Implicit Price Deflator for State and Local government Purchases of Goods and Services," as published by the U.S. Department of Commerce, for the quarter ending March 31 of the current year compared to the quarter ending March 31 of the previous year. The relative amount of the change shall be multiplied by the amount of the annual rent.

No more frequently than at five-year intervals, the State, in its sole discretion, may recalculate the productivity classification by which the annual rent is calculated for Tenant to reflect changes in the State's operational costs of the aquaculture bottom leasing program attributable to shellfish cultivation. The 10-year average oyster production values fall into three productivity classifications:

- High productivity = >100,000 oysters/acre = $150.00 per acre/year
- Moderate productivity = >20,000-99,000 oysters/acre = $100.00 per acre/year
- Low productivity = >2,000-19,999 oysters/acre = $50.00 per acre/year

Whenever such formula is updated, the annual rent first charged Tenant thereafter shall become the new base rent, subject to the foregoing adjustments for inflation thereafter.

Notice of the annual adjusted rent for the upcoming calendar year shall be given to Tenant by December 1. Until the notice of the annual adjustment is provided, Tenant remains obligated to pay rent at the previous rate. Pursuant to Fish and Game Code section 15407, the annual rent shall be paid within 30 days of the commencement date in Section 3, and within 30 days of each anniversary. Tenant shall remit such rent to: Department of Fish and Game, Fiscal and Administrative Services Branch, 1416 Ninth Street, 12th Floor, Sacramento, California 95814 RE: State Water Bottom Lease No. M-614-01, Parcel 1.

Payment shall be made to the State in lawful money of the United States, provided that, if any payment made by a check, draft or money order is returned to The State due to insufficient funds or otherwise, the State shall have the right, upon written notice to Tenant, to require Tenant to make all subsequent payments in cash, or by cashier's or certified check.

5. LATE PAYMENT. Annual payment of rent is due and payable on the commencement date of this Lease or any anniversary thereafter, and is timely if received by the State within thirty (30) days of such commencement date or anniversary. Any annual payment not received by the State within thirty (30) days of the Lease commencement date or anniversary thereof, regardless of whether the 30th day falls on a Saturday, Sunday or holiday, will be subject to a late penalty consisting of an administrative charge on the late amount, calculated at the rate of five percent (5%) of the amount of the late payment. The parties agree that the late charge represents a fair and reasonable estimate of the costs the State will incur because of late payment. Acceptance of the late charge by the State shall not constitute a waiver of Tenant's default for the overdue amount, nor prevent the State from exercising other

rights and remedies granted under this Lease. Tenant shall pay the late charge as additional rent within 30 days of the due date of the original payment.
Any annual payment not received by the State within ninety (90) days of the commencement date of the Lease or within ninety (90) days of any anniversary thereof shall constitute a breach of Lease, giving rise to the State's remedies as set forth herein.

Annual rent due to the State, if not received by the State within ninety (90) days following the due date, will bear interest from the due date until paid at the rate of ten percent (10%) per year or, if a higher rate is legally permissible, at the highest rate legally permitted. Interest shall not be payable on late charges incurred by Tenant nor on any amounts on which late charges are paid by Tenant to the extent this interest would cause the total interest to be in excess of that legally permitted. Payment of interest shall not excuse nor cure any default by Tenant.

Upon written request by Tenant to the State, demonstrating unusual or extenuating circumstances causing the late payment, the State, in its sole discretion, may waive the late charge.

6. INSURANCE. Tenant shall furnish to the State certificate(s) of insurance stating that Public Liability Insurance is presently in effect for the Tenant and will be in effect throughout the period of this Lease with a combined single liability limit of not less than One Million Dollars ($1,000,000.00) per occurrence, and shall insure against all liability of Tenant and its employees and agents arising out of or in connection with Tenant's use and occupancy of the leased Lease area. The certificate(s) of insurance shall:

(a) Be furnished to the State by the insurance companies, and no such policy shall be cancelable or subject to reduction of coverage or other modification except after 30 days prior written notice to the State.

(b) Include the State of California, its officers, agents, employees and servants are included as additional insured but only insofar as the operations under the Lease are concerned.

(c) Provide that the State shall not be responsible for any premiums or assessments on any policy of insurance hereunder.

(d) Comply with those standards as determined by the State of California, Department of General Services, Office of Risk and Insurance Management.

Tenant agrees that the insurance required herein shall be in effect at all times during the term of this Lease, at the cost of Tenant. In the event said insurance, or any of it, expires or lapses at any time during the term of this Lease, the Tenant agrees to provide, no later than fifteen (15) days after said expiration or lapse, written evidence of required insurance coverage from the date of loss of the earlier insurance and continuing for not less than the remainder of the term of the Lease. Tenant's failure to keep in effect at all times all insurance required by this Lease shall be grounds for termination of the Lease, in addition to any other remedies available to the State.

Where Tenant has any employees, a program of workers' compensation insurance, in an amount and form to meet all applicable requirements of the Labor Code of

California, shall be in place throughout the term of this Lease. Such insurance shall include employer's liability coverage of One Million Dollars ($1,000,000.00) and shall specifically cover all persons providing services by or on behalf of Tenant and shall cover all risks to such persons under this Lease.

7. INDEMNITY AND WAIVER. (For purposes of this Section 7, the term, "State", shall include the Department of Fish and Game as well as the Fish and Game Commission.) Tenant hereby waives all claims and recourse against the State, including the right to contribution for loss or damage to persons or property arising from, or in any way connected with or incident to this Lease, except claims arising from, and only to the extent of the gross negligence or willful misconduct of the State, its officers, agents or employees. Tenant shall notify the Department of Fish and Game Aquaculture Coordinator immediately in case of any serious accident, injury, or casualty on, or potentially related to, the Lease area.

Tenant shall protect, indemnify, hold harmless, and defend the State, its officers, agents or employees, against any and all claims, demands, damages, costs, expenses or liability costs arising out of the use by Tenant, including its employees and agents, of the Lease area, except for liability arising out of, and to the extent of, the gross negligence or willful misconduct of the State, its officers, agents or employees for which the State is found liable by a court of competent jurisdiction.

Should the State be named as a defendant in any claim or legal action arising out of the use by Tenant, including its employees and agents, of the Lease area, upon tender of the claim or action by the State to Tenant, the Tenant shall assume the State's defense and represent the State in such legal action at Tenant's expense, subject to the provisions herein.

In lieu of tender to Tenant of the claim or action against the State, the State may elect to represent itself, in which event, the State shall bear its own litigation costs, expenses and attorney fees. Notwithstanding the foregoing, in the event the State is required to represent itself because of a conflict of interest by counsel representing Tenant, then Tenant, upon demand by the State, shall reimburse the State for the State's litigation costs, expenses and attorney fees. Costs shall include, without limitation, all attorney fees and costs, court costs, if any, costs of mediators or arbitrators, experts and consultants, and any other costs reasonably incurred in response to any claim.

In the event the State is found to be concurrently liable with Tenant by a court of competent jurisdiction for loss or damage to persons or property arising out of the use by Tenant, its employees and agents, of the Lease area, the State and Tenant shall cooperate and use their best efforts to seek and obtain an apportionment of liability from the court and neither party shall request a jury apportionment.

In the event the State is found to be liable for any other wrongful act, for which liability to another is determined by a court of competent jurisdiction for loss or damage to persons or property arising out of the use by Tenant, its employees and agents, of the Lease area, the State shall bear its own litigation costs, expenses and attorney fees. If Tenant has paid for any such costs which are the responsibility of the the State under this provision, the State shall reimburse Tenant at Tenant's request. The State, in its sole discretion, may provide any reimbursement required in the form of a credit against any other money due the State under this Lease.

8. RENEWAL. Tenant may provide written notice to the Department of Fish and Game Aquaculture Coordinator that it is exercising its right to seek renewal of this lease at least 120 days and not more than 364 days (one year) prior to the expiration date in Section 3 pursuant to Fish and Game Code section 15406. So long as Tenant, during the period specified herein, is still actively engaged in aquaculture, as determined by the State, Tenant shall have a prior right to renew for a period of 10 years on terms to be agreed upon between the State, in consultation with the Department of Fish and Game Aquaculture Coordinator, and Tenant. If Tenant fails to give such notice of its right to seek renewal during the period specified herein, the Lease, including any remaining right to seek renewal, shall terminate upon expiration of the then-current term. Moreover, if Tenant is in default on the date of giving such notice, the notice shall be ineffective; if Tenant cures the default and provides a new notice thereafter all within the period specified herein for giving notice, that new notice shall be sufficient to exercise Tenant's prior right to renew. Provided, further, that if on the date a renewal term is to commence Tenant is in default, the renewal term shall not commence and this Lease shall expire at the end of the current term. However, if the State continues negotiating renewal terms after the prior term expires, then the holdover provisions of Section 9 may apply. In no event shall the term of this Lease, or the term of any renewal thereof, extend beyond 25 years each.

9. HOLDOVER. If the Term in Section 3 expires and the Lease has not been renewed pursuant to Section 8, and Tenant remains in possession of the Lease area with State's express or implied permission, Tenant shall become a tenant from month to month only, subject to all the provisions of this Lease except Sections 3, 4 and 5. During this holdover tenancy, a monthly rent representing one-twelfth of the current adjusted annual rent shall be payable on or before the first day of each month. It is expressly understood that a holdover tenancy does not create any right of renewal beyond that provided by Fish and Game Code section 15406 as set forth in Section 8, and that the only purpose of a holdover tenancy is to allow continuity of use of the property while the State continues to negotiate renewal terms or undertakes to issue a new lease to the highest responsible bidder pursuant to Fish and Game Code section 15406, or to allow the holdover tenant time to terminate and remove the aquaculture operation consistent with Fish and Game Code section 15409(a). If either party desires to terminate such holdover tenancy, it shall give the other party not less than thirty days advance written notice of the date of termination.

10. POSSESSORY INTEREST. Tenant understands and acknowledges that, pursuant to Revenue and Taxation Code section 107.6(a), any possessory interest created by this Lease may be subject to the payment of property taxes levied on that possessory interest.

Tenant agrees to pay, before delinquency, all lawful taxes, assessments, license fees and any other charges of any type whatsoever which at any time may be levied by the State, County, City or any tax or assessment-levying body upon any interest in or created by this Lease, or any possessory right which Tenant may have in or to the Lease area covered hereby.

11. USE. Tenant shall use the Lease area only for the purpose stated in this Lease, and such use shall be continuous from commencement of the Lease term until its expiration or termination. Pursuant to Fish and Game Code section 15414, the State

may require the Tenant to submit any periodic reports it deems necessary for the proper administration of State Water Bottom M-614-01, Parcel 1.

The Lease area shall be continuously used by Tenant to conduct aquaculture operations, as aquaculture is defined in Fish and Game Code section 17. Tenant shall not use or permit the Lease area to be used in whole or in part during the term of this Lease for any purpose, other than as set forth herein, without the prior written consent of the State.

The possessory interest herein given to the Tenant does not exclude the general public from the Lease area, and Tenant may not unreasonably impede public access to state waters for purpose of fishing, navigation, commerce or recreation or other public trust values. However, Tenant may limit public access to the extent necessary to avoid damage to the Lease area and the aquatic life culture therein. This Lease is not intended to confer third party beneficiary status to anyone benefiting from the terms of this Lease. The possessory interest is further subject to all valid and existing contracts, leases, licenses, encumbrances, and claims of title which may affect the Lease area.

This Lease provides a tenancy of a temporary nature. The parties to this Lease agree that no Relocation Payment or Relocation Advisory Assistance will be sought or provided in any form as a consequence of this tenancy.

This Lease is of no force or effect until signed by both parties and all approvals are secured. Tenant may not commence performance until such approval has been obtained. Any commencement of performance prior to Lease approval shall be done at the Tenant's own risk. Nothing in this Lease may be waived, modified, amended or discharged except by a writing signed by the State and Tenant and approved by the State in a public meeting.

12. SHELLFISH PRODUCTION IMPROVEMENTS. This lease shall be improved at no less than a minimum rate established by the provisions of Chapter 9 of Division 1 of Title 14, California Code of Regulations (commencing with section 237).

(a) Minimum Planting Requirements: 143 cases of seed-bearing shell (11,440 pounds of seed-bearing shell) or 2,145 bushels of oysters one or more years of age over the allotted lease per year. Improvement by unattached single seed (less than one year old) shall consist of planting an average of 715,000 single seed over the allotted lease per year. Term of improvement shall be four years for seed-bearing shell and three years for oysters one or more years of age. As proof of use, the Tenant shall submit to the Department of Fish and Game Aquaculture Coordinator, a written declaration under penalty of perjury showing the date, quantity of species and acreage in each planting, also including a map showing acres, amounts and dates planted.

(b) Minimum Harvesting Requirements: The annual harvest rate shall be an average rate of 286,000 oysters (over one year of age) over the allotted acreage effective three years after the effective date of the lease. Harvest reports shall be recorded in the form of a receipt in quadruplicate furnished by the Department of Fish and Game. The triplicate copy shall be delivered to the Department of Fish and Game on or before the first and sixteenth day of each month.

13. NO WARRANTY. This Lease is made without warranty of title, condition or fitness of State Water Bottom M-614-01, Parcel 1 for the Tenant's intended purpose or use.

Tenant agrees to accept the Lease area in its presently existing condition, "As Is", and that the State shall not be obligated to make any alterations, additions or betterments thereto except as otherwise provided in the Lease.

14. COMPLIANCE. As a necessary condition for this Lease, Tenant must obtain and maintain all necessary registrations, permits and any other entitlements. Tenant shall comply with all applicable federal, state and local laws, including laws relating to public health and safety, zoning, resource conservation and environmental protection including, but not limited to, the Coastal Zone Act, the Porter-Cologne Water Quality Act, and the California Environmental Quality Act.

Tenant shall comply with all applicable resource management and preservation mandates in the conduct of all activities that impact cultural, natural, or scenic resources. These mandates include, but are not limited to, those found in Public Resources Code sections 5024 and 5097 and the United States Secretary of the Interior's Guidelines for Historic Preservation. Tenant's operations under this Lease shall ensure that the State's goals of ensuring historical preservation and proper cultural, scenic and natural resource management are continually achieved in a manner consistent with applicable law.

15. RECORD KEEPING. The State may require periodic reports from Tenant as the State deems necessary for the proper administration of the State's water bottoms.

Tenant agrees that the Fish and Game Commission, Department of Fish and Game, and the Bureau of State Audits, or their designated representative, shall have the right to review and copy any records and supporting documentation pertaining to the performance of this Lease. Tenant agrees to maintain such records for possible audit for a minimum of three years after final payment. Tenant agrees to allow the auditor(s) prompt access to such records during normal business hours and similarly to allow interviews of any employees who might reasonably have information related to such records. Tenant agrees to include a similar right of the State to audit records and to interview staff in any sublease or contract related to performance of this Lease.

16. WAIVER AND CONSENT. Unless expressly acknowledged by the State in writing, no term, covenant, or condition of this Lease and no default or breach is waived by the acceptance of a late or nonconforming performance. The State's consent for one transaction or event under this Lease is not consent to any subsequent occurrence of the same or any other transaction or event.

17. BREACH. The occurrence of any one of the following shall constitute a breach of this Lease by Tenant: (1) Failure of Tenant to make any annual Lease payment within ninety (90) days of the commencement date of the Lease or within ninety (90) days of any anniversary thereof; (2) Failure of Tenant to make any other payment more than thirty (30) days after such payment is due; (3) abandonment of the Lease area determined after the State has followed the procedures set forth in Civil Code section 1951.3; or (4) any failure by Tenant to comply with laws applicable to the conduct of aquaculture.

Should a threat to public health or safety or to the environment be created or exist on the Lease area, the State may declare an emergency event and, unless an alternative arrangement is preferable in the State's discretion, may enter upon and take possession of the Lease area to remedy the emergency without prior notice and/or demand an assignment of the right to operate the Lease area. Upon entering the Lease area under this Section, the State shall provide immediate notice of such action by hand delivery or fax of its declaration to Tenant. The State may retain possession of the Lease area until the emergency event has been completely and adequately addressed to the State's satisfaction. Where a breach of this Lease has caused or exacerbated the emergency event, or where the Tenant is non-cooperative in allowing or addressing any remedial action necessary because of the emergency event, the State may terminate the Lease. The State shall not be liable in any manner for any inconvenience, disturbance, loss of business, nuisance or other damage arising out of the State's entry in the Lease area as provided herein, except damage resulting from the active negligence or willful misconduct of the State or its authorized representatives.

Any failure by Tenant to observe or perform another provision of this Lease where such failure continues for twenty (20) days after written notice thereof by the State to Tenant; any such notice shall be deemed to be the notice required under Code of Civil Procedure section 1161. However, if the nature of Tenant's breach is such that it cannot reasonably be cured within the twenty (20) day period, Tenant shall not be deemed to be in breach if Tenant shall commence such cure within the twenty (20) day period and thereafter diligently prosecutes such cure to completion.

Neither this Lease nor any interest of Tenant hereunder in the Lease area shall be subject to involuntary assignment or transfer by operation of law in any manner whatsoever, including, without limitation, the following: (a) transfer by testacy or intestacy; (b) assignments or arrangements for the benefit of creditors; (c) levy of a writ of attachment or execution on this Lease; (d) the appointment of a receiver with the authority to take possession of the Lease area in any proceeding or action in which the Tenant is a party; or (e) the filing by or against Tenant of a petition to have Tenant adjudged a bankrupt, or of a petition for reorganization or arrangement under any law relating to bankruptcy. Any such involuntary assignment or transfer by operation of law shall constitute a breach by Tenant and the State shall have the right to elect to take immediate possession of the Lease area, to terminate this Lease and/or invoke other appropriate remedies, in which case this Lease shall not be treated as an asset of Tenant.

Notices of breach shall specify the alleged breach and the applicable Lease provision and shall demand that Tenant perform the provisions of this Lease within the applicable time period or quit the Lease area. No such notice shall be deemed a forfeiture or a termination of this Lease unless the State specifically so states in the notice.

18. REMEDIES. In the event of breach by Tenant, the State shall have the following remedies. These remedies are not exclusive; they are cumulative and are in addition to any other right or remedy of the State at law or in equity.

Collection of Rent: In any case where the State has a cause of action for damages, the State shall have the privilege of splitting the cause to permit the institution of a separate

suit for rent due hereunder, and neither institution of any suit, nor the subsequent entry of judgment shall bar the State from bringing another suit for rent; it being the purpose of this provision to provide that the forbearance on the part of the State in any suit or entry of judgment for any part of the rent reserved under this Lease, to sue for, or to include in, any suit and judgment the rent then due, shall not serve as defense against, nor prejudice a subsequent action for, rent or other obligations due under the Lease. The claims for rent may be regarded by the State, if it so elects, as separate claims capable of being assigned separately.

Continued Performance: At the State's option, Tenant shall continue with its responsibilities under this Lease during any dispute.

Termination of Tenant's Right to Possession: Upon an event of breach of this Lease by Tenant, in addition to any other rights or remedies it may have, the State may give Tenant a three-day notice to cure the breach or quit the Lease area. If Tenant fails to do either, the State may bring a statutory proceeding in unlawful detainer to regain possession of the Lease area. Any notice give by the State pursuant to this Section does not constitute a termination of this Lease unless expressly so declared by the State in the notice. In the absence of written notice from the State, no act by the State, including, but not limited to, acts of maintenance, efforts to re-let and/or assign rights to possession of the Lease area, or the appointment of a receiver on the State's initiative to protect the State's interest under this Lease shall constitute an acceptance of Tenant's surrender of the Lease area, or constitute a termination of this Lease or of Tenant's right to possession of the Lease area. Upon such termination, the State has the right to recover from Tenant: (a) the worth, at the time of the award, of the unpaid rent that had been earned at the time of termination of this Lease; (b) the worth, at the time of the award, of the amount by which the unpaid rent that would have been earned after the date of termination of this Lease until the time of the award exceeds the amount of loss of rent that Tenant proves could have reasonably been avoided; (c) the worth, at the time of the award, of the amount by which the unpaid rent for the balance of the term after the time of the award exceeds the amount of the loss of rent that Tenant proves could have been reasonably avoided; and (d) any other amount necessary to compensate the State for all the detriment proximately caused by Tenant's failure to perform its obligations under this Lease, and costs of clearing the State's title of any interest of Tenant, commissions, attorneys' fees, and any other costs necessary or appropriate to make the Lease area operational by a new Tenant.

"The worth, at the time of the award," as used herein above shall be computed by allowing interest at the lesser of a rate of ten percent (10%) per annum or the maximum legal rate.

Receiver: If Tenant is in breach of this Lease, the State shall have the right to have a receiver appointed to collect rent and conduct Tenant's business or to avail itself of any other pre-judgment remedy. Neither the filing of a petition for the appointment of a receiver nor the appointment itself shall constitute an election by the State to terminate this Lease.

Right to Cure Tenant's Breach: At any time after Tenant commits a breach, the State can cure the breach at Tenant's cost. If the State, at any time by reason of Tenant's breach, pays any sum or does any act that requires the payment of any sum, the sum paid by the State shall be due immediately from Tenant to the State, and if paid at a

later date shall bear interest at the rate of ten percent (10%) per annum from the date the sum is paid by the State until the State is reimbursed by Tenant.

Personal Property of Tenant: In the event any personal property or trade fixtures of Tenant remain at the Lease area after the State has regained possession, that property or those fixtures shall be dealt with in accordance with the provisions for Surrender of the Lease area provided below.

State's Obligations After Breach: The State shall be under no obligation to observe or perform any covenant of this Lease on its part to be observed or performed that accrues after the date of any breach by Tenant. Such nonperformance by the State shall not constitute a termination of Tenant's right to possession nor a constructive eviction.

No Right of Redemption: Tenant hereby waives its rights under California Code of Civil Procedure sections 1174 and 1179 or any present or future law that allows Tenant any right of redemption or relief from forfeiture in the event the State takes possession of the Lease area by reason of any breach by Tenant.

Other Relief: The State shall have such rights and remedies for failure to pay any and all monetary obligations under this Lease as the State would have if Tenant failed to pay rent due. The remedies provided in this Lease are in addition to any other remedies available to the State at law, in equity, by statute, or otherwise.

Attorney's Fees and Costs: Tenant shall reimburse the State on demand for all reasonable attorney fees and expenses incurred by the State as a result of a breach under this Lease, provided that, in any litigation between the parties to this Lease concerning it, the prevailing party shall be entitled to recover court costs, reasonable attorney fees, and other costs reasonably incurred to secure the remedy obtained in the action.

The State shall not be in breach of the performance of any obligation required of it under this Lease unless and until it has failed to perform such obligation for more than thirty (30) days after written notice by Tenant to the State specifying the alleged breach and the applicable Lease provision giving rise to the obligation. However, if the nature of the State's obligation is such that more than thirty (30) days is required for its performance, then the State shall not be deemed in breach if it shall commence performance within such 30-day period and thereafter diligently prosecute the same to completion.

19. ASSIGNMENT AND SUBLEASES. Pursuant to Fish and Game Code section 15412, this Lease may not be assigned, in whole or in part, by Tenant, either voluntarily or by operation of law, and no subleases or other rights may be granted under it by Tenant without the prior written approval of the State, subject to the conditions that it prescribes. At the election of the State, any attempted assignment or subletting without such prior approval of the State shall terminate this Lease.

20. TERMINATION. In the event the Lease area becomes unsuitable for the practical cultivation or harvest of shellfish, or in the event the Tenant becomes unable to continue operating the Lease for aquaculture for reasons beyond Tenant's ability to control, Tenant may terminate the Lease after thirty (30) days written notice to the

State. Tenant may terminate the Lease for any other reason through a written request presented to and approved by the State at a public hearing held for purposes of consideration of Tenant's termination request. Such termination shall be effective thirty (30) days after State approval.

On expiration of or within thirty (30) days after earlier termination of the Lease, Tenant shall surrender the Lease area to the State. Tenant shall remove all of its personal property as well as all man-made material deposited during Tenant's occupancy within the above stated time unless otherwise agreed to in writing.

If Tenant fails to surrender the Lease area to the State on the expiration, or within thirty (30) days after earlier termination of the term as provided by this Section, Tenant shall hold the State harmless for all damages resulting from Tenant's failure to surrender the Lease area.

21. QUITCLAIM. Tenant shall, within ninety (90) days of the expiration or sooner termination of this Lease, execute, acknowledge and deliver to the State in a recordable form provided by the State a release of all rights under this Lease. Should Tenant fail or refuse to deliver such a release, a written notice by the State reciting such failure or refusal shall, from the date of its recordation, be conclusive evidence against Tenant of the expiration or termination of this Lease.

22. TIME OF THE ESSENCE. Time is of the essence of this Lease and any term, covenant or condition in which performance is a factor.

23. CHANGES. Nothing in this Lease may be waived, modified, amended, or discharged except by an instrument in writing signed by Tenant and the State, in consultation with the Department of Fish and Game Aquaculture Coordinator. At its discretion, the Department of Fish and Game may charge Tenant for any and all costs it incurs in any lease amendment requested by Tenant.

24. SEVERABILITY. If a court of competent jurisdiction determines that a Lease provision is legally invalid, illegal or unenforceable, and such decision becomes final, the provision shall be severed and deleted from the Lease and the remainder reasonably interpreted to achieve its intent. Tenant and the State agree to replace such void or unenforceable provision with a valid and enforceable provision that will achieve, to the extent possible, the purpose of the original provision.

25. SITE CLEANUP. Tenant shall provide to the State financial assurance sufficient to ensure that, upon termination or abandonment of this Lease, the Lease area is surrendered in a condition that is in accordance with Section 20, to the satisfaction of the State.

The financial assurance amount shall be calculated based on an analysis of the physical activities and materials necessary to surrender the site in the required condition; the unit costs or costs for third party contracting, for each of the identified activities as applicable; the number of units of these activities; and a contingency amount not to exceed ten percent (10%) of the costs of the activities.

Financial assurances may take the form of surety bonds executed by an admitted surety insurer, as defined in subdivision (a) of section 995.120 of the Code of Civil

Procedure, irrevocable letters of credit, trust funds, or other forms of financial assurances specified by the State which it reasonably determines to be adequate to perform restoration of the site. Personal surety bonds cannot provide financial assurance under this requirement. The financial assurance shall be payable to the State and shall remain in effect throughout the duration of the tenancy under the Lease, and until the State accepts surrender of the Lease area or until replaced by an equivalent financial assurance.

The financial assurance shall be applied by the State to place the Lease area in the condition required for surrender under Section 20, whenever the Tenant fails or refuses to accomplish such activities, and to reimburse the State for all its costs of achieving that condition of the Lease area. Any assets remaining from the financial assurance after all costs to the State, including administrative costs to secure the funds, have been reimbursed therefrom, shall be returned to the Tenant.

26. NON-DISCRIMINATION. In its use of the Lease area, Tenant shall not discriminate against, harass, or allow harassment against any person or class of persons on the basis of race, color, creed, religion, national origin, ancestry, sex, sexual orientation, age, marital status, medical condition or disability. Tenant shall ensure that the evaluation and treatment of its employees and applicants for employment are free from such discrimination and harassment.

Tenant shall comply with the provisions of the Fair Employment and Housing Act (Government Code section12900 et seq.) and the applicable regulations promulgated thereunder (California Code of Regulations, Title 2, section 7285.0 et seq.). Tenant shall give written notice of their obligations under this clause to labor organizations with which they have a collective bargaining or other agreement. Tenant shall include the non-discrimination and compliance provisions of this clause in all contracts to perform work under and/or in connection with this Lease.

Tenant shall be solely responsible for complying with the requirements of the Americans With Disabilities Act of 1990 (P.L. 101-336, commencing at section 12101 of Title 42, United States Code and including Titles I, II and III), the Rehabilitation Act of 1973, and all related regulations, guidelines and amendments to both laws.

27. DRUG-FREE WORKPLACE. Tenant will comply with the requirements of the Drug-Free Workplace Act of 1990, as amended, and will provide a drug-free workplace by taking the following actions:

(a) Publish a statement notifying employees that unlawful manufacture, distribution, dispensation, possession or use of a controlled substance is prohibited and specifying actions to be taken against employees for violations.

(b) Establish a Drug-Free Awareness Program to inform employees about: (1) the dangers of drug abuse in the workplace; (2) the Tenant's policy of maintaining a drug-free workplace; (3) any available counseling, rehabilitation and employee assistance programs; and, (4) penalties that may be imposed upon employees for drug abuse violations.

(c) Provide that every employee who works on the Lease area will: (1) receive a copy of the Tenant's drug-free policy statement; and, (2) agree to abide by the terms of the Tenant's statement as a condition of employment on the Lease area.

Failure to comply with these requirements may result in suspension or termination of this Lease, and Tenant may be ineligible for award of any future State Water Bottom Leases if the State determines that any of the following has occurred: (1) the Tenant has made false certification, or (2) violated the certification by failing to carry out the requirements as noted above.

28. ENTIRE AGREEMENT. This Lease contains the entire agreement between the parties, and an agreement hereafter shall be ineffective to change, modify or discharge it in whole or in part, unless such agreement is in writing and contains the authorized signature of the party against whom enforcement of the change, modification or discharge is sought.

29. CONSTRUCTION. This Lease shall be governed by and construed in accordance with the laws of the State of California. The Section titles in this Lease are inserted only as a matter of convenience and for reference, and in no way define, limit, or describe the scope or intent of this Lease or in any way affect this Lease.

Tenant shall maintain annual registration of its aquaculture facility in accordance with Fish and Game Code sections 15101 and 15103 and shall keep current with all fees and surcharges, including any penalties for late payment of same, required by those statutes.

30. INCORPORATION BY REFERENCE. The provisions of Chapters 1 through 8 of Division 12 of the Fish and Game Code (commencing with section 15000) and the provisions of Chapter 9 of Division 1 of Title 14, California Code of Regulations (commencing with section 235), as may be amended from time to time, are made part of this Lease by this reference. If there is a conflict between any term or condition of this Lease and any of the provisions incorporated by reference in it, the incorporated provisions shall control.

31. CONFLICTS OF INTEREST. Tenant warrants that no official, employee in the state civil service or other appointed state official, or any person associated with same by blood, adoption, marriage, cohabitation, and/or business relationship: (a) has been employed or retained to solicit or aid in the procuring of this Lease; or (b) will be employed in the performance of this Lease without the immediate divulgence of such fact to the State. In the event the State determines that the employment of any such official, employee, associated person, or business entity is not compatible, Tenant shall terminate such employment immediately. For breaches or violations of this Section, the State shall have the right to annul this Lease without liability.

32. EXPATRIATE CORPORATION. Tenant hereby declares that it is not an expatriate corporation or subsidiary of an expatriate corporation, within the meaning of Public Contract Code sections 10286 and 10286.1 and is eligible to contract with the State.

33. NO AGENCY. The Tenant, and the agents and employees of the Tenant in the performance of the Lease, shall act in an independent capacity and not as officers or agents of the State of California.

34. CLOSURE. Neither the State nor the Department of Fish and Game shall have any liability arising from a closure of waters by the Department of Fish and Game Director pursuant to Fish and Game Code section 5654, where aquaculture operations are taking place.

35. NOTICES. Notices to the parties to this Lease shall be made in writing and may be given by delivery in person, by U.S. Mail with postage prepaid, or by receipt-confirmed facsimile to:

FISH AND GAME COMMISSION Executive Director 1416 Ninth Street, 13TH Floor Sacramento, CA 95814 Telephone: (916) 653-4899 Facsimile: (916) 653-5040	Grassy Bar Oyster Company George Trevelyan, Owner 3488 Gilbert Avenue Cayucos, CA 93430 Telephone: (805) 471-9683

Notices shall be deemed given upon delivery to the addressee. Any notice given by facsimile shall also be given to the addressee by U.S. Mail, with postage prepaid. If a notice given by facsimile is delivered to the addressee after 5:00 p.m. Pacific time, or on a Saturday, Sunday or State of California or national holiday, the notice shall be deemed given on the next business day. Either party may change its address for notice purposes by giving written notice to the other party in the manner provided in this Section.

36. SPECIAL CONDITIONS. This lease is for the sole purpose of cultivating Pacific oysters (*Crassostrea gigas*), Quahog clams (*Mercenaria mercenaria*), Manila clams (*Venerupis philippinarum*), Mussels (*Mytilus* spp.), Ghost shrimp (*Neotrypaea* spp.), and Innkeeper worms (*Urechis* spp.). Shellfish cultivation methods for this lease shall be confined to longlines, bags, stakes, barge, and on-bottom culture methods. No other mode of operation or culture method is authorized.

SIGNATURE PAGE

This Lease and any amendment(s) may be executed in counterparts, each of which, when executed and delivered by the State and Tenant, shall be an original and together shall constitute one instrument, with the same force and effect as though all signatures appeared on a single document.

Each signatory attests he or she is duly authorized to execute this Lease on behalf of the principal he or she represents.

Where Tenant is a corporation, the signature of the Tenant on this Lease will be verifying that Tenant is currently qualified to do business in the State of California, as defined in Revenue and Taxation Code section 23101, in order to ensure that all obligations to the State are fulfilled. Both domestic and foreign corporations (those incorporated outside the State of California) must be in good standing in order to be qualified to do business in California.

STATE OF CALIFORNIA

FISH AND GAME COMMISSION

By: _____
SONKE MASTRUP, Executive Director

Date: 6/25/12

LESSEE:

GRASSY BAR OYSTER COMPANY

By: _____
GEORGE TREVELYAN, Owner

Date: 6-14-12

DEPARTMENT OF FISH AND GAME

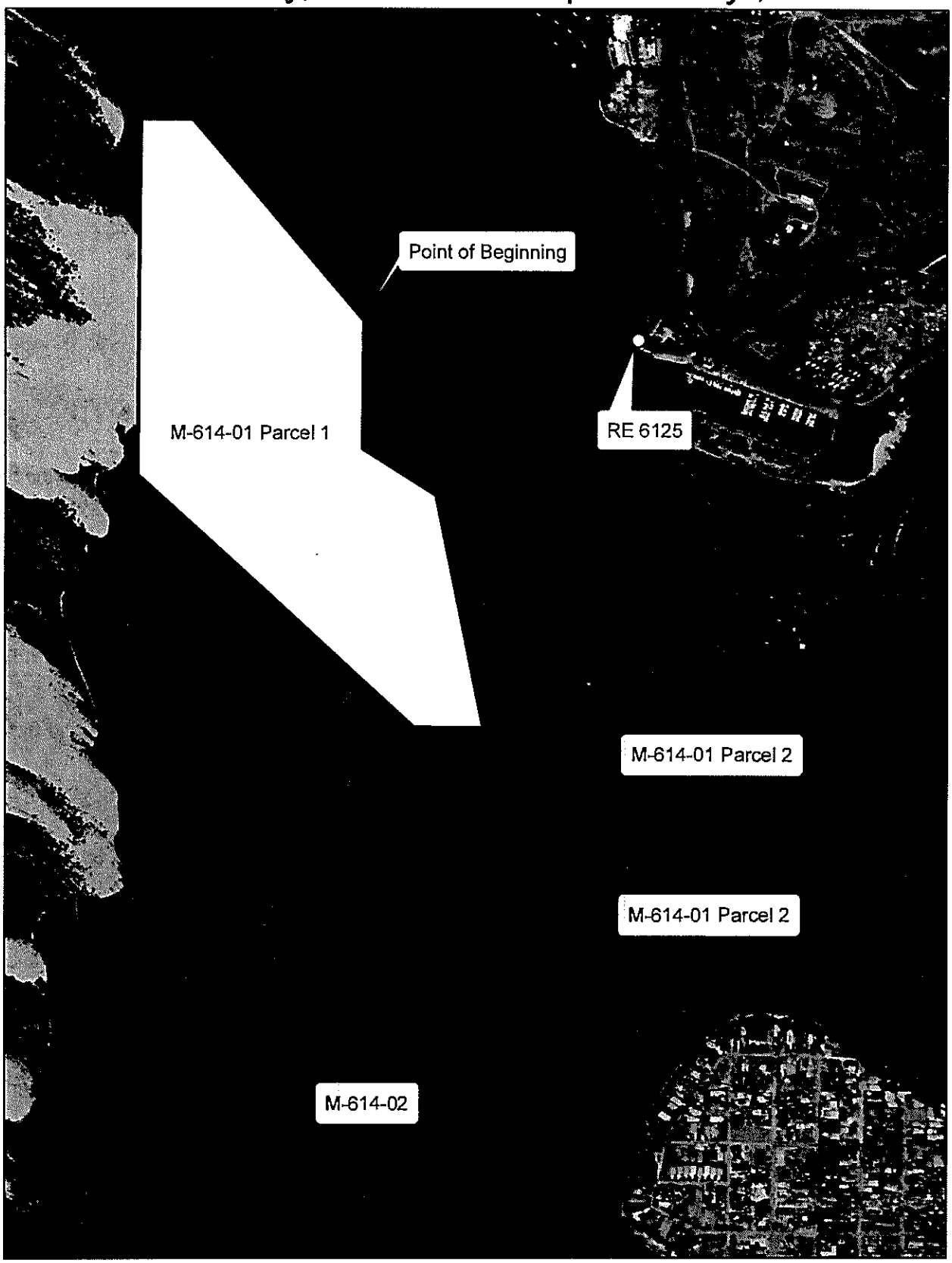
By: _____
HELEN CARRIKER, Deputy Director, Administration

Date: 7/27/12

EXHIBIT A

Official Map and Description of State Water Bottom M-614-01, Parcel 1

Exhibit A
State Water Bottom Lease M-614-01, Parcel 1
Morro Bay, San Luis Obispo County , CA



N

0 0.125 0.25 0.5 Miles

Map prepared by
CA Dept. Fish and Game
7 December 2011

EXHIBIT A

Legal description: Beginning at a point 2,055 feet westerly, on a bearing of N 86° W, of a four-inch brass cap monument labeled "State of California, Department of Natural Resources, Division of Beaches and Parks, RE 6125' near the high water mark on the extreme westerly portion of White Point at 35° 20'49.83 N, 120° 50'36.4" W; thence south 975 feet; thence S 58° E, 660 feet; thence S 12° E, 1,800 feet; thence west 525 feet; thence N 48° W, 2,835 feet; thence north 2,700 feet; thence east 390 feet; thence S 32°09'10" E, 1,893.75 feet to the point of beginning.

RECEIVED
CALIFORNIA
FISH AND GAME
COMMISSION

2012 AUG -3 PM 1:50

RECORDING REQUESTED BY AND WHEN RECORDED MAIL TO:

State of California
Fish and Game State
1416 Ninth Street, 13th Floor
Sacramento, CA 95814

Space Above Line for Recorder's Use Only

LEASE GRANTING THE EXCLUSIVE PRIVILEGE OF CONDUCTING AQUACULTURE AT STATE WATER BOTTOM NO. M-614-02

THIS LEASE GRANTING THE EXCLUSIVE PRIVILEGE OF CONDUCTING AQUACULTURE AT STATE WATER BOTTOM NO. M-614-02 ("Lease") is made and entered into as of the 21 ST day of JUNE, 2012, by and between Grassy Bar Oyster Company, ("Tenant") and the California Fish and Game Commission ("State") with reference to the following facts:

RECITALS

Tenant wishes to lease a State Water Bottom for the purpose of propagating, cultivating, maintaining and harvesting aquatic plants and/or animals in marine waters of the state.

Fish and Game Code section 15400 authorizes the State to lease to any person the exclusive privilege to conduct aquaculture in any designated State Water Bottom if it determines that such lease is in the public interest.

On August 3, 2011, the State authorized renewal of the Lease for State Water Bottom No. M-614-02 to Tenant.

TERMS AND CONDITIONS

1. LEASE. The State hereby grants to Tenant the exclusive privilege to conduct aquaculture upon State Water Bottom No. M-614-02, subject to the terms and conditions of this Lease.

2. DESCRIPTION. This Lease covers that area comprising approximately 15 acres designated as State Water Bottom No. M-614-02 and shown on the Map and Description attached as **Exhibit A**, which is made a part of this Lease by this reference.

3. TERM. This Lease is for a period of 15 years commencing on July 1, 2012 and ending on July 1, 2027, unless renewed or sooner terminated in accordance with its terms.

4. ANNUAL RENT. The base rent for the Lease area is $50.00 per acre, calculated to recover Tenant's share of the State's operational costs of the aquaculture

bottom leasing program attributable to shellfish cultivation. The base rent shall be annually adjusted in the following manner:

> The Department of Fish and Game shall determine the change in the "Implicit Price Deflator for State and Local government Purchases of Goods and Services," as published by the U.S. Department of Commerce, for the quarter ending March 31 of the current year compared to the quarter ending March 31 of the previous year. The relative amount of the change shall be multiplied by the amount of the annual rent.

No more frequently than at five-year intervals, the State, in its sole discretion, may recalculate the productivity classification by which the annual rent is calculated for Tenant to reflect changes in the State's operational costs of the aquaculture bottom leasing program attributable to shellfish cultivation. The 10-year average oyster production values fall into three productivity classifications:

- High productivity = >100,000 oysters/acre = $150.00 per acre/year
- Moderate productivity = >20,000-99,000 oysters/acre = $100.00 per acre/year
- Low productivity = >2,000-19,999 oysters/acre = $50.00 per acre/year

Whenever such formula is updated, the annual rent first charged Tenant thereafter shall become the new base rent, subject to the foregoing adjustments for inflation thereafter.

Notice of the annual adjusted rent for the upcoming calendar year shall be given to Tenant by December 1. Until the notice of the annual adjustment is provided, Tenant remains obligated to pay rent at the previous rate. Pursuant to Fish and Game Code section 15407, the annual rent shall be paid within 30 days of the commencement date in Section 3, and within 30 days of each anniversary. Tenant shall remit such rent to: Department of Fish and Game, Fiscal and Administrative Services Branch, 1416 Ninth Street, 12th Floor, Sacramento, California 95814 RE: State Water Bottom Lease No. M-614-02.

Payment shall be made to the State in lawful money of the United States, provided that, if any payment made by a check, draft or money order is returned to The State due to insufficient funds or otherwise, the State shall have the right, upon written notice to Tenant, to require Tenant to make all subsequent payments in cash, or by cashier's or certified check.

5. LATE PAYMENT. Annual payment of rent is due and payable on the commencement date of this Lease or any anniversary thereafter, and is timely if received by the State within thirty (30) days of such commencement date or anniversary. Any annual payment not received by the State within thirty (30) days of the Lease commencement date or anniversary thereof, regardless of whether the 30th day falls on a Saturday, Sunday or holiday, will be subject to a late penalty consisting of an administrative charge on the late amount, calculated at the rate of five percent (5%) of the amount of the late payment. The parties agree that the late charge represents a fair and reasonable estimate of the costs the State will incur because of late payment. Acceptance of the late charge by the State shall not constitute a waiver of Tenant's default for the overdue amount, nor prevent the State from exercising other

rights and remedies granted under this Lease. Tenant shall pay the late charge as additional rent within 30 days of the due date of the original payment.
Any annual payment not received by the State within ninety (90) days of the commencement date of the Lease or within ninety (90) days of any anniversary thereof shall constitute a breach of Lease, giving rise to the State's remedies as set forth herein.

Annual rent due to the State, if not received by the State within ninety (90) days following the due date, will bear interest from the due date until paid at the rate of ten percent (10%) per year or, if a higher rate is legally permissible, at the highest rate legally permitted. Interest shall not be payable on late charges incurred by Tenant nor on any amounts on which late charges are paid by Tenant to the extent this interest would cause the total interest to be in excess of that legally permitted. Payment of interest shall not excuse nor cure any default by Tenant.

Upon written request by Tenant to the State, demonstrating unusual or extenuating circumstances causing the late payment, the State, in its sole discretion, may waive the late charge.

6. INSURANCE. Tenant shall furnish to the State certificate(s) of insurance stating that Public Liability Insurance is presently in effect for the Tenant and will be in effect throughout the period of this Lease with a combined single liability limit of not less than One Million Dollars ($1,000,000.00) per occurrence, and shall insure against all liability of Tenant and its employees and agents arising out of or in connection with Tenant's use and occupancy of the leased Lease area. The certificate(s) of insurance shall:

(a) Be furnished to the State by the insurance companies, and no such policy shall be cancelable or subject to reduction of coverage or other modification except after 30 days prior written notice to the State.

(b) Include the State of California, its officers, agents, employees and servants are included as additional insured but only insofar as the operations under the Lease are concerned.

(c) Provide that the State shall not be responsible for any premiums or assessments on any policy of insurance hereunder.

(d) Comply with those standards as determined by the State of California, Department of General Services, Office of Risk and Insurance Management.

Tenant agrees that the insurance required herein shall be in effect at all times during the term of this Lease, at the cost of Tenant. In the event said insurance, or any of it, expires or lapses at any time during the term of this Lease, the Tenant agrees to provide, no later than fifteen (15) days after said expiration or lapse, written evidence of required insurance coverage from the date of loss of the earlier insurance and continuing for not less than the remainder of the term of the Lease. Tenant's failure to keep in effect at all times all insurance required by this Lease shall be grounds for termination of the Lease, in addition to any other remedies available to the State.

Where Tenant has any employees, a program of workers' compensation insurance, in an amount and form to meet all applicable requirements of the Labor Code of

California, shall be in place throughout the term of this Lease. Such insurance shall include employer's liability coverage of One Million Dollars ($1,000,000.00) and shall specifically cover all persons providing services by or on behalf of Tenant and shall cover all risks to such persons under this Lease.

7. INDEMNITY AND WAIVER. (For purposes of this Section 7, the term, "State", shall include the Department of Fish and Game as well as the Fish and Game Commission.) Tenant hereby waives all claims and recourse against the State, including the right to contribution for loss or damage to persons or property arising from, or in any way connected with or incident to this Lease, except claims arising from, and only to the extent of the gross negligence or willful misconduct of the State, its officers, agents or employees. Tenant shall notify the Department of Fish and Game Aquaculture Coordinator immediately in case of any serious accident, injury, or casualty on, or potentially related to, the Lease area.

Tenant shall protect, indemnify, hold harmless, and defend the State, its officers, agents or employees, against any and all claims, demands, damages, costs, expenses or liability costs arising out of the use by Tenant, including its employees and agents, of the Lease area, except for liability arising out of, and to the extent of, the gross negligence or willful misconduct of the State, its officers, agents or employees for which the State is found liable by a court of competent jurisdiction.

Should the State be named as a defendant in any claim or legal action arising out of the use by Tenant, including its employees and agents, of the Lease area, upon tender of the claim or action by the State to Tenant, the Tenant shall assume the State's defense and represent the State in such legal action at Tenant's expense, subject to the provisions herein.

In lieu of tender to Tenant of the claim or action against the State, the State may elect to represent itself, in which event, the State shall bear its own litigation costs, expenses and attorney fees. Notwithstanding the foregoing, in the event the State is required to represent itself because of a conflict of interest by counsel representing Tenant, then Tenant, upon demand by the State, shall reimburse the State for the State's litigation costs, expenses and attorney fees. Costs shall include, without limitation, all attorney fees and costs, court costs, if any, costs of mediators or arbitrators, experts and consultants, and any other costs reasonably incurred in response to any claim.

In the event the State is found to be concurrently liable with Tenant by a court of competent jurisdiction for loss or damage to persons or property arising out of the use by Tenant, its employees and agents, of the Lease area, the State and Tenant shall cooperate and use their best efforts to seek and obtain an apportionment of liability from the court and neither party shall request a jury apportionment.

In the event the State is found to be liable for any other wrongful act, for which liability to another is determined by a court of competent jurisdiction for loss or damage to persons or property arising out of the use by Tenant, its employees and agents, of the Lease area, the State shall bear its own litigation costs, expenses and attorney fees. If Tenant has paid for any such costs which are the responsibility of the the State under this provision, the State shall reimburse Tenant at Tenant's request. The State, in its sole discretion, may provide any reimbursement required in the form of a credit against any other money due the State under this Lease.

8. RENEWAL. Tenant may provide written notice to the Department of Fish and Game Aquaculture Coordinator that it is exercising its right to seek renewal of this lease at least 120 days and not more than 364 days (one year) prior to the expiration date in Section 3 pursuant to Fish and Game Code section 15406. So long as Tenant, during the period specified herein, is still actively engaged in aquaculture, as determined by the State, Tenant shall have a prior right to renew for a period of 10 years on terms to be agreed upon between the State, in consultation with the Department of Fish and Game Aquaculture Coordinator, and Tenant. If Tenant fails to give such notice of its right to seek renewal during the period specified herein, the Lease, including any remaining right to seek renewal, shall terminate upon expiration of the then-current term. Moreover, if Tenant is in default on the date of giving such notice, the notice shall be ineffective; if Tenant cures the default and provides a new notice thereafter all within the period specified herein for giving notice, that new notice shall be sufficient to exercise Tenant's prior right to renew. Provided, further, that if on the date a renewal term is to commence Tenant is in default, the renewal term shall not commence and this Lease shall expire at the end of the current term. However, if the State continues negotiating renewal terms after the prior term expires, then the holdover provisions of Section 9 may apply. In no event shall the term of this Lease, or the term of any renewal thereof, extend beyond 25 years each.

9. HOLDOVER. If the Term in Section 3 expires and the Lease has not been renewed pursuant to Section 8, and Tenant remains in possession of the Lease area with State's express or implied permission, Tenant shall become a tenant from month to month only, subject to all the provisions of this Lease except Sections 3, 4 and 5. During this holdover tenancy, a monthly rent representing one-twelfth of the current adjusted annual rent shall be payable on or before the first day of each month. It is expressly understood that a holdover tenancy does not create any right of renewal beyond that provided by Fish and Game Code section 15406 as set forth in Section 8, and that the only purpose of a holdover tenancy is to allow continuity of use of the property while the State continues to negotiate renewal terms or undertakes to issue a new lease to the highest responsible bidder pursuant to Fish and Game Code section 15406, or to allow the holdover tenant time to terminate and remove the aquaculture operation consistent with Fish and Game Code section 15409(a). If either party desires to terminate such holdover tenancy, it shall give the other party not less than thirty days advance written notice of the date of termination.

10. POSSESSORY INTEREST. Tenant understands and acknowledges that, pursuant to Revenue and Taxation Code section 107.6(a), any possessory interest created by this Lease may be subject to the payment of property taxes levied on that possessory interest.

Tenant agrees to pay, before delinquency, all lawful taxes, assessments, license fees and any other charges of any type whatsoever which at any time may be levied by the State, County, City or any tax or assessment-levying body upon any interest in or created by this Lease, or any possessory right which Tenant may have in or to the Lease area covered hereby.

11. USE. Tenant shall use the Lease area only for the purpose stated in this Lease, and such use shall be continuous from commencement of the Lease term until its expiration or termination. Pursuant to Fish and Game Code section 15414, the State

may require the Tenant to submit any periodic reports it deems necessary for the proper administration of State Water Bottom M-614-02.

The Lease area shall be continuously used by Tenant to conduct aquaculture operations, as aquaculture is defined in Fish and Game Code section 17. Tenant shall not use or permit the Lease area to be used in whole or in part during the term of this Lease for any purpose, other than as set forth herein, without the prior written consent of the State.

The possessory interest herein given to the Tenant does not exclude the general public from the Lease area, and Tenant may not unreasonably impede public access to state waters for purpose of fishing, navigation, commerce or recreation or other public trust values. However, Tenant may limit public access to the extent necessary to avoid damage to the Lease area and the aquatic life culture therein. This Lease is not intended to confer third party beneficiary status to anyone benefiting from the terms of this Lease. The possessory interest is further subject to all valid and existing contracts, leases, licenses, encumbrances, and claims of title which may affect the Lease area.

This Lease provides a tenancy of a temporary nature. The parties to this Lease agree that no Relocation Payment or Relocation Advisory Assistance will be sought or provided in any form as a consequence of this tenancy.

This Lease is of no force or effect until signed by both parties and all approvals are secured. Tenant may not commence performance until such approval has been obtained. Any commencement of performance prior to Lease approval shall be done at the Tenant's own risk. Nothing in this Lease may be waived, modified, amended or discharged except by a writing signed by the State and Tenant and approved by the State in a public meeting.

12. SHELLFISH PRODUCTION IMPROVEMENTS. This lease shall be improved at no less than a minimum rate established by the provisions of Chapter 9 of Division 1 of Title 14, California Code of Regulations (commencing with section 237).

(a) Minimum Planting Requirements: 15 cases of seed-bearing shell (1200 pounds of seed-bearing shell) or 225 bushels of oysters one or more years of age over the allotted lease per year. Improvement by unattached single seed (less than one year old) shall consist of planting an average of 75,000 single seed over the allotted lease per year. Term of improvement shall be four years for seed-bearing shell and three years for oysters one or more years of age. As proof of use, the Tenant shall submit to the Department of Fish and Game Aquaculture Coordinator, a written declaration under penalty of perjury showing the date, quantity of species and acreage in each planting, also including a map showing acres, amounts and dates planted.

(b) Minimum Harvesting Requirements: The annual harvest rate shall be an average rate of 30,000 oysters (over one year of age) over the allotted acreage effective three years after the effective date of the lease. Harvest reports shall be recorded in the form of a receipt in quadruplicate furnished by the Department of Fish and Game. The triplicate copy shall be delivered to the Department of Fish and Game on or before the first and sixteenth day of each month.

13. NO WARRANTY. This Lease is made without warranty of title, condition or fitness of State Water Bottom M-614-02 for the Tenant's intended purpose or use.

Tenant agrees to accept the Lease area in its presently existing condition, "As Is", and that the State shall not be obligated to make any alterations, additions or betterments thereto except as otherwise provided in the Lease.

14. COMPLIANCE. As a necessary condition for this Lease, Tenant must obtain and maintain all necessary registrations, permits and any other entitlements. Tenant shall comply with all applicable federal, state and local laws, including laws relating to public health and safety, zoning, resource conservation and environmental protection including, but not limited to, the Coastal Zone Act, the Porter-Cologne Water Quality Act, and the California Environmental Quality Act.

Tenant shall comply with all applicable resource management and preservation mandates in the conduct of all activities that impact cultural, natural, or scenic resources. These mandates include, but are not limited to, those found in Public Resources Code sections 5024 and 5097 and the United States Secretary of the Interior's Guidelines for Historic Preservation. Tenant's operations under this Lease shall ensure that the State's goals of ensuring historical preservation and proper cultural, scenic and natural resource management are continually achieved in a manner consistent with applicable law.

15. RECORD KEEPING. The State may require periodic reports from Tenant as the State deems necessary for the proper administration of the State's water bottoms.

Tenant agrees that the Fish and Game Commission, Department of Fish and Game, and the Bureau of State Audits, or their designated representative, shall have the right to review and copy any records and supporting documentation pertaining to the performance of this Lease. Tenant agrees to maintain such records for possible audit for a minimum of three years after final payment. Tenant agrees to allow the auditor(s) prompt access to such records during normal business hours and similarly to allow interviews of any employees who might reasonably have information related to such records. Tenant agrees to include a similar right of the State to audit records and to interview staff in any sublease or contract related to performance of this Lease.

16. WAIVER AND CONSENT. Unless expressly acknowledged by the State in writing, no term, covenant, or condition of this Lease and no default or breach is waived by the acceptance of a late or nonconforming performance. The State's consent for one transaction or event under this Lease is not consent to any subsequent occurrence of the same or any other transaction or event.

17. BREACH. The occurrence of any one of the following shall constitute a breach of this Lease by Tenant: (1) Failure of Tenant to make any annual Lease payment within ninety (90) days of the commencement date of the Lease or within ninety (90) days of any anniversary thereof; (2) Failure of Tenant to make any other payment more than thirty (30) days after such payment is due; (3) abandonment of the Lease area determined after the State has followed the procedures set forth in Civil Code section 1951.3; or (4) any failure by Tenant to comply with laws applicable to the conduct of aquaculture.

Should a threat to public health or safety or to the environment be created or exist on the Lease area, the State may declare an emergency event and, unless an alternative arrangement is preferable in the State's discretion, may enter upon and take possession of the Lease area to remedy the emergency without prior notice and/or demand an assignment of the right to operate the Lease area. Upon entering the Lease area under this Section, the State shall provide immediate notice of such action by hand delivery or fax of its declaration to Tenant. The State may retain possession of the Lease area until the emergency event has been completely and adequately addressed to the State's satisfaction. Where a breach of this Lease has caused or exacerbated the emergency event, or where the Tenant is non-cooperative in allowing or addressing any remedial action necessary because of the emergency event, the State may terminate the Lease. The State shall not be liable in any manner for any inconvenience, disturbance, loss of business, nuisance or other damage arising out of the State's entry in the Lease area as provided herein, except damage resulting from the active negligence or willful misconduct of the State or its authorized representatives.

Any failure by Tenant to observe or perform another provision of this Lease where such failure continues for twenty (20) days after written notice thereof by the State to Tenant; any such notice shall be deemed to be the notice required under Code of Civil Procedure section 1161. However, if the nature of Tenant's breach is such that it cannot reasonably be cured within the twenty (20) day period, Tenant shall not be deemed to be in breach if Tenant shall commence such cure within the twenty (20) day period and thereafter diligently prosecutes such cure to completion.

Neither this Lease nor any interest of Tenant hereunder in the Lease area shall be subject to involuntary assignment or transfer by operation of law in any manner whatsoever, including, without limitation, the following: (a) transfer by testacy or intestacy; (b) assignments or arrangements for the benefit of creditors; (c) levy of a writ of attachment or execution on this Lease; (d) the appointment of a receiver with the authority to take possession of the Lease area in any proceeding or action in which the Tenant is a party; or (e) the filing by or against Tenant of a petition to have Tenant adjudged a bankrupt, or of a petition for reorganization or arrangement under any law relating to bankruptcy. Any such involuntary assignment or transfer by operation of law shall constitute a breach by Tenant and the State shall have the right to elect to take immediate possession of the Lease area, to terminate this Lease and/or invoke other appropriate remedies, in which case this Lease shall not be treated as an asset of Tenant.

Notices of breach shall specify the alleged breach and the applicable Lease provision and shall demand that Tenant perform the provisions of this Lease within the applicable time period or quit the Lease area. No such notice shall be deemed a forfeiture or a termination of this Lease unless the State specifically so states in the notice.

18. REMEDIES. In the event of breach by Tenant, the State shall have the following remedies. These remedies are not exclusive; they are cumulative and are in addition to any other right or remedy of the State at law or in equity.

Collection of Rent: In any case where the State has a cause of action for damages, the State shall have the privilege of splitting the cause to permit the institution of a separate suit for rent due hereunder, and neither institution of any suit, nor the subsequent entry

of judgment shall bar the State from bringing another suit for rent; it being the purpose of this provision to provide that the forbearance on the part of the State in any suit or entry of judgment for any part of the rent reserved under this Lease, to sue for, or to include in, any suit and judgment the rent then due, shall not serve as defense against, nor prejudice a subsequent action for, rent or other obligations due under the Lease. The claims for rent may be regarded by the State, if it so elects, as separate claims capable of being assigned separately.

Continued Performance: At the State's option, Tenant shall continue with its responsibilities under this Lease during any dispute.

Termination of Tenant's Right to Possession: Upon an event of breach of this Lease by Tenant, in addition to any other rights or remedies it may have, the State may give Tenant a three-day notice to cure the breach or quit the Lease area. If Tenant fails to do either, the State may bring a statutory proceeding in unlawful detainer to regain possession of the Lease area. Any notice give by the State pursuant to this Section does not constitute a termination of this Lease unless expressly so declared by the State in the notice. In the absence of written notice from the State, no act by the State, including, but not limited to, acts of maintenance, efforts to re-let and/or assign rights to possession of the Lease area, or the appointment of a receiver on the State's initiative to protect the State's interest under this Lease shall constitute an acceptance of Tenant's surrender of the Lease area, or constitute a termination of this Lease or of Tenant's right to possession of the Lease area. Upon such termination, the State has the right to recover from Tenant: (a) the worth, at the time of the award, of the unpaid rent that had been earned at the time of termination of this Lease; (b) the worth, at the time of the award, of the amount by which the unpaid rent that would have been earned after the date of termination of this Lease until the time of the award exceeds the amount of loss of rent that Tenant proves could have reasonably been avoided; (c) the worth, at the time of the award, of the amount by which the unpaid rent for the balance of the term after the time of the award exceeds the amount of the loss of rent that Tenant proves could have been reasonably avoided; and (d) any other amount necessary to compensate the State for all the detriment proximately caused by Tenant's failure to perform its obligations under this Lease, and costs of clearing the State's title of any interest of Tenant, commissions, attorneys' fees, and any other costs necessary or appropriate to make the Lease area operational by a new Tenant.

"The worth, at the time of the award," as used herein above shall be computed by allowing interest at the lesser of a rate of ten percent (10%) per annum or the maximum legal rate.

Receiver: If Tenant is in breach of this Lease, the State shall have the right to have a receiver appointed to collect rent and conduct Tenant's business or to avail itself of any other pre-judgment remedy. Neither the filing of a petition for the appointment of a receiver nor the appointment itself shall constitute an election by the State to terminate this Lease.

Right to Cure Tenant's Breach: At any time after Tenant commits a breach, the State can cure the breach at Tenant's cost. If the State, at any time by reason of Tenant's breach, pays any sum or does any act that requires the payment of any sum, the sum paid by the State shall be due immediately from Tenant to the State, and if paid at a

later date shall bear interest at the rate of ten percent (10%) per annum from the date the sum is paid by the State until the State is reimbursed by Tenant.

Personal Property of Tenant: In the event any personal property or trade fixtures of Tenant remain at the Lease area after the State has regained possession, that property or those fixtures shall be dealt with in accordance with the provisions for Surrender of the Lease area provided below.

State's Obligations After Breach: The State shall be under no obligation to observe or perform any covenant of this Lease on its part to be observed or performed that accrues after the date of any breach by Tenant. Such nonperformance by the State shall not constitute a termination of Tenant's right to possession nor a constructive eviction.

No Right of Redemption: Tenant hereby waives its rights under California Code of Civil Procedure sections 1174 and 1179 or any present or future law that allows Tenant any right of redemption or relief from forfeiture in the event the State takes possession of the Lease area by reason of any breach by Tenant.

Other Relief: The State shall have such rights and remedies for failure to pay any and all monetary obligations under this Lease as the State would have if Tenant failed to pay rent due. The remedies provided in this Lease are in addition to any other remedies available to the State at law, in equity, by statute, or otherwise.

Attorney's Fees and Costs: Tenant shall reimburse the State on demand for all reasonable attorney fees and expenses incurred by the State as a result of a breach under this Lease, provided that, in any litigation between the parties to this Lease concerning it, the prevailing party shall be entitled to recover court costs, reasonable attorney fees, and other costs reasonably incurred to secure the remedy obtained in the action.

The State shall not be in breach of the performance of any obligation required of it under this Lease unless and until it has failed to perform such obligation for more than thirty (30) days after written notice by Tenant to the State specifying the alleged breach and the applicable Lease provision giving rise to the obligation. However, if the nature of the State's obligation is such that more than thirty (30) days is required for its performance, then the State shall not be deemed in breach if it shall commence performance within such 30-day period and thereafter diligently prosecute the same to completion.

19. ASSIGNMENT AND SUBLEASES. Pursuant to Fish and Game Code section 15412, this Lease may not be assigned, in whole or in part, by Tenant, either voluntarily or by operation of law, and no subleases or other rights may be granted under it by Tenant without the prior written approval of the State, subject to the conditions that it prescribes. At the election of the State, any attempted assignment or subletting without such prior approval of the State shall terminate this Lease.

20. TERMINATION. In the event the Lease area becomes unsuitable for the practical cultivation or harvest of shellfish, or in the event the Tenant becomes unable to continue operating the Lease for aquaculture for reasons beyond Tenant's ability to control, Tenant may terminate the Lease after thirty (30) days written notice to the

State. Tenant may terminate the Lease for any other reason through a written request presented to and approved by the State at a public hearing held for purposes of consideration of Tenant's termination request. Such termination shall be effective thirty (30) days after State approval.

On expiration of or within thirty (30) days after earlier termination of the Lease, Tenant shall surrender the Lease area to the State. Tenant shall remove all of its personal property as well as all man-made material deposited during Tenant's occupancy within the above stated time unless otherwise agreed to in writing.

If Tenant fails to surrender the Lease area to the State on the expiration, or within thirty (30) days after earlier termination of the term as provided by this Section, Tenant shall hold the State harmless for all damages resulting from Tenant's failure to surrender the Lease area.

21. QUITCLAIM. Tenant shall, within ninety (90) days of the expiration or sooner termination of this Lease, execute, acknowledge and deliver to the State in a recordable form provided by the State a release of all rights under this Lease. Should Tenant fail or refuse to deliver such a release, a written notice by the State reciting such failure or refusal shall, from the date of its recordation, be conclusive evidence against Tenant of the expiration or termination of this Lease.

22. TIME OF THE ESSENCE. Time is of the essence of this Lease and any term, covenant or condition in which performance is a factor.

23. CHANGES. Nothing in this Lease may be waived, modified, amended, or discharged except by an instrument in writing signed by Tenant and the State, in consultation with the Department of Fish and Game Aquaculture Coordinator. At its discretion, the Department of Fish and Game may charge Tenant for any and all costs it incurs in any lease amendment requested by Tenant.

24. SEVERABILITY. If a court of competent jurisdiction determines that a Lease provision is legally invalid, illegal or unenforceable, and such decision becomes final, the provision shall be severed and deleted from the Lease and the remainder reasonably interpreted to achieve its intent. Tenant and the State agree to replace such void or unenforceable provision with a valid and enforceable provision that will achieve, to the extent possible, the purpose of the original provision.

25. SITE CLEANUP. Tenant shall provide to the State financial assurance sufficient to ensure that, upon termination or abandonment of this Lease, the Lease area is surrendered in a condition that is in accordance with Section 20, to the satisfaction of the State.

The financial assurance amount shall be calculated based on an analysis of the physical activities and materials necessary to surrender the site in the required condition; the unit costs or costs for third party contracting, for each of the identified activities as applicable; the number of units of these activities; and a contingency amount not to exceed ten percent (10%) of the costs of the activities.

Financial assurances may take the form of surety bonds executed by an admitted surety insurer, as defined in subdivision (a) of section 995.120 of the Code of Civil

Procedure, irrevocable letters of credit, trust funds, or other forms of financial assurances specified by the State which it reasonably determines to be adequate to perform restoration of the site. Personal surety bonds cannot provide financial assurance under this requirement. The financial assurance shall be payable to the State and shall remain in effect throughout the duration of the tenancy under the Lease, and until the State accepts surrender of the Lease area or until replaced by an equivalent financial assurance.

The financial assurance shall be applied by the State to place the Lease area in the condition required for surrender under Section 20, whenever the Tenant fails or refuses to accomplish such activities, and to reimburse the State for all its costs of achieving that condition of the Lease area. Any assets remaining from the financial assurance after all costs to the State, including administrative costs to secure the funds, have been reimbursed therefrom, shall be returned to the Tenant.

26. NON-DISCRIMINATION. In its use of the Lease area, Tenant shall not discriminate against, harass, or allow harassment against any person or class of persons on the basis of race, color, creed, religion, national origin, ancestry, sex, sexual orientation, age, marital status, medical condition or disability. Tenant shall ensure that the evaluation and treatment of its employees and applicants for employment are free from such discrimination and harassment.

Tenant shall comply with the provisions of the Fair Employment and Housing Act (Government Code section12900 et seq.) and the applicable regulations promulgated thereunder (California Code of Regulations, Title 2, section 7285.0 et seq.). Tenant shall give written notice of their obligations under this clause to labor organizations with which they have a collective bargaining or other agreement. Tenant shall include the non-discrimination and compliance provisions of this clause in all contracts to perform work under and/or in connection with this Lease.

Tenant shall be solely responsible for complying with the requirements of the Americans With Disabilities Act of 1990 (P.L. 101-336, commencing at section 12101 of Title 42, United States Code and including Titles I, II and III), the Rehabilitation Act of 1973, and all related regulations, guidelines and amendments to both laws.

27. DRUG-FREE WORKPLACE. Tenant will comply with the requirements of the Drug-Free Workplace Act of 1990, as amended, and will provide a drug-free workplace by taking the following actions:

(a) Publish a statement notifying employees that unlawful manufacture, distribution, dispensation, possession or use of a controlled substance is prohibited and specifying actions to be taken against employees for violations.

(b) Establish a Drug-Free Awareness Program to inform employees about: (1) the dangers of drug abuse in the workplace; (2) the Tenant's policy of maintaining a drug-free workplace; (3) any available counseling, rehabilitation and employee assistance programs; and, (4) penalties that may be imposed upon employees for drug abuse violations.

(c) Provide that every employee who works on the Lease area will: (1) receive a copy of the Tenant's drug-free policy statement; and, (2) agree to abide by the terms of the Tenant's statement as a condition of employment on the Lease area.

Failure to comply with these requirements may result in suspension or termination of this Lease, and Tenant may be ineligible for award of any future State Water Bottom Leases if the State determines that any of the following has occurred: (1) the Tenant has made false certification, or (2) violated the certification by failing to carry out the requirements as noted above.

28. ENTIRE AGREEMENT. This Lease contains the entire agreement between the parties, and an agreement hereafter shall be ineffective to change, modify or discharge it in whole or in part, unless such agreement is in writing and contains the authorized signature of the party against whom enforcement of the change, modification or discharge is sought.

29. CONSTRUCTION. This Lease shall be governed by and construed in accordance with the laws of the State of California. The Section titles in this Lease are inserted only as a matter of convenience and for reference, and in no way define, limit, or describe the scope or intent of this Lease or in any way affect this Lease.

Tenant shall maintain annual registration of its aquaculture facility in accordance with Fish and Game Code sections 15101 and 15103 and shall keep current with all fees and surcharges, including any penalties for late payment of same, required by those statutes.

30. INCORPORATION BY REFERENCE. The provisions of Chapters 1 through 8 of Division 12 of the Fish and Game Code (commencing with section 15000) and the provisions of Chapter 9 of Division 1 of Title 14, California Code of Regulations (commencing with section 235), as may be amended from time to time, are made part of this Lease by this reference. If there is a conflict between any term or condition of this Lease and any of the provisions incorporated by reference in it, the incorporated provisions shall control.

31. CONFLICTS OF INTEREST. Tenant warrants that no official, employee in the state civil service or other appointed state official, or any person associated with same by blood, adoption, marriage, cohabitation, and/or business relationship: (a) has been employed or retained to solicit or aid in the procuring of this Lease; or (b) will be employed in the performance of this Lease without the immediate divulgence of such fact to the State. In the event the State determines that the employment of any such official, employee, associated person, or business entity is not compatible, Tenant shall terminate such employment immediately. For breaches or violations of this Section, the State shall have the right to annul this Lease without liability.

32. EXPATRIATE CORPORATION. Tenant hereby declares that it is not an expatriate corporation or subsidiary of an expatriate corporation, within the meaning of Public Contract Code sections 10286 and 10286.1 and is eligible to contract with the State.

33. NO AGENCY. The Tenant, and the agents and employees of the Tenant in the performance of the Lease, shall act in an independent capacity and not as officers or agents of the State of California.

34. CLOSURE. Neither the State nor the Department of Fish and Game shall have any liability arising from a closure of waters by the Department of Fish and Game Director pursuant to Fish and Game Code section 5654, where aquaculture operations are taking place.

35. NOTICES. Notices to the parties to this Lease shall be made in writing and may be given by delivery in person, by U.S. Mail with postage prepaid, or by receipt-confirmed facsimile to:

FISH AND GAME COMMISSION Executive Director 1416 Ninth Street, 13TH Floor Sacramento, CA 95814 Telephone: (916) 653-4899 Facsimile: (916) 653-5040	Grassy Bar Oyster Company George Trevelyan 3488 Gilbert Avenue Cayucos, CA 93430 Telephone: (805) 471-9683

Notices shall be deemed given upon delivery to the addressee. Any notice given by facsimile shall also be given to the addressee by U.S. Mail, with postage prepaid. If a notice given by facsimile is delivered to the addressee after 5:00 p.m. Pacific time, or on a Saturday, Sunday or State of California or national holiday, the notice shall be deemed given on the next business day. Either party may change its address for notice purposes by giving written notice to the other party in the manner provided in this Section.

36. SPECIAL CONDITIONS. This lease is for the sole purpose of cultivating Pacific oysters (*Crassostrea gigas*), Bay mussels (*Mytilus edulis*), Quahog clams (*Mercenaria mercenaria*), Manila clams (*Venerupis philippinarum*), Ghost shrimp (*Neotrypaea* spp.), and Innkeeper worms (*Urechis* spp.). Shellfish cultivation methods for this lease shall be confined to the bottom. No other mode of operation or culture method is authorized.

SIGNATURE PAGE

This Lease and any amendment(s) may be executed in counterparts, each of which, when executed and delivered by the State and Tenant, shall be an original and together shall constitute one instrument, with the same force and effect as though all signatures appeared on a single document.

Each signatory attests he or she is duly authorized to execute this Lease on behalf of the principal he or she represents.

Where Tenant is a corporation, the signature of the Tenant on this Lease will be verifying that Tenant is currently qualified to do business in the State of California, as defined in Revenue and Taxation Code section 23101, in order to ensure that all obligations to the State are fulfilled. Both domestic and foreign corporations (those incorporated outside the State of California) must be in good standing in order to be qualified to do business in California.

STATE OF CALIFORNIA

FISH AND GAME COMMISSION

By: Sonke Mastrup

SONKE MASTRUP, Executive Director

Date: 6/25/12

LESSEE:

GRASSY BAR OYSTER COMPANY

By: George Trevelyan

GEORGE TREVELYAN, Owner

Date: 6-14-12

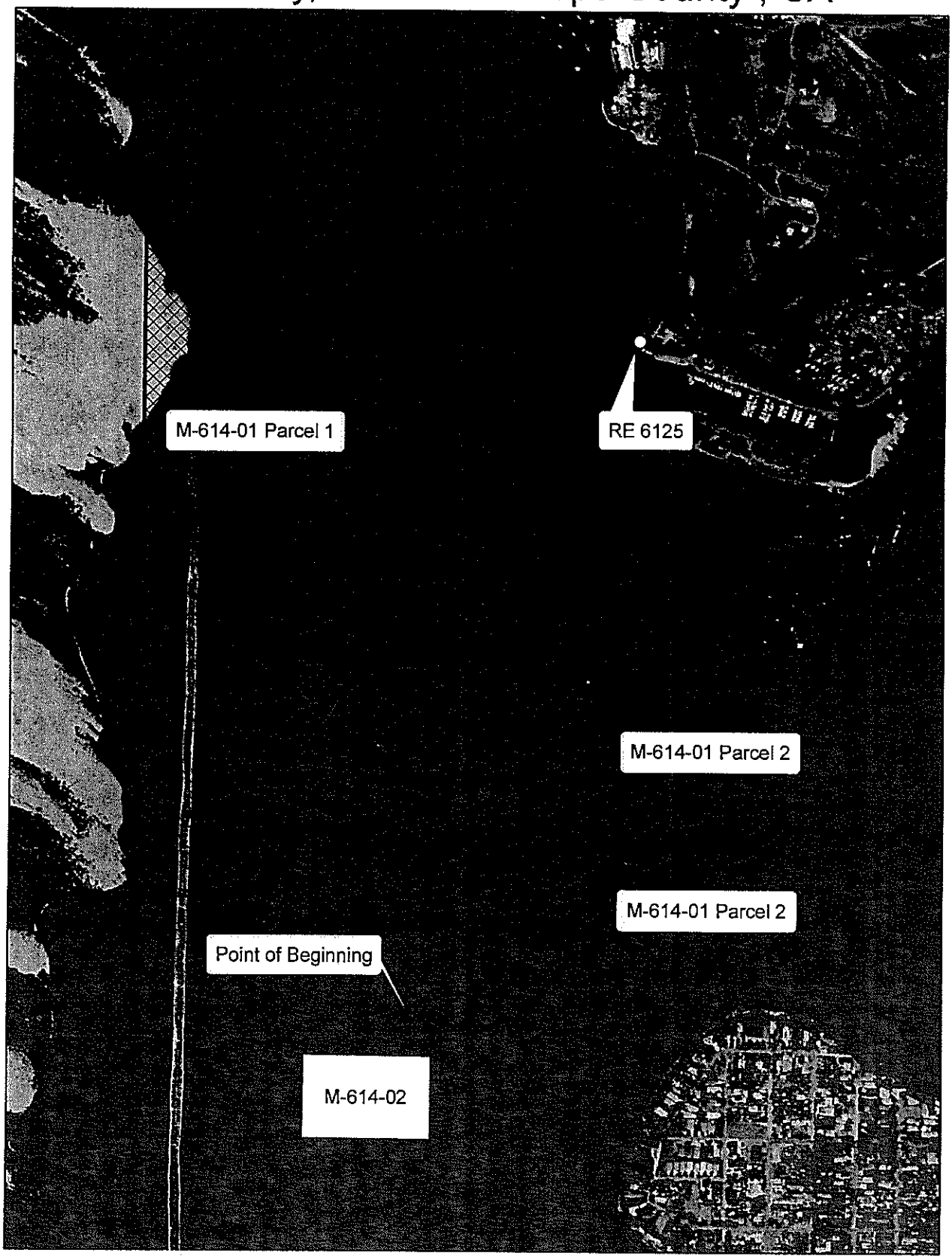
DEPARTMENT OF FISH AND GAME

By:

HELEN CARRIKER, Deputy Director, Administration

Date: 7/22/12

Exhibit A
State Water Bottom Lease M-614-02
Morro Bay, San Luis Obispo County , CA



N

0 0.125 0.25 0.5 Miles

Map prepared by
CA Dept. Fish and Game
7 December 2011

EXHIBIT A

Legal description: Beginning at a point (35° 19'54.3" N, 120° 50'42" W), 5,670 feet southwesterly, on a bearing of S 15° W, of a four-inch brass cap monument labeled "State of California, Department of Natural Resources, Division of Beaches and Parks, RE6125" near the high water mark on the extreme westerly portion of White Point at 35° 20'49.83" N, 120° 50'36" W, thence, South 660 feet; thence West 990 feet; thence North 660 feet; thence East 990 feet to the point of beginning.

Grassy Bar Oyster Company, 3488 Gilbert Ave., Cayucos, CA 93430
(805)471-9683 www.grassybaroyster.com

January 4, 2016

Sonke Mastrup, Executive Director
California Fish and Game Commission
P.O. Box 944209
Sacramento, CA 94244-2090

Dear Director Mastrup,

I am writing to request that you please make a transfer of the title of my 2 state water bottom leases. The reason for the request is that I am incorporating my oyster farm, which, up until now, has been a sole proprietorship.

Currently, the Tenant of State Water Bottom Leases M-614-01-Parcel 1, and M-614-02 is Grassy Bar Oyster Company.

The name of the new corporation is Grassy Bar Oyster Company, Inc.

Grassy Bar Oyster Company, Inc. was incorporated in California on December 18, 2015, and is listed as an active business entity with the California Secretary of State.

So I am requesting that you transfer these 2 leases to Grassy Bar Oyster Company, Inc.

Thanks so much for your attention to this transfer.

Sincerely,

George Trevelyan

George Trevelyan
Owner, Grassy Bar Oyster Company
President, Grassy Bar Oyster Company, Inc.

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2016 JAN -7 PM 3:48

Cc: Kirsten Ramey

ARTICLES OF INCORPORATION 3853596

Grassy Bar Oyster Company, Inc.

FILED
Secretary of State
State of California
DEC 18 2015

1. The name of the corporation is Grassy Bar Oyster Company, Inc.
2. The purpose of the corporation is to engage in any lawful act or activity for which a corporation may be organized under the General Corporation Law of California other than the banking business, the trust company business or the practice of a profession permitted to be incorporated by the California Corporations Code.
3. The name and address of the initial agent for service of process is:

   George Trevelyan

   3488 Gilbert Avenue

   Cayucos, CA 93430
4. The corporate address is:

   Grassy Bar Oyster Company, Inc.

   3488 Gilbert Avenue

   Cayucos, CA 93430
5. The corporation is authorized to issue only one class of shares of stock. The total number of shares which the corporation is authorized to issue is one hundred (100).
6. This corporation is a Close Corporation. All the issued shares of stock will be held of record by no more than thirty (30) persons.

December 17, 2015

Susan McElhinney
Incorporator

I hereby certify that the foregoing transcript of 1 page(s) is a full, true and correct copy of the original record in the custody of the California Secretary of State's office.

DEC 28 2015

Date:

ALEX PADILLA, Secretary of State

Business Entity Detail

Data is updated to the California Business Search on Wednesday and Saturday mornings. Results reflect work processed through Friday, December 25, 2015. Please refer to **Processing Times** for the received dates of filings currently being processed. The data provided is not a complete or certified record of an entity.

Entity Name:	GRASSY BAR OYSTER COMPANY, INC.
Entity Number:	C3853596
Date Filed:	12/18/2015
Status:	ACTIVE
Jurisdiction:	CALIFORNIA
Entity Address:	3488 GILBERT AVE
Entity City, State, Zip:	CAYUCOS CA 93430
Agent for Service of Process:	GEORGE TREVELYAN
Agent Address:	3488 GILBERT AVE
Agent City, State, Zip:	CAYUCOS CA 93430

* Indicates the information is not contained in the California Secretary of State's database.

- If the status of the corporation is "Surrender," the agent for service of process is automatically revoked. Please refer to California Corporations Code **section 2114** for information relating to service upon corporations that have surrendered.
- For information on checking or reserving a name, refer to **Name Availability**.
- For information on ordering certificates, copies of documents and/or status reports or to request a more extensive search, refer to **Information Requests**.
- For help with searching an entity name, refer to **Search Tips**.
- For descriptions of the various fields and status types, refer to **Field Descriptions and Status Definitions**.

Modify Search | **New Search** | **Printer Friendly** | **Back to Search Results**

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the ~~they~~ new FEIN is 81-0923945 for GBOC, Inc

IRS DEPARTMENT OF THE TREASURY
INTERNAL REVENUE SERVICE
CINCINNATI OH 45999-0023

Date of this notice: 12-28-2015

Employer Identification Number:
81-0923945

Form: SS-4

Number of this notice: CP 575 A

GRASSY BAR OYSTER COMPANY INC
% GEORGE TREVELYAN
3488 GILBERT AVE
CAYUCOS, CA 93430

For assistance you may call us at:
1-800-829-4933

IF YOU WRITE, ATTACH THE
STUB AT THE END OF THIS NOTICE.

WE ASSIGNED YOU AN EMPLOYER IDENTIFICATION NUMBER

Thank you for applying for an Employer Identification Number (EIN). We assigned you EIN 81-0923945. This EIN will identify you, your business accounts, tax returns, and documents, even if you have no employees. Please keep this notice in your permanent records.

When filing tax documents, payments, and related correspondence, it is very important that you use your EIN and complete name and address exactly as shown above. Any variation may cause a delay in processing, result in incorrect information in your account, or even cause you to be assigned more than one EIN. If the information is not correct as shown above, please make the correction using the attached tear off stub and return it to us.

Based on the information received from you or your representative, you must file the following form(s) by the date(s) shown.

Form 940	01/31/2017
Form 943	01/31/2017
Form 1120	03/15/2016

If you have questions about the form(s) or the due date(s) shown, you can call us at the phone number or write to us at the address shown at the top of this notice. If you need help in determining your annual accounting period (tax year), see Publication 538, *Accounting Periods and Methods*.

We assigned you a tax classification based on information obtained from you or your representative. It is not a legal determination of your tax classification, and is not binding on the IRS. If you want a legal determination of your tax classification, you may request a private letter ruling from the IRS under the guidelines in Revenue Procedure 2004-1, 2004-1 I.R.B. 1 (or superseding Revenue Procedure for the year at issue). Note: Certain tax classification elections can be requested by filing Form 8832, *Entity Classification Election*. See Form 8832 and its instructions for additional information.

IMPORTANT INFORMATION FOR S CORPORATION ELECTION:

If you intend to elect to file your return as a small business corporation, an election to file a Form 1120-S must be made within certain timeframes and the corporation must meet certain tests. All of this information is included in the instructions for Form 2553, *Election by a Small Business Corporation*.

FORM A

State Of California Department Of Fish And Game Application For Lease Of State Water Bottoms For Aquaculture

Applicant Name: George Trevelyan

Phone No. [redacted]

Address: [redacted]

Aquaculture Registration No 1002

Expiration Date 12/31/16

Species of plant or animals to be cultured:

Request to transfer leases M-614-01-parcel 1 and M-614-02 from Grassy Bar Oyster Co. (sole proprietorship) to Grassy Bar Oyster Co., Inc. (CA Corp). Species raised and culture methods used by new leaseholder will all remain unchanged from existing lease terms and conditions. Funds held in escrow providing financial surety for cleanup of the site will be transferred to apply to the new Corporation as new leaseholder.

Application is hereby made to the Fish and Game Commission of the State of California for a lease of State water bottoms in the area described in the attached exhibit entitled "Exhibit A-Legal Description", and as shown on the map attached hereto marked "Exhibit B". Each exhibit bears the name of this applicant. Such lease will be for the purpose of aquaculture involving the species designated above. In support of this application, the applicant hereby submits the following explanation of the type of operation and cultural practices to be employed:

A. Purpose of operation - research and development or production

B. Plan of development and proposed production schedule – 5 year plan

C. Type of cultural method(s) to be employed: bottom, long line, buoyed habitats, etc.

D. Department of Health Services growing water classification: approved, conditionally approved, prohibited, restricted or unclassified

(Attach additional sheets for detailed explanation)

Date: 8/4/16

Signed: George Trevelyan

Print Name: George Trevelyan

(See instructions on the back)

State of California
Department of Fish and Wildlife

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2016 AUG -2 PM 2:59

Memorandum

Date: July 28, 2016

To: Valerie Termini
Executive Director
Fish and Wildlife Commission

From: Charlton H. Bonham
Director

Subject: **Agenda Item for the August 24-25, 2016, Fish and Game Commission Meeting Regarding Proposed Transfer of State Water Bottom Leases, M-614-01, Parcel 1 and M-614-02, Grassy Bar Oyster Company, Morro Bay**

The Department of Fish and Wildlife (Department) is providing the following comments in regard to a request by Mr. George Trevelyan, Grassy Bar Oyster Company, for Fish and Game Commission (Commission) approval to transfer state water bottom leases M-614-01, Parcel 1 and M-614-02. Grassy Bar Oyster Company was a sole proprietorship, but was incorporated to Grassy Bar Oyster Company, Inc. on December 18, 2015. Mr. Trevelyan submitted written notification to the Commission on January 4, 2016, requesting to transfer the title of leases M-614-01, Parcel 1 and M-614-02 to the newly formed corporation, Grassy Bar Oyster Company, Inc. Mr. Trevelyan is currently the only officer and sole share owner of the newly formed corporation. There are no proposed changes in the culture methods or species currently approved by the Commission for the leases.

Upon staff review, it was determined that the proposed project is subject to the "Class 1" or "Existing Facilities" categorical exemption pursuant to CEQA Guidelines section 15301 (Cal. Code Regs., tit. 14, § 15301). In general, the Class 1 exemption consists of the leasing of existing facilities, involving negligible or no expansion of use beyond that existing at the time of the lead agency's determination. All provisions of the leases are identical to the original leases, with the only exception being a new corporation as the lessee. These transfers do not increase, decrease, or change existing operations in any way or allow for any new activities by the new corporation.

The Department recommends approval of the request to transfer state water bottom leases M-614-01, Parcel 1 and M-614-02, Grassy Bar Oyster Company to Grassy Bar Oyster Company, Inc.

If you have any questions regarding this item, please contact Dr. Craig Shuman, Regional Manager of the Department's Marine Region, at (805) 568-1246.

Attachments

State of California
Department of Fish and Wildlife

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COMMISSION

2016 JUL 27 AM 10: 41

Memorandum

Date: July ~~18,~~ 26, 2016

To: Valerie Termini
Executive Director
Fish and Game Commission

From: Charlton H. Bonham
Director

Subject: **Agenda Item for the August 24-25, 2016 Fish and Game Commission Meeting re: Recreational Fishing Regulations for Federal Groundfish and Associated Species for 2017 and 2018.**

At its June 22-28, 2016 meeting, the Pacific Fishery Management Council took final action regarding recreational fishing regulations for federally managed groundfish species for the 2017-2018 management cycle. In order to have conforming State regulations in place before fishing begins in 2017, the Department of Fish and Wildlife (Department) requests the Commission authorize publication of notice of its intent to consider amendment of its recreational fishing regulations for federally managed groundfish species at its August 24-25, 2016 meeting.

The Department's Initial Statement of Reasons is attached, which proposes regulatory changes needed to align state regulations with the range of federal regulations expected to be in effect for 2017 and 2018. The changes may result in modifications to season lengths, depth restrictions, and bag limits for federally managed groundfish and state-managed species, which associate with federal groundfish.

If you have any questions or need additional information, please contact Dr. Craig Shuman, Regional Manager of the Marine Region, at (805) 568-1246. The public notice should identify Senior Environmental Scientist, Joanna Grebel as the Department's point of contact for this rulemaking. Joanna can be reached at (831) 601-2279 or at Joanna.Grebel@wildlife.ca.gov.

Attachments

ec: Stafford Lehr, Deputy Director
Wildlife and Fisheries Division
Stafford.Lehr@wildlife.ca.gov

Craig Shuman, D. Env.
Regional Manager
Marine Region (Region 7)
Craig.Shuman@wildlife.ca.gov

Marci Yaremko, Program Manager
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Joanna Grebel
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Joanna.Grebel@wildlife.ca.gov

Craig Martz, Program Manager
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Wildlife and Fisheries Division
Craig.Martz@wildlife.ca.gov

Scott Barrow,
Senior Environmental Scientist
Regulations Unit
Wildlife and Fisheries Division
Scott.Barrow@wildlife.ca.gov

STATE OF CALIFORNIA
FISH AND GAME COMMISSION
INITIAL STATEMENT OF REASONS FOR REGULATORY ACTION
(Pre-publication of Notice Statement)

Amend Subsections (a) and (b) of Section 27.20, Sections 27.25, 27.30, 27.35, 27.40, 27.45, 27.50, 28.27, 28.49, and 28.55; and
Add Section 28.47
Title 14, California Code of Regulations
Re: Recreational Fishing Regulations for Federal Groundfish and Associated Species for Consistency with Federal Rules for 2017 and 2018

I. Date of Initial Statement of Reasons: June 28, 2016

II. Dates and Locations of Scheduled Hearings:

(a) Notice Hearing: Date: August 24, 2016
Location: Folsom, CA

(b) Discussion Hearing Date: October 19, 2016
Location: Eureka, CA

(c) Adoption Hearing: Date: December 7, 2016
Location: San Diego, CA

III. Description of Regulatory Action:

(a) Statement of Specific Purpose of Regulation Change and Factual Basis for Determining that Regulation Change is Reasonably Necessary:

Biennially, the Pacific Fishery Management Council (PFMC) reviews the status of west coast groundfish populations. As part of that process, it recommends groundfish fisheries regulations aimed at meeting biological and fishery allocation goals specified in law or established in the Pacific Coast Groundfish Fishery Management Plan (FMP). These recommendations coordinate west coast management of recreational and commercial groundfish fisheries in the Exclusive Economic Zone (EEZ) (three to 200 miles offshore) off Washington, Oregon and California. These recommendations are subsequently implemented as federal fishing regulations by the National Marine Fisheries Service (NMFS).

Under California law (California Fish and Game Code sections 200 and 205), the California Fish and Game Commission (Commission) adopts regulations for the recreational groundfish fishery in State waters zero to three miles from shore.

It is critical to have consistent State and federal regulations establishing season dates, depth constraints and other management measures, and also critical that the State and federal regulations be effective

concurrently. Consistency of rules in adjacent waters allows for uniformity of enforcement, minimizes confusion, and allows for a comprehensive approach to resource management. Consistency with federal regulations is also necessary to maintain State authority over its recreational groundfish fishery and avoid federal preemption under the Magnuson-Stevens Fishery Conservation Act [16 USC §1856 (b)(1)].

On June 27, 2016, the PFMC recommended changes to federal rules for recreational groundfish fishing off California for 2017 and 2018 which are expected to go into effect on or around January 1, 2017. The proposed actions in this rulemaking would make regulations for State waters consistent with these new federal regulations.

Present Regulations

Existing law authorizes the recreational take of groundfish subject to regulations set forth by federal and State authorities. Current regulations establish season lengths, depth constraints, methods of take, closed areas, and size, bag and possession limits within the five groundfish management areas for all federal groundfish and associated species [sections 27.20, 27.25, 27.30, 27.35, 27.40, 27.45, 27.50, 27.51, 28.26, 28.27, 28.28, 28.29, 28.48, 28.49, 28.54, 28.55, 28.56 and 28.58, Title 14, CCR].

Species or Species Groups Which May be Taken or Possessed

Present regulations allow anglers to take and possess federally-managed groundfish species as defined in Section 1.91 when the fishing season is open. Regulations also establish that California sheephead, ocean whitefish, and all greenlings of the genus *Hexagrammos*, which are State-managed species known to associate with federal groundfish, can be taken and possessed only when the season is open to recreational groundfish fishing.

Season Length and Depth Constraints

Current regulations specify seasons and depth constraints for the five groundfish management areas in ocean waters off California. These regulations serve as management tools that are adjusted biennially to ensure that mortality of both overfished and non-overfished stocks remain within allowable limits. The current seasons and depth constraints were designed to maximize harvest of healthy stocks while staying within allowable limits for all species.

The Northern and Mendocino Management Areas have a 20 fathom depth constraint, with a season of five and one-half months. The San Francisco Management Area has an eight and one-half month season, with a depth constraint of 30 fathoms. The Central Management Area has a nine month season, with a depth constraint of 40 fathoms. The Southern Management Area has the least restrictive regulations, with a ten month season and a depth constraint of 60 fathoms. The Cowcod Conservation Areas provide discrete depth limits within the Southern Management Area.

Bag Limits
Present regulations establish bag limits which vary by species or species groups and are designed to keep harvest within allowable limits.

Proposed Regulations
The Department of Fish and Wildlife (Department) is proposing the regulatory changes described below to be consistent with PFMC recommendations for federal groundfish regulations in 2017 and 2018. This approach will allow the Commission to adopt State recreational groundfish regulations to timely conform to those taking effect in federal ocean waters in January 2017.

The proposed regulatory changes will implement the following changes:

1. Seasons and Depths
    1. Extend the season length in the Northern and Mendocino Management Areas;
    2. Increase the allowable depth in the Northern, San Francisco and Central Management Areas;
    3. Allow for the take of all species with no depth restrictions November 1 through December 31 in the Northern and Mendocino Management Areas;
2. Bag Limits
    1. Increase the bag limit for canary rockfish from zero to one fish;
    2. Decrease the bag limit for black rockfish from five to three fish;
    3. Eliminate the three fish sub-bag limit for bocaccio;
    4. Decrease the bag limit for lingcod from three to two fish;
3. Allow petrale sole and starry flounder to be retained year round at all depths;
4. Clarifications
    1. Clarify language pertaining to Rockfish Conservation Areas;
    2. Clarify regulations for petrale sole and starry flounder; and
    3. Clarify and make consistent other provisions of the regulations.

Item 1: Proposed Changes to Seasons and Depths
The proposed regulatory changes would modify season and/or depth constraints in four of the five management areas (Northern, Mendocino, San Francisco, and Central) (Figure 1) as follows:

A. The season length is proposed to be increased by two and one-half months in the Northern and Mendocino Management Areas;
B. The depth restriction is proposed to be increased by 10 fathoms in the Northern, San Francisco, and Central Management Areas; and
C. Fishing for all species would be allowed with no depth restrictions from November 1 through December 31 in the Northern and

Mendocino Management Areas.

A new stock assessment was conducted for black rockfish in California in 2015. This new assessment indicated that while black rockfish are considered healthy, they are not as plentiful as previously thought. Therefore allowable harvest limits were reduced by the PFMC in response to this new scientific information. Because black rockfish are found in shallower waters, increasing the depth in some management areas will allow anglers to move to into deeper waters to target other species, which should reduce fishing pressure on black rockfish in shallower depths.

Yelloweye rockfish is overfished and managed under a rebuilding plan to facilitate rebuilding the stock to healthy levels. The harvest guideline for yelloweye rockfish was increased slightly by the PFMC this year, compared to previous years consistent with the results of the rebuilding plan. There is now adequate room within this harvest guideline to extend fishing both into deeper depths and for longer seasons in many areas.

The general season and depth limit changes listed above require changes in sections 27.25, 27.35 and 27.40 concerning exceptions for leopard shark, and in sections 27.30, 27.35 27.40, 27.45 and 27.50 concerning exceptions for California scorpionfish.

<table>
<tr><th>Management Area</th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
<tr><td>Northern</td><td colspan="4">Closed</td><td colspan="6">May 1 – Oct 31 <30fm</td><td colspan="2">All Depth</td></tr>
<tr><td>Mendocino</td><td colspan="4">Closed</td><td colspan="6">May 1 – Oct 31 <20fm</td><td colspan="2">All Depth</td></tr>
<tr><td>San Francisco</td><td colspan="5">Closed</td><td colspan="7">April 15 – Dec 31 <40fm</td></tr>
<tr><td>Central</td><td colspan="4">Closed</td><td colspan="8">April 1 – Dec 31 <50fm</td></tr>
<tr><td>Southern</td><td colspan="2">Closed</td><td colspan="10">Mar 1 – Dec 31 <60 fm</td></tr>
</table>

Figure 1. Season structure and depth constraints proposed for the California recreational groundfish fishery for 2017 and 2018 as recommended by the PFMC in June 2016.

<u>Item 2: Proposed Changes to Bag Limits</u>
The proposed regulatory changes would modify bag limits for canary rockfish, black rockfish, bocaccio, and lingcod as follows:

A. *Canary Rockfish* - The proposed regulations would increase the bag limit for canary rockfish from zero to one fish. Canary rockfish, a previously overfished stock, has rebuilt to healthy levels and allowing retention of one fish can be accommodated within the State's new recreational harvest guideline.
B. *Black Rockfish* - The proposed regulations decrease the bag limit for black rockfish from five to three fish statewide. A lower bag limit is needed to keep catches within reduced allowable harvest limits for this species, as described above.
C. *Bocaccio* - The proposed regulations eliminate the sub-bag limit for bocaccio within the overall 10 fish Rockfish, Cabezon, Greenling (RCG). Bocaccio is rebuilding quickly and eliminating the sub-bag limit and allowing retention of up to 10 fish can be easily

accommodated within the harvest guideline without jeopardizing the rebuilding progress of this stock.

D. *Lingcod* - The proposed regulations decrease the bag limit for lingcod from three to two fish. A lower bag limit is needed to keep catches within allowable limits. In 2015, recreational catches came very close to exceeding the limit, and with the proposed extensions to season lengths, a lower bag limit was needed to ensure the additional catches that will come with the increases to time on the water can be accommodated within the limit.

Item 3: Proposed Changes to Retention of Petrale Sole and Starry Flounder

The proposed regulations would allow petrale sole and starry flounder to be retained year-round in all depths. Both of these species are encountered while fishing for other species and allowing retention year-round will reduce discarding while keeping catches within allowable limits. Both species are taken in very low quantities in California sport fisheries compared with the State's commercial fisheries, and sport catches are expected to continue near status-quo levels with the proposed change.

Item 4: Clarifications

The proposed regulations clarify that when depth limits are in effect, fishing is prohibited seaward of the specified depth limit along the mainland coast and along islands and offshore seamounts. The proposed changes would reduce public confusion and clarify those areas which are closed to fishing, particularly around offshore islands and seamounts. To improve clarity, regulations governing petrale sole and starry flounder were removed from Section 28.49 and relocated in a new stand-alone Section 28.47 because they are no longer subject to any depth constraints. Other changes are proposed for clarity and consistency.

It is the policy of this State to encourage the conservation, maintenance, and utilization of the living resources of the ocean and other waters under the jurisdiction and influence of the State for the benefit of all the citizens of the State and to promote the development of local fisheries and distant-water fisheries based in California.

The objectives of this policy include, but are not limited to, the maintenance of sufficient populations of all species of aquatic organisms to ensure their continued existence and the maintenance of a sufficient resource to support a reasonable sport use, taking into consideration the necessity of regulating individual sport fishery bag limits to the quantity that is sufficient to provide a satisfying sport.

Adoption of scientifically-based groundfish seasons, depth restrictions, size limits, and bag and possession limits provides for the maintenance of sufficient populations of groundfish species to ensure their continued existence.

The benefits of the proposed regulations are consistency with federal law, sustainable management of groundfish resources, and promotion of businesses that rely on recreational groundfish fishing.

(b) Authority and Reference Sections from Fish and Game Code for Regulation:

Authority: Sections 200, 202, 205, 220, 702, 7071 and 8587.1, Fish and Game Code.

Reference: Sections 200, 202, 205, 220, 1802, 7071 and 8585.5, Fish and Game Code; Title 50, Code of Federal Regulations, Part 660, Subpart G; and Section 27.20, Title 14, CCR.

(c) Specific Technology or Equipment Required by Regulatory Change:

None

(d) Identification of Reports or Documents Supporting Regulation Change:

2017-2018 Groundfish Harvest Specifications and Management Measures Including Changes to Groundfish Stock Designations (Amendment 27 to the Pacific Coast Groundfish Fishery Management Plan); Description and Analysis for Council Decision-Making http://www.pcouncil.org/wp-content/uploads/2016/03/F3_Att1_17-18_GF_SpexCouncilDoc_APR2016BB.pdf

Pacific Coast Groundfish Fishery Management Plan for the California, Oregon, and Washington Groundfish Fishery. March 2016. Pacific Fishery Management Council. http://www.pcouncil.org/wp-content/uploads/2016/03/GF_FMP_FINAL_Mar2016_Mar282016.pdf

Nearshore Fishery Management Plan. Adopted October 25, 2002. Department of Fish and Game. https://www.wildlife.ca.gov/Conservation/Marine/NFMP.aspx

Fisheries Economics of the United States, 2014. May 2016. NOAA Technical Memorandum, NMFS-F/SPO-163. http://www.st.nmfs.noaa.gov/Assets/economics/publications/FEUS/FEUS-2014/Report-and-chapters/FEUS-2014-FINAL-v5.pdf

(e) Public Discussions of Proposed Regulations Prior to Notice Publication:

Pacific Fishery Management Council meetings where the proposed regulations for the 2017 and 2018 recreational groundfish and associated species were discussed:

- September 9-16, 2015, Sacramento, CA
- November 14-19, 2015, Garden Grove, CA
- March 8-14, 2016, Sacramento, CA
- April 8-14, 2016, Vancouver, WA
- June 21-28, 2016, Tacoma, WA

State public meetings where the proposed regulations for the 2017 and 2018 recreational groundfish and associated species were discussed:

- December 2, 2015, Eureka, CA
- December 3, 2015, Fort Bragg, CA
- December 9, 2015, Sausalito, CA
- January 6, 2016, Monterey, CA
- January 7, 2016, Los Alamitos, CA

IV. Description of Reasonable Alternatives to Regulatory Action:

(a) Alternatives to Regulation Change:

No alternatives were identified by or brought to the attention of Commission staff that would have the same desired regulatory effect.

(b) No Change Alternative:

Under the No Change Alternative, State law would be inconsistent with federal law. Inconsistency in regulations will create confusion among the public and may result in laws that are difficult to enforce. Additional fishing opportunity expected to come with the federal regulation changes effective in January 2017 would not be realized.

It is critical to have consistent State and federal regulations establishing season dates, depth constraints and other management measures, and also critical that the State and federal regulations be effective concurrently. Consistency with federal regulations is also necessary to maintain State authority over its recreational groundfish fishery and avoid federal preemption under the Magnuson-Stevens Fishery Conservation Act [16 USC §1856 (b)(1)].

(c) Consideration of Alternatives:

In view of information currently possessed, no reasonable alternative considered would be more effective in carrying out the purpose for which the regulation is proposed, would be as effective and less burdensome to affected private persons than the proposed regulation, or would be more cost effective to affected private persons and equally effective in implementing the statutory policy or other provision of law.

V. Mitigation Measures Required by Regulatory Action:

The proposed regulatory action will have no negative impact on the environment; therefore, no mitigation measures are needed.

VI. Impact of Regulatory Action:

The potential for significant statewide adverse economic impacts that might result from the proposed regulatory action has been assessed, and the following initial determinations relative to the required statutory categories have been made:

(a) Significant Statewide Adverse Economic Impact Directly Affecting Businesses, Including the Ability of California Businesses to Compete with Businesses in Other States:

The proposed action will not have a significant statewide adverse economic impact directly affecting business, including the ability of California businesses to compete with businesses in other states. The Commission anticipates increased opportunities for the recreational groundfish fishery in 2017-2018 compared to 2016.

(b) Impact on the Creation or Elimination of Jobs Within the State, the Creation of New Businesses or the Elimination of Existing Businesses, or the Expansion of Businesses in California; Benefits of the Regulation to the Health and Welfare of California Residents, Worker Safety, and the State's Environment:

The Commission does not anticipate any significant impacts on the creation or elimination of jobs, the creation of new business, the elimination of existing businesses or the expansion of businesses in California.

The Commission anticipates benefits to the health and welfare of California residents.

The Commission does not anticipate any benefits to worker safety.

The Commission anticipates benefits to the environment by the sustainable management of California's sport fishing resources.

(c) Cost Impacts on a Representative Private Person or Business:

The agency is not aware of any cost impacts that a representative private person or business would necessarily incur in reasonable compliance with the proposed action.

(d) Costs or Savings to State Agencies or Costs/Savings in Federal Funding to the State:

None

(e) Nondiscretionary Costs/Savings to Local Agencies:

None

(f) Programs Mandated on Local Agencies or School Districts:

None

(g) Costs Imposed on Any Local Agency or School District that is Required to be Reimbursed Under Part 7 (commencing with Section 17500) of Division 4, Government Code:

None

(h) Effect on Housing Costs:

None

VII. Economic Impact Assessment

Recreational groundfish fisheries are broadly sub-divided between private anglers and commercial passenger fishing vessels. The economic impact of regulatory changes for recreational fisheries may be estimated by tracking the resulting changes in fishing effort, angler trips and length of stay in the fishery areas. Distance traveled affects gas and other travel expenditures. Day trips and overnight trips involve different levels of spending for gas, food, and accommodations at area businesses as well as different levels of sales tax impacts. Direct expenditures ripple through the economy, as receiving businesses buy intermediate goods from suppliers that then spend that revenue again. Business spending on wages is received by workers who then spend that income, some of which goes to local businesses. Recreational fisheries spending, thus multiplies throughout the economy with the indirect and induced effects of the initial direct expenditure.

The adoption of scientifically-based regulations provides for the maintenance of sufficient populations of groundfish to ensure their continued existence and future groundfish sport fishing opportunities that in turn support the fishery economy. In a recently released report, Fisheries Economics of the United States 2014 (May 2016) by the National Marine Fisheries Service, all marine recreational anglers trip-related and equipment expenditures sum to approximately $2.0 billion in California. Coupled with the indirect and induced effects of this $2.0 billion direct revenue contribution, the total realized economic benefit to California is estimated at $2.7 billion in total economic output annually. This corresponds with about $1.1 billion in total wages to Californians, and about 23,000 jobs in the State, annually. While the precise share of these expenditures attributed solely to groundfish anglers is not known, we do know that the groundfish fishery constitutes a large share of the State's recreational angler activity.

The proposed regulations will modify State recreational groundfish regulations to conform to federal rules. Currently, the conforming State regulations for groundfish include season lengths, depth restrictions, size limits, bag limits, and possession limits. In adopting these conforming regulations the State relies on information provided in PFMC documents which includes analysis of impacts to California (http://www.pcouncil.org/wp-content/uploads/2016/03/F3_Att1_17-18_GF_SpexCouncilDoc_APR2016BB.pdf).

For public notice purposes to facilitate Commission discussion, the Department is proposing regulatory changes to encompass the range of federal groundfish regulations that are expected to be in effect for 2017 and 2018. The proposed regulatory changes would modify the bag limit for some species and/or species groups and would modify the season and/or depth constraints in four of the management areas (Northern, Mendocino, San Francisco, and Central).

The range of estimated impact on angler trips by management area and the percent increase from the status quo is presented in Table 1. The economic impacts may be close to status quo; however, some increased revenues are expected. These additional revenues would provide economic benefit to the greater community, particularly to the coastal communities in the Northern and Mendocino Management Areas.

Table 1. Estimated Impact on Angler Trips by Management Area.

Management Area	Impact on Angler Trips	Percent Increase over Status Quo
Northern	Status Quo + 2,800 Trips	Increase of 7%
Mendocino	Status Quo + 1,500 Trips	Increase of 9%
San Francisco	Status Quo	Status Quo*
Central	Status Quo	Status Quo*
Southern	Status Quo	Status Quo

*A 10 fathom increase in depth is proposed, however economic effects of such an increase cannot be quantified.

Sport fishing business owners, boat owners, tackle store owners, boat manufacturers, vendors of food, bait, fuel and lodging, and others that provide goods or services to those that recreationally pursue groundfish off California may be positively affected to some degree from increases to business that may result under the range of proposed regulations. However, anticipated impacts may vary by geographic location. Additionally, economic impacts to these same businesses may result from a number of factors unrelated to the proposed changes to groundfish fishing regulations, including weather, fuel prices, and success rates in other marine recreational fisheries such as salmon and albacore.

<u>Effects of the Regulation on the Creation or Elimination of Jobs Within the State</u>

The cumulative effects of the changes statewide are estimated to be neutral to job elimination and potentially positive to job creation in California. No significant changes in fishing effort and recreational fishing expenditures to businesses are expected as a direct result of the proposed regulation changes.

Effects of the Regulation on the Creation of New Businesses or the Elimination of Existing Businesses within the State

The cumulative effects of the changes statewide are expected to be neutral to business elimination and potentially positive to the creation of businesses in California. No significant changes in fishing effort and recreational fishing expenditures to businesses are expected as a direct result of the proposed regulation changes.

Effects of the Regulation on the Expansion of Businesses Currently Doing Business Within the State

The cumulative effects of the changes statewide are expected to be neutral to positive to the expansion of businesses currently doing business in California. No significant changes in fishing effort and recreational fishing expenditures to businesses are expected as a direct result of the proposed regulation changes.

Benefits of the Regulation to the Health and Welfare of California Residents

Providing increased fishing opportunities for groundfish encourages recreation, which can have a positive impact on the health and welfare of California residents. Groundfish taken in the sport fishery and later consumed may have positive human health benefits.

Benefits of the Regulation to Worker Safety

The proposed regulations are not anticipated to impact worker safety conditions.

Benefits of the Regulation to the State's Environment

It is the policy of this State to encourage the conservation, maintenance, and utilization of the living resources of the ocean and other waters under the jurisdiction of the State for the benefit of all citizens of the State. Benefits of the proposed management actions include increased fishing opportunity, along with the continuation of the reasonable and sustainable management of recreational groundfish resources and the protection of listed and special status species. Adoption of scientifically-based seasons, depth restrictions, and recreational bag limits provide for the maintenance of sufficient populations of groundfish to ensure their continued existence.

Other Benefits of the Regulation

Concurrence with Federal Law

The PFMC reviews the status of groundfish regulations biennially. As part of that

process, it recommends regulations aimed at meeting biological and fishery allocation goals specified in law or established in the Pacific Coast Groundfish Fishery Management Plan. These recommendations coordinate management of recreational and commercial groundfish in the EEZ (three to 200 miles offshore) off the coasts of Washington, Oregon, and California. These recommendations are subsequently implemented as ocean fishing regulations by the National Marine Fisheries Service.

California's sport fishing regulations need to conform to, or be more restrictive than, federal regulations to ensure that biological and fishery allocation goals are not exceeded.

Informative Digest/Policy Statement Overview

Biennially, the Pacific Fishery Management Council (PFMC) reviews the status of west coast groundfish populations. As part of that process, it recommends groundfish fisheries regulations aimed at meeting biological and fishery allocation goals specified in law or established in the Pacific Coast Groundfish Fishery Management Plan (FMP).

These recommendations coordinate west coast management of recreational and commercial groundfish fisheries in the Exclusive Economic Zone (EEZ) (three to 200 miles offshore) off Washington, Oregon and California. These recommendations are subsequently implemented as federal fishing regulations by the National Marine Fisheries Service (NMFS).

For consistency, the California Fish and Game Commission (Commission) routinely adopts sportfishing regulations to bring State law into conformance with federal law for groundfish and other federally-managed species.

Current regulations establish season lengths, depth constraints, methods of take, and size, bag and possession limits within the five groundfish management areas for all federal groundfish and associated species.

Summary of Proposed Amendments

The Department of Fish and Wildlife (Department) is proposing the following regulatory changes to be consistent with PFMC recommendations for federal groundfish regulations in 2017 and 2018. This approach will allow the Commission to adopt State recreational groundfish regulations to timely conform to those taking effect in federal ocean waters in January 2017.

The proposed regulatory changes will implement the following changes:

1. Seasons and Depths
    A. Extend the season length in the Northern and Mendocino Management Areas;
    B. Increase the allowable depth in the Northern, San Francisco and Central Management Areas;
    C. Allow for the take of all species with no depth restrictions November 1 through December 31 in the Northern and Mendocino Management Areas;
2. Bag Limits
    A. Increase the bag limit for canary rockfish from zero to one fish;
    B. Decrease the bag limit for black rockfish from five to three fish;
    C. Eliminate the three fish sub-bag limit for bocaccio;
    D. Decrease the bag limit for lingcod from three to two fish;
3. Allow petrale sole and starry flounder to be retained year round at all depths;
4. Clarifications
    A. Clarify language pertaining to Rockfish Conservation Areas; and
    B. Clarify and make consistent other provisions of the regulations.

The benefits of the proposed regulation changes are consistency with federal law, sustainable management of groundfish resources and promotion of businesses that rely on recreational groundfish fishing.

The proposed regulations are neither inconsistent nor incompatible with existing State regulations. The Legislature has delegated authority to the Commission to adopt sport fishing regulations (Fish and Game Code, sections 200, 202 and 205). The proposed regulations are consistent with regulations for sport fishing in marine protected areas (Section 632, Title 14, CCR), with Nearshore Fishery Management Plan regulations (sections 52.00 through 52.10, Title 14, CCR) and with sport fishing regulations in Chapters 1 and 4 of Subdivision 1 of Division 1, and Section 195, Title 14, CCR. Commission staff has searched the California Code of Regulations and has found no other State regulations related to the recreational take of groundfish.

Regulatory Language

Amend subsections (a) and (b) of Section 27.20, Title 14, CCR, as follows:

§ 27.20. Groundfish Management Areas, Seasons, Depths, Exceptions, and Fishery Closure/Rule Change Process Described.

Regulations that follow in sections 27.25 through 27.50 define fishing seasons and depth constraints that are effective within each Groundfish Management Area. These sections apply to take and possession of federally-managed groundfish species as defined in Section 1.91 and California sheephead, ocean whitefish, and all greenlings of the genus *Hexagrammos*, which are state-managed species known to associate with federal groundfish.

(a) Depth Constraints: A depth constraint means that during the open season, the aforementioned species may ~~only~~not be taken or possessed in water depths ~~shallower~~deeper than the specified depth. Two specific definitions of "depth" apply off California. In waters shallower than 30 fathoms, "depth" is defined by general depth contour lines. In waters equal to or deeper than 30 fathoms, "depth" is defined by approximating a particular depth contour by connecting the appropriate set of waypoints adopted in Federal regulations (50 CFR Part 660, Subpart C).

(b) General Provisions.

(1) Take and Possession: During any open season in any Groundfish Management Area, in waters deeper than where fishing is authorized or within special closure areas established within a Groundfish Management Area, it is unlawful to take or possess the aforementioned species except as provided in subsections (b)(1)(A) through (b)(1)(D) below and sections 27.25 through 27.50 of these regulations.

(A) Transit: The aforementioned species may be possessed aboard a vessel in transit through a closed area with no fishing gear deployed in the water.

(B) "Other Flatfish" as defined in subsection 1.91(a)(10), petrale sole, and starry flounder may be taken or possessed in all depths year-round.

(C) Shore Based Angling: When angling from shore (includes beaches, banks, piers, jetties, breakwaters, docks, and other man-made structures connected to the shore), all species may be taken or possessed year-round (See 27.50(b)(1) for exceptions in the Cowcod Conservation Areas). No vessel or watercraft (motorized or non-motorized) may be used to assist in taking or possessing these species while angling from shore under this provision.

(D) Diving or Spearfishing: When diving or spearfishing, as authorized in Section 28.90, all species may be taken or possessed year-round (See 27.50(b)(2) for exceptions in the Cowcod Conservation Areas). When boat-based groundfish fishing is closed, all types of fishing gear, except spearfishing gear, are prohibited to be aboard the vessel or watercraft (motorized or non-motorized) while spearfishing for the purpose of taking or possessing these species under this provision.

….[No changes proposed for subsections (c)-(f)]

Note: Authority cited: Sections 200, 202, 205, 702, 7071 and 8587.1, Fish and Game Code. Reference: Sections 200, 202, 205, 1802 and 7071, Fish and Game Code; and 50 CFR Part 660, Subpart G.

Amend Section 27.25, Title 14, CCR, as follows:

§ 27.25. Northern Groundfish Management Area.
This Section applies to take and possession of federally-managed groundfish species as defined in Section 1.91, California sheephead, ocean whitefish, and all greenlings of the genus *Hexagrammos*. For specific definitions, applicability, and procedures, see sections 1.91 and 27.20. For size limits, possession limits, and other regulations that apply to individual species, see specific sections beginning with Section 27.60.
(a) The Northern Groundfish Management Area means ocean waters between 42° 00' N. lat. (the Oregon/California border) and 40° 10' N. lat. (near Cape Mendocino, Humboldt County).
(b) Seasons and depth constraints (except as provided in subsection (c) below):
(1) January 1 through ~~May 14~~April 30: Closed.
~~(2) May 15 through October 31: Open for all species only in waters shallower than 20 fathoms in depth as described by general depth contour lines.~~
(2) May 1 through October 31: Take of all species is prohibited seaward of a line approximating the 30-fathom depth contour along the mainland coast and along islands and offshore seamounts. The 30-fathom depth contour is defined by straight lines connecting the set of 30-fathom waypoints as adopted in Federal regulations (50 CFR Part 660, Subpart G).
(3) November 1 through December 31: ~~Closed~~ Open for all species with no depth restrictions.
~~(c) Special exceptions to subsection (b) above:~~
~~(1)~~(c) Leopard shark may be taken or possessed in Humboldt Bay year-round ~~only in waters shallower than 20 fathoms in depth as described by general depth contour lines~~.
Note: Authority cited: Sections 200, 202, 205 and 702, Fish and Game Code. Reference: Sections 200, 202, 205, 1802 and 7071, Fish and Game Code; 50 CFR Part 660, Subpart G; and 14 CCR 27.20.

Amend Section 27.30, Title 14, CCR, as follows:

§ 27.30. Mendocino Groundfish Management Area.
This Section applies to take and possession of federally-managed groundfish species as defined in Section 1.91, California sheephead, ocean whitefish, and all greenlings of the genus *Hexagrammos*. For specific definitions, applicability, and procedures, see sections 1.91 and 27.20. For size limits, possession limits, and other regulations that apply to individual species, see specific sections beginning with Section 27.60.
(a) The Mendocino Groundfish Management Area means ocean waters between 40° 10' N. lat. (near Cape Mendocino, Humboldt County) and 38° 57.50' N. lat. (at Point Arena, Mendocino County).
(b) ~~Seasons, depth constraints, and special closure areas~~Seasons and depth constraints (except as provided in subsection (c) below):
(1) January 1 through ~~May 14~~April 30: Closed.
~~(2) May 15 through October 31: Open for all species only in waters shallower than 20 fathoms in depth as described by general depth contour lines.~~
(2) May 1 through October 31: Take of all species is prohibited seaward of 20 fathoms in depth as described by general depth contour lines along the mainland coast and along islands and offshore seamounts.

(3) November 1 through December 31: ~~Closed~~ Open for all species with no depth restrictions.
~~(c) California scorpionfish may be taken or possessed from May 15 through August 31 only in waters shallower than 20 fathoms in depth as described by general depth contour lines.~~
(c) California scorpionfish.
(1) May 1 through August 31: Take is prohibited seaward of 20 fathoms in depth as described by general depth contour lines along the mainland coast and along islands and offshore seamounts.
(2) September 1 through December 31: Closed.
Note: Authority cited: Sections 200, 202, 205 and 702, Fish and Game Code. Reference: Sections 200, 202, 205, 1802 and 7071, Fish and Game Code; 50 CFR Part 660, Subpart G; and 14 CCR 27.20.

Amend Section 27.35, Title 14, CCR, as follows:

§ 27.35. San Francisco Groundfish Management Area.
This Section applies to take and possession of federally-managed groundfish species as defined in Section 1.91, California sheephead, ocean whitefish, and all greenlings of the genus *Hexagrammos.* For specific definitions, applicability, and procedures, see sections 1.91 and 27.20. For size limits, possession limits, and other regulations that apply to individual species, see specific sections beginning with Section 27.60.
(a) The San Francisco Groundfish Management Area means ocean waters between 38° 57.50' N. lat. (at Point Arena, Mendocino County) and 37° 11' N. lat. (at Pigeon Point, San Mateo County).
(b) ~~Seasons, depth constraints, and special closure areas~~Seasons and depth constraints (except as provided in subsection (c) below):
(1) January 1 through April 14: Closed.
~~(2) April 15 through December 31: Open for all species only in waters shoreward of lines approximating the 30-fathom depth contour, defined by connecting the set of 30-fathom waypoints adopted in Federal regulations (50 CFR Part 660, Subpart G).~~
(2) April 15 through December 31: Take of all species is prohibited seaward of a line approximating the 40-fathom depth contour along the mainland coast and along islands and offshore seamounts. The 40-fathom depth contour is defined by straight lines connecting the set of 40-fathom waypoints as adopted in Federal regulations (50 CFR Part 660, Subpart G).
(c) Special exceptions to subsection (b) above:
(1) Leopard shark may be taken or possessed in Drake's Bay, Bolinas Bay, Tomales Bay, Bodega Harbor, and San Francisco Bay year-round ~~only in waters shoreward of lines approximating the 30-fathom contour, defined by connecting the set of 30-fathom waypoints adopted in Federal regulations (50 CFR Part 660, Subpart G)~~.
(2) California scorpionfish ~~may be taken or possessed from April 15 through August 31 only in waters shoreward of lines approximating the 30-fathom depth contour, defined by connecting the set of 30-fathom waypoints adopted in Federal regulations (50 CFR Part 660, Subpart G)~~.
(A) April 15 through August 31: Take is prohibited seaward of a line approximating the 40-fathom depth contour along the mainland coast and along islands and offshore seamounts. The 40-fathom depth contour is defined by straight lines connecting the set

of 40-fathom waypoints as adopted in Federal regulations (50 CFR Part 660, Subpart G).
(B) September 1 through December 31: Closed.
Note: Authority cited: Sections 200, 202, 205 and 702, Fish and Game Code. Reference: Sections 200, 202, 205, 1802 and 7071, Fish and Game Code; 50 CFR Part 660, Subpart G; and 14 CCR 27.20.

Amend Section 27.40, Title 14, CCR, as follows:

§ 27.40. Central Groundfish Management Area.
This Section applies to take and possession of federally-managed groundfish species as defined in Section 1.91, California sheephead, ocean whitefish, and all greenlings of the genus *Hexagrammos*. For specific definitions, applicability, and procedures, see sections 1.91 and 27.20. For size limits, possession limits, and other regulations that apply to individual species, see specific sections beginning with Section 27.60.
(a) The Central Groundfish Management Area means ocean waters between 37° 11' N. lat. (at Pigeon Point, San Mateo County) and 34° 27' N. ~~lat~~lat. (at Point Conception, Santa Barbara County).
(b) Seasons and depth constraints (except as provided in subsection (c) below):
(1) January 1 through March 31: Closed.
~~(2) April 1 through December 31: Open for all species only in waters shoreward of lines approximating the 40-fathom depth contour, defined by connecting the set of 40-fathom waypoints adopted in Federal regulations (50 CFR Part 660, Subpart G).~~
(2) April 1 through December 31: Take of all species is prohibited seaward of a line approximating the 50-fathom depth contour along the mainland coast and along islands and offshore seamounts. The 50-fathom depth contour is defined by straight lines connecting the set of 50-fathom waypoints as adopted in Federal regulations (50 CFR Part 660, Subpart G).
(c) Special exceptions to subsection (b) above:
(1) Leopard shark may be taken or possessed in Elkhorn Slough year-round~~ only in waters shoreward of lines approximating the 40-fathom depth contour, defined by connecting the set of 40-fathom waypoints adopted in Federal regulations (50 CFR Part 660, Subpart G)~~.
(2) California scorpionfish~~ may be taken or possessed from April 1 through August 31 only in waters shoreward of lines approximating the 40-fathom depth contour, defined by connecting the set of 40-fathom waypoints adopted in Federal regulations (50 CFR Part 660, Subpart G)~~.
(A) April 1 through August 31: Take is prohibited seaward of a line approximating the 50-fathom depth contour along the mainland coast and along islands and offshore seamounts. The 50-fathom depth contour is defined by straight lines connecting the set of 50-fathom waypoints adopted in Federal regulations (50 CFR Part 660, Subpart G).
(B) September 1 through December 31: Closed.
Note: Authority cited: Sections 200, 202 and 205, Fish and Game Code. Reference: Sections 200, 202, 205, 1802 and 7071, Fish and Game Code; and 50 CFR Part 660, Subpart G.

Amend Section 27.45, Title 14, CCR, as follows:

§ 27.45. Southern Groundfish Management Area.
This Section applies to take and possession of federally-managed groundfish species as defined in Section 1.91, California sheephead, ocean whitefish, and all greenlings of the genus *Hexagrammos*. For specific definitions, applicability, and procedures, see sections 1.91 and 27.20. For size limits, possession limits, and other regulations that apply to individual species, see specific sections beginning with Section 27.60.
(a) The Southern Groundfish Management Area means ocean waters between 34º 27' N. lat. (at Point Conception, Santa Barbara County) and the U.S./Mexico border. The Cowcod Conservation Areas are special closure areas within the Southern Groundfish Management Area.
(b) Seasons and depth constraints (except as provided in subsection (c) below):
(1) January 1 through the last day in February: Closed.
~~(2) March 1 through December 31: Open for all species only in waters shoreward of lines approximating the 60-fathom depth contour , defined by connecting the set of 60-fathom waypoints adopted in Federal regulations (50 CFR Part 660, Subpart G).~~
(2) March 1 through December 31: Take of all species is prohibited seaward of a line approximating the 60-fathom depth contour along the mainland coast and along islands and offshore seamounts. The 60-fathom depth contour is defined by straight lines connecting the set of 60-fathom waypoints as adopted in Federal regulations (50 CFR Part 660, Subpart G).
(c) Special exceptions to subsection (b) above:
(1) Regulations that apply to the Cowcod Conservation Areas are specified in Section 27.50.
(2) Leopard shark may be taken or possessed in Newport Bay, Alamitos Bay, Mission Bay, and San Diego Bay year-round~~ only in waters shoreward of lines approximating the 60-fathom depth contour, defined by connecting the set of 60-fathom waypoints adopted in Federal regulations (50 CFR Part 660, Subpart G)~~.
(3) California scorpionfish~~ may be taken or possessed January 1 through August 31 only in waters shoreward of lines approximating the 60-fathom depth contour, defined by connecting the set of 60-fathom waypoints adopted in Federal regulations (50 CFR Part 660, Subpart G)~~.
(A) January 1 through August 31: Take is prohibited seaward of a line approximating the 60-fathom depth contour along the mainland coast and along islands and offshore seamounts. The 60-fathom depth contour is defined by straight lines connecting the set of 60-fathom waypoints as adopted in Federal regulations (50 CFR Part 660, Subpart G).
(B) September 1 through December 31: Closed.
Note: Authority cited: Sections 200, 202 and 205, Fish and Game Code. Reference: Sections 200, 202, 205, 1802 and 7071, Fish and Game Code; and 50 CFR Part 660, Subpart G.

Amend Section 27.50, Title 14, CCR, as follows:

§ 27.50. Cowcod Conservation Areas.
This Section applies to take and possession of federally-managed groundfish species as defined in Section 1.91, California sheephead, ocean whitefish, and all greenlings of the genus *Hexagrammos*. For specific definitions, applicability, and procedures, see sections 1.91 and 27.20. For size limits, possession limits, and other regulations that apply to individual species, see specific sections beginning with Section 27.60.

(a) The Cowcod Conservation Areas are defined as ocean waters off southern California within each of the following two areas:
Area 1 is an area south of Point Conception that is bound by straight lines connecting the following points in the order listed:
33° 50' N. lat., 119° 30' W. long.;
33° 50' N. lat., 118° 50' W. long.;
32° 20' N. lat., 118° 50' W. long.;
32° 20' N. lat., 119° 37' W. long.;
33° 00' N. lat., 119° 37' W. long.;
33° 00' N. lat., 119° 53' W. long.;
33° 33' N. lat., 119° 53' W. long.;
33° 33' N. lat., 119° 30' W. long.; and
~~and connecting back to~~ 33° 50' N. lat., ~~119° 3 0' W. long~~119° 30' W. long.
Area 2 is a smaller area west of San Diego that is bound by straight lines connecting the following points in the order listed:
32° 42' N. lat., 118° 02' W. long.;
32° 42' N. lat., 117° 50' W. long.;
32° 36' 42" N. lat., 117° 50' W. long.;
32° 30' N. lat., 117° 53' 30" W. long.;
32° 30' N. lat., 118° 02' W. long.; and
~~and connecting back to~~ 32° 42' N. lat., 118° 02' W. long.
(b) Seasons and depth constraints (except as provided in subsection (c) below):
(1) January 1 through the last day in February: Closed.
(2) March 1 through December 31: Open for only the species or species groups listed in (A) through (G) below, and only in waters shallower than 20 fathoms in depth as described by general depth contour lines.
(A) Nearshore rockfish, as defined in subsection 1.91(a)(1)
(B) Cabezon
(C) Greenlings of the genus *Hexagrammos*
(D) California sheephead
(E) Ocean whitefish
(F) Lingcod
(G) Shelf rockfish, as defined in subsection 1.91(a)(3), except bronzespotted rockfish, ~~canary rockfish,~~ cowcod, and yelloweye rockfish which may not be taken or possessed within the Cowcod Conservation ~~Area~~Areas.
(c) Special exceptions to subsection (b) above:
(1) California scorpionfish ~~may be taken or possessed from January 1 through August 31 only in waters shallower than 20 fathoms in depth, as described by general depth contour lines~~.
(A) January 1 through August 31: Take is prohibited seaward of 20 fathoms in depth, as described by general depth contour lines along the mainland coast and along islands and offshore seamounts.
(B) September 1 through December 31: Closed.
(2) Notwithstanding subsection 27.20(b)(1)(C), when angling from shore (includes beaches, banks, piers, jetties, breakwaters, docks, and other man-made structures connected to the shore), only the species identified in (b)(2) above and California scorpionfish may be taken or possessed year-round. No vessel or watercraft (motorized or non-motorized) may be used to assist in taking or possessing these species while angling from shore under this provision.

(3) Notwithstanding subsection 27.20(b)(1)(D), when diving or spearfishing, as authorized in Section 28.90, only the species identified in (b)(2) above and California scorpionfish may be taken or possessed year-round. Except for spearfishing gear, all other types of fishing gear are prohibited to be aboard the vessel or watercraft (motorized or non-motorized) while spearfishing for the purpose of taking or possessing these species under this provision.
Note: Authority cited: Sections 200, 202 and 205, Fish and Game Code. Reference: Sections 200, 202, 205, 1802 and 7071, Fish and Game Code; 50 CFR Part 660, Subpart G; and 14 CCR 27.20.

Amend Section 28.27, Title 14, CCR, as follows:

§ 28.27. Lingcod.
(a) Open areas, seasons, and depth constraints: See Section 27.20 through Section 27.50 for definitions, special closure areas, and exceptions. Take and possession is authorized as follows:
(1) Northern Groundfish Management Area: Open and closed dates and depth constraints as defined by Section 27.25.
(2) Mendocino Groundfish Management Area: Open and closed dates and depth constraints as defined by Section 27.30.
(3) San Francisco Groundfish Management Area: Open and closed dates and depth constraints as defined by Section 27.35.
(4) Central Groundfish Management Area: Open and closed dates and depth constraints as defined by Section 27.40.
(5) Southern Groundfish Management Area: Open and closed dates and depth constraints as defined by Section 27.45.
(6) Cowcod Conservation Areas: Open and closed dates and depth constraints as defined by Section 27.50.
(b) Limit: ~~Three~~Two.
(c) Minimum size: 22 inches total length.
(d) Method of take: When angling, gear is restricted to not more than two hooks and one line. For purposes of this section, a hook is a single hook, or double or treble hook with multiple points connected to a common shank.
(e) Fishing rules for lingcod may be changed during the year or in-season by the department under the authority of subsection 27.20(e). See subsection 27.20(f) for additional information.
Note: Authority cited: Sections 200, 202, 205, 220, 702 and 8587.1, Fish and Game Code. Reference: Sections 200, 202, 205 and 1802, Fish and Game Code; 50 CFR Part 660, Subpart G; and 14 CCR 27.20.

Add Section 28.47, Title 14, CCR, as follows:

§ 28.47. Petrale Sole and Starry Flounder.
Petrale sole and starry flounder are federal groundfish, as defined in subsection 1.91(a), and are subject to special regulations as follows. Regulations of this Section do not apply to other species of flounders or sole.
(a) Open year-round.
(b) There is no limit on petrale sole or starry flounder.

(c) Petrale sole and starry flounder may be taken in all depths.
(d) Fishing rules for petrale sole and starry flounder may be changed during the year or in-season by the department under the authority of subsection 27.20(e). See subsection 27.20(f) for additional information.
Note: Authority cited: Sections 200, 202, 205 and 702, Fish and Game Code. Reference: Sections 200, 202, 205 and 1802, Fish and Game Code; 50 CFR Part 660, Subpart G; and 14 CCR 27.20.

Amend Section 28.49, Title 14, CCR, as follows:

§ 28.49. ~~Petrale Sole, Starry Flounder,~~ Soupfin Shark, Dover Sole, English Sole, Arrowtooth Flounder, Spiny Dogfish, Skates, Ratfish, Grenadiers, Finescale Codling, Pacific Cod, Pacific Whiting, Sablefish and Thornyheads.
~~Petrale sole, starry flounder, soupfin~~Soupfin shark, Dover sole, English sole, arrowtooth flounder, spiny dogfish, all skates, ratfish, all grenadiers, finescale codling, Pacific cod, Pacific whiting, sablefish, longspine thornyhead, and shortspine thornyhead are federal groundfish, as defined in subsection 1.91(a), and are subject to special regulations as follows. Regulations of this Section do not apply to other species of flounders, sole, sharks, or codlings unless otherwise specified.
(a) Open areas, seasons, and depth constraints: See Section 27.20 through Section 27.50 for definitions, special closure areas, and exceptions. Take and possession is authorized as follows:
(1) Northern Groundfish Management Area: Open and closed dates and depth constraints as defined by Section 27.25.
(2) Mendocino Groundfish Management Area: Open and closed dates and depth constraints as defined by Section 27.30.
(3) San Francisco Groundfish Management Area: Open and closed dates and depth constraints as defined by Section 27.35.
(4) Central Groundfish Management Area: Open and closed dates and depth constraints as defined by Section 27.40.
(5) Southern Groundfish Management Area: Open and closed dates and depth constraints as defined by Section 27.45.
(6) Cowcod Conservation Areas: Closed.
(b) Limit:
~~(1) There is no limit on Petrale sole or starry flounder.~~
~~(2)~~(1) The limit on soupfin shark is one fish.
~~(3)~~(2) The general bag limit of not more than 20 finfish in combination of all species with not more than 10 of any one species applies to Dover sole, English sole, arrowtooth flounder, spiny dogfish, all skates, ratfish, all grenadiers, finescale codling, Pacific cod, Pacific whiting, sablefish, longspine thornyhead and shortspine thornyhead.
(c) Fishing rules for ~~Petrale sole, starry flounder,~~ soupfin shark, Dover sole, English sole, arrowtooth flounder, spiny dogfish, all skates, ratfish, all grenadiers, finescale codling, Pacific cod, Pacific whiting, sablefish, longspine thornyhead and shortspine thornyhead may be changed during the year or in-season by the department under the authority of subsection 27.20(e). See subsection 27.20(f) for additional information.
Note: Authority cited: Sections 200, 202, 205 and 702, Fish and Game Code. Reference: Sections 200, 202, 205 and 1802, Fish and Game Code; 50 CFR Part 660, Subpart G; and 14 CCR 27.20.

Amend Section 28.55, Title 14, CCR, as follows:

§ 28.55. Rockfish (*Sebastes*).

(a) Open areas, seasons, and depth constraints: See Section 27.20 through Section 27.50 for definitions, special closure areas, and exceptions. Take and possession is authorized as follows:

(1) Northern Groundfish Management Area: Open and closed dates and depth constraints as defined by Section 27.25.

(2) Mendocino Groundfish Management Area: Open and closed dates and depth constraints as defined by Section 27.30.

(3) San Francisco Groundfish Management Area: Open and closed dates and depth constraints as defined by Section 27.35.

(4) Central Groundfish Management Area: Open and closed dates and depth constraints as defined by Section 27.40.

(5) Southern Groundfish Management Area: Open and closed dates and depth constraints as defined by Section 27.45.

(6) Cowcod Conservation Areas: Open and closed dates and depths constraints as defined by Section 27.50. Only Nearshore Rockfish, and Shelf Rockfish, as defined in subsections 1.91(a)(1) and 1.91(a)(3), may be taken and possessed, except as provided below in subsection (b)(1).

(b) Limit: Ten, within the Rockfish, Cabezon, and Greenling complex (RCG complex, as defined in Section 1.91) limit of 10 fish, in any combination of species, except as provided below.

(1) The limit on bronzespotted rockfish, ~~canary rockfish,~~ cowcod, and yelloweye rockfish is zero. These species shall not be taken or possessed as part of the RCG limit.

~~(2) The limit on bocaccio rockfish is three fish, within the RCG limit.~~

(2) The limit on canary rockfish is one fish, within the RCG bag limit.

(3) The limit on black rockfish is ~~five~~three fish, within the RCG limit.

(4) In the Cowcod Conservation Areas (see Section 27.50), the limit on slope rockfish, as defined in subsection 1.91(a)(4), is zero. These species shall not be taken or possessed as part of the RCG limit in the Cowcod Conservation Areas.

(c) Size limit: None.

(d) Method of take: When angling, gear is restricted to not more than two hooks and one line. For purposes of this section, a hook is a single hook, or a double or treble hook with multiple points connected to a common shank.

(e) Fishing rules for rockfish may be changed during the year or in-season by the department under the authority of subsection 27.20(e). See subsection 27.20(f) for additional information.

Note: Authority cited: Sections 200, 202, 205, ~~215,~~ 220, 702, 7071 and 8587.1, Fish and Game Code. Reference: Sections 200, 202, 205, ~~215,~~ 220, 1802, 7071 and 8585.5, Fish and Game Code; 50 CFR Part 660, Subpart G; and 14 CCR 27.20.

STATE OF CALIFORNIA
FISH AND GAME COMMISSION
INITIAL STATEMENT OF REASONS FOR REGULATORY ACTION
(Pre-publication of Notice Statement)

Amend Section 180.6
Title 14, California Code of Regulations (CCR)
Re: Hagfish barrel traps

I. Date of Initial Statement of Reasons: April 19, 2016

II. Dates and Locations of Scheduled Hearings:

(a)	Notice Hearing:	Date:	June 22, 2016
		Location:	Bakersfield, CA
(b)	Discussion/Adoption Hearing:	Date:	August 24, 2016
		Location:	Folsom, CA

III. Description of Regulatory Action:

(a) Statement of Specific Purpose of Regulation Change and Factual Basis for Determining that Regulation Change is Reasonably Necessary:

Effective January 1, 2016, regulations in Section 180.6, Title 14, CCR, allow for the use of 40-gallon barrel traps, attached to a central ground line, for the commercial take of hagfish; specify the maximum number of barrel traps that may be possessed; specify the maximum number of ground lines to which the barrels may be attached; specify that, when using barrel traps, no other trap type may be used or possessed; and prohibit the use of popups on buoys lines attached to barrel traps.

Immediately after the 40-gallon barrel trap allowance became effective, hagfish fishermen notified the Department of Fish and Wildlife (Department) that they had trouble finding barrels of 40-gallon capacity with which to make traps. Despite the claims of availability during the time the Fish and Game Commission (Commission) allowed the 40-gallon experimental gear, the Department has determined that there is great variability in the size and cost of adequate barrels and that the 40-gallon barrel is not as widely available or as cost effective for the permittees as had been expected.

Due to this variability, fishermen may be using barrels that could be in violation of the 40-gallon limit; furthermore, using 40 gallons as a measure

of trap capacity is difficult to enforce in the field due to how these traps are constructed. Therefore, it is necessary to amend Section 180.6 to allow for greater flexibility in the selection of barrels suitable to the fishery by removing the 40-gallon measurement and establishing a maximum total length and outside diameter. Department staff have measured several barrel styles to determine average and maximum length and outside diameter and have determined the appropriate measurements to be a maximum total length of 45 inches and a maximum outside diameter of 25 inches.

Allowing barrels with a maximum length and diameter measurement would increase the selection available to fishermen. Law Enforcement Division (LED) notes that dimensions are also easier to enforce in the field.

Fish and Game Code (FGC) §9001 requires a general trap permit to take finfish, mollusks or crustaceans with traps for commercial purposes. FGC §9001.6 specifies that bucket or Korean traps may only be used to take hagfish and that when these traps are used or possessed aboard a vessel, no other trap type may be possessed and that no other finfish species may be taken, possessed or sold.

Proposed Regulations

The proposed amendment to Section 180.6 deletes the 40-gallon requirement for barrel traps, which will be replaced by a maximum total trap length of 45 inches and maximum outside diameter of 25 inches. Added language would enact the same restrictions that are in place for other hagfish traps: 1) no take of finfish other than hagfish; and 2) no possession of any other hagfish trap type when using or in possession of barrels.

Benefits of the Regulation

It is the policy of the State to encourage the conservation, maintenance, and utilization of the living resources of the ocean and other waters under the jurisdiction and influence of the State for the benefit of all the citizens of the State. In addition, it is the policy of the State to promote the development of local fisheries and distant-water fisheries based in California in harmony with international law respecting fishing and the conservation of the living resources of the ocean and other waters under the jurisdiction and influence of the State. The objectives of this policy include, but are not limited to, the maintenance of sufficient populations of all species of aquatic organisms to ensure their continued existence and the growth of local commercial fisheries. The proposed regulation will allow for the use of a gear type that is less likely to result in whale

entanglements while still providing for a commercial hagfish fishery.

(b) Authority and Reference Sections from Fish and Game Code for Regulation:

Authority: Sections 8403 and 9022, Fish and Game Code.

Reference: Sections 8403, 9001.6, 9001.7, and 9022, Fish and Game Code.

(c) Specific Technology or Equipment Required by Regulatory Change:

None. Current regulation allows the use of barrel traps when taking hagfish. The proposed regulations increase the selection of barrels available to fishermen. While re-purposed barrels from the agricultural industry are the only economically feasible source identified by the Department for hagfish barrel traps, the regulation does not require the use of barrels or the use of re-purposed barrels from the agriculture industry.

(d) Identification of Reports or Documents Supporting Regulation Change:

None.

(e) Public Discussions of Proposed Regulations Prior to Notice Publication:

No public discussions were held prior to notice publication. The 45-day comment period provides adequate time for review of the proposed amendments.

IV. Description of Reasonable Alternatives to Regulatory Action:

(a) Alternatives to Regulation Change:

No alternatives were identified by or brought to the attention of Commission staff that would have the same desired regulatory effect.

(b) No Change Alternative:

The No Change alternative would continue the current difficulty in identifying and enforcing suitable barrel sizes for hagfish. Whale entanglement in trap/pot fisheries is a concern. The number of vertical lines used in this fishery is minimal when compared to other trap fisheries; however there is still risk of encounter. The average hagfish fisherman fishes up to five ground lines while using bucket traps. Difficulty in finding 40-gallon barrels at a cost effective price or having to modify existing barrels is acting as a deterrent to fishermen who want to switch trap types. For every fisherman that switches to barrels, there would be a net reduction of two lines.

(c) Consideration of Alternatives:

In view of information currently possessed, no reasonable alternative considered would be more effective in carrying out the purpose for which the regulation is proposed, would be as effective and less burdensome to affected private persons than the proposed regulation, or would be more cost effective to affected private persons and equally effective in implementing the statutory policy or other provision of law.

V. Mitigation Measures Required by Regulatory Action:

The proposed regulatory action will have no negative impact on the environment; therefore, no mitigation measures are needed.

VI. Impact of Regulatory Action:

The potential for significant statewide adverse economic impacts that might result from the proposed regulatory action has been assessed, and the following initial determinations relative to the required statutory categories have been made:

(a) Significant Statewide Adverse Economic Impact Directly Affecting Businesses, Including the Ability of California Businesses to Compete with Businesses in Other States:

The proposed action will not have a significant statewide adverse economic impact directly affecting business, including the ability of California businesses to compete with businesses in other states. Amending this regulation will allow fishermen to utilize any barrel, up to the maximum allowed dimensions, without need for modification or ordering special barrels at significant cost. However, fishermen may continue to use Korean or bucket traps for the take of hagfish if they desire to do so.

(b) Impact on the Creation or Elimination of Jobs Within the State, the Creation of New Businesses or the Elimination of Existing Businesses, or the Expansion of Businesses in California; Benefits of the Regulation to the Health and Welfare of California Residents, Worker Safety, and the State's Environment:

The Commission does not anticipate any impacts on the creation or elimination of jobs, the creation of new business, the elimination of existing businesses or the expansion of businesses in California, or any benefits to the health and welfare of California residents or worker safety.

The Commission anticipates possible benefits to the State's environment due to the anticipated reduction in vertical buoy lines and traps on the seafloor if more fishermen switch to barrels.

(c) Cost Impacts on a Representative Private Person or Business:

The Commission is not aware of any cost impacts that a representative private person or business would necessarily incur in reasonable compliance with the proposed action. The proposed amendment does not require fishermen to use barrel traps. Fishermen who choose to switch to barrel traps may incur costs of approximately $30 per barrel. Total cost for the allowable 25 barrels is estimated to be about $750.

(d) Costs or Savings to State Agencies or Costs/Savings in Federal Funding to the State: None.

(e) Nondiscretionary Costs/Savings to Local Agencies: None.

(f) Programs Mandated on Local Agencies or School Districts: None.

(g) Costs Imposed on Any Local Agency or School District that is Required to be Reimbursed Under Part 7 (commencing with Section 17500) of Division 4, Government Code: None.

(h) Effect on Housing Costs: None.

VII. Economic Impact Assessment:

(a) Effects of the Regulation on the Creation or Elimination of Jobs Within the State:

Amending the existing regulation is unlikely to affect the creation or elimination of jobs which are influenced more by the foreign market

demand for hagfish.

(b) Effects of the Regulation on the Creation of New Businesses or the Elimination of Existing Businesses Within the State:

Amending the existing regulation is unlikely to affect the creation or elimination of hagfish businesses which are influenced more by the foreign market demand for hagfish. Fishermen will have greater flexibility when purchasing barrels to construct their traps.

(c) Effects of the Regulation on the Expansion of Businesses Currently Doing Business Within the State:

Amending the existing regulation is unlikely to affect the expansion of hagfish businesses which are influenced by the foreign market demand for hagfish.

(d) Benefits of the Regulation to the Health and Welfare of California Residents:

This fishery is entirely for foreign export; therefore the regulation is unlikely to affect the health and welfare of California residents.

(e) Benefits of the Regulation to Worker Safety:

The regulation does not affect worker conditions or safety.

(f) Benefits of the Regulation to the State's Environment:

An intended benefit of the current regulation in subsection 180.6(b), was that the larger barrel, lower maximum barrel number compared with other hagfish trap types, and maximum of three ground lines per vessel could lessen the possibility of negative interactions with other fishing gear or cetaceans. However, industry has found that the requirement to use barrels of 40-gallon capacity is acting as a deterrent for fishermen to adopt this new gear. Amending the existing regulation to allow barrel traps up to a maximum length and diameter dimension would allow greater flexibility to fishermen due to differences in barrel design, thus encouraging more fishermen to adopt this method of take with the intended benefits.

Informative Digest/Policy Statement Overview

Current regulations in Section 180.6, Title 14, California Code of Regulations (CCR) allow hagfish, *Eptatretus spp.,* to be taken in 40-gallon barrel traps if attached to a ground line. Permittees may fish up to 25 barrel traps spread over a maximum of three ground lines.

Proposed Regulation Amendment
The proposed amendment replaces the 40-gallon requirement for barrel traps with a maximum total trap length of 45 inches and maximum outside diameter of 25 inches. Additional language is proposed to enact the same restrictions that are in place for other hagfish traps: 1) no take of finfish other than hagfish; and 2) no possession of any other hagfish trap type when using or in possession of barrels.

BENEFITS OF THE PROPOSED REGULATIONS
The proposed amendment would redefine maximum barrel size using linear dimensions instead of volume. Due to the variability in barrel manufacturing, linear dimensions offer flexibility to fishermen who want to switch to this gear and a consistent standard that enforcement staff can validate easily. With greater flexibility, more fishermen may switch over to this gear type which would reduce the number of traps on the seafloor and the number of vertical lines in the water, which may result in fewer whale entanglements. Adoption of sustainable fishing regulations, including gear type, provides for the maintenance of sufficient fish populations and ensures their continued existence.

EVALUATION OF INCOMPATIBILITY WITH EXISTING REGULATIONS:
Section 20, Article IV, of the State Constitution specifies that the Legislature may delegate to the Fish and Game Commission such powers relating to the protection and propagation of fish and game as the Legislature sees fit. The Legislature has delegated to the Commission the power to regulate the commercial take of finfish using traps (Sections 8403 and 9022, Fish and Game Code). No other State agency has the authority to promulgate commercial fishing regulations. The proposed amended regulations are compatible with Sections 180, 180.2, 180.4 and 180.5, Title 14, CCR, which address other aspects of commercial take of finfish using traps. The Commission has searched the CCR for any regulations regarding the use of traps for the commercial take of hagfish and has found no such regulation; therefore the Commission has concluded that the proposed regulations are neither inconsistent nor incompatible with existing State regulations.

Regulatory Text

Section 180.6, Title 14, CCR, is amended to read:

§ 180.6. Hagfish Traps.
(a) All openings in traps used to take hagfish, excluding the entrance funnel, shall have a minimum diameter of 9/16 inch in any dimension.
(b) Hagfish may be taken in ~~40-gallon~~ barrel traps, if attached to a ~~central~~ ground line. No permittee may possess more than 25 barrel traps ~~may be possessed~~ aboard a vessel or in the water or combination thereof. Each barrel trap shall be no greater than 45 inches total length and have an outside diameter no greater than 25 inches at its widest point. Barrels may be attached to a maximum of three ground lines. If using barrel traps, no other hagfish trap type may be used or possessed aboard the vessel. When barrel traps are used or possessed aboard a vessel, no species of finfish other than hagfish shall be taken, possessed, or sold. Popups shall not be used on buoy lines attached to barrel traps.

Note: Authority cited: Sections 8403 and 9022, Fish and Game Code. Reference: Sections 8403, 9001.6, 9001.7 and 9022, Fish and Game Code.

From:	Tanaka, Travis@Wildlife
To:	Termini, Valerie@FGC; Miller-Henson, Melissa@FGC
Cc:	Ashcraft, Susan@FGC; Fonbuena, Sherrie@FGC; Lehr, Stafford@Wildlife; Shuman, Craig@Wildlife; Martz, Craig@Wildlife; Randall, Mike@Wildlife; Barnes, Tom@Wildlife
Subject:	RE: Amend 180.6- hagfish barrel traps
Date:	Wednesday, August 10, 2016 2:07:05 PM

There have been no substantive/ significant comments received and no changes to the regulatory text or Department's recommendation.

Travis Tanaka
Environmental Scientist
CA Dept. Fish & Wildlife
20 Lower Ragsdale Dr. suite 100
Monterey, CA 93940
831-649-2881

Travis.Tanaka@wildlife.ca.gov
www.wildlife.ca.gov

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Marine Resources Committee (MRC) 2016-17 Work Plan: Scheduled topics and timeline for items referred to MRC
(Updated for Aug 2016 FGC meeting)

Topic		2016			2017		
	Type of Topic	MAR Los Alamitos	JUL Petaluma	**NOV Sacramento**	MAR	JUL	NOV
Abalone FMP / ARMP update	DFW project	X	X	**X**	X/R		
Fisheries Bycatch Workgroup	MRC workgroup	X	X	**X**			
Pier and Jetty Fishing Review	Special FGC project		X	**X**			
Herring FMP Development Updates	DFW project	X	X				
California's Fishing Communities	Special FGC project		X	**X**			
Update to MLMA Master Plan- Fisheries	DFW project	X	X	**X**	X	X	
Annual Sportfish Regulations	Annual cycle	X			X		
Kelp and Algae Harvest Management and Regulations review	DFW project			**X**			
Marine Debris and Plastic Pollution	Informational Presentation	X	R				
Ocean Acidification and Hypoxia	Informational Presentation		X				
Finding Dory – Sustainable sources	Informational Presentation		X				
Nearshore Fishery Structure Review				**X**			

KEY **X** Discussion scheduled
R Recommendation developed and moved to FGC

Commissioners
Eric Sklar, President
Saint Helena
Jacque Hostler-Carmesin, Vice President
McKinleyville
Anthony C. Williams, Member
Huntington Beach
Russell E. Burns, Member
Napa
Peter S. Silva, Member
Chula Vista

STATE OF CALIFORNIA
Edmund G. Brown Jr., Governor

Fish and Game Commission

Wildlife Heritage and Conservation
Since 1870

Valerie Termini, Executive Director
1416 Ninth Street, Room 1320
Sacramento, CA 95814
(916) 653-4899
www.fgc.ca.gov

MARINE RESOURCES COMMITTEE

Committee Chairs: Commissioner Sklar and Commissioner Silva

Meeting Agenda
July 21, 2016 10:30 a.m.

Petaluma Regional Library
100 Fairgrounds Dr., Petaluma

This meeting may be audio-recorded

NOTE: See important meeting procedures and information at the end of the agenda.
All agenda items are informational and/or discussion only. The Committee develops recommendations to the Commission but does not have authority to make policy or regulatory decisions on behalf of the Commission.

Call to order; roll call

1. Approve agenda

2. Public forum for items not on the agenda
   The Committee may not discuss or take action on any matter raised during this item, except to consider whether to recommend that the matter be added to the agenda of a future meeting. [Sections 11125, 11125.7(a), Government Code]

3. Agency Updates

4. Red Abalone Fishery Management Plan – progress update

5. Pacific Herring Fishery Management Plan – progress update

6. Marine Life Management Act Master Plan for Fisheries amendment process update

7. Update on progress and completion of new ecological impact assessment tool for scientific collecting permit applications in marine protected areas

8. California's Fishing Communities: Summary of July 20 public meeting and discuss next steps

9. Update on Fisheries Bycatch Workgroup

10. Informational Presentation and Discussion: Ocean Acidification and Hypoxia

11. Finding Dory: Opportunities to encourage environmental stewardship

12. Update on topics previously before the Committee

    (A) Marine debris and plastic pollution

    (B) Pier and jetty fishing review

13. Future agenda topics

    (A) Review work plan agenda topics and timeline

    (B) Potential new agenda topics for FGC consideration

Adjournment

2016 FISH AND GAME COMMISSION
MEETING SCHEDULE
www.fgc.ca.gov

MEETING DATE	COMMISSION MEETING	COMMITTEE MEETING
August 24-25	Lake Natoma Inn Hotel & Conference Center 702 Gold Lake Drive Folsom, CA 95630	
September 21		**Wildlife Resources** Woodland Public Library Leake Center Community Room 250 First Street Woodland, CA 95695
October 18		**Tribal** Red Lion Hotel 1929 4th Street Eureka CA 95501
October 19-20	Red Lion Hotel 1929 4th Street Eureka CA 95501	
November 17		**Marine Resources** Sacramento, CA
December 7-8	Portofino Inn & Suites 3805 Murphy Canyon Road San Diego, CA 92123	

OTHER MEETINGS OF INTEREST

Wildlife Conservation Board
- August 30, Sacramento
- November 16, Sacramento

Pacific Fishery Management Council
- August 30, Sacramento
- November 16, Sacramento

Pacific Flyway Council
- September 2016, Date and location TBD

Western Association of Fish and Wildlife Agencies
- July 21-27, 2016, Cody, WY

IMPORTANT COMMITTEE MEETING PROCEDURES INFORMATION

Welcome to a meeting of the California Fish and Game Commission's Marine Resources Committee. The Committee is chaired by up to two Commissioners; these assignments are made by the Commission.

The goal of the Committee is to allow greater time to investigate issues before the Commission than would otherwise be possible. Committee meetings are less formal in nature and provide for additional access to the Commission. The Committee follows the noticing requirements of the Bagley-Keene Open Meeting Act. It is important to note that the Committee chairs cannot take action independent of the full Commission; instead, the chairs make recommendations to the full Commission at regularly scheduled meetings.

The Commission's goal is the preservation of our heritage and conservation of our natural resources through informed decision making; Committee meetings are vital in developing recommendations to help the Commission achieve that goal. In that spirit, we provide the following information to be as effective and efficient toward that end. Welcome, and please let us know if you have any questions.

PERSONS WITH DISABILITIES

Persons with disabilities needing reasonable accommodation to participate in public meetings or other Commission activities are invited to contact the Reasonable Accommodation Coordinator at (916) 651-1214. Requests for facility and/or meeting accessibility should be received at least 10 working days prior to the meeting to ensure the request can be accommodated.

SUBMITTING WRITTEN MATERIALS

The public is encouraged to attend Committee meetings and engage in the discussion about items on the agenda; the public is also welcome to comment on agenda items in writing. You may submit your written comments by one of the following methods (only one is necessary): **Email** to fgc@fgc.ca.gov**; deliver** to California Fish and Game Commission, 1416 Ninth Street, Room 1320, Sacramento, CA 95814; or **hand-deliver to a Committee meeting.**

Comment Deadlines: Written comments received at the Commission office by **5:00 p.m. on July 7** will be made available to the Committee prior to the meeting. Written comments received between **5:00 p.m. on July 7 and 12 noon on July 15** will be made available to the Committee at the meeting. **After July 15 at noon**, five copies of written comments must be delivered at the meeting, otherwise they will not be made available to the Committee until after the meeting.

The Committee **will not** consider comments regarding proposed changes to regulations that have been noticed. If you wish to provide comment on a noticed item, please provide your comments during Commission business meetings, via email, or deliver to the commission office.

NOTE: Materials provided to the Committee may be made available to the general public.

REGULATION CHANGE PETITIONS

As a general rule, requests for regulatory change need to be redirected to the full Commission and submitted on the required petition form, FGC 1, titled “Petition to the California Fish and Game Commission for Regulation Change” (Section 662, Title 14, CCR). However, at the Committee’s discretion, the Committee may request that staff follow up on items of potential interest to the Committee and possible recommendation to the Commission.

SPEAKING AT THE MEETING

Committee meetings operate informally and provide opportunity for everyone to comment on agenda items. If you wish to speak on an agenda item, please follow these guidelines:

1. Raise your hand and wait to be recognized by the Committee co-chair(s).
2. Once recognized, please begin by giving your name and affiliation (if any) and the number of people you represent.
3. Time is limited; please keep your comments concise so that everyone has an opportunity to speak.
4. If there are several speakers with the same concerns, please try to appoint a spokesperson and avoid repetitive comments.
5. If you would like to present handouts or written materials to the Committee, please provide five copies to the designated staff member just prior to speaking.
6. If speaking during public forum, the subject matter you present should not be related to any item on the current agenda (public comment on agenda items will be taken at the time the Committee members discuss that item). As a general rule, public forum is an opportunity to bring matters to the attention of the Committee, but you may also do so via email or standard mail. At the discretion of the Committee, staff may be requested to follow up on the subject you raise.

VISUAL PRESENTATIONS/MATERIALS

All electronic presentations must be submitted by the written materials deadline **(July 15 at 12 noon)** and approved by the Commission executive director before the meeting.

1. Electronic presentations must be provided by email or delivered to the Commission on a USB flash drive by the deadline.
2. All electronic formats must be Windows PC compatible.
3. It is recommended that a print copy of any electronic presentation be submitted in case of technical difficulties.
4. A data projector, laptop and presentation mouse will be available.

LASER POINTERS may only be used by a speaker during a presentation.

Commissioners
Eric Sklar, President
Saint Helena
Jacque Hostler-Carmesin, Vice President
McKinleyville
Anthony C. Williams, Member
Huntington Beach
Russell E. Burns, Member
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Since 1870

Valerie Termini, Executive Director
1416 Ninth Street, Room 1320
Sacramento, CA 95814
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July 19, 2016

Dear Honorable Tribal Representative:

The California Fish and Game Commission (Commission) respectfully requests your Tribe's input regarding draft text related traditional knowledge (TK), including traditional ecological knowledge (TEK), that is proposed for incorporation in the final draft Marine Life Protection Act Master Plan for Marine Protected Areas (Master Plan for MPAs). The Department of Fish and Wildlife (Department) has been working on updating the Master Plan for MPAs in preparation for adoption by the Commission. The Department and Commission have sought input from Tribes for the Master Plan for MPAs update prior to and during the public comment process; the Master Plan for MPAs is now scheduled for adoption at the August 23-24, 2016 meeting in Folsom.

On May 5, 2016, the Commission and the Department sent a joint letter to your tribe inviting input concerning TEK information by June 1, 2016. The May 5 letter, which provides additional background regarding the process leading up to the request, is attached for your reference.

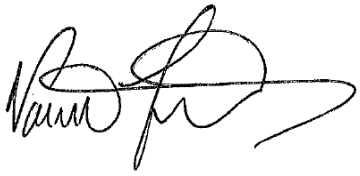
No formal response or input from Tribes was received in response to the May 5 letter. However, the Commission's Tribal Committee meeting agenda for June 21, 2016 (available at http://fgc.ca.gov/meetings/2016/June/TC/062116tcagd.pdf) included a review and discussion of draft text related to TEK for possible inclusion in the final draft 2016 Master Plan for MPAs. The discussion included draft ideas from Department and Commission staff and informal intertribal input from collaborators on the Traditional Ecological Knowledge of Keystone Marine Species and Ecosystems project, which is part of the North Coast MPA Baseline Monitoring Program project.

Based on discussion and input from tribal representatives attending the Tribal Committee meeting, the Department developed draft proposed text regarding TEK and TK for the final draft 2016 Master Plan for MPAs (see attached table). The draft text was provided to the Commission for consideration and discussion at their meeting on June 22-23, 2016, in Bakersfield (Under item 10 of agenda at http://fgc.ca.gov/meetings/2016/June/FGC/0622216agd.pdf; see attached table for draft text). Tribal leaders requested additional time for tribal review and potential formal approval from Tribal Councils. In response, the Commission chose to delay adoption of the final draft 2016 Master Plan for MPAs to allow additional time for Tribal input on the drafted text.

The Commission respectfully requests that all input on the draft text be provided by **July 29, 2016.** The attached table includes the text related to TEK and TK that is proposed for incorporation in the final draft Master Plan for MPAs. This table, as well as the final draft Master Plan for MPAs, is available on the Department's website, at www.wildlife.ca.gov/Conservation/Marine/MPAs/Master-Plan. Please feel free to contact me with questions or your input at valerie.termini@fgc.ca.gov, or by mail at California Fish and Game Commission, 1416 9th Street, Suite 1320, Sacramento, CA 95814.

We look forward to receiving your response and input on the final draft TK and TEK text by July 29, 2016, in advance of Commission's consideration to adopt the final 2016 Master Plan for MPAs at the August 23-24, 2016 meeting.

Sincerely,



Valerie Termini
Executive Director
California Fish and Game Commission

Attachments

ec: FGC Commissioners

Nathan Voegeli, Tribal Liaison
Office of the General Counsel
Department of Fish and Wildlife

Craig Shuman, Regional Manager
Marine Region
Department of Fish and Wildlife

ATTACHMENT 1

STATE OF CALIFORNIA
EDMUND G. BROWN JR., GOVERNOR

NATURAL RESOURCES AGENCY

California Department of Fish and Wildlife
1416 Ninth Street, #1205
Sacramento, CA 95814

California Fish and Wildlife Commission
1416 Ninth Street, #1320
Sacramento, CA 95814

May 5, 2016

Honorable [Name, Title
Federally recognized tribe name
Address]

Dear Honorable Tribal Representative:

The California Fish and Game Commission (Commission) and the California Department of Fish and Wildlife (Department) respectfully request your Tribe's comments regarding the incorporation of information from tribes in the final draft Marine Life Protection Act Master Plan for Marine Protected Areas (Master Plan for MPAs). The Department has been working on updating the Master Plan for MPAs.

To facilitate the planning and scoping process, the Department on February 6, 2015, sent a letter to your Tribe inviting your input regarding the update prior to the public comment process. A follow up letter was sent by the Department on September 25, 2015, to inform you that a preliminary draft Master Plan for MPAs was available for your review and input prior to the Department's release of a draft document for public comment. These letters also welcomed your additional input during the public comment period. The Department has incorporated tribal input received up to the date of this letter into the draft Master Plan for MPAs.

The Department presented the draft Master Plan for MPAs to the Commission at their December 9, 2015, meeting, and the Commission set a public comment deadline of January 28, 2016. At the Commission's February 10, 2016, discussion hearing, the Department provided an overview of public comments received, and the Commission directed Commission staff to work with Tribal leaders and the Department to incorporate traditional ecological knowledge (TEK) into the Master Plan for MPAs as it relates to MPA management and monitoring.

The Department revised the draft Master Plan for MPAs to address comments received and minor errors identified, and submitted the final draft Master Plan for MPAs to the Commission for their April 13, 2016 adoption hearing.

At their April 13, 2016, meeting, the Commission closed all comments on the final draft Master Plan for MPAs except for tribal comments regarding the incorporation of TEK. The Commission held open this aspect of the comment period through June 1, 2016, to allow more time for tribal input.

The Commission and the Department respectfully request your input regarding the final draft Master Plan for MPAs by June 1, 2016. The final draft Master Plan for MPAs is available on the Department's website: https://www.wildlife.ca.gov/Conservation/Marine/MPAs/Master-Plan. If you would like more information on the final draft Master Plan for MPAs, please contact Environmental Scientist Adam Frimodig by email Adam.Frimodig@wildlife.ca.gov or by mail at Department of Fish and Wildlife, 619 2nd Street, Eureka, California, CA 95501.

To request formal government-to-government consultation with the Department, please contact the Tribal Liaison Nathan Voegeli by email tribal.liaison@wildlife.ca.gov or by mail at California Department of Fish and Wildlife, 1416 9th Street, Suite 1341, Sacramento, CA 95814. To request formal government-to-government consultation with the Commission, please contact Acting Deputy Director Susan Ashcraft by email Susan.Ashcraft@fgc.ca.gov or by mail at California Fish and Game Commission, 1416 9th Street, Suite 1320, Sacramento, CA 95814.

We look forward to receiving your response and input on the final draft Master Plan for MPAs.

Sincerely,

Craig Shuman, D. Env.
Regional Manager
Department of Fish and Wildlife

Mike Yaun
Acting Executive Director
California Fish and Game Commission

ec: FGC Commissioners

Nathan Voegeli, Tribal Liaison
Office of the General Counsel
Department of Fish and Wildlife

Becky Ota
Environmental Program Manager
Marine Region
Department of Fish and Wildlife

ATTACHMENT 2

Proposed draft text developed by CDFW based on input from the Fish and Game Commission Tribal Committee discussion on June 21, 2016, to incorporate into the final draft 2016 Master Plan for MPAs

Document section (page numbers)[1]	***Proposed draft text developed by CDFW based on Tribal Committee input***
Acronyms (page v)	Suggest adding TEK (traditional ecological knowledge) and TK (traditional knowledge) to the acronyms table
Chapter 1.1, 2nd paragraph (pages 5-6)	California's inhabitants have depended on the state's marine and coastal resources for ~~at least 11,500 years, with some estimates indicating 19,000 years or more~~ millennia (Walker & DeNiro 1986, Pritzker 2000, Erlandson et al. 2005, Rick et al. 2008~~). For countless generations,~~ Since time immemorial, California Tribes have stewarded and utilized marine and coastal resources in the region ~~and stewarded marine and coastal ecosystems across California's approximately 1,100 mile coastline~~. The foundation of their management is a collective storehouse of knowledge about the natural world, acquired through direct experience and contact with the environment, and gained through many generations of learning passed down by elders about practical as well as spiritual practices (Anderson 2005). This knowledge, which is the product of keen observation, patience, experimentation, and long-term relationships with the resources, today is commonly called "traditional ecological knowledge" (TEK) (Anderson 2005, and references therein). TK encompasses TEK, science, and other relevant information from tribes. Many California Tribes continue to regularly harvest marine resources within their ancestral territories and maintain relationships with the coast for ongoing customary uses. Today, California's inhabitants and visitors continue to gain significant benefits from the state's ~~oceans and coasts~~coastal waters, including economic, nutritional, recreational, cultural, spiritual, and educational, as well as climate regulation and protection from coastal hazards. ~~Many California Tribes continue to regularly harvest marine resources within their ancestral territories and maintain relationships with the coast for ongoing cultural uses, including spiritual and ceremonial purposes.~~ Anderson, K. (2005). *Tending the wild: Native American knowledge and the management of California's natural resources.* Berkeley and Los Angeles, California: University of California Press.

[1] Page numbers correspond to the Final Draft 2016 Master Plan for MPAs: https://www.wildlife.ca.gov/Conservation/Marine/MPAs/Master-Plan

Document section (page numbers)[1]	***Proposed draft text developed by CDFW based on Tribal Committee input***
Chapter 4.3, 2nd paragraph (page 43)	This need is described in the MLPA, which requires "monitoring, research, and evaluation at selected sites to facilitate adaptive management of MPAs and ensure that the [MPA] system meets the goals."[127] Therefore, monitoring results and additional information potentially collected from TK, ~~other~~ scientific data, governance and management review, workshops, and public forums ~~is~~ are an accumulation of information that could be used to inform adaptive management which is a response to that information (see Chapter 4.5). For example, the North Coast Regional MPA Baseline Monitoring Program is the first regional MPA baseline monitoring program in California to incorporate a TK research project (see Appendix C, Section 5).[128] The MLPA, together with policy guidance including the Partnership Plan and the MSLT Work Plan, have guided and will continue to guide the MPA monitoring approach outlined in this section, which will be used to inform adaptive management of California's MPA network. [128] Rocha, M., Rosales, H., Sundberg, R., and T. Torma. *Traditional Ecological Knowledge of Keystone Marine Species and Ecosystems*. Retrieved Feb 18, 2016 from https://caseagrant.ucsd.edu/news/new-projects-to-take-snapshot-of-north-coasts-mpas#keystone-marine-species
Chapter 4.3, Using a Partnership-Based Approach, 3rd paragraph (Page 46)	To date, the partnership-based approach to MPA management has involved more than 70 agencies, California Tribes and Tribal governments, and organizations in regional baseline MPA monitoring programs. Long-term monitoring will build on this experience, continuing to leverage capacity and establish partnerships to build a cost-effective, sustainable monitoring program statewide. For example, incorporating TK can improve the understanding of historical and current ocean conditions. The MSLT has developed an MSLT Work Plan that emphasizes the ongoing need to build partnerships, broaden participation, include knowledge from diverse sources, and build a deeper understanding of ocean health. The MSLT Work Plan reflects the philosophy that all quality science may be useful in building a robust monitoring program, including academic, local, traditional, and citizen science contributions. Citizen science programs provide monitoring support through activities such as trainings to gather biological data in key habitats and recording observations of consumptive and non-consumptive uses of MPAs.

YUROK TRIBE

190 Klamath Boulevard • Post Office Box 1027 • Klamath, CA 95548

Sent via electronic mail

July 19, 2016

President Eric Sklar
California Fish and Game Commission
P.O. Box 944209
Sacramento, CA 94244-2090

Re: Draft Text Related to "Traditional Ecological Knowledge" for Proposed Final Master Plan for MPAs

Aiy-ye-kwee' President Sklar and Commissioners,

The purpose of this letter is to provide feedback on the most recently proposed traditional ecological knowledge ("TEK") and traditional knowledge ("TK") text to be included in the 2016 Master Plan, as it relates to marine protected area management and monitoring.

Yurok proposes the following revisions be made to the June 21, 2016 proposed text developed by CDFW based on input from the Fish and Game Commission Tribal Committee:

For Chapter 1.1, pages 5-6, Yurok proposes adding the following points, cited by the USGS:

- No single definition of TEK is accepted
- TEK is "A cumulative body of knowledge, practice and belief, evolving by adoptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with the environment." (Berkes 1999)
- "TEK refers specifically to all types of knowledge about the environment derived from the experience and traditions of a particular group of people." (Usher 2000)

For Chapter 4.3, page 43, Yurok proposes rejecting the proposed strikeout of the word "other" so the text reads as follows:

> "Therefore, monitoring results and additional information potentially collected from TK, other scientific data, governance and management review, workshops, and public forums is are an accumulation of information that could be used to inform adaptive management which is a response to that information (see Chapter 4.5)."

The Yurok Tribe interprets removal of the work "other" from the above proposed sentence as necessarily implying that TK does not include scientific data, which is not the case. Including the word "other" is most consistent with the proposed text seen in Chapter 1.1., pages 5-6.

We appreciate your careful review of our proposed revisions to the draft text. If you have any questions, please contact Office of Tribal Attorney at 707-482-1350.

Sincerely,

Thomas P. O'Rourke, Sr.
Chairman

Cc: Valerie Termini, Executive Director California Fish and Game Commission

Cher-Ae Heights Indian Community of the Trinidad Rancheria

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July 28, 2016

Eric Sklar, President
California Fish and Game Commission
1416 9th Street, Suite 1320
Sacramento, CA 95814

RE: Tribal Input on TK and TEK Draft Text

Dear Honorable Commissioners:

The Trinidad Rancheria appreciates the opportunity to submit comments on the draft text related to traditional knowledge (TK) and traditional ecological knowledge (TEK) that is proposed for incorporation in the final draft Marine Life Protection Act Master Plan for Marine Protected Areas. Also, we would like to thank the Commission for extending the tribal comment period to July 29, 2016 at the request of tribal leaders present at the Tribal Committee meeting on June 21, 2016.

Trinidad Rancheria is a Federally Recognized Tribe located in Humboldt County, California, with the Pacific Ocean as the western boundary of our tribal lands. We have been an active participant throughout the MLPA process and attend the Commission's Tribal Committee meetings when possible. The tribe's culture is inextricably intertwined with the marine environment and the ecological resources in our tribal area, and the Rancheria has an active role in the stewardship of the marine ecosystem. Additionally, Trinidad Rancheria has contributed informal inter-tribal input through collaboration on the Traditional Ecological Knowledge of Keystone Marine Species and Ecosystems project. This collaborative effort provided a foundation for the current proposed language.

Rachel Sundberg, our Tribal Historic Preservation Officer, participated in the TEK Ecosystems project and provided perspective for our comments. Our input is:

Acronyms (page v)	Agree to add TK and TEK to the acronyms table
Chapter 1.1, 2nd Paragraph (p.5-6)	Agree with the proposed draft. However, we would like to comment that TEK is a cumulative body of scientific knowledge; therefore TEK is science and should be defined as such.

www.trinidadrancheria.com
1 Cher-Ae Lane • PO Box 630 • Trinidad, California • 95570 • 707.677.0211 • 707.677.3921 (fax)

Chapter 4.3 (p.43)	Delete the "For example" in the sentence "For example, the North Coast Regional MPA Baseline Monitoring Program is the first regional MPA baseline monitoring program in California to incorporate a TK research project (see Appendix C, Section 5)." It is a statement of fact, not only an example, which could imply and be construed as optional, something that can be disregarded. By using the sentence as a statement of fact and not an example, the information is a more meaningful and integral part of the paragraph.
Chapter 4.3 (p.46)	Delete the "For example" in the sentence "For example, incorporating TK can improve the understanding of historical and current ocean conditions." Same reasons as above.

Thank you for your consideration of the Trinidad Rancheria's input to the proposed TK and TEK draft text for incorporation into the Master Plan for MPA's. Please contact Shirley Laos, Governmental Affairs Coordinator at (707) 677-0211 or slaos@trinidadrancheria.com should you have questions regarding this matter.

Sincerely,

Garth Sundberg

Garth Sundberg
Chairman

Tolowa Dee-ni' Nation

140 Rowdy Creek Rd, Smith River, CA 95567-9525
Ph: (707) 487-9255 Fax: (707) 487-0930

Loren Me'-lash-ne Bommelyn
Chairman

Denise Padgette
Vice Chairperson

Scott D. Sullivan
Council Secretary

Dr. Joseph Giovannetti
Treasurer

Marvin Richards Sr.
Council Member

Jeri Lynn Thompson
Council Member

Leann McCallum
Council Member

Elizabeth Wray
Chief Executive Officer

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July 26, 2016

California Fish and Game Commission
c/o Valerie Termini, Executive Director
1416 Ninth Street, Room 1320
Sacramento, CA 95814

RE: Formal input regarding draft text related to traditional knowledge proposed for incorporation in the final draft Marine Life Protection Act Master Plan for Marine Protected Areas.

Dv-laa-ha~ Commissioners,

On behalf of the Tolowa Dee-ni' Nation ("Nation"), a federally recognized Indian Tribe, with aboriginal lands and territory throughout Northern California and Southern Oregon, and organized pursuant to the duly adopted Constitution of the Tolowa Dee-ni' Nation, the Nation would like to formally provide context and input in regards to the draft text related to traditional knowledge (TK), including traditional ecological knowledge (TEK), that is proposed for incorporation in the final draft Marine Life Protection Act Master Plan for Marine Protected Areas (Master Plan for MPAs).

Since 2009, the Nation has been intimately involved in the Marine Life Protection Act Initiative process, and has held a position on the Initiative that the Nation has never ceded any rights to use and govern the resources found within the Nation's aboriginal territory. The Nation has been at the forefront in the development of co-management in relationship to shared resources of the State and federally recognized Indian Tribes. Since time immemorial, the Nation has retained inherent aboriginal rights for the use, regulation and stewardship of the resources within our aboriginal territory as defined in Article I, Section I of the Nations' Constitution.

Affirming this position, the Nation advocated for federally recognized Indian Tribes to be at the table for the monitoring and establishment of the baseline of MPAs within their respected regions. In 2013, after the regulations were adopted for the North Coast study region, the Nation, through strong advocacy, key legal arguments, common platform, solution-orientated approach, and persistence, the MPA network was shaped in a manner that acknowledged Tribal rights within the marine environment by the State of California.

The need for inclusion of Traditional Knowledge through co-management is a result of the regulations that resulted in tribal exemptions within certain MPAs.

In 2013, the Nation was awarded the *Informing the North Coast MPA Baseline: Traditional Ecological Knowledge of Keystone Marine Species and Ecosystems* Project for the establishment of a baseline of ecological features and keystone species observations as well as to identify areas of concern and/or threats for long-term monitoring of MPAs and to inform North Coast ocean policy and adaptive management. In the Tribe's proposal, TEK is defined as a cumulative body of scientific knowledge, passed through cultural transmission, that evolves adaptively through time as a result of Indigenous Peoples living in and observing the local environment for many generations; it is a form of adaptive management. (Berkes 1999; Berkes et al. 2000). The information gathered through this Project spanned beyond data sets of TEK, and a broader definition of Traditional Knowledge was needed to understand the role federally recognized Indian tribal governments played in the stewardship and management of the marine environment. Through this development, TEK is encompassed into the broader scope of Traditional Knowledge, where TK refers to indigenous communities' ways of knowing that both guide and result from their community members' close relationships with, and responsibilities towards, the landscapes, waterscapes, plants, and animals that are vital to the flourishing of indigenous cultures. These ways of knowing and living have been accrued over thousands of years of experience, relationships, and upheld responsibilities towards other living beings and places (Wildcat 2009). In Berke's definition there are six faces of TEK, compartmentalizing the use of TEK in a way that can be transferred into a western paradigm of scientific analysis. Autonomous sovereign Nations have inherent responsibilities to their family, community, and environment and their own ways to express and protect TK. The development of the Nations' TK Baseline Project has given further understanding to the fact that these responsibilities cannot be broken down in a western science context, further demonstrating the Nation's position on the need for co-management

The Nation has monitored the development of the Master Plan for MPAs, requesting the need to define and move towards a governance structure of co-management for the governance of resources in part due to the shared responsibilities of resources as well as the inability to alienate TK from the knowledge group who defines it. The Nation provided public comment to the Fish and Game Commission in 2016 stating official comments were not provided on the Master Plan for MPAs as the nexus for co-management has not been incorporated in the Master Plan for MPAs after numerous requests to expand beyond monitoring and education and to move towards a co-governance structure in all the areas of management as identified in the plan.

The Nation's support of draft text language of TEK and TK will hinge on the understanding that these definitions are systems of knowledge best understood through the co-management by the Individual federally recognized Indian Tribe in partnership with the State. Any potential impact to the resources governed by the Master Plan shall be presented and consulted on with the Nation per Governor's Executive Order B-10-11 to seek a mutually beneficial outcome in the absence of a co-management agreement.

We thank you for your attention to this important matter in developing our working relationship with the State on the management of our shared resources and the Commission's commitment to Indian Country. For questions regarding this matter please contact Chief Governance Officer Briannon Fraley at (707) 487-9255 ex 1125 or Briannon.Fraley@tolowa.com.

Shu' shaa nin-la,

Loren Me'-lash-ne Bommelyn

Loren Me'-lash-ne Bommelyn
Chairperson on behalf of Tribal Council

CC: TK Baseline Project Tribes: Tolowa Dee-ni' Nation, Trinidad Rancheria, Wiyot Tribe, Intertribal Sinkyone Wilderness Council

John Laird, Secretary for Natural resources,
California Natural Resources Agency

Deborah Halberstadt, OPC Executive Director/Deputy Secretary for Oceans and Coastal Policy,
California Natural Resources Agency

Charlton Bonham, Director,
Department of Fish and Wildlife

Nathan Voegeli, Tribal Liaison, Office of the General Counsel,
Department of Fish and Wildlife

Craig Shuman, Regional Manager Marine Region,
Department of Fish and Wildlife

OSG/bkf

State of California
Department of Fish and Wildlife

M e m o r a n d u m

Date: August 8, 2016

To: Valerie Termini
Executive Director
California Fish and Game Commission

From: Craig Shuman
Regional Manager, Marine Region

Subject: **Agenda Item for the August 23 and 24, 2016, Fish and Game Commission Meeting Regarding Proposed Traditional Ecological Knowledge Text for Final Draft Master Plan for Marine Protected Areas**

At its April 13, 2016 adoption hearing for the 2016 Master Plan for Marine Protected Areas (MPAs), the Commission closed all comments on the final draft plan, except to allow additional time for Tribal input regarding traditional ecological knowledge (TEK). On June 23, 2016, the Commission moved adoption of the final draft 2016 Master Plan for MPAs to their August 24-25, 2016 meeting. This provided Tribes with additional time to review and respond to the Department's proposed text regarding TEK that was developed in response to Tribal input received at the Commission's June 21, 2016 Tribal Committee meeting.

The attached document shows the Department's final proposed TEK text for incorporation into the final draft 2016 Master Plan for MPAs. The proposed text is based on input received at the June 21, 2016 Tribal Committee meeting and comment letters submitted by the Tolowa Dee-ni' Nation, Trinidad Rancheria, and Yurok Tribe to the Commission office following the June 23, 2016 Commission meeting.

If you have any questions regarding this item, please contact Dr. Craig Shuman, Regional Manager, Marine Region at (805) 568-1246.

Attachment

ec: Nathan Voegeli, Attorney and Tribal Liaison
Office of General Counsel
Nathan.Voegeli@wildlife.ca.gov

Becky Ota, Program Manager
Marine Region
Becky.Ota@wildlife.ca.gov

Stephen Wertz, Senior Environmental Scientist
Marine Region
Stephen.Wertz@wildlife.ca.gov

Attachment. Final proposed traditional ecological knowledge and traditional knowledge text for incorporation into the final draft 2016 Master Plan for Marine Protected Areas developed by California Department of Fish and Wildlife based on input from the Fish and Game Commission Tribal Committee discussion on June 21, 2016, and comment letters submitted by Tribes received by July 29, 2016.

Document Section (page numbers)[1]	Final Proposed Text
Acronyms (page v)	~~Suggest a~~ Add~~ing~~ TEK (traditional ecological knowledge) and TK (traditional knowledge) to the acronyms table
Chapter 1.1, 2nd paragraph (pages 5-6)	California's inhabitants have depended on the state's marine and coastal resources for ~~at least 11,500 years, with some estimates indicating 19,000 years or more~~ millennia (Walker & DeNiro 1986, Pritzker 2000, Erlandson et al. 2005, Rick et al. 2008).~~). For countless generations,~~ Since time immemorial, California Tribes have stewarded and utilized marine and coastal resources in the region ~~and stewarded marine and coastal ecosystems across California's approximately 1,100 mile coastline~~. The foundation of their management is a collective storehouse of knowledge about the natural world, acquired through direct experience and contact with the environment, and gained through many generations of learning passed down by elders about practical as well as spiritual practices (Anderson 2005). This knowledge, which is the product of keen observation, patience, experimentation, and long-term relationships with the resources, today is commonly called "traditional ecological knowledge" (TEK) (Anderson 2005). While no single definition of TEK is universally accepted, it has been described as "a cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment" (Berkes 1999).~~, and references therein)~~. ~~TK~~ Traditional Knowledge (TK) encompasses TEK, science, and other relevant information from tribes. Many California Tribes continue to regularly harvest marine resources within their ancestral territories and maintain relationships with the coast for ongoing customary uses. Today, California's inhabitants and visitors continue to gain significant benefits from the state's ~~oceans and coasts~~coastal waters, including economic, nutritional, recreational, cultural, spiritual, and educational, as well as climate regulation and protection from coastal hazards. ~~Many California Tribes continue to regularly harvest marine resources within their ancestral territories and maintain relationships with the coast for ongoing cultural uses, including spiritual and ceremonial purposes.~~ Berkes, F. (1999). Sacred ecology: traditional ecological knowledge and management systems. Taylor and Francis, Philadelphia and London, UK. Anderson, K. (2005). Tendingthe wild:Native American knowledgeand the management of California'snaturalresources.Berkeley and Los Angeles, California: University of California Press.

[1] Page numbers correspond to the Final Draft 2016 Master Plan for MPAs: https://www.wildlife.ca.gov/Conservation/Marine/MPAs/Master-Plan

Attachment. Final proposed traditional ecological knowledge and traditional knowledge text for incorporation into the final draft 2016 Master Plan for Marine Protected Areas developed by California Department of Fish and Wildlife based on input from the Fish and Game Commission Tribal Committee discussion on June 21, 2016, and comment letters submitted by Tribes received by July 29, 2016.

Document section (page numbers)[1]	Final Proposed Text
Chapter 4.3, 2nd paragraph (page 43)	This need is described in the MLPA, which requires "monitoring, research, and evaluation at selected sites to facilitate adaptive management of MPAs and ensure that the [MPA] system meets the goals."[127] Therefore, monitoring results and additional information potentially collected from TK, ~~other~~ other scientific data, governance and management review, workshops, and public forums ~~is~~ are an accumulation of information that could be used to inform adaptive management which is a response to that information (see Chapter 4.5). ~~For example, t~~The North Coast Regional MPA Baseline Monitoring Program is the first regional MPA baseline monitoring program in California to incorporate a TK research project (see Appendix C, Section 5).[128] The MLPA, together with policy guidance including the Partnership Plan and the MSLT Work Plan, have guided and will continue to guide the MPA monitoring approach outlined in this section, which will be used to inform adaptive management of California's MPA network. [128]Rocha, M., Rosales, H., Sundberg, R., and T. Torma. *Traditional Ecological Knowledge ofKeystoneMarineSpeciesandEcosystems*. Retrieved Feb 18, 2016 from https://caseagrant.ucsd.edu/news/new-projects-to-take-snapshot-of-north-coasts-mpas#keystone-marine-species
Chapter 4.3, Using a Partnership-Based Approach, 3rd paragraph (Page 46)	To date, the partnership-based approach to MPA management has involved more than 70 agencies, California Tribes and Tribal governments, and organizations in regional baseline MPA monitoring programs. Long-term monitoring will build on this experience, continuing to leverage capacity and establish partnerships to build a cost-effective, sustainable monitoring program statewide. ~~For example, i~~Incorporating TK can improve the understanding of historical and current ocean conditions. The MSLT has developed an MSLT Work Plan that emphasizes the ongoing need to build partnerships, broaden participation, include knowledge from diverse sources, and build a deeper understanding of ocean health. The MSLT Work Plan reflects the philosophy that all quality science may be useful in building a robust monitoring program, including academic, local, traditional, and citizen science contributions. Citizen science programs provide monitoring support through activities such as trainings to gather biological data in key habitats and recording observations of consumptive and non-consumptive uses of MPAs.

August 11, 2016

California Fish and Game Commission
P.O. Box 944209
Sacramento, CA 94244-2090

Via email: fgc@fgc.ca.gov, valerie.termini@fgc.ca.gov

RE: Marine Life Protection Act Master Plan Update Adoption

Dear President Sklar and Members of the Commission:

Over the past several years, the Marine Protected Area (MPA) Collaborative Network has been actively engaged in MPA implementation efforts and has made great progress in strengthening public awareness, compliance and monitoring of MPAs. We are pleased to see that the Marine Life Protection Act (MLPA) Master Plan update has a strong focus on the need for partnerships to sustain long-term MPA durability **and urge you to adopt this updated plan at your meeting on August 24, 2016.**

The MPA Collaborative Network is made up of community partners in fourteen coastal counties who provide local expertise and support MPA activities including outreach and education, compliance and enforcement, and research and monitoring. Our members include lifeguards, tribes, local municipalities, beach managers, academic institutions, federal agencies, non-profit organizations, and others, all working together to create the social infrastructure necessary to protect California's MPAs into the future.

We believe that the lasting success of the state's MPAs relies heavily on local stewardship and civic investment in these special places. The MPA Collaborative Network is committed to ensuring our protected areas are woven into community culture and viewed as public assets for recreation and exploration. We look forward to continuing our work in support of MPA management and encourage you to adopt the Master Plan update at your next meeting.

Sincerely,

Rosa Laucci, Co-Chair
Del Norte Collaborative

Beth Chaton, Co-Chair
Humboldt Collaborative

Delia Bense-Kang, Co-Chair
Humboldt Collaborative

Michele Luna, Co-Chair
Sonoma Collaborative

Brian Baird, Co-Chair
Golden Gate Collaborative

David McGuire, Co-Chair
Golden Gate Collaborative

Rikki Dunsmore, Co-Chair
Santa Cruz Collaborative

Phyllis Grifman, Co-Chair
Los Angeles Collaborative

Zach Plopper, Co-Chair
San Diego Collaborative

Rebecca Johnson, Co-Chair
San Mateo Collaborative

Kristen Hislop, Co-Chair
Santa Barbara Collaborative

Joe Tyburczy, Co-Chair
Humboldt Collaborative

Karen Grimmer, Co-Chair
Monterey Collaborative

Carla Navarro, Chair
Orange County Marine Protected Area Council

August 11, 2016

California Fish and Game Commission
P.O. Box 944209
Sacramento, CA 94244-2090

Via email: fgc@fgc.ca.gov, valerie.termini@fgc.ca.gov

RE: Support for Marine Life Protection Act Master Plan

Dear President Sklar and Members of the Commission:

Between 2004 and 2012, we served as members of the four Marine Life Protection Act (MLPA) Regional Stakeholder Groups (RSG), dedicating ourselves to work collaboratively with our fellow stakeholders to help the State of California design its globally significant network of marine protected areas (MPAs). We are writing to you now in support of the MLPA Master Plan (Master Plan) update and to **urge your Commission to approve this important document at its August 2016 meeting.**

The MLPA Master Plan provides an important record of the MPA planning process and outlines a vision and actions for successful ongoing management, which includes leveraging existing activities and collaborative partnerships, as well as a scientifically based adaptive management review cycle to facilitate improved MPA network effectiveness over time.

The MPAs that string the coast of California today represent a network of hard fought compromises, a network of protections where each individual MPA reflects painstaking attempts to meet science guidelines while balancing the sometimes conflicting perspectives and values around fishing, recreation, conservation, culture, and tradition.

California's MPA network was always intended to provide lasting protection for the state's ocean habitats and wildlife. The massive social and financial investments required to create and implement the MPA network were not made with the intent to simply "reopen" these areas to satisfy a particular stakeholder group after a few years. Instead, the care and effort that went into designing the state's MPA network was an investment to ensure that California's marine ecosystems, which support booming tourism, fishing and recreational economies and hold intrinsic and cultural value for residents and visitors alike, are thriving and sustainable into the future.

Thank you for consideration of these comments and we urge you to approve the Master Plan at your August meeting.

Sincerely,

Jenn Eckerle South Coast	Samantha Murray North Central Coast	Bill Lemos North Coast
Frederick Smith North Central Coast	Marce Gutiérrez-Graudiņš South Coast	Jim Webb Central Coast

Greg Helms
South Coast

Ray Hiemstra
South Coast

Steve Shimek
Central Coast

John Pearse
Central Coast

Marc Shargel
Central Coast

Rick Johnson
North Central Coast

Craig Swolgaard
North Central Coast

David Jensen
North Coast

Karen Garrison
North Central Coast

Phyllis Grifman
South Coast

Lia Protopapadakis
South Coast

Lance Morgan
North Central Coast

Kate Hanley
South Coast

Francesca Koe
North Central Coast

Jennifer Savage
North Coast

Bob Wilson
North Central Coast

Jack Engle
South Coast

Roberta Cordero
South Coast

Mike Osmond
Central Coast

STATE OF CALIFORNIA

FISH AND GAME COMMISSION
MEMORANDUM

DATE: August 16, 2016

TO: All Commissioners

FROM: Valerie Termini, Executive Director

SUBJECT: Agenda item for August 24-25, 2016, Commission meeting, authorize publication of notice of intent to amend regulations concerning tribal take in marine protected areas, Section 632, Title 14, California Code of Regulations

At its April 13-14, 2016, meeting, the Commission directed staff to initiate a rulemaking concerning tribal take in marine protected areas in the north coast study region. The Initial Statement of Reasons to establish the regulations is still under development, and the proposed regulations cover the following items:

- The regulatory text in subsection 632(b)(6) is proposed to be amended to add Cher-Ae Heights Indian Community of the Trinidad Rancheria and Resighini Rancheria to the list of tribes exempt from the area and take regulations for Reading Rock State Marine Conservation Area.

- The regulatory text in subsections 632(b)(1) and 632(b)(2) is proposed to be updated to reflect Smith River Rancheria's name change to Tolowa Dee-Ni' Nation.

- Other changes are proposed for clarity and consistency.

Authorization of this request to publish notice will allow for discussion at the October 19-20, 2016, meeting, and possible adoption at the December 7-8, 2016, Commission meeting.

If you have any questions or need additional information, please contact Susan Ashcraft at (916) 653-1803 or Susan.Ashcraft@fgc.ca.gov.

Attachment: Draft Proposed Regulatory Language

Proposed Regulatory Language

Section 632, Title 14, CCR, is amended to read:

§ 632. Marine Protected Areas (MPAs), Marine Managed Areas (MMAs), and Special Closures.

(a) General Rules and Regulations:

The areas specified in this section have been declared by the commission to be marine protected areas, marine managed areas, or special closures. Public use of marine protected areas, marine managed areas, or special closures shall be compatible with the primary purposes of such areas. MPAs, MMAs, and special closures are subject to the following general rules and regulations in addition to existing Fish and Game Code statutes and regulations of the commission, except as otherwise provided for in subsection 632(b), areas and special regulations for use. Nothing in this section expressly or implicitly precludes, restricts or requires modification of current or future uses of the waters identified as marine protected areas, special closures, or the lands or waters adjacent to these designated areas by the Department of Defense, its allies or agents.

[No changes to subsections (a)(1) through (a)(10)]

(11) Tribal Take. For purposes of this regulation, "federally recognized tribe" means any tribe on the *List of Indian Entities Recognized and Eligible to Receive Services from the United States Bureau of Indian Affairs*, published annually in the Federal Register. Any member of a federally recognized tribe authorized to take living marine resources from an area with area-specific take restrictions in subsection 632(b), when engaging in take within an authorized area shall possess on his person, in his immediate possession, or where otherwise specifically required by law to be kept, any valid license, report card, tag, stamp, validation, permit, or any other entitlement that is required in the Fish and Game Code, or required by other state, federal, or local entities, in order to take living marine resources. Members shall possess a valid photo identification card issued by a federally recognized tribe that contains expiration date, tribal name, tribal member number, name, signature, date of birth, height, color of eyes, color of hair, weight, and sex; and display any of the items listed above upon demand to any peace officer. Members taking living marine resources under this provision are subject to current seasonal, bag, possession, gear and size limits in existing Fish and Game Code statutes and regulations of the commission, except as otherwise provided for in subsection 632(b). No member, while taking living marine resources pursuant to this section, may be assisted by any person who does not possess a valid tribal identification card and is not properly licensed to take living marine resources. Nothing in the regulation is intended to conflict with, or supersede, any state or federal law regarding the take of protected, threatened or endangered species.

[No changes to subsection (a)(13)]

(b) Areas and Special Regulations for Use. Pursuant to the commission's authority in Fish and Game Code Section 2860 to regulate commercial and recreational fishing and any other taking of marine species in MPAs, Fish and Game Code Sections 10500(f), 10500(g), 10502.5, 10502.6, 10502.7, 10502.8, 10655, 10655.5, 10656, 10657, 10657.5, 10658, 10660, 10661, 10664, 10666, 10667, 10711, 10801, 10900, 10901, 10902, 10903, 10904, 10905, 10906, 10907, 10908, 10909, 10910, 10911, 10912, 10913, and 10932 are superseded as they apply to designations in Subsection 632(b). All geographic coordinates listed use the North American Datum 1983 (NAD83) reference datum:

(1) Pyramid Point State Marine Conservation Area.

(A) This area is bounded by the mean high tide line and straight lines connecting the following points in the order listed except where noted:
42° 00.000′ N. lat. 124° 12.735′ W. long.;
42° 00.000′ N. lat. 124° 19.814′ W. long.; thence southward along the three nautical mile offshore boundary to
41° 57.500′ N. lat. 124° 17.101′ W. long.; and
41° 57.500′ N. lat. 124° 12.423′ W. long.

(B) Area restrictions defined in subsection 632(a)(1)(C) apply, with the following specified exceptions:

1. The recreational take of surf smelt [Section 28.45] by dip net or Hawaiian type throw net [Section 28.80] is allowed.
2. The following federally recognized ~~tribes (listed alphabetically) are~~tribe is exempt from the area and take regulations found in subsection 632(b)(1) of these regulations and shall comply with all other existing regulations and statutes:
~~Smith River Rancheria~~ Tolowa Dee-Ni' Nation.

(2) Point St. George Reef Offshore State Marine Conservation Area.

(A) This area is bounded by straight lines connecting the following points in the order listed except where noted:
41° 52.000 ′ N. lat. 124° 23.189 ′ W. long.;
41° 52.000 ′ N. lat. 124° 25.805 ′ W. long.; thence southward along the three nautical mile offshore boundary to
41° 49.000′ N. lat. 124° 26.252′ W. long.;
41° 49.000′ N. lat. 124° 23.189′ W. long.; and
41° 52.000′ N. lat. 124° 23.189′ W. long.

(B) Area restrictions defined in subsection 632(a)(1)(C) apply, with the following specified exceptions:

1. The recreational take of salmon by trolling [subsection 27.80(a)(3)]; and Dungeness crab by trap is allowed.
2. The commercial take of salmon with troll fishing gear [subsection 182(c)(4)]; and Dungeness crab by trap is allowed.
3. The following federally recognized tribes (listed

alphabetically) are exempt from the area and take regulations found in subsection 632(b)(2) of these regulations and shall comply with all other existing regulations and statutes:
Elk Valley Rancheria, and
~~Smith River Rancheria~~ Tolowa Dee-Ni' Nation.

[No changes to subsections (b)(3) through (b)(5)]

(6) Reading Rock State Marine Conservation Area.

(A) This area is bounded by the mean high tide line and straight lines connecting the following points in the order listed:
41° 20.100′ N. lat. 124° 04.911′ W. long.;
41° 20.100′ N. lat. 124° 10.000′ W. long.;
41° 17.600′ N. lat. 124° 10.000′ W. long.; and
41° 17.600′ N. lat. 124° 05.399′ W. long.

(B) Area restrictions defined in subsection 632(a)(1)(C) apply, with the following specified exceptions:

1. The recreational take of salmon by trolling [subsection 27.80(a)(3)]; surf smelt [Section 28.45] by dip net or Hawaiian type throw net [Section 28.80]; and Dungeness crab by trap, hoop net or hand is allowed.
2. The commercial take of salmon with troll fishing gear [subsection 182(c)(4)]; surf smelt by dip net; and Dungeness crab by trap is allowed.
3. The following federally recognized ~~tribe is~~tribes (listed alphabetically) are exempt from the area and take regulations found in subsection 632(b)(6) of these regulations and shall comply with all other existing regulations and statutes:

Cher-Ae Heights Indian Community of the Trinidad Rancheria,
Resighini Rancheria, and
Yurok Tribe of the Yurok Reservation.

[No changes to subsections (b)(7) through (b)(147)]

Note: Authority cited: Sections 200, 202, 205(c), 220, 240, 1590, 1591, 2860, 2861 and 6750, Fish and Game Code; and Sections 36725(a) and 36725(e), Public Resources Code. Reference: Sections 200, 202, 205(c), 220, 240, 2861, 5521, 6653, 8420(e) and 8500, Fish and Game Code; and Sections 36700(e), 36710(e), 36725(a) and 36725(e), Public Resources Code.

Factual Record of Current and Historical Uses by the Cher-Ae Heights Indian Community of the Trinidad Rancheria
Submission to the California Fish and Game Commission
August 29, 2011

INTRODUCTION

On June 29, 2011, the California Fish & Game Commission, on a 4-1 vote, moved to adopt Tribal Option 1, as presented by the June 9, 2011 joint report prepared by the California Department of Fish & Game and the Marine Life Protection Act Initiative staff.

The Commission adopted Tribal Option 1 as the preferred alternative within the North Coast Study Region, to allow tribal gathering to continue within proposed State Marine Conservation Areas (SMCAs) by federally recognized tribes who, within sixty (60) days, submitted a factual record with sufficient documentation confirming current or historical use within the proposed SMCAs.

In response to the Commission's request, the following factual record has been prepared and is being submitted on behalf of the Cher-Ae Heights Indian Community of the Trinidad Rancheria. Given the time constraints, if necessary, the Tribe respectfully requests the opportunity to supplement the record at a later date. Further, although this record is being submitted within the timeframe proposed by the Fish & Game Commission, other federally recognized tribes who are unaware of this process should be afforded the opportunity to provide their submission at a later date.

HISTORY, CULTURAL GEOGRAPHY AND HUMAN ECOLOGY OF THE YUROK OF THE TRINIDAD RANCHERIA

The Cher-Ae Heights Indian Community of the Trinidad Rancheria is a federally recognized tribe[1] with ancestral ties to the Yurok, Wiyot, Tolowa, Chetco, Karuk and Hupa peoples. While they share similar cultural and historical traditions, each tribe has a distinct heritage. The Rancheria is within the aboriginal territory of the Yurok peoples and is located in an area of great cultural significance to the Trinidad Rancheria and other local tribal entities. While the Rancheria's membership maintains ancestral and cultural ties to several culture groups in the North Coast Study Region, our membership is primarily Yurok and as such we will focus on Yurok cultural geography and history.

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[1] Federal Register, Vol. 75, No. 190, p. 60810, Oct 1, 2010.

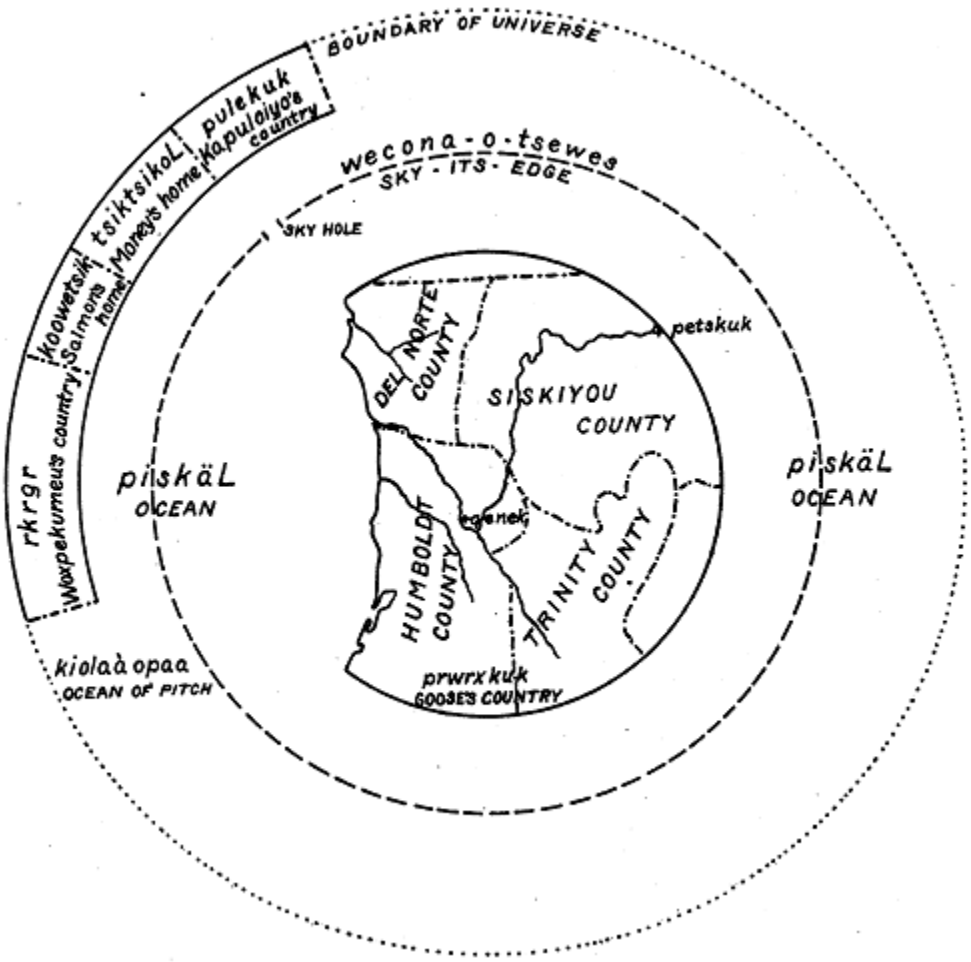

Fig. 1 Diagram showing the Yurok idea of the world. (Waterman; 1920)

A. Historic Documentation of the Tribe within the North Coast Study Region

Yurok ancestral territory encompasses approximately 320,000 acres of the North Coast extending north from the villages on the Little River (Me'tsko and S're-por) in Humboldt County to the mouth of Damnation Creek in Del Norte County, and inland along the Klamath River from the mouth of the river at Requa (Re'kwoi) to the confluence of Slate Creek and the Klamath River. Though our people have been confined to a small portion of this territory, whether as members of the Trinidad, Big Lagoon or Resighini Rancherias or of the Yurok Tribe, the people have continued to practice their traditional life ways.

Ancestral Lands include all submerged lands, lagoons, and the beds, banks, and waters of all the tributaries within the territory just described, comprising approximately seven and a half percent (7.5%) of the California coastline, and off this coastline west to the horizon. Also included within the Ancestral Lands are shared interests with other tribes in usual and customary hunting, fishing, and gathering sites (Yurok Tribe 1993, 2010).

Yurok ancestral lands are powerful cultural landscapes with ritual, spiritual, social, narrative, and economic associations. The 20th century ethnographer Thomas T. Waterman documented over 1,000 place-names within Yurok territory.

> "My impression is that local geography seems to mean rather more to the Yurok than is ordinarily the case with Indian tribes. The Yurok have a very large number of local names…In certain areas the separate place names crowd so thickly that it is difficult to find space for them on a map. In their nomenclature certain principles are very clearly visible, which it is interesting to point out, particularly with reference to those features in which the Yurok practice differs from our own. The places having names exhibit in themselves a good deal of variety; for example, a place name in a given case may become attached to a flat of thirty acres, or to a village site, or to a boulder the size of a steamer trunk, or to a few elderberry bushes, or to a single tan-oak tree…"[2]

Yurok place names and narratives identify village sites, gathering, hunting, and fishing places, major and minor topographical features, microhabitats and ephemeral phenomena. In addition to naming and revering hundreds of marine and terrestrial species, the Yurok named and revered sloughs, flats along the river, crags, coves, sea stacks, flat rocks, rocks that were partially submerged, points where rocks are always falling; places where water drips from a cave, and points in the ocean you could swim to; creeks, riffles, areas where salmon spawn on gravel, places to set annual and seasonal weirs and nets for fish and lamprey; places where smelt gather, where smelt can and cannot be dried, where the fattest salmon can be found, where the bluff "gets low" or terminates at the shoreline, where seabirds gather in crags, where to launch a boat into the sea, places to catch eels, to collect oysters, clams, mussels, and small game and waterfowl (Waterman 1920).

> "…He lived at Sumig, Thunder lived at Sumig. He was the one who said, 'Where shall we make water to be? How will they live if we leave prairie there? Let us have it so…He said to Earthquake, 'What do you think? Do you think it would be right to have it so? I want water to be there, so that people may live. (Otherwise) they will have nothing to subsist on.' Then Earthquake thought, 'That is what I believe,' He said, 'That is true. Far off I always see it, see water there, and there are salmon there…' (Kroeber: 460-461)
>
> *-Ann of Espau*

Within the Yurok territory, stretches of beach, river, or rock are designated as localities where sweat houses and fish camps were established, and where ecological and geographical features embody, and are infused by, ancient stories.

[2] Waterman 1920 p.195

The Trinidad Head (Chue-rey-wa or Tsurewa), for instance, figures prominently in tribal histories regarding ceremonial practices.

As the story begins, we meet a young man from Tsurau (Chue-rey). He had a sister. He told her one morning, "I should like to see a pretty hill be" "What for?" she asked. "I always hear laughing when the wind blows from there. I almost hear someone laughing. That is why I want to make a good hill here. I want to sit it on it that I may look about. There may be people somewhere. Perhaps they will see me when they come by." (Kroeber 1976:18).

He then went down to the beach, gathered a pile of sand in his hands and made the pile round, and set it down again. So he made Tsurewa. After the young man had created Tsurewa, he sat upon it and said, "I wish you would be higher," and the sand grew higher. After some time, the young man said, "I wish you would be a little higher," and the sand grew a little more. He looked around and said, "That is all," (Kroeber 1976:19).

As the story continues the young man sits upon the top of Tsurewa and creates a spring and it is at the spring that he goes to get woodpecker crests for his regalia. The story concludes as the young man of Tsurai travels within Yurok Ancestral Territory and visits many villages to instruct other Yurok on how to properly conduct ceremonies (Kroeber 1976:19-28).

Fig. 2 Close up of a traditional ceremonial dress (muen-chehl) owned by Tribal Member C. Jean (Natt) Walker (Yurok, Tolowa, Tututni) featuring abalone and clam shell decoration.

B. Traditional Practices and Uses of Marine Resources within the North Coast Region

Traditional tribal practices and use of marine resources are consistent with the goals of the Marine Life Protection Act. Yurok harvesting, hunting, and fishing practices are sustainable and contribute to the health and resilience of the ecosystem, while simultaneously helping to maintain the health and resilience of the Yurok culture and way of life.

Yurok people have existed as an intrinsic part of the marine environment since time immemorial. Our people are known as great fisherman, eelers, basket weavers, canoe makers, storytellers, singers, dancers, healers and strong medicine people. Over the course of this 10,000 plus year experience intimately linked adaptive management practices have been developed to mirror the natural life cycles of this unique marine environment now recognized by Western society as the North Coast of California.
These traditional management practices, reflected in prayer and incorporated in everyday life activity, gave protection to resources with an "elaborate system of rights assuming the force of law" (Kroeber(c):3).

Historically, Yurok hunting, fishing, and gathering areas were very firmly monitored and controlled. As Waterman noted, "The Yurok talk a great deal about 'beach rights.' Certainly the territories belonging to different towns were carefully discriminated and the limits very accurately known. The people who could by right share in a given piece of good fortune, such as a stranded whale, were the individuals who owned rights in that particular stretch of beach" (1920: 220-21)

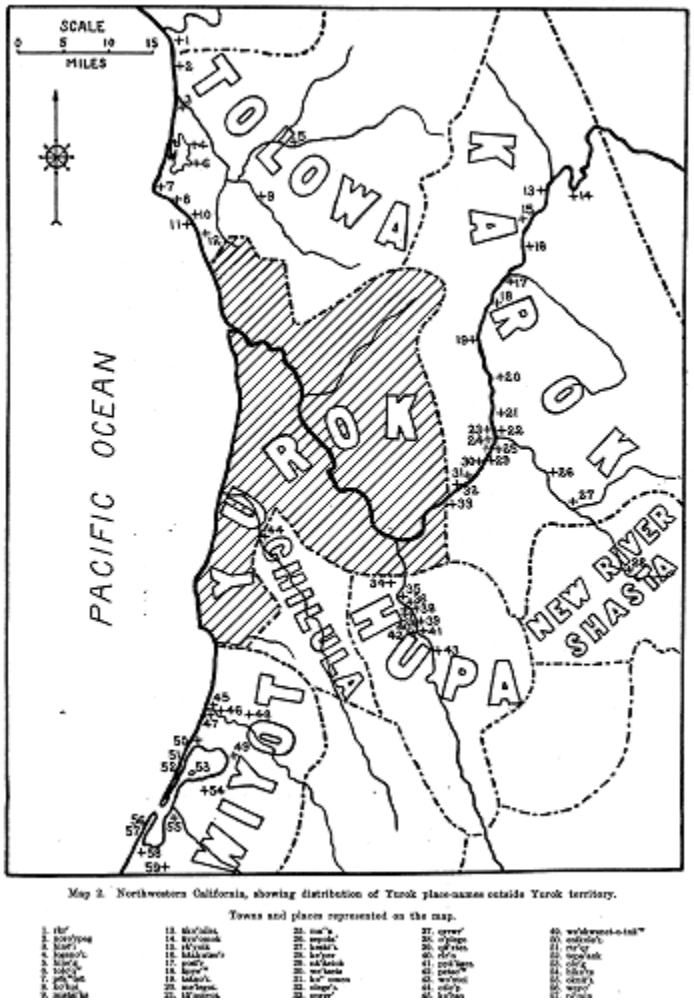

Fig 3. Map showing distribution of Yurok place names outside Yurok Territory (Waterman; 1920)

C. Overlapping Territory and the Interrelatedness of North Coast Tribes

This application for a non-exclusive right to harvest may overlap with other eligible Tribes. The boundaries provided delineating ancestral and/or aboriginal lands and waters

by each California Tribe shall be understood as defined in the document of the respective Tribe. However, it must also be recognized that there was always and continues to be traditional subsistence, ceremonial, and customary uses that may be inter-tribal and intra-tribal within a specific geography beyond and/or within those defined boundaries. This may be based on ownership, gathering, hunting, and/or harvesting rights obtained through permission, heredity, marriage, trade, gambling, dowry, need for resource, etc… Furthermore, there are areas shared for ceremonial, trade, and other customary purposes. Within the North Coast Study Region, there are a wealth of connections intertwined between California Tribes, Tribal communities, and individual Indians that are both familial and evident in shared cultural traits. For fishing, some of the similarities in technique and stewardship may be seen in the detailed report prepared by Kroeber and Barrett (1960) specific to northwestern California.

It is also understood that there are certainly areas of geographic overlap identified among California Tribes. This is a result of relationships described above, as well as the individual history unique to each Tribe post-contact. The assertion, negotiation, claims, by each California Tribe of their respective ancestral and/or aboriginal lands and waters is a matter for California Tribes to resolve among ourselves. This is not a matter for the State of California to broach in any manner; nor is it necessary to address or resolve in order to move forward on legislative, administrative, and/or regulatory solutions between California Tribes and the State in the MLPA process. Rather, this is and will continue to be a matter for resolution between California Tribes, Tribal communities, and individual Indians on into the future.

D. Historic Overview and Documentation of the Contact with Non-Indians

California's incorporation to the Union in 1850 brought about a new wave of laws that attempted to break and control California Indian populations. The 1850 California's Act for the Government and Protection of Indians facilitated the removal of California Indians from their traditional lands, separating generations of children and adults from their families, languages, and cultures (Johnston-Dodds:1).

Between first land contact with Euro-Americans in 1849 and the California gold rush a hundred years later, the tribal population of Chue-rey Village (one of the largest pre-contact Yurok villages in the region) was decimated—by 1916, only a single Chue-rey resident remained.

Thus, in recovering from near annihilation a century ago, the continuation and preservation of the native culture, languages, and traditional life ways have been a very high priority among members of the Trinidad Rancheria. Critical to the social and spiritual recovery of these tribal members is the ability to access traditional food staples from the ancestral coastline. Subsistence fishing and seaweed gathering continue to be essential to both physical and cultural survival.

E. Trinidad Rancheria's Current Reservation and Population

The Trinidad Rancheria was established in 1906 by an act of the U.S. Congress that authorized the purchase of small tracts of land for "homeless Indians". In 1908, 60 acres of land were purchased on Trinidad Bay to accommodate the Tribe. The Tribe's Federal Recognition was granted by the Department of the Interior in 1917, and between 1950 and 1961 the Trinidad Rancheria approved home assignments on the reservation and enacted their original Articles of Association. In 2008 the Tribe passed a new constitution that replaced the original Articles of Association and has increased their Enrolled Membership to 199.

The Trinidad Rancheria is now comprised of three separate parcels that total 82 acres. The largest parcel is located on the west side of Highway 101 along the Pacific Coast and is made up of 46.5 acres. This parcel accommodates Tribal Member Housing, Tribal Offices, a Tribal Library, and the Cher-Ae Heights Casino.

In 1962, when the current layout of Highway 101 was constructed, it bisected the Rancheria on the north eastern corner which left small nine-acre parcel on the eastern side of Highway 101. This parcel was subsequently disposed of by the Bureau of Indian Affairs because an adjacent land owner refused to give the Rancheria the right-of-way. Through economic development and self sufficiency, the Tribe was able to purchase additional land. Approximately 8 acres were purchased in Westhaven, directly across Highway 101 in the late 1980s and a third 27.5-acre parcel, located in the unincorporated community of McKinleyville, was purchased in the 1990s and now houses 12 residential properties.

In addition to Rancheria property, the Tribe also owns the Trinidad Pier & Harbor and Seascape Restaurant in the City of Trinidad. This property includes the main entrance and access point to the Trinidad Head, which hosts walking trails, and cultural and historical points of interest.

F. Trinidad Rancheria Tribal Government

The membership of the Cher-Ae Heights Indian Community of the Trinidad Rancheria (Trinidad Rancheria) is currently comprised of 199 enrolled individuals. The membership consists of persons listed on the Trinidad Rancheria Base Roll and their direct lineal descendants. Enrolled members are categorized by four groups: Base Roll, Voting Members, Non-Voting members, and Minors. The governing body of the Tribe (Community Council) consists of all duly enrolled, base roll and voting members (eighteen years of age or over and who satisfy a number of annual requirements to maintain voting privileges).

The Trinidad Rancheria Community Council meets monthly and establishes the dates, time and location on an annual basis. Community Council Meetings are facilitated by the

Tribal Council and provide a regular forum in which the community is able to come together and conduct business on behalf of the Tribe.

From the Community Council, a Tribal Council is elected. It is the duty of the Tribal Council to govern all the people, resources, land, and water reserved to the Tribe in accordance with the Trinidad Rancheria Constitution, such laws as adopted by the Tribal Council, such limitations as may lawfully be imposed by the Tribal Council, and such limitations as may be lawfully imposed by the statutes or the Constitution of the United States.

The Tribal Council consists of a Chairperson, Vice-Chairperson, Secretary/Treasurer and two (2) additional members to serve as Tribal Council Members. Any Community Council member (eighteen years of age or over) is eligible to serve on the Tribal Council if duly elected. The Tribal Council meets twice a month - regular times, dates and location are established by the Chairperson.

The Tribal Council Officer's duties include a wide range of responsibility including attending all meetings, serving as liaisons to advisory committees, and most importantly, upholding the Tribal Constitution. Specific responsibilities, duties, expectations, and guidelines are thoroughly outlined in the Trinidad Rancheria's Tribal Constitution.

The Chairperson is entitled to vote in all meetings and exercises the following powers as the chief executive officer of the tribe: preside over and vote in all meetings of the Tribal Council and Community Council; establish such boards, committees, or subcommittees as the business of the Tribal Council may require, and to serve as an ex-officio member of all such committees and boards; and serve as a contracting officer or agent for the Tribe including authority to retain legal counsel.

The Vice-Chairperson shall, in the absence or incapacity of the Chairperson, perform all duties and assume all the responsibilities vested in the Chairperson. The Vice-Chairperson shall, upon request of the Council, assist in carrying out the duties of the Chairperson. The Vice-Chairperson shall perform any other duties of the Chairperson and any other duties as the Council may direct. The Vice-Chairperson is entitled to vote in all meetings.

The Secretary/Treasurer shall be entitled to vote in all meetings and have the following powers and duties: Ensure that the minutes of the meetings are kept on the Community Council and the Tribal Council; certify all official enactments or petitions of the Community Council and the Tribal Council; monitor financials and report them to the Community Council; and approve all vouchers for payment in accordance with a written procedure approved and adopted by the Tribal Council by resolution.

The additional two Council Members assist the Chairperson and other Officers in carrying out the functions of the Tribal Council and shall be entitled to vote in all meetings.

The jurisdiction of the Trinidad Rancheria, with its Community Council and Tribal Council, shall extend to the fullest extent permitted by applicable law to the following: all lands, water and other resources within the exterior boundaries of the Trinidad Rancheria established by the Secretary of the Department of the Interior in 1917; other lands, water and resources as may be hereafter acquired by the tribe, whether within or without said boundary lines, under any grant, transfer, purchase, adjudication, treaty, Executive Order, Act of Congress or other acquisition; all members of the Trinidad Rancheria and other non-member Indians within any territory under the jurisdiction of the tribe; and all tribal members, wherever located.

THE TRIBE'S CURRENT TRADITIONAL PRACTICES

Since time immemorial, despite the successive waves of immigration, colonization, genocide, ethnic cleansing, subjugation, and illegal expropriation of tribal lands and material culture, the members of the Trinidad Rancheria have always lived within their aboriginal homelands and sustained a continuous relationship with the ocean, coastline, and marine resources.

The Rancheria's members maintain active tangible and intangible relationships with sites, i.e. tangible (sites used for harvesting, hunting, or habitat maintenance, social or ritual gatherings, shelter, or trade - including reciprocal site-sharing relationships with other tribes), or intangible relationships (sites referred to in stories, songs, sayings, or the traditional knowledge base of the tribe).

Trinidad Rancheria tribal members depend upon the rich diversity of marine and coastal plant resources found within Rancheria lands, as well as throughout ancestral territory, as part of their daily lives. The Rancheria's lands support many types of culturally significant plants such as red alder (Alnus rubra), Douglas fir (Psuedotsuga meziesii), Blue blossom or soap plant (Ceanothus thyrsiflorus), bracken fern (Pteridium aquilinum), sword fern (Polysticum munitum) and Sitka Spruce (Picea sitchensis), and various other roots and herbs. Tribal members regularly gather these plant materials for medicinal and cultural uses.

Important marine resources include salmon, clams and abalone (as both food sources and for the shells, which are used in ceremonial regalia), mussels, seaweed, eels, crab, surf fish, candle fish and sea salt. Rancheria Tribal Elders relate memories of subsistence gathering and prayer activities all along the coast line from the Luffenholtz Beach area to the Trinidad Harbor and beyond. Subsistence fishing for crab, salmon, surf fish (smelt), mussels and clams occurred regularly from the rocky beaches within the Rancheria's

borders. Families would set up fish camps during the dry months and would harvest and dry these important resources. Non-plant or animal materials with cultural significance found on Rancheria lands in the coastal zone include steatite and chert (Verwayen, 2007) which are used to make items such as bowls and arrow points respectively

During the MLPAI process Initiative staff compiled a list of species harvested by California Tribes and Tribal Communities in the North Coast Region (California MLPAI 2010). This list, as most ethnographic information compiled externally by anthropologists, is incomplete. For purposes of building a factual record of categories of species traditionally taken by Yurok and other local tribal peoples are as follows:

·Fin Fish ·Pinnipeds ·Marine Plants ·Invertebrates
·Marine Mammals ·Marine Birds ·Shells

Currently take of Pinnipeds, marine mammals and others are restricted pursuant the Endangered Species Act and other applicable law.

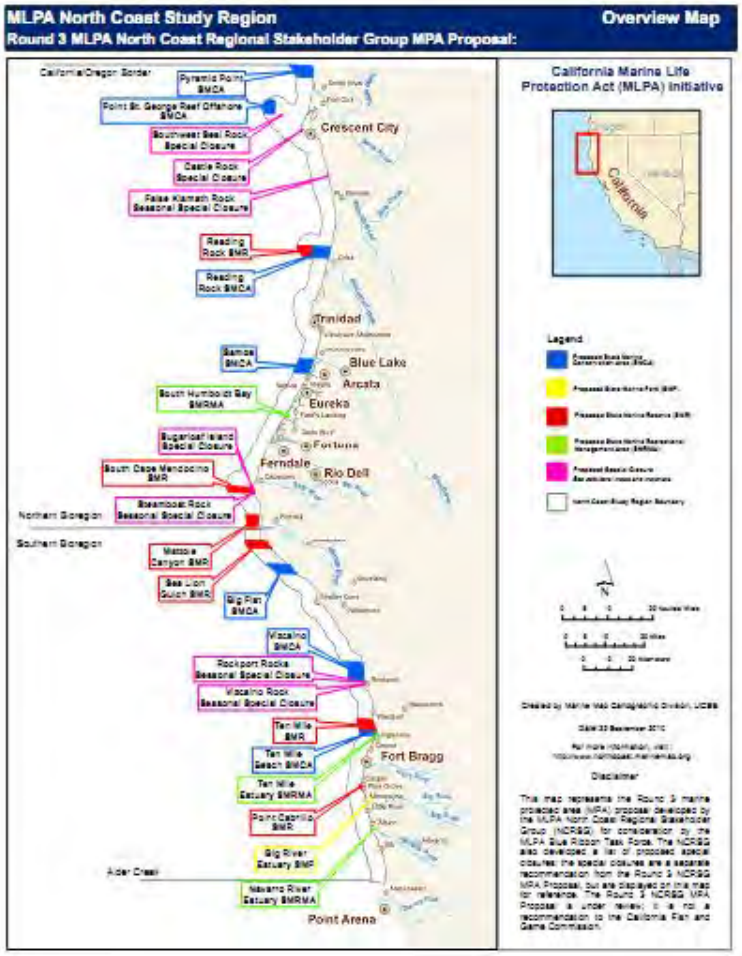

Fig. 4- Proposed Marine Protected Areas (MPAs) within Yurok Ancestral Territory and Traditional Fishing Grounds

The entirety of Yurok Ancestral territory lies within the area described as the North Coast Study Region by the Marine Life Protection Act Initiative (MLPAI). This includes, but is in no way limited to the Marine Protected Areas and Special Closures as follows:
Pyramid Point SMCA
Point St. George SMCA
Southwest Seal Rock Special Closure
Castle Rock Special Closure
False Klamath Cove Special Closure
Reading Rock SMCA/SMR

Reading Rock
Reading Rock, as it is known to the non-Yurok world, is a place of immense important to Ner-er-ner, Coastal Yuroks. Archaeological evidence suggests that Yuroks have historically hunted sea lion with harpoons at Reading Rock. (Milburn *et al*: 1979)

Er'Hler-ger' (False Klamath Rock), 'O Men 'We-Roy
Er'Hler-ger', or False Klamath Rock, is a significant location for Yurok people, most specifically the village of 'Omen, or what is known today as False Klamath Cove near the mouth of Wilson Creek. Yurok history in relation to False Klamath Rock dates back to the time of its creation:

> The youngest of five brothers became transformed into a supernatural being and took up his abode in this rock ['R Hlrgr']. He has a pipe, of mysterious powers, which he keeps in a pipe-case of weasel skin. This latter 'becomes alive' and runs about the country, and occasionally enters houses where people are eating … It may be recognized as the supernatural animal by a white stripe across its nose, and a short tail. The owner of the pipe said long ago when he went into the rock that if people looked at the rock and cried, they would get many woodpecker heads (chii's) (Yurok Language Project: YG230).

Southwest Seal Rock (Special Closure)
Sea lion hunting,
[Gould—*Seagoing Canoes of the Northwest*…Yurok and Tolowa]

Point St. George – Ko-pey • *n* • Crescent City, site of Crescent City
Kee lahchue' so Ko-pey. They are making a voyage to Crescent City. (Yurok Language Project)

Pyramid Point Hee-neg • *pn* • a Tolowa town on Smith River, Smith River
Pyramid Point, known to the Tolowa as *Tr'uu'luu'k'wvt*, is known to Yuroks as *Hee-neg*. Yurok's used this area, under traditional inter-tribal use agreements, to gather many traditional food staples.

Health implications of Limiting Access to Traditional Foods

Fig. 5: Acorns in shell (woo-mehl)

Native Americans are at the greatest risk for diabetes than any other population in the United States. According to the American Diabetes Association, American Indians and Alaskan Natives are 2.2 times more likely to have Type II Diabetes than non-Hispanic whites. [3] Diabetes diagnosis brings costly complications which include blindness, amputations of lower extremities, kidney failure, cardiovascular disease, decreased quality of life and premature death.[4]

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[3] "Native American Complications". American Diabetes Association. http://www.diabetes.org/living-with-diabetes/complications/native-americans.html

[4] Harris MI. Summary. In: Harris MI, Cowie CC, Stern MP, et al., eds. Diabetes in America, 2nd ed. Washington, DC: U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health, 1995 (DHHS publication no. NIH 95-1468).

Current dietary choices of Native American people are the result of systematic loss of culture, historical trauma stemming from systematic genocide, forced removal, and assimilation policies of the United States government which forced Native Americans to become dependent upon government rations and food programs. Other contributing factors to the extreme rates of diabetes in Native communities are the high rates of poverty, low education levels, lack of resources, facilities and equipment and lack of access to nutritious foods.

Direct access to a traditional food source is essential to the health, safety and survival of Native American communities. Utilizing traditional knowledge and lifestyles can influence positive change in Native American communities. Regular engagement in traditional gathering provides necessary physical activity and access to nourishing foods like seaweed, mussels, barnacles and surf fish (Ferreira).

The limitation and prohibition of traditional tribal uses of marine resources by the State of California will further contribute to the declining health of Native American populations by denying access to a reliable healthy traditional food source

Traditional Cultural Properties

A Traditional Cultural Property is any place-a site, structure, a district made up of multiple sites or structures, a landscape….to which a living community ascribes cultural significance that is rooted in the group's traditions and history. TCP's are most often found eligible under criterion "A", for association with significant patterns of events in the traditional history and culture of the group that ascribes value to them.

CONCLUSION

Trinidad Rancheria's membership descends from Yurok, Tolowa, and Wiyot people who have occupied the North Coast since time immemorial. Rancheria members maintain spiritual, cultural, and customary relationships with a wide variety of marine resources. Tribal harvesting, hunting, and fishing practices are sustainable and contribute to ecological and cultural health and resilience. The historical record demonstrates that each of these distinct cultural groups have taken finfish, invertebrates, mammals, and marine plants since time immemorial and should be included as traditional uses protected under the regulations.

The extensive and irreplaceable cultural heritage of our people and other tribes within the North Coast region has been well documented throughout history. Traditional tribal practices are consistent with the goals of the MLPA, and are permitted uses. A prohibition on fishing and gathering in the proposed MPAs would significantly interfere with the Tribe's religious, spiritual, customary, subsistence, and cultural practices.

Disruption of these activities would have detrimental effects to the health and spiritual well being of our membership. The tribe is applying for continued use of all species currently covered within DFG regulations.

The Cher-Ae Heights Indian Community of the Trinidad Rancheria is a sovereign nation, in perpetuity. No tribal rights have been ceded. The tribe will continue to assert its rights to continue to fish and gather within our ancestral homelands. This factual record is being submitted as an act of good faith by the Trinidad Rancheria, who wish to establish a collaborative relationship with the State of California to work toward our mutual goals with respect to the protection and preservation of marine resources.

Fig. 6: Tribal Member Kayla Maulson (Yurok; Ner-er-ner; Ojibwe) in traditional dress

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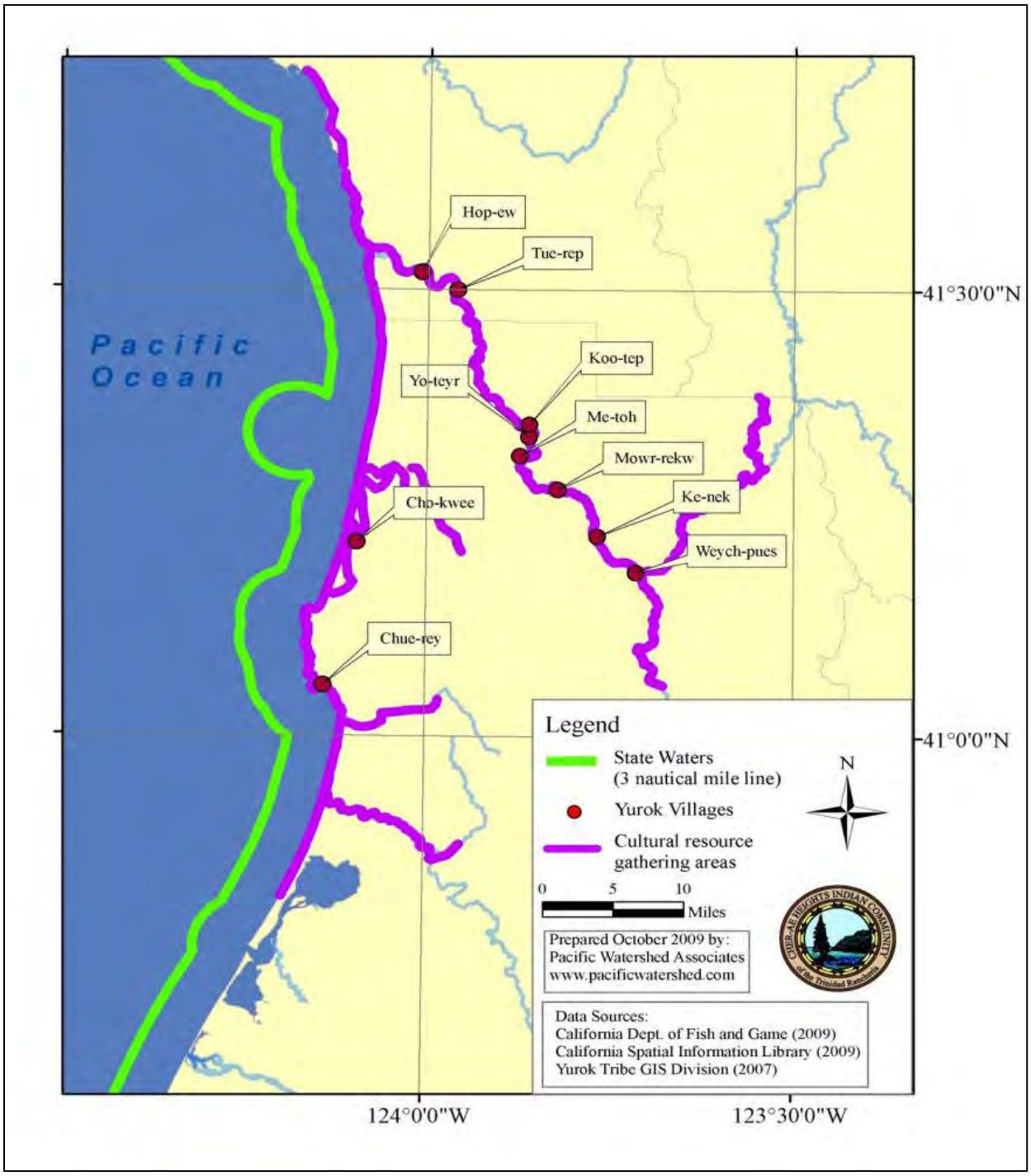
Appendix A – Map of Cultural Resource Gathering Areas



APPENDIX B - Villages

Preliminary list of Villages Trinidad Rancheria Original Assignees descend from, compiled by Rachel Sundberg (lineal descendant of Trinidad Rancheria Original Assignee, Joy Sundberg). Complete list pending further historical research.

Bill Crutchfield		
Village	County	Tribal Territory
Yah-ter	Humboldt	Yurok
Tuley Creek	Humboldt	Yurok
Turup	Del Norte	Yurok
Koh-tep	Humboldt	Yurok
Chue-rey (Tsurai)	Humboldt	Yurok (Ner-er-ner)
Cho'-kwee (Stone Lagoon)	Humboldt	Yurok (Ner-er-ner)
Peen-pey (Big Lagoon)	Humboldt	Yurok (Ner-er-ner)

Eva Duncan		
Village	County	Tribal Territory
Table Bluff	Humboldt	Wiyot
Eel River Valley	Humboldt	Wiyot

Carol Ervin		
Village	County	Tribal Territory
Weych-pues (Weitchpec)	Humboldt	Yurok
Warseck	Humboldt	Yurok
Katamiin	Siskiyou	Karuk

Vera Green		
Village	County	Tribal Territory
Twehl-keyr	Humboldt	Yurok
Pecwan	Humboldt	Yurok
Yah-ter (Yocta)	Humboldt	Yurok

Henry Hancorne, Jr.		
Village	County	Tribal Territory
Natchko (Hancorne Ranch)	Humboldt	Yurok
Mettah	Humboldt	Yurok
Capell	Humboldt	Yurok
Moreck	Humboldt	Yurok
Hoppel	Del Norte	Yurok

Appendix B-Continued

Theodore "Teddy" James		
Village	County	Tribal Territory
Chue-rey (Tsurai)	Humboldt	Yurok (Ner-er-Ner)
Weych-pues (weitchpec)	Humboldt	Yurok
Mettah	Humboldt	Yurok
Moreck	Humboldt	Yurok

Mayme (John) Keparisis		
Village	County	Tribal Territory
Mettah	Humboldt	Yurok
Moreck	Humboldt	Yurok
Lake Earl	Del Norte	Tolowa

Fred Lamberson, Jr.		
Village	County	Tribal Territory
Weych-pues (Weitchpec)	Humboldt	Yurok
Eel River Valley	Humboldt	Wiyot
Mad River	Humboldt	Wiyot

Myra (Lamberson) Lowe		
Village	County	Tribal Territory
Weych-pues (Weitchpec)	Humboldt	Yurok
Eel River Valley	Humboldt	Wiyot
Mad River	Humboldt	Wiyot

Betty (John) Najmon		
Village	County	Tribal Territory
Mettah	Humboldt	Yurok
Moreck	Humboldt	Yurok
Lake Earl	Del Norte	Tolowa

Lillian J. Quinn		
Village	County	Tribal Territory
Hoppel	Del Norte	Yurok
Hoopa (probably Takmilding)	Humboldt	Hupa
Capell	Humboldt	Yurok
Koh-tep	Humboldt	Yurok

Appendix B-Continued

Juanita Samuels (Letson)		
Village	County	Tribal Territory
Requa	Del Norte	Yurok
Mettah	Humboldt	Yurok
Moreck	Humboldt	Yurok
Lake Earl	Del Norte	Tolowa

Marian Seidner (Crutchfield)		
Village	County	Tribal Territory
Table Bluff	Humboldt	Wiyot
Eel River	Humboldt	Wiyot

Rose Joy (Crutchfield) Sundberg		
Village	County	Tribal Territory
Yah-ter	Humboldt	Yurok
Tuley Creek	Humboldt	Yurok
Turup	Del Norte	Yurok
Koh-tep	Humboldt	Yurok
Chue-rey (Tsurai)	Humboldt	Yurok (Ner-er-ner)
Cho'-kwee (Stone Lagoon)	Humboldt	Yurok (Ner-er-ner)
Peen-pey (Big Lagoon)	Humboldt	Yurok (Ner-er-ner)

Harry J. Walker		
Village	County	Tribal Territory
Waukell Flat	Del Norte	Yurok
Requa	Del Norte	Yurok
Pecwan	Humboldt	Yurok
Weych-pues (Weitchpec)	Humboldt	Yurok

Cornelia Jean (Natt) Walker		
Village	County	Tribal Territory
Koh-tep	Humboldt	Yurok
Chue-rey (Tsurai)	Humboldt	Yurok (Ner-er-ner)
Winchuck River	Curry (OR)	Chetco
Yontocket	Del Norte	Tolowa

George Williams		
Village	County	Tribal Territory
Weych-pues (Weitchpec)	Humboldt	Yurok
Capell (possibly)	Humboldt	Yurok

RESIGHINI RANCHERIA

P.O. Box 529 • Klamath, CA 95548
Tel (707) 482-2431 • Fax (707) 482-3425

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2011 OCT 31 PM 2:43

October 24, 2011

California Fish and Game Commission
Attn: Sonke Mastrup, Executive Director
P.O. Box 944209
Sacramento, CA 94244-2090

SUBJECT: Resighini Rancheria Factual Record of Historic or Current Uses in North Coast Marine Protected Areas

Dear Mr. Mastrup:

On June 29, 2011, the California Fish & Game Commission (Commission) moved, on a 4-1 vote, to adopt Tribal Option 1, as presented in the June 9, 2011 joint report prepared by the California Department of Fish & Game (Department) and the Marine Life Protection Act Initiative (MLPAI) staff. The Commission adopted Tribal Option 1 as the Preferred Alternative within the North Coast Study Region, to allow tribal gathering to continue within proposed State Marine Conservation Areas (SMCAs) by federally-recognized tribes who, within sixty (60) days, submitted a factual record confirming current or historical use within the proposed Marine Protected Areas (MPAs).

Since there was no outreach, informal or formal, conducted by the State, the Resighini Rancheria only recently became aware of the Commission's request. Regardless of the arbitrary timeframe developed by the Commission, the Resighini Rancheria would like to take this opportunity to provide the following in response to the Commission's request. We trust you will take this submission into account in the similar manner in which you accepted the factual records from other North Coast federally-recognized Tribes during the created 60 day period.

The Resighini Rancheria is a federally-recognized Indian Tribe, eligible to receive services from the United States Bureau of Indian Affairs (Federal Register Vol. 75, No. 190). Our reservation lands are located along the south bank of the Klamath River and on the west by Highway 101 bridge and backed up against privately owned land within what is now known as the Yurok Reservation in southern Del Norte County. As a sovereign nation, our tribal government consists of a General Council with an elected Tribal Council to operate our governmental and private tribal affairs as well as represent the tribal needs of our small membership (133). The Tribal Council consists of 5 tribal members who are elected annually by staggered two year term of Chairman, Vice Chairman, Secretary, Treasurer and councilperson. Our general membership serves on boards, committees, commission and corporations to assist the Tribal Council.

Members of the Resighini Rancheria have always been known to have exercised the same rights as all other Yurok Indian individuals. We encourage and support tribal members to participate in

local cultural activities offered in our traditional areas. We continue to assert our sovereign status and aboriginal marine use rights for all of our citizens; rights that have never been ceded and are non-negotiable. The Tribe continues to assert a full reservation of rights and recognize that the State may desire a mutual reservation of rights in this process.

Marine Protected Areas proposed in the Preferred Alternative and/or Alternative Two that include current or historical uses by citizens of the Resighini Rancheria include Pyramid Point SMCA and the Redding Rock SMCA/SMR complex. The False Klamath Rock and Castle Rock Special Closures are also areas of historic or current use. A myriad of marine species have historically or currently been harvested by citizens of the Resighini Rancheria for subsistence, ceremonial, and/or other customary uses along the coastline of our aboriginal territory. We reserve the right to continue to use these areas and all species contained within for our continued use. This includes, but is not limited to finfish, invertebrates, marine plants, birds, and marine mammals. Resighini Rancheria seeks formal inclusion by the Commission and Department in Tribal Option 1 for these identified areas.

We look forward to being included in the dialog regarding the North Coast MLPA process. Please feel free to contact us if you have any questions.

Woh-klaw,

Rick Dowd
Chairman

cc: Charlton H. Bonham, Director, CA Fish and Game Department

RESIGHINI RANCHERIA

P.O. Box 529 • Klamath, CA 95548
Tel (707) 482-2431 • Fax (707) 482-3425

August 13, 2012

Sonke Mastrup, Executive Director
California Fish and Game Commission
P.O. Box 944209
Sacramento, CA 94244-2090

RECEIVED
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MLS
CC: S. Fonbuena
C. Shuman
A. Bredeimann
B. Ota
S. Mastrup
A. Shea

Dear Mr. Mastrup:

The Resighini Rancheria would like to respectfully request to be included on the October 3-4, 2012 agenda of the California Fish and Game Commission (Commission) to reconsider the exclusion of our Tribe on Marine Protected Areas within our ancestral waters within the North Coast Study Region.

Problem Statement: On June 6th, 2012, the Commission adopted regulations that designated a network of marine protected areas (MPAs) within the North Coast Study Region under the California Marine Life Protection Act (MLPA). Those adopted regulations included the identification of certain federally-recognized Tribes that could continue to harvest for traditional, non-commercial purposes under the newly adopted definition of "tribal take" within specific MPAs. For a Tribe to be identified as eligible for "tribal take" within specific MPAs, a Factual Record had to be submitted that demonstrated a current or historic use within that geography and that the Tribe was federally-recognized.

Resighini Rancheria submitted a brief factual record affirming that we are a federally-recognized Indian Tribe of Yurok Indians, eligible to receive services from the United States Bureau of Indian Affairs (Federal Register Vol. 75, No. 190) and that our citizens have current or historic uses within specific MPAs and Special Closures proposed in the North Coast Study Region. Subsequently, we were included in the Initial Statement of Reasons for Regulatory Action in the following MPAs: Pyramid Point SMCA, Point St. George Reef SMCA, and the Redding Rock SMCA/SMR Complex.

Although we do maintain current or historic uses within those MPAs and reserve all rights to continue to rely on the ocean and marine resources in all usual and customary fishing places, due to the implied/perceived jurisdictional concerns that the State associated with this process,

we signed on to a joint multi--tribal letter that was sent to the Commission, requesting to be removed from the Pyramid Point SMCA and Point St. George Reef SMCA, out of respect for the Smith River Rancheria and Elk Valley Rancheria. However, Resighini Rancheria should have remained on the Redding Rock SMCA/SMR complex for the Commission's consideration at your June 6th meeting in Eureka.

In the interim, Chairman McCovey contacted Mr. Mastrup to confirm that no other information was required by the Commission to ensure our inclusion at Redding Rock and that the Tribe was included in the draft regulations as required for adoption consideration. Mr. Mastrup confirmed that no other information was required and the item would proceed accordingly. Then at the June 6th meeting Mr. Mastrup made the erroneous statement for the Motion of only including the Yurok Tribe as a Tribe eligible of "tribal take" within the Redding Rock MPAs, which the Commission ultimately adopted. We understand this may have been a misunderstanding and thus, we request this to be amended appropriately.

On July 26, 2012, in a meeting with Resighini Rancheria, Mr. Mastrup suggested a request be made of the Commission to reconsider our Tribe as eligible for "tribal take" at the Redding Rock SMCA/SMR complex to resolve this misunderstanding. This request for reconsideration should include substantiating from a federal entity that we are a federally-recognized Tribe of Yurok people. The following is a factual basis demonstrating that the United States federal government recognizes us as a federally-recognized Tribe of Yurok people.

Factual Basis: The Yurok people are aboriginal to Northern California and are dispersed among several distinct federally recognized Tribes located within their ancestral territory, including the Resighini Rancheria. The Resighini Rancheria is a federally recognized Indian Tribe that is formally organized under the authority of the Indian Reorganization Act of 1934.

By deed dated January 7, 1938, Gus Resighini deeded to the United States in trust approximately 228 acres[1] of land that constitutes the Resighini Rancheria, under the authority of the Indian Reorganization Act. By Proclamation dated October 21, 1939, the Secretary of the Interior declared the land purchased to be an Indian reservation. All of the lands that comprise the Reservation are located within the exterior boundaries of the original Klamath River Reservation and are located at the intersection of Highway 101 and the Klamath River.

After the establishment of the Reservation, two disastrous floods occurred, one in 1955 and another in 1964. The tragic flood of 1964 swept away all but two homes, forcing thirteen families to evacuate and move. Despite this, the people of the Resighini Rancheria stood together and remained a structured Indian organization with a strong desire to return to the

[1] The 1973 survey map of the Reservation recorded by Richard B. Davis shows the original lands purchased from Gus Resighini that because the Resighini Rancheria as containing 238.78 acres.

reservation. On April 4, 1975, the people of the Resighini Rancheria formed a Tribal government and adopted a Constitution.

Since 1975, when members adopted a Constitution, the Tribe has been actively involved in developing a tribal government and in protecting its land base and advocating for our traditional rights as Yurok Indians. In 1988, Congress enacted the Hoopa-Yurok Settlement Act, which partitioned the extended Hoopa Valley Reservation into the present Hoopa Valley Reservation, consisting of the original twelve-mile square bisected by the Trinity River and established under Executive Order in 1864, and the Yurok Reservation, consisting of the area along the Klamath River within the old Klamath River Reservation, including the 1892 Extension,[2] and excluding the Resighini Rancheria. The Resighini Rancheria is the only Indian Reservation in California situated within the exterior boundaries of lands granted to a separate federally recognized Indian Tribe.

The fact that members of the Resighini Rancheria are Yurok is indisputable. The first federally-published list in the Federal Register of Indian Tribes that maintain a government-to-government relationship with the United States and are eligible to receive related services was on January 31, 1979. It includes the "*Resighini Rancheria, Coast Indian Community of Yurok Indians, California*" (see Exhibit A). As Exhibit B demonstrates, all subsequent lists from 1979 to 2003 also recognize that the Resighini Rancheria are Yurok. After 2003, the Tribe changed our name to simply the *Resighini Rancheria* for solely simplification purposes (see Exhibit C). This is reflected in the Federal Register from 2005 to the most recent list published in 2010.

Under Article of the Tribe's Secretarially-approved Constitution, the jurisdiction of the Tribe, acting through its Tribal Council, extends to: (a) all land encompassing the ancestral territory of the Klamath River Tribe; (b) all lands, water, and other resources within the exterior boundaries of those lands constituting what is commonly known as the Resighini Rancheria purchased by the Secretary of the Interior on January 7, 1938, under the authority of the Wheeler Howard Act,[3] June 18, 1934; (c) all of the lands, water, and resources as may hereinafter be acquired by the Tribe, whether within or without said boundary lines, under any grant, transfer, purchase, adjudication, treaty, Executive Order, Act of Congress, or other acquisitions; (d) all persons within any territory under the jurisdiction of the tribe; and (e) all tribal members, wherever located.

The Yurok people of the Resighini Rancheria historically and currently have exercised our rights to hunt, fish, and gather foods and materials for subsistence, ceremonial, and customary uses throughout our ancestral lands. We also maintain that we have unceded rights that have never

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[2] The "Extension" included a stretch, one-mile on each side of the Klamath River, connecting the old Klamath River Reservation to the Hoopa Square.

[3] Also referred to as the Indian Reorganization Act.

been extinguished, to continue to fish in all usual and customary traditional fishing places as identified by our members. We reserve all rights to continue these practices that are inherent to use as Yurok. Like our ancestors, we have continued to practice traditional Yurok customs, traditions, and religious practices. We are committed to our culture and language. Tribal members are recognized as skilled basket weavers and makers of ceremonial regalia and many participate in local Yurok ceremonies and dances.

Request: To agendize this request at your October 3-4, 2012 meeting in Sacramento in order to resolve this issue of extreme importance to our members and include the Resighini Rancheria within the Redding Rock SMCA/SMR complex at this time.

Please contact us to confirm whether we will be included on the October 3-4, 2012 agenda. We wish to deal with this issue expeditiously before the regulatory review process concludes for the North Coast Study Region.

Sincerely,

Don McCovey

Donald McCovey
Chairman

cc: Dr. Virgil Atkins
Superintendent
Northern California Agency
Bureau of Indian Affairs

Amy Dutschke
Regional Director
Pacific Region
Bureau of Indian Affairs

[4310-02-M]

DEPARTMENT OF THE INTERIOR

Bureau of Indian Affairs

INDIAN TRIBAL ENTITIES [1] THAT HAVE A GOVERNMENT-TO-GOVERNMENT RELATIONSHIP WITH THE UNITED STATES

Delegation of Authority

JANUARY 31, 1979.

This notice is published in exercise of authority delegated by the Assistant Secretary—Indian Affairs under 5 U.S.C. 2 and 9; and 230 DM 1 and 2.

Notice is hereby given in accordance with 25 CFR 54.6(b) by the Bureau of Indian Affairs of the tribal entities that have a government-to-government relationship with the United States. The United States recognizes its trust responsibility to these Indian entities and, therefore, acknowledges their eligibility for programs administered by the Bureau of Indian Affairs. The listed entities are not necessarily eligible for programs administered by other Federal Agencies. The list of eligible Alaskan entities will be published at a later date.

INDIAN TRIBAL ENTITIES [1] THAT HAVE A GOVERNMENT-TO-GOVERNMENT RELATIONSHIP WITH THE UNITED STATES

Absentee-Shawnee Tribe of Oklahoma, Acoma Pueblo of New Mexico
Aqua-Caliente Band of Cahuilla Indians (Palm Springs), Aqua-Caliente Indian Reservation, California
Ak Chin Indian Community, Maricopa, Ak Chin Reservation, Arizona
Alabama-Quassarte Creek Tribal Town, Oklahoma
Alturas Rancheria of Pit River Indians, California
Apache Tribe of Oklahoma
Arapahoe Tribe of Wind River Reservation, Wyoming
Assiniboine and Sioux Tribes of the Fort Peck Reservation, Montana
Augustine Band of Cahuilla Mission Indians, Augustine Reservation, California
Bad River Band of Lake Superior Chippewa Indians, Bad River Reservation, Wisconsin
Barona Capitan Grande Band of Diegueno Mission Indians, Barona Reservation, California
Bay Mills Indian Community, Bay Mills Reservation, Michigan
Berry Creek Rancheria of Maidu Indians, California
Big Bend Rancheria of Pit River Indians, California
Big Lagoon Rancheria of Smith River Indians, California
Big Pine Band of Owens Valley Paiute Shoshone Indians, Big Pine Reservation, California
Blackfeet Tribe, Blackfeet Indian Reservation, Montana
Bridgeport Paiute Indian Colony, California
Burns Paiute Indian Colony, Oregon
Cabazon Band of Cahuilla Mission Indians, Cabazon Reservation, California
Cachil Delle Band of Wintun Indians of Colusa Rancheria, California
Caddo Tribe of Oklahoma
Cahuilla Band of Mission Indians, Cahuilla Reservation, California
Cahto Indian Tribe of the Laytonville Rancheria, California
Campo Band of Diegueno Mission Indians, Campo Reservation, California
Capitan Grande Band of Diegueno Mission Indians, Capitan Grande Reservation, California
Cayuga Nation of New York
Cedarville Rancheria of Northern Paiute Indians, California
Chemehuevi Tribe, Chemehuevi Reservation, Arizona
Cher-Ae Heights Indian Community of the Trinidad Rancheria, California
Cherokee Nation of Oklahoma
Cheyenne-Arapaho Tribes of Oklahoma
Cheyenne River Sioux Tribe, Cheyenne River Reservation, South Dakota
Chickasaw Nation of Oklahoma
Chippewa-Cree Tribe of the Rocky Boy Reservation, Montana
Chitimacha Tribe of Louisiana
Choctaw Nation of Oklahoma
Citizen Band of Potawatomi Indians of Oklahoma
Cochiti Pueblo of New Mexico
Cocopah Tribe of Arizona
Coeur D'Alene Tribe, Coeur D'Alene Reservation, Idaho
Cold Springs Rancheria of Mono Indians, California
Colorado River Tribes of the Colorado River Indian Reservation, Arizona
Comanche Tribe of Oklahoma
Confederated Tribes of the Chehalis Reservation, Washington
Confederated Tribes of the Colville Reservation, Washington
Confederated Tribes of the Goshute Reservation, Nevada & Utah
Confederated Salish & Kootenai Tribes of the Flathead Reservation, Montana
Confederated Tribes of the Siletz Reservation, Oregon
Confederated Tribes of the Umatilla Reservation, Oregon
Confederated Tribes of the Warm Springs Reservation, Oregon
Cortina Rancheria of Wintum Indians, California
Coushatta Tribe of Louisiana
Covelo Indian Community of the Round Valley Reservation, California
Coyote Valley Band of Pomo Indians, California
Creek Nation of Oklahoma
Crow Tribe of Montana
Crow Creek Sioux Tribe of the Crow Creek Reservation, South Dakota
Cuyapaipe Band of Diegueno Mission Indians, Cuyapaipe Reservation, California
Delaware Tribe of Western Oklahoma
Devils Lake Sioux Tribe, Devils Lake Sioux Reservation, North Dakota
Dry Creek Rancheria of Pomo Indians, California
Duckwater Shoshone Tribe, Duckwater Reservation, Nevada
Eastern Band of Cherokee Indians of North Carolina
Eastern Shawnee Tribe of Oklahoma
Elem Indian Colony of Pomo Indians of California
Ely Indian Colony, Nevada
Enterprise Rancheria of Maidu Indians, California
Flandreau Santee Sioux Tribe, South Dakota
Forest County Potawatomi Indian Community of Wisconsin
Fort Belknap Indian Community, Fort Belknap Reservation, Montana
Fort Bidwell Indian Community, Paiute Indians of the Fort Bidwell Reservation, California
Fort Independence Indian Community, Paiute Indians of the Fort Independence Reservation, California
Fort McDermitt Paiute-Shoshone Tribes, Fort McDermitt Reservation, Nevada
Fort McDowell, Mohave-Apache Indian Community, Fort McDowell Indian Reservation, Arizona
Fort Mojave Tribe of Arizona
Fort Still Apache Tribe of Oklahoma
Gila River Indian Community, Gila River Reservation, Arizona
Grindstone Indian Rancheria of Wintun-Wailaki Indians, California
Hannahville Potawatomi Indian Community of Michigan
Havasupai Tribe, Havasupai Reservation, Arizona
Hoh Tribe, Hoh Indian Reservation, Washington
Hoopa Valley Tribe of the Hoopa Valley Reservation, California
Hopi Tribe of Arizona
Hopland Band of Pomo Indians, Hopland Rancheria, California
Hualapai Tribe, Hualapai Reservation, Arizona
Inaja & Cosmit Reservation (Diegueno Indians), California
Iowa Tribe of Kansas & Nebraska
Iowa Tribe of Oklahoma
Isleta Pueblo of New Mexico
Jackson Rancheria of Me-Wuk Indians, California
Jemez Pueblo of New Mexico
Jicarilla Apache Tribe, Jicarilla Apache Indian Reservation, Arizona
Kaibab Band of Paiute Indians, Kaibab Indian Reservation, Arizona
Kalispel Indian Community, Kalispel Reservation, Washington
Karok Tribe of California
Kashia Band of Pomo Indians of Stewards Point Rancheria, California
Kaw Tribe of Oklahoma
Keweenaw Bay Chippewa Indian Community, L'Anse Reservation, Michigan
Kialegee Tribal Town of Creek Indians, Oklahoma
Kickapoo Tribe of Kansas
Kickapoo Tribe of Oklahoma
Kiowa Tribe of Oklahoma
Kootenai Tribe of Idaho
La Jolla Band of Luiseno Mission Indians, LaJolla Reservation, California
La Posta Band of Diegueno Mission Indians, La Posta Reservation, California
Lac Courte Oreilles Band of Lake Superior Chippewa Indians, Lac Courte Oreilles Reservation, Wisconsin
Lac du Flambeau Band of Lake Superior Chippewa Indians, Lac du Flambeau Reservation, Wisconsin
Laguna Pueblo of New Mexico
Las Vegas Tribe of Paiute Indians, Las Vegas Colony, Nevada
Lookout Rancheria of Pit River Indians, California
Los Coyotes Band of Cahuilla Mission Indians, Los Coyotes Reservation, California
Lovelock Paiute Tribe, Lovelock Indian Colony, Nevada

[1] Includes within its meaning Indian tribes, bands, villages, groups and pueblos as well as Eskimos and Aleuts.

ower Brule Sioux Tribe, Lower Brule Reservation, South Dakota
ower Elwha Tribal Community, Lower Elwha Reservation, Washington
ower Sioux Indian Community, Lower Sioux, Reservation, Minnesota
ummi Tribe, Lummi Reservation, Washington
lakah Tribe, Makah Reservation, Washington
lanchester Band of Pomo Indians, Manchester-Pt. Arena Rancheria, California
lanzanita Band of Diegueno Mission Indians, Manzanita Reservation, California
lenominee Tribe, Menominee Reservation, Wisconsin
lesa Grande Band of Diegueno Mission Indians, Mesa Grande Reservation, California
lescalero Apache Tribe, Mescalero Reservation, New Mexico
liami Tribe of Oklahoma
liccosukee Tribe of Florida
liddletown Rancheria of Pomo Indians, California
linnesota Chippewa Tribe, Minnesota (Six component reservations: Boise Fort Band (Nett Lake), Fond du Lac Band, Grand Portage Band, Leech Lake Band, Mille Lac Band, White Earth Band)
lississippi Band of Choctaw Indians, Mississippi
loapa Band of Paiute Indians, Moapa River Reservation, Nevada
lodoc Tribe of Oklahoma
lontgomery Creek Rancheria of Pit River Indians, California
lorongo Band of Cahuilla Mission Indians, Morongo Reservation, California
luckleshoot Tribe, Muckleshoot Reservation, Washington
lambe Pueblo of New Mexico
lavajo Tribe of Arizona, New Mexico and Utah
lez Perce Tribe of Idaho, Nez Perce Reservation, Idaho
lisqually Indian Community, Nisqually Reservation, Washington
looksack Indian Tribe of Washington
lorthern Cheyenne Tribe, Northern Cheyenne Reservation, Montana
lorthwestern Band of Shoshone Indians of Utah (Washakie)
)glala Sioux Tribe of the Pine Ridge Reservation, South Dakota
)maha Tribe of Nebraska
)neida Nation of New York
)neida Tribe of Wisconsin, Oneida Reservation, Wisconsin
)nondaga Nation of New York
)sage Tribe of Oklahoma
)ttawa Tribe of Oklahoma
)toe-Missouria Tribe, Oklahoma
'aiute-Shoshone Indians of the Bishop Community, Bishop Colony, California
'aiute-Shoshone Indians of the Fallon Reservation, Nevada
'aiute-Shoshone Indians of the Lone Pine Community, Lone Pine Reservation, California
'ala Band of Luiseno Mission Indians, Pala Reservation, California
'apago Tribe of Arizona
'ascua Yaqui Tribe of Arizona
'assamaquoddy Tribe of Maine
'auma Band of Luiseno Mission Indians, Pauma & Yuima Reservation, California
'awnee Tribe of Oklahoma
'ayson Tonto Apache Tribe of Arizona
'echanga Band of Luiseno Mission Indians, Pechanga Reservation, California
'enobscot Tribe of Maine
Peoria Tribe of Oklahoma
Picuris Pueblo of New Mexico
Pit River Tribe, X-L Ranch Reservation, California
Pojoaque Pueblo of New Mexico
Ponca Tribe of Oklahoma
Port Gamble Indian Community, Port Gamble Reservation, Washington
Prairie Band of Potawatomi Indians of Kansas
Prairie Island Sioux Indian Community, Prairie Island Reservation, Minnesota
Puyallup Tribe, Puyallup Reservation, Washington
Pyramid Lake Paiute Tribe, Pyramid Lake Reservation, Nevada
Quapaw Tribe of Oklahoma
Quechan Tribe of the Fort Yuma Indian Reservation, California
Quileute Tribe, Quileute Reservation, Washington
Quinault Tribe, Quinault Reservation, Washington
Ramona Reservation, California
Red Cliff Band of Lake Superior Chippewa Indians, Red Cliff Reservation, Wisconsin
Red Lake Band of Chippewa Indians, Red Lake Reservation, Minnesota
Reno-Sparks Indian Colony, Nevada
Resighini Rancheria, Coast Indian Community of Yurok Indians, California
Rincon Band of Luiseno Mission Indians, Rincon Reservation, California
Roaring Creek Rancheria of Pit River Indians, California
Robinson Rancheria of Pomo Indians, California
Rosebud Sioux Tribe, Rosebud Indian Reservation, South Dakota
Rumsey Rancheria of Wintun Indians, California
Sac & Fox Tribe of the Mississippi in Iowa
Sac & Fox Tribe of the Missouri in Kansas
Sac & Fox Tribe of Oklahoma
Saginaw Chippewa Tribe of the Isabella Reservation, Michigan
Salt River Pima-Maricopa Indian Community, Salt River Reservation, Arizona
San Carlos Apache Tribe, San Carlos Reservation, Arizona
San Felipe Pueblo of New Mexico
San Ildefonso Pueblo of New Mexico
San Juan Pueblo of New Mexico
San Manual Band of Serrano Mission Indians, San Manual Reservation, California
San Pasqual Band of Diegueno Indians, San Pasqual Reservation, California
Sandia Pueblo of New Mexico
Santa Ana Pueblo of New Mexico
Santa Clara Pueblo of New Mexico
Santa Rosa Indian Community, Santa Rosa Rancheria of California
Santa Rosa Band of Cahuilla Mission Indians, Santa Rosa Reservation, California
Santa Ynez Band of Chumash Mission Indians, Santa Ynez Reservation, California
Santa Ysabel Band of Diegueno Mission Indians, Santa Ysabel Reservation, California
Santee Sioux Tribe, Santee Reservation, Nebraska
Santo Domingo Pueblo of New Mexico
Sauk-Suiattle Indian Tribe of Washington
Sault Ste. Marie Chippewa Tribe of Michigan
Seminole Nation of Oklahoma
Seminole Tribe of Florida
Seneca Nation of New York
Seneca-Cayuga Tribe of Oklahoma
Shakopee Mdewakanton Sioux Community of Minnesota (Prior Lake)
Sheep Ranch Rancheria of Me-Wuk Indians, California
Sherwood Valley Rancheria of Pomo Indians, California
Shingle Springs Rancheria (Verona Tract) of Miwok Indians, California
Shoalwater Bay Tribe, Shoalwater Bay Reservation, Washington
Shoshone Tribe of the Wind River Reservation, Wyoming
Shoshone-Bannock Tribes of the Fort Hall Reservation, Idaho
Shoshone-Paiute Tribe of the Duck Valley Reservaton, Nevada
Sisseton-Wahpeton Sioux Tribe, Lake Traverse Reservation, South Dakota
Skokomish Tribe, Skokomish Reservation, Washington
Skull Valley Band of Goshute Indians, Utah
Soboba Band of Luiseno Mission Indians, Soboba Reservation, California
Sokoagon Chippewa Community, Mole Lake Band, Wisconsin
Southern Ute Tribe, Southern Ute Reservation, Colorado
Spokane Tribe of the Spokane Reservation, Washington
Squaxin Island Tribe, Squaxin Island Reservation, Washington
St. Croix Chippewa Indians of Wisconsin, St. Croix Reservation, Wisconsin
St. Regis Band of Mohawk Indians of New York
Standing Rock Sioux Tribe, Standing Rock Reservation, North & South Dakota
Stockbridge-Munsee Mohican Indian Community, Wisconsin
Stillaguamish Tribe of Washington
Summit Lake Paiute Tribe, Summit Lake Reservation, Nevada
Suguamish Tribe, Port Madison Reservation, Washington
Susanville Rancheria of Paiute, Maidu, Pit River & Washoe Indians of California
Swinomish Indian Tribal Community, Swinomish Reservation, Washington
Sycuan Band of Diegueno Mission Indians, Sycuan Reservation, California
Table Bluff Rancheria of California
Table Mountain Rancheria of Yokut Indians of California
Taos Pueblo of New Mexico
Te-Moak Bands of Western Shoshone Indians, Nevada (Battle Mountain, Elko & South Fork)
Tesuque Pueblo of New Mexico
Thlopthlocco Creek Tribal Town of Oklahoma
Three Affiliated Tribes of the Fort Berthold Reservation, North Dakota
Tonawanda Band of Seneca Indians of New York
Tonkawa Tribe of Oklahoma
Torres-Martinez Band of Cahuilla Mission Indians, Torres-Martinez Reservation, California
Tule River Tribe, Tule River Reservation, California
Tulalip Tribes of the Tulalip Reservation, Washington
Tuolumne Band of Me-Wuk Indians, Tuolumne Rancheria, California
Turtle Mountain Band of Chippewa Indians, Turtle Mountain Reservation, North Dakota
Tuscarora Nation of New York
Twenty-Nine Palms Band of Luiseno Mission Indians, 29 Palms Reservation, California
United Keetoowah Band of Cherokee Indians, Oklahoma

Exhibit B. All References of the Resighini Rancheria as a Federally Recognized Tribe in the Federal Register

1979	Federal Register Vol. 44 No. 26 7236	Resighini Rancheria, Coast Indian Community of Yurok Indians, California
1980	Federal Register Vol. 45 No. 81 27828	Coast Indian Community of Yurok Indians of the Resighini Rancheria, California
1988	Federal Register Vol. 53 52829	Coast Indian Community of Yurok Indians of the Resighini Rancheria, California
1995	Federal Register Vol. 60 No. 32 9250	Coast Indian Community of Yurok Indians of the Resighini Rancheria, California
1996	Federal Register Vol. 61 No. 220 58211	Coast Indian Community of Yurok Indians of the Resighini Rancheria, California
1997	Federal Register Vol. 62 No. 205 55270	Coast Indian Community of Yurok Indians of the Resighini Rancheria, California
1998	Federal Register Vol. 63, No. 250 71941	Resighini Rancheria, California (formerly known as the Coast Indian Community of Yurok Indians of the Resighini Rancheria)
1999	Federal Register Vol. 62 No. 250 55270	Coast Indian Community of Yurok Indians of the Resighini Rancheria, California
2000	Federal Register Vol. 65 No. 49 13298	Resighini Rancheria, California (formerly known as the Coast Indian Community of Yurok Indians of the Resighini Rancheria)
2002	Federal Register Vol. 67 No. 134 46328	Resighini Rancheria, California (formerly the Coast Indian Community of Yurok Indians of the Resighini Rancheria)
2003	Federal Register Vol. 68 No. 234 68180	Resighini Rancheria, California (formerly the Coast Indian Community of Yurok Indians of the Resighini Rancheria)
2005	Federal Register Vol. 70 No. 226 71194	Resighini Rancheria, California
2007	Federal Register Vol. 72 No. 055 13648	Resighini Rancheria, California
2008	Federal Register Vol. 73 No. 066 18553	Resighini Rancheria, California
2009	Federal Register Vol. 74 No. 153 40218	Resighini Rancheria, California
2010	Federal Register Vol. 75 No. 190 60810	Resighini Rancheria, California

Exhibit C

DEPARTMENT OF THE INTERIOR

Bureau of Indian Affairs

Indian Entities Recognized and Eligible To Receive Services From the United States Bureau of Indian Affairs

AGENCY: Bureau of Indian Affairs, Interior.

ACTION: Notice.

SUMMARY: This notice publishes the current list of 561 tribal entities recognized and eligible for funding and services from the Bureau of Indian Affairs by virtue of their status as Indian tribes. The list is updated from the notice published on December 5, 2003 (68 FR 68180).

FOR FURTHER INFORMATION CONTACT: Daisy West, Bureau of Indian Affairs, Division of Tribal Government Services, Mail Stop 320–SIB, 1951 Constitution Avenue, NW., Washington, DC 20240. Telephone number: (202) 513–7641.

SUPPLEMENTARY INFORMATION: This notice is published pursuant to Section 104 of the Act of November 2, 1994 (Pub. L. 103–454; 108 Stat. 4791, 4792), and in exercise of authority delegated to the Assistant Secretary—Indian Affairs under 25 U.S.C. 2 and 9 and 209 DM 8.

Published below is a list of federally acknowledged tribes in the contiguous 48 states and in Alaska.

The Delaware Tribe of Indians, Oklahoma, was removed from the list in response to a final judgment and order sought by the Cherokee Nation of Oklahoma in the United States District Court for the Northern District of Oklahoma in *Cherokee Nation of Oklahama* v. *Norton, et al.*, Case No. 98–CV–903–TCK–FHM on remand from the Tenth Circuit Court of Appeals in *Cherokee Nation of Oklahoma* v. *Norton*, 389 F.3d 1074 (10th Cir. 2004), as amended, 2005 U.S. App. LEXIS 2773 (10th Cir. Feb. 16, 2005).

The list does not include any additional new tribes. The updates are limited to several tribal name changes. To aid in identifying tribal name changes, the tribe's former name is included with the new tribal name. We will continue to list the tribe's former name for several years before dropping the former name from the list. We have also made several corrections. To aid in identifying corrections, the tribe's previously listed name is included with the tribal name.

The listed entities are acknowledged to have the immunities and privileges available to other federally acknowledged Indian tribes by virtue of their government-to-government relationship with the United States as well as the responsibilities, powers, limitations and obligations of such tribes. We have continued the practice of listing the Alaska Native entities separately solely for the purpose of facilitating identification of them and reference to them given the large number of complex Native names.

Dated: November 14, 2005.

Michael D. Olsen,

Acting Principal Deputy Assistant Secretary—Indian Affairs.

Indian Tribal Entities Within the Contiguous 48 States Recognized and Eligible To Receive Services From the United States Bureau of Indian Affairs

Absentee-Shawnee Tribe of Indians of Oklahoma
Agua Caliente Band of Cahuilla Indians of the Agua Caliente Indian Reservation, California
Ak Chin Indian Community of the Maricopa (Ak Chin) Indian Reservation, Arizona
Alabama-Coushatta Tribes of Texas
Alabama-Quassarte Tribal Town, Oklahoma
Alturas Indian Rancheria, California
Apache Tribe of Oklahoma
Arapahoe Tribe of the Wind River Reservation, Wyoming
Aroostook Band of Micmac Indians of Maine
Assiniboine and Sioux Tribes of the Fort Peck Indian Reservation, Montana
Augustine Band of Cahuilla Mission Indians of the Augustine Reservation, California
Bad River Band of the Lake Superior Tribe of Chippewa Indians of the Bad River Reservation, Wisconsin
Bay Mills Indian Community, Michigan
Bear River Band of the Rohnerville Rancheria, California
Berry Creek Rancheria of Maidu Indians of California
Big Lagoon Rancheria, California
Big Pine Band of Owens Valley Paiute Shoshone Indians of the Big Pine Reservation, California
Big Sandy Rancheria of Mono Indians of California
Big Valley Band of Pomo Indians of the Big Valley Rancheria, California
Blackfeet Tribe of the Blackfeet Indian Reservation of Montana
Blue Lake Rancheria, California
Bridgeport Paiute Indian Colony of California
Buena Vista Rancheria of Me-Wuk Indians of California
Burns Paiute Tribe of the Burns Paiute Indian Colony of Oregon
Cabazon Band of Mission Indians, California (previously listed as the Cabazon Band of Cahuilla Mission Indians of the Cabazon Reservation)
Cachil DeHe Band of Wintun Indians of the Colusa Indian Community of the Colusa Rancheria, California
Caddo Nation of Oklahoma (formerly the Caddo Indian Tribe of Oklahoma)
Cahuilla Band of Mission Indians of the Cahuilla Reservation, California
Cahto Indian Tribe of the Laytonville Rancheria, California
California Valley Miwok Tribe, California (formerly the Sheep Ranch Rancheria of Me-Wuk Indians of California)
Campo Band of Diegueno Mission Indians of the Campo Indian Reservation, California
Capitan Grande Band of Diegueno Mission Indians of California:
  Barona Group of Capitan Grande Band of Mission Indians of the Barona Reservation, California
  Viejas (Baron Long) Group of Capitan Grande Band of Mission Indians of the Viejas Reservation, California
Catawba Indian Nation (aka Catawba Tribe of South Carolina)
Cayuga Nation of New York
Cedarville Rancheria, California
Chemehuevi Indian Tribe of the Chemehuevi Reservation, California
Cher-Ae Heights Indian Community of the Trinidad Rancheria, California
Cherokee Nation, Oklahoma
Cheyenne-Arapaho Tribes of Oklahoma
Cheyenne River Sioux Tribe of the Cheyenne River Reservation, South Dakota
Chickasaw Nation, Oklahoma
Chicken Ranch Rancheria of Me-Wuk Indians of California
Chippewa-Cree Indians of the Rocky Boy's Reservation, Montana
Chitimacha Tribe of Louisiana
Choctaw Nation of Oklahoma
Citizen Potawatomi Nation, Oklahoma
Cloverdale Rancheria of Pomo Indians of California
Cocopah Tribe of Arizona
Coeur D'Alene Tribe of the Coeur D'Alene Reservation, Idaho
Cold Springs Rancheria of Mono Indians of California
Colorado River Indian Tribes of the Colorado River Indian Reservation, Arizona and California
Comanche Nation, Oklahoma
Confederated Salish & Kootenai Tribes of the Flathead Reservation, Montana
Confederated Tribes of the Chehalis Reservation, Washington
Confederated Tribes of the Colville Reservation, Washington
Confederated Tribes of the Coos, Lower Umpqua and Siuslaw Indians of Oregon
Confederated Tribes of the Goshute Reservation, Nevada and Utah
Confederated Tribes of the Grand Ronde Community of Oregon

Confederated Tribes of the Siletz Reservation, Oregon
Confederated Tribes of the Umatilla Reservation, Oregon
Confederated Tribes of the Warm Springs Reservation of Oregon
Confederated Tribes and Bands of the Yakama Nation, Washington
Coquille Tribe of Oregon
Cortina Indian Rancheria of Wintun Indians of California
Coushatta Tribe of Louisiana
Cow Creek Band of Umpqua Indians of Oregon
Cowlitz Indian Tribe, Washington
Coyote Valley Band of Pomo Indians of California
Crow Tribe of Montana
Crow Creek Sioux Tribe of the Crow Creek Reservation, South Dakota
Death Valley Timbi-Sha Shoshone Band of California
Delaware Nation, Oklahoma
Dry Creek Rancheria of Pomo Indians of California
Duckwater Shoshone Tribe of the Duckwater Reservation, Nevada
Eastern Band of Cherokee Indians of North Carolina
Eastern Shawnee Tribe of Oklahoma
Elem Indian Colony of Pomo Indians of the Sulphur Bank Rancheria, California
Elk Valley Rancheria, California
Ely Shoshone Tribe of Nevada
Enterprise Rancheria of Maidu Indians of California
Ewiiaapaayp Band of Kumeyaay Indians, California (formerly the Cuyapaipe Community of Diegueno Mission Indians of the Cuyapaipe Reservation)
Federated Indians of Graton Rancheria, California (formerly the Graton Rancheria)
Flandreau Santee Sioux Tribe of South Dakota
Forest County Potawatomi Community, Wisconsin
Fort Belknap Indian Community of the Fort Belknap Reservation of Montana
Fort Bidwell Indian Community of the Fort Bidwell Reservation of California
Fort Independence Indian Community of Paiute Indians of the Fort Independence Reservation, California
Fort McDermitt Paiute and Shoshone Tribes of the Fort McDermitt Indian Reservation, Nevada and Oregon
Fort McDowell Yavapai Nation, Arizona
Fort Mojave Indian Tribe of Arizona, California & Nevada
Fort Sill Apache Tribe of Oklahoma
Gila River Indian Community of the Gila River Indian Reservation, Arizona
Grand Traverse Band of Ottawa and Chippewa Indians, Michigan
Greenville Rancheria of Maidu Indians of California
Grindstone Indian Rancheria of Wintun-Wailaki Indians of California
Guidiville Rancheria of California
Habematolel Pomo of Upper Lake, California (formerly the Upper Lake Band of Pomo Indians of Upper Lake Rancheria of California)
Hannahville Indian Community, Michigan
Havasupai Tribe of the Havasupai Reservation, Arizona
Ho-Chunk Nation of Wisconsin
Hoh Indian Tribe of the Hoh Indian Reservation, Washington
Hoopa Valley Tribe, California
Hopi Tribe of Arizona
Hopland Band of Pomo Indians of the Hopland Rancheria, California
Houlton Band of Maliseet Indians of Maine
Hualapai Indian Tribe of the Hualapai Indian Reservation, Arizona
Huron Potawatomi, Inc., Michigan
Inaja Band of Diegueno Mission Indians of the Inaja and Cosmit Reservation, California
Ione Band of Miwok Indians of California
Iowa Tribe of Kansas and Nebraska
Iowa Tribe of Oklahoma
Jackson Rancheria of Me-Wuk Indians of California
Jamestown S'Klallam Tribe of Washington
Jamul Indian Village of California
Jena Band of Choctaw Indians, Louisiana
Jicarilla Apache Nation, New Mexico
Kaibab Band of Paiute Indians of the Kaibab Indian Reservation, Arizona
Kalispel Indian Community of the Kalispel Reservation, Washington
Karuk Tribe of California
Kashia Band of Pomo Indians of the Stewarts Point Rancheria, California
Kaw Nation, Oklahoma
Keweenaw Bay Indian Community, Michigan
Kialegee Tribal Town, Oklahoma
Kickapoo Tribe of Indians of the Kickapoo Reservation in Kansas
Kickapoo Tribe of Oklahoma
Kickapoo Traditional Tribe of Texas
Kiowa Indian Tribe of Oklahoma
Klamath Tribes, Oregon (formerly the Klamath Indian Tribe of Oregon)
Kootenai Tribe of Idaho
La Jolla Band of Luiseno Mission Indians of the La Jolla Reservation, California
La Posta Band of Diegueno Mission Indians of the La Posta Indian Reservation, California
Lac Courte Oreilles Band of Lake Superior Chippewa Indians of Wisconsin
Lac du Flambeau Band of Lake Superior Chippewa Indians of the Lac du Flambeau Reservation of Wisconsin
Lac Vieux Desert Band of Lake Superior Chippewa Indians, Michigan
Las Vegas Tribe of Paiute Indians of the Las Vegas Indian Colony, Nevada
Little River Band of Ottawa Indians, Michigan
Little Traverse Bay Bands of Odawa Indians, Michigan
Lower Lake Rancheria, California
Los Coyotes Band of Cahuilla & Cupeno Indians of the Los Coyotes Reservation, California (formerly the Los Coyotes Band of Cahuilla Mission Indians of the Los Coyotes Reservation)
Lovelock Paiute Tribe of the Lovelock Indian Colony, Nevada
Lower Brule Sioux Tribe of the Lower Brule Reservation, South Dakota
Lower Elwha Tribal Community of the Lower Elwha Reservation, Washington
Lower Sioux Indian Community in the State of Minnesota
Lummi Tribe of the Lummi Reservation, Washington
Lytton Rancheria of California
Makah Indian Tribe of the Makah Indian Reservation, Washington
Manchester Band of Pomo Indians of the Manchester-Point Arena Rancheria, California
Manzanita Band of Diegueno Mission Indians of the Manzanita Reservation, California
Mashantucket Pequot Tribe of Connecticut
Match-e-be-nash-she-wish Band of Pottawatomi Indians of Michigan
Mechoopda Indian Tribe of Chico Rancheria, California
Menominee Indian Tribe of Wisconsin
Mesa Grande Band of Diegueno Mission Indians of the Mesa Grande Reservation, California
Mescalero Apache Tribe of the Mescalero Reservation, New Mexico
Miami Tribe of Oklahoma
Miccosukee Tribe of Indians of Florida
Middletown Rancheria of Pomo Indians of California
Minnesota Chippewa Tribe, Minnesota (Six component reservations:
Bois Forte Band (Nett Lake); Fond du Lac Band; Grand Portage Band; Leech Lake Band; Mille Lacs Band; White Earth Band)
Mississippi Band of Choctaw Indians, Mississippi
Moapa Band of Paiute Indians of the Moapa River Indian Reservation, Nevada
Modoc Tribe of Oklahoma
Mohegan Indian Tribe of Connecticut
Mooretown Rancheria of Maidu Indians of California
Morongo Band of Cahuilla Mission Indians of the Morongo Reservation, California

Muckleshoot Indian Tribe of the Muckleshoot Reservation, Washington
Muscogee (Creek) Nation, Oklahoma
Narragansett Indian Tribe of Rhode Island
Navajo Nation, Arizona, New Mexico & Utah
Nez Perce Tribe of Idaho
Nisqually Indian Tribe of the Nisqually Reservation, Washington
Nooksack Indian Tribe of Washington
Northern Cheyenne Tribe of the Northern Cheyenne Indian Reservation, Montana
Northfork Rancheria of Mono Indians of California
Northwestern Band of Shoshoni Nation of Utah (Washakie)
Oglala Sioux Tribe of the Pine Ridge Reservation, South Dakota
Omaha Tribe of Nebraska
Oneida Nation of New York
Oneida Tribe of Indians of Wisconsin
Onondaga Nation of New York
Osage Tribe, Oklahoma
Ottawa Tribe of Oklahoma
Otoe-Missouria Tribe of Indians, Oklahoma
Paiute Indian Tribe of Utah (Cedar City Band of Paiutes, Kanosh Band of Paiutes, Koosharem Band of Paiutes, Indian Peaks Band of Paiutes, and Shivwits Band of Paiutes)
Paiute-Shoshone Indians of the Bishop Community of the Bishop Colony, California
Paiute-Shoshone Tribe of the Fallon Reservation and Colony, Nevada
Paiute-Shoshone Indians of the Lone Pine Community of the Lone Pine Reservation, California
Pala Band of Luiseno Mission Indians of the Pala Reservation, California
Pascua Yaqui Tribe of Arizona
Paskenta Band of Nomlaki Indians of California
Passamaquoddy Tribe of Maine
Pauma Band of Luiseno Mission Indians of the Pauma & Yuima Reservation, California
Pawnee Nation of Oklahoma
Pechanga Band of Luiseno Mission Indians of the Pechanga Reservation, California
Penobscot Tribe of Maine
Peoria Tribe of Indians of Oklahoma
Picayune Rancheria of Chukchansi Indians of California
Pinoleville Rancheria of Pomo Indians of California
Pit River Tribe, California (includes XL Ranch, Big Bend, Likely, Lookout, Montgomery Creek and Roaring Creek Rancherias)
Poarch Band of Creek Indians of Alabama
Pokagon Band of Potawatomi Indians, Michigan and Indiana
Ponca Tribe of Indians of Oklahoma
Ponca Tribe of Nebraska
Port Gamble Indian Community of the Port Gamble Reservation, Washington
Potter Valley Tribe, California (formerly the Potter Valley Rancheria of Pomo Indians of California)
Prairie Band of Potawatomi Nation, Kansas
Prairie Island Indian Community in the State of Minnesota
Pueblo of Acoma, New Mexico
Pueblo of Cochiti, New Mexico
Pueblo of Jemez, New Mexico
Pueblo of Isleta, New Mexico
Pueblo of Laguna, New Mexico
Pueblo of Nambe, New Mexico
Pueblo of Picuris, New Mexico
Pueblo of Pojoaque, New Mexico
Pueblo of San Felipe, New Mexico
Pueblo of San Juan, New Mexico
Pueblo of San Ildefonso, New Mexico
Pueblo of Sandia, New Mexico
Pueblo of Santa Ana, New Mexico
Pueblo of Santa Clara, New Mexico
Pueblo of Santo Domingo, New Mexico
Pueblo of Taos, New Mexico
Pueblo of Tesuque, New Mexico
Pueblo of Zia, New Mexico
Puyallup Tribe of the Puyallup Reservation, Washington
Pyramid Lake Paiute Tribe of the Pyramid Lake Reservation, Nevada
Quapaw Tribe of Indians, Oklahoma
Quartz Valley Indian Community of the Quartz Valley Reservation of California
Quechan Tribe of the Fort Yuma Indian Reservation, California & Arizona
Quileute Tribe of the Quileute Reservation, Washington
Quinault Tribe of the Quinault Reservation, Washington
Ramona Band or Village of Cahuilla Mission Indians of California
Red Cliff Band of Lake Superior Chippewa Indians of Wisconsin
Red Lake Band of Chippewa Indians, Minnesota
Redding Rancheria, California
Redwood Valley Rancheria of Pomo Indians of California
Reno-Sparks Indian Colony, Nevada
Resighini Rancheria, California
Rincon Band of Luiseno Mission Indians of the Rincon Reservation, California
Robinson Rancheria of Pomo Indians of California
Rosebud Sioux Tribe of the Rosebud Indian Reservation, South Dakota
Round Valley Indian Tribes of the Round Valley Reservation, California
Rumsey Indian Rancheria of Wintun Indians of California
Sac & Fox Tribe of the Mississippi in Iowa
Sac & Fox Nation of Missouri in Kansas and Nebraska
Sac & Fox Nation, Oklahoma
Saginaw Chippewa Indian Tribe of Michigan
St. Croix Chippewa Indians of Wisconsin
St. Regis Band of Mohawk Indians of New York
Salt River Pima-Maricopa Indian Community of the Salt River Reservation, Arizona
Samish Indian Tribe, Washington
San Carlos Apache Tribe of the San Carlos Reservation, Arizona
San Juan Southern Paiute Tribe of Arizona
San Manual Band of Serrano Mission Indians of the San Manual Reservation, California
San Pasqual Band of Diegueno Mission Indians of California
Santa Rosa Indian Community of the Santa Rosa Rancheria, California
Santa Rosa Band of Cahuilla Mission Indians of the Santa Rosa Reservation, California
Santa Ynez Band of Chumash Mission Indians of the Santa Ynez Reservation, California
Santa Ysabel Band of Diegueno Mission Indians of the Santa Ysabel Reservation, California
Santee Sioux Nation, Nebraska (formerly the Santee Sioux Tribe of the Santee Reservation of Nebraska)
Sauk-Suiattle Indian Tribe of Washington
Sault Ste. Marie Tribe of Chippewa Indians of Michigan
Scotts Valley Band of Pomo Indians of California
Seminole Nation of Oklahoma
Seminole Tribe of Florida, Dania, Big Cypress, Brighton, Hollywood & Tampa Reservations
Seneca Nation of New York
Seneca-Cayuga Tribe of Oklahoma
Shakopee Mdewakanton Sioux Community of Minnesota
Shawnee Tribe, Oklahoma
Sherwood Valley Rancheria of Pomo Indians of California
Shingle Springs Band of Miwok Indians, Shingle Springs Rancheria (Verona Tract), California
Shoalwater Bay Tribe of the Shoalwater Bay Indian Reservation, Washington
Shoshone Tribe of the Wind River Reservation, Wyoming
Shoshone-Bannock Tribes of the Fort Hall Reservation of Idaho
Shoshone-Paiute Tribes of the Duck Valley Reservation, Nevada
Sisseton-Wahpeton Oyate of the Lake Traverse Reservation, South Dakota (formerly the Sisseton-Wahpeton Sioux Tribe of the Lake Traverse Reservation)
Skokomish Indian Tribe of the Skokomish Reservation, Washington
Skull Valley Band of Goshute Indians of Utah

Cher-Ae Heights Indian Community of the Trinidad Rancheria

April 10, 2012

President Daniel Richards
California Fish and Game Commission
POB 944209
Sacramento, CA. 94244-2090

Re: Formal Comments to the Marine Life Protection Act, Draft EIR

President Richmond and Commissioners:

Please accept this letter as Cher-Ae Heights Indian Community of the Trinidad Rancheria's (Trinidad Rancheria) formal request to adopt North Coast Study Region Draft Regulations Sub-Option (B) to re-designate Reading Rock as a State Marine Conservation Area, (SMCA), rather than the current preferred alternative as a State Marine Reserve.

The Reading Rock SMCA designation sub-option before you now, reflects the Trinidad Rancheria's need to maintain access to the location for cultural, religious and ceremonial subsistence gather purposes as we have since time immemorial.

The Declaration of Rose Joy Crutchfield Sundberg, an enrolled member and one of the Original Assignees of the Cher-Ae Heights Indian Community of the Trinidad Rancheria, is attached and gives a detailed history of the villages she descended from and the creation story of Reading Rock.

Additionally, Trinidad Rancheria Resolution TC-12-05 declares the area of Sek-kwo-nar (Reading Rock) as a traditional cultural property within a Yurok cultural landscape eligible for inclusion on the National Register of Historic Places.

A SMCA designation at Reading Rock would align the Marine Life Protection Act regulations with the 2006 MOU between the Bureau of Land Management and the Trinidad Rancheria, which states that the Trinidad Rancheria will serve as a steward of the portion of the California Coastal National Monument (CCNM), in the vicinity of the Trinidad Rancheria, in Humboldt County, a portion of the ancestral territory of the Trinidad Rancheria.

We also support the Yurok Tribe's request for a "no change" for the specific location of False Klamath Rock Special Closure. This Special Closure was included at the last minute in the October 26th, 2010, Blue Ribbon Task Force meeting and was not part of earlier consultation or discussions.

www.trinidadrancheria.com
1 Cher-Ae Lane • PO Box 630 • Trinidad, California • 95570 • 707.677.0211 • 707.677.3921 (fax)

Trinidad Rancheria requests that our Nation be deleted from the Tribes listed in the Pyramid Point and Point St. George Marine Protected areas within the ancestral territory of the Smith River Rancheria. The Rancheria further commits to continue through consultation to move forward in the Marine Life Protection Act process and formally requests the development of a Memorandum of Understanding to addressing monitoring and enforcement. We do not agree with the recommendation from the Department of Fish and Game to enforce tribal gathering and subsistence through fishing licenses. We formally request this be included in the MOU and enforced through Tribal Ordinances and Tribal monitoring cooperatively with the Fish and Game Law enforcement.

The Trinidad Rancheria makes a full reservation of rights and specifically asserts the right to regulate all Native Americans within the boundaries of the Trinidad Rancheria.

Sincerely,

Garth Sundberg

Garth Sundberg
Tribal Chairman
Trinidad Rancheria

Attachments: Declaration of Rose Joy Crutchfield Sundberg
Trinidad Rancheria Resolution TC-12-05
Bureau of Land Management MOU with Trinidad Rancheria

DECLARATION OF ROSE JOY CRUTCHFIELD SUNDBERG

I, Rose Joy Crutchfield Sundberg, Declare:

1. My name is Rose Joy Crutchfield Sundberg.
2. I was born at Yo-teyr he-wan (above the village of Yo-teyr, also known as Donnelly Prairie) on the Klamath River, California.
3. I was raised there at Yo-teyr he-wan for the first three years of my life until my family moved to Blue Lake, California. However I still maintain ties and have a home above the village of Yah-ter to the present day.
4. I was raised by my parents Edward Crutchfield and Lila Shaffer Natt.
5. I descend from the coastal Yurok villages of Chue-rey (Tsurai) through my grandmother Mary Shaffer Natt; Peen-pey (at Big Lagoon) through my great grandmother Annie Turner; Cho-kwee through my grandmother Susan Donnelly Crutchfield; as well as the Yurok villages of Hop-ew through my great grandmother Mary Donnelly; Koo-tep through my grandfather Robert Natt; and Tue-rep through grandma Crutchfield's father.
6. My birth date is March 25, 1932.
7. I am an enrolled member of the Cher-Ae Heights Indian Community of the Trinidad Rancheria and have lived in on the coast in Trinidad, California for 56 years.
8. I have knowledge of the spiritual and cultural significance of Reading Rock as told to me by my relatives.
9. My uncle Frank Douglas told me the origin story of Reading Rock and it is as follows:

> There was a woman from Stone Lagoon (Chah-pekw) that was bought by a man up at Red Mountain. They were married and had a baby. He was very cruel to her. When the baby was still in its basket, she planned to leave him. She started hiding food in the baby's basket to ready for their escape. He continued to be cruel to her and she became desperate to leave. And so one night she was cooking sturgeon for him, for his dinner. She cooked it with the skin on in the coals, as they did at her home at Chah-pekw. Her husband got very angry with her because he didn't like the way she cooked it, so he beat her. She decided to leave that night. She had to very quietly sneak out of the village with the baby. When she got to the ocean she found a canoe. I can't remember how she got it but she did. She started

paddling south to her home. Her husband was standing up on Red Mountain and he saw her. He was so angry that she left him, he picked up her pestle and threw at it her, hitting the back side of her boat, which broke off. That pestle is still there where it landed. It is called Sek-kwo-nar, Reading Rock. That is also why the ends of the canoes boats are sheared off like that. When she landed at her home, at the village of Chah-pekw her family was very happy to see her.

10. I know that Sek-kwo-nar, was also a place where people would go fishing for seals and fish and gather.

Dated: _____

Rose Joy Crutchfield Sundberg

April 16, 2012
Vickie L. Keene
Vickie L. Keene
1-28-2014

Cher-Ae Heights Indian Community of the Trinidad Rancheria

CHER-AE HEIGHTS INDIAN COMMUNITY OF THE TRINIDAD RANCHERIA
RESOLUTION OF THE TRIBAL COUNCIL

RESOLUTION NO.: TC-12-05

SUBJECT: **Trinidad Rancheria Cultural Landscape and Traditional Cultural Property Designation for Sek-kwo-nar (Reading Rock).**

WHEREAS: The Cher-Ae Heights Indian Community of the Trinidad Rancheria (hereinafter the "Tribe") is a federally recognized Indian Tribe eligible for all rights and privileges afforded to recognized Tribes; and

WHEREAS: The Cher-Ae Heights Indian Community Tribal Council (hereinafter "Tribal Council") is the governing body of the Tribe under the authority of the Tribe's Constitution; and

WHEREAS: The Tribe, as a sovereign Indian Nation, has a Tribal Historic Preservation Officer (THPO) who has assumed the responsibilities of the State Historic Preservation Officer (SHPO) for National Historic Preservation Act (NHPA), Section 106 and 110 duties; and

WHEREAS: The Tribe operates a cultural resource program which works directly with Yurok elders in documenting cultural resources and traditional cultural properties and said elders have determined that the place known as Sek-kwo-nar (Reading Rock) is presently and has always been a place of immeasurable religious, and spiritual significance for Yurok people; and

WHEREAS: The Tribe declares that Sek-kwo-nar (Reading Rock) must be protected and managed in a traditional manner as a traditional cultural property within the Yurok cultural landscape and it must be accessed by Yurok people for cultural and spiritual purposes forever.

NOW THEREFORE BE IT RESOLVED: That the Trinidad Rancheria Tribal Council hereby declares the area of Sek-kwo-nar (Reading Rock) as a traditional cultural property within a Yurok cultural landscape eligible for inclusion on the National Register of Historic Places; and

BE IT FURTHER RESOLVED: The Tribal Vice Chairperson is hereby authorized to sign this resolution and to negotiate all matters pertaining hereto and that the Recording Secretary is authorized to attest.

www.trinidadrancheria.com
1 Cher-Ae Lane • PO Box 630 • Trinidad, California • 95570 • 707.677.0211 • 707.677.3921 (fax)

CERTIFICATION

This is to certify that **Resolution TC-12-05** was approved through the standard Trinidad Rancheria Tribal Council Polling Procedure, through which a quorum was established, and that this Resolution was adopted by a vote of 4 in favor, 0 opposed, and 0 abstaining.

Dated this 16th day of April 2012,

Shirley Laos, Vice Chairperson

ATTEST:

Amy Atkins, Recording Secretary

MEMORANDUM OF UNDERSTANDING
BETWEEN THE
CHER-AE HEIGHTS INDIAN COMMUNITY OF THE TRINIDAD RANCHERIA
AND THE
BUREAU OF LAND MANAGEMENT
REGARDING THE
CALIFORNIA COASTAL NATIONAL MONUMENT

I. PARTIES AND PURPOSE

This Memorandum of Understanding (MOU) is entered into by and between the **Cher-Ae Heights Indian Community of the Trinidad Rancheria** (hereinafter referred to as the "Trinidad Rancheria") and the United States Department of the Interior's **Bureau of Land Management** (hereinafter referred to as the "BLM") to establish an agreement whereby the Trinidad Rancheria will serve as a steward for a portion of the California Coastal National Monument (CCNM) in the vicinity of the Trinidad Rancheria in Humboldt County, California.

II. INTRODUCTION

A. **BLM & the California Coastal National Monument.** By Presidential Proclamation on January 11, 2000, all unappropriated or unreserved lands and interest in lands owned or controlled by the United States in the form of islands, rocks, and pinnacles above mean high tide within 12 nautical miles of the shoreline of the State of California were designated as the CCNM. The CCNM was nationally recognized in the Presidential Proclamation as a biological and geological treasure, rich in biodiversity, and providing essential habitat for many species of scientific interest. The CCNM designation mandates the protection of historic and scientific objects, particularly wildlife species which normally inhabit the CCNM area, and limits management discretion that the Federal managers otherwise have. The Secretary of the Interior manages the CCNM through the BLM and under the BLM's existing authorities, subject to the overriding purpose of protecting the resources described in the Presidential Proclamation. The BLM is directed by Congress to administer the public lands so that all various land and resource uses and values are managed in combinations that will best meet the needs of the American people.

B. **Core-Managing Partners.** BLM, the California Department of Fish and Game (CDFG), and the California Department of Parks and Recreation (CDPR) serve as the "Core-Managing Partners" of the CCNM. Through an interim MOU signed in the spring of 2000, BLM extended its partnership with CDFG and added CDPR, the State agency that administers 25% of the California coast. Collectively, BLM, CDFG, and CDPR are responsible for the management of the CCNM.

C. **Stewardship.** With a national monument as extensive and connected to so many varied jurisdictions as the CCNM, the opportunities for partnerships are not only enormous, but also necessary. The BLM is committed to continuing existing partnerships and establishing new ones in order to effectively administer the CCNM. Consistent with appropriate authorities, stewardship agreements will be developed with select entities with management interests along the coast. "CCNM Stewards" will work in partnership with BLM to help in the management of a specific portion of the CCNM (See Attachment A, CCNM Stewardship Program Fact Sheet).

D. **Trinidad Rancheria.** As a Federally recognized tribe, the Trinidad Rancheria is interested in serving as a "CCNM Steward" for the management of the portion of the CCNM adjacent to the Trinidad Rancheria (See Attachment B, Map of Trinidad Rancheria Stewardship Area of the CCNM).

III. AUTHORITIES

A. **BLM Authority.** The Federal Land Policy and Management Act of 1976, Section 307(b) provides that the Secretary of the Interior may undertake programs of resource management through cooperative agreements.

B. **Trinidad Rancheria Authority.** Trinidad Rancheria, as a federally recognized tribe, has established a Business Committee to conduct business on behalf of the Community Council. Approval by the Business Committee and the signing of this MOU by the Tribal Chair constitutes authority to enter into this agreement.

IV. PRINCIPLES OF STEWARDSHIP AGREEMENT

A. **The Trinidad Rancheria Agrees To:**

1. Serve as a CCNM Steward and work closely with the Core-Managing Partners of CCNM and other CCNM partners, as appropriate, to assist with the protection and administration of the portion of the CCNM and its various resources and resource values within the Trinidad Rancheria Stewardship Area (hereinafter referred to as the "Stewardship Area").

2. Designate a contact person to serve as the Trinidad Rancheria liaison with the CCNM.

3. Cooperate with the BLM on the protection, monitoring, and research needs for the CCNM in the Stewardship Area consistent with the Trinidad Rancheria's Environmental Program and associated annual work plans.

4. Work with the BLM to develop interpretive and environmental education opportunities associated with CCNM's cultural and ecological resources. This could include the placement of interpretive displays on Trinidad Rancheria property where agreed upon by both parties.

5. Alert BLM to known and potential problems related to activities on the CCNM within the Stewardship Area.

6 Implement Trinidad Rancheria activities to avoid or minimize impacts to the CCNM as practicable.

7. Report to BLM on a quarterly basis, or more frequent, on any activity or action related to the CCNM.

B. **The BLM Agrees To:**

1. Respect any existing Trinidad Rancheria rights to the use of or access to the CCNM and surrounding coastal waters.

2. Provide the Trinidad Rancheria with a local contact for items and actions related to the CCNM and provide guidance regarding the role of a CCNM Steward (See CCNM Stewardship Program Fact Sheet, Attachment A).

3. Keep the Trinidad Rancheria informed and updated on matters related to the CCNM.

4. Identify potential funding opportunities for the Trinidad Rancheria that might relate to the various aspects of the implementation of this MOU.

B. **The Trinidad Rancheria and the BLM Mutually Agree To:**

1. Seek opportunities to coordinate, share, and/or combine resources and data to carry out protection, monitoring, research, and/or public education initiatives associated with unique coastal habitats and resource values associated with this Stewardship Area of the CCNM.

2. Work together to ensure consistency and coordination in the protection and management of the CCNM.

V. OTHER PROVISIONS

A. **Limits of Authority and Funding**

1. Nothing in this MOU shall be construed as limiting or affecting in any way the authority or legal responsibility of the Parties.

2. Nothing in this MOU binds the Parties to perform beyond their respective authorities.

3. Nothing in this MOU requires the Parties to assume or expend any funds in excess of available appropriations.

4. The mission requirements, funding, personnel, and other priorities of either Party may affect that Party's ability to fully implement all the provisions identified in this MOU.
5. This MOU is neither a fiscal nor a funds obligation document. Specific activities that involve the transfer of money, services, or property between the Parties shall require execution of separate agreement or contract.

Attachment A

CALIFORNIA COASTAL NATIONAL MONUMENT
STEWARDSHIP PROGRAM
FACT SHEET

PURPOSE:

To establish a series of California Coastal National Monument (CCNM) "Stewards" to work with the U.S. Department of the Interior's Bureau of Land Management (BLM), California Department of Fish and Game (CDFG), California Department of Parks and Recreation (CDPR), and other CCNM partners for long-term protection and management of CCNM and its various resources and resource values.

GOALS & OBJECTIVES:

- Increase protection and monitoring of the CCNM.
- Involve adjacent landowners and/or resource managers of properties with various coastal and marine protection programs, initiatives, and/or interests associated with portions of the CCNM in the integrated, long-term management of the CCNM.
- Increase the knowledge and understanding of the various resources and resource values of the CCNM.
- Enhance the cooperative management of fragile ecosystems of California's coastline.

BACKGROUND & ORGANIZATION:

- CCNM was established by Presidential Proclamation of January 11, 2000, and BLM, under the Secretary of the Interior, was directed to provide long-term management.
- Through a memorandum of understanding (MOU), signed in the Summer of 2000, CDFG and CDPR where brought in as managing partners to assist BLM, who retains the ultimate legal responsibility for the CCNM, in "...preserving the [CCNM's] objects of historic and scientific interest, ...mapping and understanding resources within the Monument, [and] ...working with the public to explain the values of the Monument."
- In order to effectively deal with the wide array of partnership opportunities associated with the CCNM, three basic categories have been developed:
    - Core-Managing Partner - Each of the three "core" agencies- -BLM, CDFG, and CDPR- -responsible for collaborating in the overall management of the entire CCNM.
    - Collaborative Partner - An organization, governmental or private, that is interested in collaborating with the core-managing partners in any of a variety of programs, actions, and management elements associated with the long-term management of

the CCNM.

- Steward - A select entity with ownership and management responsibility for a portion of the coast that adjoins part of the CCNM and that is interested in serving as the "steward" for that portion of CCNM.

- Stewards will work with BLM and other partners to help in the management of their specific portion of the CCNM, a portion that is offshore of the Steward's onshore property.

METHODS:

- BLM will invite other governmental, tribal, or private organizations that own coastal lands and manage programs that provide for the protection and long-term management of portions of the California coast adjacent to parts of the CCNM, to be "Stewards" for that portion of the CCNM.

- A stewardship agreement will be developed with each approved Steward and each agreement will identify the specific portion of the CCNM for which the Steward will assist in the long-term management, as well as outline the expected role and responsibilities in working with the BLM and its various CCNM partners.

- The Steward will serve as the local CCNM representative for the assigned portion of the CCNM by:

  - Designating a contact person to serve as the CCNM liaison.

  - Providing local contact point for items and actions related to the CCNM.

  - Alerting BLM to known and potential problems.

  - Identifying specific management needs, including protection, monitoring, and research.

  - Integrating the management of its portion of the CCNM with its other resource management responsibilities.

  - Reporting to BLM on a quarterly basis on any activity or action related to the CCNM.

- BLM will provide the Stewards with guidance and direction regarding the role of a CCNM Steward and keep the Stewards updated on the evolving protection and management needs and requirements related to the CCNM.

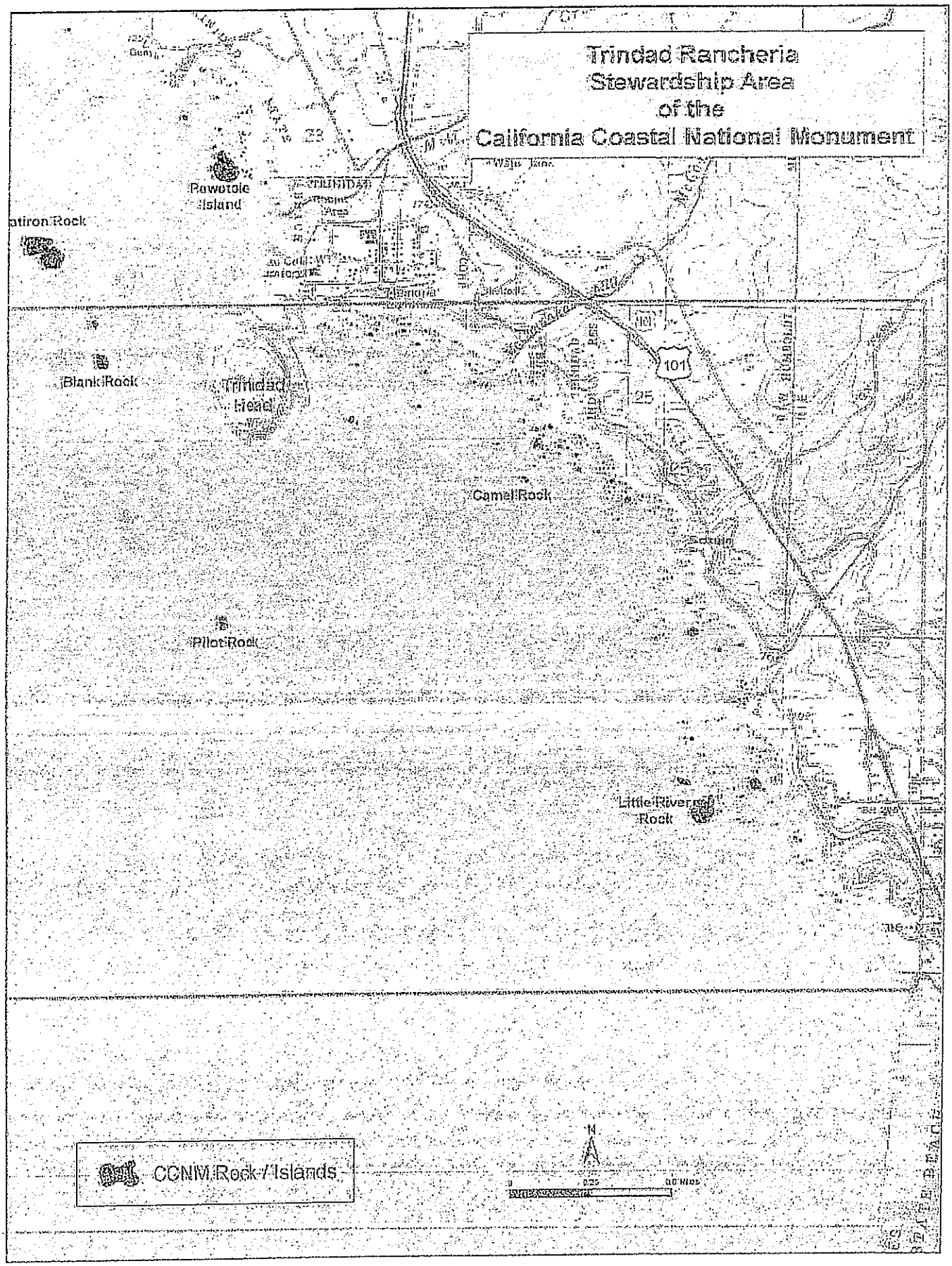
INTENDED OUTCOMES & BENEFITS:

- Increased monitoring and protection of the CCNM.

- Greater involvement of partners in the long-term management of the CCNM.

- Increased awareness and knowledge of the specific resources and resource values of the CCNM.
- Regular reports on the condition of the CCNM resources and on the activities in and around the CCNM.
- Identification of actions needed related to enhance the long-term management of the CCNM.
- More effective use of limited funding and capabilities.

Attachment B



6. Nothing in this MOU restricts the Parties from participating in similar activities or arrangements with other public or private agencies, organizations, or individuals

7. BLM retains the sole decision-making authority for public lands and resources it administers.

B. **Amendment of Agreement.** Amendments or supplements to this MOU may be proposed by either Party and shall become effective upon written approval of both Parties.

C. **Dispute Resolution.** The Parties shall attempt to resolve controversies through alternative dispute resolution methods that are mutually acceptable to both Parties. Methods may include, but are not limited to fact-finding, mediation, and non-binding arbitration.

D. **Termination of Agreement.** Either Party may terminate its participation in this MOU at any time through written notification to the other Party at least 90 days prior to termination.

E. **Effective Date of Agreement.** This MOU shall become effective upon signature by both Parties. This MOU may be executed in one or more counterparts, each of which will be considered an original document.

VI. APPROVALS

The Parties Hereto have executed this agreement as of the last date shown below.

9/16/05

Mike Pool
State Director
Bureau of Land Management

Date

9-8-05

Garth Sundberg
Tribal Council Chairperson
Cher-Ae Heights Indian Community of the Trinidad Rancheria

Date

2 ATTACHMENTS:

Attachment A - CCNM Stewardship Program Fact Sheet
Attachment B - Map of Trinidad Rancheria's Stewardship Area of the CCNM

Cher-Ae Heights Indian Community of the Trinidad Rancheria

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August 9, 2013

Sonke Mastrup
Executive Director
CA Fish and Game Commission
P.O. Box 944209
Sacramento, CA 94244-2090

Director Mastrup:

The Cher-Ae Heights Indian Community of the Trinidad Rancheria ("Trinidad Rancheria" or "Tribe") is a Federally Recognized Sovereign Tribal Nation located on the Northern California Coast. The Tribe's culture is inextricably intertwined with marine resources and those marine resources continue to play a vital role in the Tribe's beliefs, ceremonies, traditional arts, diet, substance activities, and stewardship of these resources is an important the role of the tribal government. For thousands of years, the Trinidad Rancheria and other tribes have been the stewards of the North Coast and have regulated the use of the marine resources located within this area. The traditional tribal uses, which continue today, reflect the Tribe's stewardship and the Tribe's regulation of its traditional practices. The manner and timing of these uses, and the tribes' regulation of them, are an integral part of the cultural system and beliefs of the North Coast tribes.

On April 10, 2012, the Trinidad Rancheria submitted the attached documents to Fish and Game Commission President Richards regarding Reading Rock and the Tribe's request that Reading Rock be designated as a State Marine Conservation Area, (SMCA), rather than a State Marine Reserve. The Tribe made this formal request to secure the Trinidad Rancheria's need to maintain access to the location for cultural, religious and ceremonial subsistence gather purposes as we have since time immemorial.

Upon receipt of the *Notice to Tribes and Tribal Communities regarding the New and Revised Marine Protected Areas in Effect in Northern California, Effective December 19, 2012* the Tribe became aware that Reading Rock was designated as a State Marine Conservation Area, (SMCA), but that the exceptions for Take of All Living Marine Resources list the Yurok Tribe as the only Federally Recognized tribe exempt from regulations within the SMCA.

As a Federally Recognized Tribe and Sovereign Nation we share a unique political and legal relationship with the Federal, State and local governments. A key aspect to this relationship is the establishment and continuance of meaningful Government to Government Consultation between Tribes and various Federal, State and local governments. On behalf of the Trinidad Rancheria, I would like to request Government to Government Consultation with the CA Fish and Game Commission regarding the SMCA designation of Reading Rock and the fact that the Cher-Ae Heights Indian Community of the Trinidad Rancheria was not listed as a Federally Recognized tribe exempt from regulations within this SMCA.

Please contact Trinidad Rancheria Chief Executive Officer Jacque Hostler-Carmesin at (707) 677-0211 ext. 2736 to plan and coordinate meeting dates and times for a Government to Government Consultation.

Sincerely,

Garth Sundberg

Garth Sundberg
Tribal Chairman
Trinidad Rancheria

Cher-Ae Heights Indian Community of the Trinidad Rancheria

August 14, 2013

Sonke Mastrup
Executive Director
CA Fish and Game Commission
P.O. Box 944209
Sacramento, CA 94244-2090

Director Mastrup:

On behalf of the Cher-Ae Heights Indian Community of the Trinidad Rancheria, please accept this letter to clarify an error made in the August 9, 2013 Trinidad Rancheria letter to you requesting formal Government to Government Consultation with the CA Fish and Game Commission. I inadvertently noted Trinidad Rancheria CEO Jacque Hostler-Carmesin as the point of contact for the Trinidad Rancheria in regards to this consultation request. As Mrs. Hostler-Carmesin was recently appointed to serve on the CA Fish and Game Commission, she has requested recusal from any interactions between the Tribe and the Commission in order to avoid any potential conflict of interest due to her due positions.

Please contact Trinidad Rancheria Executive Manager Amy Atkins at (707) 677-0211 ext. 2702 or Tribal Historic Preservation Officer Rachel Sundberg at (707) 677-0211 ext. 2726 to plan and coordinate meeting dates and times for a Government to Government Consultation of Reading Rock as originally requested in the August 9, 2013 letter.

Sincerely,

Garth Sundberg
Tribal Chairman
Trinidad Rancheria

YUROK TRIBE

190 Klamath Boulevard • Post Office Box 1027 • Klamath, CA 95548

June 13, 2016

President Eric Sklar
California Fish and Game Commission
P.O. Box 944209
Sacramento, CA 94244-2090

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Re: Amendments to Tribal Take at Sek-kwo-nar (Reading Rock) SMCA

Aiy-ye-kwee' President Sklar and Commissioners,

This letter is in response to the current requests for exemptions to Marine Protected Area ("MPA") take regulations from the Resighini Rancheria and Cher-Ae Heights Indian Community of the Trinidad Rancheria for the Sek-kwo-nar (Reading Rock) SMCA in Humboldt County. **The Yurok Tribe opposes both requests.**

The Yurok Tribe is the largest tribe in California, with over 6,100 tribal members. Yurok ancestral territory extends continuously for eighty-three miles along the Pacific Ocean coast, in northern California. This area represents approximately 7.5% of the total California coastline. Yurok aboriginal rights include the right to manage and utilize all natural resources – a right that Yurok has never relinquished. The Sek-kwo-nar (Reading Rock) SMCA is outside the exterior boundaries of the Yurok Reservation, but within Yurok ancestral territory.

As evidenced by the Tribe's work with Yurok elders and subsequent documentation of the Tribes' cultural resources and cultural properties, Sek-kwo-nar has since time immemorial held immense spiritual significance to the Yurok Tribe. Through Yurok Tribal Resolution 12-06 (attached), the Tribe has designated Sek-kwo-nar as a traditional cultural property eligible for inclusion in the National Register of Historic Places. The Yurok Tribe is currently the only federally recognized tribe exempt from the MPA area and take regulations pertaining to Sek-kwo-nar.

The Yurok Constitution mandates the Tribe to protect our natural and cultural resources, well beyond the scope of protection provided by the Marine Life Protection Act ("MLPA"). Yurok Tribal members shall maintain access to all locations within Yurok ancestral territory for cultural, religious and ceremonial purposes, including Sek-kwo-nar. The Yurok Tribe has demonstrated unparalleled capacity to monitor gathering and harvesting areas within Yurok ancestral territory.

The Yurok Tribe has had the opportunity to review the August 13, 2012 letter from the Resighini Rancheria requesting exemption to the take regulations at Sek-kwo-nar (Reading Rock) SMCA. We reject some of Resighini Rancheria's assertions of fact and law supporting their claim for exemption. Similarly, the Yurok Tribe has had the opportunity to review the August 14, 2013, August 9, 2013, and April 10, 2012 letters from the Cher-Ae Heights Indian Community of the Trinidad Rancheria requesting exemption to the take regulations at Sek-kwo-nar (Reading Rock) SMCA. The Yurok Tribe rejects some of Trinidad Rancheria's assertions of facts and law supporting their claim for exemption. It is the understanding of the Yurok Tribe that the Commission is contemplating a review of additional information from the Resighini Rancheria and Cher-Ae Heights Indian Community of the Trinidad Rancheria in support of their claims. To the extent that the Commission considers their requests, the Yurok Tribe asks that our Tribal Council, staff, and elders be invited to present an alternative perspective on the validity of their claims to the Sek-kwo-nar. The Yurok Tribe further requests that no action on Resighini Rancheria and Cher-Ae Heights Indian Community of the Trinidad Rancheria's requests for exemption be taken until formal consultation takes place between the Commission and the Yurok Tribe on this issue.

We appreciate your careful review of this letter. Should you have any questions, please contact Javier Kinney, Director of Self-Governance at jkinney@yuroktribe.nsn.us or 707-482-1350 ext. 1369.

Sincerely,

Thomas P. O'Rourke, Sr.
Chairman

Cc: Valerie Termini, Executive Director California Fish and Game Commission

SETTLEMENT AGREEMENT

This Settlement Agreement ("Agreement") is made between the Department of Fish and Wildlife ("DFW") and Steven Kramer (individually, a "Party," and collectively, "Parties").

I. Recitals

The Parties execute this Agreement with reference to and in contemplation of the following facts:

a. Mr. Kramer possessed a Pacific Herring Gillnet Permit (Permit), Permit Number (H-003-E).

b. DFW license records indicate that the Permit was last valid during the 2013-14 permit year, making it eligible for renewal in 2014-2015, but not 2015-2016.

c. On October 5, 2015, Mr. Kramer submitted to DFW a request to renew the Permit. ("Renewal Request;" Exhibit A.) In the Renewal Request, Mr. Kramer explained he did not submit the Renewal Request by the March 31, 2015 deadline because he does not recall if he received a renewal notice and this oversight prevented him for receiving a worksheet for the 2015-16 permit year. The Department's license records show that the renewal worksheet for the 2014-2015 permit year was mailed to Mr. Kramer's current address.

d. On December 9, 2015, DFW denied the Renewal Request pursuant to Fish and Game Code Section 7852.2 (Section 7852.2), subdivision (c). (Exhibit B.) Section 7852.2, subdivision (c) states "The department shall deny any application for renewal received after March 31 of the permit year following the year in which the applicant last held a valid permit for that fishery." For DFW to grant the Renewal Request, Mr. Kramer would have had to submit the Renewal Request along with applicable fees by March 31, 2015.

e. Section 7852.2, subdivision (d), states "An applicant who is denied renewal of a late application may submit a written appeal for renewal to the commission within 60 days of the date of the department's denial. The commission, upon consideration of the appeal, may grant renewal. If the commission grants renewal, it shall assess the applicable late fee pursuant to subdivision (a)." On December 22, 2015, Mr. Kramer submitted to the California Fish and Game Commission ("Commission") a request for an appeal of DFW's denial of his Renewal Request. (Exhibit C.)

f. Section 7852.2, subdivisions (a) and (b) state:
   (a) In addition to the base fee for the license, stamp, permit, or other entitlement, the department shall assess a late fee for any renewal the application for which is received after the deadline, according to the following schedule:
      (1) One to 30 days after the deadline, a fee of one hundred twenty-five dollars ($125).
      (2) Thirty-one to 60 days after the deadline, a fee of two hundred fifty dollars ($250).

(3) Sixty-one days or more after the deadline, a fee of five hundred dollars ($500).

(b) The department shall not waive the applicable late fee. The late fees specified in this section are applicable beginning in the 2008 license year, and shall be adjusted annually thereafter pursuant to Section 713."

g. Pursuant to Section 7852.2, subdivisions (a) and (b), Mr. Kramer would owe $1,478.50 in fees if the Commission reinstates the PERMIT. (Exhibit D.)

h. The Parties understand that this Agreement is solely between DFW and Mr. Kramer and that the Commission is neither a signatory to it nor bound by it in any way. Furthermore, the Parties understand that pursuant to Section 7852.2, subdivision (d), the Commission, and not DFW, has the sole discretion to approve or deny the Renewal Request.

i. For the purpose of saving time and costs associated with an appeal hearing, the Parties agree to compromise and settle these issues. In light of recent discussions between DFW and Mr. Kramer, the Parties have come to an agreement on terms upon which they can resolve this matter.

II. Terms

The Parties hereby agree to the following:

a. DFW agrees to not oppose the Renewal Request.

b. If the Commission reinstates the PERMIT, Mr. Kramer agrees to fully pay all fees owed pursuant Section 7852.2, subdivisions (a) and (b), within 60 days of the Commission's decision. DFW shall not issue the PERMIT until all fees are paid.

c. The Parties agree that this Agreement, all documents attached to this Agreement, and documents previously submitted to the Commission related to the Renewal Request constitute Mr. Kramer's written appeal pursuant to Section 7852.2, subdivision (d), provided that the Commission considers the Renewal Request at an upcoming Commission meeting. Each Party may, at its discretion, address the Commission at a Commission meeting regarding the Renewal Request, so long as the address is consistent with the terms of this Agreement. In addition, DFW or Mr. Kramer may submit a memorandum or other documents to the Commission requesting that it take action on the Renewal Request, so long as these documents are consistent with the terms of this Agreement.

d. This Agreement is intended to be a full and complete settlement of all disputes between the Parties pertaining to the Renewal Request. Provided that the Commission considers the Renewal Request at an upcoming Commission meeting, Mr. Kramer agrees to waive any present and future administrative appeal related to this renewal of the PERMIT, the December 9, 2015 denial of the Renewal Request, and all future claims and/or causes of action against DFW related to renewing the PERMIT.

e. This Agreement may be pleaded as a full and complete defense and may be used as the basis for an injunction against any action, suit or proceeding which may be prosecuted, instituted or attempted by any Party in breach thereof.

f. This Agreement is only applicable to Mr. Kramer's Renewal Request. This Agreement does not relate in any way to Mr. Kramer's general Commercial Fishing License or any other DFW-issued entitlement held by Mr. Kramer.

g. Each party shall bear its own costs and attorneys' fees, and any other expenses, related to the Renewal Request subject to resolution by this Agreement.

h. The obligations of this Agreement apply to and are binding on DFW or any successor agency or department and Mr. Kramer and his respective heirs, executors, administrators, and permitted assigns.

i. The Parties represent and warrant to each other that the execution of this Agreement and the performance of such Party's obligations hereunder have been duly authorized and that the Agreement is a valid and legal agreement binding on each Party and is enforceable in accordance with its terms.

j. If any provision of this Agreement is found to be illegal or unenforceable, then any such provision shall be deemed stricken and the remaining provisions hereof shall remain in full force and effect.

k. This Agreement constitutes the entire understanding between the Parties as to the Renewal Request and can only be amended or modified in writing, signed by duly authorized representatives of the Parties. This Agreement supersedes all prior representations and agreements, if any, between the Parties regarding the Renewal Request.

l. This Agreement, when signed by all of the signatories, shall become effective as of the last signature date.

m. This Agreement may be signed in counterparts, which together shall constitute one and the same Agreement. A facsimile or scanned signature shall be the same an original.

IN WITNESS THEREOF, the Parties have executed this Agreement as of the date of the last signature below:

By: _____
Gabriel Tiffany
Deputy Director, Administration Division
Department of Fish and Wildlife

_____
Steven Kramer

Date: 7/26/16

July 21, 2016

Department Exhibit A

Attachment #1

Steven H. Kramer

[redacted]

October 5, 2015

Ms. Debbie Noriega

CDFW, License and Revenue Branch

1740 N. Market Blvd.

Sacramento, CA 95834

Subject: Restoration of Humboldt Bay Herring Permit (H-003-E)

Dear Ms. Noriega,

I spoke with you on the phone today, regarding my Humboldt Bay Herring Permit (H-003-E). I am writing this letter to try and recover the permit. Apparently it was not renewed for the 2014/15 season and it is now late for the 2015/16 season.

If you will please recall, in 2014 the Fish and Game Commission (Commission) was considering closing the Humboldt Bay Herring Fishery due to little or no landings. I wrote a June 7, 2014 letter (attached) to the Commission that supported maintaining the status quo, since no fishing was occurring for herring in Humboldt Bay anyway. Later in 2014, the Commission eventually decided to maintain the status quo and kept the fishery open.

The best that I can recollect, is that I either did not receive a 2014/15 Permit Renewal Notice and work sheet, or I held off renewing it until the Commission decided, and then forgot to renew. Since I did comment on maintaining the fishery open, I demonstrated that my intent was to maintain my Herring Permit and not give it up. And since I did not fish that year, I did not realize I did not have a 2014/15 Permit.

This year, I did not recall receiving the June 2015 Permit Notice and worksheet from CDFW. I realized that the overdue day was Oct 2nd, so I called Mr. Lee Thao, (today) at CDFW to make sure I had paid, and was on the list to receive the permit in November. Mr. Thao informed me that I did not pay for 2014/15, so I did not get the 2015 Notice. He suggested I contact you to try and recover the permit.

I have paid for my Herring permit, on time, for more than a dozen years. In addition, I have paid on time, for my commercial fishing license and commercial boat license, for more than 15 years including 2014, and 2015. It was an oversight on my part, that I forgot to pay for the 2014 Herring permit, and because of that I did not receive the 2015 Herring permit Notice and worksheet.

I am asking to have my Humboldt Herring (H-003-E) permit restored to me. Please advise me on how best to proceed.

Thank you for your assistance.

Sincerely,

Steven H. Kramer

Attachment #2

June 7, 2014

Steven H. Kramer

[redacted]

California Fish and Game Commission

1416 Ninth Street

Sacramento, CA 95814

RE: REQUEST FOR AUTHORIZATION TO PUBLISH NOTICE OF COMMISSION INTENT TO AMEND COMMERCIAL HERRING REGULATIONS (SECTIONS 163 AND 164, TITLE 14, CCR)

Dear Commissioners,

I wish to comment on the proposal to lower the Pacific Herring quotas in Humboldt Bay to zero. Doing so would close the fishery in the near future and possibly for good.

I am a part-time commercial fisherman. When I fish, it is for roe herring in Humboldt Bay under my CA Herring Permit (H3). I have been fishing for herring in the bay since 1998. I have a considerable amount of time and money invested in the fishery (boat, equipment, license fees over the years, etc.) To my knowledge, only one other boat, also fishes the bay.

For full time work, I am a fisheries biologist for a federal agency. I possess a Masters degree in fisheries biology from Humboldt State University.

In approximately 2004 I ceased fishing for herring because of several reasons. First, the herring population seemed to crash and there were too few fish around to make it worthwhile. Second, the Eureka cold storage facility closed, which would make it impossible to land, store, sell, and ship tons of frozen herring to buyers in various locations that are out of this area.

To my knowledge, no one has commercially fished for herring in Humboldt Bay for approximately 10 years, which effectively was a self-imposed closure of the fishery by the fisherman. In addition, I am not aware of any spawning/population surveys by CA Fish and Wildlife (CDFW) since approximately 2007. I believe that the last surveys were by Mr. John Mello who managed the herring fisheries for CDFW until his recent retirement.

In conclusion, the Humboldt Bay roe herring the fishery is already closed. CDFW has not done any surveys in years, and therefore has no current information on what the status of the herring population is in Humboldt Bay. It seems that imposing a zero quota is unnecessary, and is in effect, a management solution looking for a problem, where there is no management problem. The fishermen in Humboldt Bay have a self-imposed closure in place. Setting the quota at zero would be the equivalent of not letting a good deed go unpunished.

Rather than close the fishery, I would like to suggest that annual spawning/population surveys should be continued and conducted to gather information on what the actual current status of the Humboldt Bay herring population is. If CDFW is unable to conduct the surveys, then perhaps the Fish and Game Commission, CDFW, or other entity, could issue a request for proposals, for independent surveys by consultants or others.

Thank you for the opportunity to comment on this proposed regulation change.

Sincerely,

Steven H. Kramer

Department Exhibit B

Attachment #3

State of California - The Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
License and Revenue Branch
1740 N. Market Blvd
Sacramento, CA 95834
http://www.wildlife.ca.gov

EDMUND G. BROWN JR, Governor
CHARLTON H. BONHAM, Director

Certified Mail

December 9, 2015

Letter delivered 12/18/15

Mr. Steven H. Kramer
[redacted]

SUBJECT: **NOTICE OF DENIAL FOR RENEWAL OF A PACIFIC HERRING GILL NET PERMIT**

Dear Mr. Kramer:

This letter is in response to your request to reinstate your Pacific Herring Gill Net Permit (PHGNP), Permit Number H003-E (L82700).

Authority-Pacific Herring Gill Net Permit
Section 163(b)(3), Title 14, of the California Code of Regulations (CCR), states applications for renewal of all herring permits shall be received by the Department of Fish and Wildlife (Department), or if mailed, postmarked, on or before the first Friday of October each year.

Authority-Late Fee
Effective April 1, 2008, pursuant to Section 7852.2, of the Fish and Game Code (FGC), a graduated late fee was established for any renewal application that is received after the deadline. Section 7852.2(a), of the FGC, states in addition to the base fee for the license, stamp, permit, or other entitlement, the Department shall assess a late fee for any renewal the application for which is received after the deadline. Section 7852(b), of the FGC, states the Department shall not waive the applicable late fee. The late fees beginning in the 2008 license year shall be adjusted annually thereafter pursuant to Section 713, of the FGC.

Section 7852.2 (c), of the FGC, states the Department shall deny any application for renewal received after March 31 of the permit year following the year in which the applicant last held a valid permit in the fishery.

Reason for Appeal to the Department
In your letter, dated October 5, 2015, you stated you either did not receive a 2014-2015 Commercial Herring Permit Renewal Worksheet or you held off renewing your Herring Permit due to the Fish and Game Commission (Commission) considering closing the Humboldt Bay Herring Fishery due to little or no landings. You also stated that you wrote a letter to the Commission on June 7, 2014, that supported maintaining the status quo. You stated your intent was to maintain your herring permit and not give up on the fishery. You further stated that you have always paid for your commercial permits on time and it was an oversight on your part.

Documentation Submitted
Copy of letter submitted to the Commission dated, June 7, 2014, concerning the Pacific Herring quotas in Humboldt Bay.

Department Findings
Department license records show that you last held a valid 2013-2014 PRHGNP, which made you eligible to renew your permit for the 2014-2015 permit year.

Permits Held by Applicant
Resident Commercial Fishing License

Department Determination
Based on previously stated information, your request for renewal of your PRHGNP is denied, because you last held a valid PRHGNP in 2013-2014. As previously stated, FGC Section 7852.2(c), requires the Department to deny any application for renewal received after March 31 of the permit year following the year in which the applicant last held a valid permit for the fishery.

Deadline to File an Appeal to the Fish and Game Commission
If you wish to appeal the Department decision, you must submit a written appeal to the Commission at 1416 Ninth Street, Sacramento, California 95814. Pursuant to FGC Section 7852.2(d), your appeal must be received within 60 days of the date of this letter.

The Commission, upon consideration of the appeal, may grant renewal. If the Commission grants renewal, it shall assess the applicable license, permit and late fees of $1,478.50 which would be due after receipt of the Commission's approval letter. A fee schedule is enclosed.

If you have any questions or require further assistance, please contact Ms. Debbie Noriega, of my staff, at the letterhead address, by telephone at (916) 928-58174, or e-mail Debbie.Noriega@wildlife.ca.gov.

Sincerely,

James Fong, Chief
License and Revenue Branch

Enclosure

cc: Mr. Sonke Mastrup
Fish and Game Commission
Sacramento, California

Ms. Debbie Noriega
Department of Fish and Wildlife
Sacramento, California

State of California - The Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
License and Revenue Branch
1740 N. Market Blvd
Sacramento, CA 95834
http://www.wildlife.ca.gov

EDMUND G. BROWN JR, Governor
CHARLTON H. BONHAM, Director

December 9, 2015

Mr. Steven H. Kramer (L82700)
Fees Required for Reinstatement for a
Pacific Herring Gill Net Permit (PHGNP)

Year		**Permit Fees**
2014-2015	PHGNP	$372.50
	Late Fee (61 days to March 31, 2015)	$581.25
		$953.75
Prior Year Fees Due		**$953.75**

Prior Year permit fees must be paid before 2015-2016 PRHGNP can be issued.

2015-2016	PHGNP	$377.25
	Late Fee (one to 30 days)	$147.50
		$524.75
Total Current Fees		**$524.75**
Total Fees Due		**$1,478.50**

If the Fish and Game Commission (Commission) should recommend approval, payment of $1,478.50 would be due within 30 days after receipt of the Commission's approval letter.

Department Exhibit C

RECEIVED
CALIFORNIA
FISH AND GAME
COMMISSION

2015 DEC 28 PM 2:32

MLS

December 22, 2015

Steven H. Kramer

[redacted]

California Fish and Game Commission

Attn: Mr. Sonke Mastrup

1416 Ninth Street

Sacramento, CA 95814

Subject: Renewal of Humboldt Bay Herring Gillnet Permit (H-003-E). Appeal of the CDFW Decision of Denial for Renewal

Dear Commissioners:

I am requesting reinstatement of my Pacific Herring Gillnet Permit (PHGNP), Permit Number (H-003-E) (L82700). I previously wrote to Ms. Debbie Noriega, at the California Department of Fish and Wildlife (CDFW), License and Revenue Branch on October 5, 2015 (see attachment #1.). In that letter I explained that I had inadvertently overlooked renewing the permit for the 2014/15 season. This year, I did not recall receiving the June 2015 Permit Notice and worksheet from CDFW. I realized that the overdue day was Oct 2nd, so I called Mr. Lee Thao (Oct. 5, 2015) at CDFW to make sure I had paid, and that I was on the list to receive the permit in November. Mr. Thao informed me that I did not pay for 2014/15, so I did not get the 2015 Notice. He suggested I contact Ms. Noriega and I did so by phone and through my Oct 5, 2015 letter.

If you will please recall, in 2014 the Fish and Game Commission (Commission) was considering closing the Humboldt Bay Herring Fishery due to little or no landings. I wrote a June 7, 2014 letter (attachment #2) to the Commission that supported maintaining the status quo, since no fishing was occurring for herring in Humboldt Bay anyway. Later in 2014, the Commission eventually decided to maintain the status quo and kept the fishery open. I was holding off renewing my permit until the Commission made a decision. Apparently, I just forgot to renew my permit later in 2014.

On December 18, 2015 I received a certified letter (attachment #3) dated December 9, 2015 from Mr. James Fong, Chief, License and Revenue Branch, CDFW in reply to my October 5, 2015 letter. In that letter, my request for renewal of my Pacific Herring Gillnet Permit was denied. Mr. Fong's letter outlines the nature of my request to have my herring permit reinstated. His letter also recommended that if I wanted to appeal the Department decision, I must submit a written appeal to the Commission at 1416 Ninth Street, Sacramento, CA 95814. Pursuant to

FGC Section 7852.2(d), my appeal must be received within 60 days of the date of Mr. Fong's letter, dated December 9, 2015.

This letter serves as my written appeal.

Mr. Fong's letter also stated that The Commission, upon consideration of the appeal, may grant renewal. If the Commission grants renewal, it shall assess the applicable license, permit, and late fees of $1,478.50 which would be due within 30 days after receipt of the Commission's approval letter.

I am willing to pay that fee.

Over the years, I have made a considerable investment, in time and money, in order to remain eligible to participate in the Humboldt Bay Herring Gillnet fishery. I have paid for my Herring permit, on time, for more than a dozen years. In addition, I have paid on time, for my commercial fishing license, and commercial boat license, for over 15 years, including for the 2014, and 2015 seasons, even though I did not fish for herring. It was an oversight on my part, that I forgot to pay for the 2014 Herring permit, and because of that, I did not receive the 2015 Herring permit Notice and worksheet. My June 7, 2014 letter to the Commission, encouraging them to keep the fishery open, indicates that my intent has always been to renew my Herring permit.

Please accept this letter as my written appeal. Thank you for your time and consideration.

Respectfully yours

Steven H. Kramer

Cc:

Mr James Fong, CDFW, Sacramento

Ms. Debbie Noriega, CDFW, Sacramento

Department Exhibit D

State of California - The Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
License and Revenue Branch
1740 N. Market Blvd
Sacramento, CA 95834
http://www.wildlife.ca.gov

EDMUND G. BROWN JR, Governor
CHARLTON H. BONHAM, Director

December 9, 2015

Mr. Steven H. Kramer (L82700)
Fees Required for Reinstatement for a
Pacific Resident Herring Gill Net Permit (PHGNP)

Year		**Permit Fees**
2014-2015	PHGNP	$372.50
	Late Fee (61 days to March 31, 2015)	$581.25
		$953.75
Prior Year Fees Due		**$953.75**

Prior Year permit fees must be paid before 2015-2016 PRHGNP can be issued.

2015-2016	PHGNP	$377.25
	Late Fee (one to 30 days)	$147.50
		$524.75
Total Current Fees		**$524.75**
Total Fees Due		**$1,478.50**

If the Fish and Game Commission (Commission) should recommend approval, payment of $1,478.50 would be due within 30 days after receipt of the Commission's approval letter.

BEFORE THE FISH AND GAME COMMISSION
STATE OF CALIFORNIA

In the Matter of:	)	Case No. 15ALJ09-FGC
	)	
Steven Kramer,	)	
	)	
Appellant.	)	
	)	
	)	
	)	
	)	
_____	)	

DECISION

Consistent with the terms of the attached Settlement Agreement between Seven H. Kramer ("Appellant") and the Department of Fish and Wildlife ("Department"), fully executed July 26, 2016, and the authority provided in Fish and Game Code Section 7852.2, subdivision (d), and Government Code section 11415.60, the Fish and Game Commission hereby orders that:

1. The Commission hereby grants renewal of the Pacific Herring Gillnet Permit (Permit), Permit Number (Fl-003-E) previously issued to Appellant by the Department.
2. The Appellant must pay the Department all license, permit, and late fees owed pursuant to Section 7852.2, subdivisions (a) and (b), within 60 days of this Decision, which total $1,478.50.
3. The Department shall renew the permit if the fees are paid consistent with this Decision.

IT IS SO ORDERED this_____ day of August 2016.

_____
Eric Sklar, President

BEFORE THE
FISH AND GAME COMMISSION
STATE OF CALIFORNIA

In the Matter of: EXOTIC FELINE BREEDING COMPOUND, INC., Appellant,	Case No. 15ALJ03-FGC OAH No. 2015061034

PROPOSED DECISION

This written review appeal is before Administrative Law Judge (ALJ) Timothy J. Aspinwall, Office of Administrative Hearings (OAH), State of California.

Scott M. Pearson represents appellant Exotic Feline Breeding Compound, Inc., (appellant).

David Kiene, Staff Counsel, represents the Department of Fish and Wildlife (Department).

The parties submitted initial and supplemental written arguments pursuant to briefing schedules. The parties delivered oral arguments on May 24, 2016, whereupon the matter was submitted for decision.

ISSUE PRESENTED

1. Should appellant be granted an exemption from permitting requirements pursuant to Fish and Game Code section 2150, subdivision (c)?

ADMINISTRATIVE RECORD ON REVIEW

The record on review consists of the following:

Exhibit 1: Order Setting Briefing Schedule, signed July 13, 2015.

Exhibit 2:	Written Statement of Appellant In Support of Its Appeal of The Department of Fish and Wildlife's Denial of Waiver Application, signed July 13, 2015.
Exhibit 3:	Declaration of Joseph Maynard In Support of Appellant, signed July 10, 2015, with attached exhibits 1 through 14.
Exhibit 4:	Appendix of the Record In Support of Written Statement of Appellant, Volume 1 of 3, pages 1 through 434.
Exhibit 5:	Appendix of the Record In Support of Written Statement of Appellant, Volume 2 of 3, pages 435 through 829.
Exhibit 6:	Appendix of the Record In Support of Written Statement of Appellant, Volume 3 of 3, pages 830 through 1338.
Exhibit 7:	Supplemental Appendix of the Record In Support of Written Statement of Appellant, Volume 4, pages 1339 through 1344.
Exhibit 8:	Department's Response to Appellant's Written Statement, signed August 12, 2015, with attachments 1 and 2.
Exhibit 9:	Appellant's Reply Brief In Support of Its Appeal of The Department of Fish and Wildlife's Denial of Waiver Application, signed September 4, 2015.
Exhibit 10:	Supplemental Declaration of Joseph Maynard In Support of Appellant, signed September 4, 2015.
Exhibit 11:	Order Setting Briefing Schedule, signed October 28, 2015.
Exhibit 12:	Stipulation to extend briefing deadlines, dated December 11, 2015.
Exhibit 13:	Appellant's Supplemental Brief In Support of Its Appeal of The Department of Fish and Wildlife's Denial of Waiver Application, signed December 21, 2015.
Exhibit 14:	Department's Brief In Response to Issues Raised In October 28, 2015 Order, signed December 21, 2015, with attached exhibit A, Declaration of William Caputo, signed December 18, 2015.
Exhibit 15:	Stipulation to extend briefing deadlines, dated January 22, 2016.
Exhibit 16:	Department's Response to Appellant's December 21, 2015 Brief, signed February 9, 2016.

Exhibit 17: Appellant's Supplemental Brief In Support of Its Appeal of The Department of Fish and Wildlife's Denial of Waiver Application, signed February 9, 2016.

Exhibit 18: Order Setting Oral Argument, signed April 6, 2016.

FACTUAL FINDINGS

Background and Procedural History

1. Appellant houses, breeds, and displays wild felines for public viewing. Until October 19, 2011, appellant held two permits issued by the Department – a breeding permit which allowed appellant to breed animals, and a resident exhibiting permit which allowed appellant to exhibit animals at least half-time for commercial and/or educational purposes. The permits expired and have not been renewed.

2. On October 24, 2011, the Department received appellant's initial application for a waiver of all permitting requirements associated with its breeding and exhibiting permits previously issued by the Department.

Fish and Game Code[1] section 2150, subdivision (c), allows organizations such as appellant to apply for a waiver of permit requirements, providing as follows:

> A **zoo is exempt** from any permit requirement pursuant to this chapter . . . . For purposes of this section, **"zoo" means any organization which is accredited as meeting the standards and requirements of the American Zoo and Aquarium Association (AZA).** Any California organization which is not accredited by the AZA may apply to the [D]epartment for a waiver of specified permit requirements of this chapter. The [D]epartment may grant or deny the request for a waiver for **justified reasons**. . . . Any organization may appeal the determination of the [D]epartment to the [C]ommission. (Emphasis added.)

Appellant is not accredited by the American Zoo and Aquarium Association (AZA). Appellant is instead accredited by another accrediting organization – the Zoological Association of America (ZAA).

3. On April 24, 2012, the Department denied appellant's initial application for waiver based on the Department's position at that time that there were no standards in law to

[1] Subsequent statutory references are to the Fish and Game Code, unless otherwise specified.

guide the Department in determining whether "justified reasons" exist. Appellant timely filed an appeal.

4. On January 30, 2013, the Department sent a letter notifying appellant to complete the permit renewal process, or the Department would seek law enforcement action. On July 24, 2013, appellant met with representatives of the Department and the Fish and Game Commission (Commission) in an unsuccessful attempt to reach a resolution. On September 17, 2013, the Department again sent a letter notifying appellant to complete the permit renewal process no later than October 4, 2013, or face possible law enforcement action.

5. On October 7, 2013, appellant filed two legal actions in Kern County Superior Court – a Complaint for Declaratory and Injunctive Relief challenging the constitutionality of section 2150, subdivision (c), and a Verified Petition for Writ of Mandate seeking an order compelling the Department to consider appellant's waiver application.

6. On March 10, 2014, the Kern County Superior Court issued a Peremptory Writ of Mandate ordering the Department to: (1) vacate the Department's previous denial of appellants waiver application, (2) reconsider appellant's waiver application and determine whether appellant meets the waiver criteria set forth in section 2150, subdivision (c), and (3) refrain from taking any action against appellant until the Department's decision to grant or deny appellant's waiver application becomes final. Appellant dismissed without prejudice its complaint for declaratory relief challenging the constitutionality of section 2150, subdivision (c).

7. On April 21, 2014, appellant re-submitted an application for waiver of permit requirements. On May 14, 2014, Department counsel sent appellant a letter stating that the Department was then in the process of reconsidering whether appellant met the waiver criteria set forth in section 2150, subdivision (c). The letter also informed appellant that it must meet, at minimum, the same standards required for AZA accreditation. The Department offered appellant an opportunity to supplement its application for waiver to demonstrate that it meets the AZA accreditation criteria.

8. During the subsequent months, appellant submitted additional materials on July 18, August 8, and October 3, 2014. On November 20, 2014, the Department sent a response to appellant, allowing appellant to submit additional materials by December 22, 2014. On December 22, 2014, appellant sent the Department a letter requesting that it make a final decision based on the materials previously submitted.

9. On April 14, 2015, the Department sent a letter to appellant denying its request for a waiver of permit requirements. The Department asserted that appellant did not meet 25 of the standards in the AZA accreditation criteria. On May 14, 2015, appellant sent a letter to the Commission requesting an appeal of the Department's denial of its waiver request.

Appellant's Contentions

Underground Regulation

10. Appellant contends that the Department impermissibly utilized the AZA accreditation criteria referenced in section 2150, subdivision (c), in determining whether there were justified reasons to grant or deny appellant's waiver application. Specifically, appellant contends that the AZA accreditation standards as utilized by the Department constitute an impermissible "underground regulation."

Government Code section 11340.5, subdivision (a), states:

> No state agency shall issue, utilize, enforce, or attempt to enforce any guideline, criterion, bulletin, manual, instruction, order, **standard of general application**, or other rule, which is a regulation as defined in Section 11342.600, unless the guideline, criterion, bulletin, manual, instruction, order, standard of general application, or other rule has been adopted as a regulation and filed with the Secretary of State pursuant to this chapter. (Emphasis added.)

Government Code section 11342.600 defines a "regulation" states:

> Regulation" means every rule, regulation, order, or **standard of general application** or the amendment, supplement, or revision of any rule, regulation, order, or standard adopted by any state agency **to implement, interpret, or make specific the law** enforced or administered by it, or to govern its procedure. (Emphasis added.)

11. The AZA accreditation standards have not been adopted pursuant to the Administrative Procedure Act (APA) rulemaking process. Rather, they are referenced in section 2150, subdivision (c), to allow entities accredited by the AZA to seek exemption from permit requirements. As to entities not accredited by the AZA, such as appellant, the AZA accreditation criteria have not been formally adopted for determining whether "justified reasons" exist to grant an exemption from permit requirements.

12. There are two identifying characteristics of a regulation subject to the regulatory rulemaking requirements under the Administrative Procedure Act. "First, the agency must intend its rule to apply generally, rather than in a specific case. . . . Second, the rule must 'implement, interpret, or make specific the law enforced or administered by [the agency], or ... govern [the agency's] procedure.'" (*Tidewater Marine W., Inc. v. Bradshaw* (1996) 14 Cal.4th 557, 571, (quoting Gov. Code, § 11342, subd. (g).)

13. The evidence is clear that the Department utilized the AZA criteria to implement, interpret, and make specific section 2150, subdivision (c), in determining whether "justified reasons" existed to grant appellant's application for permit waivers. The evidence is not clear, however, whether the Department used the AZA accreditation criteria as a "standard of general application" subject to the rulemaking requirements under the Government Code.

14. The fact that the Department utilized the AZA accreditation criteria to determine whether there were "justified reasons" to grant appellant's application for waiver does not in itself demonstrate that the Department intended that the AZA accreditation criteria be used as a standard of general application. The Department's counsel at the hearing on the petition for writ of mandate understood that it would violate the prohibition against underground regulations to use the AZA accreditation criteria as a standard of general application. The Department's counsel stated to the judge that "... in order to consider what justified reasons are for the [D]epartment to consider these waiver requests it would have to develop standards that would apply to every waiver request, which would be the underground regulation." (Administrative Record (AR), Exhibit 5, page 734, lines 11-15.)

15. The Superior Court judge on petition for writ of mandate responded during hearing to the concerns articulated by the Department's counsel, as follows:

> I don't think that the[C]ommission is wholly without guidance here. I mean, you have a specific exception for a specific group, the AZA. . . . And so I'm not saying that it [the exemption criteria] would have to be identical [to the AZA exemption criteria]. I'm not even saying it would have to be substantially similar.
>
> There is some guidance. Justified reasons and the fact that there is a specific exception, those two things together in my mind help give us some guidance.

(AR, Exhibit 5, page 738, lines 7-20.)

16. Following the Superior Court judge's order mandating that the Department take action on appellant's waiver application, the Department sent a letter to appellant stating that to qualify for an exemption, appellant would be required at a minimum to meet the AZA exemption criteria. The evidence is not clear whether the Department intended this as a standard of general application, or whether this standard was individually tailored to the situation with appellant.

Arbitrary Standard

17. Appellant contends that the AZA criteria as applied by the Department is either an underground regulation, or it is arbitrary if not applied equally to all waiver applicants. The record establishes that appellant's waiver application is the only instance in which the Department has applied the AZA accreditation criteria to determine whether an entity not accredited by the AZA qualifies for a waiver pursuant to section 2150, subdivision (c). The record also establishes that the Department has both granted and denied previous waiver requests by other parties. Specifically, the Department granted waiver requests to Orange County Zoo in 1993, and Micke Grove Zoo in 1992, neither of which is accredited by the AZA. The Department denied waiver requests to Moon Ridge Animal Park in 2007, California Living Museum in 2011, and Animal Educators in 2012. (AR, Exhibit 5, page 493.) The record does not establish what reasons were given, if any, to grant or deny the waiver applications. Nor does the record establish that the various applicants were similarly situated beyond the fact that they had all submitted waiver applications, and that the two entities granted waivers in 1992 and 1993 were not AZA accredited.

18. Appellant cites three cases as authority that an agency action is arbitrary when the agency offers insufficient reasons for treating similar situations differently. (*Mercy Catholic Med. Ctr. v. Thompson* (3d Cir. 2014) 380 F.3d 142, 158; *Yetman v. Garvey* (7th Cir. 2001) 261 F.3d 664, 669; *Transactive Corp.* v. United States (D.C. Cir. 1996) 232, 237.) The record in the current case, however, does not establish what standard the Department used to grant or deny waiver applications submitted by other parties. This absence of a clear factual record contrasts with the authorities cited by appellant. For example, in *Yetman v. Garvey*, a group of commercial pilots challenged the Federal Aviation Administration (FAA) rule prohibiting persons over the age of 60 from serving as commercial pilots. Though the court affirmed the FAA's rule, it was significant in court's analysis that the pilots challenging the rule were able to show that the FAA had not uniformly applied the age 60 rule. Specifically, the FAA allowed pilots over the age of 60 to fly for foreign airlines operating in United States airspace, and for commuter airlines. (*Yetman*, *supra*, 261 F.3d at pages 669-670.)

This factual record in this matter is insufficiently analogous to the authorities cited by appellant to establish that the Department gave disparate treatment to similarly situated parties, or that it acted arbitrarily when it used the AZA accreditation criteria to evaluate appellant's waiver application.

The Legislature's Intent

19. Appellant contends that the Department's use of the AZA accreditation criteria to evaluate appellant's waiver application contradicts the Legislature's intent, and renders meaningless the provision in section 2150, subdivision (c), permitting the Department to grant or deny a waiver request for "justified reasons."

Section 2116.5 articulates the Legislature's intent, as follows:

> The Legislature finds and declares that wild animals are being captured for importation and resale in California; that some populations of wild animals are being depleted; that many animals die in captivity or transit; that some keepers of wild animals lack sufficient knowledge or facilities for the proper care of wild animals; that some wild animals are a threat to the native wildlife or agricultural interests of this state; and that some wild animals are a threat to public health and safety. It is the intention of the Legislature that the importation, transportation, and possession of wild animals shall be regulated to protect the health and welfare of wild animals captured, imported, transported, or possessed, to reduce the depletion of wildlife populations, to protect the native wildlife and agricultural interests of this state against damage from the existence at large of certain wild animals, and to protect the public health and safety in this state.

20. The Legislature's intent is essentially to protect the public health and safety, and the welfare of wild animals. The Department must implement section 2150, subdivision (c), consistent with the Legislature's intent. Entities accredited by the AZA are exempt from permit requirements, as provided by section 2150, subdivision (c). It is not inconsistent with the Legislature's intent to require entities not accredited by the AZA to meet substantially the same criteria that are required for AZA accreditation. In that way, similarly situated entities are treated similarly, and the Legislature's intent to protect the public safety and wild animal welfare is effectuated. This is a "justified reason" consistent with section 2150, subdivision (c).

Constitutional Claims

21. Appellant contends that the AZA accreditation standard results in an unconstitutional delegation of police power to a private party (the AZA), and that implementation of the AZA standard ensures that section 2150, subdivision (c), violates the Equal Protection Clauses of the United States and California Constitutions. Neither the Commission nor the Department has authority to rule on these constitutional claims. California Constitution, Article III, Section 3.5, states in part as follows:

> An administrative agency, including an administrative agency created by the Constitution or an initiative statute, has no power:
>
> (a) To declare a statute unenforceable, or refuse to enforce the statute, on the basis of it being unconstitutional unless an appellate court has made a determination that such statute is unconstitutional;
>
> (b) To declare a statute unconstitutional; . . . .

Based on the California Constitution, appellant's constitutional arguments are not considered in this Decision.

Bona Fide Zoo

22. Appellant contends that it is a bona fide zoo which is regulated by the United States Fish & Wildlife Service and the United States Department of Agriculture (USDA), and that state supervision of its operations is not needed to protect animal welfare or public safety. Appellant argues "justified reasons" exist to grant its waiver application because: (1) the Department recognized appellant as a "bona fide zoo" under a prior version of section 2150, subdivision (c); (2) appellant is accredited by the ZAA; (3) three professional zookeepers confirm that ZAA-accredited facilities are professionally managed zoos that can be trusted to protect animal welfare and public safety (AR Exhibit 4, pp. 300-305.); (4) five states have found the ZAA accreditation to be equivalent to AZA accreditation for permitting purposes; (5) appellant has been operating for 38 years without a single escape or injury; (6) appellant is licensed by the United States Fish and Wildlife Service and the USDA; and (7) appellant is a recognized expert in its field.

23. To support its claim that the Department previously recognized it as a zoo, appellant cites to a letter from the Department dated December 19, 1984, stating that the Department recognized appellant as a bona fide zoo. This recognition was pursuant to an earlier version of section 2150, subdivision (c), which last existed in 1985. The fact that the Department recognized appellant as a bona fide zoo under an earlier version of section 2150, subdivision (c), does not define whether appellant is a zoo under current law. Similarly, ZAA and AZA accreditation requirements are not identical and do not provide all the same safeguards. The fact that five other states have accepted ZAA accreditation for permitting purposes reflects the priorities of those states, which do not necessarily reflect the California legislature's intent. The fact that appellant is regulated by federal agencies does not make it unnecessary or undesirable for the Department to exercise its responsibilities to protect the public safety and animal welfare. Finally, assuming that appellant runs a safe and reputable facility, it does not necessarily follow that appellant should be exempt from specific requirements that the Department deems appropriate to protect the public safety and animal welfare.

Independent Basis for Waiver

24. Appellant contends that its participation in AZA sponsored Species Survival Plans (SSP) provides an independent basis to grant appellant's waiver application, because SSP participants not accredited by the AZA are expected to abide by AZA accreditation standards.

25. SSP participants not accredited by the AZA are not, by virtue of their participation in the SSP, considered accredited or certified by the SSP. They are referred to as approved non-member participants. (AR, Exhibit 6, p. 847.) Notwithstanding its participation in AZA SSPs as an approved non-member participant, appellant does not meet

a number of substantive AZA accreditation standards. Examples provided by the Department are discussed below, under Substantial Compliance.

Substantial Compliance

26. Appellant contends that it has substantially complied with the AZA accreditation standards sufficiently to serve the legislature's intent to protect animal welfare and public safety. Appellant did not meet 25 of the AZA accreditation standards. The Department discussed these accreditation criteria in a letter dated April 14, 2015, to appellant's counsel (AR, Exhibit 6, pp. 1318-1330), quoted in part as follows:

> 1.3.1. The institution must have an Institutional Collection Plan (ICP).
>
> Explanation: The purpose of an ICP is to thoroughly assess, on a regular basis, the reason for having each taxon in the collection. The ICP should include a statement of justification for all species and individuals in the institution's planned collection. . . .
>
> Department Finding: [Appellant] has not submitted materials demonstrating it complies with this AZA standard. Although the department recognizes [appellant] maintains a single taxon (Felidae), and ICP is nevertheless required for that single taxon. . . .
>
> [¶] . . . [¶]
>
> 1.4.3. Animals must be identifiable, whenever practical, and have corresponding ID numbers. . . .
>
> Department Finding: [Appellant] has not submitted materials demonstrating that it complies with this AZA standard. . . . All animals of the family Felidae held by [appellant] must either be micro-chipped, tattooed or have Department approval for an alternative method of identification prior to a permit being issued, or this waiver request approved. Based on [appellant's] documentation, the Department identifies the following animals as either not being micro-chipped, tattooed or having an approved alternative identification method. [List of 24 animals]
>
> [¶] . . . [¶]
>
> 2.1.1. A full-time staff veterinarian is recommended. In cases where such is not practical, a consulting/part-time veterinarian

must be under written contract to make at least twice monthly inspections of the animals and to respond as soon as possible to any emergencies.

Department Finding: [Appellant] has not submitted materials demonstrating it complies with this AZA standard. The Department recognizes [appellant] has completed a United States Department of Agriculture Program of Veterinary Care (PVC) with [a Dr. of veterinary medicine] . . . . The PVC states [the Dr. of veterinary medicine] will make a minimum of three scheduled annual visits. . . .

[¶] . . . [¶]

2.7.2. Written, formal procedures for quarantine must be available and familiar to all staff working with quarantined animals.

Department Finding: [Appellant] has not submitted written procedures that comply with this AZA standard. This written procedure may include but is not limited to: quarantine length, personnel, protocols, and veterinary procedures to be performed. The [appellant] has not submitted sufficient to material or documentation to satisfy this standard.

2.8.1. Pest control management programs must be administered in such a manner that the animals, staff, and public are not threatened by the pests, contamination from pests, or the control methods used.

Department Finding: [Appellant] has not submitted materials demonstrating it complies with this AZA standard.

[¶] . . . [¶]

7.3. There must be an adequate number of trained staff to care for the animals and to conduct the institution's programs.

Explanation: Although there is no set formula for prescribing the size of the staff, the number and type of species within the institution, the general condition of the animals and exhibits, and past staff practices may be used to define what is considered "adequate."

> Department Finding: [Appellant] has not submitted documentation that demonstrates [appellant] maintains an adequate number of trained staff to care for the animals and conduct its programs.
>
> [¶] . . . [¶]
>
> 11.2.5. Live-action emergency drills must be conducted at least once annually for each of the four basic types of emergency (fire; weather/environment appropriate to the region; injury to staff or a visitor; animal escape). Four separate drills are required. These drills must be recorded and evaluated to determine that procedures are being followed, that staff training is effective, and is that what is learned is used to correct and/or improve the emergency procedures. Records of these drills must be maintained in improvements in the procedures documented whenever such are identified.
>
> Explanation: Emergency drills determine if institution staff are aware of emergency procedures, and understand their respective duties and responsibilities. Emergency drills enable the institution to identify potential areas that could cause problems in case of an actual emergency. . . .
>
> Department Finding: [Appellant] has not submitted materials demonstrating it complies with this AZA standard. . . .

27. The AZA accreditation standards discussed above relate directly to the Legislature's intent to protect the public safety, and the health and welfare of animals. Appellant responded substantively to some but not all of the areas of concern expressed in the Department's letter discussed above. For example, with respect to standard 1.3.1, appellant contends that it makes no sense for it to have an ICP because it is focused on a single taxon, felidae, so there is no reason to have such a plan. The Department is not unreasonable in requiring an applicant for a permit waiver (such as appellant) to have an ICP, even though appellant keeps animals of only a single taxon. With respect to standard 2.1.1, appellant asserts that it substantially complies with the veterinary staff requirements by having two part-time veterinarians who are always on-call and a third consulting veterinarian, who on average inspect the animals more than twice-monthly as required by the AZA standard. The Department is not unreasonable in requiring appellant to have a contractual agreement requiring the veterinarians to be on site at least twice a month.

28. With respect to other areas, appellant may have more substantially addressed the Department's concerns. For example, with respect to the animal identification standard 1.4.3, appellant utilizes photographic identification of unique markings in lieu of a tattoo or microchip until the animal must be anesthetized for some other purpose. Appellant asserts

that this avoids unnecessary anesthesia, without compromising their ability to identify the animals. Appellant's assertion is supported by an affidavit from James G. Sanderson, who has studied many different species of wild cats and worked with many zoos, and is familiar with the nature of felid markings. Mr. Sanderson attests: "I can confirm that it is a scientific fact that photographs of wildcats with markings such as spots or stripes can be used to uniquely identify individual animals." (AR, Exhibit 4, p. 364.) This does not establish that appellant has satisfied standard 1.4.3; it does suggest, however, that the Department may evaluate reasonable alternatives the tattooing or microchip requirement.

Discussion

29. Appellant did not establish that its practices would protect animals and the public safety as effectively as the standards required for AZA accreditation. Nor did appellant establish that the standards the Department required are either unnecessary or unreasonable in light of the legislature's intent to protect the public safety and animal welfare. Appellant thus failed to demonstrate "justified reasons" why the Department should be required grant appellant a waiver of permit requirements.

LEGAL CONCLUSIONS

1. Appellant bears the burden of proving by a preponderance of evidence that justified reasons exist to grant a waiver of permit requirements pursuant to section 2150, subdivision (c). Unless otherwise provided by law, the standard of proof is by a preponderance of the evidence. (Evid. Code, § 115.) There is no statute, regulation, or case authority that requires a standard of proof other than a preponderance of evidence in an appeal from a denial of an application for waiver pursuant to section 2150, subdivision (c).

2. The administrative record as a whole has been considered. Taking into account the administrative record, and as set forth in the Factual Findings and Legal Conclusions as a whole, appellant has not met its burden. Appellant's request for an exemption from permitting requirements pursuant to Fish and Game Code section 2150, subdivision (c), should therefore be denied.

ORDER

The appeal of appellant Exotic Feline Breeding Compound, Inc., is DENIED.

DATED: July 22, 2016

DocuSigned by:
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TIMOTHY J. ASPINWALL
Administrative Law Judge
Office of Administrative Hearings

BEFORE THE
FISH AND GAME COMMISSION
STATE OF CALIFORNIA

In the Matter of the Appeal of: EXOTIC FELINE BREEDING COMPOUND, INC., Appellant.	Case No. 15ALJ03-FGC OAH No. 2015061034 **ORDER OF DECISION**

DECISION

The attached Proposed Decision of the Administrative Law Judge is hereby adopted by the Fish & Game Commission (Licensing and Permits) as its Decision in the above-entitled matter.

This Decision shall become effective on _____.

IT IS SO ORDERED this _____ day of _____.

By: _____

STAFF SUMMARY FOR JULY 19, 2016

3. RECREATIONAL ROCK CRAB EMERGENCY

Today's Item **Information** ☐ **Action** ☒

Consider re-adopting emergency regulations for the Dungeness crab and rock crab fisheries due to elevated levels of domoic acid.

Summary of Previous/Future Actions

- Adopt emergency crab regulations — Nov 5, 2015; Teleconference
- Re-adopted emergency regulations — Apr 13-14, 2016; Santa Rosa
- **Today re-adopt emergency regulations** — Jul 19, 2016; Teleconference

Background

On Nov 5, 2015, FGC adopted emergency regulations to delay the opening of the recreational Dungeness crab fishery statewide and to close the recreational rock crab fishery north of the Ventura/Santa Barbara county line due to persistently high levels of domoic acid, under recommendation from the Office of Environmental Health Hazard Assessment (OEHHA) in consultation with the California Department of Public Health (CDPH); DFW adopted similar regulations for the commercial fisheries. Emergency regulations were re-adopted in Apr 2016. The previous FGC emergency crab regulations will expire on Aug 3, 2016.

Pursuant to the regulations adopted and re-adopted by FGC, certain state waters along the California coast have reopened based on the results of domoic acid testing indicating levels below the federal action level and resulting recommendations of OEHHA in consultation with the director of CDPH. However, current monitoring results (Exhibit 4) indicate that domoic acid levels in rock crab are persisting above the federal action level in some areas of the state, and an emergency closure remains in effect for rock crabs caught in state waters north of Pigeon Point in San Mateo County (Latitude 37° 11′ N). As determined by the director of OEHHA, in consultation with the director of CDPH, consuming crab from these areas poses a significant risk to public health; since current regulations will expire on Aug 3, 2016, readopting the emergency regulations for an additional 90 days is necessary for the preservation of public health.

Note that because the recreational Dungeness crab season will have closed before the current emergency extension has expired, this second re-adoption of the regulations *will have no impact on the recreational Dungeness crab fishery.* However, the most expeditious method for maintaining the rock crab closure north of Pigeon Point is to re-adopt the existing emergency regulations rather than pursue an entirely new emergency regulation.

Pursuant to Section 11346.1(h), Government Code, OAL may approve not more than two re-adoptions, each for a period not to exceed 90 days, of an emergency regulation that is the same as or substantially equivalent to an emergency regulation previously adopted by that agency. This action is for the second 90-day extension which will allow the original emergency action to remain in place pending completion of a process to address health-based emergency crab closures in the long-term.

Recognizing the need for improvements in the way California addresses harmful algal blooms (HABs) and protecting human health, a task force led by the California Ocean Protection Council (OPC) and composed of CDPH, OEHHA, DFW, and FGC staff, is proactively pursuing a science working group on HABs and a set of standard operating procedures for the state agencies. The task force is creating a standard operating procedure for delineating the process, timing and manner in which a fishery should be closed in the event of another health concern; the procedure will also outline the process and chain of custody for monitoring efforts and is expected to be complete before the end of 2016. FGC staff has suggested that part of the procedure should also delineate the manner in which closed fisheries would be reopened.

In addition, legislation has been introduced (SB 1287) that would grant authority to the director of DFW to immediately close or restrict any fishery that is likely to pose a human health risk from high levels of toxic substances; such closures or restrictions would be exempt from the Administrative Procedure Act and would preclude the need for FGC to hold emergency meetings to adopt emergency regulations in such instances.

Significant Public Comments (N/A)

Recommendation

FGC staff: Re-adopt emergency regulations related to recreational Dungeness crab and rock crab fisheries closures due to elevated levels of domoic acid.

Exhibits

1. Statement of proposed emergency regulatory action and regulatory text
2. Original statement of proposed emergency regulatory action, effective November 5, 2015 – May 3, 2016 (File No. 2015-1105-01E)
3. Statement of proposed emergency regulatory action, , effective May 4, 2016 – Aug 2, 2016 (File No. 2016-0421-02EE)
4. *Summary of Domoic Acid Levels in Crab*, CDPH, received Jun 23, 2016

Motion/Direction

Moved by _____ and seconded by _____ that the Commission determines, pursuant to Section 240 of the Fish and Game Code, adoption of this regulation is necessary for the immediate protection of public health from ingesting elevated levels of poisonous domoic acid detected in recent samples of crab, specifically rock crab caught in state waters north of Pigeon Point in San Mateo County (Latitude 37° 11′ N).

Therefore, the Commission amends and re-adopts the emergency changes to Section 29.85, Title 14, related to the recreational Dungeness crab and rock crab fisheries for the immediate preservation of public health in the areas identified above.

Frequently Asked Questions:

Harmful Algal Blooms and California Fisheries

Developed in Response to the 2015-16 Domoic Acid Event

California Ocean Science Trust

CALIFORNIA OCEAN SCIENCE TRUST

AUGUST 2016

About this Document

GOAL : The goal of this document is to provide clarity for members of the fishing industry, consumers, non-governmental organizations, state agencies, and the Legislature on the California's current practices (through August 2016) in regards to harmful algal bloom (HAB) monitoring and management, and seafood toxin sampling and testing protocols. This document is intended to bring diverse audiences together around a common pool of information, and support more engaged conversations where everyone can move forward together.

Recent California fishery closures and health advisories during 2015-2016, resulting from elevated seafood toxin levels, have raised questions among California's coastal communities about the science supporting current biotoxin monitoring and fishery management practices. In response, the California Ocean Protection Council (OPC) and the Interagency Marine HAB Task Force[1] (HAB Task Force) have asked California Ocean Science Trust to develop a frequently asked questions (FAQ) document to address questions focused on:

I. HABs and seafood toxin monitoring efforts in California
II. Domoic acid and California fisheries
III. Human health and seafood safety concerns
IV. California's fishery and seafood toxin management

Questions were submitted to Ocean Science Trust by the HAB Task Force, along with input from the California Dungeness Crab Task Force (DCTF) Executive Committee, Commercial Fishermen of Santa Barbara, the office of California Senator Mike McGuire, and the Joint Committee on Fisheries and Aquaculture. Additionally, a public conference call was held on July 27, 2016 to further engage with the fishing industries involved and other interested parties. The majority of the questions included in this FAQ originated from these conversations, public comment, emails, and/or direct calls from stakeholders to agency or legislative staff. For the full list of questions submitted to Ocean Science Trust, visit here[2].

Ocean Science Trust compiled responses to the questions in this FAQ document based on existing scientific literature and consultation with representatives from the HAB Task Force, Ocean Protection Council Science Advisory Team "Harmful Algal Blooms and California Fisheries" working group (see below), and additional scientific experts (university researchers, and state and federal agency scientists). Additionally, this FAQ document prioritizes addressing questions that did not require additional research, due to the timeframe set by the California Legislature to begin addressing this issue.

This document is complementary to the work of an Ocean Protection Council Science Advisory Team (SAT) working group[3], convened by Ocean Science Trust to provide longer-term recommendations that can help California agencies and the Legislature prioritize future science-informed actions focused on better understanding and predicting fishery and human health impacts related to HABs.

An overview and more general scientific information about HABs in California can be found in a report created by leading academic experts in the field titled "A Primer on California Harmful Algal Blooms: Common questions and answers for stakeholders, decision-makers, coastal managers, and the education community," available here[4].

1 The HAB Task Force membership includes representatives from California Department of Public Health, California Fish and Game Commission, California Department of Fish and Wildlife, Ocean Protection Council, and the Office of Environmental Health Hazard Assessment.

2 http://www.oceansciencetrust.org/wp-content/uploads/2016/07/Full-List-of-Submitted-questions-HABs-and-fisheries-2016.pdf

3 For more about the SAT working group, visit here: http://www.oceansciencetrust.org/project/harmful-algal-blooms-and-california-fisheries/

4 McGaraghan et al., 2012: http://fisheries.legislature.ca.gov/content/august-10-2016-progress-reports-crab-season-domoic-acid-and-disaster-declaration

List of Acronyms

ASP – Amnesic Shellfish Poisoning
CDFW – California Department of Fish and Wildlife
CDPH – California Department of Public Health
CeNCOOS - Central and Northern Ocean Observing System
DCTF – Dungeness Crab Task Force
DSP – Diarrhetic Shellfish Poisoning
EMB – Environmental Management Branch of the California Department of Public Health
EPA – United States Environmental Protection Agency
FAQ – Frequently Asked Questions
FDA – United States Food and Drug Administration
FDB - Food and Drug Branch of the California Department of Public Health
FGC – Fish and Game Commission
HAB – harmful algal bloom
ISSC - Interstate Shellfish Sanitation Conference
MSA - Magnuson-Stevens Fishery and Conservation Management Act
NOAA – National Oceanic and Atmospheric Administration
OPC - California Ocean Protection Council
PSMFC – Pacific States Marine Fisheries Council
PSP – Paralytic Shellfish Poisoning
SAT - Ocean Protection Council Science Advisory Team
SOP - Standard Operating Procedures
Spp. - species
Task Force – California Interagency Marine Harmful Algal Bloom Task Force
WARNN-West – Wildlife Algal Toxins Research and Response Network for the West Coast

About Ocean Science Trust

Ocean Science Trust is an independent non-profit that brings together governments, scientists, and citizens to build trust and understanding in ocean and coastal science. We empower participation in the decisions that are shaping the future of our oceans. We were established by the California Ocean Resources Stewardship Act to support managers and policymakers with sound science. For more information, visit our website at www.oceansciencetrust.org.

About the Interagency Marine HAB Task Force

The Interagency HAB Task Force was established by the Ocean Protection Council in early 2016. Task Force members include Sonke Mastrup (California Department of Fish and Wildlife), Susan Ashcraft (Fish and Game Commission), Patrick Kennelly (Department of Public Health), Gregg Langlois (Department of Public Health, retired), Susan Klasing (Office of Environmental Health Hazard Assessment), Valerie Termini (Fish and Game Commission), and Jenn Phillips (Ocean Protection Council). During the winter of 2016-17, the Task Force will help guide the working group in developing a longer term management document about what information is needed and what investments are needed to help to better predict and plan for future events. The Task Force will also work together to review and update standard operating procedures (SOP) that will be utilized by the agencies responsible for oversight of public health and the fisheries.

About the Ocean Protection Council Science Advisory Team Working Group

The Harmful Algal Blooms and California Fisheries SAT working group was convened by Ocean Science Trust to develop scientific guidance and options for adding capacity to the California's existing HAB monitoring and sampling efforts, as well as advance our understanding and ability to predict HAB events and fishery impacts. Members include Raphael Kudela (UC Santa Cruz), William Cochlan (San Francisco State University), Dave Caron (University of Southern California), and Gregg Langlois (California Department of Public Health, retired).

Contacts

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Acknowledgements: In addition to members of the HAB Task Force and SAT working group, Ocean Science Trust would like to thank the following individuals for their contributions to this FAQ: Vera Trainer, Robert Dickey, Pete Kalvass, Jerry Borchert, Kimberly Selkoe, Carrie Pomeroy, Carrie Culver, Joe Tyburczy, Kathi Lefebvre, Stacey Degrasse, and Emily Knight.

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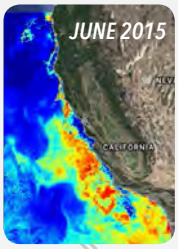
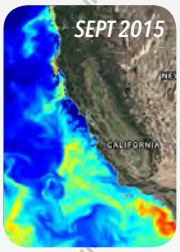
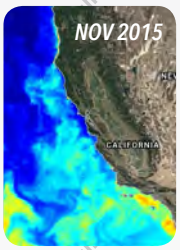
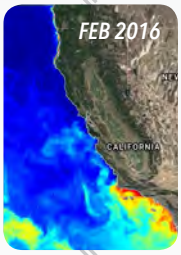
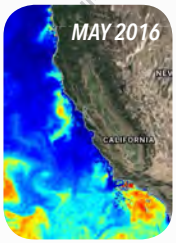
Timeline of Events: Domoic Acid and the California 2015-16 Fishing Season











Historical probability of particulate domoic acid (>500 nanograms/L)

Map data: CeNCOOS

2015

JUNE 1, 2015
CDPH advised consumers not to eat recreationally harvested mussels and clams, commercially or recreationally caught anchovy and sardines, or the internal organs of commercially or recreationally caught crab taken from Monterey and Santa Cruz counties due to elevated domoic acid levels.

JUNE 8, 2015
CDPH expanded the warning to include the internal organs (viscera) of scallops due to domoic acid.

JULY 3, 2015
CDPH expanded the warning to include Santa Barbara County.

AUGUST 26, 2015
CDPH advised consumers not to eat recreationally harvested bivalve shellfish (mussels and clams) from Humboldt or Del Norte counties due to elevated domoic acid.

SEPTEMBER 11, 2015
CDPH and CDFW began preseason Dungeness crab meat quality and toxin testing.

NOVEMBER 3, 2015
CDPH issued health advisory not to consume Dungeness and Rock crabs caught in waters between OR border and the southern Santa Barbara County line.

OEHHA and CDPH recommended delaying opening of Dungeness crab season and closing the rock crab fishery due to unsafe levels of domoic acid.

NOVEMBER 5, 2015
FGC held an emergency meeting and voted to delay the opening of the recreational Dungeness crab fishery.

NOVEMBER 6, 2015
Director of CDFW enacted an emergency rulemaking to delay the opener of the commercial Dungeness crab season and close commercial rock crab.

NOVEMBER 13, 2015
CDPH lifted advisory for bivalve shellfish (mussels and clams) and small finfish (anchovies and sardines) caught in the Santa Cruz, Monterey, or Santa Barbara County areas.

DECEMBER 9, 2015
CDPH lifted advisory for bivalve shellfish (except razor clams) from Humboldt and Del Norte Counties.

DECEMBER 31, 2015
CDPH lifted advisory for Dungeness and rock crabs caught along the coasts of Santa Barbara and San Luis Obispo counties. CDFW opens commercial and recreational rock crab, and recreational Dungeness crab in these regions.

2016

FEBRUARY 9, 2016
Governor Brown requested that the federal government declare a fishery resource disaster and commercial fishery failure under the Magnuson-Stevens Act in order to seek federal assistance.

FEBRUARY 11, 2016
CDPH lifted health advisory for Dungeness crabs caught in all areas south Point Reyes. CDFW and FGC opened recreational Dungeness crab fishing in areas south of Point Reyes.

MARCH 18, 2016
CDPH lifts health advisory for Dungeness crabs caught in areas south of the Sonoma/Mendocino County line. Recreational Dungeness crab fishery opens in this region, and CDFW provides commercial Dungeness crab fishermen seven days' notice of opening.

MARCH 26, 2016
Commercial Dungeness crab season opened south of the Sonoma/Mendocino County Line.

MARCH 28, 2016
CDPH lifted health advisory for rock crabs caught in state waters off the Channel Islands, with the exception of one area between Santa Rosa and Santa Cruz Islands. Recreational and commercial rock crab fisheries open in these regions.

APRIL 22, 2016
CDPH lifted Dungeness crab health advisory in Mendocino and portions of Humboldt Counties. Rock crab advisory lifted for Monterey County.

APRIL 27, 2016
FGC closed recreational razor clam fishery in Humboldt and Del Norte Counties.

MAY 2, 2016
Dungeness Crab health advisory lifted along Northern California Coast. California coast is open for recreational Dungeness crab, except one area within Humboldt county.

MAY 12, 2016
Commercial Dungeness crab fishery opened in Mendocino, portion of Humboldt and Del Norte counties.

MAY 19, 2016
Recreational Dungeness crab fishery opened statewide, Commercial fishermen given seven days' notice of opening.

MAY 26, 2016
Commercial Dungeness crab fishery opens statewide.

JUNE 3, 2016
Commercial and recreational rock crab fisheries open in remainder of Channel Islands.

JULY 6, 2016
CDPH lifted advisory for rock crab in portions of San Mateo County. Recreational and commercial rock crab fisheries open south of Pigeon Point.

Background

Harmful algal blooms (HABs) are extreme biological events that can result in negative impacts to fisheries, coastal ecosystems, economies, and public health via the production of natural toxins. These toxins can accumulate in meat and organs of shellfish and other seafood species and, when consumed by marine wildlife and humans, can result in various illnesses or death. It is generally accepted that HABs are increasing in frequency, intensity, and duration in all aquatic environments on a global scale. In California, the prevalence and intensity of HABs is a growing concern.

In 2011, a HAB event in coastal areas of Sonoma County led to the mass mortality of red abalone, urchins, sea stars, chitons, and crabs, and was the largest invertebrate die-off recorded for the region[5]. In the spring and summer of 2015, an unprecedented HAB of the marine algae *Pseudo-nitzschia* stretched from central California to the Alaska Peninsula, resulting in some of the highest concentrations of the toxin domoic acid ever observed in California. This particular event even exceeded domoic acid levels researchers had previous thought could occur in the natural environment. This most recent HAB was a consequence of a series of abnormal ocean changes in the Pacific Ocean, including a large mass of warm and nutrient-poor water, named "the blob," combined with warm water driven by El Niño.

As a result of this West Coast-wide HAB event, elevated levels of domoic acid were observed in major commercial and recreational California fisheries in 2015 and 2016, including Dungeness crab, rock crab, anchovies, mussels, and razor clams. This led to multiple fishery and aquaculture closures and health advisories during the 2015-2016 season, including California's commercial and recreational Dungeness crab and rock crab, and recreational razor clam fisheries. These closures resulted in extensive impacts and economic hardships on the commercial fishing and seafood industry, prompting Governor Brown to request[6] a fishery resource disaster and commercial fishery failure declaration under the Magnuson-Stevens Act on behalf of the commercial Dungeness crab and rock crab industries.

Given California's changing ocean conditions and increasing threats to coastal industries, communities, and economies, the State is interested in better understanding and predicting HAB events, as well as exploring opportunities to bolster its existing seafood toxin sampling and monitoring programs.

In this document, we focus on addressing frequently asked questions related to California's current practices for HAB monitoring, management, and seafood toxin sampling and testing protocols. In some sections, we address questions about California's HAB and shellfish monitoring efforts, broadly. In others, we focus more specifically on domoic acid and California's crab fisheries. Where possible, we attempt to distinguish between bivalve and crustacean shellfish. **Bivalve shellfish** (mussels, clams, oysters), are routinely monitored year round by the California Department of Public Health and have strict requirements for commercial shellfish growing areas in compliance with the National Shellfish Sanitation Program (NSSP)[7]. **Crustacean shellfish** (e.g., Dungeness and rock crab) and finfish (e.g., Pacific sardine, northern anchovy) are tested for toxins when there is an indicator present (see Box 1) and/or during routine monitoring, such as the preseason meat quality testing that takes place for Dungeness crab.

5 De Wit et al., 2014. Available at: http://www.nature.com/ncomms/2014/140416/ncomms4652/full/ncomms4652.html

6 Governor Brown Letter: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=116284

7 The National Shellfish Sanitation Program (NSSP) is the federal/state cooperative program recognized by the U. S. Food and Drug Administration (FDA) and the Interstate Shellfish Sanitation Conference (ISSC) for the sanitary control of shellfish produced and sold for human consumption. Participants in the NSSP include agencies from shellfish producing and non-producing States, FDA, EPA, NOAA, and the shellfish industry. For more information, visit here: http://www.fda.gov/Food/GuidanceRegulation/FederalStateFoodPrograms/ucm2006754.htm

Photo: NOAA

I. Harmful Algal Bloom and Biotoxin Monitoring Efforts in California

▪ *How are harmful algal blooms and associated biotoxins being monitored along California's coast?*

California has the longest-standing biotoxin monitoring program in the U.S., beginning in 1927 in response to a massive paralytic shellfish poisoning (PSP) episode. That event resulted in several deaths and over 100 illnesses that were associated with mussel consumption. In 1991, the California Department of Public Health (CDPH) began monitoring state fisheries for domoic acid after it was first detected in Monterey Bay.

CDPH has implemented a prevention program that has traditionally been comprised of the following basic elements:

1. a coastal bivalve shellfish monitoring program (see *CDPH Shellfish Monitoring Program* below) that serves to protect recreational harvesters and serves as an early warning for HABs that could be transported into the bays and estuaries used for commercial shellfish aquaculture;
2. a coastal phytoplankton monitoring program (see *CDPH Volunteer-based Phytoplankton Monitoring Program* below) for early detection of toxin producing species that could impact shellfish and other seafood resources. Early bloom detection, coupled with the ongoing bivalve shellfish monitoring, inform and direct the need for sampling other seafood species (e.g., crab, anchovy);
3. frequent monitoring of commercial bivalve shellfish growing areas;
4. an annual statewide quarantine on sport harvested mussels (from May 1 through October 31);
5. mandatory reporting of disease cases;
6. public information and education activities.

CDPH Shellfish Monitoring Program

Bivalve Shellfish

The shellfish monitoring component of the Marine Biotoxin Monitoring Program (Biotoxin Program) relies on participation of people from a wide variety of local, state, and federal agencies, Tribal biologists, educational organizations, researchers, and, increasingly, citizen volunteers. Program participants collect shellfish samples, primarily mussels, and ship them to the CDPH laboratory in Richmond, California where they are tested for the PSP toxins and domoic acid. Sampling frequency is often dependent on exceptionally low tides and calm seas, varying from once to twice per month. Approximately 1200 bivalve shellfish samples are collected annually by over 60 samplers at more than 100 sampling sites. Sites are selected based both on being representative of a coastal region's fishing sites (or embayments) and safety of access.

Commercial shellfish growers, who account for approximately two-thirds of the total number of samples, are required to submit shellfish samples at least weekly for toxin testing as a condition of their certification by CDPH. Some commercial bivalve shellfish companies operating in high-risk areas for domoic acid are required to conduct weekly field tests for this toxin in addition to shipping the sample to the CDPH laboratory. These qualitative tests (which only indicate presence/absence of domoic acid) provide the industry valuable information on the initial occurrence of toxin and can guide harvesting plans to ensure public health. This information also allows CDPH to prioritize samples that have tested positive in the field to be tested first when they arrive in the laboratory to confirm the positive test as well as ascertain levels of domoic acid in the samples.

It is also worth noting that commercial bivalve species fall under the protocol outlined in the FDA's National Shellfish Sanitation Program (NSSP). The NSSP only applies to commercial bivalve shellfish and requires each state to have a Biotoxin Contingency Plan that consists of the following:

- Initiate an emergency shellfish sampling and assay program.
- Close growing areas and embargo shellfish.
- Prevent harvesting of contaminated species.
- Provide for product recall.
- Disseminate information on the occurrences of toxic algal blooms and/or toxicity in shellfish meats to adjacent states, shellfish industry, and local health agencies.
- Coordinate control actions taken by authorities and federal agencies.

Crustacean Shellfish and Finfish

For most crustacean shellfish and finfish species, CDPH will initiate testing for HAB-induced toxins when there is an indicator that the toxin may be present or has entered the food chain (see Box 1 for indicators). Once CDPH learns of an indicator they consult with California Department of Fish and Wildlife (CDFW) to learn of any active commercial or recreational fisheries in the same geographical region where the indicator is present and determine whether or not sampling is needed.

Box 1. List of indicators that prompt CDPH to consider sampling seafood species (other than bivalves) for HAB-induced toxins in a given area.

- Increased toxin levels in CDPH bivalve sampling program, typically mussels
- Active toxin-producing bloom observed by CDPH, academic researchers or the public
- HAB species detected through CDPH phytoplankton monitoring
- Marine mammal strandings and bird die-off events, etc.
- Notifications from independent academic researchers who are conducting their own research and monitoring efforts

Typically, if there is an indictor present, CDPH will first check existing or new bivalve samples to see if the toxin has entered the food chain in an area where an indicator is observed. Bivalves are particularly good indicator species because they are efficient filter feeders, they are ubiquitous along the coast and easily accessible on low tides, and will often show presence of HAB-related toxins in their tissue before other non-bivalve species. If a toxin is present at high levels in the bivalves, CDPH will take necessary public health actions for the commercial and recreational bivalve fishery in question CDPH will also take into consideration whether additional indicators are also present while also consulting with CDFW to learn if there are other active fisheries in the area that could be impacted and initiating sampling for those species as necessary.

In addition to the above, for Dungeness crab, CDPH will work with CDFW during the pre-season meat quality testing to secure samples for toxin testing in advance of the season opener. If elevated toxin levels are observed, or if an active bloom on fishing grounds is present, then bi-weekly to weekly testing occurs until the bloom is no longer observed and/or toxin levels are no longer detected near the action level.

For rock crab, testing is implemented when a bloom is observed, if mussels test positive in the area, or other indicators signify testing is warranted (see Box 1). If the fishery is closed due to elevated toxin levels, sampling occurs weekly to bi-weekly.

CDPH Volunteer-based Phytoplankton Monitoring Program

CDPH initiated a volunteer-based phytoplankton monitoring program in 1991 to detect an initial increase of a toxin-producing species before shellfish and other seafood resources are impacted. This program draws on a wide range of participants as detailed for the shellfish sampling program. Phytoplankton monitoring participants are provided nets for collecting concentrated seawater samples, which are sent to the CDPH laboratory for examination under a microscope. This effort allows CDPH to focus additional attention on those coastal areas experiencing an increase in toxin-producing phytoplankton or an increase in toxins in shellfish. When phytoplankton levels are on the rise, additional samples are requested. Observations of high levels of toxin-producing phytoplankton are one of the indicators that can prompt CDPH to expand seafood sampling to other (non-bivalve) potentially impacted seafood species like crab and anchovy (see Box 1) in the area.

▪ *What harmful algal species and associated toxins are routinely monitored by the State and how?*

CDPH's phytoplankton monitoring program is focused primarily on the early detection of three toxin-producing species most prevalent in California and the West Coast (Figure 1, Table 1):

- *Alexandrium spp.*, a dinoflagellate responsible for the PSP toxins
- *Pseudo-nitzschia spp.*, a diatom that produces domoic acid, the toxin responsible for amnesic shellfish poisoning (ASP)
- *Dinophysis spp.*, a less common dinoflagellate species that produces toxins responsible for diarrhetic shellfish poisoning (DSP)

Other less common toxin-producing species are tracked via CDPH's phytoplankton monitoring efforts and, if warranted, CDPH will pursue shellfish testing. Common non-toxic species are also identified and tracked and can provide insight into other HAB events being investigated by researchers and other agency scientists. General trends in the relative abundance and geographic distribution of major phytoplankton groups (diatoms, dinoflagellates) can provide insight into the likelihood of a given toxin-producer being present. Summary data for toxin and phytoplankton monitoring is provided in monthly reports (see link in section *Where can HAB monitoring and active bloom information be found?* below).

HAB monitoring occurs in several ways in California, including a number of university researchers and the CDPH phytoplankton monitoring program. CDPH equips its program participants with a standard net (20 micrometer mesh size) for collecting concentrated seawater samples, which are sent to the CDPH laboratory. Samples are collected at varying frequencies, ranging from weekly to monthly. Approximately 1700 samples are collected each year by over 80 samplers at more than 150 sampling sites. Sites are selected based on safe access (e.g., piers) and being representative of a given region. Samples are examined microscopically and data collected on the presence of any known or suspected toxin-producer. Data is also collected on the percent composition of toxic and non-toxic genera.

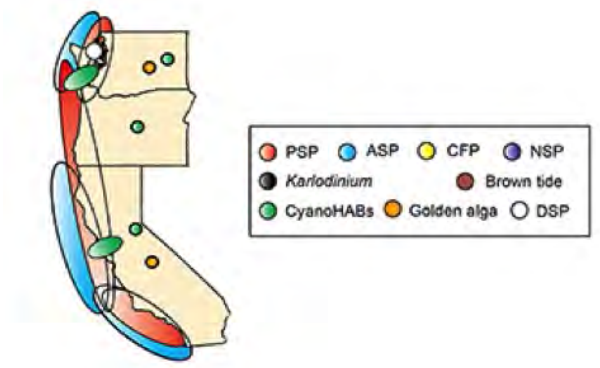
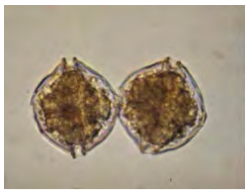
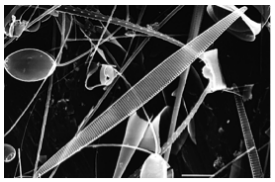
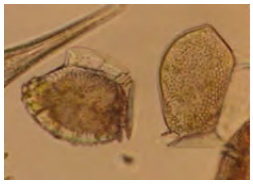


Figure 1. A generalized view of west coast states depicting the various HAB poisoning syndromes and other impacts that occur in specific areas. Note: all 50 states are impacted by cyanobacterial HABs, thus these areas are depicted using a single green and/or gold dot. Larger green areas denote widespread cyanoHAB problems. (Credit: modified from WHOI)

Table 1. Harmful algal species and their associated biotoxins routinely

Species	Biotoxin	Disease / Symptoms	Action Levels*
Alexandrium spp.  (WHOI / D. Anderson)	Saxitoxin and its derivatives	**Paralytic Shellfish poisoning (PSP)** Numbness and tingling of the lips, mouth, face, and neck; nausea; and vomiting. Severe cases result in paralysis of the muscles of the chest and abdomen possibly leading to death.	0.8 ppm (80µg/100g) saxitoxin equivalent
Pseudo-nitzschia spp.  (J. Rines)	Domoic acid	**Amnesic Shellfish Poisoning (ASP)** Nausea, vomiting, diarrhea, headache, dizziness, confusion, disorientation, short-term memory deficits, and motor weakness. Severe cases result in seizures, cardiac arrhythmia, respiratory distress, coma, and possibly death.	20 ppm domoic acid, except in the viscera of crustaceans, where 30 ppm is the action level**
Dinophysis spp.  (WHOI / D. Anderson)	Okadaic acid and its derivatives	**Diarrhetic Shellfish Poisoning (DSP)** Nausea vomiting, severe diarrhea, and abdominal cramps	0.2 ppm okadaic acid plus 35-methyl okadaic acid

*Current action levels in California, which are also recognized by all food safety authorities (for example, the U.S. Food and Drug Administration, the Canadian Food Inspection Agency, and the European Union). US FDA, 2011, available at http://www.fda.gov/downloads/Food/GuidanceRegulation/UCM251970.pdf

**While the FDA specifically lists 30 ppm action level for Dungeness crab viscera, California applies this to all harvested crustacean viscera.

- ***Are HAB events increasing in frequency? Are there links between climate change and HAB events?***

There is increasing recognition that the effects of HABs on public health, marine and freshwater ecosystems, economies, and human social structures are worsening[8]. It is generally accepted that HABs are increasing in frequency, intensity, and duration in all aquatic environments on a global scale[9]. Eutrophication (excessive nutrients that lead to dense algal growth and subsequent oxygen declines), climate change, ballast water dispersal, and improved monitoring are the most cited factors for the increased frequency of reported blooms.

Much is still unknown regarding the link between climate change and HAB events. Warmer sea surface temperatures are projected to broaden the seasonal period over which phytoplankton can grow, as well as expanding the ranges of warm water HAB species, potentially enhancing the risk of negative impacts and exposure to dangerous toxins. Scientists are still working to understand not only when HAB events occur, but what physiological characteristics of the phytoplankton and physical characteristics of the ocean cause them to start producing toxins. Changes in seawater carbon dioxide concentrations (ocean acidification) are also likely to influence phytoplankton species assemblages. More research is still needed in this area.

Scientists at the National Oceanic and Atmospheric Administration (NOAA) and the Wildlife Algal Toxins Research and Response Network for the West Coast (WARRN-West) are studying samples (2004 to present) from bowhead whales in the arctic to determine whether there is a link between climate factors and toxin levels, and whether there is a trend of increasing toxins over time[10].

- ***Can we predict future HAB events and impacts to fisheries?***

The short answer to this questions is that is it difficult to predict with certainty that a HAB will or will not occur in a specific year. However, scientists can make broad generalizations based on conditions that are favorable for blooms (see below). Scientists are refining models that can assist with forecasting when and where HAB events are likely to occur in California, and over what time frames. While there is no way to know for sure, it is unlikely to see another bloom to the scale of the 2015/16 event (magnitude, duration and geographical reach) again this year. Though scientists do expect unusual HAB events to occur with greater frequency.

Factors Contributing to *Pseudo-nitzschia* Blooms

Along the West Coast of California, Oregon and Washington, *Pseudo-nitzschia* blooms cause problems almost every year, related in part to upwelling of deep ocean water in these regions[11]. Upwelling brings waters with elevated nutrient levels to the top 300 meters of the ocean where light penetrates – ideal conditions for phytoplankton growth. There is no direct evidence to link land-based nutrient sources to *Pseudo-nitzschia* blooms on the CA coast[12]. This does not, however, preclude the possibility that the growth of these HAB species, their toxicity, and the frequency or duration of toxic events may be exacerbated by anthropogenic nutrient inputs since nitrogen sources traditionally associated with cultural eutrophication (e.g., ammonium and urea) have been shown to support equal or greater cellular growth rates and domoic acid production rates by many species of *Pseudo-nitzschia* in controlled laboratory studies[13] and have been suggested to sustain non-bloom concentrations of HAB species during upwelling-free periods[14].

For additional information on history, trends, causes, and impacts on *Pseudo-nitzschia* and other species, see here[15].

Predictive Modeling Efforts

Researchers at UC Santa Cruz, led by Dr. Raphael Kudela, have partnered with CeNCOOS to produce predictive "nowcasts" and forecasts of *Pseudo-nitzschia* blooms and domoic acid probabilities along the California coast. Nowcasts of HAB conditions are created through a combination of 1) sophisticated circulation models that predict the ocean physics, 2) satellite remote-sensing data of the ocean "color" and chlorophyll patterns, and 3) statistical models for predicting bloom and toxin likelihoods. These predictions are generated daily to provide a snapshot of where you might encounter a *Pseudo-nitzschia* bloom and/or domoic acid event. Predictions are also generated daily to provide a forecast of where you might encounter a *Pseudo-nitzschia* bloom and/or domoic acid event in the next one to three days. Data and additional information are available here: http://www.cencoos.org/data/models/habs.

8 Anderson et al. 2015, available at: http://oceandatacenter.ucsc.edu/home/Publications/2014/Anderson_Coastal&MarineHazards_2014.pdf
9 Moore et al. 2008, available at: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2586717/
10 Kathi Lefebvre, personal communication
11 Mos 2001, available at: http://ic.ucsc.edu/~kudela/OS130/Readings/DA_review.pdf
12 Anderson et al., 2005; Lewitus et al. 2012, available at: http://www.sciencedirect.com/science/article/pii/S1568988312001175
13 Auro and Cochlan, 2013, available at: http://onlinelibrary.wiley.com/doi/10.1111/jpy.12033/abstract
14 Cochlan et al., 2008, available at: http://www.sciencedirect.com/science/article/pii/S1568988308001005
15 Lewitus et al. 2012, available at: http://www.sciencedirect.com/science/article/pii/S1568988312001175

▪ *Where can HAB monitoring and active bloom information be found?*

CDPH Monthly Biotoxin Report

The CDPH Environmental Management Branch (EMB) publishes a monthly biotoxin report that is distributed via email and posted on its web page: http://www.cdph.ca.gov/healthinfo/environhealth/water/Pages/Shellfish.aspx

This site also contains a web map with selectable weekly layers of data showing the distribution and relative abundance of toxin-producing species: http://cdphdata.maps.arcgis.com/apps/MapTools/index.html?appid=42a78fba680c4c43970cfc5dfe878d8d

Current Quarantines and Health Advisories

A toll free number (1-800-553-4133) is maintained that contains up-to-date information on current quarantines and health advisories. Messages can be left for a call-back by program staff. The CDPH Food and Drug Branch (FDB) web page will contain ongoing monitoring results for Dungeness crab and other commercial species: http://www.cdph.ca.gov/HealthInfo/Pages/fdbDomoicAcidInfo.aspx

Advisories are also posted on the CDFW website here: https://www.wildlife.ca.gov/Fishing/Ocean/Health-Advisories

CalHABMAP

The California Harmful Algal Bloom Monitoring and Alert Program (CalHABMAP)[16] is a proactive HAB alert network that provides information on current algal blooms and facilitates information exchange among HAB researchers, managers and the general public throughout the State of California. CalHABMAP hosts a website where weekly algae and toxin data from eight California piers can be accessed. The eight sampling locations are:

- Santa Cruz Wharf
- Monterey Wharf
- Cal Poly Pier
- Goleta Pier
- Stearns Wharf
- Santa Monica Pier
- Newport Pier
- Scripps Pier

CeNCOOS

Central and Northern California Ocean Observing System (CeNCOOS) is a collaborative that enables sustained and coordinated measurements, model "nowcasts" and forecasts, and integrated products to inform decisions about our regional ocean. CeNCOOS helps support routine algae and toxin sampling at coastal locations throughout the region. Algae samples are currently being collected weekly at wharves in Santa Cruz and Monterey with the aid of CeNCOOS funds. Samples are also being collected at a Tiburon station in San Francisco Bay. Additionally, UC Santa Cruz frequently analyzes HAB toxins for government agencies (for informational purposes only), conservation groups, scientists, and others with the help of CeNCOOS support.

16 McGaraghan et al., 2012, available at: http://fisheries.legislature.ca.gov/sites/fisheries.legislature.ca.gov/files/u8/Primer%20on%20HAB%20westcoast.pdf

II. Domoic Acid and California Fisheries

▪ *What is the history of domoic acid toxicity in seafood in the U.S.?*

Domoic acid is a neurotoxin produced under certain conditions by the diatom *Pseudo-nitzschia* that can result in the illness called amnesic shellfish poisoning (ASP). It was identified as the toxin responsible for the first human domoic acid poisoning event, reported in 1987 in Prince Edward Island, Canada[17,18]. About 145 people became ill after eating blue mussels that had accumulated the toxin as a result of a *Pseudo-nitzschia* bloom present in the water. Nineteen people were hospitalized and 16 were treated in the Intensive Care Unit. Three people died (71, 82, and 84 years of age) while hospitalized and a fourth patient died of a heart attack three months later. Information from 10 of those people, ranging in age from 60 to 84, was used to estimate the levels of domoic acid that people consumed[19] (see question *What is the scientific rationale behind the action levels for domoic acid toxicity in seafood?* below for how this level was determined).

Pseudo-nitzschia is a phytoplankton species of global importance. It has been recorded in nearly every major marine and estuarine environment, and domoic acid has been found in the tissue or feces of organisms in multiple trophic levels in the oceans[20]. *Pseudo-nitzschia* has been present on the West Coast since at least the 1920s[21]. Domoic acid has been frequently observed in seafood around the U.S. (Figure 2), and events have occurred almost every year over the last decade in California (Figure 3).

Domoic acid enters the marine food chain by contaminating species such as mussels that filter their food out of the water[22] (Box 2). This water can contain both the algae and the toxin itself, which is released to the water column. The toxin accumulates in the digestive gland and certain other tissues of shellfish. For example, razor clams accumulate and retain the toxin in the edible portions (siphon, foot) as well as the viscera. ASP symptoms are characterized by gastrointestinal disorders (vomiting, diarrhea, abdominal pain), neurological problems (confusion, loss of short-term memory, disorientation, seizure, coma) and potentially death.

Box 2. Potential Vectors for Domoic Acid

Bivalves

razor clams, mussels, Pacific littleneck, geoduck, manila clams, oysters

Crustaceans

Dungeness, rock, and pelagic red king crab, spiny lobster, krill

Finfish

Pacific sardines, northern anchovies

Other invertebrates

market squid and other benthic invertebrates

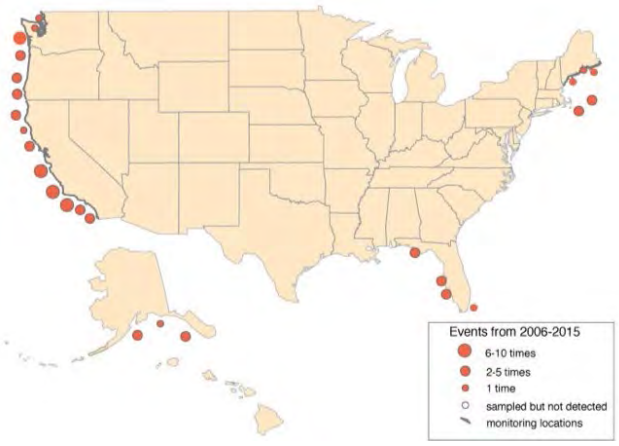


Figure 2. Presence of ASP toxins (i.e., domoic acid) in seafood in the U.S. from 2004-2015. (US National Office for Harmful Algal Blooms, Woods Hole Oceanographic Institution)

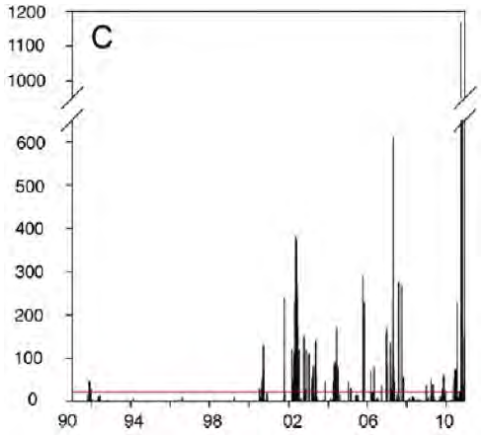


Figure 3. Historical time series of domoic acid toxins (ug/g shellfish meat) in California. The regulatory action level of 20 ug/g is shown in red. (CDPH Data. Figure taken from Lewitus et al. 2012)

17 Bates et al. 1989, available at: http://www.nrcresearchpress.com/doi/abs/10.1139/f89-156#.V5EtopOANBc
18 Perl et al. 1990, available at: http://www.nejm.org/doi/pdf/10.1056/NEJM199006213222504
19 Todd, 1993, available at: http://www.marearoja.cl/IMG/pdf/AMNESIC_SHELLFISH_POISON_REVIEW_BLOOM_CANADA_1987.pdf
20 Thessen, 2007, available at: http://bit.ly/23bVdLf
21 Lewitus et al. 2012, available at: http://www.sciencedirect.com/science/article/pii/S1568988312001175
22 Mos 2001, available at: http://ic.ucsc.edu/~kudela/OS130/Readings/DA_review.pdf

As a result of the 1987 acute toxicity episode, the Canadian government implemented a regulatory level of 20 mg DA/kg of meat (i.e., 20 ppm)[23] for all seafood. There have been no further documented human illness cases of ASP since 1987.

Although the regulatory level has been successful in preventing other human episodes of ASP, there are reports of domoic acid intoxication in marine animals, including sea lions, whales, sea otters and sea birds, as well as reports of coastal water contamination in many world regions[24]. A number of shellfish and finfish have been reported as potential vectors of the disease (Box 2), leading to widespread transfer through marine food webs and potentially to humans[25].

▪ *What are the current (2016) domoic acid action levels in California?*

Current action levels for domoic acid in seafood in California, which are also recognized by all food safety authorities (for example, the U.S. Food and Drug Administration[26], the Canadian Food Inspection Agency, and the European Union) are:

- ≥ 20 ppm in all seafood; except,
- ≥ 30 ppm in viscera (i.e., guts) of Dungeness crab

The U.S .Food and Drug Administration (FDA) sets policy for interstate and international commerce (i.e., transport and sale of seafood over state boundaries), which the states must follow as a minimum requirement. States can adopt more stringent standards and requirements, but cannot lower the action levels.

The FDA regulatory actions[27] to be considered by the states when the action levels are met are:

- closure of harvest areas found to produce crabs with such levels of the toxin; and/or
- evisceration of contaminated crabs.

▪ *What is the scientific rationale behind the action levels for domoic acid toxicity in seafood?*

The results of the first outbreak of amnesic shellfish poisoning that occurred in 1987 in Canada (see above) provided the best basis for the acute (short-term exposure) reference dose used to set the currently adopted domoic acid action levels in California[28,29] as mandated by the FDA.

During this outbreak, impacted individuals increased in the severity of signs and symptoms based on their dosage received (i.e., the amount of domoic acid a person consumed based on the levels in the mussels eaten), allowing experts to calculate a relationship between the amount of domoic acid ingested and the observed severity of symptoms[30]. The ***lowest observed adverse effect level*** (i.e., the lowest concentration of domoic acid ingested that caused symptoms of amnesic shellfish poisoning) was determined to be 1 mg/kg of body weight. This value was then divided by a precautionary "safety factor" of 10 to derive a precautionary ***reference dose*** of 0.1 mg/kg body weight. The Canadian authorities used the reference dose to establish the ***maximum residue limit*** (MRL) of 20 µg DA/g (20 ppm) shellfish (i.e., the threshold or guidance level) for domoic acid, the highest level that is tolerated in or on food for human consumption. The MRL was developed based on an average serving of shellfish (300 grams, approximately 0.7 pounds) for a person with a body weight of 60 kilograms (approximately 132 pounds). See Table 2 for a walk through of the action level calculation.

Health and Welfare Canada established 20 µg DA/g tissue (20 ppm) above which shellfish commercial operations should be closed. At present, this level has also been adopted by the U.S.[31], European Union, New Zealand, and Australia.

Action level adjustment for Dungeness crab viscera

In 1993, new data was presented in a memo[32,33] to the Health Hazard Evaluation Board (Board) at the U.S. Department of Health and Human Services suggested the tolerable level of domoic acid, applied to whole crab, was unnecessarily stringent. The Board agreed that a better estimate of consumption

23 Toyofuku 2006, available at: http://www.sciencedirect.com/science/article/pii/S0025326X06002797
24 Pulido 2008, available at: http://www.mdpi.com/1660-3397/6/2/180/htm
25 Lewitus et al. 2012, available at: http://www.sciencedirect.com/science/article/pii/S1568988312001175
26 US FDA, 2011. Available at: http://www.fda.gov/downloads/Food/GuidanceRegulation/UCM251970.pdf
27 Department of Health and Human Services. 1993a, available at: http://www.oceansciencetrust.org/wp-content/uploads/2016/07/DA_Crabs_93.pdf
28 Toyofuku, 2006, available at: http://dx.doi.org/10.1016/j.marpolbul.2006.07.007.
29 Pulido, 2008, available at: http://www.mdpi.com/1660-3397/6/2/180/htm
30 Todd, 1993, available at: http://www.marearoja.cl/IMG/pdf/AMNESIC_SHELLFISH_POISON_REVIEW_BLOOM_CANADA_1987.pdf
31 US FDA, 2011, available at: http://www.fda.gov/downloads/Food/GuidanceRegulation/UCM251970.pdf
32 Department of Health and Human Services. 1993a, available at: http://www.oceansciencetrust.org/wp-content/uploads/2016/07/DA_Crabs_93.pdf
33 Department of Health and Human Services. 1993b, available at: http://www.oceansciencetrust.org/wp-content/uploads/2016/07/DA_Crab.pdf

of Dungeness crab is to assume that one person consumes one whole crab in any one meal, which is (on average) equal to eating 300 grams of crabmeat, and 150 grams of crab viscera (in other words, a crab contains more meat than viscera). Therefore, since less viscera is consumed, a higher level of domoic acid is tolerated in the viscera. The FDA subsequently raised the action level for Dungeness crab viscera from 20 ppm to 30 ppm.

Table 2. Walking through the domoic acid action level calculation.

Value	Units	Toxicity Description	Supporting Date
1	mg domoic acid /kg tissue	**Lowest observed adverse effect level** (LOEL): this was the lowest dose amount that resulted in observable symptoms in one of 10 patients during the 1987 outbreak in Canada	Data from patients in the 1987 outbreak in Canada (Perl et al. 1990 ; Todd 1992; Toyofuku 2006)
0.1	mg domoic acid/kg tissue	**Acute reference dose:** the maximum acceptable oral dose of a toxic substance. "Acute" refers to a short term (single exposure) period or event. *Calculation: This was calculated by applying a precautionary safety factor of 10 to the LOEL above (i.e., 1mg/kg divided by 10). This level was then converted into an allowable level in shellfish tissue.*	
300	g	Average weight of shellfish consumed during the 1987 outbreak event	
60	kg	Average human body weight used to set the action level	
6	mg domoic acid	Acute dose for 60 kg person *Calculation: 0.1 mg/kg domoic acid * 60 kg body weight*	
20	mg domoic acid / kg shellfish tissue	Action level implemented in Canada and adopted internationally, including in California and the U.S. *Calculation: 6 mg acute dose divided by 300 g shellfish multiplied by 1000 (to convert to kg)*	

- ***What are the current criteria for opening and closing the Dungeness crab fishery based on the domoic acid action levels?***

Table 3. Dungeness crab season opening and closing criteria (as of August 2016).

	Seafood Testing Requirement
Season Opening Criteria	All crab collected during pre-season quality testing from each area (minimum of six), tested individually, have viscera levels of less than 30 ppm domoic acid. Each port has 2 or more sampling areas, depending on the geographical size of the fishing area it covers. Currently, three or more crab have to test above the limit to delay opening the fishery (see below)
Closing Criteria	3 or more crab viscera (of 6) from one area ≥30 ppm *or* 1 of 6 crabs with meat ≥ 20 ppm domoic acid. *Note: As of August 2016, the Tri-State Dungeness Crab Committee is updating the criteria related to closing so that closing and opening criteria are consistent.*
Re-opening Criteria	2 sets (6 crabs per set) collected one week apart, with all viscera samples testing below 30 ppm domoic acid

- ***Where can information be found on California's current domoic acid monitoring plans? What plan do other West Coast states adhere to?***

Dungeness Crab Monitoring Plan

CDPH adopted the Washington Department of Health's protocol "Strategy for Preventing Consumer Exposure to Domoic Acid from Dungeness Crab,"[34] with some variances in implementation (Table 4). The Washington Department of Health's protocol was reviewed and approved by the FDA and conforms to the U.S. Environmental Protection Agency (EPA) standards[35]. The Oregon Department of Agriculture (ODA) and CDPH have also adopted this protocol, although California samples more frequently then set forth in the Washington protocol.

The current protocol is under review by the West Coast states that are working with the Tri-State Dungeness Crab Committee[36] to make sure rational and justifiable standards are applied across the three states. The committee is composed of state agency, processor, and fishermen representatives from each state. The protocol will be posted on agency web sites when that process is completed.

Bivalve and Phytoplankton Monitoring Plans

CDPH maintains specific protocols for bivalve shellfish sampling and phytoplankton sampling procedures. Sampling plans for commercial bivalve shellfish aquaculture areas are contained in the management plans for each area.CDPH also has a biotoxin contingency plan for bivalve shellfish in compliance with the National Shellfish Sanitation Program guidelines. For more information on any of these documents contact EMB's biotoxin information line at 1-800-553-4133, or email redtide@cdph.ca.gov.

- ***Where are the domoic acid biotoxin monitoring sites in California?***

Commercial Bivalve Aquaculture/ Recreational bivalves

Commercial bivalve shellfish aquaculture sampling sites are based on active harvest locations. In some shellfish growing areas additional sentinel mussel stations may be established as early warning sites, typically near the entrance to the bays and estuaries used for shellfish production. Recreational bivalve shellfish sampling locations are representative of the region with respect to biotoxin exposure. Other factors include the ease of public access and safety of access to the intertidal zone, and of course the presence of significant shellfish resources.

CDPH monitors all five commercial bivalve shellfish aquaculture sites in the state year round, some with multiple sampling locations, and over 100 coastal sites.

Maps of bivalve shellfish and phytoplankton sampling locations can be found in the annual biotoxin reports located here: http://www.cdph.ca.gov/HealthInfo/environhealth/water/Pages/Shellfishreports.aspx

Commercial Finfish

When sampling is initiated because of an indicator(s) present (see Box 1), samples of commercial finfish, such as anchovy, will be obtained by CDPH FDB or CDFW when landed. Locations can vary as the fish population moves; CDFW block numbers are recorded for each catch sampled.

Dungeness and Rock Crab

When sampling is initiated because an indicator(s) is present (see Box 1), CDPH will monitor and test Dungeness and rock crab samples from up to 19 ports with multiple sampling locations: Mission Bay, Oceanside, Newport Beach, San Clemente, San Nicolas, LA/Long Beach, King Harbor, Ventura, Santa Barbara, Channel Islands, Avila, Morro Bay, Monterey, Half Moon Bay/SF, Bodega Bay, Fort Bragg, Eureka, Trinidad, Crescent City.

Dungeness and rock crab are also sampled in the same places and locations as the preseason crab quality testing (see section *What is the process for testing Dungeness and rock crab for domoic acid in advance of the season opener?*).

34 Washington State Department of Public Health, 2008, available at: http://www.ifrfish.org/wp-content/uploads/2016/02/Crab-DA-Monitoring-Plan-2008-2009.pdf

35 USEPA. 2000. Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories: Volume 1, Fish Sampling and Analysis, 3rd Ed. EPA 823-B-00-007

36 Under the Pacific States Marine Fisheries Commission Dungeness Crab Tri-state process, the three state Fish and Wildlife agencies consult on issues affecting the commercial Dungeness crab fishery.

Table 4. Dungeness crab domoic acid sampling strategy comparison between the three West Coast states. (Tri-State Dungeness Crab Committee, May 2016)

	WASHINGTON	OREGON	CALIFORNIA
DOMOIC ACID ACTION LEVEL / VISCERA	30 ppm	30 ppm	30 ppm
DOMOIC ACID ACTION LEVEL / MEAT	20 ppm	20 ppm	20 ppm
NUMBER OF CRAB PER SAMPLE	six legal size male crab	6-8 legal size male crab	six legal male crab preferred; sub-legals and females secondary
DEPTH STRATA	Best reflect current fishing activity; Shallow (5 - 15 fms) Deep (30-45 fms) or as directed by WDOH	5-10 fa, 15 fa, 30 fa, 45 fa or as directed by ODA	Best reflect current fishing activity; Shallow (15 fms), Mid (25-30 fms) Deep (45 fms)
CLOSURE CRITERIA FOR VISCERA	3 of 6 crab with viserca ≥ 30 ppm or 1 crab with viscera ≥ 80 ppm	3 of 6 crab with viserca ≥ 30 ppm or 1 crab with viscera ≥ 80 ppm (ODA currently trying to get FDA guidance)	3 of 6 crab with viserca ≥ 30 ppm
CLOSURE CRITERIA FOR MEAT	1 of 6 crab with meat ≥ 20 ppm	1 of 6 crab with meat ≥ 20 ppm	1 of 6 crab with meat ≥ 20 ppm
REOPENING CRITERIA	Reopening a zone requires two (2) consecutive sets of crab samples, not less than seven (7) days apart, with all crab in each sample, testing below 30 ppm in the viscera	Reopening a zone requires two (2) consecutive sets of crab samples, not less than seven (7) days apart, with all crab in each sample, testing below 30 ppm in the viscera, or 20 ppm in meat	Reopening a zone requires two (2) consecutive sets of crab samples, not less than seven (7) days apart, with all crab in each sample, testing below 30 ppm in the viscera
NORMAL SAMPLING FREQUENCY	Monthly or as directed by WDOH	Started coastwide monthly sampling in May 2016	During Pre-season quality testing or as directed by CDPH
TRIGGER FOR EXPANDING SAMPLING FREQUENCY	Increased domoic acid levels in razor clam samples as directed by WDOH	Increased domoic acid levels in razor clam samples as directed by ODA	Developing DA-producing HAB, increasing DA levels in mussels/seafood samples, as directed by CDPH
EXPANDED SAMPLING FREQUENCY	10 days to 2 weeks or as directed by WDOH	Bimonthly or as directed by ODA	1-2 weeks depending on DA concentration
GEOGRAPHIC SAMPLING AND CLOSURE ZONES	Five Zones; WA/OR Border to Pt. Chehalis; PT. Chehalis to Destruction Is.; Destruction Is. to US/Canada Border; Grays Harbor; Willapa Bay	Six Offshore Zones: Astoria, Garibaldi, Newport, Charleston, Port Orford and Brookings. Bays and Columbia River as directed by ODA	Up to 20 Port areas with multiple sampling locations (depending on area of the bloom): Mission Bay, Oceanside, Newport Beach, San Clemente, San Nicolas, LA/Long Beach, King Harbor, Ventura, Santa Barbara, Channel Islands, Avila, Morro Bay, Monterey, Half Moon Bay/SF, Bodega Bay, Fort Bragg, Eureka, Trinidad, Crescent City

The number of ports sampled during a given biotoxin event is based on the geographic extent of the bloom (Table 2)[37]. CDFW used the existing pre-season crab quality test sites as a baseline with input from CDPH and modified some of these areas, e.g. Mendocino County to San Mateo County to get more complete coverage. Each port has two or more sampling locations to ensure adequate representation of the areas where the respective species are typically fished. Additional areas may be sampled for other species (e.g., shrimp).

- ***How were the Dungeness crab sites selected?***

Dungeness crab sampling locations from Half Moon Bay northward were determined by CDFW, based on previous experience with the annual preseason sampling for meat quality and domoic acid levels. Sampling sites south of Half Moon Bay for Dungeness and rock crab were determined with input from the industry and based on the location of the crab resources and hence the greatest fishing activity. Sampling locations were selected to represent the nearshore fishery, as well as the fishery offshore around the northern Channel Island chain.

- ***How frequently are biotoxin sites sampled? What determines how frequently sampling occurs?***

Dungeness and Rock Crabs

Prior to season opening for Dungeness crabs, samples are collected for domoic acid toxin testing during the meat quality testing. Although not required, preseason meat quality testing has occurred in the southern region for informational purposes only. In addition, domoic acid levels have also been tested in this region during the same time period. If the season has opened, sampling can be initiated mid-season if a bloom is observed and/or other indicator(s) are present (see Box 1). If sampling indicates high levels of toxin are present in crab samples, bi-weekly to weekly testing occurs. Sampling frequency may be decreased or delayed if there is continued bloom activity in an area tied with recent crab samples testing well above the action level.

For rock crab, since the season is open year round, testing is only implemented when a bloom is observed and/or other indicator(s) are present (see Box 1). Depending upon the overlap in presence of the indicators with fishing grounds, monitoring may occur monthly under low toxicity conditions, with sampling increasing as toxin concentrations in rock crab tissue and viscera increase. Sampling occurs weekly or bi-weekly when a fishery closure is in place, based on the prevailing levels of domoic acid being found in the samples. Previous sampling efforts show that extremely high levels of domoic acid will not clear from the system of the crabs within a week. Therefore, when crabs are still testing high, bi-weekly sampling was considered appropriate. However, when sampled crabs within an area are nearing the action level, weekly sampling was considered appropriate. These sampling time frames are subject to weather conditions. As of July 2016, CDPH continues domoic acid testing for rock crab since the commercial and recreational rock crab fisheries remain closed north of Pigeon Point.

Due to previous sampling and testing efforts along the West Coast, along with independent research on the depuration ("clearing") rate of domoic acid in Dungeness crab[38], it is known that the toxin is not likely to clear from crab meat and viscera within a week or two if samples have been consistently testing well above the action level and there is still a toxic bloom present in the water. As samples start approaching the action level, more frequent testing will be conducted to ensure that the health advisories can be lifted as soon as it is safe to do so. Inclement weather and adverse ocean conditions can significantly delay sample collection. When the fishery was closed this year, sampling frequency was determined, in part, by weather and the ability of fishermen to go out and collect samples.

Razor Clams

Razor clams are a high-risk species since they appear to handle domoic acid differently than other bi-valves, some holding on to the toxin for over a year even in the absence of a bloom. Razor clam samples are requested by the CDPH Marine Biotoxin Monitoring Program from local CDFW biologists and program volunteers when routine coastal mussel and phytoplankton monitoring indicates the presence of a toxin or a potential toxic bloom developing. When a toxin is detected in razor clams, sampling is increased as tides and ocean conditions allow. The frequency of sample collection is based on the availability of adequate low tides. Twice per month is the greatest frequency and in some months the tides or inclement weather will not support any sampling. Due to the ability of razor clams to retain domoic acid for considerable periods of time (months to over a year), sampling frequency may be decreased until toxin concentrations decline closer to the action level.

37 Source: Tri-State Dungeness Crab Committee, May 2016

38 Lund et al., 1997, available at: http://www.ifrfish.org/wp-content/uploads/2015/11/Domoic-Acid-Update-and-Deputation-in-Dungeness-Crab.Wekellpdf.pdf

Additional species

Marine mammal strandings, mass seabird die-offs, or other environmental factors indicative of an offshore bloom may trigger extra sampling in designated areas, or sampling of a localized species, despite the lack of current biotoxin activity (See Box 1).

Opportunistic sampling of other species may be done for public health protection in consultation with CDFW, Tribal representatives, or local county health departments. CDPH works with CDFW to determine what species are being fished in an area, and then collect species at the dock for testing to ensure public health before that product makes it to the market for human consumption.

- ***How is spacing of sites considered?***

Bivalve Shellfish

Sampling locations representing recreational harvest areas for bivalve shellfish can vary from one to several sites per coastal county, depending on the number of suitable access points and available program participants. Commercial bivalve shellfish growing areas are sampled intensively, with each major growing area having several locations in close proximity sampled at least weekly.

Dungeness and rock crab

Dungeness crab sampling locations are based on those used by CDFW for pre-season assessment of quality and previous domoic acid sampling. Sites are representative of the fishery range, with multiple sites sampled per landing port. Sampling locations are also selected to be representative of different depths and distance from shore. Rock crab sampling locations are selected based on resource location and are representative of CDFW fishing blocks located nearshore and offshore around islands such as the Channel Islands, Catalina, etc.

- ***How are samples collected within a site (distance, including buffer zones)? Does sampling control for potential differences in domoic acid levels between male and female Dungeness crabs?***

Bivalves

Recreational bivalve shellfish samples are collected as low as possible in the intertidal zone while ensuring the safety of the collector. Sentinel mussel stations are preferably located subtidally to represent maximum exposure to toxin-producing phytoplankton. Commercial bivalve shellfish samples are representative of current harvest locations and can include multiple species (mussels, oysters, and clams).

Dungeness and rock crab

Crab samples are obtained along transect lines predetermined by CDFW. Samplers are required to stay within one mile of the transect coordinates. Three different depths are sampled along the transect. At each depth two samples are collected, for a total of six crabs. The priority is on the collection of legal-sized male crabs since take of only males are allowed in the commercial fishery. If inadequate numbers are available, then a sample may be supplemented with female and/or undersized crab to ensure an adequate sample size. There is no scientific information to suggest differences in toxicity between male and female Dungeness crabs.

- ***How is domoic acid detected in seafood samples? How are the samples processed during testing (i.e., are whole crabs homogenized in seawater or freshwater? Are viscera tested separately from crab tissue?)?***

CDPH uses the most accepted regulatory method for detecting domoic acid in seafood, which is a reversed-phase high performance liquid chromatographic (HPLC) method with ultraviolet (UV) detection[39]. This method is approved by AOAC International and FDA. The CDPH Food and Drug Laboratory has a reporting limit of 2.5 micrograms per gram of tissue (µg/g or parts per million [ppm]). There is also an AOAC International approved enzyme-linked immunosorbent assay (ELISA) for the detection of domoic acid in mussels, oysters and clams. This method has not been validated for crab tissue or other seafood species.

Crab viscera are analyzed separately from the meat. Samples are not diluted in either freshwater or seawater. Crabs are steamed so as not to be contaminated by the cooking medium, and each crab is individually wrapped in foil to avoid any cross-contamination during steaming. The homogenized tissue is mixed with a solvent (methanol) to extract any domoic acid that is present. This extract is then analyzed by the HPLC method mentioned above.

39 Dhoot et al., 1993, available at: http://www.cdph.ca.gov/pubsforms/Documents/fdbSSdaMeth.pdf

▪ *How long does it take to process crab samples once they have been received by CDPH?*

During pre-season testing samples are processed with sufficient time to recommend opening or closing of the fishery for Dungeness crab. Once the Dungeness crab or other fishery is closed or, for fisheries like rock crab that are open year round, the following process and timeline is typical:

1. **Sample request**
   (approximate time = 1 – 2 days, weather and availability of fishermen permitting)

   CDFW staff contact volunteer fishermen and request samples from the areas of interest. If the fishermen are not in port, it can take a day or two to connect with them to make the request. After contact, CDFW sets the sampling schedule and specifying sampling date window, location, and disposition of samples.

2. **Sample collection**
   (approximate time = 1 – 5 days, conditions permitting)

   Fishermen or CDFW staff collects samples as permitted by CDFW and as ocean conditions, scheduling, and mechanical issues allow. Sometimes fishermen freeze and retain samples overnight depending on when they return to shore (0-1 days). Samples are delivered directly to CDPH lab in Richmond, California or a local CDFW field office.

3. **Samples shipped and delivered to CDPH lab**
   (approximate time = 2 – 5 days, depending on day of the week samples are brought to CDFW offices for shipping)

   If samples are brought/delivered to a CDFW office, the samples are frozen and packaged and shipped within one business day depending upon the time received. If a sample was received on Friday, it is often not shipped until the following Monday to ensure viability of frozen sample(s) upon arrival (i.e., if shipped on a Friday, samples may sit in an office at CDPH and thaw out until they open Monday morning) (0-4 days, depending on time and day received). Once samples are shipped they are in the mail and received by CDPH the next day (1 day).

4. **Laboratory toxicity testing and results available**
   (approximate time = 2 – 4 days)

   Once CDPH receives the sample(s), they run laboratory tests for domoic acid, run quality assurance testing, and post the results online (2-3 days; max 4 days). The only time that CDPH does not turn specific samples around within 2-3 days is when certain blocks of samples were prioritized for testing over other samples, even if they had been received first. Samples are given priority for the following reasons:

   - Samples for areas that had a clean test the previous week and therefore a second set of clean crabs would result in opening the fishery in that area.
   - Samples for areas where crabs from the previous week were at or near the action level of 30 ppm for viscera and/or 20 ppm for meat.

   The rationale for prioritizing of certain blocks of samples is to test those for which an area might be opened (already had one week of clean samples) or for those which might have their first set of clean samples (previous samples had been near action level). By prioritizing these sample sets, CDPH ensure areas that can be opened are opened as quickly as possible while also prioritizing sample sets that could give fishermen an indication that they may be able to fish an area in the near term should the area test clean again the following week. Additionally, even if a sample set is delayed due to de-prioritization, it was still processed before the second set of samples, thus not delaying the opening of a clean area.

▪ *How are government agencies responding to the 2015/16 shellfishery closures in California (e.g., Dungeness and rock crab, razor clam)?*

CDPH has and continues to deliberate with counterparts in Oregon, Washington, and the FDA to discuss the recent unprecedented domoic acid event and potential modifications to future monitoring and regulatory efforts. Currently, this effort is taking the form of CDPH and CDFW participating in the Tri-State Dungeness Crab Committee work group meeting to discuss potential changes in sampling criteria and decision criteria, as well as to consider alternatives for managing impacted fisheries. The goal is for all three West Coast states to agree upon and utilize the same sampling and operating standards.

In addition, in early 2016, the Ocean Protection Council convened the HAB Task Force, composed the following members:

- **Sonke Mastrup**, California Department of Fish and Wildlife
- **Susan Ashcraft**, California Fish and Game Commission
- **Patrick Kennelly**, California Department of Public Health

- **Gregg Langlois**, California Department of Public Health (retired)
- **Susan Klasing**, Office of Environmental Health Hazard Assessment
- **Valerie Termini**, California Fish and Game Commission
- **Jenn Phillips**, California Ocean Protection Council

The HAB Task Force requested that Ocean Science Trust develop this FAQ document, as well as convene an Ocean Protection Council Science Advisory Team (SAT) working group[40] to provide scientific guidance on ways to the State's existing HAB and biotoxin monitoring in California. In addition, during the winter of 2016-17, the HAB Task Force will work together to review and update standard operating procedures (SOP) that will be utilized by the agencies responsible for oversight of public health and the fisheries.

40 More information on the SAT working group can be found here: http://www.oceansciencetrust.org/project/harmful-algal-blooms-and-california-fisheries/

III. Health and Seafood Safety Concerns

- ***After consumption of crab meat, is toxin accumulation additive if multiple crabs are eaten? In other words, if toxin levels are below the threshold of concern, but still >0 PPM, how many crabs or pounds of crab meat are safe to eat for an average adult, a child, or an elderly person?***

  Because the action level is based on limited data and does not estimate levels for sensitive populations such as the fetus and young children, the threshold between safety and non-safety is not precise enough to make detailed recommendations for specific populations. The original action level was based on a consumption of 250 - 300 grams (about 8 ounces) at which negative impacts were observed to human health. OEHHA recommends limiting consumption of seafood that tests positive for domoic acid, but at levels below the action level, to 8 ounces, and less than that for children. OEHHA also recommends that guts (viscera) not be consumed during a domoic acid event. Additionally, consumers can consider it best practice to not consume the viscera at any time since this is where the majority of the toxin is present in the crab.

- ***What are the long-term effects of low levels of domoic acid exposure?***

  It is not known whether repeated exposure over several days, months or years will make someone more susceptible to the toxic effects of domoic acid. Researchers have explored the effects of low-level domoic acid exposure in sea lions[41] and zebrafish[42,43]. This work suggests repetitive, low-level exposure could contribute to chronic health consequences. However, there are still significant gaps in knowledge of the health effects of chronic exposure.

  Researchers are working to better understand responses in humans. An ongoing study funded by the National Institute of Health is looking at domoic acid neurotoxicity in native Americans in the Pacific Northwest[44].

- ***Do some fished species accumulate domoic acid toxin more than others?***

  Research into this question is currently underway by researchers at Oregon Department of Fish and Wildlife, as well as California Sea Grant Extension program.

- ***What is known about angler exposure to domoic acid via consumption of contaminated fishes?***

  A study conducted by California Sea Grant measured domoic acid in 11 fish species targeted by Santa Cruz Wharf anglers in Monterey Bay, California, USA, and sur-veyed anglers regarding their fish consumption patterns[45]. In this geographically limited study, results suggested that anglers who consume their catch are exposed to asymptomatic domoic acid doses, and that exposure is a function of the species and parts consumed, as well as storage methods and domoic levels in the seawater when the fish are caught.

For additional questions on human health and consumer safety concerns, see California Sea Grant's FAQ report *Natural Biotoxins in California Crabs: Domoic Acid, Frequently Asked Questions on Human Health, Fishery Closures, and Biotoxins in Crabs*[46].

41 Goldstein et al., 2008: http://www.sciencedirect.com/science/article/pii/S1568988313000139#bib0065
42 Lefebvre et al., 2012: http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0036213
43 Hiolski et al., 2015, available at: http://www.ncbi.nlm.nih.gov/pubmed/25033243
44 More information on this work http://tools.niehs.nih.gov/portfolio/index.cfm/portfolio/grantDetail/grant_number/R01ES012459
45 Mazzillo et al., 2010, available at: http://www.int-res.com/articles/feature/b009p001.pdf
46 California Sea Grant's FAQ report https://caseagrant.ucsd.edu/sites/default/files/Biotoxins-SU16-FAQ-v2.pdf

Table 5. Overview of jurisdiction and roles of the various state bodies involved in California's fishery and seafood toxin management.

Agency / Body	Jurisdiction / Mission	Authority / Role
California Department of Public Health, Food and Drug Branch	Protect and improve the health of all California residents by assuring that food, drugs, medical devices and certain other consumer products are safe for public consumption and use	• Seafood monitoring • Sample commercial fisheries such as Dungeness crab, rock crab, and anchovies. • Communication with OEHHA toxicologists when dangerous levels of toxin are detected • Regulate human food supply (ensure products in marketplace are safe for human consumption) • Laboratory toxin testing
California Department of Public Health, Environmental Management Branch	Seeks to create a safer environment through advanced public health protection	• Manage the Marine Biotoxin Monitoring Program for bivalve shellfish • Bivalve shellfish biotoxin sampling and monitoring • Phytoplankton monitoring
California Department of Fish and Wildlife	Responsible for implementing regulations as set forth by the Fish and Game Commission and State Legislature	• Director has authority to open or close the commercial Dungeness crab fishery in the event of toxic substances upon recommendation of the public health agencies (CDPH and OEHHA) • Engage in preseason Dungeness crab testing
California Fish and Game Commission	Manage the recreational Dungeness crab fishery	• Authority to open or close the recreational Dungeness crab fishery in the event of toxic substances upon recommendation of the public health agencies
California State Legislature	Manage and regulate the commercial Dungeness crab fishery	• Authority to regulate the fishery including setting seasons, size limits, management boundaries, etc. • Establish limited entry and trap limit programs • Set permit fees and tax rates • Establish advisory bodies
Office of Environmental Health Hazard Assessment	Protect and enhance public health and the environment by scientific evaluation of risks posed by hazardous substances	• Advise CDPH on human health risk and then consult with CDPH Director, if necessary to advise CDFW and FGC to close or re-open an affected commercial or recreational fishery when action levels are exceeded or fall below action levels, respectively
Tri-state Dungeness Crab Committee, Pacific States Marine Fisheries Commission	Consult on issues affecting the commercial Dungeness crab fishery in California, Oregon and Washington	• Create opportunity for West Coast states to collaborate and coordinate on common sampling protocols and best practices

IV. California's Fishery and Seafood Toxin Management

- ***What agency leads California's seafood biotoxin monitoring and sampling programs, and how are these programs funded?***

As the shellfish control authority for California, CDPH manages the State's marine biotoxin monitoring program. CDPH is responsible for ongoing bivalve shellfish (e.g. mussels) and phytoplankton monitoring, and does a limited amount of environmental sampling for other seafood species (e.g., crab, lobster). These samples are largely volunteer-based and help inform the program of offshore events that may not be detected at nearshore sampling stations. When dangerous levels of toxin are detected in recreationally-harvested species, EMB will issue a health advisory for the affected species and region. If commercial bivalve shellfish aquaculture is impacted, CDPH EMB will implement a harvest closure until toxin concentrations decline to safe or undetectable levels. CDPH FDB is responsible for processing the samples of commercial fisheries species such as Dungeness crab, rock crab, and anchovies.

There are no dedicated funding sources for domoic acid monitoring in California. As events occur, limited support is provided by the redirection of General Funds from other programs to cover the necessary activities.

- ***What are the roles of the California government agencies and state bodies with regard to HAB response, monitoring, and fisheries management?***

See table 2 for an overview of the various state bodies involved in California's fishery and seafood toxin management.

Bivalve shellfish sampling for biotoxin testing is organized by CDPH EMB's Biotoxin Monitoring Program. Monitoring of other commercial seafood species is coordinated by both CDPH FDB and CDFW. The testing is done at CDPH laboratories in Richmond, California, the only NSSP-certified laboratory in California that can conduct biotoxin analysis for regulatory purposes relative to human health impacts.

When dangerous levels of toxin are detected in commercial seafood, CDPH FDB communicates with toxicologists in the Office of Environmental Health Hazard Assessment (OEHHA), who determine the risk to human health. The OEHHA Director consults with the CDPH Director before recommending to the CDFW and the Fish and Game Commission (FGC) to close the affected commercial or recreational fishery, respectively.

During the 2015-2016 domoic acid event, CDFW worked closely with CDPH and OEHHA to determine when and where fisheries could safely be sampled and reopened.

- ***How do HAB and fishery management measures in California, specifically for domoic acid and Dungeness crab, link to what is being done in Oregon and Washington?***

Regulatory issues that affect more than one state's fishery are negotiated through the Tri-State Dungeness Crab Committee coordinated by the Pacific States Marine Fisheries Commission (PSMFC). The Committee comprises one member from each state management agency, each with five industry advisors, and is chaired by the PSMFC. The committee signed an interstate Memorandum of Understanding (MOU, 1996) stating that all three state management agencies will develop consistent and complementary management actions for Dungeness crab.

The current crab monitoring plan "Strategy for Preventing Consumer Exposure to Domoic Acid from Dungeness Crab," developed by Washington State and implemented, with some variances in California and Oregon is under review by the West Coast states working with the Tri-State Dungeness Crab Committee to make sure rational and justifiable standards are applied in the three states.

- ***How does Dungeness crab management differ between the recreational and commercial sector, and what is the rationale for this difference?***

The commercial Dungeness crab fishery is managed by the State Legislature, while the recreational fishery is managed by the FGC. Unlike most of our other major commercial fisheries, the Legislature has not delegated its management authority to the FGC, in part because the industry has opposed it.

CDFW is responsible for enforcement of regulations for both fisheries. However, when it comes to public health, regulations state that the Director of CDFW has the authority to close a commercial fishery when CDPH issues a health advisory and the Director of OEHHA, in consultation with the Director of CDPH, recommends closure of a fishery to ensure public health. SB1287 has a provision to give the Director of CDFW more authority in the recreational fishery should an event like this occur again. As of July 2016, SB1287, is currently being considered in the State Legislature.

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) exempts the Dungeness crab fishery from the requirement of a federal fishery management plan (FMP). Instead, it authorizes the States of California, Oregon and Washington to adopt and enforce state laws and regulations governing Dungeness crab fishing and processing in the federal exclusive economic zone adjacent to each state. Under the MSA, California, Oregon and Washington have jurisdiction over their respective permit holders and permit conditions (such as gear and seasons), as well as control over conditions for making landings within a state.

- ***What do differences in Dungeness crab management between the commercial and recreational sectors mean for opening and closing of each sector? (i.e., Why did the commercial sector have to wait while the sport sector was opened?)***

While commercial Dungeness crab management is typically under the authority of the California State Legislature, the FGC Code section 7715[47] currently gives the Director of CDFW authority to open or close the commercial fishery in the event of toxic substances upon recommendation of the public health agencies. Otherwise, all regulatory authority lies with the California State Legislature. The FGC has regulatory authority over the recreational fishery and does not need directive from CDPH and/or OEHHA to close a fishery under their jurisdiction due to public health or other concerns.

During the 2015-16 Dungeness crab fishery closures, the commercial and recreational sectors had requested the CDFW allow approximately one week notice before opening the commercial fishery to allow commercial fishermen time to gear up, and to allow recreational fishermen time to fish before commercial crabbers dropped their gear. Current law requires the FGC to open the recreational fishery immediately upon being notified by the health agencies that a health risk no longer exists. Logistically, the FGC must also come together to meet in person in order to decide upon opening a fishery, which can also cause delays in the opening of the recreational fishery. Emergency regulations[48] also stipulated that fisheries open in an orderly fashion, and an effort was made to avoid opening the recreational fishery in a patchwork manner, with some contiguous counties open while others were not.

With regards to the commercial Dungeness crab fishery, the State initially consulted with some members of the commercial industry (via the DCTF, and later in the season through the DCTF public calls) at the start of the regular season in October 2015 when the first samples came back above the action level for domoic acid. At this time, some members of the industry stated that their desire was to open the fishery coast-wide, rather than in sections, with the caveat that they would reconsider this request if the domoic problem persisted for a long period[49]. When the problem did persist longer-term, with crabs testing above the domoic acid action level well into the 2015-16 crabbing season, it became evident that delaying season until the whole coast could be opened might result in no areas of the fishery being opened at all. Some members of the fishing industry began requesting that the State consider opening traditional management areas of the fishery rather than delaying until the whole coast could be opened. There was not consensus among fishermen in these regions as to which management option was preferred[50].

As sampling areas began having crabs decrease in toxin levels, nearing the action level, CDPH would inform CDFW. CDFW and CDPH worked collaboratively to identify enforceable boundaries for the area to be opened while ensuring their were sufficient buffer zones to account for crab mobility. If there were data gaps within that particular geographic area, CDPH and/or CDFW would request and process extra samples from an area not previously sampled to ensure no crabs were found with elevated levels of domoic acid. If the first data gap verification sample set was clean, CDPH did not require a second set.

In addition, the fair start statute (FGC Code Section 8279.1) that prevents permit holders who had fished in other states or locations in California from fishing for 30 days from the start of the delayed season opener, was applicable to the domoic acid fishery delay.

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47 Fish and Game Code section 7715. (a) If the Director of Environmental Health Hazard Assessment, in consultation with the State Director of Health Services, determines, based on thorough and adequate scientific evidence, that any species or subspecies of fish is likely to pose a human health risk from high levels of toxic substances, the Director of Fish and Game may order the closure of any waters or otherwise restrict the taking under a commercial fishing license in state waters of that species. Any such closure or restriction order shall be adopted by emergency regulation in accordance with Chapter 3.5 (commencing with Section 11340) of Part 1 of Division 3 of Title 2 of the Government Code. (b) Any closure or restriction pursuant to subdivision (a) shall become inoperative when the Director of Environmental Health Hazard Assessment, in consultation with the State Director of Health Services, determines that a health risk no longer exists. Upon making such a determination, the Director of Environmental Health Hazard Assessment shall notify the Director of Fish and Game and shall request that those waters be reopened for commercial fishing.

48 Emergency regulations for Dungeness and rock crab are posted here: https://www.wildlife.ca.gov/Conservation/Marine/Invertebrates/Crabs

49 Dungeness crab Task Force Executive Committee letter: http://www.opc.ca.gov/webmaster/_media_library/2009/04/DCTF_EC_FINAL_DAMemo_Nov2015.pdf

50 Letters from the fishing community:
http://www.opc.ca.gov/webmaster/ftp/project_pages/dctf/ec-meeting-15/DCTF-EC-DAMemo-FINAL-Feb2016.pdf
http://www.opc.ca.gov/webmaster/ftp/project_pages/dctf/ec-meeting-15/HMBSMA-CDFW-2-15-16.pdf
http://www.opc.ca.gov/webmaster/ftp/project_pages/dctf/ec-meeting-15/DomoicLetter-CCEurTrin-Feb2016.pdf
http://www.opc.ca.gov/webmaster/_media_library/2009/04/crab2016.pdf

- ***What is the process for testing Dungeness and rock crab for domoic acid in advance of the season opener? When will domoic acid testing for the 2016-17 season commence?***

In advance of season opener for Dungeness crab in 2016, CDFW, Washington Department of Fish and Wildlife, and Oregon Department of Fish Wildlife conduct a test fishery in the area from Point Arena California to the U.S. Canadian border for meat quality and yield to inform commercial Dungeness crab season opening date(s)[51]. During this time, six additional crab samples are also collected from each site and shipped to CDPH laboratories in Richmond, California for domoic acid testing. While quality testing is not required in the southern region of California, crabs are also taken from the area south of Point Arena for domoic acid testing and meat quality (for informational purposes only) during this same time period.

As of August 5, 2016, the date for commencement of pre-season crab testing has not been set. The criteria in Box 1 will help determine the exact time, with consultation with public health agencies and industry[52].

In California, preseason testing typically occurs in late October and November of each year. However, during the 2015-16 season, the preseason testing for domoic acid was initiated in September. This was a joint decision of the CDFW based on high domoic acid levels observed during the summer months, and the concerns voiced by some crab fishermen. CDPH agreed to process the samples and began designing a sampling plan in collaboration with CDFW.

The 2015-16 sampling was conducted coast-wide from Crescent City to Santa Barbara and the Northern Channel Islands (as opposed to Half Moon Bay and northward, which is the case in a typical year), and included domoic acid testing for both Dungeness and rock crab, in their respective fishery ranges, and testing continued on a near weekly basis through July (the end of the Dungeness crab season). As of July 2016, CDPH continues domoic acid testing for rock crab since the commercial and recreational rock crab fisheries remain closed north of Pigeon Point.

CDFW staff and leadership are currently determining an appropriate time to begin preseason testing for the 2016-17 season based on CDPH data. Preliminary observations from CDPH phytoplankton sampling (as of late June 2016) suggest that *Pseudo-nitzschia*, the species responsible for domoic acid production, may be present in high concentrations along portions of the California coast, though this does not always mean that domoic acid levels will be elevated in seafood. Contact Pete Kalvass, Senior Environmental Scientist Supervisor at California Department of Fish and Wildlife with additional questions about preseason testing (Peter.kalvass@wildlife.ca.gov).

There are challenges associated with preseason testing sampling for domoic acid. First, preseason testing relies largely on the efforts of commercial fishermen volunteers able and willing to collect samples at the various ports on their own vessels. These fishermen often incur the cost of sample collection (time, crew, and operational expenses), though in recent years the crabs collected during preseason quality testing have been allowed to be sold to pay for some of the expenses associated with crab quality testing only. In addition, there are chain-of-custody procedure requirements that may necessitate an on-board observer on sample collection vessels. In the future, if extensive sampling efforts are required (additional sites, samples, and species) as was the case in 2015, this method of sample collection may not be a long-term solution.

Because rock crab is open year round, toxin testing will begin when or if any of the indicators in Box 1 are present in the same region as rock crab fishing grounds, or during the preseason testing for Dungeness crab (which was the case in 2015), and on recommendation of CDPH.

- ***Why was a "two clean test" system required most of the time and a "one-test" system at other times? Describe CDFW's rationale for opening the District 10 line without the two consecutive clean tests required elsewhere.***

The standard requirement to re-open a closed Dungeness crab fishery due to elevated toxin levels in California is two consecutive clean tests: two sets (6 crabs per set) collected at a site one week apart, with all viscera samples testing below 30 ppm and meat testing below 20 ppm domoic acid. (Note: CDPH did not test both meat and viscera in most situations because once one of the crab viscera samples tested above 30 ppm, the levels in the meat did not make a difference. If samples were testing very high (>90 ppm) in the viscera, CDPH did test domoic acid levels in some of those meat samples.)

However, there were two instances (in Sonoma and Trinidad locations) where the health agencies, in consultation with CDFW, recommended opening an area to crab fishing without the "two clean test" system. There were several factors that went into the adaptive management decisions that led the health agencies to conclude that they could confidently assume that all crab in the area were below the federal domoic acid action levels in both meat and viscera and therefore safe for entering the marketplace.

51 The preseason crab testing protocol is available here: http://www.psmfc.org/crab/2013_FINAL_PreSeasonTestingProtocol.pdf

52 Pete Kalvass, Senior Environmental Scientist Supervisor, CDFW, personal communication

Both Sonoma and Trinidad locations had the same sampling history:

- One week of all six crabs tested well below the action levels,
- immediately followed by one week where five of the six crabs tested well below the action level, and one crab tested above the action level (but in the 30 ppm range) ;
- followed by one week where all crabs tested well below the action level again.
- Additionally, the two sampling locations immediately above and below these areas had also been testing well below the action levels for several weeks.

Because of this sample history, the health agencies determined that it would be safe to open the fishery in these areas without conducting and testing another round of samples. The health agencies would not have made this recommendation if any one crab had tested well above the action level or if any of the "clean" crabs in the sample had tested near the action level, rather than in the low 20s or below. Similarly, they would like have not made this recommendation if the areas immediately north and south had not also been testing consistently clean, thus assuring that crab moving in and out of the fished area were also safe for consumption.

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CALIFORNIA FISH AND GAME COMMISSION
DECISION LIST FOR REGULATORY ACTION THROUGH JUN 23, 2016
Revised 08-10-2016

FGC - California Fish and Game Commission **DFW** - California Department of Fish and Wildlife **WRC** - Wildlife Resources Committee **MRC** - Marine Resources Committee

Grant: FGC is *willing to consider* the petition through a process **Deny:** FGC is *not willing to consider* the petition **Refer:** FGC *needs more information* before deciding whether to grant or deny the petition

Green cells: Referrals to DFW for more information
Lavender cells: Accepted and moved to a rulemaking
Blue cells: Referrals to FGC staff or committee for more information
Yellow cells: Current action items

Tracking No.	Date Received	Response Due (10 work days)	Response letter to Petitioner	Accept or Reject	Name of Petitioner	Subject of Request	Code or Title 14 Section Number	Short Description	Staff Recommendation	FGC Decision
2016-013	6/22/2016	7/7/2016	7/7/2016	A	April Wakeman	Use of cast nets	28.80	Permit use of cast nets south of Point Conception for consistency in all state marine waters.	*REFER to DFW for evaluation and recommendation.*	RECEIPT: 6/22-23/2016 **ACTION: Scheduled 8/24-25/16**

2016-013

Tracking Number: (~~Click here to enter text.~~)

To request a change to regulations under the authority of the California Fish and Game Commission (Commission), you are required to submit this completed form to: California Fish and Game Commission, 1416 Ninth Street, Suite 1320, Sacramento, CA 95814 or via email to FGC@fgc.ca.gov. Note: This form is not intended for listing petitions for threatened or endangered species (see Section 670.1 of Title 14).

Incomplete forms will not be accepted. A petition is incomplete if it is not submitted on this form or fails to contain necessary information in each of the required categories listed on this form (Section I). A petition will be rejected if it does not pertain to issues under the Commission's authority. A petition may be denied if any petition requesting a functionally equivalent regulation change was considered within the previous 12 months and no information or data is being submitted beyond what was previously submitted. If you need help with this form, please contact Commission staff at (916) 653-4899 or FGC@fgc.ca.gov.

SECTION I: Required Information.

Please be succinct. Responses for Section I should not exceed five pages

1. **Person or organization requesting the change (Required)**
   Name of primary contact person: April Wakeman, The Sportfishing Conservancy
   Address: [redacted]
   Telephone number: [redacted]
   Email address: [redacted]

2. **Rulemaking Authority (Required)** - Reference to the statutory or constitutional authority of the Commission to take the action requested: Regulation requested to be amended: Title 14 Section 28.80 Authority: Pursuant to Fish and Game Code section 200, power is "delegated to the commission…to regulate the taking or possession of birds, mammals, fish, amphibian, and reptiles…"

3. **Overview (Required)** - Summarize the proposed changes to regulations: Regulations provide that cast nets may only be used north of Point Conception and specify certain species that may be taken by cast net by recreational anglers. We request that: cast nets be allowed in all state marine waters.

4. **Rationale (Required)** - Describe the problem and the reason for the proposed change: There appears to be no rationale for the distinction between using cast nets north or south of Point Conception. While we anticipate use of cast nets to be mostly limited to private boaters, cast nets are appropriate for only certain species. We request that regulatory authority be expanded to cover all of these species. At this time commercial bait boats generally use massive seine nets to harvest these same species. The cast net impact would be limited as currently recreational fishermen would acquire [though not as easily] the same bait by fishing sabiki rigs, squid jigs, brailles, dip nets, or by purchase from the bait haulers.

SECTION II: Optional Information

5. **Date of Petition: June 23, 2016**

6. **Category of Proposed Change**
   ☒ Sport Fishing
   ☐ Commercial Fishing
   ☐ Hunting
   ☐ Other, please specify: Click here to enter text.

7. **The proposal is to:** (*To determine section number(s), see current year regulation booklet or https://govt.westlaw.com/calregs*)
   ☒ Amend Title 14 Section(s):28.80 *Dip nets of any size and baited hoop nets not greater than 36 inches in diameter may be used to take herring, Pacific staghorn sculpin, shiner surfperch, surf smelt, topsmelt, anchovies, shrimp and squid~~. Hawaiian-type throw nets may be used north of Point Conception to take such species.~~*
   ☐ Add New Title 14 Section(s): Click here to enter text.
   ☐ Repeal Title 14 Section(s): Click here to enter text.

8. **If the proposal is related to a previously submitted petition that was rejected, specify the tracking number of the previously submitted petition** Click here to enter text.
   Or ☒ Not applicable.

9. **Effective date**: If applicable, identify the desired effective date of the regulation.
   If the proposed change requires immediate implementation, explain the nature of the emergency: Click here to enter text.

10. **Supporting documentation:** Identify and attach to the petition any information supporting the proposal including data, reports and other documents: Click here to enter text.

11. **Economic or Fiscal Impacts:** Identify any known impacts of the proposed regulation change on revenues to the California Department of Fish and Wildlife, individuals, businesses, jobs, other state agencies, local agencies, schools, or housing: There should be no or minor cost to DFW and would reduce costs of anglers south of Point Conception. Should the department incur costs in implementing this regulation a license stamp similar to the 2nd Rod Stamp could be used to cover those costs.

12. **Forms:** If applicable, list any forms to be created, amended or repealed:
    Click here to enter text.

SECTION 3: FGC Staff Only

Date received: Click here to enter text.

FGC staff action:

RECEIVED AT

JUN 22 2016

COMMISSION MEETING
AGENDA ITEM 2

- ☒ Accept - complete
- ☐ Reject - incomplete
- ☐ Reject - outside scope of FGC authority

Tracking Number

Date petitioner was notified of receipt of petition and pending action: July 6, 2016

Meeting date for FGC consideration: August 24-25, 2016

FGC action:

- ☐ Denied by FGC
- ☐ Denied - same as petition _____

  Tracking Number
- ☐ Granted for consideration of regulation change

CALIFORNIA FISH AND GAME COMMISSION
DECISION LIST FOR NON-REGULATORY ACTION THROUGH JUN 23, 2016
Revised 08-10-2016

FGC - California Fish and Game Commission **DFW** - California Department of Fish and Wildlife **WRC** - Wildlife Resources Committee **MRC** - Marine Resources Committee

Date Received	Name of Petitioner	Subject of Request	Short Description	Staff Recommendation	FGC Decision
4/7/2016	Brandt Stickle	Frolic Cove abalone	Request comprehensive survey of abalone in Frolic Cove in order to reconsider restoring the northern boundary of Point Cabrillo State Marine Reserve to its original 2013 boundary.	*DENY; DFW's abalone staff resources are dedicated to red abalone fishery management plan along the north coast.*	RECEIPT: 6/22-23/2016 **ACTION: Scheduled 8/24-25/2016**
4/12/2016	Neal Maloney Morro Bay Oyster Co.	Add species to state water bottom lease	Request to add Kumamoto oysters (*Crassostrea sikamea*), Olympic oysters (*Ostrea lurida*) Pismo clam (*Tivela stultorum*), seaweed (*Gracilaria andersonii* and *Gracilariia pacifica)* to current lease (No. M-614-01, Parcel 2)	*REFER to DFW and FGC staff for evaluation and recommendation.*	RECEIPT: 6/22-23/2016 **ACTION: Scheduled 8/24-25/2016**
2/3/2016	Devon Harger Neushul Mariculture	Transfer state water bottom lease	Request to transfer current state water bottom lease No. M-654-03 from Neushul Mariculture to PharmaSea, LLC, owned by Daniel Marquez.	*GRANT; scheduled for consideration at August 2016 meeting.*	RECEIPT: 6/22-23/2016 **ACTION: Scheduled 8/24-25/2016**
6/22/2016	Butch Powers	Permit transferability	Verbal request for MRC to schedule discussion of permit transferability of deeper nearshore and shallow nearshore permits.	*GRANT; support MRC recommendation to schedule for November 2016 MRC meeting.*	RECEIPT: 6/22-23/2016 **ACTION: Scheduled 8/24-25/2016**

LAW OFFICES OF
HOGAN & STICKEL, INC.
811 NORTH MAIN STREET
P.O. BOX 1286
FORT BRAGG, CALIFORNIA 95437
(707) 961-4400
FAX (707) 961-4410

RECEIVED
CALIFORNIA
FISH AND GAME
COMMISSION
2016 APR 18 PM 3:55
MLS

BRANDT R. STICKEL, JD, LLM

LARRY FLORES, CPA

April 7, 2016

Commissioner of the Department
of Fish and Wildlife
1416 Ninth Street
Sacramento, CA 95814

Dear Sir:

I am writing to request that the Department of Fish and Wildlife re-survey Frolic Cove and restore the northern boundary of Point Cabrillo State Marine Reserve to its original boundaries prior to 2013.

It is not clear to me why the Department determined the abalone fishery in Frolic Cove to be endangered. I live in the residential community of Caspar South, which borders Point Cabrillo Light Station Park. I have dived Frolic Cove regularly for ten years. In the year before the closure, I counted 40 abalone in the course of swimming across the Cove. The abalone were accessible, although you certainly had to search for them.

Now that MPA's and MMA's have been opened to transit for access to open areas, I resumed swimming in Frolic Cove to access the otherwise inaccessible cove directly north of Frolic Cove. I did so this last weekend, and observed abalone are flourishing in Frolic Cove. Within ten feet of the north tideline I observed six full-size abalone in three to four feet of water, and many more beyond. Obviously, the abalone did not reproduce overnight to grow to life size. Last year, I observed a full-size abalone clinging to the end of a kelp stock several feet from the bottom! They have been there all along, but now have spread out.

It is hard for me to understand how a comprehensive survey of Frolic Cove could have suggested that resident abalone population was threatened. The simple fact of the matter is Frolic Cove never was heavily dived by abalone divers.

In sum, I would request Frolic Cove be re-surveyed. I am sure it will lead to the same observations I have made and that the Cove be restored for taking abalone.

Very truly yours,

Brandt R. Stickel

cc: Dept. of Fish & Wildlife (Fort Bragg)

From:	[redacted]
To:	FGC
Cc:	Ramey, Kirsten@Wildlife
Subject:	Consideration for the addition of species to DFW Lease M-614-01 Parcel 2
Date:	Tuesday, April 12, 2016 12:54:46 PM
Attachments:	SpeciesRequest2016.docx

Executive Director,
I am sending the attached letter as a formal request to add the various species that I have listed. I currently farm Pacific Oysters (C. gigas), however, I have a desire to add these species so that we can have more viable options for the success of our business. Thank you for your time and concern on this matter and would love to discuss this further with you at your convenience.

Neal Maloney
Morro Bay Oyster Company

Executive Director
Fish and Game Commission
PO Box 944209
Sacramento, CA 94244-2090
fgc@fgc.ca.gov

April 12th, 2016

RE: Addition of selected species to Morro Bay Oyster Company's Lease M-614-01, #2.

This is a request that the following species be added to our lease:

Oysters

--Kumamoto oysters (Crassostrea Sikamea)

--Olympic oysters (Ostrea Lurida) – Indigenous

Growing methods will be a combination of the same ones we currently use; long line, floating culture, bottom culture and modified self tipping rack and back.

Clams

--Pismo Clam (Tivela Stultorum) – Indigenous

Growing method: No plans for planting yet, growing methods would need more research but most likely planted in sediment and covered with mesh to keep predation out.

Seaweed

--Gracilaria Andersonii - Indigenous

--Gracilariia Pacifica – Indigenous

Growing methods: Harvest of wild stock on the lease, additional grow out in above ground tanks at our land based facility, 1287 Embarcadero. Morro Bay CA 93442. Possible sea pens at our Land based facility that would allow natural flow of seawater through mesh.

If you have any questions or need additional information, please let us know.

Regards,

Neal Maloney

January, 2016

Fish and Game Commission

P. O. Box 944209

Sacramento, CA 94244-2090

Cc: Kirsten.ramey@wildlife.ca.gov

RE: Neushul Mariculture, Inc. Lease site M-654-03

Dear Fish and Game Commission,

I would like to transfer Lease site M-654-3 to Daniel Marquez's company, Pharmasea, LLC. Would you please add this item to the agenda for consideration at the next Commisson meeting.

Sincerely,

Devon Harger

Neushul Mariculture, Inc.

[redacted]

CEA

CAREER EXECUTIVE ASSIGNMENT

The California Fish and Wildlife
Invites you to apply for a

Career Executive Assignment
for Deputy Executive Director, Fish and Game Commission, CEA A
(Sacramento)

Final Filing Date – August 31, 2016
(Application must be postmarked by this date.)
SALARY RANGE: $6,353-$9,277

POSITION INFORMATION

Position Description: The Deputy Executive Director, Fish and Game Commission, CEA A, under the general direction of the Executive Director, serves as a member of the California Fish and Game Commission (Commission) Executive Leadership Team to aid in a wide range of capacities. The Deputy Executive Director focuses on the implementation of administrative priorities for the Commission; aids the Executive Director and the Commission in long-term planning for the Commission and is responsible for overall meeting preparation and meeting deadlines. The Commission conducts its business at six meetings a year, which are strategically located throughout the State to encourage public outreach and participation. In addition, the Commission currently has three committees that each meets three times per year.

Additionally, the Deputy Executive Director:

- Aids in planning of a wide range of California fish and wildlife issues, which are controversial in nature and have legal implications;
- Represents the Executive Director at meetings as needed;
- Helps to develop, organize, coordinate and manage the development of the Commission strategic planning effort, which will set priorities for all of California's fish and wildlife;
- Directs the activities of a professional staff including supervision and management of Commission staff workloads and tasks;
- Assists in other projects as assigned or as needed at the discretion of the Executive Director.
- Aids in the development of regulations for the California's fish and wildlife resources, including, but not limited to;
    - Using the best available scientific information to best inform Commissioners regarding habitat conservation and ecosystem-based management needs of fish and wildlife;
    - Providing background information to Commissioners in an effort to aid Commissioners making complex public policy and biological decisions on behalf of the people of California;
    - Addressing non-native species importation, possession, and sale;
    - Listing and delisting of threatened and endangered species under the California Endangered Species Act; and
    - Establishing and regulating uses of protected lands and waters such as wildlife areas, ecological reserves and marine protected areas.

REQUIREMENTS FOR ADMITTANCE TO THE EXAMINATION

Minimum Qualifications for Admittance:

All applicants must possess the knowledge and abilities, and any other requirements, described in this bulletin.

NOTE: Eligibility to take a CEA exam does not require current permanent status in the civil service.

Knowledge and Abilities:

Applicants must have the ability to perform high administrative and policy influencing functions effectively. Such overall ability requires possession of most of the following more specific knowledge and abilities:

Knowledge of:
The organization and functions of California State Government including the organization and practices of the Legislature and the Executive Branch; principles, practices, and trends of public administration, organization, and management techniques of organizing and motivating groups; program development and evaluation; methods of administrative problem solving; principles and practices of policy formulation and development; personnel management; equal employment opportunity and anti-discrimination programs.

Ability to:
Plan, organize, and direct the work of multi-disciplinary professional and administrative staff; analyze administrative policies, organization, procedures, and practices; integrate the activities of a diverse program to attain common goals; gain the confidence and support of top level administrators and advise them on a wide range of administrative matters; develop cooperative working relationships with representatives of all levels of government, the public and the Legislature and Executive Branches; analyze complex problems and recommend effective courses of action; prepare and review reports; and effectively contribute to the Department's equal employment opportunity objectives.

These knowledge and abilities are expected to be obtained from the following kinds of experience with substantial participation in the formulation, operation and/or evaluation of program policies (experience may have been paid or volunteer; in State service, other government settings, or in a private organization):

CEA Level A. Responsible for board administrative and program activities, including the execution and/or evaluation of program policies.

STATEMENT OF QUALIFICATIONS

Desirable Qualifications (Screening Criteria):

Please submit a Statement of Qualifications which includes the following information:

- Knowledge of California's hunting, fishing, and environmental laws and regulations, ecosystem methodologies, and fish and wildlife programs, and the Commission's overall mission;
- Knowledge of Department of Fish and Wildlife programs, policies and procedures;
- Knowledge of supervisory practices and techniques;
- Demonstrated knowledge and experience in personnel, budgetary, purchasing and other fiscal procedures;
- Ability to interpret and apply State and federal natural resource and fish and game laws;
- Demonstrated ability to develop and implement program policies and procedures;
- Demonstrated ability to supervise a subordinate professional, para-professional and administrative support staff;

- Ability to establish program goals and objectives supporting strategic plans;
- Demonstrated ability to identify problems, evaluate alternatives, and implement effective solutions;
- Ability to communicate effectively orally and in writing;
- Demonstrated ability to work on controversial topics while remaining neutral;
- Work effectively and positively in a team environment;
- Possession of a Master's Degree in public administration, environmental policy, environmental science, natural science, wildlife or fisheries management, business economics, or a related field; and
- Six or more years of experience in the administration and development of natural resource or conservation programs in which he/she was responsible for the day to day operations and decision making, including two years of personnel management.

Type of Examination: This examination consists of an application and Statement of Qualifications screening process with examination interviews conducted, if necessary, for those applicants meeting the pre-determined screening criteria listed above. Candidates must obtain a minimum rating of 70% to obtain list eligibility. Candidates are notified in writing of his/her results. The Director may conduct hiring interviews before a selection is made.

FILING INSTRUCTIONS

Filing Instructions: **INTERESTED APPLICANTS MUST SUBMIT:**

- **A COMPLETED STANDARD STATE APPLICATION (FORM 678).**
- **A "STATEMENT OF QUALIFICATIONS".**
- **THE STATEMENT SHOULD CLEARLY INDICATE "STATEMENT OF QUALIFICATIONS" AT THE TOP OF THE PAGE AND BE ORGANIZED USING THE SCREENING CRITERIA IN THE ORDER GIVEN ABOVE. THE STATEMENT SHOULD BE TYPED AND NO MORE THAN TWO PAGES IN LENGTH. THE STATEMENT DOCUMENTS YOUR EDUCATION, TRAINING, EXPERIENCE, SKILLS AND YOUR ABILITY TO PRESENT INFORMATION CLEARLY AND CONCISELY IN WRITING. INCLUDE IN YOUR STATEMENT OF QUALIFICATIONS SPECIFIC EXAMPLES OF YOUR EXPERIENCE THAT DEMONSTRATE EACH OF THE SCREENING CRITERIA FACTORS.**
- **PLEASE NOTE THAT THE EXAMPLES YOU PROVIDE IN THE STATEMENT OF QUALIFICATIONS MAY BE THE ONLY TOOL USED FOR DETERMINING YOUR FINAL SCORE AND RANK ON THE ELIGIBLE LIST.**
- **RESUMES DO NOT TAKE THE PLACE OF THE STATEMENT OF QUALIFICATIONS.**
- **APPLICANTS NOT SUBMITTING A STATEMENT OF QUALIFICATIONS WILL BE DISQUALIFIED FROM THIS EXAMINATION.**

Where to Mail: The State Examination/Employment Application (Std. 678) and Statement of Qualifications must be **RECEIVED** or **POSTMARKED by the U.S. Postal Service no later than the final filing date. Applications POSTMARKED, PERSONALLY DELIVERED, OR RECEIVED VIA INTER-OFFICE MAIL, after the final filing date of August 31, 2016 will not be accepted.** Applications and Statement of Qualifications may be filed in person or by mail at

Department of Fish and Wildlife
Attention: Exam Unit
1416 Ninth Street, Room 1217-B
Sacramento, CA 95814

How to Get an Application: Obtain a State Examination/Employment Application (Std. 678) at Employment Development Department (EDD) offices, at Department of Fish and Wildlife offices, or download the form from https://jobs.ca.gov/Public/StateForms.aspx

Accommodations for Persons with Disabilities: If you have a disability and need special testing arrangements, mark the appropriate box in Part 2 of the Examination/Employment Application. The Exam Unit will contact you to make specific arrangements.

Length of List Eligibility: The results of this examination may be used to fill subsequent vacancies in this position within the next twelve months. However, the Commission may elect to consider new applicants in addition to those previously screened.

General Information: If you meet the requirements stated in this bulletin, you may take this examination, which is competitive. Possession of the entrance requirements does not assure a place on the eligible list. Your performance in the examination described on this bulletin will be compared to the performance of others who take this exam, and all candidates who pass will be ranked according to their scores.

The Commission reserves the right to revise the examination plan to better meet the Commission's needs if the circumstances under which this examination was planned change. Such revision will be in accordance with civil service laws and rules and all competitors will be notified.

General Qualifications: Candidates must possess essential personal qualifications including integrity, initiative, dependability, good judgment, and ability to work cooperatively with others.

QUESTIONS

If you have any questions concerning this CEA examination or the testing process, please contact Tanya Bell, Personnel Analyst with the Department of Fish and Wildlife, Human Resources Branch at (916) 653-8120.

California Relay (Telephone) Service for the deaf or hearing impaired
From TDD phones: 1-800-735-2929
From voice phones: 1-800-735-2922

THE DEPARTMENT OF FISH AND WILDLIFE PROVIDES EQUAL EMPLOYMENT OPPORTUNITIES TO ALL REGARDLESS OF AGE, ANCESTRY, COLOR, DISABILITY (MENTAL AND PHYSICAL), EXERCISING THE RIGHT TO FAMILY CARE AND MEDICAL LEAVE, GENDER, GENDER EXPRESSION, GENDER IDENTITY, GENETIC INFORMATION, MARITAL STATUS, MEDICAL CONDITION, MILITARY OR VETERAN STATUS, NATIONAL ORIGIN, POLITICAL AFFILIATION, RACE, RELIGIOUS CREED, SEX (INCLUDES PREGNANCY, CHILDBIRTH, BREASTFEEDING AND RELATED MEDICAL CONDITIONS), AND SEXUAL ORIENTATION. IT IS THE OBJECTIVE OF THE STATE OF CALIFORNIA TO ACHIEVE A DRUG-FREE STATE WORK PLACE. ANY APPLICANT FOR STATE EMPLOYMENT WILL BE EXPECTED TO BEHAVE IN ACCORDANCE WITH THIS OBJECTIVE BECAUSE THE USE OF ILLEGAL DRUGS IS INCONSISTENT WITH THE LAW OF THE STATE, THE RULES GOVERNING CIVIL SERVICE AND THE SPECIAL TRUST PLACED IN PUBLIC SERVANTS. APPLICANTS FOR STATE SERVICE ARE EXPECTED TO BE DRUG-FREE.

Save the Date · 49th ANNUAL · 2016

NATIVE AMERICAN DAY

EDUCATION: BUILDING TOMORROW THROUGH TEACHINGS TODAY

Friday, September 23, 2016

West Steps · State Capitol · Sacramento

CULTURAL PRESENTATIONS:
10:00A.M. - 2:00P.M.

NATIVE AMERICAN ARTS & CRAFTS VENDORS OPEN:
9:00A.M. - 3:00P.M.

Host Tribal Sponsor: Central California Tribal Chairpersons' Association

Presented by:
Central California Tribal Chairpersons' Association
Northern California Tribal Chairmen's Association
Southern California Tribal Chairmen's Association
and the California State Tribal Liaisons

For Information: facebook.com/NativeAmericanDay
General Information: tribalpolicyadvisor@water.ca.gov
Arts and Crafts Vendors: Sharaya.Souza@NAHC.ca.gov

photo courtesy of
Shingle Springs Rancheria
Miwok Dance Group

California Fish and Game Commission
Staff Report on Staff Time Allocation and Accomplishments

August 12, 2016

Staff time is a tangible and invaluable asset. This report identifies where Commission staff allocated time to general activity categories (see table) and specific activities (see activities lists) during June and July 2016.

While the table below summarizes time allocation across all staff classifications, it should be noted that some classifications require a greater emphasis on certain categories than others. For example, the advisors spend up to 30% of their time on special projects due to committee project assignments, while regulatory analysts spend up to 70% of their time on regulatory program tasks.

General Allocation

Task Category*	June Staff Time	July Staff Time
Regulatory Program	15%	18%
Commission Meetings	31%	18%
Legal Matters	4%	5%
External Affairs	7%	7%
Special Projects	8%	14%
Administration	21%	17%
Leave Time	8%	16%
Unfilled Positions	12%	12%
Total Staff Time[1]	108%	106%

1- Total staff time is greater than 100% due to overtime

Activities for June 2016

- Prepared for and conducted two publically-noticed meetings (June 22 Tribal Committee and June 22-23 commission meetings)
- Began preparing for three publically-noticed meetings (July 12 Wildlife Resources Committee's Predator Policy Workgroup meeting, July 20 Fishing Communities Public Meeting and Discussion, and July 21 Marine Resources Committee meeting)
- Continued onboarding new executive director
- Oriented two new commissioners
- Participated in Marine Life Management Act planning meetings
- Participated in Fish and Game Preservation Fund meetings
- Participated in interagency calls and coordination efforts related to harmful algal blooms
- All staff participated in sexual harassment prevention training

Activities for July 2016

- Prepared for and conducted four publically-noticed meetings (July 12 Wildlife Resources Committee's Predator Policy Workgroup meeting, July 19 Commission emergency teleconference, July 20 Fishing Communities Public Meeting and Discussion, and July 21 Marine Resources Committee meeting)
- Began preparing for two publically-noticed meetings (August 24-25 Commission and September 21 Wildlife Resources Committee)
- Attended summer meeting of the Western Association of Fish and Wildlife Agencies
- Assisted in recruiting deputy executive director
- Participated in Fish and Game Preservation Fund meetings
- Participated in interagency calls and coordination efforts related to harmful algal blooms
- Participated in workshop for marine aquaculture in the Southern California Bight
- Began preparing for tribal co-management workgroup meeting
- All staff participated in security training (computer and personal information)

*** General Allocation Categories with Sample Tasks**

Regulatory Program

- Coordination meetings with DFW to develop timetables and notices
- Review and process CESA petitions
- Prepare and file notices, re-notices, ISORs and FSORs
- Prepare administrative records
- Track and respond to public comments
- Consult, research and respond to inquiries from OAL

Commission/Committee Meetings and Support

- Research and review practices and procedures for adaptive management
- Research and compile subject-specific information
- Review and develop policies
- Develop and distribute meeting agendas and materials
- Agenda and debrief meetings
- Prepare meeting summaries and audio files
- Maintain voting records
- Develop and distribute after-meeting memos/letters
- Make travel arrangements for staff and commissioners
- Conduct onsite meeting management
- Process submitted meeting materials
- Provide commissioner support (expense claims, office hours, etc.)
- Process and analyze regulatory petitions and non-regulatory requests

Legal Matters

- Respond to Public Records Act requests
- Process appeals and accusations
- Process requests for permit transfers
- Process kelp and state water bottom leases
- Litigation

External Affairs

- Engage and educate legislators, monitor legislation
- Maintain state, federal and tribal government relations
- DFW partnership, including joint development of management plans and concepts
- Website maintenance

Special Projects

- Predator Policy Workgroup
- Fishing from piers and jetties
- Fishing Communities
- Fisheries Bycatch Workgroup
- Streamline routine regulatory actions

Administration

- Correspondence
- Purchases and payments
- Contract management
- Personnel management
- Strategic planning
- Budget development and tracking
- Health and safety oversight
- Internal processes and procedures
- Staff training and professional development

Leave Time

- Holidays
- Sick leave
- Vacation or annual leave
- Jury duty
- Bereavement

Unfilled

- Executive secretary
- Deputy executive director

Commissioners
Eric Sklar, President
Saint Helena
Jacque Hostler-Carmesin, Vice President
McKinleyville
Anthony C. Williams, Member
Huntington Beach
Russell E. Burns, Member
Napa
Peter S. Silva, Member
Chula Vista

STATE OF CALIFORNIA
Edmund G. Brown Jr., Governor

Fish and Game Commission

Wildlife Heritage and Conservation
Since 1870

Valerie Termini, Executive Director
1416 Ninth Street, Room 1320
Sacramento, CA 95814
(916) 653-4899
www.fgc.ca.gov

MEETING OUTCOMES FOR JUNE 22-23, 2016

These meeting outcomes were finalized by staff on July 28, 2016.

The official meeting minutes – video and audio recordings – may be obtained from www.cal-span.org.

DAY 1 – JUNE 22, 2016

Pursuant to the call of the president, the California Fish and Game Commission (Commission) convened at the Bakersfield Elks Lodge #266, 1616 30th Street, Bakersfield, California on June 22, 2016. The meeting was called to order at 9:07 a.m. by President Eric Sklar.

A quorum was established:

Eric Sklar	**President**	**Present**
Jacque Hostler-Carmesin	**Vice President**	**Present**
Anthony C. Williams	**Member**	**Present**
Russell E. Burns	**Member**	**Present**
Peter S. Silva	**Member**	**Present**

President Eric Sklar introduced Executive Director Valerie Termini, who shared details about the meeting format and procedures, and invited the new Commission members, Pete Silva and Russ Burns, to introduce themselves. Commissioner Williams welcomed everyone to his hometown of Bakersfield. Valerie Termini also introduced Commission staff, legal counsel, and California Department of Fish and Wildlife (Department) staff.

1. Approve agenda and order of items

   The Commission approved the agenda and order of items as noticed.

   Ayes: R. Burns, J. Hostler-Carmesin, P. Silva, E. Sklar, A. Williams

   Noes: None

2. Public forum for items not on agenda

   No action taken.

3. Committee assignments

(A) Marine Resources

(B) Wildlife Resources

(C) Tribal

The Commission assigned P. Silva to the Marine Resources Committee, assigned R. Burns to the Wildlife Resources Committee, and retained existing assignments for E. Sklar on the Marine Resources Committee, A. Williams on the Wildlife Resources Committee, and J. Hostler-Carmesin on the Tribal Committee.

Ayes: R. Burns, J. Hostler-Carmesin, P. Silva, E. Sklar, A. Williams

Noes: None

4. Delegation of Commission president responsibilities in the absence of the president

The Commission selected Commissioner Williams to be presiding officer for any activities otherwise delegated to the president and vice president in the absence of the president and vice president, or their incapacity, and directed that the vice president attend Wildlife Conservation Board meetings in the absence of the president.

Ayes: R. Burns, J. Hostler-Carmesin, P. Silva, E. Sklar, A. Williams

Noes: None

CONSENT ITEMS

5. Receive white seabass fishery management plan annual review (Pursuant to Section 5.9, Fishery Management Plan)

6. Request for authorization to publish notice of intent to amend commercial hagfish regulations (Section 180.6, Title 14, CCR)

The Commission adopted the Consent Calendar, agenda items 5-6.

Ayes: R. Burns, J. Hostler-Carmesin, P. Silva, E. Sklar, A. Williams

Noes: None

7. Marine Resources Committee

(A) Work plan development

I. Update on work plan and draft timeline

II. Discuss and approve new topics

The Commission approved the draft agenda topics for the July 2016 Marine Resources Committee meeting and approved adding:

(1) an update on a tool developed by the Department in cooperation with the Ocean Protection Council's Science Advisory Team which helps to evaluate the risk of allowing scientific collecting in a marine protected area (MPA) relative to the goals of the MPA and any other collecting currently taking place in that MPA;

(2) the topic of marine debris and plastic pollution, including a recommendation on whether to formally oppose the initiative to overturn the state's plastic bag ban;

(3) an update from the Department's Marine Region on its review of the pending request for nearshore fishery permit changes; and

(4) the topic of the Commission potentially partnering with Pixar or others on a public service campaign about blue tang fish.

Ayes: R. Burns, J. Hostler-Carmesin, P. Silva, E. Sklar, A. Williams

Noes: None

Staff announced that the fishing communities public meeting has been moved to July 20 in Petaluma, the day before the Marine Resources Committee meeting.

8. Tribal Committee

(A) June 21, 2016, meeting summary
  I. Receive and adopt recommendations

(B) Work plan development
  I. Update on work plan and draft timeline
  II. Discuss and approve new topics

The Commission approved five recommendations from the June 21, 2016 Tribal Committee meeting related to:

(1) Requesting the Ocean Protection Council seek tribal government representation on the MPA Statewide Leadership Team.

(2) Additional training module for tribal exemptions in MPAs for the Department's Law Enforcement Division and increasing its interactions with tribal nations.

(3) Tribal ecological knowledge (TEK) language proposed for inclusion in the MPA master plan.

(4) Working with the Department on co-management definitions and strategies.

(5) Developing sub-committees or workgroups for the subjects of co-management and tribal committee legislation.

Ayes: R. Burns, J. Hostler-Carmesin, P. Silva, E. Sklar, A. Williams

Noes: None

9. Point Reyes Oyster Company

(A) Approve request to renew state water bottom lease M-430-13

(B) Approve request to renew state water bottom lease M-430-17

The Commission approved the state water bottom leases for a period of 15 years and determined that the approvals are exempt from the California Environmental Quality Act.

Ayes: R. Burns, J. Hostler-Carmesin, P. Silva, E. Sklar, A. Williams

Noes: None

10. Master Plan for Marine Protected Areas

    (A) Receive and provide direction concerning incorporation of information received related to traditional ecological knowledge

    (B) Adopt proposed final Master Plan for Marine Protected Areas and the Marine Life Protection Program pursuant to the Marine Life Protection Act (Pursuant to Section 2850, et seq., Fish and Game Code)

The Commission continued this item for possible adoption at its August 2016 meeting, with the expectation that by July 29 tribal councils would provide any input on the tribal ecological knowledge portion of the master plan. The Commission closed public comment on all other aspects of the master plan.

Ayes: R. Burns, J. Hostler-Carmesin, P. Silva, E. Sklar, A. Williams

Noes: None

11. Adopt proposed changes to spiny lobster sport and commercial fishing regulations (Section 29.80, et al., and Appendix A, Title 14, CCR)

The Commission adopted the proposed changes as recommended by the Department.

Ayes: R. Burns, J. Hostler-Carmesin, P. Silva, E. Sklar, A. Williams

Noes: None

12. Wildlife Prosecutor of the Year

    (A) Discuss and approve proposed policy

    The Commission adopted the proposed policy.

    Ayes: R. Burns, J. Hostler-Carmesin, P. Silva, E. Sklar, A. Williams

    Noes: None

    (B) Announce 2016 recipient

    The Commission selected Deputy District Attorney Matt Beauchamp as the 2016 Wildlife Prosecutor of the Year.

    Ayes: R. Burns, J. Hostler-Carmesin, P. Silva, E. Sklar, A. Williams

    Noes: None

13. Announce results from Executive Session

The Commission adopted the proposed decision regarding John A. Wilson's licenses and permits consistent with the settlement agreement reached by the parties.

14. Marine items of interest from previous meetings

(A) Update and direction for best management practices for state water bottom leases

(B) Update concerning proposed tribal take exemptions in marine protected areas

(C) Other

No action taken.

15. Marine petitions for regulation change and non-regulatory requests from previous meetings

(A) Action on petitions for regulation change

(B) Action on non-regulatory requests

(C) Update on pending petitions and requests referred to staff or the Department for review

The Commission approved the staff recommendations for actions on April 2016 regulatory petitions and non-regulatory requests.

Ayes: R. Burns, J. Hostler-Carmesin, P. Silva, E. Sklar, A. Williams

Noes: None

16. Other informational items

(A) Staff report

I. Update on crab closures due to domoic acid and future planning efforts

(B) Legislative update and possible action

(C) Federal agencies report

(D) Other

No action taken.

17. Department informational items

(A) Director's report

(B) Wildlife and Fisheries Division, and Ecosystem Conservation Division

(C) Law Enforcement Division

(D) Marine Region

(E) Other

No action taken.

The Commission recessed at 3:38 p.m. to reconvene on June 23, 2016 at 8:00 a.m.

DAY 2 – JUNE 23, 2016

Pursuant to the call of the president, the Commission reconvened at the Bakersfield Elks Lodge #266, 1616 30th Street, Bakersfield, California on June 23, 2016. The meeting was called to order at 8:10 a.m. by President Eric Sklar.

President Eric Sklar introduced two new commissioners, Russell Burns and Peter Silva, as well as the new executive director, Valerie Termini, who shared details about the meeting format and procedures. Commissioner Williams welcomed everyone to his hometown of Bakersfield. Valerie Termini also introduced Commission staff, legal counsel, and Department staff.

A quorum was established:

Eric Sklar	**President**	**Present**
Jacque Hostler-Carmesin	**Vice President**	**Present**
Anthony C. Williams	**Member**	**Present**
Russell E. Burns	**Member**	**Present**
Peter S. Silva	**Member**	**Present**

18. Public forum for items not on agenda

    No action taken.

CONSENT ITEMS

19. Approve UC Merced request to add transgenic zebrafish to its Restricted Species Permit No. 3054
    (Pursuant to Section 671.1(a)(8), Title 14, CCR)

20. Receive the Department's one-year status report on the petition to list Townsend's big-eared bat (*Corynorhinus townsendii*) as an endangered species
    (Pursuant to Section 2075, Fish and Game Code)

21. Receive the Department's one-year status report on the petition to list Livermore tarplant *(Deinandra bacigalupii)* as an endangered species
    (Pursuant to Section 2075, Fish and Game Code)

22. Approve proposed Duck Stamp projects for Fiscal Year 2016-17

23. Receive and approve initial Private Lands Wildlife Habitat Enhancement and Management Area (PLM) plans and 2016-2021 licenses for:
    (Pursuant to Section 601, Title 14, CCR)

    (A) Long Prairie Farms (Siskiyou County)
    (B) Red Rock Valley Farms (Siskiyou County)
    (C) Sky Rose Ranch, LLC (Monterey County)

24. Receive and approve annual PLM plans and 2016-2021 licenses for:
    (Pursuant to Section 601, Title 14, CCR)

(A) 3D Ranch (Tehama County)
(B) Alexander Ranch (Monterey County)
(C) Alexandre Ecodairy Farms (Mendocino County)
(D) Amann Ranch (Mendocino County)
(E) Ash Valley Ranch (Lassen County)
(F) Avenales Ranch (San Luis Obispo County)
(G) Big Bluff Ranch (Tehama County)
(H) Big Lagoon PLM (Humboldt County)
(I) Camp 5 Outfitters-Roth Ranch PLM (Monterey and San Luis Obispo counties)
(J) Capistran Ranch (Mendocino County)
(K) Carley Ranch (Mendocino County)
(L) Carnaza Ranch (San Luis Obispo County)
(M) Carrizo Ranch (San Luis Obispo County)
(N) Chimney Rock Ranch (San Luis Obispo County)
(O) Christensen Ranch (Mendocino County)
(P) Clark and White Ranch (San Luis Obispo County)
(Q) Connolly and Corral Hollow Ranch (San Joaquin County)
(R) Cottrell Ranch (Humboldt County)
(S) Diamond C Outfitters (Humboldt County)
(T) D-Rafter-“L” Ranch, LLC (San Luis Obispo County)
(U) Five Dot Ranch-Horse Lake (Lassen County)
(V) Five Dot Ranch-Tunnel Springs (Lassen County)
(W) Five Dot Ranch-Willow Creek (Lassen County)
(X) Four Pines Ranch (Mendocino County)
(Y) Fulton Ranch (Humboldt County)
(Z) Hartnell Ranch (Monterey County)
(AA) Hearst Ranch (San Luis Obispo County)
(BB) Hunter Ranch (Humboldt County)
(CC) Jerusalem Creek Ranch (Shasta County)
(DD) JS Ranch (Shasta County)
(EE) Klamath PLM (Humboldt County)
(FF) Lewis Ranch (San Benito County)
(GG) Llano Seco Ranch (Butte County)
(HH) Lookout Ranch (Modoc County)
(II) Mendiboure Ranch (Lassen County)
(JJ) Miller-Eriksen Ranch (Mendocino County)
(KK) Morisoli Ranch (Monterey and San Benito counties)
(LL) Pepperwood Springs Ranch (Humboldt County)
(MM) Potter Valley Wildlife Management Area (Mendocino County)
(NN) Rainbow Ridge PLM (Humboldt County
(OO) Red Rock Ranch (Lassen County)
(PP) Redwood House Ranch (Humboldt County)
(QQ) Roberts Ranch (Modoc County)
(RR) Roostercomb Ranch (Stanislaus County)
(SS) Schneider Ranch (Mendocino County)
(TT) SL Ranch (Modoc County)
(UU) Smith River PLM (Humboldt County)
(VV) Spring Valley Ranch (Mendocino County)
(WW) Stackhouse Ranch (Shasta County)
(XX) Stewart Ranch (Trinity County)

(YY) Stover Ranch (Humboldt County)
(ZZ) Summer Camp Ranch (Mendocino County)
(AAA) Tejon Ranch (Kern and Los Angeles counties)
(BBB) Temblor Ranch (San Luis Obispo and Kern counties)
(CCC) Travis Ranch (Trinity County)
(DDD) Trinchero Ranch (San Benito County)
(EEE) Wiggins Ranch (Humboldt County)
(FFF) Work Ranch (Monterey County)

25. Receive and approve five-year PLM plans and 2016-2021 licenses for: (Pursuant to Section 601, Title 14, CCR)

(A) Buckeye Ranch (Solano County)
(B) DE Francesco & Eaton Ranch (Merced County)
(C) Dixie Valley Ranch (Lassen County)
(D) Indian Valley Cattle Company-Lombardo Ranch (Monterey County)
(E) Lone Ranch (San Benito County)
(F) Peachtree Ranch (Monterey County)
(G) R-R Ranch (Mendocino County)
(H) Rancho La Cuesta (San Benito County)
(I) Roseburg Resources Pondosa (Siskiyou County)
(J) Salt Creek Ranch (Tehama County)
(K) Shamrock Ranch (Mendocino)
(L) Triple B Ranch (Shasta County)

The Commission adopted the Consent Calendar, agenda items 19-25.

Ayes: R. Burns, J. Hostler-Carmesin, P. Silva, E. Sklar, A. Williams

Noes: None

26. Wildlife Resources Committee

(A) May 18, 2016, meeting summary
I. Receive and adopt recommendations
(B) Work plan development
I. Update on work plan and draft timeline
II. Discuss and approve new topics

The Commission directed staff to add to the Wildlife Resources Committee (WRC) work plan a discussion about the Hatchery and Inland Fisheries Fund.

The Commission approved the recommendations from the May 2016 WRC meeting and directs staff to not add any more reviewers to the Predator Policy Workgroup.

Ayes: R. Burns, J. Hostler-Carmesin, P. Silva, E. Sklar, A. Williams

Noes: None

27. Consider the petition, Department's evaluation report, and comments received to determine whether listing the northern spotted owl (*Strix occidentalis caurina*) as a

threatened or endangered species is warranted
(Pursuant to Sections 2075 and 2075.5, Fish and Game Code)

The Commission continued this item to its August 2016 meeting.

Ayes: R. Burns, J. Hostler-Carmesin, P. Silva, E. Sklar, A. Williams

Noes: None

28. Adopt proposed changes to Commission meeting procedures regulations
(Section 665, Title 14, CCR)

The Commission adopted the proposed changes as presented.

Ayes: R. Burns, J. Hostler-Carmesin, P. Silva, E. Sklar, A. Williams

Noes: None

29. Adopt proposed regulations to establish a nonlead coupon program
(Add Section 250.2, Title 14, CCR)

The Commission adopted the proposed changes as presented.

Ayes: R. Burns, J. Hostler-Carmesin, P. Silva, E. Sklar, A. Williams

Noes: None

30. Request for authorization to publish notice of intent to amend falconry regulations
(Section 670, Title 14, CCR)

The Commission continued this item to its August 2016 meeting.

The Commission requested that additional potential amendments to falconry regulations that are not included in the current initial statement of reasons be discussed by WRC.

31. Request for authorization to publish notice of intent to amend nongame animal regulations (Section 472, Title 14, CCR)

The Commission authorized publication of the notice as presented.

Ayes: R. Burns, J. Hostler-Carmesin, P. Silva, E. Sklar, A. Williams

Noes: None

32. Request for authorization to publish notice of intent to amend upland game bird special hunt drawing regulations (Section 702 and add Section 715, Title 14, CCR)

The Commission authorized publication of the notice as presented.

Ayes: R. Burns, J. Hostler-Carmesin, P. Silva, E. Sklar, A. Williams

Noes: None

33. Discuss proposed changes to upland game bird hunting regulations (Sections 300, et al., Title 14, CCR)

No action taken.

34. Discuss proposed changes to definitions for tidal waters and finfish gear restrictions in San Francisco and San Pablo bays (Sections 1.53 and 27.00, and subsection 28.65(a), Title 14, CCR)

No action taken.

35. Discuss proposed changes to Department lands pass program and lands public uses regulations (Sections 550, et al., Title 14, CCR)

No action taken.

36. Department presentation on five-year status report of Swainson's Hawk (*Buteo swainsoni*)

No action taken.

37. Non-marine items of interest from previous meetings

No action taken.

38. Non-marine petitions for regulation change and non-regulatory requests from previous meetings

(A) Action on petitions for regulation change

(B) Action on non-regulatory requests

(C) Update on pending petitions and requests referred to staff and the Department for review

The Commission adopted the staff recommendations for actions on April 2016 regulatory petitions and non-regulatory requests, and approves moving petition 2016-003 to the 2017 regulation cycle for consideration.

Ayes: R. Burns, J. Hostler-Carmesin, P. Silva, E. Sklar, A. Williams

Noes: None

39. Discuss and act on future Commission meeting items

(A) Next meetings

The Commission approved the draft agenda items for its August 24-25, 2016 meetings, as amended.

Ayes: R. Burns, J. Hostler-Carmesin, P. Silva, E. Sklar, A. Williams

Noes: None

The Commission directed staff to make two changes to the draft proposed 2017 meeting schedule.

(B) Rulemaking calendar updates

The Commission approved the proposed changes as presented.
Ayes: R. Burns, J. Hostler-Carmesin, P. Silva, E. Sklar, A. Williams
Noes: None

(C) New business

No action taken.

(D) Other

No action taken.

There being no further business, the Commission adjourned at 2:23 p.m.

EXECUTIVE SESSION

(Not Open to Public)

Pursuant to the authority of Government Code Section 11126(a)(1), (d)(2), and (e)(1), and Section 309 of the Fish and Game Code, the Commission will meet in closed Executive Session. The purpose of this Executive Session is to consider:

(A) Pending litigation to which the Commission is a Party

I. Big Creek Lumber Company and Central Coast Forest Assoc. v. California Fish and Game Commission (Coho listing, south of San Francisco)

II. James Bunn and John Gibbs v. California Fish and Game Commission (squid permits)

III. Center for Biological Diversity and Earth Island Institute v. California Fish and Game Commission (black-backed woodpecker)

IV. Dennis Sturgell v. California Fish and Game Commission, California Department of Fish and Wildlife, and Office of Administrative Hearings (revocation of Dungeness crab vessel permit No. CT0544-T1)

V. Kele Young v. California Fish and Game Commission, et al. (restricted species inspection fee waiver)

VI. Public Interest Coalition v. California Fish and Game Commission (California Environmental Quality Act)

(B) Possible litigation involving the Commission

(C) Staffing

(D) Deliberation on license and permit items

I. Proposed settlement agreement between John Anthony Wilson and the California Department of Fish and Wildlife regarding Mr. Wilson's commercial fishing license, lobster operator permit, southern rock crab trap permit, and fish receiver's license

FISH AND GAME COMMISSION
2016 MEETING SCHEDULE
www.fgc.ca.gov

MEETING DATE	COMMISSION MEETING	COMMITTEE MEETING
July 21		**Marine Resources** Petaluma Regional Library 100 Fairgrounds Drive Petaluma, CA 94952
August 24-25	Lake Natoma Inn Hotel & Conference Center 702 Gold Lake Drive Folsom, CA 95630	
September 21		**Wildlife Resources** Woodland Public Library Leake Center Community Room 250 First Street Woodland, CA 95695
October 18		**Tribal** Red Lion Inn 1929 4th Street Eureka, CA 95501
October 19-20	Red Lion Inn 1929 4th Street Eureka, CA 95501	
November 17		**Marine Resources** Sacramento
December 7-8	Portofino Inn & Suites 3805 Murphy Canyon Road San Diego, CA 92123	

OTHER MEETINGS OF INTEREST

Wildlife Conservation Board
- August 30, Sacramento
- November 16, Sacramento

Pacific Fishery Management Council
- August 30, Sacramento
- November 16, Sacramento

Pacific Flyway Council
- September 30, Sun Valley, ID

Western Association of Fish and Wildlife Agencies
- July 21-27, Cody, WY

Commissioners
Eric Sklar, President
Saint Helena
Jacque Hostler-Carmesin, Vice President
McKinleyville
Anthony C. Williams, Member
Huntington Beach
Russell E. Burns, Member
Napa
Peter S. Silva, Member
Chula Vista

STATE OF CALIFORNIA
Edmund G. Brown Jr., Governor

Fish and Game Commission

Wildlife Heritage and Conservation
Since 1870

Valerie Termini, Executive Director
1416 Ninth Street, Room 1320
Sacramento, CA 95814
(916) 653-4899
www.fgc.ca.gov

EMERGENCY MEETING OUTCOMES FOR JULY 19, 2016

These meeting outcomes were prepared and finalized by staff on July 26, 2016.
The official meeting minutes – audio recording – may be obtained from www.cal-span.org.

Pursuant to the call of the president, the Commission convened via teleconference on July 19, 2016. Commissioners and members of the public were at five publically-noticed locations:

- **California Fish and Game Commission, Conference Room, 1416 Ninth Street, Room 1320, Sacramento, CA 95814**
- **California Department of Fish and Wildlife, 50 Ericson Court, Arcata, CA 95521**
- **California Department of Fish and Wildlife, 7329 Silverado Trail, Napa, CA 94558**
- **California Department of Fish and Wildlife, Regional Manager's Office, 4665 Lampson Avenue, Suite C, Los Alamitos, CA 90720**
- **California Department of Fish and Wildlife, Second Floor Conference Room, 3883 Ruffin Road, San Diego, CA 92123**

The meeting was called to order at 9:00 a.m. by President Eric Sklar.

A quorum was established:

Eric Sklar	**President**	**Present**
Jacque Hostler-Carmesin	**Vice President**	**Present**
Anthony C. Williams	**Member**	**Absent**
Russell E. Burns	**Member**	**Present**
Peter S. Silva	**Member**	**Present**

The meeting was called to order at 9:00 a.m. by President Eric Sklar.

1. Approve agenda and order of items

   The Commission approved the agenda.

2. Public forum for items not on agenda

   No action taken.

3. Second re-adoption of emergency regulations regarding closure of recreational Dungeness and rock crab fishing due to elevated levels of domoic acid (Section 29.85, Title 14, CCR)

The Commission re-adopted the emergency regulations as presented.

Ayes: R. Burns, J. Hostler-Carmesin, P. Silva, E. Sklar, A. Williams

Noes: None

There being no further business, the Commission meeting adjourned at 9:07 a.m.

Pursuant to Government Code, Section 11125.5, below is the list of persons who were notified, or were attempted to be notified, of this meeting and the Commission's potential action. Some names may be listed more than once due to having multiple addresses and because multiple mailing lists were used. Names are shown as entered by the subscribers.

Angela Barlow
Michael Cantor
Robert Williams
Andrew Harding
Tonya Light
David Parvin
Bill Bernard
Josh Brones
John Carlson
Jim Conrad
Noelle Cremers
Sam Davidson
George Osborn
Wayne Raupe
Florence Sloane
Jerry Springer
Edward Worley
Mark Ono
Lori Jacobs
Jeffrey A. Volberg
Lisa McNamee
John Duffy
Rachelle Fisher
Karen Garrison
Dale Glantz
Vern Goehring
David Goldenberg
Pete Halmay
Jennifer Herrera
Harry Liquornik
Jim Marshall
Jim Martin
Geoff Shester
Sarah Sikich
milo vukovich
Randy Lovell
Robert Puccinelli
Christopher Ames
Tony Copp
william vickers
Perry St. John
Patrick Kallerman
Caleen Sisk
Megan Yarnall
Diane Pleschner-Steele
Wesley Hamasaki
Dan Silver
Jim Cook
Michael Weber
Joe Wylie
Aaron Wilson
Craig Fusaro
David Thompson
Tom Engstrom
Eric Anderson
Diane Colborn
Anna Holder
Andrew Rasmussen
B Dicely
Brian Baird
Chet M. Bardo
Dan McCorquodale
Dan Fox
Darrell Smith
Donald Mooney
E Venrick PhD
Ed Moore
Fran Roudebush
Garry George
Gary Rynearson
Glenn Olson
Greg Tatarian
Greg Stotesbury
Greg Giusti
Gregory Andrew
Jim Lopresto
Jim Matthews
Joel Reynolds
John Finger
Judy Bendix
Lara Martin
Linda McIntyre
Mark Drew
Maureen Gorsen
Pete DeSimone
Peter Fimrite
R. Clark Morrison
Ray Fields
Richard Anderson
Richard Alan Stabler
Robert Deitz II
Sarah Marquis
Sean Hastings
Tony Vaught
Valerie Nera
Wendy Winningham
NC Sportsmen
Coachella Valley Water District staff
Pius Lee
Sarah Ryan
Ed Murphy
George Bristol
David Bischel
Bill Lemos
Dan Yparraguirre
Ed Pert
Gem Laoyan
Helen Birss
James Fong
Jan Ortiz

Karen Mitchell
Margie Bowe
Jodi Roberts
Thomas Gibson
Steve McLaughlin
Crystal Norris
Eric Mills
Charlie Lorenz
Doug DeRoy
Tom Rudolph
Chad Hanson
Richard Garcia
Michael Greenberg
Caren Woodson
Josh Fisher
Michael Gould
David Kushner
Scott Barrow
justin grandmaison
James Young
RANDAL MASSARO
Michelle Horeczko
Jeff Hahn
Frank Melendez
William Back
Jack Gregg
Scott McMorrow
john riordan
Salvatore DAnna
Ruthie Maloney
Melanie Day
Ian Taniguchi
David Martin
Lori Dermody
Carolyn Morse
Rachel Fazio
Paul Schmitt
John Marques
Dave Holloway
james wells
Chris Ziegenhagel
Colby Roberts
Justin DeVorss
John Peplowski
wayne brawn
Karen Fothergill
Jamil Najd
Sara Dent
Louis DeMay
Julie Long Gallegos
John Uebel
Melissa Kelly
Nita Rolfe
Rosanne Bentley
melvin takahashi
Adam Copeland
jack ingram, jr.
Lawrence Erickson
Tom Mattusch
Jason Green
Chelsea Protasio
Ernest Pagan
Jerry Paddack
Briana Brady
Donald York
Matthew Perman
Eric Benton
Kristal Tumey
Camilla Fox
Brendan Cummings
Alice Moses
Barry Miller
ronald stephens
Josh Rhodes
Daniel Shafer
Keith Dietle
Hayley Carter
JD Mostoufi
Ryan Watanabe
Lynn Alley
Julia Larke
Rachel O'Leary
Dennis Shaffer
steven ivey
Gary Slade
Liz Neese
John Buckley
Joe Wible
Kyle Hardee
James Upton
David Okita
Dagan Boyce
Alison Dettmer
Lana Meade
Arthur Seavey
Mara Ziehn
Russ Snow
Keith Ringgenberg
Willard Hunter
Jose Bacallao
BILL SUTTON
Preston Brown
Lowell Ashbaugh
Anecita Agustinez
Shannon Wall
Denise de Cock
Robert Edgley
Pam Severtson
nancy caruso
Larry Angus
John Ugoretz
Bill Power
Howard Strohn
Fred Meyer
Jennifer Harrison
Brian Larky
Sammy Soohoo
Tom Behr
Staci Heaton
Mary Bolin
Bill Craven
John Marshall
Sandra Krause
Ken Loomis
Mark Fowler
Dan Cockayne
Charlene Carveth
William Copren
Michael Lacy
Kimberly Richard
Will Evans
Sophia Snyder
Joseph DeBernardi
Michael Kenny
Kristine Lesyna
Alex Breitler
Rachel O'Brien
kathy hillesland
Marilyn Jasper
Steve Rienecke
Marisa Katnic
scott bringman
Kevin Conway
Erica Stanojevic
Lisa Belenky
Alex Kim
Marko Mlikotin
Brian Morris
Bill Wright
Brian Morton
Cynthia Luellen
Victor Jedlicka
Tom Durr
Christina Bowers
Erin Hauge
JD Richey
Julia DiSieno
Hilary Pickles
Regina Wastiqoliqol
David Wappler
Marylee Sanders
Sue Williamson
Jeff Stackhouse
Laura Corsiglia
Paul Molder
Elissa Blair
Talvi Fried
Linda Drabova
Ron Hoff
John Hybarger
Dan Capshaw
Mary Fairbanks
Pamela Hansen
Laurel Fagan
Xai Her
Les Wright
Terry Guerrero
Mary Jean Quirk
Cara Roderick
steve dawson

Lesley Nicolaisen
Margaret Park
Teresa Romero
David Frost
Steven Hutchason
Daniel McCarthy
Veronica Bowers
Sandra Sisouvanh
Ahna Christensen
Roy Van de Hock
Steve Bardwell
Steve Santen
erin selleck
Marilyn Delgado
Patrick Foy
Ross Giuliani
George Kautsky
Dennis McEwan
Kari Burr
Nadananda Hamilton
Mike Stanton
Billy Matilton
Jim Yarnall
Vanessa Vasquez
Dan Ehresman
Brock Dolman
Brian Corrigan
Craig Stone
Fred Euphrat
Doug Threloff
Desma Williams
Gene Demachi
Capt. David Bacon
weasel wizard
Michael Lopes
Robin Kulakow
Stefan Awender
Frank Galea
Eric Meins
Brennan Bentley
Erica Sanko
Christine Pattison
Jozal Aguilera
Clark Blanchard
Allen Elsholz
Billie Wilson
Eric Simenstad
harlan bailey
Sally Manning
Kari Lewis
james vandenburg
mr. kylie cook
Bruce Dormody
Dylan Dean
Jerry Spitzer
Estelle Jackson
Marc Beyeler
Bill Gaines
Bil Quinn
tom weseloh
Manuel Grinage
Jeff Thomas
John Massie
Marc Ozimec
joe nunez
Barbara Inatsugu
Greg Cook
Steven Eberhart
Mark Longpre
William Betts
Benjamin Edwards
Martin Firestein
Tawni Thomson
Kris Nikolauson
Cynthia Mertes
Laura Quesada
Brian Adkins
Craig Stone
Richard Schussel
Ralph Hilton
Warren Clark
Anastasia Stanish
Amanda Culpepper
Robert Monokton
Dale Pelton
Emily Sawyer
Stephen Rae
Mike Boer
Debra Sharpton
Ned Coe
Molly Attell
Eliki Damuni
Steve Thompson
Aaron Reuter
Michael Sherman
Philip Bairrington
Adam Rich
Jason Ouimette
Dan Knowlden
Randi Adair
Ken Jensen
eric granado
Laura Cockrell
Wendy Branine
Karina Johnston
Stephen Wertz
Gerry Hans
Sara Nichols
Chris dePolo
Elizabeth Tischoff
maridee green
Jason Chin
J.A. Schov
Debra Sharpton
helen ferguson
Timothy Bowler
k langman
Douglas Fay
Tony Luna
Tim Thie
Mark McCulloch
Gary Zell
Morgan Ivens-Duran
John Koeppen
Kylie Heriford
John Draper
MICHAEL godfrey
Roger Berkenpas
anthony alfieri
Stuart Farber
Liz Vernand
Mike Schaadt
Ernest Schultz
Mathew Keller
chad curtice
Tim Sloane
Robert Ruddock
Michael Willing
Shevis Shima
David Moser
Marilyn Kern
Rick Oefinger
Eric Kramer
Amber Duff
Kieth Carley
R.J Perrone
Sharleen Allred-Hofland
Robert Butte
Andy Guiliano
Elizabeth Perkins
Don Disraeli
rick grover
Hezekiah Allen
Nate Owen
Russell Timmer
Talib Wahab
Robert Christensen
Ken Bates
Travis Apgar
Gary Hirtensteiner
Dawn Graham
Karen Dupuy
Susan Kirks
Karina Nielsen
Andrew Sloter
Morgan Patton
Brenda Blinn
Alexandra Pitkin
Steve Schramm
Daniel Epperson
Kelly Peterson
Theresa Labriola
Mindy Martin
stuart itoga
T.O. Smith
Wayne Caywood
Cody Canale
Nancy Poss
Kelly Sayce
James Guglielmoni

Nathan Reade
Margaret Howse
Deborah Mosley
Susan Giller
Diana Lacson
Delia Bense-Kang
Roy Griffith
Courtney Gutman
Michael McGuire
Richard Taylor
KEMP PIEPER
Terri Rector
James Smith
Jane Jarlsberg
David Matza
Stan Brandenburg
Karen Hawkins
Paige Berube
James Herota
Ron Givens
Toni Coreli
Tom Wheeler
John Stokes
Gregg Batchelor
Kevin Bullock
Linda Mccall
John Beuttler
Tim Sloane
Darris Nelson
Melissa Miller-Henson
Sherrie Koell
John K Warren Jr.
Lance Cochrane
Damon Nagami
Steven Carlson
Donald Flanagan
Donald Fithian
Jason Rohrbach
Brent Collier
Robert Danelen
Louis Krokover
Patrick McIntyre
Jeff Chambers
Jimmy H
John Williams
Damon Havrick
Anthony Stratton
Susan Chambers
George Cinquini
Manny Gorgita
Rick Bulloch
Joe Exline
Sep Hendrickson
Kathryn Lynch
Sam Madamba
Robert Moore
Randy Morrison
Sam Paredes
Robert Treanor
Jim Waters

Andi Pacis
Scott Franklin
David Halbrook
Bill Gaines
Matt Davis
Joel Greenberg
Robert Smith
Tom Paulek
susan nash
Mercer lawing
Nancy Rapoport
john goit
Steven Childs
Bob Bertelli
Amy Vierra
Jenn Eckerle
august felando
Josh Fisher
PETER H FLOURNOY
Tom Ford
Phyllis Grifman
Neil Guglielmo
Christine Heinrichs
Greg Helms
Raymond Hiemstra
Emily Knight
Cat Kuhlman
Mike McCorkle
Diane Pleschner-Steele
Rene L. Rudie
Sam Schuchat
Don Thompson
Anna Weinstein
Dan Williams
Diane Windham
Julie Oltamnn
Christopher Ames
Craig Shuman
Travis Chun
Melissa Miller-Henson
Anthony Boudreau
Ramon Boyd
Robert Christopherson
Camilla Fox
Terrence Mathers
Donna McGee
Matthew Gause
Amy Quinton
Ramon Boyd
byron hector
Patrick Ostly
Dennis Rosario
nathan dorris
Capitol Morning Report staff
Daniel Harris
Robert Leos
Mark Smith
Joanna Grebel
Jeanine Pfeiffer
Rob DiPerna

Daniel Applebee
Emma Suarez
margo parks
Gordon Hensley
Scott Anderson
Jeanne Wallen
Ted Romo
Scott McMorrow
Bill Simmons
Mike Conroy
Michael Stapleton
Judd Strong
Philip Leitner
Rocky Church
Jacob Studer
mike kucura
Greg Yarris
Becky Ota
Cheryl Kunert
Russell Henly
Dereck Wymer-Lucero
Joe Margiotta
charley rea
Laura Ryley
Chriss Bowles
Melissa Farmer
Allison Rudalevige
Andrea Blum
April Wakeman
Aran H. Dokovna
Barbara Quine
Bill Karr
Bob Trimm
Bobbi Marchand
Cindy Charles
Clare Jean Kim
Cliff Moriyama
Daniel Campbell
Daniel Gotshall
Dave Elm
David Kehoe
Deborah Whitman
Doug Houston
Ed Struffenegger
Eileen Maher
Fred S Conte
Gary West
Gary Adams
George Clyde
Ilson New
J Bochove
Jaime Hotz
Jamie Ray
Jeremiah O'Brien
Jim Curland
Jim Jones
Joe Maynard
John Whittington
John Kluge
JoLynn Taylor

Justin Fredrickson
Keith Marine
Keith Garner
Kim Delfino
Kirsten Ramey
Kristen Kittleson
Les Baugh
Marcia Wolfe
Myra Chirila
Malcolm Maclachlan
Marilyn Tierney
Marilyn Jasper
Marilyn Hendrickson
Michael Payne
Michael Mizumoto
Michael Legarza
Michael Kitahara
Michael W. Neville
Mick Kronman
Mike Weber
Mike Lum
Pamela Hotz
Ric Boyd
Richard Haldeman
Richard Matteis
Rick Leflore
Rob Ross
Rob Donlan
Robert Dunn
Roy Torres
Ruble Beauchamp
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FISH AND GAME COMMISSION LEGISLATIVE TRACKING LOG 2015-2016

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Bill No.	Impact	Authors	Title & General Purpose	Fish & Game Code/ Govt Code Sections	Bill Status	Location	Summary of FGC Action	Gov Action/Act No.
AB-665	None	Frazier (A)	**Hunting or fishing: local regulation (2/24/2015)(2 YR)** Provides that unless authorized by the Fish and Game Code or other state or federal law, the commission and the department are the only entities that may adopt or promulgate regulations regarding the taking or possession of fish and game on any lands or waters within the state.	Amend Sections 200, 203.1, 3004 and add Sections 200.5 and 200.6 to, the Fish and Game Code	9/10/15 Re-ref to Com. on APPR.	A-AAPR		
AB-1792	Major	Wood (A)	**Elk Tags: Indian Tribes --** Would require the DFW upon request, to meet with individual federally recognized Indian tribes in California to discuss elk-related issues for elk located within the territory of the individual tribe. The bill would require DFW to work collaboratively, and in good faith, with that tribe to identify possible science-based solutions.	Amend Section 332 of the Fish and Game Code	8/8/16 Ref to APPR suspense file. 6/29/16 Pass and re-refer to APPR. 6/9/16 Referred to NRW 6/2/16 3rd read. Passed. To Senate.	S- APPR		
AB-1842	None	Levine (A)	**Water: pollution: fines.** -- Would impose an additional civil penalty of not more than $10 for each gallon or pound of polluting material discharged. Would prohibit a person from being subjected to both a civil penalty described above and a civil penalty imposed pursuant to the Lempert-Keene-Seastrand Oil Spill Prevention and Response Act for the same act or failure to act.	amend Section 5650.1 of the Fish and Game Code, and and to amend Section 8670.61 of the Government Code,	8/9/16 2nd read. Ord to 3rd read. 8/2/16 Re-ref to APPR. 8/1/16 Pass as amended 6/9/16 Referred to EQ. 6/1/16 3rd read. Passed. To Senate.	Senate		

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Bill No.	Impact	Authors	Title & General Purpose	Fish & Game Code/ Govt Code Sections	Bill Status	Location	Summary of FGC Action	Gov Action/Act No.
AB-1844	Minor	Baker (A)	**Hunting and fishing licenses: reduced license fees: veterans --** would require DFW to reduce the fee to obtain a lifetime hunting or fishing license by 25% for a person who is an honorably discharged veteran of the Armed Forces of the United States States and a resident of California.	amend Sections 714, 3031.2, and 7149.2 of the Fish and Game Code	8/1/16 Ref to APPR. suspense file. 6/29/16 Pass. Re-refer to APPR. 6/9/16 Referred to NRW 6/1/16 3rd read. Passed. To Senate.	S- APPR		
AB-1845	None	Dahle (A)	**Protected species: take: rough sculpin --** would permit the department to authorize, under the California Endangered Species Act, the take of the rough sculpin (Cottus asperrimus) resulting from impacts attributable to repairing the Spring Creek Bridge in the County of Shasta if certain conditions are satisfied.	amend Section 5515 of, and to add Section 2081.4 to, the Fish and Game Code	8/3/16 2nd read. Ord to 3rd read. 8/2/16 3rd read and amended. 4/21/16 Read 3rd time. Passed. To Senate.	Senate		
AB-2001	None	Mathis (A)	**Fully protected fish: Owens pupfish: --** This bill would authorize the department to permit the taking of the Owens pupfish in the Owens River and Mojave River watersheds if the take is authorized under a safe harbor agreement.	Add Section 2089.7, Amend Section 5515 of the Fish and Game Code	08/03/16 2nd read. Ord to 3rd reading 8/2/16 3rd read, amended. 4/28/16 Read 3rd time. Passed. To Senate.	Senate		

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Bill No.	Impact	Authors	Title & General Purpose	Fish & Game Code/ Govt Code Sections	Bill Status	Location	Summary of FGC Action	Gov Action/Act No.
AB-2087	None	Levine (A)	**Regional conservation frameworks** -- This bill would authorize the department, or any other public agency, to propose a regional conservation framework that would be required to contain specified information, including a regional conservation assessment. The bill would authorize the department to approve a regional conservation framework, or approve the framework with amendments, for a period of up to 10 years after certain public meetings and a public comment period regarding the proposed framework have been held and after it finds that the framework meets certain requirements.	add Chapter 9 (commencing with Section 1850) to Division 2 of the Fish and Game Code	8/8/16 Ref to APPR. suspense file 8/1/16 2nd read, amended. Re-ref to APPR 6/30/16 Pass as amended, re-ref to APPR 6/2/16 3rd read. Passed. To Senate	S- APPR		
AB-2148	None	Holden	**Unmanned aircraft systems: take of fish and wildlife --** This bill would make it unlawful to launch, land, or operate an unmanned aircraft system from Department and Parks managed lands, waters, or airspace; also make it unlawful to use an unmanned aircraft system to take, or assist in the take of, fish or wildlife, including, but not limited to, the use of unmanned aircraft systems for scouting purposes,	An act to amend Section 3003.5 of, and to add Sections 1746 and 2001.5 to, the Fish and Game Code, and to add Article 4 (commencing with Section 5085) to Chapter 1.2 of Division 5 of the Public Resources Code,	8/8/16 Referred to APPR. suspense file. 8/2/16 2nd read, amended, re-ref to APPR 6/22/16 2nd read, amended, re-ref NRW 6/9/16 Referred to NRW	S - APPR		

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Bill No.	Impact	Authors	Title & General Purpose	Fish & Game Code/ Govt Code Sections	Bill Status	Location	Summary of FGC Action	Gov Action/Act No.
AB-2488	None	Dababneh (A)	**Protected species - unarmored threespine stickleback --** This bill would permit the department to authorize, under the California Endangered Species Act, the take of the unarmored threespine stickleback attributable to the periodic dewatering, inspection, maintenance, or repair of the Metropolitan Water District of Southern California's Foothill Feeder water supply facility from Castaic Dam to the Joseph Jensen Treatment Plant in the County of Los Angeles if certain conditions, including the adoption of an adaptive management process, are satisfied.	amend Section 5515 of, and to add Section 2081.10 to, the Fish and Game Code,	8/2/16 2nd read. Ord to 3rd read 6/21/16 2nd read, amended. Re-ref APPR. 6/20/16 Pass as amended, re-ref APPR 5/5/16 3rd read. Passed. To Senate.	Senate		
AB-2549	Minor	WPW (A)	**Public Resources --** Extends the procedures outlined in CESA indefinitely, extends the authority to DFW concerning dreissenid mussles to Jan 2020, and other provisions.	Amend Section 2301 of, and to amend and repeal Sections 2074.2, 2074.6, 2074.8, and 2075.5 of, the Fish and Game Code, and to amend Sections 5002.2, 5009.1, 5010.6, and 5080.23 of the Public Resources Code, relating to public resources	8/9/16 2nd read, amended. To consent. 8/1/16 2nd read, amended, re-ref to APPR. 6/14/16 Pass, re-refer APPR 6/6/16 2nd read; amended, re-ref to NRW.	S - CONSENT		

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Bill No.	Impact	Authors	Title & General Purpose	Fish & Game Code/ Govt Code Sections	Bill Status	Location	Summary of FGC Action	Gov Action/Act No.
ACR-148	Minor	Chau(A) Roth (S)	**California Law Revision Commission: studies --** This measure would grant approval to the commission to continue its study of designated topics that the Legislature previously authorized or directed the commission to study including the Fish and Game Code.		8/2/16 2nd read. Ord to 3rd reading 6/16/16 Re-ref APPR. pur Joint Rule 10.5. 6/16/16 2d read. To Consent. 5/9/16 Adopted and ref to Senate.	Senate		
SB-122	Minor	Jackson (S) Hill (S)	**California Environmental Quality Act: record of proceedings (1/15/2015)** Would require the lead agency, at the request of a project applicant and consent of the lead agency, to prepare a record of proceedings concurrently with the preparation of a negative declaration, mitigated negative declaration, EIR, or other environmental document for projects.	Amend Sections 21082.1, 21091, 21159.9, and 21167.6 of, and to add Section 21167.6.2 to, the Public Resources Code	7/15/15 Placed on APPR. suspense file	A-APPR		

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Bill No.	Impact	Authors	Title & General Purpose	Fish & Game Code/ Govt Code Sections	Bill Status	Location	Summary of FGC Action	Gov Action/Act No.
SB-233	None	Hertzberg (S) Rendon (A)	**Marine resources and preservation (2/13/2015) (2 YR)** Would require offshore oil applicants to apportion and transmit a portion of the cost savings to the department, the department to apportion those cost-savings by prescribed schedule, requires State Lands Commission to serve as the lead agency for the environmental review under CEQA and take certain adverse impacts to air quality and greenhouse gas emissions into account.	Amend Sections 6603, 6604, 6610, 6611, 6612, 6613, 6614, 6615, 6616, and 6618 of the Fish and Game Code	8/26/15 Placed on APPR suspense file	A-APPR		
SB-345	Major	Berryhill (S) Bigelow (A)	**The Sport Fishing Stimulus Act of 2015 (2/24/15) (2 YR)** Would authorize a charitable organization or nonprofit organization to possess fish taken under a sport fishing license in excess of a possession limit if the charitable organization or nonprofit organization was given the fish by a donor intermediary, and requires the commission to recommend legislation or adopt regulations to clarify when a possession limit is not violated by processing into food lawfully taken sport fish, also makes changes to junior sport fishing license age requirements and sport fishing license fees.	Amend Section 7120; amend, repeal, and add Sections 7149.05, and, add Sections 7122 and 7233 to the Fish and Game Code	8/3/16 Placed on APPR. suspense file 6/28/16 Pass and re-ref to APPR 6/15/15 Ref to WPW	A-APPR	Discussion at MRC and WRC meetings.	

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Bill No.	Impact	Authors	Title & General Purpose	Fish & Game Code/ Govt Code Sections	Bill Status	Location	Summary of FGC Action	Gov Action/Act No.
SB-1089	Minor	Pavley (S)	**Wildlife Conservation Board** -- Under existing law, the board consists of the President of the Fish and Game Commission, the Director of Fish and Wildlife, and the Director of Finance. This bill would expand the composition of the board to include two public members appointed by a the Speaker of the Assembly and Senate Committee on Rules to serve terms of four years each. The bill would also authorize the Director of Finance to appoint a designee to serve on the board to represent the Director of Finance.	Amend Section 1320 of the Fish and Game Code	08/04/16 Ord to 3rd read 08/04/16 3rd read and amended 8/3/16 2nd read. Ord 3rd read 8/2/16 2nd read, amended. 8/01/16 Pass as amended 5/5/16 Referred to WPW 4/14/16 Read third time. Passed. To Assm	Assembly		

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Bill No.	Impact	Authors	Title & General Purpose	Fish & Game Code/ Govt Code Sections	Bill Status	Location	Summary of FGC Action	Gov Action/Act No.
SB-1235	Minor	McCarty (A) DeLeon (S)	**Ammunition** -- Would, if the Safety for All Act of 2016 is enacted by voters, amend the act to instead allow ammunition to be sold only to a person whose information matches an entry in the Automated Firearms System and who is eligible to possess ammunition, to a person who has a current certificate of eligibility issued by the department, or to a person who purchases or transfers the ammunition in a single ammunition transaction, as specified.	amend Sections 16150, 17315, 30000, and 30306 of, to add Sections 11106.5, 16151 to, to add Article 4 (commencing with Section 30355) and Article 5 (commencing with Section 30360) to Chapter 1 of Division 10 of Title 4 of Part 6 of, to repeal Sections 16650, 16662, and 30312 of, and to repeal and add Article 3 (commencing with Section 30345) of Chapter 1 of Division 10 of Title 4 of Part 6 of, the Penal Code, relating to ammunition.	06/30/16 Enrolled and presented to Gov 6/30/16 Assembly amendments concurred 6/30/16 In Sen. Concurrence in Assem. 5/19/16 3rd read. Passed. To Assembly.	CHAPTERED		7/01/16 Chaptered by Secretary of State. Chapter 55, Statutes of 2016. 7/01/16 Appr by the Governor.
SB-1287	Minor	McGuire (S) Achadjian (A) Levine (A)	**Fishing --** This bill would (1) expand the authority of DFW to order the closure of any waters or restricting the taking of any species of fish, (2) require the Director to notify the FGC and request that FGC schedule a public discussion of the closure or restriction at its next scheduled full meeting, and (3) remove the requirement that the closure or restriction be adopted by emergency regulation and would instead exempt a closure or restriction from the Administrative Procedure Act	amend Sections 5654, 8276.5, 8279.1, and 9002.5 of, and to amend and renumber Section 7715 of, the Fish and Game Code, and to amend Section 131052 of the Health and Safety Code, relating to fishing	8/3/16 Placed on APPR. suspense file. 6/29/16 2nd read, re-ref to APPR 6/28/16 Pass as amended. Re-ref to APPR 6/20/16 2nd read. Re-ref to WPW 6/9/16 Ref to WPW	A- APPR		

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Bill No.	Impact	Authors	Title & General Purpose	Fish & Game Code/ Govt Code Sections	Bill Status	Location	Summary of FGC Action	Gov Action/Act No.
SB-1363	None	Monning (S) Pavley (S)	**Ocean Protection Council: Ocean Acidification and Hypoxia Reduction Program** -- would require the council, in consultation with the State Coastal Conservancy and other relevant entities, to establish and administer the Ocean Acidification and Hypoxia Reduction Program for the purposes of achieving specified goals. The bill would authorize moneys in the trust fund to be expended for grants or loans for projects or activities that further public purposes consistent with the Ocean Acidification and Hypoxia Reduction Program.	amend Section 35650 of, and to add Sections 35630 and 35631 to, the Public Resources Code, relating to coastal resources	8/3/16 Placed on APPR. suspense file. 6/29/16 2nd read, amended. Ref to APPR 6/28/16 Pass as amended, re-ref to APPR 6/9/16 Ref to NR 6/2/16 In Assembly. Read first time. .	A- APPR		
SB-1396	None	Wolk (S) Dodd (A)	**Inner Coast Range Program--** Housed within WCB, this bill establishes the Inner Coast Range Program with specified goal areas and authorization related to the Inner Coast Range Region, as defined. This bill would require the board to establish an advisory board for the program, funds for the program, and requires a biannual report.	An act to add Chapter 4.5 (commencing with Section 1440) to Division 2 of, and to repeal Article 7 (commencing with Section 1462) of Chapter 4.5 of Division 2 of, the Fish and Game Code	6/9/16 Ref to WPW 6/2/16 In Assembly. Read first time. 6/2/16 3rd read. Passed. To the Assembly.	A - WPW		

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Bill No.	Impact	Authors	Title & General Purpose	Fish & Game Code/ Govt Code Sections	Bill Status	Location	Summary of FGC Action	Gov Action/Act No.
SB-1473	Major	NRW (S)	**Natural resources --** would clarify that those procedures apply generally to any commission regulation that governs the take or possession of any bird, mammal, fish, amphibian, or reptile, except as provided. The bill would conform certain commission rulemaking procedures to the rulemaking procedures of the Administrative Procedure Act. The bill would delete obsolete and superfluous provisions, make organizational changes, delete obsolete cross references, and make other conforming changes. This bill would repeal those provisions of a 1946 grant of tidelands and submerged lands in trust to the City of Santa Monica, with the exception of certain described lands reserved to the state, subject to certain conditions	Various	08/08/16 Ordered to third reading 08/04/16 2nd read. Ordered to consent 8/3/16 Pass. To consent calendar. 8/1/16 2nd read, amended. Re-ref to APPR 5/5/16 Ref to WPW. and NR. 4/28/16 In Assembly. Read first time. 4/28/16 Read third time. Passed. To Assm.	Assembly		

Department of Fish & Wildlife
Legislative Report
August 2016

(as of August 10, 2016)

AB 1188 **(Gipson D) Importation or sale of endangered animals.**

Introduced: 2/27/2015

Last Amend: 9/4/2015

Status: 5/23/2016-In committee: Hearing postponed by committee.

Location: 1/28/2016-S. N.R. & W.

Summary: Current law makes it unlawful to import into the state for commercial purposes, to possess with intent to sell, or to sell within the state, the dead body or other part or product of specified endangered animals, including kangaroos. This bill would delete the prohibition on the importation, possession with the intent to sell, and selling within the state of kangaroos. This bill contains other related provisions.

AB 1575 **(Bonta D) Medical cannabis.**

Introduced: 1/4/2016

Last Amend: 8/1/2016

Status: 8/8/2016-Referred to APPR. suspense file.

Location: 8/8/2016-S. APPR. SUSPENSE FILE

Summary: Current law requires the classification of goods and services to conform to the classifications adopted by the United States Patent and Trademark Office. This bill would, notwithstanding that provision, for purposes of those marks for which a certificate of registration is issued on or after January 1, 2017, authorize the use of specified marks related to medical cannabis goods and services that are lawfully in commerce in the state. This bill contains other related provisions and other current laws.

AB 1611 **(Committee on Budget) Public resources.**

Introduced: 1/7/2016

Last Amend: 6/15/2016

Status: 6/28/2016-In Assembly. Concurrence in Senate amendments pending. May be considered on or after June 30 pursuant to Assembly Rule 77.

Location: 6/28/2016-A. CONCURRENCE

Summary: Current law prohibits an entity from substantially diverting or obstructing the natural flow of, or substantially changing or using any material from the bed, channel, or bank of, any river, stream, or lake, or from depositing certain material where it may pass into any river, stream, or lake designated by the Department of Fish and Wildlife, without first notifying the department of that activity, and entering into a lake or streambed alteration agreement if required by the department to protect fish and wildlife resources. This bill would make it unlawful for any entity to violate those provisions, thereby imposing a state-mandated local program by changing the definition of a crime.

AB 1704 **(Dodd D) Water rights: small irrigation use: lake or streambed alteration agreements.**

Introduced: 1/25/2016

Last Amend: 6/20/2016

Status: 8/1/2016-In committee: Referred to APPR. suspense file.

Location: 8/1/2016-S. APPR. SUSPENSE FILE

Summary: The Water Rights Permitting Reform Act of 1988 provides that the State Water Resources Control Board is not required to adopt general conditions for small irrigation use until the board determines that funds are available for that purpose and that a registration for small irrigation use pursuant to the act is not authorized until the board establishes general conditions for small irrigation use to protect instream beneficial uses, as specified. This bill would require the board, on or before January 1, 2018, to adopt general conditions that would permit a registrant to construct a facility that would store water for small irrigation use during times of high streamflow in exchange for the registrant reducing diversions during periods of low streamflow, as specified.

AB 1716 **(McCarty D) Lower American River Conservancy Program.**

Introduced: 1/27/2016

Last Amend: 8/2/2016

Status: 8/8/2016-Referred to APPR. suspense file.

Location: 8/8/2016-S. APPR. SUSPENSE FILE

Summary: Would require the Wildlife Conservation Board to implement and administer the Lower American River Conservancy Program to receive and expend moneys for the benefit of the Lower American River and related lands by, among other things, providing grants to local public agencies and nonprofit organizations for projects benefiting the Lower American River. The bill would require the board to establish an advisory committee, as specified. The bill would establish the Lower American River Conservancy Program Fund in the State Treasury and would make moneys in the fund available, upon appropriation by the Legislature, for purposes of the program.

AB 1755 **(Dodd D) The Open and Transparent Water Data Act.**

Introduced: 2/2/2016

Last Amend: 8/1/2016

Status: 8/1/2016-From committee chair, with author's amendments: Amend, and re-refer to committee. Read second time, amended, and re-referred to Com. on APPR. In committee: Referred to APPR. suspense file.

Location: 8/1/2016-S. APPR. SUSPENSE FILE

Summary: Would enact the Open and Transparent Water Data Act. The act would require the Department of Water Resources, in consultation with the California Water Quality Monitoring Council, the State Water Resources Control Board, and the Department of Fish and Wildlife, in accordance with a specified schedule, to create, operate, and maintain a statewide integrated water data platform that, among other things, would integrate existing water and ecological data information from multiple databases and provide data on completed water transfers and exchanges. This bill contains other existing laws.

AB 1792 **(Wood D) Elk tags: federally recognized Indian tribes.**

Introduced: 2/4/2016

Last Amend: 5/31/2016

Status: 8/8/2016-Referred to APPR. suspense file.

Location: 8/8/2016-S. APPR. SUSPENSE FILE

Summary: Would require the Department of Fish and Wildlife, upon request, to meet with individual federally recognized Indian tribes in California to discuss elk -related issues for elk located within the territory of the individual tribe. The bill would require the department to work collaboratively, and in good faith, with that tribe to identify possible science-based solutions.

AB 1842 **(Levine D) Water: pollution: fines.**

Introduced: 2/9/2016

Last Amend: 8/2/2016

Status: 8/9/2016-Read second time. Ordered to third reading.

Location: 8/9/2016-S. THIRD READING

Summary: Current law imposes a maximum civil penalty of $25,000 on a person who discharges various pollutants or other designated materials into the waters of the state. This bill would impose an

additional civil penalty of not more than $10 for each gallon or pound of material discharged. The bill would require that the civil penalty be reduced for every gallon or pound of the illegally discharged material that is recovered and properly disposed of by the responsible party. This bill contains other related provisions and other current laws.

AB 1844 **(Gallagher R) Hunting and fishing licenses: reduced license fees: veterans.**

Introduced: 2/9/2016

Last Amend: 5/27/2016

Status: 8/1/2016-In committee: Referred to APPR. suspense file.

Location: 8/1/2016-S. APPR. SUSPENSE FILE

Summary: Would require the Department of Fish and Wildlife to reduce the fee required to obtain the lifetime licenses by 25% for a person who is a veteran of the Armed Forces of the United States, was honorably discharged, and is a resident of California.

AB 1845 **(Dahle R) Protected species: take: rough sculpin.**

Introduced: 2/9/2016

Last Amend: 8/2/2016

Status: 8/3/2016-Read second time. Ordered to third reading.

Location: 8/3/2016-S. THIRD READING

Summary: Would permit the Department of Fish and Wildlife to authorize, under the California Endangered Species Act, the take of the rough sculpin (Cottus asperrimus) resulting from impacts attributable to replacing the Spring Creek Bridge in the County of Shasta if certain conditions are satisfied.

AB 1958 **(Wood D) Forestry: timberlands: restoration and conservation forest management activities.**

Introduced: 2/12/2016

Last Amend: 8/4/2016

Status: 8/8/2016-Referred to APPR. suspense file.

Location: 8/8/2016-S. APPR. SUSPENSE FILE

Summary: The Z'berg-Nejedly Forest Practice Act of 1973 authorizes the State Board of Forestry and Fire Protection to exempt from some or all of specified provisions of the act a person engaging in specified forest management activities. Current law authorizes a registered professional forester in an emergency to file, on behalf of a timber owner or operator, a specified emergency notice with the department that allows for the immediate commencement of timber operations. This bill would also, until January 1, 2024, authorize the board to exempt from some or all of those provisions of the act a person cutting or removing trees in specified areas to restore and conserve California black or Oregon white oak woodlands and associated grasslands, as specified.

AB 2001 **(Mathis R) Fully protected fish: Owens pupfish: California State Safe Harbor Agreement Program Act.**

Introduced: 2/16/2016

Last Amend: 8/2/2016

Status: 8/3/2016-Read second time. Ordered to third reading.

Location: 8/3/2016-S. THIRD READING

Summary: Under current law, the Department of Fish and Wildlife is authorized to permit the taking of a fully protected fish for necessary scientific research, including efforts to recover fully protected, threatened, or endangered species. This bill would authorize the department to permit the taking of the Owens pupfish in the Owens River watershed if the take is authorized under a safe harbor agreement. This bill contains other related provisions and other existing laws.

AB 2087 **(Levine D) Regional conservation frameworks.**

Introduced: 2/17/2016

Last Amend: 8/1/2016

Status: 8/8/2016-Referred to APPR. suspense file.

Location: 8/8/2016-S. APPR. SUSPENSE FILE

Summary: Would authorize the Department of Fish and Wildlife, or any other public agency, to propose a regional conservation framework that would be required to contain specified information, including a regional conservation assessment. The bill would authorize the department to approve a regional conservation framework, or approve the framework with amendments, for an initial period of up to 10 years after certain public meetings and a public comment period regarding the proposed framework have been held and after it finds that the framework meets certain requirements.

AB 2148 **(Holden D) Unmanned aircraft systems: managed lands or waters: take of fish and wildlife.**

Introduced: 2/17/2016

Last Amend: 8/2/2016

Status: 8/8/2016-Referred to APPR. suspense file.

Location: 8/8/2016-S. APPR. SUSPENSE FILE

Summary: Would make it unlawful for any person to launch, land, or operate an unmanned aircraft system from or within lands, waters, or airspace managed by the Department of Fish and Wildlife and Department of Parks and Recreation, except as authorized by these departments, or unless exempted from this prohibition. The bill would authorize the departments to consider certain factors when reviewing a request for the departments' authorization for the use of an unmanned aircraft system. This bill contains other related provisions and other existing laws.

AB 2165 **(Bonta D) Firearms: prohibitions: exemptions.**

Introduced: 2/17/2016

Last Amend: 6/28/2016

Status: 8/2/2016-Read second time. Ordered to third reading.

Location: 8/2/2016-S. THIRD READING

Summary: Current law makes it a crime for any person in this state to manufacture, import into the state for sale, keep for sale, offer or expose for sale, give, or lend an unsafe handgun. Under current law, this prohibition does not apply to the sale or purchase of a handgun if the handgun is sold to, or purchased by, a police department, the Department of Corrections and Rehabilitation, or any federal law enforcement agency, among other entities. This bill would also make the above prohibition inapplicable to the sale or purchase of a handgun if the hand gun is sold to, or purchased by, specified entities or sworn members of those entities who have satisfactorily completed the firearms portion of a training course prescribed by the Commission on Peace Officer Standards and Training.

AB 2243 **(Wood D) Medical cannabis: taxation: cannabis production and environment mitigation.**

Introduced: 2/18/2016

Last Amend: 8/1/2016

Status: 8/8/2016-Referred to APPR. suspense file.

Location: 8/8/2016-S. APPR. SUSPENSE FILE

Summary: The Medical Cannabis Regulation and Safety Act, administered by the director of the Bureau of Medical Cannabis Regulation, provides for the licensure of persons engaged in specified activities relating to medical cannabis, including cultivation and distribution. This bill would, for the privilege of doing business as a distributor in this state, impose a tax in specified amounts on every distributor upon all medical cannabis and medical cannabis products distributed to a dispensary in this state, as specified. The bill would require the State Board of Equalization to administer and collect the tax pursuant to the procedures set forth in the Fee Collection Procedures Law.

AB 2245 **(Cooper D) Firearms: prohibitions: exemptions: probation departments.**

Introduced: 2/18/2016

Last Amend: 6/30/2016

Status: 8/8/2016-Referred to APPR. suspense file.

Location: 8/8/2016-S. APPR. SUSPENSE FILE

Summary: Current law makes it a crime for any person in this state to manufacture, import into the state, keep for sale, offer or expose for sale, give, or lend an unsafe handgun. Under current law, this prohibition does apply to the sale or purchase of a handgun if the handgun is sold to, or purchased by, the Department of Corrections and Rehabilitation or to any federal law enforcement agency, among other entities. This bill would also make the above prohibition inapplicable to the sale to, or purchase by, a probation department, or a sworn member of a probation department if that person satisfies certain requirements.

AB 2446 **(Gordon D) State Water Resources Control Board: judicial review.**

Introduced: 2/19/2016

Last Amend: 8/1/2016

Status: 8/2/2016-Read second time. Ordered to third reading.

Location: 8/2/2016-S. THIRD READING

Summary: The Porter-Cologne Water Quality Control Act, within 30 days of any action or failure to act by a California regional water quality control board under specified law, authorizes an aggrieved person to petition the State Water Resources Control Board to review that action or failure to act. Current law authorizes the state board, in the case of such a review, upon notice and hearing, if a hearing is requested, to stay in whole or in part the effect of the decision and order of a regional board or of the state board. This bill would expand that provision to authorize the state board to issue a stay in the case of review by the state board of a decision or order issued under authority delegated to an officer or employee of the state board where the state board by regulation has authorized a petition for reconsideration by the state board.

AB 2488 **(Dababneh D) Protected species: unarmored threespine stickleback: taking or possession.**

Introduced: 2/19/2016

Last Amend: 6/21/2016

Status: 8/2/2016-Read second time. Ordered to third reading.

Location: 8/2/2016-S. THIRD READING

Summary: Would permit the Department of Fish and Wildlife to authorize, under the California Endangered Species Act, the take of the unarmored threespine stickleback (Gasterosteus aculeatus williamsoni) attributable to the periodic dewatering, inspection, maintenance, modification, or repair of the Metropolitan Water District of Southern California's Foothill Feeder water supply facility from Castaic Dam to the Joseph Jensen Treatment Plant in the County of Los Angeles, as specified, if certain conditions, including the adoption of an adap tive management process, are satisfied.

AB 2549 **(Committee on Water, Parks, and Wildlife) Public resources.**

Introduced: 2/19/2016

Last Amend: 8/9/2016

Status: 8/9/2016-Read second time and amended. Ordered to consent calendar.

Location: 8/9/2016-S. CONSENT CALENDAR

Summary: Under the California Endangered Species Act , an interested person may petition the Fish and Game Commission to add a species to, or remove a species from, either the list of endangered species or the list of threatened species, and current law requires the commission to consider the petition at a meeting, as prescribed. Current law, until January 1, 2017, establishes additional procedures for the review of a petition, including public hearings and public comment. This bill would extend those additional procedures indefinitely.

AB 2800 **(Quirk D) Climate change: infrastructure planning.**

Introduced: 2/19/2016

Last Amend: 8/2/2016

Status: 8/8/2016-Referred to APPR. suspense file.

Location: 8/8/2016-S. APPR. SUSPENSE FILE

Summary: Would until July 1, 2020, require state agencies to take into account the expected impacts of climate change when planning, designing, building, and investing in state infrastructure. The bill, by

July 1, 2017, would require the Natural Resources Agency to establish a Climate-Safe Infrastructure Working Group for the purpose of examining how to integrate scientific data concerning projected climate change impacts into state infrastructure engineering, as prescribed.

AB 2912 **(Committee on Natural Resources) Oil spills.**

Introduced: 3/15/2016

Last Amend: 6/30/2016

Status: 8/2/2016-Read second time. Ordered to Consent Calendar.

Location: 8/2/2016-S. CONSENT CALENDAR

Summary: Would require each owner or operator of a tank vessel, nontank vessel, vessel carrying oil as a secondary cargo, or facility to submit, upon request of the administrator for oil spill response, a copy of a federally approved oil spill response plan at the time of approval of the plan. The bill also would revise and add various definitions within the Lempert-Keene-Seastrand Oil Spill Prevention and Response Act and would make nonsubstantive changes to these and other provisions.

SB 233 **(Hertzberg D) Marine resources and preservation.**

Introduced: 2/13/2015

Last Amend: 7/16/2015

Status: 8/4/2016-Set for hearing.

Location: 8/4/2016-A. APPR. SUSPENSE FILE

Summary: The California Marine Resources Legacy Act establishes a program, administered by the Department of Fish and Wildlife, to allow partial removal of offshore oil structures. Before the first application to partially remove an offshore oil structure is filed, this bill would authorize a prospective applicant to pay a portion of the startup costs in an amount determined by the department to be necessary for staff and other costs in anticipation of receipt of the first application. The bill would require an applicant, upon conditional approval for partial removal of an offshore oil structure, to apportion and transmit a portion of the cost savings to the department, instead of to the specified entities and funds.

SB 345 **(Berryhill R) The Sport Fishing Stimulus Act of 2015.**

Introduced: 2/24/2015

Last Amend: 6/2/2015

Status: 8/3/2016-August 3 set for first hearing. Placed on APPR. suspense file.

Location: 8/3/2016-A. APPR. SUSPENSE FILE

Summary: Would authorize a charitable organization or nonprofit organization to possess fish taken under a sport fishing license in excess of a possession limit established by statute or by regulations adopted by the Fish and Game Commission at any time if the charitable organization or nonprofit organization was given the fish by a donor intermediary, as defined, or a person who holds a sport fishing license and an applicable license tag or tags, the charitable organization or nonprofit organization has documentation to that effect, as specified, and the charitable organization or nonprofit organization retains any tag required to be affixed to a fish in the manner prescribed in the Fish and Game Code or regulations adopted by the commission.

SB 837 **(Committee on Budget and Fiscal Review) State government.**

Introduced: 1/7/2016

Last Amend: 6/12/2016

Status: 6/27/2016-Chaptered by Secretary of State - Chapter 32, Statutes of 2016.

Location: 6/27/2016-S. CHAPTERED

Summary: Would, among other things, change the name of the Medical Marijuana Regulation and Safety Act, the Bureau of Medical Marijuana Regulation, and the Medical Marijuana Regulation and Safety Act Fund to the Medical Cannabis Regulation and Safety Act, the Bureau of Medical Cannabis Regulation, and the Medical Cannabis Regulation and Safety Act Fund, and would change references to medical marijuana or marijuana to medical cannabis or cannabis, respectively. The bill would authorize licensing authorities, as defined, to adopt rules and regulations to carry out the purposes of

that act and emergency regulations, as specified.

SB 839 **(Committee on Budget and Fiscal Review) Public resources.**

Introduced: 1/7/2016

Last Amend: 6/14/2016

Status: 6/16/2016-In Senate. Concurrence in Assembly amendments pending.

Location: 6/16/2016-S. CONCURRENCE

Summary: Existing law prohibits an entity from substantially diverting or obstructing the natural flow of, or substantially changing or using any material from the bed, channel, or bank of, any river, stream, or lake, or from depositing certain material where it may pass into any river, stream, or lake designated by the Department of Fish and Wildlife, without first notifying the department of that activity, and entering into a lake or streambed alteration agreement if required by the department to protect fish and wildlife resources. Would make it unlawful for any entity to violate those provisions, thereby imposing a state-mandated local program by changing the definition of a crime. The bill would subject to that civil penalty any entity that violates those provisions. This bill contains other related provisions and other existing laws.

SB 987 **(McGuire D) Medical marijuana: Marijuana User Fee Act.**

Introduced: 2/10/2016

Last Amend: 6/13/2016

Status: 6/20/2016-June 20 set for first hearing. Placed on REV. & TAX. suspense file. June 20 hearing: Failed passage in committee. (Ayes 4. Noes 5.)

Location: 6/20/2016-S. REV. & TAX SUSPENSE FILE

Summary: Would enact the Marijuana User Fee Act. The bill, on and after January 1, 2018, unless a specified initiative is passed by the voters at the November 8, 2016, statewide general election, would impose a fee on the consumption or other use in this state of medical marijuana purchased from any retailer for the consumption or other use in this state at the rate of 10% of the sales price of the medical marijuana.

SB 1062 **(Lara D) Elephants: prohibited treatment.**

Introduced: 2/16/2016

Last Amend: 6/15/2016

Status: 8/4/2016-In Senate. Concurrence in Assembly amendments pending.

Location: 8/4/2016-S. CONCURRENCE

Summary: Would, beginning January 1, 2018, prohibit any person who houses, possesses, or is in direct contact with an elephant from using, or authorizing or allowing an employee, agent, or contractor to use, a bullhook, ankus, baseball bat, axe handle, pitchfork, or other device designed to inflict pain for the purpose of training or controlling the behavior of an elephant. A person who violates these provisions would not be subject to criminal penalty but would be subject to civil penalties and the restricted species permit for the elephant would be subject to immediate suspension or revocation by the Department of Fish and Wildlife.

SB 1089 **(Pavley D) Wildlife Conservation Board.**

Introduced: 2/17/2016

Last Amend: 8/4/2016

Status: 8/4/2016-Read third time and amended. Ordered to third reading.

Location: 8/4/2016-A. THIRD READING

Summary: Would expand the composition of the Wildlife Conservation Board to include 4 public members to serve terms of 4 years each and would require one public member to be appointed by the Speaker of the Assembly, one public member to be appointed by the Senate Committee on Rules, and 2 public members to be appointed by the Governor. This bill would require the public members appointed to the board to have demonstrated interest and expertise in land acquisition for conservation purposes.

SB 1188 **(McGuire D) Wildlife management areas: payment of taxes and assessments.**

Introduced: 2/18/2016

Status: 8/3/2016-August 3 set for first hearing. Placed on APPR. suspense file.

Location: 8/3/2016-A. APPR. SUSPENSE FILE

Summary: Current law regulates real property acquired and operated by the state as wildlife management areas, and authorizes the Department of Fish and Wildlife, when income is directly derived from that real property, as provided, to annually pay to the county in which the property is located an amount equal to the county taxes levied upon the property at the time it was transferred to the state. This bill would require, instead of authorize, the department to make these payments subject to appropriation by the Legislature.

SB 1235 **(De León D) Ammunition.**

Introduced: 2/18/2016

Last Amend: 6/22/2016

Status: 7/1/2016-Chaptered by Secretary of State - Chapter No. 55, Statutes of 2016

Location: 7/1/2016-S. CHAPTERED

Summary: Would, if the Safety for All Act of 2016 is enacted by the voters at the November 8, 2016, statewide general election, amend the act to instead allow ammunition to be sold only to a person whose information matches an entry in the Automated Firearms System and who is eligible to possess ammunition, to a person who has a current certificate of eligibility issued by the department, or to a person who purchases or transfers the ammunition in a single ammunition transaction, as specified. This bill contains other related provisions and other existing laws.

SB 1287 **(McGuire D) Fishing.**

Introduced: 2/19/2016

Last Amend: 6/29/2016

Status: 8/3/2016-August 3 set for first hearing. Placed on APPR. suspense file.

Location: 8/3/2016-A. APPR. SUSPENSE FILE

Summary: Curent law authorizes the Director of Fish and Wildlife to order the closure of any waters or otherwise restrict the taking under a commercial fishing license in state waters of species of fish if the Director of Environmental Health Hazard Assessment, in consultation with the State Public Health Officer, determines that the species or subspecies of fish is likely to pose a human health risk from high levels of toxic substances. The closure or restriction is required to be adopted by emergency regulation, as specified. Under current law, any violation of the Fish and Game Code, or of any rule, regulation, or order made or adopted under the code, is generally a misdemeanor. This bill would expand this authority to all fishing.

SB 1386 **(Wolk D) Resource conservation: working and natural lands.**

Introduced: 2/19/2016

Last Amend: 8/1/2016

Status: 8/4/2016-Read second time. Ordered to third reading.

Location: 8/4/2016-A. THIRD READING

Summary: W

SB 1416 **(Stone R) Voluntary contribution: Revive the Salton Sea Fund.**

Introduced: 2/19/2016

Last Amend: 6/15/2016

Status: 8/4/2016-Read second time. Ordered to consent calendar.

Location: 8/4/2016-A. CONSENT CALENDAR

Summary: Would allow an individual to designate on his or her tax return that a specified amount in excess of his or her tax liability be transferred to the Revive the Salton Sea Fund, which would be created by this bill. The bill would prohibit a voluntary contribution designation for the Revive the Salton Sea Fund from being added on the tax return until another voluntary contribution designation is

removed or a space is available and would require, once the designation is added, specified information to be on the tax form, including the purposes for which the contribution would be used.

SB 1473 **(Committee on Natural Resources and Water) Natural resources.**

Introduced: 2/29/2016

Last Amend: 8/1/2016

Status: 8/8/2016-From consent calendar on motion of Assembly Member Calderon. Ordered to third reading.

Location: 8/8/2016-A. THIRD READING

Summary: The California Constitution provides for the delegation to the Fish and Game Commission of powers relating to the protection and propagation of fish and game. Current statutory law delegates to the commission the power to regulate the taking or possession of birds, mammals, fish, amphibians, and reptiles, except as provided. Current law establishes procedures that are specific to regulations adopted by the commission pursuant to this authority. This bill would clarify that those procedures apply generally to any commission regulation that governs the take or possession of any bird, mammal, fish, amphibian, or reptile, except as provided.

SBX1 1 **(Beall D) Transportation funding: environmental mitigation: oversight.**

Introduced: 6/22/2015

Last Amend: 4/21/2016

Status: 4/21/2016-From committee with author's amendments. Read second time and amended. Re-referred to Com. on APPR.

Location: 4/21/2016-S. APPR.

Summary: Would create the Road Maintenance and Rehabilitation Program to address deferred maintenance on the state highway system and the local street and road system and for other specified purposes. The bill would provide for the deposit of various funds for the program in the Road Maintenance and Rehabilitation Account, which the bill would create in the State Transportation Fund.

For more information call:

Susan LaGrande, CDFW Deputy Director at (916) 651-6719
Julie Oltmann, CDFW Legislative Representative at (916) 653-9772

You can also find legislative information on the web at http://leginfo.legislature.ca.gov/ and follow the prompts from the ‘bill information’ link.

14-0011

September 30, 2014

VIA PERSONAL DELIVERY

RECEIVED
SEP 30 2014
INITIATIVE COORDINATOR
ATTORNEY GENERAL'S OFFICE

The Honorable Kamala D. Harris.
Attorney General
1300 I Street, 17th Floor, P.O. Box 944255
Sacramento, CA 95814

Attention: Ashley Johansson, Initiative Coordinator

Re: Request for Title and Summary for Proposed Referendum

Dear Ms. Harris:

Pursuant to Article II, Section 10(d) of the California Constitution, I hereby submit the attached proposed statewide referendum of all portions of Senate Bill 270 (2013-2014 Regular Session of the California Legislature), *except for* subdivision (a) of Section 42288 of the Public Resources Code, to your office and request that you prepare a title and summary of the measure as provided by law. Included with this submission is the required proponent affidavit signed by the proponent of this measure pursuant to section 9608 of the California Elections Code. My address as a registered voter is attached to this letter, along with a check for $200.00.

All inquires or correspondence relative to this initiative should be directed to Nielsen, Merksamer, Parrinello, Gross & Leoni, LLP, 1415 L Street, Suite 1200, Sacramento, CA 95814, (916) 446-6752, Attention: Kurt Oneto

Thank you for your assistance.

Sincerely,

Doyle Johnson

Doyle L. Johnson, Proponent

Enclosure: Proposed Referendum Statute

REFERENDUM AGAINST AN ACT PASSED BY THE LEGISLATURE

NOTICE: CHAPTER 850, STATUTES OF 2014 (SB 270), IS BEING SUBMITTED FOR APPROVAL OR REJECTION BY THE VOTERS IN ITS ENTIRETY, EXCEPT FOR PUBLIC RESOURCES CODE § 42288, SUBD. (a), AS INDICATED IN BOLD, ITALICIZED, 8-POINT TYPE BELOW

CHAPTER 850

An act to add Chapter 5.3 (commencing with Section 42280) to Part 3 of Division 30 of the Public Resources Code, relating to solid waste, and making an appropriation therefor.

LEGISLATIVE COUNSEL'S DIGEST

SB 270, Padilla. Solid waste: single-use carryout bags.

(1) Existing law, until 2020, requires an operator of a store, as defined, to establish an at-store recycling program that provides to customers the opportunity to return clean plastic carryout bags to that store.

This bill, as of July 1, 2015, would prohibit stores that have a specified amount of sales in dollars or retail floor space from providing a single-use carryout bag to a customer, with specified exceptions. The bill would also prohibit those stores from selling or distributing a recycled paper bag at the point of sale unless the store makes that bag available for purchase for not less than $0.10. The bill would also allow those stores, on or after July 1, 2015, to distribute compostable bags at the point of sale only in jurisdictions that meet specified requirements and at a cost of not less than $0.10. The bill would require these stores to meet other specified requirements on and after July 1, 2015, regarding providing reusable grocery bags to customers, including distributing those bags only at a cost of not less than $0.10. The bill would require all moneys collected pursuant to these provisions to be retained by the store and be used only for specified purposes.

The bill, on and after July 1, 2016, would additionally impose these prohibitions and requirements on convenience food stores, foodmarts, and entities engaged in the sale of a limited line of goods, or goods intended to be consumed off premises, and that hold a specified license with regard to alcoholic beverages.

The bill would allow a retail establishment to voluntarily comply with these requirements, if the retail establishment provides the department with irrevocable written notice. The bill would require the department to post on its Internet Web site, organized by county, the name and physical location of each retail establishment that has elected to comply with these requirements.

REFERENDUM AGAINST AN ACT PASSED BY THE LEGISLATURE

The bill would require the operator of a store that has a specified amount of sales in dollars or retail floor space and a retail establishment that voluntarily complies with the requirements of this bill to comply with the existing at-store recycling program requirements.

The bill would require, on and after July 1, 2015, a reusable grocery bag sold by certain stores to a customer at the point of sale to be made by a certified reusable grocery bag producer and to meet specified requirements with regard to the bag's durability, material, labeling, heavy metal content, and, with regard to reusable grocery bags made from plastic film on and after January 1, 2016, recycled material content. The bill would impose these requirements as of July 1, 2016, on the stores that are otherwise subject to the bill's requirements.

The bill would prohibit a producer of reusable grocery bags made from plastic film from selling or distributing those bags on and after July 1, 2015, unless the producer is certified by a 3rd-party certification entity, as specified. The bill would require a reusable grocery bag producer to provide proof of certification to the department. The bill would require the department to provide a system to receive proofs of certification online.

The department would be required to publish on its Internet Web site a list of reusable grocery bag producers that have submitted the required certification and their reusable grocery bags. The bill would require the department to establish an administrative certification fee schedule, which would require a reusable grocery bag producer providing proof to the department of certification or recertification to pay a fee. The bill would require that all moneys submitted to the department pursuant to these fee provisions be deposited into the Reusable Grocery Bag Fund, which would be established by the bill, and continuously appropriated for purposes of implementing these proof of certification and Internet Web site provisions, thereby making an appropriation. The bill would also require a reusable grocery bag producer to submit applicable certified test results to the department. The bill would authorize a person to object to a certification of a reusable grocery bag producer by filing an action for review of that certification in the superior court of a county that has jurisdiction over the reusable grocery bag producer. The bill would require the court to determine if the reusable grocery bag producer is in compliance with the

provisions of the bill and, based on the court's determination, would require the court to direct the department to either remove or retain the reusable grocery bag producer on its published Internet Web site list.

The bill would allow a city, county, or city and county, or the state to impose civil penalties on a person or entity that knows or reasonably should have known it is in violation of the bill's requirements. The bill would require these civil penalties to be paid to the office of the city attorney, city prosecutor, district attorney, or Attorney General, whichever office brought the action, and would allow the penalties collected by the Attorney General to be expended by the Attorney General, upon appropriation by the Legislature, to enforce the bill's provisions.

The bill would declare that it occupies the whole field of the regulation of reusable grocery bags, single-use carryout bags, and recycled paper bags provided by a store and would prohibit a local public agency from enforcing or implementing an ordinance, resolution, regulation, or rule, or any amendment thereto, adopted on or after September 1, 2014, relating to those bags, against a store, except as provided.

(2) The California Integrated Waste Management Act of 1989 creates the Recycling Market Development Revolving Loan Subaccount in the Integrated Waste Management Account and continuously appropriates the funds deposited in the subaccount to the department for making loans for the purposes of the Recycling Market Development Revolving Loan Program. Existing law makes the provisions regarding the loan program, the creation of the subaccount, and expenditures from the subaccount inoperative on July 1, 2021, and repeals them as of January 1, 2022.

This bill would appropriate $2,000,000 from the Recycling Market Development Revolving Loan Subaccount in the Integrated Waste Management Account to the department for the purposes of providing loans for the creation and retention of jobs and economic activity in California for the manufacture and recycling of plastic reusable grocery bags that use recycled content. The bill would require a recipient of a loan to agree, as a condition of receiving the loan, to take specified actions.

(3) The bill would require the department, no later than March 1, 2018, to provide a status report to the Legislature on the implementation of the bill's provisions.

Appropriation: yes.

The people of the State of California do enact as follows:

SECTION 1. Chapter 5.3 (commencing with Section 42280) is added to Part 3 of Division 30 of the Public Resources Code, to read:

CHAPTER 5.3. SINGLE-USE CARRYOUT BAGS

Article 1. Definitions

42280. (a) "Department" means the Department of Resources Recycling and Recovery.

(b) "Postconsumer recycled material" means a material that would otherwise be destined for solid waste disposal, having completed its intended end use and product life cycle. Postconsumer recycled material does not include materials and byproducts generated from, and commonly reused within, an original manufacturing and fabrication process.

(c) "Recycled paper bag" means a paper carryout bag provided by a store to a customer at the point of sale that meets all of the following requirements:

(1) (A) Except as provided in subparagraph (B), contains a minimum of 40 percent postconsumer recycled materials.

(B) An eight pound or smaller recycled paper bag shall contain a minimum of 20 percent postconsumer recycled material.

(2) Is accepted for recycling in curbside programs in a majority of households that have access to curbside recycling programs in the state.

(3) Has printed on the bag the name of the manufacturer, the country where the bag was manufactured, and the minimum percentage of postconsumer content.

(d) "Reusable grocery bag" means a bag that is provided by a store to a customer at the point of sale that meets the requirements of Section 42281.

(e) (1) "Reusable grocery bag producer" means a person or entity that does any of the following:

(A) Manufactures reusable grocery bags for sale or distribution to a store.

(B) Imports reusable grocery bags into this state, for sale or distribution to a store.

(C) Sells or distributes reusable bags to a store.

(2) "Reusable grocery bag producer" does not include a store, with regard to a reusable grocery bag for which there is a manufacturer or importer, as specified in subparagraph (A) or (B) of paragraph (1).

(f) (1) "Single-use carryout bag" means a bag made of plastic, paper, or other material that is provided by a store to a customer at the point of sale and that is not a recycled paper bag or a reusable grocery bag that meets the requirements of Section 42281.

(2) A single-use carryout bag does not include either of the following:

(A) A bag provided by a pharmacy pursuant to Chapter 9 (commencing with Section 4000) of Division 2 of the Business and Professions Code to a customer purchasing a prescription medication.

(B) A nonhandled bag used to protect a purchased item from damaging or contaminating other purchased items when placed in a recycled paper bag, a reusable grocery bag, or a compostable plastic bag.

(C) A bag provided to contain an unwrapped food item.

(D) A nonhandled bag that is designed to be placed over articles of clothing on a hanger.

(g) "Store" means a retail establishment that meets any of the following requirements:

(1) A full-line, self-service retail store with gross annual sales of two million dollars ($2,000,000) or more that sells a line of dry groceries, canned goods, or nonfood items, and some perishable items.

(2) Has at least 10,000 square feet of retail space that generates sales or use tax pursuant to the Bradley-Burns Uniform Local Sales and Use Tax Law (Part 1.5 (commencing with Section 7200) of Division 2 of the Revenue and Taxation Code) and has a pharmacy licensed pursuant to Chapter 9 (commencing with Section 4000) of Division 2 of the Business and Professions Code.

(3) Is a convenience food store, foodmart, or other entity that is engaged in the retail sale of a limited line of goods, generally including milk, bread, soda, and snack foods, and that holds a Type 20 or Type 21 license issued by the Department of Alcoholic Beverage Control.

(4) Is a convenience food store, foodmart, or other entity that is engaged in the retail sale of goods intended to be consumed off the premises, and that holds a Type 20 or Type 21 license issued by the Department of Alcoholic Beverage Control.

(5) Is not otherwise subject to paragraph (1), (2), (3), or (4), if the retail establishment voluntarily agrees to comply with the requirements imposed upon a store pursuant to this chapter, irrevocably notifies the department of its intent to comply with the requirements imposed upon a store pursuant to this chapter, and complies with the requirements established pursuant to Section 42284.

Article 2. Reusable Grocery Bags

42281. (a) On and after July 1, 2015, a store, as defined in paragraph (1) or (2) of subdivision (g) of Section 42280, may sell or distribute a reusable grocery bag to a customer at the point of sale only if the reusable bag is made by a producer certified pursuant to this article to meet all of the following requirements:

(1) Has a handle and is designed for at least 125 uses, as provided in this article.

(2) Has a volume capacity of at least 15 liters.

(3) Is machine washable or made from a material that can be cleaned and disinfected.

(4) Has printed on the bag, or on a tag attached to the bag that is not intended to be removed, and in a manner visible to the consumer, all of the following information:

(A) The name of the manufacturer.

(B) The country where the bag was manufactured.

(C) A statement that the bag is a reusable bag and designed for at least 125 uses.

(D) If the bag is eligible for recycling in the state, instructions to return the bag to the store for recycling or to another appropriate recycling location. If recyclable in the state, the bag shall include the chasing arrows recycling symbol or the term "recyclable,"

consistent with the Federal Trade Commission guidelines use of that term, as updated.

(5) Does not contain lead, cadmium, or any other toxic material that may pose a threat to public health. A reusable bag manufacturer may demonstrate compliance with this requirement by obtaining a no objection letter from the federal Food and Drug Administration. This requirement shall not affect any authority of the Department of Toxic Substances Control pursuant to Article 14 (commencing with Section 25251) of Chapter 6.5 of Division 20 of the Health and Safety Code and, notwithstanding subdivision (c) of Section 25257.1 of the Health and Safety Code, the reusable grocery bag shall not be considered as a product category already regulated or subject to regulation.

(6) Complies with Section 260.12 of Part 260 of Title 16 of the Code of Federal Regulations related to recyclable claims if the reusable grocery bag producer makes a claim that the reusable grocery bag is recyclable.

(b) (1) In addition to the requirements in subdivision (a), a reusable grocery bag made from plastic film shall meet all of the following requirements:

(A) On and after January 1, 2016, it shall be made from a minimum of 20 percent postconsumer recycled material.

(B) On and after January 1, 2020, it shall be made from a minimum of 40 percent postconsumer recycled material.

(C) It shall be recyclable in this state, and accepted for return at stores subject to the at-store recycling program (Chapter 5.1 (commencing with Section 42250)) for recycling.

(D) It shall have, in addition to the information required to be printed on the bag or on a tag, pursuant to paragraph (4) of subdivision (a), a statement that the bag is made partly or wholly from postconsumer recycled material and stating the postconsumer recycled material content percentage, as applicable.

(E) It shall be capable of carrying 22 pounds over a distance of 175 feet for a minimum of 125 uses and be at least 2.25 mils thick, measured according to the American Society of Testing and Materials (ASTM) Standard D6988-13.

(2) A reusable grocery bag made from plastic film that meets the specifications of the American Society of Testing and Materials (ASTM) International Standard Specification for Compostable Plastics D6400, as updated, is not required to meet the requirements

of subparagraph (A) or (B) of paragraph (1), but shall be labeled in accordance with the applicable state law regarding compostable plastics.

(c) In addition to the requirements of subdivision (a), a reusable grocery bag that is not made of plastic film and that is made from any other natural or synthetic fabric, including, but not limited to, woven or nonwoven nylon, polypropylene, polyethylene-terephthalate, or Tyvek, shall satisfy all of the following:

(1) It shall be sewn.

(2) It shall be capable of carrying 22 pounds over a distance of 175 feet for a minimum of 125 uses.

(3) It shall have a minimum fabric weight of at least 80 grams per square meter.

(d) On and after July 1, 2016, a store as defined in paragraph (3), (4), or (5) of subdivision (g) of Section 42280, shall comply with the requirements of this section.

42281.5. On and after July 1, 2015, a producer of reusable grocery bags made from plastic film shall not sell or distribute a reusable grocery bag in this state unless the producer is certified by a third-party certification entity pursuant to Section 42282. A producer shall provide proof of certification to the department demonstrating that the reusable grocery bags produced by the producer comply with the provisions of this article. The proof of certification shall include all of the following:

(a) Names, locations, and contact information of all sources of postconsumer recycled material and suppliers of postconsumer recycled material.

(b) Quantity and dates of postconsumer recycled material purchases by the reusable grocery bag producer.

(c) How the postconsumer recycled material is obtained.

(d) Information demonstrating that the postconsumer recycled material is cleaned using appropriate washing equipment.

42282. (a) Commencing on or before July 1, 2015, the department shall accept from a reusable grocery bag producer proof of certification conducted by a third-party certification entity, submitted under penalty of perjury, for each type of reusable grocery bag that is manufactured, imported, sold, or distributed in the state and provided to a store for sale or distribution, at the point of sale, that meets all the applicable requirements of this article.

The proof of certification shall be accompanied by a certification fee, established pursuant to Section 42282.1.

(b) A reusable grocery bag producer shall resubmit to the department proof of certification as described in subdivision (a) on a biennial basis. A reusable grocery bag producer shall provide the department with an updated proof of certification conducted by a third-party certification entity if any modification that is not solely aesthetic is made to a previously certified reusable bag. Failure to comply with this subdivision shall result in removal of the relevant information posted on the department's Internet Web site pursuant to paragraphs (1) and (2) of subdivision (e) for each reusable bag that lacks an updated proof of certification conducted by a third-party certification entity.

(c) A third-party certification entity shall be an independent, accredited (ISO/IEC 17025) laboratory. A third-party certification entity shall certify that the producer's reusable grocery bags meet the requirements of Section 44281.

(d) The department shall provide a system to receive proofs of certification online.

(e) On and after July 1, 2015, the department shall publish a list on its Internet Web site that includes all of the following:

(1) The name, location, and appropriate contact information of certified reusable grocery bag producers.

(2) The reusable grocery bags of producers that have provided the required certification.

(f) A reusable grocery bag producer shall submit applicable certified test results to the department confirming that the reusable grocery bag meets the requirements of this article for each type of reusable grocery bag that is manufactured, imported, sold, or distributed in the state and provided to a store for sale or distribution.

(1) A person may object to the certification of a reusable grocery bag producer pursuant to this section by filing an action for review of that certification in the superior court of a county that has jurisdiction over the reusable grocery bag producer. The court shall determine if the reusable grocery bag producer is in compliance with the requirements of this article.

(2) A reusable grocery bag producer whose certification is being objected to pursuant to paragraph (1) shall be deemed in compliance with this article pending a determination by the court.

(3) Based on its determination, the court shall direct the department to remove the reusable grocery bag producer from, or retain the reusable grocery bag producer on, its list published pursuant to subdivision (e).

(4) If the court directs the department to remove a reusable grocery bag producer from its published list, the reusable grocery bag producer shall remain off of the published list for a period of one year from the date of the court's determination.

42282.1. (a) A reusable grocery bag producer shall submit the fee established pursuant to subdivision (b) to the department when providing proof of certification or recertification pursuant to Sections 42281.5 and 42282.

(b) The department shall establish an administrative certification fee schedule that will generate fee revenues sufficient to cover, but not exceed, the department's reasonable costs to implement this article. The department shall deposit all moneys submitted pursuant to this section into the Reusable Grocery Bag Fund, which is hereby established in the State Treasury. Notwithstanding Section 11340 of the Government Code, moneys in the fund are continuously appropriated, without regard to fiscal year, to the department for the purpose of implementing this article.

Article 3. Single-Use Carryout Bags

42283. (a) Except as provided in subdivision (e), on and after July 1, 2015, a store, as defined in paragraph (1) or (2) of subdivision (g) of Section 42280, shall not provide a single-use carryout bag to a customer at the point of sale.

(b) (1) On and after July 1, 2015, a store, as defined in paragraph (1) or (2) of subdivision (g) of Section 42280, shall not sell or distribute a reusable grocery bag at the point of sale except as provided in this subdivision.

(2) On and after July 1, 2015, a store, as defined in paragraph (1) or (2) of subdivision (g) of Section 42280, may make available for purchase at the point of sale a reusable grocery bag that meets the requirements of Section 42281.

(3) On and after July 1, 2015, a store, as defined in paragraph (1) or (2) of subdivision (g) of Section 42280, that makes reusable grocery bags available for purchase pursuant to paragraph (2) shall not sell the reusable grocery bag for less than ten cents ($0.10) in

order to ensure that the cost of providing a reusable grocery bag is not subsidized by a customer who does not require that bag.

(c) (1) On and after July 1, 2015, a store, as defined in paragraph (1) or (2) of subdivision (g) of Section 42280, shall not sell or distribute a recycled paper bag except as provided in this subdivision.

(2) A store, as defined in paragraph (1) or (2) of subdivision (g) of Section 42280, may make available for purchase a recycled paper bag. On and after July 1, 2015, the store shall not sell a recycled paper bag for less than ten cents ($0.10) in order to ensure that the cost of providing a recycled paper bag is not subsidized by a consumer who does not require that bag.

(d) Notwithstanding any other law, on and after July 1, 2015, a store, as defined in paragraph (1) or (2) of subdivision (g) of Section 42280, that makes reusable grocery bags or recycled paper bags available for purchase at the point of sale shall provide a reusable grocery bag or a recycled paper bag at no cost at the point of sale to a customer using a payment card or voucher issued by the California Special Supplemental Food Program for Women, Infants, and Children pursuant to Article 2 (commencing with Section 123275) of Chapter 1 of Part 2 of Division 106 of the Health and Safety Code or an electronic benefit transfer card issued pursuant to Section 10072 of the Welfare and Institutions Code.

(e) On and after July 1, 2015, a store, as defined in paragraph (1) or (2) of subdivision (g) of Section 42280, may distribute a compostable bag at the point of sale, if the compostable bag is provided to the consumer at the cost specified pursuant to paragraph (2), the compostable bag, at a minimum, meets the American Society for Testing and Materials (ASTM) International Standard Specification for Compostable Plastics D6400, as updated, and in the jurisdiction where the compostable bag is sold and in the jurisdiction where the store is located, both of the following requirements are met:

(1) A majority of the residential households in the jurisdiction have access to curbside collection of foodwaste for composting.

(2) The governing authority for the jurisdiction has voted to allow stores in the jurisdiction to sell to consumers at the point of sale a compostable bag at a cost not less than the actual cost of the bag, which the Legislature hereby finds to be not less than ten cents ($0.10) per bag.

(f) A store, as defined in paragraph (1) or (2) of subdivision (g) of Section 42280, shall not require a customer to use, purchase, or accept a single-use carryout bag, recycled paper bag, compostable bag, or reusable grocery bag as a condition of sale of any product.

42283.5. On and after July 1, 2016, a store, as defined in paragraph (3), (4), or (5) of subdivision (g) of Section 42280, shall comply with the same requirements of Section 42283 that are imposed upon a store, as defined in paragraph (1) or (2) of subdivision (g) of Section 42280.

42283.6. (a) The operator of a store, as defined in paragraph (1) or (2) of subdivision (g) of Section 42280 that makes recycled paper or reusable grocery bags available at the point of sale, shall be subject to the provisions of the at-store recycling program (Chapter 5.1 (commencing with Section 42250)).

(b) A store that voluntarily agrees to comply with the provisions of this article pursuant to subdivision (g) of Section 42280, shall also comply with the provisions of the at-store recycling program (Chapter 5.1 (commencing with Section 42250)).

42283.7. All moneys collected pursuant to this article shall be retained by the store and may be used only for the following purposes:

(a) Costs associated with complying with the requirements of this article.

(b) Actual costs of providing recycled paper bags or reusable grocery bags.

(c) Costs associated with a store's educational materials or educational campaign encouraging the use of reusable grocery bags.

42284. (a) A retail establishment not specifically required to comply with the requirements of this chapter is encouraged to reduce its distribution of single-use plastic carryout bags.

(b) Pursuant to the provisions of subdivision (g) of Section 42280, any retail establishment that is not a "store," that provides the department with the irrevocable written notice as specified in subdivision (c), shall be regulated as a "store" for the purposes of this chapter.

(c) The irrevocable written notice shall be dated and signed by an authorized representative of the retail establishment, and shall include the name and physical address of all retail locations covered

by the notice. The department shall acknowledge receipt of the notice in writing and shall specify the date the retail establishment will be regulated as a "store," which shall not be less than 30 days after the date of the department's acknowledgment. The department shall post on its Internet Web site, organized by county, the name and physical location or locations of each retail establishment that has elected to be regulated as a "store."

Article 4. Enforcement

42285. (a) A city, a county, a city and county, or the state may impose civil liability on a person or entity that knowingly violated this chapter, or reasonably should have known that it violated this chapter, in the amount of one thousand dollars ($1,000) per day for the first violation of this chapter, two thousand dollars ($2,000) per day for the second violation, and five thousand dollars ($5,000) per day for the third and subsequent violations.

(b) Any civil penalties collected pursuant to subdivision (a) shall be paid to the office of the city attorney, city prosecutor, district attorney, or Attorney General, whichever office brought the action. The penalties collected pursuant to this section by the Attorney General may be expended by the Attorney General, upon appropriation by the Legislature, to enforce this chapter.

Article 5. Preemption

42287. (a) Except as provided in subdivision (c), this chapter is a matter of statewide interest and concern and is applicable uniformly throughout the state. Accordingly, this chapter occupies the whole field of regulation of reusable grocery bags, single-use carryout bags, and recycled paper bags, as defined in this chapter, provided by a store, as defined in this chapter.

(b) On and after January 1, 2015, a city, county, or other local public agency shall not enforce, or otherwise implement, an ordinance, resolution, regulation, or rule, or any amendment thereto, adopted on or after September 1, 2014, relating to reusable grocery bags, single-use carryout bags, or recycled paper bags, against a store, as defined in this chapter, unless expressly authorized by this chapter.

(c) (1) A city, county, or other local public agency that has adopted, before September 1, 2014, an ordinance, resolution, regulation, or rule relating to reusable grocery bags, single-use carryout bags, or recycled paper bags may continue to enforce and implement that ordinance, resolution, regulation, or rule that was in effect before that date. Any amendments to that ordinance, resolution, regulation, or rule on or after January 1, 2015, shall be subject to subdivision (b), except the city, county, or other local public agency may adopt or amend an ordinance, resolution, regulation, or rule to increase the amount that a store shall charge with regard to a recycled paper bag, compostable bag, or reusable grocery bag to no less than the amount specified in Section 42283.

(2) A city, county, or other local public agency not covered by paragraph (1) that, before September 1, 2014, has passed a first reading of an ordinance or resolution expressing the intent to restrict single-use carryout bags and, before January 1, 2015, adopts an ordinance to restrict single-use carryout bags, may continue to enforce and implement the ordinance that was in effect before January 1, 2015.

Article 6. Financial Provisions

42288. (a) Notwithstanding Section 42023.2, the sum of two million dollars ($2,000,000) is hereby appropriated from the Recycling Market Development Revolving Loan Subaccount in the Integrated Waste Management Account to the department for the purposes of providing loans for the creation and retention of jobs and economic activity in this state for the manufacture and recycling of plastic reusable grocery bags that use recycled content, including postconsumer recycled material.	**NOT SUBJECT TO REFERENDUM**

(b) The department may expend, if there are applicants eligible for funding from the Recycling Market Development Revolving Loan Subaccount, the funds appropriated pursuant to this section to provide loans for both of the following:

(1) Development and conversion of machinery and facilities for the manufacture of single-use plastic bags into machinery and facilities for the manufacturer of durable reusable grocery bags that, at a minimum, meet the requirements of Section 42281.

(2) Development of equipment for the manufacture of reusable grocery bags, that, at a minimum, meet the requirements of Section 42281.

(c) A recipient of a loan authorized by this section shall agree, as a condition of receiving the loan, to retain and retrain existing employees for the manufacturing of reusable grocery bags that, at a minimum, meet the requirements of Section 42281.

(d) Any moneys appropriated pursuant to this section not expended by the end of the 2015–16 fiscal year shall revert to the Recycling Market Development Revolving Loan Subaccount for expenditure pursuant to Article 3 (commencing with Section 42010) of Chapter 1.

(e) Applicants for funding under this section may also apply for funding or benefits from other economic development programs for which they may be eligible, including, but not limited to, both of the following:

(1) An income tax credit, as described in Sections 17059.2 and 23689 of the Revenue and Taxation Code.

(2) A tax exemption pursuant to Section 6377.1 of the Revenue and Taxation Code.

SEC. 2. No later than March 1, 2018, the department, as a part of its reporting requirement pursuant to Section 40507 of the Public Resources Code, shall provide a status report on the implementation of Chapter 5.3 (commencing with Section 42280) of Part 3 of Division 30 of the Public Resources Code.

NOAA HABITAT CONSERVATION | RESTORATION CENTER
NATIONAL MARINE FISHERIES SERVICE

Projects selected for $9 million in community-based habitat restoration funding

17 projects will improve protected species recovery and support sustainable fisheries

July 20, 2016 NOAA is recommending $9 million in funding for 17 coastal and marine habitat restoration projects for its 2016 Community-based Restoration Program, as part of agency efforts to support healthy ecosystems and resilient coastal communities.

The recommended projects, in 10 states and territories, range from coral reef restoration in Florida to fish passage improvements in California.

This year's projects will restore habitat for a variety of coastal and marine species, including three of NOAA Fisheries' highly at-risk "Species in the Spotlight" – Atlantic salmon, Central California Coast coho, and Sacramento River winter-run Chinook. Projects will also concentrate on habitat improvement in two of NOAA's Habitat Focus Areas – Puerto Rico's Culebra Island, and West Hawaii – where agency and partner efforts can come together to yield community and environmental benefits.

"These restoration projects are a win-win for the environment and surrounding communities," said Pat Montanio, director of the NOAA Fisheries Office of Habitat Conservation. "When we make smart investments in habitat restoration, we not only help sustain fisheries and recover protected resources, we also use these projects to provide additional benefits, like protecting coastal communities from flooding and erosion, and boosting local economies through increased recreational opportunities."

This year marks the 20th anniversary of the Community-based Restoration Program, which was established in 1996 and authorized under the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006. Since the program's beginning, NOAA has provided more than $140 million to implement more than 2,000 habitat restoration projects, all through strong partnerships with

more than 2,500 organizations. Through the program and the Magnuson-Stevens Act, NOAA and its partners are helping to create healthy habitats and resilient fish populations in the United States.

At this point in the selection process, the application approval and obligation of funds is not final. Each of the 17 applications is being "recommended" and is not a guarantee of funding. Final approval is subject to funding availability as well as final review and approval by both the NOAA Grants Management Division and Department of Commerce Federal Assistance Law Division. Applicants should expect to receive formal notification of award approval by October 1.

Details about the 17 projects recommended for funding are available on the NOAA Fisheries Office of Habitat Conservation website.

NOAA's mission is to understand and predict changes in the Earth's environment, from the depths of the ocean to the surface of the sun, and to conserve and manage our coastal and marine resources. Join us on Twitter, Facebook, Instagram and our other social media channels.

Contact:
Kate Brogan, katherine.brogan@noaa.gov, 301-427-8030

Recommended Projects

This year, we are recommending $9 million in funding for 17 coastal habitat restoration projects across the United States through the Community-based Restoration Program. These projects will restore at least 1,400 acres of habitat, and up to 80 stream miles for fish passage.

Recommended projects will use a habitat-based approach to increase fish production and foster species recovery. Successful proposals will **help rebuild fish stocks, help recover threatened and endangered species, or benefit other coastal and marine species** (such as forage fish).

These projects contribute to NOAA's conservation efforts in two Habitat Focus Areas and to the recovery of three Species in the Spotlight.

Restoration efforts will include:

- ***California***
    - **Restoring Coho Salmon along the Lost Coast** ($304,752): This project, in partnership with Trout Unlimited, will reduce sediment in priority streams in Northern California. Funding will support timberland road decommissioning, fish passage barrier removal, and installation of instream large wood structures to improve habitat complexity. Many of these projects are located in priority areas identified in the NOAA Fisheries Recovery Plan for Central California Coast Coho Salmon.
    - **Willow Bend Floodplain Habitat Restoration** ($587,399): This project, in partnership with River Partners, will restore floodplain habitat and mimic natural flood patterns. These actions will provide critical rearing habitat for juvenile salmon and steelhead. The project will benefit multiple Central Valley migratory fish species listed under the Endangered Species Act, including Central Valley steelhead, spring-run Chinook, and critically-endangered Sacramento River winter-run Chinook salmon.
    - **Pennington Creek Steelhead Barrier Removal** ($239,327): This project, in partnership with Trout Unlimited, will restore fish passage to two miles of stream with year-round

flow. The project will benefit the South-Central California Coast Distinct Population Segment of steelhead trout, which is listed under the Endangered Species Act.

- ***Florida***
  - **Restoration of ESA Threatened Coral Species in Florida** ($492,850): This project, in partnership with the Coral Restoration Foundation, will plant more than 50,000 corals on eight reefs across the Florida Reef Tract. The reefs will be planted with two species of coral listed under the Endangered Species Act. The project will also develop the capacity to grow and transplant three additional threatened species, potentially benefitting a total of five threatened coral species in south Florida and the Florida Keys National Marine Sanctuary.
- ***Hawaii***
  - **Hawaii Fishpond Estuary Restoration** ($200,000): This project, in partnership with The Nature Conservancy, will restore up to seven acres of habitat. It will also promote the exchange of knowledge between practitioners engaged in fishpond management. The ecological function of West Hawai'i's nearshore ecosystems will be improved by restoring traditional fishpond, coastal estuarine, coral reef, and aquatic habitats.
- ***Maine***
  - **Sheepscot River Barrier Removal** ($393,051): This project, in partnership with the Atlantic Salmon Federation, will remove the 15-foot high Coopers Mills Dam. It will also replace undersized culverts in the watershed. The project will significantly improve fish passage for Endangered Species Act-listed Atlantic salmon, and enhance habitat for other migratory fish such as river herring, within the Sheepscot River.
- ***Maryland***
  - **Bloede Dam Removal** ($733,391): This project, in partnership with American Rivers, will restore migratory fish species habitat in the Patapsco River by removing the Bloede Dam. This 34-foot-high dam is a documented safety hazard in the Patapsco Valley State Park. The project will benefit river herring and other migratory species.
- ***Massachusetts***
  - **Barstow's Pond Dam Removal** ($101,000): This project, in partnership with Massachusetts Department of Fish and Game, will remove the Barstow's Pond Dam. The project will benefit river herring by providing access to eight miles of riverine habitat. The dam is classified as a significant hazard by the Massachusetts Office of Dam Safety.
  - **Tack Factory Dam Removal** ($98,000): This project, in partnership with the North and South Rivers Watershed Association, will remove the Tack Factory Dam. The project will benefit river herring by reconnecting eight miles of spawning and juvenile rearing habitat and restoring natural sediment and nutrient transport.
  - **Coonamessett River Restoration** ($430,000): This project, in partnership with the Town of Falmouth, will remove two dams associated with former commercial cranberry operations. It will also replace an undersized culvert with a larger arch structure. The former cranberry bog sites will be restored to native riparian and floodplain habitat. The barrier removals will restore fish passage to more than two stream miles and the 158-acre Coonamesett Pond, providing spawning habitat for river herring.
  - **Herring River Restoration Project** ($700,034): This project, in partnership with Friends of Herring River, will provide funds and technical assistance to design and permit the Herring River Restoration Project. When constructed, the project will slowly return tidal flow to the Herring River to allow for gradual rebuilding of the salt marsh. The marsh has subsided since the Chequessett Neck Road dike was built in 1909.
- ***North Carolina***
  - **Pamlico Sound Oyster Restoration** ($1,275,000): This project, in partnership with the North Carolina Coastal Federation, will construct 45 acres of oyster reef sanctuary. This

will advance the state's goal to create a network of sanctuaries within Pamlico Sound over the next ten years. The project locations are designated as Essential Fish Habitat for at least 26 species of fish. It will provide highly-productive habitat that will benefit commercially and recreationally important species.

- ***Oregon***
  - **Winter Lake Restoration** ($1,210,000): This project, in partnership with The Nature Conservancy, will restore 407 acres of tidal wetlands. It will also increase fish passage on 1,300 acres at a site in the Coquille River Estuary of western Oregon. The project will benefit Endangered Species Act- listed coho salmon.
  - **Willamette Confluence Floodplain Restoration** ($850,129): This project, in partnership with The Nature Conservancy, will restore 330 acres of floodplain habitat at the confluence of two forks of the Willamette River. This project will benefit spring Chinook salmon, listed under the Endangered Species Act.
- ***Puerto Rico***
  - **Culebra Island Restoration of Coral Reef Critical Habitat** ($212,036): In partnership with Protectores de Cuencas, this funding will support seven high-priority projects. All these projects are listed under the Culebra Watershed Management Plan and the Implementation Framework for NOAA's Habitat Blueprint Focus Area in the Caribbean. These efforts will reduce land-based sources of pollution, which will benefit coastal and coral reef habitats.
- ***Washington***
  - **Illabot Creek Alluvial Fan Restoration** ($491,705): This project, in partnership with the Skagit River System Cooperative, will restore Illabot Creek into its historic channel and allow it to migrate freely through the floodplain. This will be accomplished by removing dikes, excavating pilot channels, installing two new bridges, and building log structures to improve habitat conditions. The project will benefit Chinook and coho salmon and steelhead trout.
  - **Accelerating Recovery across Puget Sound** ($896,655): This project, in partnership with The Nature Conservancy, will accelerate the restoration of floodplain and estuary habitat in Puget Sound. Partners will implement two on-the-ground projects and one feasibility and design project. These projects will restore at least 250 acres of delta, tidal, floodplain, and riparian habitat in two of the most important watersheds within Puget Sound for the recovery of Endangered Species Act-listed salmon.

Our investment in habitat is part of a long-term effort to rebuild fisheries, many of which have declined precipitously from habitat loss, over-fishing, and climate change. Recent successes show that restoring habitat is a way to not only stop the decline of fish populations, but also to regrow them to historically healthy numbers.

Approximately $10 million available for fisheries projects

New process provides more guidance for Saltonstall-Kennedy grant applicants

July 22, 2016 NOAA Fisheries is announcing the availability of approximately $10 million in funding for projects focusing on sustainable fisheries and coastal fishing communities.

Also, changes to how stakeholders apply for the grants — the 2017 round of NOAA's Saltonstall-Kennedy grants — will help applicants sharpen their submissions for greater success.

The new "pre-proposal" process asks applicants to briefly show the technical merits and relevance of their project before they submit a full proposal. Applicants will then either be encouraged to submit a full proposal or given feedback how to improve their submission. A pre-proposal is required in order to be eligible to submit a full proposal.

"The Saltonstall-Kennedy grants are one of the primary ways NOAA Fisheries supports fisheries and fishing community research each year," said Eileen Sobeck, assistant NOAA administrator for fisheries. "We want to make sure all stakeholders interested in applying and have fresh ideas about improving fisheries sustainability and coastal community resilience are well-informed about the application process."

This new process builds upon improvements made to the program in 2016 which increased transparency and expanded stakeholder participation in the review process. Proposals undergo a rigorous evaluation process, including extensive technical review both within the agency and by an external constituent panel before final agency review.

To be considered for 2017 funding, projects should advance research in one of the following focus areas:

- Marine aquaculture
- Fishery data collection
- Techniques for reducing bycatch and other adverse impacts
- Adapting to climate change and other long term ecosystem change
- Sustainable seafood promotion, development, and marketing
- Socio-economic fisheries research
- Advancing fisheries science in U.S. territories, including research into enhancing annual catch limits and ecosystem-based fishery management

The deadline for pre-proposals is Sept. 20. Information on eligibility and application requirements can be found at www.grants.gov and the Saltonstall-Kennedy grant program website. NOAA will hold online webinars to introduce the new application process and address questions this August.

President Eisenhower signed the Saltonstall-Kennedy Act, authored by U.S. senators Leverett Saltonstall and John F. Kennedy, the future president, both of Massachusetts, in 1954. Its grants have been a key source of funding for innovative and collaborative projects that advance efforts to achieve sustainable fisheries and enhance economic opportunities for fishing communities and working waterfronts.

NOAA's mission is to understand and predict changes in the Earth's environment, from the depths of the ocean to the surface of the sun, and to conserve and manage our coastal and marine resources. Join us on Facebook, Twitter, Instagram and our other social media channels.

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CDFW News

ENFORCEMENT, ENVIRONMENTAL SCIENCE, HUNTER EDUCATION, HUNTING, LAW ENFORCEMENT, PUBLIC LANDS, WILDLIFE

Nonlead Ammunition Implementation Phase 2 Starts July 1

JUNE 28, 2016 | AHUGHAN

Starting July 1, 2016, nonlead shot will be required when taking upland game birds with a shotgun in California, except for dove, quail, snipe, and any game birds taken at licensed game bird clubs. In addition, nonlead shot will be required when using a shotgun to take resident small game mammals, furbearing mammals, nongame mammals, nongame birds and any wildlife for depredation purposes.

Existing restrictions on the use of lead ammunition in the California condor range, when taking Nelson bighorn sheep and when hunting on all California Department of Fish and Wildlife (CDFW) wildlife areas and ecological reserves remain in effect.

The next phase of the implementation goes into effect July 1, 2019, when hunters must use nonlead ammunition when taking any animal anywhere in the state for any purpose. There are no restrictions on the use of lead ammunition for target shooting purposes.

Nonlead ammunition for some firearm calibers may be in short supply so hunters should plan accordingly. Hunters are encouraged to practice shooting nonlead ammunition to make sure firearms are sighted-in properly and shoot accurately with nonlead ammunition.

In October 2013, Assembly Bill 711 was signed into law requiring the phase-out of lead ammunition for hunting anywhere in the state by July 1, 2019. The law also required an implementation plan designed to impose the least burden on California's hunters while adhering to the intent of the law.

In order to determine what was least disruptive to hunters, CDFW coordinated question and answer sessions at sportsmen's shows, held meetings with hunting organizations, and hosted a series of eight public workshops throughout the state. Incorporating the public input from these workshops, CDFW then presented draft regulations to the Fish and Game Commission.

In April 2015, the Fish and Game Commission adopted CDFW's proposed regulations and implementation plan.

More information on the phase-out of lead ammunition for hunting in California can be found at www.wildlife.ca.gov/hunting/nonlead-ammunition (http://www.wildlife.ca.gov/hunting/nonlead-ammunition).

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CDFW News

HABITAT CONSERVATION, HUNTING, WILDLIFE

Big Game Grants Program Awards $1.1 Million for Wildlife

JULY 8, 2016 | KMACINTY

Hunters' Dollars to Fund Big Game Conservation and Management Projects

The California Department of Fish and Wildlife (CDFW) has awarded $1.1 million in grants for big game conservation projects in Fiscal Year 2016-2017.

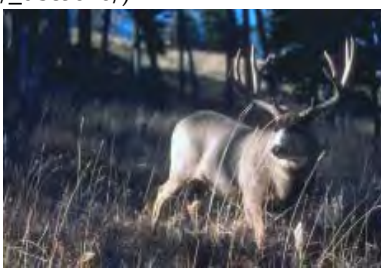
The Big Game Grant Program (BGGP), which allocates funds generated by big-game hunters through the purchase of tags for sheep, bear, deer, pronghorn antelope and wild pig, identified 15 proposals for projects that will benefit big-game populations and the habitats upon which they depend.

"This year we are funding some exceptional studies that will broaden our knowledge and understanding of the unique needs of elk and sheep," said Craig Stowers, CDFW's Big Game Program Manager. "Other projects will help restore crucial habitat for deer and other wildlife, and provide water sources necessary for their survival. All of these proposals have been identified as an appropriate use of hunter dollars. Their funding goes directly to benefit and sustain the wildlife populations they hunt."

(https://cdfgnews.wordpress.com/2016/07/08/big-game-grants-program-awards-1-1-million-for-wildlife/841190_428241567255316_1569857989_o-2/)

(https://cdfgnews.wordpress.com/2014/04/01/cdfw-and-usfws-successfully-relocate-tule-elk-from-san-luis-national-wildlife-refuge/dsc_0390/)

(https://cdfgnews.wordpress.com/2013/04/17/cdfw-creates-first-bighorn-sheep-herd-in-25-years/_dsc5828/)



(https://cdfgnews.wordpress.com/2012/01/18/hunters-and-wildlife-both-win-with-big-

game-fund-raising-tags/buck-2/)

(https://cdfgnews.wordpress.com/2013/05/17/deer-hair-loss-syndrome-challenges-california-researchers/img_0287-2/)

The projects are selected and budget approved by a public advisory committee. Funded proposals must reflect the grantees' dedication to big game conservation and management and meet a series of criteria, including increased hunting opportunity. Awards approved for 2016-2017 include:

- Three grants totaling $277,000 to Oregon State University and the California chapter of the Wild Sheep Foundation for several studies on the effects of pneumonia and respiratory disease in Desert Bighorn Sheep.
- A $29,000 grant to the Society for the Conservation of Bighorn Sheep to develop water sources for wildlife on isolated parcels of land in the Mojave Desert.
- A $205,000 grant to Humboldt State University to study Roosevelt elk populations in Humboldt and Del Norte counties.
- Four grants totaling $127,000 to the Rocky Mountain Elk Foundation to study elk populations in Modoc and Siskiyou counties.
- A $27,000 grant to the Society for the Conservation of Bighorn Sheep to refill dried-up water guzzlers for wildlife in rural areas.
- Two grants totaling $160,000 to the Mendocino County Blacktail Association to remove fir trees and improve forage and cover for deer in Mendocino, Glenn and Humboldt counties.
- A $54,000 grant to CalFauna to conduct a prescribed burn in the Stanislaus National Forest and to document revegetation that will benefit wildlife.
- An $81,000 grant to the Mule Deer Foundation to restore riparian meadows near Little Rattlesnake Creek in the Stanislaus National Forest.
- A $150,000 grant to the California Deer Association to reconstruct and maintain watering devices for wildlife in the northern part of the state.

Grant monies awarded to the California chapter of the Wild Sheep Foundation will allow the continuation of an ongoing study of the spread and consequences of respiratory disease for bighorn sheep in the eastern Mojave Desert. In addition to conserving and enhancing wild sheep populations, the nonprofit is committed to educating the public about sustainable use and the conservation benefits of hunting.

"We could not have funded this three-year sheep study without the support from the Big Game Management Account," said Kyle Meintzer, an avid outdoorsman and bow hunter who serves on the Board of Directors for the Wild Sheep Foundation. "The BGGP shows the importance and value of hunters and the dollars their licenses and tags provide for wildlife management and conservation."

The Big Game Management Account and BGGP were created by the California Legislature in 2010 (currently Fish and Game Code, section 3953). Since the inception of the BGGP, more than $5 million has gone to such projects. More information about the BGGP can be found at www.wildlife.ca.gov/grants/big-game (http://www.wildlife.ca.gov/grants/big-game).

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BIG GAME **GRANT FUNDING** **GRANTS** **HUNTING**

California Fish and Game Commission
Potential Agenda Items for October 2016 Commission Meeting

The next FGC meeting is scheduled October 19-20 at the Red Lion Inn, in Eureka. This document identifies potential agenda items for the meeting, including items to be received from FGC staff and the Department of Fish and Wildlife (DFW).

Wednesday, October 19: Marine-related and administrative items

1. Public forum
2. Marine Resources Committee update
3. Tribal Committee update
4. Discuss: Tribal take in northern California MPAs
5. Discuss: Recreational groundfish
6. Adopt: FGC Conflict of Interest Code
7. Marine items of interest from previous meetings
8. Action on marine regulatory petitions and non-regulatory requests from prior meetings
9. Presentation: DFW Law Enforcement Division efforts through Watershed Enhancement Team (WET) and Marijuana Eradication Team (MET) to remediate rodenticide disposal from illegal grows
10. Receive DFW informational items
11. Receive other information (staff report, legislative update, federal report)

Thursday, October 20: Non-marine-related and administrative items

12. Public forum
13. Wildlife Resources Committee update
14. Discuss: Sport fish
15. Discuss: Falconry cleanup
16. Adopt: Upland game bird special hunt drawing
17. Adopt: Nongame animals
18. Approve: Initial, annual and five-year Private Lands Wildlife Habitat Enhancement and Management Area (PLM) plans and licenses
19. Ratify findings on Livermore tarplant final consideration of listing
20. Ratify findings on northern spotted owl final consideration of listing
21. Ratify findings on Townsend's big-eared bat final consideration of listing
22. Receive: Petition to list Lassics lupine as endangered
23. Receive: DFW 90 day evaluation report on petition to list coast yellow leptosiphon as endangered
24. Receive: DFW 1-year status review report on petition to list flat-tailed horned lizard as endangered
25. Receive: DFW coho salmon recovery annual report
26. Receive, discuss and adopt revisions to Commission policy on wild trout waters designations
27. Presentation: DFW overview of California Bat Conservation Plan
28. Non-marine items of interest from previous meetings
29. Action on non-marine regulatory petitions and non-regulatory requests from prior meetings
30. Update on DFW review of petitions for night hunting in wolf zone and trapping fees
31. Discuss/Approve: Future meetings (next meeting agenda items, rulemaking calendar updates, and new business)

PERPETUAL TIMETABLE FOR CALIFORNIA FISH AND GAME COMMISSION ANTICIPATED REGULATORY ACTIONS

Updated: 08/10/16

ITEMS PROPOSED FOR CHANGE ARE SHOWN IN BLUE

For FGC Staff use. QTRLY EFFECTIVE	DFW RU ANALYST	FGC ANALYST	LEAD	REGULATORY CHANGE CATEGORY	ACTION DATE, TYPE AND LOCATION	2016 AUG 24	2016 AUG 25	2016 SEP 21	2016 OCT 19	2016 OCT 20	2016 NOV 17	2016 DEC 7	2016 DEC 8	2017 JAN 18	2017 FEB 7	2017 FEB 8	2017 FEB 9	2017 MAR 15	2017 MAR 23	2017 APR 13	2017 APR 26	2017 APR 27	2017 MAY 24	2017 JUN 20	2017 JUN 21	2017 JUN 22	2017 JUL 20	2017 AUG 16	2017 AUG 17	2017 SEP 13	2017 OCT 11	2017 OCT 12	2017 NOV 9	2017 DEC 6	2017 DEC 7
						FGC FOLSOM		WRC WOODLAND	FGC EUREKA		MRC SACRAMENTO	FGC SAN DIEGO		WRC REDDING	TC SANTA ROSA	FGC SANTA ROSA		TELECONFERENCE	MRC SAN CLEMETE/OCEANSIDE	TELECONFERENCE	FGC LOS ANGELES		WRC SACRAMENTO	TC FORTUNA	FGC FORTUNA		MRC PETALUMA	FGC SACRAMENTO		WRC RIVERSIDE	FGC VENTURA		MRC MARINA	FGC SAN DIEGO	
					File Notice w/OAL by	6/28/16			8/11/15			10/13/15				12/13/16		01/17/17		02/14/17	02/28/17				04/25/17			06/20/17			8/16/15			10/11/15	
					Notice Published	7/8/16			8/21/15			10/23/15				12/23/16		01/27/17		02/24/17	03/10/17				05/05/17			06/30/17			8/26/15			10/21/15	
					Title 14 Section(s)																														
	SB	JS	FB	SPORT FISH	1.05 et al.		N			D			A	V				E 3/1					R					N				D			A
	SB	SF	MR	OCEAN SALMON SPORT FISHING (PHASE I)	27.80(c)												D	A		E 4/1															N
	SB	SF	MR	PACIFIC HALIBUT SPORT FISHING	28.20							N					D			A			E 5/1												N
	SB	SF	MR	OCEAN SALMON SPORT FISHING (PHASE II)	27.80(d)												D			A			E 5/1												N
	SB	SF	FB	KLAMATH RIVER SPORT FISHING	7.50(b)(91.1)	E 8/1		R				N				D				A						V		E 8/1		R					N
*		ST	OGC	TRICOLORED BLACKBIRD - 2084 EMERGENCY	749			EE 9/6																											
	SB	ST	FB	UPPER SACRAMENTO RIVER EMERGENCY	7.50(b)(156.5)	EE 8/29																													
		ST	MR	RAZOR CLAM EMERGENCY - 180 DAY E 4/26	29.45						EE10/25																								
		ST	MR	RECREATIONAL CRAB FISH - 90 DAY E 8/1							EE10/30																								
	MR	JS	FB	CENTRAL VALLEY SALMON SPORT FISHING	7.50(b)	E 8/1							N			D					A							E 8/1						N	
	MR	JS	WLB	MAMMAL HUNTING 2016-2017	265 et al.			R					N			D					A		V				E 7/1		R					N	
	MR	JS	WLB	WATERFOWL	502			R					N			D					A		V				E 7/1		R					N	
*	MR	CW	MR	ELECTRONIC REPORT OF MARINE LOGBOOKS	190																														
*	MR	ST	MR	COMMERCIAL SEA URCHIN (PHASE I)	120.7																														
*		SF	FGC	COMMISSION MEETING PROCEDURES	665				E 10/1																										
*	SB	ST	MR	SPINY LOBSTER, SPORT AND COMMERCIAL	29.80 et al.				E 10/1																										
*	SB	CW	WLB	NONLEAD AMMUNITION COUPON PROGRAM	250.2				E 10/1																										
	SB	JS	LED	TIDAL WATERS SF/SAN PABLO BAY	1.53 27.00 28.65(a)		A							E 1/1																					
*	SB	CW	WLB	DFW LANDS PASS	550 et al.		A							E 1/1																					
	MR	CW	WLB	UPLAND (RESIDENT) GAME BIRD	300, 311, 745.5		A	E 9/1						R		N					D				A					E 9/1					
*		CW	OGC	CONFLICT OF INTEREST CODE	782.1					D/A				E 1/1																					
*	MR	SF	MR	COMMERCIAL HAGFISH BARREL TRAPS	180.6(b)	D/A								E 1/1																					
*	MR	CW	WLB	NONGAME ANIMALS - GENERAL PROVISIONS	472		D/A			A				E 1/1																					
*	MR	CW	LED	UPLAND GAME BIRD SPECIAL HUNT DRAWING	702, 715 (new)		D			A				E 1/1						E 4/1															
		SF	FGC	TRIBAL TAKE IN MPAs	632	N			D			A								E 4/1															
	MR	SF	MR	RECREATIONAL GROUNDFISH	27.20 et al.	N			D			A		E 1/1																					
*	SB	CW	LED	ENHANCE PENALTIES FOR GAME ILLEGAL TAKE	748.6 (new)		N						A							E 4/1															
*	MR	JS	WLB	FALCONRY CLEAN-UP	670		N			D			A							E 4/1															
	MR	JS	WLB	BIG GAME TAG QUOTA REPORTING PROCESS	360, 361, 362, 363, 364																				N			D			A				
*			MR	KELP AND ALGAE HARVEST MANAGEMENT	165, 165.5, 704						V																								
*			MR	COMMERCIAL SEA CUCUMBER [2016]	128																														
*		ST	MR	COMMERCIAL SEA URCHIN (PHASE II) [TBD]	120.7																														
*				POSSESS GAME / PROCESS INTO FOOD [TBD]	TBD																														
*			OGC	AZA/ZAA [TBD]	671.1																														

EM = Emergency, EE = Emergency Expires, E = Anticipated Effective Date (RED "E" = expedited OAL review), N = Notice Hearing, D = Discussion Hearing, A = Adoption Hearing,
V =Vetting, R = Committee Recommendation, WRC = Wildlife Resources Committee, MRC = Marine Resources Committee, TC = Tribal Committee

State of California
Department of Fish and Wildlife

Memorandum

RECEIVED
CALIFORNIA
FISH AND GAME
COMMISSION
2016 AUG 10 AM 11: 1

Date: August 11, 2016

To: Valerie Termini, Executive Director
Fish and Game Commission

From: Charlton Bonham
Director

Subject: **Request for change to the Fish and Game Commission's Timetable for Anticipated Regulatory Actions**

The Department of Fish and Wildlife requests the following schedule changes to the Fish and Game Commission's regulatory timetable:

- Advance the 2017 Upland Game regulation schedule from the current April notice, June discussion, and August adoption to notice in February, discussion in April, and adoption in June. This revised schedule will avoid delays in publishing the Waterfowl/Upland Game/Department Lands regulations booklets, which need to be available to the public by September 1.
- Move the adoption date for the amendment of Section 472, nongame animals, from the August meeting to the October meeting. This change is needed to provide the 45-day comment period required by the Administrative Procedure Act.

If you have any questions or need additional information, please contact Regulations Unit Manager, Craig Martz at (916) 653-4674 or by email at Craig.Martz@wildlife.ca.gov.

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CALIFORNIA FISH AND GAME COMMISSION
RESOLUTION HONORING

Mr. Howard N. Ellman

WHEREAS, the Waterfowler's Hall of Fame was established in 2006 to recognize those individuals who have made significant contributions to enhancing waterfowl and their habitats in California; and

WHEREAS, many wildlife professionals, have dedicated their life's work to management and research to conserve waterfowl and their habitats; and

WHEREAS, many sportsmen and other conservationists have served a critical role in conserving our waterfowl resource by preserving, restoring, and enhancing natural habitats, managing agricultural habitats with wildlife in mind, and implementing other land uses specifically designed to benefit the waterfowl resource; and

WHEREAS, some sportsmen and other conservationists have significantly benefited the waterfowl resource by advocating legislation and other policies that provide needed resources for nesting and wintering waterfowl populations;

NOW THEREFORE, BE IT RESOLVED, that the California Fish and Game Commission hereby recognizes the addition of Mr. Howard N. Ellman to the Waterfowler's Hall of Fame.

FURTHER, BE IT RESOLVED, that the Commission recognizes Mr. Ellman for his integral role in the establishment of the California Game Warden Foundation. Mr. Ellman, a man of extraordinary ethics and commitment, forged conservation partnerships that helped to save many endangered wetlands by working successfully with landowners and guiding them through the complex maze of legal issues, as well as securing much needed water for them. Mr. Ellman collaboratively fashioned the complex water rights issues in the negotiations with the US Fish and Wildlife Service, the California Department Fish and Game, the Nature Conservancy and a land owner to create a conservation easement for Rancho Llano Seco.

FINALLY, BE IT RESOLVED, that the Fish and Game Commission further recognizes Mr. Ellman's distinguished career practicing law, concentrating on real estate, land use and environmental regulation. Mr. Ellman is a true protector of our waterfowl resource and of our hunting heritage.

DATED: AUGUST 25, 2016

Eric Sklar, President	**Jacque Hostler-Carmesin, Vice President**
Anthony C. Williams, Member	**Russell Burns, Member**
Peter Silva, Member	**Valerie Termini, Executive Director**

CALIFORNIA FISH AND GAME COMMISSION
RESOLUTION HONORING

Mr. Bill Pinches

WHEREAS, the Waterfowler's Hall of Fame was established in 2006 to recognize those individuals who have made significant contributions to enhancing waterfowl and their habitats in California; and

WHEREAS, many wildlife professionals, have dedicated their life's work to management and research to conserve waterfowl and their habitats; and

WHEREAS, many sportsmen and other conservationists have served a critical role in conserving our waterfowl resource by preserving, restoring, and enhancing natural habitats, managing agricultural habitats with wildlife in mind, and implementing other land uses specifically designed to benefit the waterfowl resource; and

WHEREAS, some sportsmen and other conservationists have significantly benefited the waterfowl resource by advocating legislation and other policies that provide needed resources for nesting and wintering waterfowl populations;

NOW THEREFORE, BE IT RESOLVED, that the California Fish and Game Commission hereby recognizes the addition of Mr. Bill Pinches to the Waterfowler's Hall of Fame.

FURTHER, BE IT RESOLVED, that the Fish and Game Commission recognizes Mr. Pinches for his substantial contributions as a master decoy carver. Mr. Pinches has carved over a thousand blocks and donated a large portion of these decoys to fundraising events benefiting waterfowl conservation. Mr. Pinches was also instrumental in forming the North Coast Waterfowlers Association. With his help, one of the Association's biggest accomplishments was working with the California Department of Fish and Wildlife and the US Fish and Wildlife Service to keep brant hunting open on Humboldt Bay. In the late 1970's Mr. Pinches served on the California Waterfowl Association (CWA) Board and Executive Board. He is a CWA Life Member, Honorary Life Member of the Pacific Flyway Decoy Association and a Washington Brant Foundation Donor.

FINALLY, BE IT RESOLVED, that the Fish and Game Commission further recognizes Mr. Pinches's passion has been instrumental in bringing hunters and non-hunters together in recognizing the importance of conservation of waterfowl and their habitats.

DATED: AUGUST 25, 2016

Eric Sklar, President	**Jacque Hostler-Carmesin, Vice President**
Anthony C. Williams, Member	**Russell Burns, Member**
Peter Silva, Member	**Valerie Termini, Executive Director**

CALIFORNIA FISH AND GAME COMMISSION
RESOLUTION HONORING

Thomas A. Seeno

WHEREAS, the Waterfowler's Hall of Fame was established in 2006 to recognize those individuals who have made significant contributions to enhancing waterfowl and their habitats in California; and

WHEREAS, many wildlife professionals, have dedicated their life's work to management and research to conserve waterfowl and their habitats; and

WHEREAS, many sportsmen and other conservationists have served a critical role in conserving our waterfowl resource by preserving, restoring, and enhancing natural habitats, managing agricultural habitats with wildlife in mind, and implementing other land uses specifically designed to benefit the waterfowl resource; and

WHEREAS, some sportsmen and other conservationists have significantly benefited the waterfowl resource by advocating legislation and other policies that provide needed resources for nesting and wintering waterfowl populations;

NOW THEREFORE, BE IT RESOLVED, that the California Fish and Game Commission hereby recognizes the addition of Mr. Thomas A. Seeno to the Waterfowler's Hall of Fame.

FURTHER, BE IT RESOLVED, that the Fish and Game Commission recognizes Mr. Seeno as a leader in the waterfowl conservation community. One of his crowning achievements was becoming co-owner and restoring wetlands at Behring Ranch in the Butte Sink. Part of the effort included converting 525 acres of rice to diverse natural habitat. The Behring Ranch now places a critical role as an essential link in both south and north Pacific Flyway migration. Mr. Seeno, a California Waterfowl Association (CWA) Ruby Benefactor, has served as a National Trustee on Ducks Unlimited Wetland American Trust. Mr. Seeno has also played an integral role on CWA's Regulations and Traditions committee which proposes season and harvest regulations to the California Department of Fish and Wildlife.

FINALLY, BE IT RESOLVED, that the Fish and Game Commission further recognizes Mr. Seeno for his leadership role in developing the Suisun Marsh Preservation Action Committee to protect and enhance the Suisun Marsh, the largest brackish water marsh on the west coast of the United States.

DATED: AUGUST 25, 2016

Eric Sklar, President	**Jacque Hostler-Carmesin, Vice President**
Anthony C. Williams, Member	**Russell Burns, Member**
Peter Silva, Member	**Valerie Termini, Executive Director**

CALIFORNIA FISH AND GAME COMMISSION
RESOLUTION HONORING

Dr. John Y. Takekawa

WHEREAS, the Waterfowler's Hall of Fame was established in 2006 to recognize those individuals who have made significant contributions to enhancing waterfowl and their habitats in California; and

WHEREAS, many wildlife professionals, have dedicated their life's work to management and research to conserve waterfowl and their habitats; and

WHEREAS, many sportsmen and other conservationists have served a critical role in conserving our waterfowl resource by preserving, restoring, and enhancing natural habitats, managing agricultural habitats with wildlife in mind, and implementing other land uses specifically designed to benefit the waterfowl resource; and

WHEREAS, some sportsmen and other conservationists have significantly benefited the waterfowl resource by advocating legislation and other policies that provide needed resources for nesting and wintering waterfowl populations;

NOW THEREFORE, BE IT RESOLVED, that the California Fish and Game Commission hereby recognizes the addition of Dr. John Y. Takekawa to the Waterfowler's Hall of Fame.

FURTHER, BE IT RESOLVED, that the Fish and Game Commission recognizes Dr. John Takekawa as a highly productive waterfowl scientist who authored hundreds of scientific publications beginning with his dissertation on canvasback energetics on the Upper Mississippi River; is acknowledged as an expert in the fields of salt marsh ecology and restoration; played a leadership role by anticipating the potential to focus attention on wild migratory birds as a way to spread highly pathogenic avian influenza, determining the migration ecology of lesser snow geese from Russia; assessing wintering habitat for waterfowl and other waterbirds in Mexico, and studying the wintering ecology of sea ducks and other migratory birds, both in California and internationally. Dr. Takekawa was the first to use satellite telemetry on geese, and he and his cooperators were early leaders in providing migration information for the conservation of tule white-fronted geese.

FINALLY, BE IT RESOLVED, that the Fish and Game Commission further recognizes Dr. Takekawa for his endeavors to recognize the importance of San Francisco Bay to waterfowl, and through his decades of research, mentoring dozens of new biologists that today carry on his high scientific integrity.

DATED: AUGUST 25, 2016

Eric Sklar, President	**Jacque Hostler-Carmesin, Vice President**
Anthony C. Williams, Member	**Russell Burns, Member**
Peter Silva, Member	**Valerie Termini, Executive Director**

CALIFORNIA FISH AND GAME COMMISSION
RESOLUTION HONORING

Mr. C Jeff Thomson

WHEREAS, the Waterfowler's Hall of Fame was established in 2006 to recognize those individuals who have made significant contributions to enhancing waterfowl and their habitats in California; and

WHEREAS, many wildlife professionals, have dedicated their life's work to management and research to conserve waterfowl and their habitats; and

WHEREAS, many sportsmen and other conservationists have served a critical role in conserving our waterfowl resource by preserving, restoring, and enhancing natural habitats, managing agricultural habitats with wildlife in mind, and implementing other land uses specifically designed to benefit the waterfowl resource; and

WHEREAS, some sportsmen and other conservationists have significantly benefited the waterfowl resource by advocating legislation and other policies that provide needed resources for nesting and wintering waterfowl populations;

NOW THEREFORE, BE IT RESOLVED, that the California Fish and Game Commission hereby recognizes the addition of Mr. C. Jeff Thomson to the Waterfowler's Hall of Fame.

FURTHER, BE IT RESOLVED, that the Fish and Game Commission recognizes Mr. Thomson for his substantial contributions to preserve the Tulare Basin Wetlands. In the early 1990's, Mr. Thomson organized a meeting of local duck club owners, representatives from the U.S. Fish and Wildlife Service, Department of Fish and Game, California Waterfowl Association, Ducks Unlimited and Southern California Ducks, and from his efforts the Tulare Basin Wetlands Association was created. Mr. Thomson also was a leader by enhancing the Tulare Basin's first private habitat project on his own El Cinco duck club. Mr. Thomson also worked with the Semitropic Water Storage District to firm up annual water availability allowing ground water to be banked and used for habitat.

FINALLY, BE IT RESOLVED, that the Fish and Game Commission further recognizes Mr. Thomson for his unprecedented vision and leadership that has ensured that the Tulare Basin will be protected in perpetuity.

DATED: AUGUST 25, 2016

Eric Sklar, President	**Jacque Hostler-Carmesin, Vice President**
Anthony C. Williams, Member	**Russell Burns, Member**
Peter Silva, Member	**Valerie Termini, Executive Director**

State of California
California Department of Fish and Wildlife

Memorandum

Date: July 25, 2016

To: Valerie Termini, Executive Director
Fish and Game Commission

From: Charlton H. Bonham
Director

Subject: **Request for 30-day extension, coast yellow leptosiphon (*Leptosiphon croceus*)**

The California Department of Fish and Wildlife (CDFW) requests a 30 day extension of time pursuant to Fish and Game Code section 2073.5 to allow the CDFW additional time to analyze and evaluate the petition to list coast yellow leptosiphon (*Leptosiphon croceus*) under the California Endangered Species Act and to complete our evaluation report. This extension would change the due date for the CDFW's evaluation from 90 days due on August 25, 2016, to 120 days due on September 24, 2016.

If you have any questions or need additional information, please contact Mr. Richard Macedo, Branch Chief, Habitat Conservation Planning Branch at (916) 653-3861 or at richard.macedo@wildlife.ca.gov.

ec: Department of Fish and Wildlife

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California Fish and Game Commission

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CALIFORNIA
NATIVE PLANT SOCIETY

May 25, 2016

California Fish and Game Commission
P.O. Box 944209
Sacramento, CA
94244-2090

Memorandum: Evaluation of a Petition to List *Leptosiphon croceus* (coast yellow leptosiphon) under the California Endangered Species Act

Dear California Fish and Game Commission:

The California Native Plant Society (CNPS) has reviewed a petition to list *Leptosiphon croceus* (coast yellow leptosiphon) as Endangered under the California Endangered Species Act (CESA). We provide our recommendation below.

CNPS is a non-profit organization that works to protect California's native plant heritage and preserve it for future generations. CNPS' mission is to increase the understanding and appreciation of California's native plants and to preserve them in their natural habitat. Our nearly 10,000 members promote native plant appreciation, research, education, and conservation through our 5 statewide programs and 35 Chapters across the state of California, and Baja California, MX.

CNPS has completed a review of this petition for its scientific validity and conservation merits. The CNPS Rare Plant Program Committee has assessed the petition's scientific validity by evaluating the accuracy of information regarding taxonomy, ecology, life history, and demographic data presented herein. The CNPS Conservation Program Committee has assessed the petition's conservation merits by evaluating threats, stressors, and management information applicable to this species.

Based upon our review of these factors, CNPS finds the current status of *Leptosiphon croceus* to merit consideration for listing as Endangered under the California Endangered Species Act. Therefore, the California Native Plant Society endorses this petition and should be considered a co-sponsor of this effort.

Our organization looks forward to working with you to ensure *Leptosiphon croceus* is provided the protections and management requirements afforded to it through the CESA. Please do not hesitate to contact us with any questions regarding our review and endorsement.

Sincerely,

James M. André

Jim André
Rare Plant Program Senior Advisor
Rare Plant Program Committee Chair

Greg Suba

Greg Suba
Conservation Program Director

FGC - 670.1 (3/94)

A PETITION TO THE STATE OF CALIFORNIA
FISH AND GAME COMMISSION

For action pursuant to Section 670.1, Title 14, California Code of Regulations (CCR) and Sections 2072 and 2073 of the Fish and Game Code relating to listing and delisting endangered and threatened species of plants and animals.

I. SPECIES BEING PETITIONED:

Common Name: coast yellow leptosiphon

Scientific Name: *Leptosiphon croceus*

II. RECOMMENDED ACTION:

(Check appropriate categories)

a. List XX

As Endangered XX

As Threatened ___

b. Change Status

from _____

to _____

Or Delist ___

III. AUTHOR OF PETITION:

Name: Toni Corelli, Botanist (corelli@coastside.net)
former Rare Plant Chairperson, Santa Clara Valley Chapter of California Native Plant Society

Address: 250 Granelli Avenue

Half Moon Bay, California 94019

Phone Number: (650) 726-0689

I hereby certify that, to the best of my knowledge, all statements made in this petition are true and complete.

Signature: Toni Corelli

Date: May 23, 2016

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A PETITION TO THE STATE OF CALIFORNIA FISH AND GAME COMMISSION
SUPPORTING INFORMATION FOR

coast yellow leptosiphon	*Leptosiphon croceus*
Common Name	Scientific Name

EXECUTIVE SUMMARY

Coast yellow leptosiphon (*Leptosiphon croceus*) is a bright yellow flowered, low growing annual in the phlox family (Polemoniaceae) first described by Alice Eastwood in 1904 as a "strictly local species" (Strother & Kersh 2016). Although four Element Occurrences (EOs) are included in the California Natural Diversity Database (CDFW 2016) *Leptosiphon croceus* (LECR) is currently known from a single extant occurrence, element occurrence 2 (EO2), and is a San Mateo County endemic species (Baldwin, 2012). The colony is limited to a 60x30' area at Fitzgerald Marine Reserve, County of San Mateo Parks and Recreation Division. Located on Vallemar Bluff in Moss Beach, San Mateo County, California.

Leptosiphon croceus is listed in the California Native Plant Society's *Inventory of Rare and Endangered Plants* as a California Rare Plant Rank 1B.1 species Rare, threatened, or endangered in California and elsewhere; .1 Seriously threatened in California. (California Native Plant Society, Rare Plant Program 2016). Three historical occurrences of LECR - EO1, EO3, EO4 are now documented as extirpated making the Moss Beach, Fitzgerald Marine Reserve LECR EO2 the last remaining population. LECR occurs on the immediate coastal terrace bluff top in coastal prairie habitat. This colony has steadily been reduced by cliff erosion, encroachment of non-native plants, fragmentation and compaction of soil within and around the population. The adjacent coastal prairie habitat has been impacted in the past by heavy equipment used to drill test wells and now there is a proposed development to build houses on the lots located there (see Figure 6).

LECR should be proposed for listing under the Federal Endangered Species Act as well since the last population is on public land and the colony is endangered. Listing the coast yellow leptosiphon under the California Endangered Species Act is necessary to provide critical legal protections and habitat designations to ensure survival of this highly endangered species.

TAXONOMY AND DESCRIPTION

TAXONOMIC HISTORY

Coast yellow leptosiphon (*Leptosiphon croceus*) is now known from only one colony. That population is on Vallemar Bluff in Moss Beach, San Mateo County, California (LECR EO2). The plants were first found and named at the species rank as *Linanthus croceus* Eastwood (Botanical Gazette, vol. 37, p. 442, April 1904). Alice Eastwood collected the type specimen and in the protologue for the name wrote, "This beautiful species was collected by the author May 9, 1901, near Point San Pedro, San Mateo County, California." The Eastwood name is basionym for the currently accepted name for the species: *Leptosiphon croceus* (Eastwood) Strother & Kersh. Other synonyms of *Leptosiphon croceus* include: *Linanthus parviflorus* var. *croceus* Milliken, Univ. Calif. Publ. Bot. 2:59. 1904. *Linanthus androsaceus* var. *croceus* (Eastwood) Jepson, Man. Fl. Pl. Calif. 805. 1925. *Linanthus androsaceus* ssp. *croceus* (Milliken) Mason in Abrams, Ill. Fl. Pacific States 3:430. 1951. *Leptosiphon croceus* (Eastw.) J.M. Porter & L.A. Johnson (Baldwin 2012). Also *Linanthus croceus* has been treated as a synonym of *Linanthus parviflorus* (Bentham) Greene, e.g., in J. C. Hickman ed., The Jepson Manual. 1993.

DESCRIPTION

Coast yellow leptosiphon (*Leptosiphon croceus*, henceforth abbreviated LECR) is a low growing, hairy, annual. It is often much-branched from base and when mature grows to a height of 4-7 cm. The inflorescence is in a

dense, bracted head with a long corolla tube and bright yellow flowers. The calyx is sessile, clustered within a head of leaf-like bracts. Each of the 5 calyx lobes is densely glandular-hairy. The flowers are bright yellow with 5 corolla lobes 6-8 mm long, > 5 mm wide and generally with 2 red spots at base. Each flower has a corolla tube measuring 26-39 mm long. The stamens are exserted and the stigmas are 2-5 mm long. The leaves are thick and somewhat succulent fleshy, opposite, palmately 3-9 lobed, each lobe 4-7 mm long. (Baldwin 2012, Battaglia 2001). The fruit is a capsule. The number of seeds in each capsule for similar species when pollinated is 20-60 (Goodwillie).

Figure 1. Coast yellow leptosiphon (*Leptosiphon croceus*). Photograph by Avis Boutell

PHENOLOGY

LECR generally flowers from April-May (Baldwin 2012)

SIMILAR TAXA (similar taxa of *Leptosiphon* labeled *L.)*

LECR is extremely low growing, being the shortest of all the species (4-7 cm) and the width of corolla lobes, both at middle and tip, are the largest in the complex. LECR shares morphological characteristics with *L. androsaceus, L. parviflorus, L. latisectus, L. rosaceus* and some of the characteristics are intermediate between them. LECR can be distinguished from *L. androsaceus* and *L. rosaceus* by its calyx lobes that are densely glandular-hairy throughout the whole surface as opposed to the calyx hairs ciliate only on the margins and nonglandular in *L. androsaceus* and *L. rosaceus.* LECR is distinguished from *L. parviflorus* and *L. latisectus* by its rounded corolla lobes and short habit of <7 cm tall (Battaglia 2001). *L. latisectus* is also not known to occur in the same geographical range as LECR.

ECOLOGY

HABITAT

LECR occurs at an elevation of 14 meters atop a sea bluff at the edge of the coastline on a marine terrace supported by sedimentary sandstone derived soil. This habitat is highly influenced by wind, cool salt-laden air and fog.

Of the natural communities list the most similar association for LECR is Coastal Terrace Prairie Code CTT41100CA (California Department of Fish and Wildlife, Natural Communities - List a Hierarchical List of Natural Communities with Holland Types, Sept. 2010).

Coastal prairie along the San Mateo Coast is characterized by low growing perennial grasses and annual and perennial forbs. LECR EO2 occurs with a diverse array of perennial grasses (*Bromus maritimus, Danthonia californica, Deschampsia cespitosa* ssp*. holciformis, Hordeum brachyantherum, Agrostis blasdalei*) and other native herbaceous flowering plants (see associated species section below), but has become diminished as non-native plants have colonized the bluff top. The last population of LECR occurs with two other California Rare Plant Rank species *Agrostis blasdalei*, and *Castilleja ambigua* var*. ambigua*. LECR has been sheltered by the 2.5 acre undeveloped coastal prairie adjacent that provides a natural buffer between Highway 1 and the bluff top edge. LECR yellow mats shown below in Figure 2.

Figure 2. LECR occurrence EO2 Vallemar Bluff, Moss Beach, San Mateo County. Photograph by Avis Boutell

POLLINATION

Pollination studies have been conducted on similar species of *Leptosiphon* and have shown that they are predominantly bee fly (Bombyliidae) pollinated and wind pollinated (Goodwillie 2001). Other potential pollinators have been recently observed on LECR, such as the beetle (*Listrus* sp.) in the Melyridae (soft-wing flower beetles) see Figure 3 (Bug Guide 2013-2016).

Figure 3. Family Melyridae (soft-wing flower beetles), Genus *Listrus* on LECR, photographed on LECR by Aaron Schusteff in Moss Beach, San Mateo County, California, USA

ASSOCIATED SPECIES

LECR is associated with a number of native species including *Agrostis blasdalei, Armeria maritima, Bromus maritimus, Danthonia californica, Deschampsia cespitosa* ssp*. holciformis, Castilleja ambigua* ssp*. ambigua, Eriogonum latifolium, Eryngium armatum, Fragaria chiloensis*, *Gamochaeta ustulata, Grindelia stricta* var*. platyphylla, Hordeum brachyantherum, Zeltnera davyi.* Non-native species including *Carpobrotus edulis (*CAL-IPC category High*), Festuca myuros, Festuca perennis, Hordeum murinum* ssp*. leporinum* (CAL-IPC category Moderate), *Hypochaeris radicata* (CAL-IPC category Moderate)*, Plantago coronopus, Plantago lanceolata* (CAL-IPC category Limited).

DISTRIBUTION AND ABUNDANCE

The only known extant population of LECR is located at the Fitzgerald Marine Reserve in Moss Beach, San Mateo County element occurrence (EO2). Attempts to locate other populations and account for historical occurrences EO1, 3 and 4 are noted in the following tables.

OCCURRENCES

Table 1. LECR Element Occurrences

Element Occurrence (EO)	Quad, County, Location	Presence
EO1	Pigeon Point, San Mateo, PEBBLE BEACH	LECR is not present now or in the past at Pebble Beach, San Mateo County, see Table 2
EO2	Montara Mountain, San Mateo, VALLEMAR BLUFF MOSS BEACH	Extant, see Table 3
EO3	Montara Mountain, San Mateo, NEAR POINT SAN PEDRO	No longer a valid EO since no vouchers were collected from Point San Pedro
EO4	Bolinas, Marin, BOLINAS, NEAR RADIO STATION	LECR is not present now or in the past in Marin County, see Table 4

LECR EO1 - Pebble Beach population. Presence of this population is based on 1929 and1935 collections. After reviewing the specimens it is determined that sheets labeled LECR as occurring at Pebble Beach are *Leptosiphon parviflorus*.

Table 2. LECR EO1

Collector, Number, Date Collected	Annotation 2016	Taxon Name on Collection Sheet	County, Locality
Specimen number: POM279138			
H. E. Wieser, May 1929	*Leptosiphon parviflorus*	*Leptosiphon croceus*	San Mateo, Pebble Beach
Specimen number: RSA18361, SD244610, UC729640			
C. B. Wolf, 3727, May 25 1929	*Leptosiphon parviflorus*	*Leptosiphon croceus*	San Mateo, Pebble Beach
Specimen number: POM310909, UC964718, UC908670			
H. L. Mason, 8315, May 21 1935	*Leptosiphon parviflorus*	*Leptosiphon croceus*	San Mateo, Pebble Beach

LECR EO2 - Moss Beach (Blenheim is an older place name for Moss Beach (Morrall 2009). LECR has been collected 7 times from 1899-2015 in Moss Beach, San Mateo County. After a survey of historical documents and herbarium collections LECR EO2 was and is the only occurrence (see Table 5).

Table 3. LECR EO2

Collector, Number, Date Collected	Annotation 2016	Taxon Name on Collection Sheet	County, Locality
Specimen number: CAS394			
Alice Eastwood, May 2 1899	*Leptosiphon croceus*	*Linanthus croceus*	San Mateo, Near Pt. San Pedro (Blenheim)
Specimen number: CAS393			
Alice Eastwood, May 9 1901	*Leptosiphon croceus*	*Linanthus croceus*	San Mateo, Blenheim
Specimen number: DS133196, POM3565, GH78828, NY336940, UC106861			
Alice Eastwood, May 19 1901	*Leptosiphon croceus*	*Linanthus croceus*	San Mateo, Blenheim
Specimen number: UC106675			
Katharine Brandegee, Jun 19 1905	*Leptosiphon croceus*	*Linanthus androsaceus*	Moss Beach
Specimen number: UC176059			
Miss Kate Cole, May 1914	*Leptosiphon croceus*	*Linanthus androsaceus*	San Mateo, Moss Beach
Specimen number: SEINET3861922			
Genevieve K. Walden, 203, 2009-06-22	*Leptosiphon croceus*	*Leptosiphon croceus*	San Mateo, Moss Beach
Specimen number: SJSU15003			
Toni Corelli, 1193, 5/3/2015	*Leptosiphon croceus*	*Leptosiphon croceus*	San Mateo, Moss Beach

The Moss Beach (Blenheim) population of LECR was collected 5 times between 1899-1914, then not again until 2009 (*Walden 203*), and was last collected in 2015 (*Corelli 1193*). In May 2015, a census conducted of EO2 (Corelli 2015) estimated less than 500 individuals. Figure 4 shows the mapped location as Moss Beach, California.

Figure 4. LECR occurrence EO2 map.

LECR EO3 – Point San Pedro - Lacking any other evidence, this occurrence was likely generated because of Alice Eastwood's CAS394, May 2, 1899 collection (see Table 3). On the herbarium label it reads "Near Pt. San Pedro (Blenheim)". Pt. San Pedro is most likely the geographical area and the collection was made in Blenheim where the extant EO2 occurrence is located. EO3 should be removed as an occurrence for LECR.

LECR EO4 - Bolinas, Marin County. No herbarium sheets were found labeled LECR for Bolinas, Marin County; however two collections were found from Point Reyes, Marin County (see Table 4). These have been annotated as *Leptosiphon parviflorus*. In a personal communication with Doreen Smith, Rare Plant Chair, California Native Plant Society (CNPS) Marin Chapter on 11/11/2015 she said "I was never able to find (the) Bolinas population." LECR is not confirmed as present now or in the past in Marin County.

Table 4. LECR EO4

Collector, Number, Date Collected	Annotation 2016	Taxon Name on Collection Sheet	County, Locality
Specimen number: RSA12224			
C. B. Wolf, 5768, Jun 28 1934	*Leptosiphon parviflorus*	*Leptosiphon croceus*	Marin, Pt. Reyes
Specimen number: RSA148677			
Verne Grant, Jun 23 1961	*Leptosiphon parviflorus*	*Leptosiphon croceus*	Marin, Point Reyes

ATTEMPTS TO LOCATE ADDITIONAL POPULATIONS

There is very limited collection history of plants in general in the vicinity of Moss Beach, San Mateo County or Blenheim and most collections date from the early 1800's to the 1940's with very few recent collections.

- Katharine Brandegee in the 1880s and early 1900s - San Mateo Coast - *Leptosiphon* collections shown in Table 5
- Alice Eastwood in the 1890s and early 1900s - San Mateo Coast - *Leptosiphon* collections shown in Table 5
- Maibelle Williams in 1920s - San Mateo Coast - no *Leptosiphon* collections
- Ira L. Wiggins in the 1920s 1930s and 1940s - San Mateo Coast - *Leptosiphon* collections shown in Table 5
- Lyman Benson in the 1930s - San Mateo Coast - *Leptosiphon* collections shown in Table 5
- Lewis S. Rose in the 1930s and 1940s - San Mateo Coast - no *Leptosiphon* collections

However, botanists Robert Patterson (patters@sfsu.edu), convening editor and treatment author of the Polemoniaceae family and genus *Leptosiphon* in The Jepson Manual, Second Edition; Mike Vasey (mcvasey@gmail.com), Director of the San Francisco Bay National Estuarine Research Reserve; Robyn Battaglia (battagliabunch@sbcglobal.net), author of "A Morphometric Analysis of the *Leptosiphon androsaceus* complex (Polemoniaceae) in the Central and South Coast Ranges" (2001); Neal Kramer (kramerbotanical@yahoo.com), local environmental consult and myself, Curator Emeritus at Carl W. Sharsmith Herbarium, San Jose State University and Research Associate at the Oakmead Herbarium and Collections, Jasper Ridge Biological Preserve, Stanford University, have searched throughout the San Mateo Coast for over 15 years for LECR and have only found one colony element occurrence 2 (EO2). There are no other validated collections of coast yellow leptosiphon (*Leptosiphon croceus*) elsewhere in California.

A search for LECR in the Consortium of California Herbaria database and California herbaria throughout the State found 40 collection sheets labeled LECR or synonyms of LECR. Table 5 is a review of these collections arranged by county and date collected.

Table 5 - LECR Collection History

Collector, Number, Date Collected	Annotation 2016	Taxon Name on Collection Sheet	County, Locality
Specimen number: POM279091A			
Lyman Benson, 861, Apr 1927	*Leptosiphon parviflorus*	*Leptosiphon croceus*	Lake, Kelseyville
Specimen number: RSA93024			
Milo S. Baker, 12931, May 6 1954	*Leptosiphon parviflorus*	*Leptosiphon croceus*	Lake, Middleton
Specimen number: RSA12224			
C. B. Wolf, 5768, Jun 28 1934	*Leptosiphon parviflorus*	*Leptosiphon croceus*	Marin, Pt. Reyes
Specimen number: RSA148677			
Verne Grant, Jun 23 1961	*Leptosiphon parviflorus*	*Leptosiphon croceus*	Marin, Point Reyes
Specimen number: POM202880			
Alice Eastwood, 1311, Apr 10 1934	*Leptosiphon parviflorus*	*Leptosiphon croceus*	Mendocino, Longvale
Specimen number: POM65133, POM65135			
A. A. Heller, 6673, May 4 1903	*Leptosiphon parviflorus*	*Leptosiphon croceus*	Monterey, Pacific Grove
A. A. Heller, 6699, May 8 1903	*Leptosiphon parviflorus*	*Leptosiphon croceus*	Monterey, Del Monte
Specimen number: RSA259010			
Florence J. Youngberg, Jul 1938	*Leptosiphon androsaceus*	*Leptosiphon croceus*	Monterey, Near Monterey

Specimen number: CAS37502, POM65848, UC75210			
C. F. Baker, 706, May 2 1902	*Leptosiphon androsaceus*	*Leptosiphon croceus*	San Francisco, Presidio
Specimen number: RSA164304			
Clare B. Hardham, 6833, Apr 17 1961	*Leptosiphon parviflorus*	*Leptosiphon croceus*	San Luis Obispo, Pine Mt
Specimen number: CAS394			
Alice Eastwood, May 2 1899	*Leptosiphon croceus*	*Linanthus croceus*	San Mateo, Near Pt. San Pedro (Blenheim)
Specimen number: CAS393			
Alice Eastwood, May 9 1901	*Leptosiphon croceus*	Polemoniaceae	San Mateo, Blenheim
Specimen number: DS133196, POM3565, *GH78828, *NY336940, UC106861			
Alice Eastwood, May 19 1901	*Leptosiphon croceus*	*Linanthus croceus*	San Mateo, Blenheim
Specimen number: *GH91312, POM65887, UC133649			
E. B. Copeland, 3260, May 24 1903	*Leptosiphon rosaceus*	*Leptosiphon croceus*	San Mateo, Montara Point
Specimen number: POM65886, UC133724			
E. B. Copeland, 3300, Jun 6 1903	*Leptosiphon rosaceus*	*Leptosiphon croceus*	San Mateo, Montara Point
Specimen number: UC106675			
Katharine Brandegee, Jun 19 1905	*Leptosiphon croceus*	*Linanthus androsaceus*	San Mateo, Moss Beach
Specimen number: UC176059			
Miss Kate Cole, May 1914	*Leptosiphon croceus*	*Linanthus androsaceus*	San Mateo, Moss Beach
Specimen number: POM279138			
H. E. Wieser, May 1929	*Leptosiphon parviflorus*	*Leptosiphon croceus*	San Mateo, Pebble Beach
Specimen number: RSA18361, SD244610, UC729640			
C. B. Wolf, 3727, May 25, 1929	*Leptosiphon parviflorus*	*Leptosiphon croceus*	San Mateo, Pebble Beach
Specimen number: POM279148			
Arthur L. Cohen, 629, Apr 21 1935	*Leptosiphon parviflorus*	*Leptosiphon croceus*	San Mateo, Jasper Ridge
Specimen number: POM310909, UC964718, UC908670			
H. L. Mason, 8315, May 21 1935	*Leptosiphon parviflorus*	*Leptosiphon croceus*	San Mateo, Pebble Beach
Specimen number: RSA51347, RSA128553			
P. H. Raven, 1954, Apr 30 1950	*Leptosiphon rosaceus*	*Leptosiphon croceus*	San Mateo, Montara
Specimen number: SEINET3861922			
Genevieve K. Walden, 203, 2009-06-22	*Leptosiphon croceus*	*Leptosiphon croceus*	San Mateo, Moss Beach
Specimen number: SJSU15003			
Toni Corelli, 1193, 5/3/2015	*Leptosiphon croceus*	*Leptosiphon croceus*	San Mateo, Moss Beach
Specimen number: UCR197844, UCD38190			
Beecher Crampton, 392, Aug 3 1941	*Leptosiphon parviflorus*	*Linanthus androsaceus* subsp. *croceus*	Santa Cruz, Boulder Creek

*Collections from GH (Harvard University Herbaria) and NY (New York Botanical Garden) were not looked at but the duplicate collections were annotated.

These records indicate that LECR is restricted to one colony in Moss Beach, San Mateo County, first collected at Blenheim (Moss Beach) by Alice Eastwood and it was and is the only occurrence. There are no current or historical LECR populations in Lake, Marin, Mendocino, Monterey, San Francisco, San Luis Obispo or Santa Cruz counties. Current publications of floras and checklists show that LECR does not occur in Monterey County (Mathews 2015), Santa Cruz County (Neubauer 2013), or in San Francisco's Natural Areas (Wood 2013). One location is mentioned in San Mateo County (Corelli 2011), the Moss Beach occurrence. The collections along the San Mateo Coast at Pebble Beach (Bean Hollow State Beach) were redetermined as *L. parviflorus* and the Montara collections redetermined as *L. rosaceous* (CNPS 1B).

Table 6 - Other Collections of *Leptosiphon* from the San Mateo Coast

Collector, Number, Date Collected	Annotation 2016	Taxon Name on Collection Sheet	County, Locality
Specimen number: UC106675, UC106678			
Katharine Brandegee, Jun 19 1905	*Leptosiphon rosaceus*	*Linanthus androsaceus*	San Mateo, Moss Beach
Specimen number: DS81352, JEPS58097			
Adele Lewis Grant, 936, 5/6/1917	*Leptosiphon androsaceus*	*Linanthus parviflorus*	San Mateo, Pebble Beach
Specimen number: RSA18460			
C. B. Wolf, 547, June 29 1927	*Leptosiphon androsaceus*	*Leptosiphon androsaceus*	San Mateo, Pebble Beach
Specimen number: RSA18357, SD27819, UC729676			
C. B. Wolf, 3731, May 26 1929	*Leptosiphon androsaceus*	*Leptosiphon androsaceus*	San Mateo, N of Pigeon Pt
Specimen number: CHSC1270			
H. Pearl, 05 01 1930	*Leptosiphon rosaceus*	*Linanthus androsaceus*	San Mateo, Moss Beach
Specimen number: UC908670, UC964718			
Herbert L. Mason, 8314, 8315, May 21 1935, May 21 1936	*Leptosiphon androsaceus*	*Linanthus parviflorus*	San Mateo, near Moss Beach
Specimen number: UC727278			
Ira L. Wiggins, 10164, 4/21/1943	*Leptosiphon androsaceus*	*Linanthus parviflorus*	San Mateo, near Pescadero

At one time there were populations of *L. androsaceus* and *L. parviflorus* along the San Mateo Coast at Pebble Beach (now a part of Bean Hollow State Beach), and *L. androsaceus* and *L. rosaceus* were collected at or near Moss Beach. Currently only *L. croceus* and *L. rosaceus* occur on the San Mateo Coast (Boutell, Corelli, Frost 2013).

POPULATION TRENDS AND THREATS

The threat to the last remaining occurrence LECR EO2 is significant and immediate. The primary threats are habitat destruction through potential development that includes a plan to build 6 houses adjacent to LECR population on coastal prairie habitat (see Figure 6) (County of San Mateo, Planning and Building, Case Number PLN2015-00380). Competition from non-native plants especially the invasive Carpobrotus that is a highly ranked noxious weed, and other human-related activities (including an informal trail and park bench). Another threat is bluff top erosion, and rising ocean levels. Mean sea level along the California coast will rise from 1.0 to 1.4 meters by the year 2100. In areas where the coast erodes easily, sea-level rise will likely accelerate shoreline recession due to erosion (Heberger, et al. 2009).

When Alice Eastwood first mentioned this colony in 1904 (Eastwood 1904), she stated "It covered the ground for several acres, but was seen in no other place, and is probably a strictly local species. It is perhaps the most strikingly beautiful species of the group where it belongs, with the long threadlike tubes of the corolla supporting the wonderfully beautiful yellow disks. The great masses almost monopolized the ground." Since then, most coastal prairie habitat has been extirpated as a result of agriculture, urban development, habitat fragmentation and non-native plant encroachment (Ford and Hayes 2007).

LECR EO2 occurs in an area approximately 60'x30' at the edge of the cliff. A census was conducted in 1999 and 2015 (Corelli) utilizing the same survey technique. The area was divided into 10 sections, and individual plants were counted in each section while standing outside the edge of the colony to avoid trampling of plants. The estimated number of plants in 1999 was 400-500 plants, and in 2015 <500 plants were estimated (Corelli 1999, 2015). The earliest survey reported by R. Battaglia was done in 1998 and ~1000 plants were estimated

(Battaglia 1998).

Compared to 1998 there was a decrease in the number of plants in 1999. The decline could be explained by inherent natural demographic variation in this annual plant, and/or it could be the result of sampling error because of the two different sampling schemes. It could also be timing of surveys and variation in the environment conditions such as the amount of annual rainfall. Total amount of rainfall for nearby Half Moon Bay in 1998 was 50.2 inches and 29.59 inches in 1999 (Woyshner 2010). The survey method and number of plants for the 1999 and 2015 surveys are roughly similar.

There have been yearly field observation visits between 2000-2014 without documentation. The colony as observed is resilient, but fragile as its location makes it vulnerable and exposed to the multiple threats mentioned including development of adjacent habitat, and the number of plants and colony size compared to what was found in the early 1900's when it "covered the ground for several acres".

CURRENT MANAGEMENT ACTIVITIES

Fitzgerald Marine Reserve, a San Mateo County Park is also a part of the California Marine Protected Area (MPAs) that lies in California state waters within the Montara State Marine Reserve.

The Fitzgerald Marine Reserve encompasses approximately 35 acres of terrestrial area along the coastline. The Vallemar Bluff top where LECR occurs is the last intact coastal prairie on the reserve. At one time there was a continuous stretch of coastal prairie that extended along the bluff top throughout the preserve but much of it was planted with Monterey cypress (*Hesperocyparis macrocarpa*) more than a century ago. Monterey cypress is not native to San Mateo County and where it occurs on the reserve the understory is sparse and associated with non-native vegetation.

The County of San Mateo released a Master Plan for the Fitzgerald Marine Reserve in May 2002. The area where LECR occurs was not surveyed and none of the 3 rare plants occurring there are accounted for in the master plan. Since discovering this omission the San Mateo County Parks Department has been contacted with the information about these rare plant locations and habitat. The county will be surveying this property in 2016 (written and personal communication in 2016 with San Mateo County staff: Ramona Arechiga (trarechiga@smcgov.org), Natural Resource Manager; Senior Planners Samuel F. Herzenberg (SHerzberg@co.sanmateo.ca.us) and Dave Holbrook (dholbrook@smcgov.org) and revising the Master Plan to include management and protection of LECR and other rare plants at Fitzgerald Marine Reserve.

POTENTIAL MANAGEMENT ACTIVITIES

To assure adequate management and recovery of LECR, the species must be listed pursuant to the California Endangered Species Act (CESA) by the State of California and the last remaining population must be protected and assured of sufficient ecosystem function, adequate buffering from disturbance, appropriate ecological management, and inclusion of areas of potential, unoccupied habitat.

LISTING THE SPECIES UNDER CESA

Given the extreme rarity of the species and its current threats, listing under the CESA is an appropriate action to be undertaken by the State of California. This plant is not currently proposed for listing under the Federal Endangered Species Act (FESA), but a proposal for FESA listing should be considered given that the species is endangered to the point of potential extinction. State and Federal listing will make it possible to procure private and public funding to initiate some of the protective and research needs of the species.

ADEQUATE BUFFERING

For development projects that have the potential to occur at or near LECR EO2 adequate buffering should be delineated. Buffering for sensitive species is typically set at a minimum buffer of 100 feet (California Coastal Commission 2013) Buffering of sensitive species is theorized to provide protection from edge effects, which include invasion of non-native species, microclimate changes, and changes in hydrology.

LECR EO2 cannot be buffered where it occurs on the immediate cliff edge so can only be buffered to the north and east of the extant colony (Figure 6). A concern is that LECR is currently insufficiently buffered from direct impacts on the bluff top because of an informal trail, a park bench and proposed development on adjacent property as shown in Figure 6. There should be yearly monitoring because of the continued impacts from these activities, from non-native plants within and outside the colony, and direct and indirect impacts brought on by development.

The buffer zone should be large enough to support, in perpetuity, a biologically secure, reproducing population, of the annual LECR in the preferred coastal prairie habitat where it occurs. Little information exists regarding an accurate minimum buffering requirement for LECR. With little known about the reproductive biology of LECR, buffers need to be set at conservative distances until we understand what is the allowable minimum. Vegetation monitoring of this colony will help analyze the yearly changes that occur within and nearby on the coastal prairie that supports LECR.

PRESERVATION OF POTENTIAL HABITAT

Principles of conservation biology include an emphasis on the need for the preservation of both occupied and unoccupied, potential habitat of a given species. Currently within San Mateo County only very small remnant pockets of coastal prairie habitat occur on the San Mateo Coast. Most occur on public land owned by State Beaches and Parks, Golden Gate National Recreation Area, Land Trusts, Peninsula Open Space Preserve and other open space agencies. Other rare plants occur in the coastal prairie habitat within these public lands including *Agrostis blasdalei, Castilleja ambigua* ssp*. ambigua, Centromadia parryi* ssp*. parryi, Chorizanthe robusta* var*. robusta*, *Fritillaria liliacea*, *Hosackia gracilis, Lasthenia californica* ssp*. macrantha, Leptosiphon rosaceus, Plagiobothrys chorisianus* var*. chorisianus, Plagiobothrys diffusus*, and *Potentilla hickmanii*.

It should be noted that although protecting adjacent similar habitat for long-term viability is a viable concept, all areas mapped as similar habitat may not be suitable since much of it is occupied by other rare plants and coastal prairie associates, and it would be inadvisable to disturb those sites. There is no current evidence that LECR can survive outside its current distribution since it occurs at no other place. However there is one stretch of disturbed coastal terrace bluff top at Montara State Beach (Figure 5), about 1.3 miles north of LECR EO2. This bluff top was planted in the past with ornamental *Agapanthus africanus*, but it should be looked at to see if it can be restored to provide potential coastal prairie habitat for LECR.

Figure 5. Potential Coastal Prairie habitat at Montara State Beach.

ECOLOGICAL MANAGEMENT

A program of ecological management, including the principles of adaptive management, is required to ensure the long-term viability of LECR. LECR EO2 was not accounted for or protected by the Fitzgerald Marine Reserve Master Plan. It is now limited to a small 60'x30' area fragmented by an informal trail, park bench, non-native plant encroachment and the proposed development of the adjacent 2.5 acres of coastal prairie habitat as shown in Figure 6.

Figure 6. Proposed development on potential coastal prairie habitat on Moss Beach's Vallemar Bluffs

LECR should be protected and accounted for by the County of San Mateo, and a management plan should be written providing protection for this species and other rare plant species found at Fitzgerald Marine Reserve.

RESEARCH NEEDS

Priorities for biological and ecological research include studies that address population genetics, demographics, pollination biology, seed dispersal, seed viability, herbivory, germination and soil and other habitat requirements.

One of the greatest threats within the population and coastal prairie habitat are the invasive non-native plants. Management research should explore the best ways to control the non-native plants as well as the timing, frequency and intensity of these activities.

Seed should be collected and stored at a reputable seed bank. Research should be undertaken to see what is the best use and time to use these seeds at this location or another designated appropriate coastal prairie habitat.

MONITORING

Demographic and site monitoring of LECR EO2 should be undertaken yearly using standardized protocols that ensure the least disturbance of this population and habitat. Data obtained should be submitted to the California

Department of Fish and Wildlife Natural Diversity Database. Surveys of any additional suitable habitat should also be performed.

AGENCIES AND ORGANIZATIONS TO BE INVOLVED

Department of Interior, U.S. Fish and Wildlife Service
California Department of Fish and Wildlife
California Coastal Commission
California State Parks, San Mateo Coast Sector
Midcoast Community Council
San Mateo County Board of Supervisors
San Mateo County Parks Department
San Mateo County Planning Department

SOURCE INFORMATION

HERBARIA	CONTACT
CAS/DS California Academy of Sciences	Debra Trock, Rebecca Peters
CHCS California State University, Chico	Lawrence Janeway
GH Harvard University	
NY New York Botanical Garden	
RSA/POM Rancho Santa Ana Botanic Garden & Pomona College	Mare Nazaire
SEINET Southwest Environmental Information Network	
SD San Diego Natural History Museum	Jon Rebman
SJSU San Jose State University	Lars Rosengreen
UC/JEP UC Berkeley	John Strother, Kim Kersh
UCR UC Riverside	Andrew Sanders

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State of California
Department of Fish and Wildlife

M e m o r a n d u m

Date: July 12, 2016

To: Valerie Termini
Executive Director
Fish and Game Commission

From: Charlton H. Bonham
Director

Subject: **Agenda Item for the August 24- 25, 2016 Fish and Game Commission Meeting Regarding the Correction of the Authorized Harvest for DeFrancesco/Eaton Ranch**

DeFrancesco/Eaton Ranch was approved at the June 23, 2016 Fish and Game Commission meeting with incorrect numbers of authorized harvest for deer and elk. The purpose of this memo is to correct these harvest numbers. The Department of Fish and Wildlife is requesting the following changes be made:

DeFrancesco/Eaton Ranch –

- Change the authorizes harvest for deer from 9 deer of which no more than 5 may be forked horn or better buck deer and 4 may be antlerless deer to 10 buck deer forked horn or better.
- Add the authorized harvest of elk as: 2 bull elk, and 1 antlerless elk.
- Add the season dates for elk as:
    - Issue 2 bull elk tags for the period of September 6, 2016 through November 30, 2016.
    - Issue 1 antlerless elk tag for the period of September 6, 2016 through November 30, 2016.

We apologize for the inconvenience. If you have any questions, please contact Ms. Victoria Barr at (916) 445-4034 or by email at victoria.barr@wildlife.ca.gov.

Attachment

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Table containing errors (highlighted)

PLM AREA LICENSE *5-YEAR MANAGEMENT PLANS, 2016-2021* *PROPOSED SEASONS, HARVESTS, AND HABITAT IMPROVEMENTS*		
PLM Area	**Proposed Season and Harvest**	**Habitat Improvement Program**
	CENTRAL REGION	
DEFRANCESCO & EATON RANCH DEER ZONE A MERCED 4,149 ACRES	***Authorized Harvest:*** 9 deer of which no more than 5 may be forked horn or better buck deer and 4 may be antlerless deer • Issue 9 either-sex deer tags for the period of August 15, 2016 through November 30, 2016. • No antlerless deer shall be harvested before September 15, 2016.	➢ Eliminate cattle grazing on APNs 087-070-011 and 087-070-013 between May 31 and December 15, 2016. ➢ Maintain water troughs at Main Spring, Deer Camp, Laurel Spring, and Hay Barn for wildlife.

Corrected table (corrections highlighted)

PLM AREA LICENSE *NEW 5-YEAR MANAGEMENT PLANS, 2016-2021* *PROPOSED SEASONS, HARVESTS, AND HABITAT IMPROVEMENTS*		
PLM Area	**Proposed Season and Harvest**	**Habitat Improvement Program**
	CENTRAL REGION	
DEFRANCESCO/ EATON RANCH DEER ZONE A SOUTH MERCED 4,149 ACRES	***Authorized Harvest:*** 10 buck deer forked horn or better, 2 bull elk, and 1 antlerless elk. • Issue 10 buck deer tags to take forked horn or better bucks for the period of July 9, 2016 through November 30, 2016. • Issue 2 bull elk tags for the period of September 6, 2016 through November 30, 2016. • Issue 1 antlerless elk tag for the period of September 6, 2016 through November 30, 2016.	➢ Eliminate cattle grazing on APNs 087-070-011 and 087-070-013 between May 31 and December 15, 2016. ➢ Maintain water troughs at Main Spring, Deer Camp, Laurel Spring, and Hay Barn for wildlife.

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State of California
Department of Fish and Wildlife

Memorandum

Date: ~~July 12,~~ July 19, 2016

To: Valerie Termini
Executive Director
Fish and Game Commission

From: Charlton H. Bonham
Director

Subject: **Agenda Item for the August 24- 25, 2016 Fish and Game Commission Meeting 5-Year Private Lands Wildlife Habitat Enhancement and Management (PLM) Area License**

The Department of Fish and Wildlife has reviewed the 5-year management plans and renewal applications for 5 properties in 4 counties consisting of 10,002 acres.

The new 5-year management plans for these areas are in compliance with Commission policy for private lands management. The applicants have identified the location where records will be kept and made available for inspection.

Habitat improvements accomplished under these plans will enhance and maintain wildlife resources on and around the PLM areas. The goals and objectives stated in the management plans are compatible with Department management plans for appropriate species in these areas. In addition, access to public lands will not be diminished under implementation of these management plans.

The Department recommends that the Commission approve the specified wildlife management plan, application, and the 2016/17 harvest program under conditions specified in the attached table.

If you have any questions, please contact Ms. Victoria Barr at (916) 445-4034 or by email at victoria.barr@wildlife.ca.gov.

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Memorandum

Date: ~~July 12~~ July 19, 2016

To: Valerie Termini
Executive Director
Fish and Game Commission

From: Charlton H. Bonham
Director

Subject: **Agenda Item for the August 24-25, 2016 Fish and Game Commission Meeting Initial Private Lands Wildlife Habitat Enhancement and Management (PLM) Area License**

The Department of Fish and Wildlife has reviewed the Initial Management Plans for 2 properties in 2 counties consisting of 4,950 acres. The management plans for these properties are in compliance with Commission policy for private lands management. The applicants have identified the location where records will be kept and made available for inspection.

Public notices were published in local newspapers, and certified letters were mailed to adjacent landowners with notification of each applicant's intent to enter into the program. No letters of concern were received by the Department for either property.

Habitat improvements accomplished under these plans will enhance and maintain wildlife resources on and around each PLM area. The goals and objectives stated in the management plans are compatible with Department management plans for appropriate species in these areas. In addition, access to public lands will not be diminished by implementing these management plans.

The Department recommends that the Commission approve the specified wildlife management plans, applications, and each 2016/17 harvest program under conditions specified in the attached table.

If you have any questions, please contact Ms. Victoria Barr at (916) 445-4034 or by email at victoria.barr@wildlife.ca.gov.

Attachment

ec: Stafford Lehr, Deputy Director
Wildlife and Fisheries Division
Stafford.Lehr@wildlife.ca.gov

PLM AREA LICENSE INITIAL MANAGEMENT PLANS, 2016-2021 PROPOSED SEASONS, HARVESTS, AND HABITAT IMPROVEMENTS		
PLM Area	**Proposed Season and Harvest**	**Habitat Improvement Program**
NORTHERN REGION		
KRAMER RANCH PLM DEER ZONE X1 LASSEN 4,070 ACRES	***Authorized Harvest:*** 5 buck deer forked horn or better • Issue 5 buck deer tags for the period of October 1, 2016 through October 16, 2016. • No person shall take more than 1 buck deer annually in the X zones.	➢ Remove all western junipers from at least 25 acres in Area 1 except for any large, old-growth juniper that are being used by wildlife. ➢ Create 1 brush pile for every 1-5 acres of western juniper removal to provide cover for wildlife. ➢ Replace 0.45 miles of 5-strand barbed wire fencing with wildlife-friendly fencing. ➢ Remove noxious weeds including scotch thistle, perennial pepper weed, and diffuse knapweed from at least 2 acres by chemical treatment or hand grubbing. ➢ Implement rotational grazing practices in the juniper removal area to allow for establishment of native grasses, forbs, and shrubs for wildlife. Cattle will be rotated before grasses reach a 6-inch stubble height to another area on the ranch. Available forage for wildlife on the ranch will be monitored using 1 m^2 grazing exclosure cages.
CLOVER CREEK RANCH PLM DEER ZONE C3 SHASTA 880 ACRES	***Authorized Harvest:*** 3 buck deer forked horn or better • Issue 3 buck deer tags for the period of September 17, 2016 through October 23, 2016.	➢ Replace the bottom strand of barbed wire with smooth wire on at least 1 mile of fencing. ➢ Enhance a spring by removing encroaching blackberries and install 600 feet of pipe leading to a 2,500 gallon water tank. Stored water will be used for an irrigated food plot and a water trough. ➢ Build and install 5 wood duck boxes on Clover Creek. ➢ Prohibit commercial wood cutting and rock picking on the ranch. ➢ Develop 1 pond in an area of the ranch that does not currently have a wildlife water source. ➢ Establish a 75-acre wildlife refuge on the ranch where no hunting and no disturbance will occur. ➢ Reduce the number of livestock grazed on the ranch from 80 to 50 cow/calf pairs.

PLM AREA LICENSE ***NEW 5-YEAR MANAGEMENT PLANS, 2016-2021*** ***PROPOSED SEASONS, HARVESTS, AND HABITAT IMPROVEMENTS***		
PLM Area	**Proposed Season and Harvest**	**Habitat Improvement Program**
NORTHERN REGION		
LITTLE DRY CREEK RANCH DEER ZONE C4 TEHAMA 2,000 ACRES	***Authorized Harvest:*** 2 buck deer forked horn or better • Issue 2 buck deer tags for the period of October 20, 2016 through November 30, 2016.	➢ Maintain 3 springs that serve as wildlife water sources by checking for broken pipes and repairing as necessary. ➢ Treat at least 2 acres of yellow star thistle with herbicides. ➢ Continue to exclude livestock grazing from the entire ranch to benefit wildlife. ➢ Keep trespass livestock off the ranch by annually inspecting the perimeter fence and making any necessary repairs.
MENDIBOURE COLD SPRINGS RANCH DEER ZONE X5B LASSEN 1,880 ACRES	***Authorized Harvest:*** 1 buck deer forked horn or better • Issue 1 buck deer tag for the period of October 1, 2016 through October 16, 2016. • No person shall take more than 1 buck deer annually in the X zones.	➢ Cut and disperse at least 50 mountain mahogany branches with ripe seeds in order to recruit young plants. ➢ Mechanically remove western juniper from 5 acres in the southeast corner of Section 36 to improve shrub and forb recruitment. ➢ Maintain East Meadow spring by checking and repairing any damaged parts. ➢ Remove sediment from the Halls Cabin pond to improve its storage capacity. The increased capacity will provide additional water for wildlife. ➢ Implement rotational cattle grazing between 2 pastures so that the residual dry matter does not fall below 40% using the Double-Weight sampling technique. The feed will be measured prior to turning the cattle out to establish the 100% baseline.
R WILD HORSE RANCH DEER ZONE B5 TEHAMA 4,000 ACRES	***Authorized Harvest:*** 4 buck deer forked horn or better • Issue 3 buck deer tags for the period of November 15, 2016 through November 18, 2016. • Issue 1 buck deer tag to an apprentice hunter for the period of November 15, 2016 through November 18, 2016.	➢ Mechanically treat (by crushing) at least 10 acres of decadent brush to promote new growth and create wildlife travel corridors. ➢ Plant 10 acres of brush treatment areas with legumes and grasses. ➢ Create a year-round water source for wildlife by adding a pump and water trough to an old hand-dug well. ➢ Build at least 10 brush piles (each 20 feet in diameter) to provide escape cover for wildlife.

PLM AREA LICENSE NEW 5-YEAR MANAGEMENT PLANS, 2016-2021 PROPOSED SEASONS, HARVESTS, AND HABITAT IMPROVEMENTS		
PLM Area	**Proposed Season and Harvest**	**Habitat Improvement Program**
ROARING RIVER RANCH DEER ZONE B5 SHASTA 472 ACRES	***Authorized Harvest:*** 2 buck deer forked horn or better • Issue 2 buck deer tags for the period September 15, 2016 through November 30, 2016.	➢ When water levels are low, pump additional water into 2 small ponds to provide additional water for wildlife. ➢ Maintain fencing which excludes livestock from 22 acres of irrigated grain fields (peas, oats, and barley) by inspecting regularly and repairing as necessary. ➢ Treat at least 6 acres of yellow star thistle using herbicides. ➢ Retain oaks by prohibiting commercial firewood cutting. ➢ Retain all standing foothill pine snags for wildlife habitat. ➢ Install a wildlife-friendly fence around an existing 5 acre food plot to exclude cattle and maximize forage for wildlife. ➢ Maintain 2 water troughs to provide water for wildlife by checking for broken pipes and repairing as necessary.
BAY DELTA REGION		
COON CREEK RANCH DEER ZONE A SANTA CLARA 1,650 ACRES	***Authorized Harvest***: 8 buck deer • Issue 8 buck deer tags to take forked horn or better bucks for the period of July 11, 2016 through November 30, 2016.	➢ Brush approximately 30 new acres of chaparral. ➢ Plant seed/cover crops on small areas for quail and other wildlife. ➢ Develop 1 spring. ➢ Limit cattle grazing to 80 acres of ranch. ➢ Conduct morning deer surveys on property in October.

State of California
Department of Fish and Wildlife

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Memorandum

Date: ~~July 12~~ July 19, 2016

To: Valerie Termini
Executive Director
Fish and Game Commission

From: Charlton H. Bonham
Director

Subject: **Agenda Item for the August 24- 25, 2016 Fish and Game Commission Meeting Annual Private Lands Wildlife Habitat Enhancement and Management (PLM) Area License**

The Department of Fish and Wildlife has reviewed the annual reports for 21 properties in 12 counties consisting of 144,414 acres.

These PLM areas were previously licensed under Commission regulations Section 601, Title 14, California Code of Regulations. Full payment was made for all tags used in 2015, and all habitat work was completed.

The Department recommends that the Commission approve the 2016/17 harvest programs under conditions specified in the attached table.

If you have any questions, please contact Ms. Victoria Barr at (916) 445-4034 or by email at victoria.barr@wildlife.ca.gov.

Attachment

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Garry Kelley, Acting Chief
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garry.kelley@wildlife.ca.gov

PLM AREA LICENSE ANNUAL RENEWALS, 2016/2017 PROPOSED SEASONS, HARVESTS, AND HABITAT IMPROVEMENTS		
PLM Area	**Proposed Season and Harvest**	**Habitat Improvement Program**
NORTHERN REGION		
BASIN VIEW RANCH DEER ZONE X2 MODOC 8,500 ACRES	***Authorized Harvest:*** 7 buck deer forked horn or better and 1 buck pronghorn antelope • Issue 7 buck deer tags for the period of October 1, 2016 through November 27, 2016. • No person shall take more than 1 buck deer annually in the X zones. • Issue 1 buck pronghorn antelope tag for the period of September 10, 2016 through October 2, 2016.	➢ Remove western juniper from 200 acres in Unit 7 to encourage shrub and forb recruitment. ➢ Remove western juniper by hand from the 70 acre Elliot Ranch parcel. Fence, till, and seed the area with a recommended seed mix provided by the Natural Resource Conservation Service. ➢ Inspect and, as necessary, repair 10 miles of interior fencing that controls livestock movement and grazing ➢ Exclude livestock grazing from 1 of the rotation management units (775 acres) year-round. ➢ Inspect livestock exclusion fencing around the ponds and make any necessary repairs.
BELL RANCH DEER ZONE C4 TEHAMA 15,000 ACRES	***Authorized Harvest:*** 19 buck deer forked horn or better • Issue 22 buck deer tags to take 19 buck deer for the period October 22, 2016 through December 4, 2016. • No more than 3 buck deer may be harvested after November 30, 2016. • In no case shall the number of tags issued be used to exceed the authorized harvest. • The number of tag holders actively hunting shall not exceed the number of deer available to harvest.	➢ Maintain 15 previously developed springs by checking for broken pipes and repairing as necessary. ➢ Maintain 6 reservoirs by inspecting spillways and dams for damage and making any necessary repairs. ➢ Develop a water source at Whistler's Gate by installing a water catchment apron, storage tanks and an in-ground trough. ➢ Mechanically treat (by crushing with a bull dozer and masticating) at least 15 acres of decadent brush to encourage the growth of more nutritious deer forage. ➢ Remove at least ¼ mile of woven wire interior fencing to enhance wildlife movement. ➢ Restrict off-road vehicle use to protect the recent brush treatment areas and minimize disturbance to wildlife. ➢ Maintain 4 wood duck boxes around Rattlesnake Pond by checking use and replacing nesting material as necessary.

PLM AREA LICENSE ANNUAL RENEWALS, 2016/2017 PROPOSED SEASONS, HARVESTS, AND HABITAT IMPROVEMENTS		
PLM Area	**Proposed Season and Harvest**	**Habitat Improvement Program**
BLACK RANCH SHASTA DEER ZONE C3 1,000 ACRES	***Authorized Harvest:*** 1 bull elk, 1 antlerless elk, elk, 2 buck deer forked horn or better, and 2 antlerless deer • Issue 1 bull elk tag and 1 antlerless elk tag for the period of November 1, 2016 through November 30, 2016. • Issue 2 buck deer tags and 2 antlerless deer tags for the period of November 1, 2016 through November 30, 2016.	➢ Begin work on a 145-acre riparian restoration project on Burney Creek by removing the berm along the west bank of the creek to permit inundation of the flood plain during high flows. ➢ Restrict livestock grazing to 5 acres on the entire ranch to benefit wildlife. ➢ Maintain previously planted willows and aspens along Burney Creek riparian habitats and replant as necessary. ➢ Remove at least 600 feet of unnecessary interior fencing to enhance wildlife movement. ➢ Maintain 30 wood duck nest boxes and 6 goose nesting platforms by checking use and replacing nesting material as necessary ➢ Maintain 4 existing owl and 7 existing bat boxes by checking use and replacing nesting material as necessary.
CLARKS VALLEY RANCH DEER ZONE X3B LASSEN 2,793 ACRES	***Authorized Harvest:*** 3 buck deer forked horn or better • Issue 3 buck deer tags for the period of October 1, 2016 through October 16, 2016. • No person shall take more than 1 buck deer annually in the X zones.	➢ Remove western juniper from 40 acres in Sections 27 or 23 in Clarks Valley. ➢ Maintain previously-developed springs by checking for broken pipes and repairing as necessary. ➢ Maintain 3 aspen and willow enclosures by inspecting fencing and making any necessary repairs. ➢ Continue rotational grazing by resting a different pasture each spring to protect critical wildlife habitat areas and aspen. ➢ Remove western juniper from 2 acres within the aspen and willow enclosures to encourage aspen and willow growth.
DUNCAN CREEK RANCH DEER ZONE B5 SHASTA 1,366 ACRES	***Authorized Harvest:*** 6 buck deer forked horn or better • Issue 8 buck deer tags for the period September 1, 2016 through November 30, 2016. • In no case shall the number of tags issued be used to exceed the authorized harvest. • The number of tag holders actively hunting shall not exceed the number of deer available to harvest.	➢ Burn at least 50 acres of decadent brush to improve wildlife forage.

PLM AREA LICENSE ANNUAL RENEWALS, 2016/2017 PROPOSED SEASONS, HARVESTS, AND HABITAT IMPROVEMENTS		
PLM Area	**Proposed Season and Harvest**	**Habitat Improvement Program**
FIVE DOT RANCH - AVILA DEER ZONE X3A LASSEN 11,000 ACRES	***Authorized Harvest***: 6 buck deer forked horn or better • Issue 12 buck deer tags to take 6 forked horn or better buck deer for the period of September 17, 2016 through November 30, 2016. • No person shall take more than 1 buck deer annually in the X zones. • In no case shall the number of tags issued be used to exceed the authorized harvest. • The number of tag holders actively hunting shall not exceed the number of deer available to harvest.	➢ Continue reduced livestock use at 200 head (previously 450 head). ➢ Exclude livestock from 7 aspen and wetland habitat enclosures by inspecting fencing and making any necessary repairs. These habitats provide important deer fawning areas. ➢ Remove conifers from within the 7 aspen/wetland enclosures to encourage aspen regeneration and growth. ➢ Maintain 6 nesting platforms for Canada geese at 4 reservoirs by checking use and replacing nesting material as necessary. ➢ Cut 100 and disperse mountain mahogany branches with ripe seeds in order to recruit young plants. ➢ Maintain 6 existing springs by checking for broken pipes and repairing as necessary. ➢ Maintain 4 existing reservoirs by inspecting spillways and dams for damage and making any necessary repairs.
FIVE DOT RANCH – SCHOOL SECTION DEER ZONE X5A LASSEN 640 ACRES	***Authorized Harvest:*** 1 buck deer forked horn or better • Issue 1 buck deer tag for the period of September 17, 2016 through November 30, 2016. • No person shall take more than 1 buck deer annually in the X zones.	➢ Limit livestock grazing to May 1, 2017 through September 1, 2017 to provide early and late season grasses and forbs to provide food for wildlife. ➢ Maintain the livestock exclusion fence around a ½ acre aspen patch by inspecting it regularly and making any necessary repairs. ➢ Cut and disperse 50 mountain mahogany branches with ripe seed to recruit young plants.
HATHAWAY OAK RUN RANCH DEER ZONE C3 SHASTA 6,640 ACRES	***Authorized Harvest:*** 12 buck deer forked horn or better • Issue 12 buck deer tags for the period September 17, 2016 through November 30, 2016. • No more than 9 buck deer may be harvested after October 23, 2016.	➢ Maintain the 20 acre riparian livestock exclusion on Swede Creek by inspecting fencing and making any necessary repairs. ➢ Maintain 7 springs that provide year-round water for wildlife by checking for broken pipes and repairing as necessary. ➢ Maintain 10 wood duck boxes along Oak Run Creek by checking use and replacing material as necessary. ➢ Maintain 1 owl box along Oak Run Creek by checking use and replacing material as necessary. ➢ Irrigate 4 wildlife forage plots to provide food for wildlife during the summer months.

PLM AREA LICENSE ANNUAL RENEWALS, 2016/2017 PROPOSED SEASONS, HARVESTS, AND HABITAT IMPROVEMENTS		
PLM Area	**Proposed Season and Harvest**	**Habitat Improvement Program**
HATHAWAY OAK RUN RANCH CONT.		➢ Modify at least ½ mile of fencing to make it wildlife friendly.
NORTH CENTRAL REGION		
BIRD HAVEN RANCH DEER ZONE D-3 GLENN 2,500 ACRES	***Authorized Harvest:*** 6 buck deer • Issue 6 buck deer tags with 1 of the 6 tags being reserved for a junior hunter. 1 or 2 of these tags can be sold to generate revenue for California Waterfowl Association. The harvest period will be from August 20, 2016 to November 30, 2016.	➢ Maintain current conditions. ➢ Plant 10 valley oak trees. ➢ Install and monitor 5 wood duck boxes. ➢ Install 5 bat boxes. ➢ Spray, cut and remove 5 acres of Himalayan Blackberry ➢ Plant 3-4 acres of safflower. ➢ Spot spray 150 acres for noxious weeds.
DESERET FARMS – BALLARD UNIT DEER ZONE C-4 BUTTE 2,948 ACRES	***Authorized Harvest:*** 2 buck deer and 10 antlerless deer • Issue 2 deer tags to take forked-horn or better bucks for the period of November 1, 2016 through December 31, 2016. • Issue 10 tags to take antlerless deer for the period of November 1, 2016 through December 31, 2016. 1 of the antlerless tags must be a junior tag.	➢ Monitor new plantings and replace any that may have died and keep a record of plant survival. ➢ Install 4 raptor perches (1 perch may be in Wilson unit). ➢ Continue star thistle control. ➢ Place 3 additional owl boxes. ➢ Maintain current conditions in riparian areas. ➢ Continue feral pig eradication. ➢ Monitor wood duck and owl box occupancy. ➢ Perform body condition survey on all deer taken on the farm. ➢ If new orchards are installed construct fencing to reduce depredation.
DESERET FARMS – WILSON UNIT DEER ZONE C-4 BUTTE 7,989 ACRES	***Authorized Harvest:*** 6 buck deer and 15 antlerless deer • Issue 6 deer tags to take forked-horn or better bucks for the period of November 1, 2016 through December 31, 2016. • Issue 15 tags to take antlerless deer for the period of November 1, 2016 through December 31, 2016. 1 of the antlerless tags must be a junior tag.	➢ Monitor new plantings and replace any that may have died and keep a record of plant survival. ➢ Continue star thistle control. ➢ Place 3 additional owl boxes. ➢ Maintain current conditions in riparian areas. ➢ Continue feral pig eradication. ➢ Monitor wood duck and owl box occupancy. ➢ Perform body condition survey on all deer taken on the farm. ➢ If new orchards are installed construct fencing to reduce depredation.

PLM AREA LICENSE ANNUAL RENEWALS, 2016/2017 PROPOSED SEASONS, HARVESTS, AND HABITAT IMPROVEMENTS		
PLM Area	**Proposed Season and Harvest**	**Habitat Improvement Program**
M&T CHICO RANCH DEER ZONE C4 BUTTE 5,332 ACRES	***Authorized Harvest:*** 10 antlerless deer and 5 buck deer • Issue 10 tags to take antlerless deer and 5 deer tags to take forked horn or better buck deer for the period of November 1, 2016 through December 31, 2016.	➢ Cattle grazing levels at approximately 100 head or less. ➢ Maintain existing deer fencing. ➢ Maintain or replace 8 existing pond turtle basking structures. ➢ Maintain or replace existing 20 barn owl and 30 wood duck nest boxes. ➢ Remove trash from Little Chico Creek. ➢ Perform annual fall deer count to include in the annual CDFW Sacramento River Herd Survey data.
ORDWAY RANCH DEER ZONE D-5 CALAVERAS 850 ACRES	***Authorized Harvest:*** 6 buck deer • Issue 6 buck deer tags to take forked horn or better buck deer for the period of September 24, 2016 through November 30, 2016.	➢ No cattle grazing in Pastures A & B. ➢ Light cattle grazing in Pastures C & D. ➢ Maintain 3 water sources for wildlife (including 2 solar-powered wells). ➢ Maintain fencing around 2 natural springs and creek to exclude cattle. ➢ Continue control of invasive weeds. ➢ Develop new wildlife brush piles and enhance existing brush piles.
ROCK CREEK DEER ZONE C4 BUTTE/TEHAMA 9,945 ACRES	***Authorized Harvest:***30 buck deer • Issue 33 deer tags to take 30 forked horn or better buck deer for the period of August 20, 2016 through November 30, 2016.	➢ Complete the Negro Springs project. This includes a top pond and running a 2" underground PVC gravity flow pipe approximately 100 feet to a 600 gallon trough. To eliminate any mud areas around the trough area excess water will be piped 40+ feet through a 1 ¼" PVC underground pipe to another small pond. Approximately ¾ acre will be fenced around the top pond with brush piles both inside and outside the fenced area. ➢ Start installing fencing on Round Mtn. ➢ Begin work on the "Cat Trail" Springs on the west part of Garner Ranch to promote good water flow, and fencing the area to keep cattle out. Construct brush piles inside and outside fenced area for wildlife cover. ➢ Install 0.25 miles of "wildlife friendly" cross fencing from Cohasset Rd to Buck Eye Ridge to Rock Creek cattle guard, and then to the Loafer Creek property boundary. ➢ Continue to graze at a sustainable level. Cattle levels and duration will be adjusted for drought. ➢ Continue maintenance on all ponds, springs, wells, troughs, and fencing.

PLM AREA LICENSE ANNUAL RENEWALS, 2016/2017 PROPOSED SEASONS, HARVESTS, AND HABITAT IMPROVEMENTS		
PLM Area	**Proposed Season and Harvest**	**Habitat Improvement Program**
SOPER-WHEELER DEER ZONE D-3 BUTTE 5,250 ACRES	***Authorized Harvest:*** 18 buck deer, 26 turkey, 200 quail, and 16 bear tags to take 8 bear • Issue 18 buck tags to take forked horn or better buck deer for the period of September 24, 2016 through November 30, 2016. 1 to 3 tags to be donated to California Deer Association for auction with the season extended to December 10, 2016 for any donated tags. • Issue 26 turkey tags for the periods of October 15, 2016 through November 30, 2016 (fall season, either-sex harvest) and March 10, 2017 through May 15, 2017 (spring season, bearded turkey only harvest). 2 tags to be donated to the Hunter Education Instructor Tag Incentive Program (HEI). • Issue 200 quail tags for the periods of October 1, 2016 through February 28, 2017. • 16 bear tags to take up to 8 bears with either archery or rifle. The season will run August 20, 2016 through December 25, 2016 or until 1700 bears have been taken statewide.	➢ Put in a water tank and trough on the west side of the large meadow. ➢ Increase brush pile size. ➢ Run water line from a well and put in trough on east side of the property. ➢ Maintain and provide maintenance on all wells, water sources, and guzzlers. ➢ Continue planting turkey mullein. ➢ Maintain restrictions on grazing.
SPURLOCK RANCH DEER ZONE B-3 GLENN 2,630 ACRES	***Authorized Harvest***: 10 buck deer • Issue 10 deer tags to take forked horn or better buck deer for the period of August 20, 2016 through November 30, 2016.	➢ Cattle numbers at or below 200 cow/calf pairs. ➢ Cattle grazing season October 25 to May 20; post- season grazing standard of 1,200 lbs/acre residual dry matter (RDM). ➢ Treat approximately 20-25 acres of yellow starthistle and/or bull thistle with herbicide. ➢ Construct wildlife-friendly cattle exclusion fence in riparian area of Vanderford Valley, along approximately ¾ of a mile on each side of the creek.

PLM AREA LICENSE ANNUAL RENEWALS, 2016/2017 PROPOSED SEASONS, HARVESTS, AND HABITAT IMPROVEMENTS		
PLM Area	**Proposed Season and Harvest**	**Habitat Improvement Program**
SUGARLOAF-BANGOR RANCH DEER ZONE D-3 YUBA 2,626 ACRES	***Authorized Harvest:*** 12 buck deer, 50 turkey, and 200 quail • Issue 12 buck deer tags to take forked horn or better buck deer for the period of September 24, 2016 through November 30, 2016. • Issue 50 turkey tags for the periods of October 1, 2016 through January 15, 2017 (fall season, either-sex harvest) and March 1, 2017 through May 15, 2017 (spring season, gobbler-only harvest). • Issue 200 upland game seals for the period of September 1, 2016 through February 28, 2017. Additional orders are approved in 100 seal increments up to the authorized harvest.	➢ Moderate livestock grazing program. ➢ Maintain hot line around Round Lake to keep livestock from willow and cottonwood plantings. ➢ Maintain solar-operated well that is water source for Round Lake. ➢ Crush brush to improve deer browse; pile brush for quail habitat. ➢ Maintain ditch and pipe that supplies water to Wood Duck Lake. ➢ Modify water intake for Wood Duck Lake. ➢ Maintain 40 bluebird nest boxes.
BAY DELTA REGION		
PACHECO RANCH DEER ZONE A SANTA CLARA 673+ ACRES	***Authorized Harvest***: 4 buck deer • Issue 4 buck deer tags to take forked horn or better bucks for the period of July 9, 2016 to November 30, 2016.	➢ Mechanical removal (0.5 acre minimum) and hand pruning (0.5 acre minimum) of decadent chamise. Broadcast native seed in cleared area. ➢ Enclose at least 25 blue oak seedlings with no-climb horse fencing ➢ Collect and plant at least 100 blue oak acorns in open grassy area placing 3 acorns per hole. ➢ Remove approximately 1000 yards of bottom wire from internal barb wire fencing. Completely remove fence where appropriate. ➢ Plant native willows, maple and/or other riparian vegetation at waterworks spring location.
CENTRAL REGION		
BARDIN RANCH MONTEREY 8,000 ACRES	***Authorized Harvest.*** 2 bull and 4 antlerless tule elk • Issue 2 bull elk tags for the period October 1, 2016 through December 31, 2016. • Issue 4 antlerless elk tags for the period October 1, 2016 through December 31, 2016.	➢ Develop new spring and trough in Buck Canyon. ➢ Maintain existing springs, troughs and reservoirs to provide water for wildlife. ➢ Create 10 brush piles for use by wildlife.

PLM AREA LICENSE ANNUAL RENEWALS, 2016/2017 PROPOSED SEASONS, HARVESTS, AND HABITAT IMPROVEMENTS		
PLM Area	**Proposed Season and Harvest**	**Habitat Improvement Program**
BARDIN RANCH CONT.		➢ Maintain rotational grazing system and allow cattle access to the upper hills only from November-June to reserve forage for wildlife. ➢ Plant 30 acres of forage mix in the Corral and Lower hayfields in Gabilan Canyon for use by wildlife. ➢ Recondition Lone Tree stock pond for wildlife.
SOUTH COAST REGION		
SANTA CATALINA ISLAND DEER ZONE D15 LOS ANGELES 42,100 ACRES	***Authorized Harvest:*** 500 deer: 250 antlerless deer and 250 either-sex deer • Issue 300 tags, 150 antlerless deer tags and 150 either sex deer tags for the period of September 9, 2016 to December 30, 2016. • Upon written request of the licensee on or before October 1, 2016, issue up to an additional 50 antlerless deer tags and up to an additional 50 either-sex deer tags to accomplish the authorized harvest. Any tags not requested during this request-period can be rolled over into and allocated during the next request period. • Upon written request of the licensee on or before December 1, 2016, issue up to an additional 50 antlerless deer tags and up to 50 either-sex deer tags to accomplish the authorized harvest.	➢ Continue annual Catalina Island fox recovery activities including: census, vaccination of 300 individuals against canine distemper virus (CDV)/rabies, and monitoring 50 radio collared individuals. ➢ Continued monitoring of Island for non-native mammals (raccoons). ➢ Continued bison herd management through contraception (maintain at 150). ➢ Continue animal and plant baseline monitoring activities. ➢ Continued monitoring of federally threatened Island rush rose (*Helianthemum greenei*) populations. ➢ Continue optimize weather data collection and analysis. ➢ Continue invasive plant removal through the Catalina Habitat Improvement and Restoration Project (CHIRP). ➢ Continue monitoring and maintaining of deer enclosures erected after the 2006, ➢ 2007 and 2011 fires (Empire Landing, Island Fire, Banning Fire). ➢ Continue and expand education and outreach through Naturalist Training, Kids In Nature, Island Scholars, Families In Nature, and Nature Works ➢ programs.

PLM AREA LICENSE ANNUAL RENEWALS, 2016/2017 PROPOSED SEASONS, HARVESTS, AND HABITAT IMPROVEMENTS		
PLM Area	**Proposed Season and Harvest**	**Habitat Improvement Program**
INLAND DESERTS REGION		
BIG MORONGO SPRINGS RANCH DEER ZONE D14 SAN BERNARDINO 6,632 ACRES	***Authorized Harvest***: 12 buck deer, 2 antlerless deer, and 10 black bear • Issue 12 deer tags to take forked-horn or better bucks and 2 deer tags to take antlerless deer for the period of September 10 through December 4, 2016. • Issue 10 tags to take black bear for the period of September 10 through December 25, 2016 or when the statewide quota of 1,700 is met.	➢ Continue non-use by livestock. ➢ Repair or replace all pipelines and tanks damaged by Sawtooth wildfire. ➢ Repair fire-damaged roads within PLM. ➢ Continue monitoring of water sources with trail cameras.

Wildlife Resources Committee (WRC) 2016-2017 Draft Work Plan: Schedule topics and timeline for items referred to WRC (Updated for Aug 2016 FGC meeting)

Topic	Type of Topic	2016			2017		
		JAN *Cancelled*	MAY (West Sac)	**SEP (Woodland)**	JAN (TBD)	MAY (TBD)	SEP (TBD)
Annual Game Regulations							
Upland Game Birds	Annual	X / R		**X**	X / R		
Sport Fish	Annual	X	X / R		X	X / R	
Mammals	Annual		X	**X / R**		X	X / R
Waterfowl	Annual		X	**X / R**		X	X / R
Central Valley Salmon	Annual			**X / R**		X	X / R
Klamath River Sport Fish	Annual		X	**X / R**		X	X / R
Regulations & Legislative Mandates							
Possession of game for processing into food (Sec. 3080(e), Fish and Game Code)	Referral for review	X			X	X / R	
Falconry	Referral for review				X	X	
Emerging Management Issues							
Lead Ban Implementation	DFW project				X	X	X
Wild Pig Management	Referral for review		X	**X**	X / R		
Hatchery & Inland Fisheries Fund	Referral for review					X	X
Special Projects							
Predator Policy Workgroup	WRC workgroup		X	**X**	X	X / R	

KEY **X** Discussion scheduled **R** Recommendation developed and moved to FGC

DRAFT

CALIFORNIA LEGISLATURE

OUTDOOR SPORTING CAUCUS

August 11, 2016

RECEIVED
CALIFORNIA
FISH AND GAME
COMMISSION
2016 AUG 11 PM 3: 18

Anthony Williams, Co-Chair

Russ Burns, Co-Chair

Wildlife Resources Committee

California Fish and Game Commission

1416 9th St., 13th Floor

Sacramento, CA 95814

Dear Commissioners Williams and Burns:

We are writing to express concern regarding the solvency of the Hatchery and Inland Fisheries Fund which is overseen by the Department of Fish and Wildlife (DFW). According to the Department of Finance (DOF), this fund is operating at an annual loss and is perilously close to insolvency. This would dangerously impact California freshwater anglers.

When presented with DOF's analysis, in the attached letter of opposition to AB 1844 (Gallagher), of the Hatchery and Inland Fisheries Fund, DFW was unable to provide concrete data that the fund will continue to remain solvent in the future. In the letter, DOF reported, "Expenditures in the Hatchery and Inland Fisheries Fund also exceed revenues resulting in an annual imbalance of $2.2 million; the fund is anticipated to become insolvent in fiscal year 2018-2019." DFW's response was simply that the fund is not currently insolvent and provided no data regarding the alleged operating loss. Considering the importance of the Hatchery and Inland Fisheries Fund, we believe that DFW should be required to provide a detailed analysis of the fund.

The undersigned members of the California Legislature Outdoor Sporting Caucus (OSC) support a detailed analysis of revenues and expenditures for the Hatchery and Inland Fisheries Fund for the fiscal years 2013-2014, 2014-2015 and 2015-2016. It is our understanding that the Fish and Game Commission staff will make a recommendation to the full Commission at the August 24 meeting as to whether or not this analysis should be presented by DFW at a public meeting. We strongly urge the Commission to have DFW present the aforementioned analysis to the Wildlife Resources Committee at its September 21, 2016 meeting in order to identify the necessary steps to prevent insolvency.

Thank you for your attention to this important matter.

Sincerely,

[PLEASE SEE SIGNATURES BELOW]

cc: The Honorable Jerry Brown, Governor

Fish and Game Commission

Charleton H. Bonham, Director, DFW

Encl. – DOF opposition letter to AB 1844 (Gallagher)

SIGNATURES:

Senator Cathleen Galgiani, 5th District, Co-chair

Senator John Moorlach, 37th District, Co-chair

Assemblymember Brian Dahle, District 1, Co-Chair

Assemblymember Jim Frazier, District 11, Co-chair

Senator Tom Berryhill, District 8

Senator Anthony Cannella, District 12

Senator Jean Fuller, District 16, Senate Republican Leader

Senator Jim Nielsen, District 4

Assemblymember Catherine Baker, District 16

Assemblymember Ken Cooley, District 8

Assemblymember James Gallagher, District 3

Assemblymember Devon Mathis, District 26 #26

Assemblymember Frank Bigelow, District 5

Assemblymember Travis Allen, District 72

DEPARTMENT OF FINANCE
OFFICE OF THE DIRECTOR

EDMUND G. BROWN JR. GOVERNOR
STATE CAPITOL ■ ROOM 1145 ■ SACRAMENTO CA ■ 95814-4998 ■ WWW.DOF.CA.GOV

Honorable James Gallagher
Member of the Assembly
State Capitol, Room 5128
Sacramento, CA 95814

Dear Assemblymember Gallagher:

Our office has reviewed AB 1844 as amended March 10, 2016. On the basis of our attached analysis of available information, we regret that we must oppose your legislation. If you feel that we may have overlooked factors that may be important in evaluating your legislation, please call me at 445-8610 and we will arrange any assistance necessary.

Sincerely,

MICHAEL COHEN
Department Director

Attachment

DEPARTMENT OF FINANCE BILL ANALYSIS

AMENDMENT DATE: 03/10/2016
POSITION: Oppose
SPONSOR: California Sports Fishing League

BILL NUMBER: AB 1844
AUTHOR: Gallagher, James
RELATED BILLS: SB 1081, Morrell

BILL SUMMARY: Hunting and fishing licenses: reduced license fees: veterans.

Existing law requires the Department of Fish and Wildlife (Department) to issue a reduced-fee sport fishing license or hunting license to disabled veterans and to active military personnel who are recovering from an injury.

This bill would expand the list of those eligible to receive reduced-priced hunting and fishing licenses by requiring the Department to issue both annual and lifetime fishing, hunting, and sportsman licenses, to honorably discharged U.S. veterans who are residents of California, at a 25 percent discount. Further, for fishing report cards or associated tags, validations or other entitlements that may be required in addition to a lifetime fishing license, this bill would provide a 25 percent discount to resident discharged U.S. veterans, and a 50 percent reduction for resident disabled veterans. The Fish and Game Commission (Commission) would be precluded from increasing fees to recover the costs of providing these discounts.

FISCAL SUMMARY

The Department estimates a loss of $768,000 in revenue for the issuance of reduced-fee annual and lifetime fishing, hunting and sportsman licenses, assuming that 6.19 percent of licensees would be resident veterans. This estimate does not include potential workload that the Department is still evaluating associated with this bill. Finally, there may be some offset to the extent that lowered fees encourage more qualifying veterans to pursue licenses.

Revenue from sport fishing and hunting licenses are deposited in the Fish and Game Preservation Fund and the Hatchery and Inland Fisheries Fund. The Fish and Game Preservation Fund currently has a structural deficit with expenditures exceeding revenues by over $21.5 million; the Governor's Budget reflects a reserve balance of $6 million in fiscal year 2016-17. Expenditures in the Hatchery and Inland Fisheries Fund also exceed revenues resulting in an annual imbalance of $2.2 million; the fund is anticipated to become insolvent in fiscal year 2018-19.

COMMENTS

While the intent of this bill is meritorious, the Department of Finance opposes this bill because it reduces revenue for the Fish and Game Preservation Fund and the Hatchery and Inland Fisheries Fund, both of which are structurally imbalanced with annual expenditures exceeding annual revenues.

Currently, hunting and sport fishing licenses each cost $47.01 for California residents; reduced-priced licenses are provided at $6.95 to disabled veterans and recovering active military members. In addition to licenses, the application fee for hunting tags for specific species cost between $5.97 and $38.62; hunting tags themselves can cost between $22.42 and $445.35. Validations for ducks and some upland game birds are up to $20.52. Sport fishing licenses also require report cards for certain fish with costs between $6.22 and $22.42 depending upon specified species.

Analyst/Principal (0684) A.Martin	Date	Program Budget Manager Karen Finn	Date
Department Deputy Director		Orig. Signed By J.W.H. APR 25 2016	Date
Governor's Office:	By:	Date:	Position Approved Position Disapproved

BILL ANALYSIS — Form DF-43 (Rev 03/95 Buff)

RECO RES : AB 1844 - 4/19/2016 17:17:50 PM

COMMENTS (continued)

Existing law requires the Department to issue hunting and sport fishing licenses at reduced-fees or at no cost to certain groups including low income senior citizens and Native Americans, disabled veterans, recovering service members, and persons who are blind, developmentally disabled, or mobility impaired. Approximately 17,500 resident and nonresident disabled veterans currently take advantage of reduced-fee hunting and fishing licenses with revenue of approximately $118,000.

According to the author's office, there are only limited opportunities for reduced-fee hunting and sport fishing licenses for military men and women and this bill will allow those who devoted their lives to the service of our country to more easily participate in fishing and hunting in California. The author anticipates that the proposed fee reduction will encourage greater participation among Veterans and their family and friends. This expanded participation would then lead to increased sales of licenses in future years.

Senate Bill 1081 (Morrell) is a related bill that reduces fees to a base of five dollars for hunting and fishing licenses for honorably discharged veterans, provides a 50 percent discount for fishing report cards or associated tags, validations or other entitlements, and waives all fees for disabled veterans and recovering active military personnel.

Code/Department Agency or Revenue Type	SO LA CO RV	PROP 98	FC	(Fiscal Impact by Fiscal Year) (Dollars in Thousands) 2015-2016 FC	2016-2017 FC	2017-2018	Fund Code
3600/FishWild	SO	No		----- See Fiscal Summary -----			0200
3600/FishWild	SO	No		----- See Fiscal Summary -----			3103

Fund Code	Title
0200	Fish and Game Preservation Fund
3103	Hatchery and Inland Fisheries Fund

BEFORE THE STATE OF CALIFORNIA
FISH AND GAME COMMISSION

PETITION TO LIST THE NORTHERN SPOTTED OWL AS "THREATENED" OR "ENDANGERED" UNDER THE CALIFORNIA ENDANGERED SPECIES ACT

ENVIRONMENTAL PROTECTION INFORMATION CENTER

September 4, 2012

Notice of Petition

California Fish and Game Commission
1416 Ninth Street, Suite 1320
Sacramento, CA 95814

The Environmental Protection Information Center (EPIC) hereby formally petitions the California Fish and Game Commission to list the northern spotted owl (*Strix occidentalis caurina*) as "threatened" or "endangered" pursuant to the California Endangered Species Act (CESA). California Fish and Game Code §§ 2050 *et seq*. This petition is filed under Sections 2072 and 2073 of the California Fish and Game Code and pursuant to Section 670.1, Title 14 of the California Code of Regulations which grants interested parties the right to petition for issue of a rule. This petition demonstrates that the northern spotted owl clearly warrants listing under CESA based on the factors specified in the statute.

This petition sets in motion a specific process placing definite response requirements on the California Fish and Game Commission and the California Department of Fish and Game and specific time constraints upon those responses. Petitioner certifies that all statements made in this petition are true and complete.

Petitioner:

Andrew J. Orahoske, Conservation Director
Environmental Protection Information Center
145 G Street, Suite A
Arcata, CA 95521

The Environmental Protection Information Center (EPIC) is a nonprofit organization that works to protect and restore ancient forests, watersheds, coastal estuaries, and native species in Northern California. EPIC's members have a direct interest in the conservation of the forests that support Northern Spotted Owls on both public and private lands which contribute to the continued existence of this species. Consequently, EPIC seeks to promote sustainable, restoration-based forestry through education, outreach, litigation, advocacy, and collaboration.

www.wildcalifornia.org

Executive Summary

The Northern Spotted Owl (*Strix occidentalis caurina*) has been listed under the federal Endangered Species Act (ESA) as "threatened" since 1990. By definition, a threatened species is ". . . likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." 16 U.S.C. §1531. Despite more than 20 years of protections, the northern spotted owl is now closer to extinction than ever. Recently, spotted owl biologists have published a comprehensive analysis that determined the species has been declining on seven of eleven active demographic study areas at about 3% annually range-wide from 1985-2008, and that the decline is accelerating in recent years (Forsman et al. 2011). The rate of decline is steepest in northern Oregon and Washington, where spotted owl populations would decline by more than half in the next 20 years. On the remaining federal lands, population decline is accelerating and vital rates are deteriorating (Forsman et al. 2011). On non-federal lands, including areas that once provided some of the highest quality habitat for spotted owls, declines are significantly greater than on federal lands, with vast areas no longer supporting any spotted owls at all. (Forsman et al. 2011, Anthony et al. 2006). The outlook for the northern spotted owl is dire based on the population trends, continued habitat loss, competition by the aggressive, invading barred owl, and the inadequacy of regulatory mechanisms, especially the lack of recovery efforts on state and private lands. This petition requests the U.S. Fish and Wildlife Service (USFWS) to acknowledge the best available science, and to act accordingly by changing the status of the northern spotted owl from "threatened" to "endangered" under the ESA.

The State of California has never acted to protect the northern spotted owl under the California Endangered Species Act (CESA). California Fish and Game Code §§ 2050 *et seq*. This is despite clear declines throughout the species range in California, as well as the remainder of the range. After listing the owl under the ESA, the USFWS and federal land managers developed a strategy, the "Northwest Forest Plan," to recover the spotted owl by heavily relying on a selection of federal lands to shoulder the burden of conservation. The plan's centerpiece was a network of habitat islands for spotted owls, termed "late-successional reserves" (LSRs). Unfortunately, the reliance on the Northwest Forest Plan meant that the conservation needs for spotted owls outside of the LSRs were largely ignored. This was especially true on state and private lands where spotted owls have been largely extirpated, with the remaining individuals in dire need of protections. The heavy reliance on fragmented reserves on federal lands without a comprehensive approach to spotted owl conservation on non-federal lands has proven to be a critical error, and one of the primary reasons why recovery has failed. Coupled with continued habitat loss is the very significant threat posed by the barred owl, which displaces spotted owls and thrives in the highly fragmented and simplified industrial forest landscapes.

It is now time for the State of California Fish and Game Commission to recognize its duties under CESA, and based on the overwhelming evidence, act swiftly to protect the northern spotted owl. Without a more holistic view of species recovery and landscape-scale conservation, the spotted owl is likely to go extinct in the foreseeable future.

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I. Introduction

The northern spotted owl (*Strix occidentalis caurina*) is a subspecies of spotted owls that was listed as "threatened' under the federal Endangered Species Act (ESA) in 1990, due to widespread loss of suitable habitat and the inadequacy of existing regulatory mechanisms. (USFWS 1990). The State of California has never acted to protect the northern spotted owl under the California Endangered Species Act (CESA). California Fish and Game Code §§ 2050 *et seq*. This subspecies has a low reproductive rate, restrictive habitat requirements and specializes on a limited number of prey species. In this petition we summarize the evidence of population declines and ongoing threats that are well documented in recently published literature making the subspecies vulnerable to extinction (Forsman et al 2011, Courtney et al. 2004, 2008, Davis et al. 2011, Anthony et al. 2006, Noon and Blakesley 2006).

This petition, combined with recent extensive studies of spotted owls, and the extensive documentation provided to the Fish and Game Commission herein, leads to the conclusion that northern spotted owls should be listed as "threatened' or "endangered" under the CESA. The best available science clearly shows that threats faced by the northern spotted owl have increased since listing the subspecies as "threatened" in 1990, and that the owl has been extirpated or nearly extirpated in many portions of its range. In light of this overwhelming evidence, the northern spotted owl is presently in danger of extinction, as defined by the CESA.

II. The Listing Process under the California Endangered Species Act

The State of California enacted the California Endangered Species Act (CESA) in order to address and prevent the extinction of native biological diversity. The purpose of CESA is to "conserve, protect, restore, and enhance any endangered species or any threatened species and its habitat...." Fish & Game Code § 2052. The first step under CESA is to identify and list species as "threatened" and "endangered." A "threatened species" refers to a native species or subspecies of a bird, mammal, fish, amphibian, reptile, or plant that, although not presently threatened with extinction, is likely to become an endangered species in the foreseeable future in the absence of special protection and management efforts. Fish & G. Code § 2067. An "endangered species" refers to a native species or subspecies of a bird, mammal, fish, amphibian, reptile, or plant which is in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes, including loss of habitat, change in habitat, overexploitation, predation, competition, or disease. Fish & G. Code § 2062.

The California Fish and Game Commission (Commission) is the administrative body that makes all final decisions regarding the listing of species under CESA. The California Department of Fish and Game (DFG) is the expert agency that makes recommendations to the Commission regarding species listings. The listing process may be set in motion in two ways: "any person" may petition the Commission to list a species, or the Department may on its own initiative put

forward a species for consideration. “Petitions shall include information regarding the population trend, range, distribution, abundance, and life history of a species, the factors affecting the ability of the population to survive and reproduce, the degree and immediacy of the threat, the impact of existing management efforts, suggestions for future management, and the availability and sources of information. The petition shall also include information regarding the kind of habitat necessary for species survival, a detailed distribution map, and any other factors that the petitioner deems relevant.” Fish & G. Code § 2072.3. In the case of a citizen proposal, CESA sets forth a process for listing that contains several discrete steps.

Upon receipt of a petition to list a species, a 90-day review period ensues during which the Commission refers the petition to the Department, as the relevant expert agency, to prepare a detailed report. The Department’s report must determine whether the petition, along with other relevant information possessed or received by the Department, contains sufficient information indicating that listing may be warranted. Fish & G. Code § 2073.5.

During this period interested persons are notified of the petition and public comments are accepted by the Commission. Fish & G. Code § 2073.3. After receipt of the Department’s report, the Commission considers the petition at a public hearing. Fish & G. Code § 2074. At this time the Commission is charged with its first substantive decision: determining whether the Petition, together with the Department’s written report, and comments and testimony received, present sufficient information to indicate that listing of the species “may be warranted.” Fish & G. Code § 2074.2. This standard has been interpreted as the amount of information sufficient to "lead a reasonable person to conclude there is a substantial possibility the requested listing could occur." Natural Resources Defense Council v. California Fish and Game Comm. 28 Cal.App.4th at 1125, 1129.

If the petition, together with the Department’s report and comments received, indicates that listing “may be warranted,” then the Commission must accept the petition and designate the species as a “candidate species.” Fish & G. Code § 2074.2. “Candidate species” means a “native species or subspecies of a bird, mammal, fish, amphibian, reptile, or plant that the commission has formally noticed as being under review by the department for addition to either the list of endangered species or the list of threatened species, or a species for which the commission has published a notice of proposed regulation to add the species to either list.” Fish & G. Code § 2068.

Once the petition is accepted by the Commission, then a more exacting level of review commences. The Department has twelve months from the date of the petition’s acceptance to complete a full status review of the species and recommend whether such listing “is warranted.” Following receipt of the Departments status review, the Commission holds an additional public hearing and determines whether listing of the species “is warranted.” If the Commission finds that the species is faced with extinction throughout all or a significant portion of its range, it must list the species as endangered. Fish & G. Code § 2062. If the Commission finds that the species is likely to become an endangered species in the foreseeable future, it must list the species as threatened. Fish & G. Code § 2067.

Notwithstanding these listing procedures, the Commission may adopt a regulation that adds a species to the list of threatened or endangered species at any time if the Commission finds that there is any emergency posing a significant threat to the continued existence of the species. Fish & G. Code § 2076.5.

Despite the fact that the northern spotted owl has been threatened with extinction since the 1980's, and listed under the federal Endangered Species Act since 1990, the Commission has not protected the northern spotted owl under the California Endangered Species Act (CESA).

III. Biology and Ecology of the Northern Spotted Owl

A. Physical Description and Taxonomy

The northern spotted owl is a medium-sized owl and the largest of the three subspecies of spotted owls currently recognized by the American Ornithologists' Union (Gutierrez et al.1995). It is dark brown with a barred tail and white spots on the head and breast, and has dark brown eyes that are surrounded by prominent facial disks. The taxonomic separation of these three subspecies is supported by numerous factors (Courtney et al. 2004), including genetic (Barrowclough and Gutierrez 1990, Barrowclough et al. 1999, Haig et al. 2004, Barrowclough et al. 2005) morphological (Gutierrez et al. 1995), behavioral (Van Gelder 2003), and biogeographical characteristics (Barrowclough et al. 1999).

B. Range

Historically, the northern spotted owl was found from British Columbia through western Washington, western Oregon, and northwestern California from Siskiyou County south to Marin County (American Ornithological Union 1957, Forsman 1976, Forsman et al. 1984, Gutiérrez et al. 1995). The ranges of the northern and California subspecies of spotted owls meet at the southern end of the Cascade Range, near the Pit River area in northern California (Thomas et al. 1990, USFWS 1992, Barrowclough et al. 1999, Haig et al. 2001).

Currently, the northern spotted owl is extirpated or nearly extirpated from a portion of its historic range. Populations in British Columbia are nearly extinct (COSEWIC 2008), and those in Washington have been extirpated or nearly extirpated in many areas, including most notably southwestern Washington and much of the Olympic Peninsula and Puget Sound where the owl has suffered particularly precipitous declines. Significant populations remain in southern Oregon, but in northwestern Oregon and much of the Oregon Coast Range the owl is nearly extirpated. And, in California, populations are declining in two of three long-term monitoring sites, while numerous historic territories have been lost from interior forests in California. The Revised Recovery Plan for the northern spotted owl states: "Many historical spotted owl site-centers are no longer occupied because spotted owls have been displaced by barred owls, timber harvest, or fires" (USFWS 2011). The California Department of Fish and Game maintains records of

spotted owl territories in the California Natural Diversity Database (CNDDB). Detailed distribution maps of northern spotted owls are provided below.

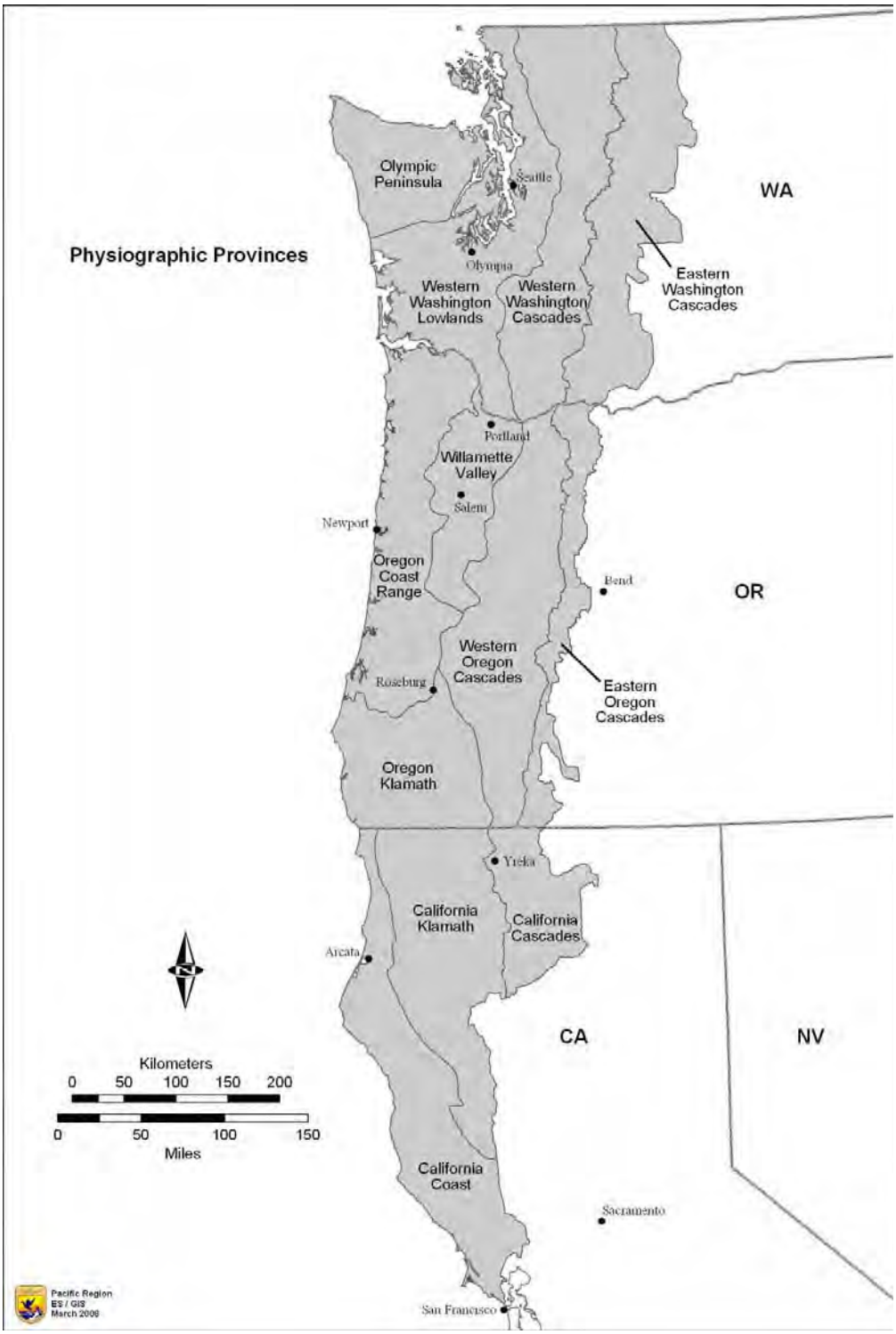


Figure 1: Overall range of the Northern Spotted Owl

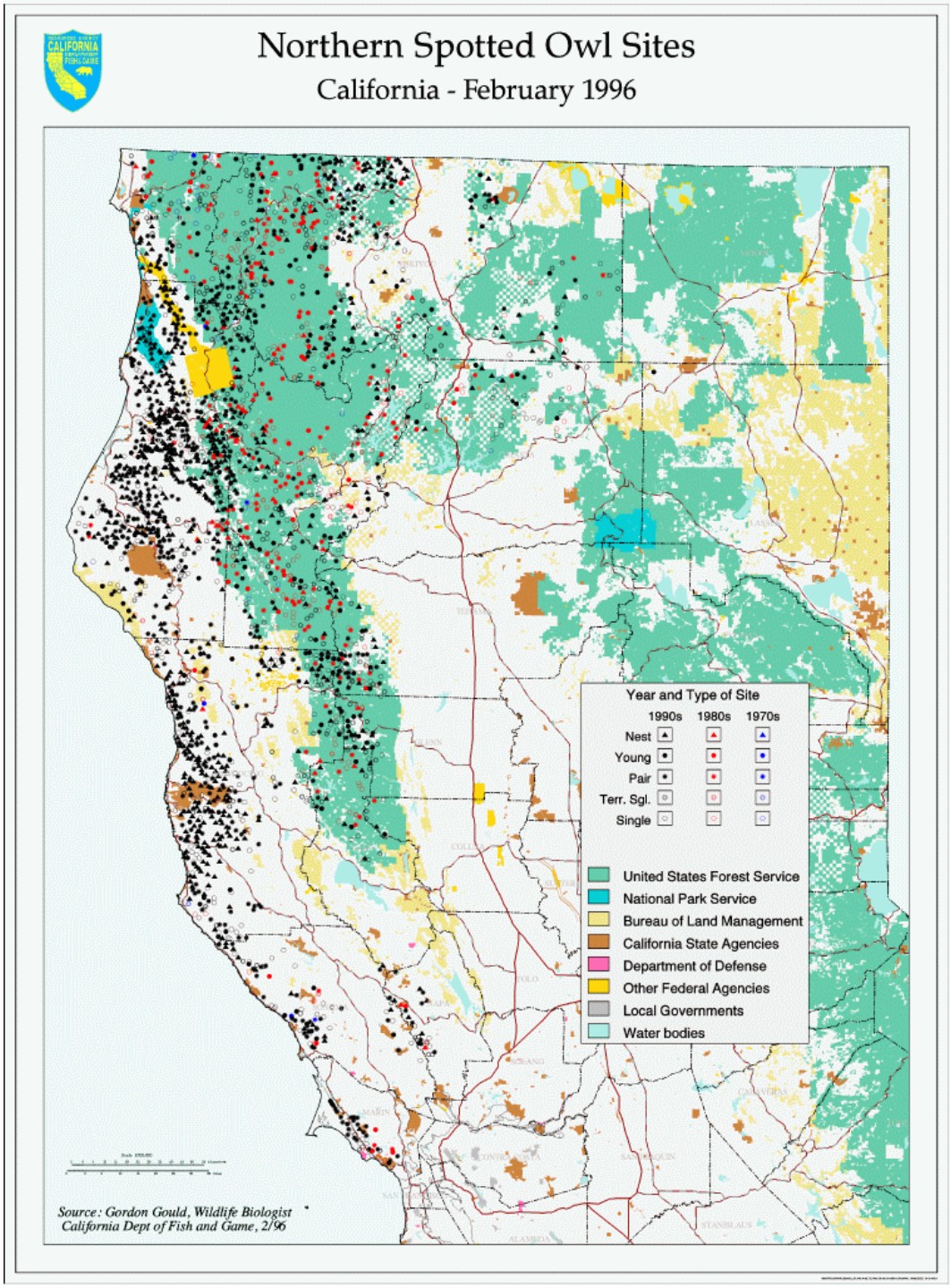


Figure 2: Northern Spotted Owl distribution in California (see legend for details).

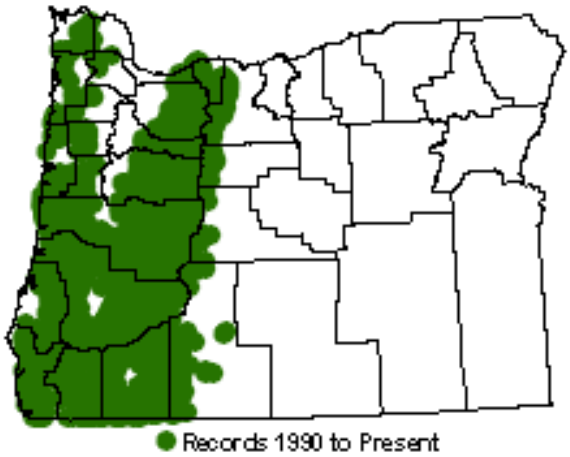


Figure 3: Northern spotted owl distribution in Oregon (green shaded area).

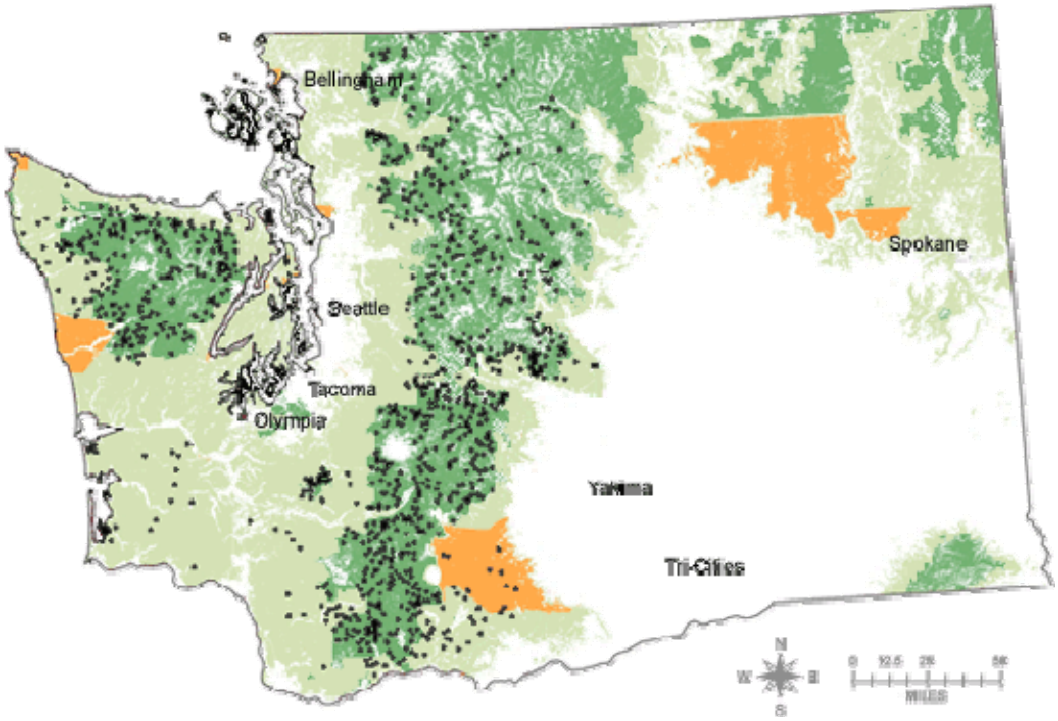


Figure 4: Northern Spotted Owl distribution in Washington (black dots).

C. Prey

Prey distribution and abundance plays a central role in the ecology of the northern spotted owl (Carey et al. 1992, Carey and Peeler 1995, Courtney et al. 2008). There is significant variation in the prey of the northern spotted owl across its range (Forsman et al. 2004, Courtney et al. 2008) and even within prey species, life history, and ecology vary geographically (Carey 2000, Lehmkuhl et al. 2006, Courtney et al. 2008). The northern portions of the owls' range lack several key prey species. For example, the red tree vole (*Aborimus longicaudus*) and dusky-footed wooded rat (*Neotoma fuscipes*) are not found north of the Columbia River (Carey et al.

1992, Carey 1999). However, southern Oregon provides some of the best remaining northern spotted owl habitat. In the margins of river valleys such as those along the Umpqua River, both the number of prey species and their abundance reaches a peak. In these areas, prey biomass may be the highest in the owl's entire range (Carey et al. 1992, Carey 1999). Ecotones between areas of older hemlock and mixed conifer forests may have three abundant prey species—red tree vole, bushy-tailed wood rat (*Neotoma cinerea*), and northern flying squirrel (*Glaucomys sabrinus*). Valley margins in southern Oregon often have these three prey species plus dusky-footed wood rat in abundance.

Carey et al. (1992) estimated the effect of the number of available prey species on the area needed to support a pair of northern spotted owls. In Douglas-fir (*Pseudotsuga menziesii*) / western hemlock (*Tsuga heterophylla*) forests in the southern Oregon Coast Range, when flying squirrels and bushy-tailed woodrats were available, 1,000 ha of old growth within a 2,000-ha area was sufficient to provide a high expectation of a pair surviving for one year. In more diverse nearby mixed conifer forests, with flying squirrels, bushy-tailed wood rats, dusky-footed wood rats, and red tree voles, owls needed less than half the area reported elsewhere. Cary et al. (1992) estimated that 500 ha of old forest within a 2,000-ha range could support a pair of northern spotted owls with a high probability of surviving for one year. In northern California, dusky-footed wood rat provides a major part of the northern spotted owl's diet (Courtney et al. 2008). The red tree vole is found in northwestern most California and is replaced by the Sonoma vole (*Arborimus pomo*) farther south.

While Courtney et al. (2004, 2008) provide a more extensive review of the diet of the northern spotted owl, little is known about the abundance and variability of prey populations. Owl demographic rates and population size may be influenced by prey abundance (Korpimäki 1992, Rohner 1996, Hakkarainen et al. 1997). Much of the high variation in northern spotted owl demographic rates may be explained, at least partially, by variations in prey abundance (Courtney et al. 2004).

D. Habitat Requirements

The best available science shows that relatively large areas of structurally complex, older forests provide the habitat necessary to support viable populations of northern spotted owls (Forsman et al. 2011). Spotted owls generally rely on older forested habitats because such forests contain the structures and characteristics required for nesting, roosting, and foraging, and dispersal. Forest characteristics associated with spotted owls usually develop with increasing forest age, but their occurrence may vary by location, past forest practices, and stand type, history, and condition. Although spotted owl habitat is variable over its range, some general attributes are common to the owl's life-history requirements throughout its range. To support northern spotted owl reproduction, a home range requires appropriate amounts of nesting, roosting, and foraging habitat arrayed so that nesting pairs can survive, obtain resources, and breed successfully. In northern parts of the range where nesting, roosting, and foraging habitat have similar attributes, nesting is generally associated with increasing old forest in the core area (Swindle et al. 1999). In some southern portions of the range, northern spotted owl survival is positively associated with

the area of old forest habitat in the core, but reproductive output is positively associated with amount of edge between older forest and other habitat types in the home range (Franklin et al. 2000). This pattern suggests that where dusky-footed woodrats (*Neotoma fuscipes*) are the primary prey species, core areas that have nesting habitat stands interspersed with varied types of foraging habitat may be optimal for northern spotted owl survival and reproduction. Both the amount and spatial distribution of nesting, roosting, foraging, and dispersal habitat influence reproductive success and long-term population viability of northern spotted owls. Population growth can occur only if there is adequate habitat in an appropriate configuration to allow for the dispersal of owls across the landscape. This includes support of dispersing juveniles, as well as nonresident subadults and adults that have not yet recruited into the breeding population. The survivorship of northern spotted owls is likely greatest when dispersal habitat most closely resembles nesting, roosting, and foraging habitat, but owls may use other types of habitat for dispersal on a short term basis. Dispersal habitat, at a minimum, consists of stands with adequate tree size and canopy closure to provide protection from avian predators and at least minimal foraging opportunities.

Large areas of older, structurally complex forests provide the habitat necessary to support viable populations of northern spotted owls. Extensive studies have supported the strong association of northern spotted owls and older forests. Northern spotted owls select older forests for nesting (Hershey et al. 1998, Swindle et al. 1999) and roosting and foraging (Forsman et al. 1984, Bart and Forsman 1992, Thomas et al. 1990, Herter et al. 2002, Glenn et al. 2004, Forsman et al. 2005). Nest site occupancy also is related to the presence of mature and old-growth forests throughout the owls' range although the nature of this relationship varies (Carroll and Johnson 2008). On private lands in northwestern California, northern spotted owls usually occur in the oldest forests available (Diller and Thome 1999). Understory structure characteristic of late-successional habitat is also important for northern spotted owls and their prey (Carey et al. 1992, Rosenberg and Anthony 1992, Buchanan et al. 1995, LaHaye and Gutiérrez 1999, Lehmkuhl et al. 2006).

Recruitment is positively related to the proportion of older forest habitat in owl territories, and higher levels of recruitment have been observed on federal lands with high proportions of old forest habitat (Forsman et al. 2011). Other studies have documented lower reproduction in areas with less old forest habitat. For example, pairs produced fewer fledglings in areas with less than 20 percent old forest habitat (average = 0.33 fledglings/pair) than in areas with greater than 60 percent old forest habitat (average = 0.93 fledglings/pair) (Bart and Forsman 1992).
Survival and fecundity are positively associated with the proportion of old forest surrounding nesting territories (Franklin et al. 2000, Dugger et al. 2005, Olson et al. 2004). In southern Oregon reproduction increased as the proportion of old forest within 730 m of activity centers increased (Dugger et al. 2005). Habitat may partially mitigate the effects of the invasive barred owl. The effects of barred owls increase with a decrease in old forest habitat (Dugger et al. 2011).

IV. Population Status

Forsman et al. (2011) determined that northern spotted owl populations declined on 7 of 11 study areas range-wide from 1985-2008. Overall population declines were documented throughout the range of the northern spotted owl at 2.9% annually, with estimates of population declines ranging from 5 to 15% in the Tyee, Klamath, Southern Cascades, and Hoopa study areas, and 40 to 60% in the Olympic, Cle Elum, Rainier, and Oregon Coast Range study areas (Forsman et al. 2011). See Table 1.

TABLE 1: Summary of trends in demographic parameters for northern spotted owls, from 11 study areas 1985-2008, adapted from Forsman et al. (2011).

Study Area	**Fecundity**	**Apparent survival**	**Population trend**
Washington			
Cle Elum	Declining	Declining	Declining
Rainier	Increasing	Declining	Declining
Olympic	Stable	Declining	Declining
Oregon			
Coast Range	Increasing	Declining since 1998	Declining
H.J. Andrews	Increasing	Declining since 1997	Declining
Tyee	Stable	Declining since 2000	Stationary
Klamath	Declining	Stable	Stationary
Southern Cascades	Declining	Declining since 2000	Stationary
California			
Northwestern California	Declining	Declining	Declining
Hoopa	Stable	Declining since 2004	Stationary
Green Diamond	Declining	Declining	Declining

Areas of primarily non-federal land support few or no owls and Forsman et al. (2011) state that too few northern spotted owls exist in these regions (i.e., southwestern Washington, the Coast Range of northwest Oregon, the California Cascades, and much of Washington's Olympic Peninsula) even to conduct a demographic study with their methods. It is likely that these declines will continue on both federal and especially on non-federal lands.

The effectiveness monitoring program of the NWFP confirms the dire trajectories reported in the studies discussed above. Analysis of data from government monitoring of owl populations on eight sites on federal lands (including sites in Washington, Oregon, and California) show a 2.8% decline per year. A 3.1% decline per year was calculated for the other three study areas (Davis et al. 2011). While these declines are dramatic, rates of decline are even more precipitous on non-federal lands (Anthony et al. 2006, Davis et al. 2011).

Funk et al. (2010) provide additional independent evidence that northern spotted owls continue to decline and document that the subspecies is experiencing a reduced effective population size. The loss of genetic variation in the spotted owl is an emerging threat not considered during the original listing. The evidence for recent genetic bottlenecks in northern spotted owls is based on a large genetic dataset. This study observes that the genetic bottleneck, in addition to field

evidence for demographic decline, highlights the increasing vulnerability of the northern spotted owl to extinction.

Demographic data from studies initiated as early as 1985 have been analyzed every 5 years to estimate northern spotted owl demographic rates and population trends (Franklin et al. 1999, Anthony et al. 2006, Davis et al. 2011, Forsman et al. 2011). The most current evaluation of population status and trends is based on data through 2008 (Forsman et al. 2011). Based on this analysis, populations on 7 of 11 study areas (Cle Elum, Rainier, Olympic Peninsula, Oregon Coast Ranges, H.J. Andrews, Northwest California, and Green Diamond) were declining (Forsman et al. 2011). Estimates of realized population change (cumulative population change across all study years) indicated that, in the more rapidly declining populations (Cle Elum, Rainier, and Olympic Peninsula), the 2006 populations were 40 to 60 percent of the population sizes observed in 1994 or 1995 (Forsman et al. 2011). Populations at the remaining areas (Tyee, Klamath, Southern Oregon Cascades, and Hoopa) showed declining population growth rates as well, although the estimated rates were not significantly different from stable populations (Forsman et al. 2011). A meta-analysis combining data from all 11 study areas indicates that rangewide the population declined at a rate of about 2.9 percent per year for the period from 1985 to 2006. Northern spotted owl populations on Federal lands had better demographic rates than elsewhere, but still declined at a mean annual rate of about 2.8 percent per year for 1985–2006 (Forsman et al. 2011). In addition to declines in population growth rates, declines in annual survival were reported for 10 of the 11 study areas (Forsman et al. 2011). Number of young produced each year showed declines at 5 areas (Cle Elum, Klamath, Southern Oregon Cascades, Northwest California, and Green Diamond), was relatively stable at 3 areas (Olympic Peninsula, Tyee, Hoopa), and was increasing at 2 areas (Oregon Coast Ranges, H. J. Andrews) (Forsman et al. 2011). The barred owl has emerged as a greater threat to the northern spotted owl than was previously recognized. The range of the barred owl has expanded in recent years and now completely overlaps that of the northern spotted owl (Crozier et al. 2006). The presence of barred owls has significant negative effects on northern spotted owl reproduction (Olson et al. 2004), survival (Anthony et al 2006), and number of territories occupied (Kelly et al. 2003; Olson et al. 2005). The determination of population trends for the northern spotted owl has become complicated by the finding that northern spotted owls are less likely to call when barred owls are also present; therefore, they are more likely to be undetected by standard survey methods (Olson et al. 2005, Crozier et al. 2006). As a result, it is difficult to determine whether northern spotted owls no longer occupy a site, or whether they may still be present but are not detected. The 2011 Revised Recovery Plan for the Northern Spotted Owl concludes that ‘‘barred owls are contributing to the population decline of spotted owls, especially in Washington, portions of Oregon, and the northern coast of California.’’ (USFWS 2011). British Columbia has a small population of northern spotted owls. This population has declined at least 49 percent since 1992 (Courtney et al. 2004), and by as much as 90 percent since European settlement (Chutter et al. 2004) to a 2004 breeding population estimated at about 23 birds on 15 sites (Chutter et al. 2004). Chutter et al. (2004) suggested immediate action was required to improve the likelihood of recovering the spotted owl population in British Columbia. In 2007, the Spotted Owl Population Enhancement Team recommended to remove spotted owls from the wild in British Columbia. Personnel in British Columbia captured and brought into captivity the remaining 16 known wild

spotted owls. Prior to initiating the captive-breeding program, the population of spotted owls in Canada was declining by as much as 35 percent per year (Chutter et al. 2004).

V. Nature, Degree and Immediacy of the Threat to Northern Spotted Owls in California

The following sections provide an overall summary of the threats to northern spotted owls throughout their range, including California. Taking all of the information together, it is clear that the species should be protected under CESA.

A. Present or threatened destruction, curtailment, or modification of habitat or range

The destruction of old-growth forests in the Pacific Northwest and northern California is the original reason why spotted owls are imperiled. The warning signs of extinction were first document in the 1970s, due to the heavy logging throughout the owl's range, especially on many federal lands that had escaped logging up until that point. Lower elevation forests throughout Washington, Oregon and California were clearcut and substantial amounts of spotted owl habitat was high-graded by logging the biggest trees first (USFWS 1990). Many of these areas have never recovered to a point that they support spotted owls, particularly in southwestern Washington and the coast ranges of Oregon. The patchily distributed federal lands present in these regions are insufficient to provide sufficient habitat to recover spotted owls. Therefore, the spotted owl has been extirpated from large portion of its historic range and it is unlikely that the habitat on these predominantly private lands will be recovered in the foreseeable future. Management of federal lands, while improved from before ESA-listing, continues to allow the removal and degradation of spotted owl habitat, even areas deemed critical to their conservation. The Revised Recovery Plan even contemplates continued habitat losses with Recovery Action 32 (USFWS 2011). This action provides protections for "high quality" habitat but not for suitable owl habitat – as a result, ongoing losses are anticipated for nesting, roosting, foraging, and dispersal habitat that is not determined to be "high quality" by the action agencies or through consultation with USFWS.

According to the USFWS, spotted owl habitat losses have continued across ownerships despite the "threatened" listing (Moeur et al. 2005, Raphael 2006, Courtney et al. 2004). See Table 2.

TABLE 2. Spotted owl habitat losses across ownerships, 1994 to 2004.

Area (acres)	Time	Ownership	Cause	Description	Citation
16,900	1994 to 2003	Federal	Logging	older forest	Moeur et al. 2005
141,300	1994 to 2004	Federal and non-	Stand-replacing fire	owl habitat	Raphael 2006

		Federal			
155,999	1994 to 2003	Federal	Logging	owl habitat	Courtney et al. 2004
583,500	1994 to 2004	Non-Federal	Logging	owl habitat	Courtney et al. 2004

According to Campbell et al. 2010, over 50% of the state's old-growth forests have been lost. From 1994 to 2003 in Oregon and Washington fragmentation of forests increased substantially, in some regions as high as five-fold (Davis and Lint 2005). Even if owl habitat has not been completely lost by clearcut logging, most other types of commercial logging remove important components of functional owl habitat. This simplification of forest ecosystems contributes the overall decline in habitat quality and the ability of owls to survive over the long-term. Within native forests with older-forest habitat, important components for owls and their prey such as standing dead trees, large down wood, multi-layered canopies, and other features have been lost throughout much of the owls' range and are in short supply particularly on nonfederal lands mainly because of lax forest practices. In many places, it will take centuries for forests to recover their former productivity even with the Northwest Forest Plan, and other measures in place due to the extensive ecological debt in late-seral habitat (Strittholt et al. 2006).

1. Ongoing and Threatened Habitat Loss in California

Within California alone, EPIC has identified numerous logging proposals on both private and public lands that will destroy or degrade spotted owl habitat. For example, on private lands owned by Sierra Pacific Industries, EPIC has identified over 27 timber harvest plans (THPs) that are currently ongoing or proposed that will destroy over 7,000 acres of spotted owl habitat. See Table 3. We provide the supporting information for the identified Sierra Pacific THPs, including the owl and habitat survey data with this petition to the USFWS.

TABLE 3: Sierra Pacific Industries' timber harvest plans (THPs) destroying northern spotted owl habitat in violation of the ESA Section 9 "Take" prohibition

THP number	**THP Name**	**Spotted Owl Habitat Destroyed (acres)**
1-09-054HUM	Roweisner	157
1-09-061HUM	Rerun	399
1-09-085HUM	Acer	371
1-10-025HUM	Green Mule	130
1-10-048HUM	Kragness	112
1-10-085HUM	Marvel	34
1-12-042HUM	Hiker's Parade	724
2-09-010TRI	Hogs	83
2-09-038TRI	Wilcox	727
2-09-041TRI	Halls	227
2-09-042SHA	Derby	68

2-09-078LAS	Big Widow	123
2-09-085TRI	Bowman	91
2-09-091TRI	Lowball	64
2-10-011TRI	Dyno	403
2-10-019TRI	Ebert	321
2-10-074TRI	Ranger	189
2-10-075TRI	Hinkey	22
2-11-004TRI	Llium	54
2-11-014TRI	3B's	138
2-11-035TRI	Bowtie	2
2-11-061TRI	Pappy	895
2-11-064TRI	Southern Star	271
2-11-070TRI	Thurman	426
2-11-076SHA	Tea Kettle	167
2-11-078SHA	Uncle	717
2-11-080TRI	Hay	173
		7088 acres destroyed in total

Notably, the ongoing destruction of northern spotted owl habitat by Sierra Pacific Industries is taking place without an incidental take permit as required under the ESA. Therefore, EPIC has formally notified Sierra Pacific Industries with letter of intent to sue over violations of the ESA (EPIC 2012). The Secretary and USFWS have been aware of this ongoing "take" since at least February 2012, but the federal authorities have failed to act. The overall habitat destruction on Sierra Pacific Industries and other private lands in northern California has resulted in the abandonment of dozens of historic spotted owl territories (USFWS 2009). Those that remain are mostly all severely deficient in suitable habitat, particularly nesting and roosting habitat made up of older forests.

2. Habitat Loss and the Decline of Preferred Prey Species

Northern Flying Squirrel

The northern flying squirrel northern flying squirrel (*Glaucomys sabrinus*) is an essential prey species for spotted owls, particularly in the Oregon and Washington. Carey (2003) determined that logging in forests of the Pacific Northwest and northern California has produced imbalanced mammal communities, with some species that were once common in natural forests (Carey, 1995; Carey and Johnson, 1995) no being low in abundance. In particular, northern flying squirrels are very rare in the industrial timber stands due to dense homogeneous tree plantations with simplified understory while also promoting excessively high and uniform chipmunk abundance (Carey 2003). Manning et al. (2011) determined that large-scale commercial thinning of Douglas-fir forests is detrimental northern flying squirrels, and brings into question many of the proposed thinning treatments in spotted owl habitat. A recent meta-analysis of effects of silvicultural practices on northern flying squirrels found that previous studies asserting a benefit or no effect of harvesting on squirrel populations lacked statistical power and support for those

assertions (Holloway and Smith 2011). The implication of Holloway and Smith's meta-analysis is that forest management practices that are currently widespread in the Pacific Northwest (thinning and clearcutting) have negative short-term and long-term impacts on northern flying squirrels (Manning et al 2011).

Tree Voles

Tree voles are small, mouse-sized rodents that live in conifer forests and spend almost all of their time in the tree canopy. Tree voles rarely come to the ground, and do so only to move briefly between trees. They are one of the few animals to persist on a diet of conifer needles, which is their principal food. Spotted owls in Oregon and California rely on heavily on tree voles as a main source of prey. Tree voles are endemic to the humid, coniferous forests of western Oregon and northwestern California. Recently, the USFWS has proposed listing the northwestern Oregon distinct population segment of red tree vole under the ESA. See 76 Fed. Reg. 198 (October 13, 2011). The status review found that despite federal protections afforded by the Northwest Forest Plan, that the red tree vole was threatened due to ongoing clearcutting and habitat destruction on private, state and federal lands. Id. The clear declines for red tree voles throughout the range of the spotted owl are another indication that the owl faces significant threats warranting an endangered listing.

B. Disease or Predation

West Nile Virus is a potential threat to the northern spotted owl (Blakesley et al. 2004). Large numbers of wild birds have been killed by West Nile Virus since its introduction in 1999 and subsequent spread across North America (McLean et al. 2001, Caffrey 2003, Marra et al. 2004, Blakesley et al. 2004). Owls are known to be susceptible to West Nile Virus (Fitzgerald et al. 2003) and a captive spotted owl has died of the virus (Gancz et al. 2004). In addition, recent examination of the rates of infection by blood parasites indicates that northern spotted owls have a high rate of infection by *Leucocytozoon* and other parasites (Ishak et al. 2008). In addition, a *Plasmodium* parasite was documented for the first time in a northern spotted owl. The observed discrepancy between prevalence of blood parasites in barred and spotted owls could be explained by a better host immune response to the parasites. This differential in blood parasite infection rates led Ishak et al. (2008) to speculate that barred owls on the West coast may have a competitive advantage over the potentially immune compromised spotted owls.

C. Predation

Northern spotted owls are subject to predation by great horned owls (*Bubo virginianus*), goshawks (*Accipiter gentilis*), and red tailed hawks (*Buteo jamaicensis*) (Forsman et al. 1984, Courtney et al. 2004). This natural predation has been severely exacerbated by the destruction and fragmentation of suitable habitat. Industrial forestry models across millions of acres of private lands that create dense tree plantations, coupled with ongoing habitat degradation on public lands has resulted in more open habitat suitable for predators of spotted owls (Courtney et

al 2004). Additionally, barred owls (*Strix varia*) physically attack (Livezey and Fleming 2007) and may prey upon spotted owls (Leskiw and Gutiérrez 1998). With the expansion of the barred owl's range (Livezey 2009) this source of predation is increasing.

D. Inadequacy of Existing Regulatory Mechanisms

The inadequacy of existing regulatory mechanisms has been repeatedly cited as a primary threat to northern spotted owls for more than 20 years (USFWS 1990, Franklin and Courtney 2004, USFWS 2004, USFWS 2011). The primary inadequacies are the lack of protections for spotted owls on non federal lands, especially large swaths of industrial forestry lands controlled by a few large corporations. The regulatory inadequacies on non-federal lands were reviewed by DellaSala (2011) and categorized as follows: variable and often inadequate protection given to owls and owl habitat; lack of landscape-scale planning, especially on non-federal lands; use of survey protocols and other standards that fail to incorporate current relevant science; prevalence of discretionary guidelines and/or unclear or unsuitable direction; failure to consistently require involvement of personnel with biological expertise in evaluating/assessing ecological information. On federal lands and despite the protections afforded by the Northwest Forest Plan, insufficient protections and a lack of recovery planning outside of late-successional reserves continues to plague the agencies involved in forest management. This petition and supporting documentation clearly show that existing regulatory mechanisms have not prevented the continued decline of northern spotted owls since the 1990 ESA listing.

1. Non-federal Lands

Private and state lands managed for intensive timber production, employing clearcutting and short rotation, mono-culture and herbicide use have been largely overlooked by state regulators. Even though such practices were the primary reason for the original ESA-listing, this major cause of the spotted owl's decline and continued imperilment is simply not adequately addressed by existing laws and regulations. Most attention has focused on federal forest management, primarily because federal authorities have refused to prosecute ESA violations. Because the USFWS has abandoned its clear duties to prosecute "take" under the ESA, the lack of adequate regulations non-federal lands continues to pose a threat to northern spotted owls. Rather than issue protective regulations or prosecute violations of the ESA, the USFWS has allowed individual state agencies with conflicting missions to issue inadequate regulations in an attempt to create a façade of conservation. The following sections describe the regulatory approach and inadequacies for California, Oregon and Washington.

a) California

The California Forest Practices Rules ("CA FPRs") are the primary state regulations affecting the management of the spotted owl on private lands in California. These regulations implement the Z'berg Nejedley Forest Practices Act of 1973 (4 Pub. Res. Code Ch. 8). Unbelievably, the State of California has never listed the spotted owl under the state's own California Endangered

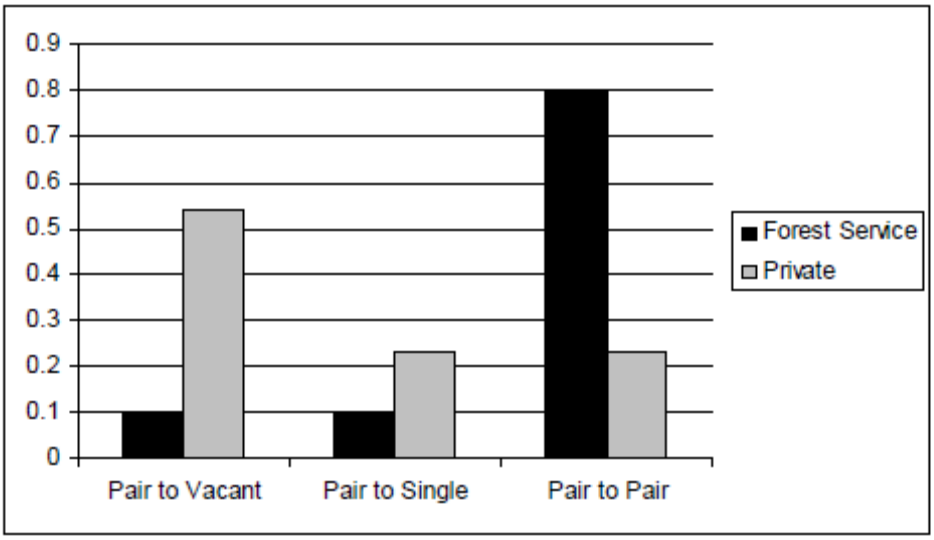
Species Act (CESA). Lacking any listing under CESA, the California Department of Fish and Game (CA DFG), the state agency charged with defending the public wildlife trust, is completely absent from conservation efforts. Therefore, the CA FPRs, as administered by the California Department of Forestry and Fire Protection (CalFire), are the state's only attempt at conserving spotted owls, and they are woefully inadequate. The CA FPRs require timber operators to prepare and submit a Timber Harvest Plan (THP) that is intended to serve as a substitute for the planning and environmental protection requirements of the California Environmental Quality Act of 1970 (Pub. Res. Code sections 21000-21177). The CA FPRs allow for the removal of spotted owl habitat below threshold guidelines for the avoidance of "take" set by the U.S. Fish and Wildlife Service (CA FPRs 2012, USFWS 2009).

The Yreka Field Office of the U.S. Fish and Wildlife Service completed an extensive analysis of the status of historical spotted owl activity centers on federal and private lands in interior northern California (USFWS 2009). The Service found that extensive losses of owl pairs occurred on private lands, which sharply contrasted with the persistence of owl pairs on federal lands. Yreka USFWS concluded:

> To quantify the pattern of territory loss identified during the technical assistance process, we compared results of protocol surveys conducted at verified NSO territories supporting at least one year of occupancy by paired owls on Forest Service lands (N=196) with similar data from private timberlands (N=75) in Shasta and Trinity counties. The data set consisted of activity center status records in the California Department of Fish and Game's Spotted Owl Database (CDFG-NSO database), supplemented with territory locations and recent survey records received during technical assistance. We first evaluated the validity of activity center records in the CDFG-NSO database, and eliminated 18 sites on private lands due to lack of verification of status. The remaining 57 private-land activity centers had verified NSO status in at least one year between 1989 and 2007; 44 of these sites had supported pairs during at least one year. Of these verified pair sites, 54% declined from pair status to no response, and an additional 23% declined from pair status to a territorial single owl during subsequent protocol surveys (Figure I.B.1). On Forest Service-administered lands, 80% of pair sites did not change status during the same time periods. While we recognize that annual variation in survey effort and results at this relatively coarse scale of resolution may influence this type of analysis, the strong differences in trends observed on private versus federal lands supports the contention that management on private timberlands is creating habitat conditions that do not support sustained occupancy by NSO.

(USFWS 2009: 11-12). The Service also created the figure below to illustrate the results of their analysis. Clearly, the California Forest Practice Rules are completely inadequate to protect spotted owls on private lands.

Figure I.B.1. Status of valid historical northern spotted owl activity centers (pair sites only) when resurveyed after 5-10 years. Data are from U.S. Fish and Wildlife Service technical assistance records and USFS monitoring records



The application of the limited protections contained in the CA FPRs depends upon prior identification of areas as "activity centers." If an activity center has not been identified, then no habitat protections nor surveys are required. In addition, the current database of activity centers is generally acknowledged to be out of date, poorly maintained, not well updated, and not reliable. Further, the definition of an "active nest site" or "pair activity center" in §919.9(g)(1-2) & 939.9(g)(1-2) (known as "Option G") is not inclusive enough to apply to all the sites entitled to protection under the Endangered Species Act. For known activity centers, the CA FPRs "Option G" only requires that a minimum amount of general spotted owl habitat be maintained, and makes no distinction as to whether the habitat must be nesting, roosting or foraging habitat. This critical deficiency means that logging operations may result in the complete removal of nesting and roosting habitat from an activity center, and still comply with the rules so long as enough foraging habitat remains. This on-the-ground reality is why the USFWS has found most activity centers on private lands have been abandoned since the early 1990s.

b) Oregon

Only a nest site and 70 acres of adjacent habitat is protected in Oregon, and the Oregon Department of Forestry does not consider foraging habitat to be a specific resource site, and therefore it is not protected under the Oregon forest practice rules (Oregon Administrative Rules (OAR) 665, Oregon Forest Practice Act Rulebook 2010). Nothing contained within the state rules reflects the best available science regarding the habitat needs for spotted owls. Even though the species is listed under the Oregon Endangered Species Act, the state has not developed a regulatory mechanism adequate to protect, much less recover, northern spotted owl habitat and populations.

c) Washington

Although the northern spotted owl has been listed as "endangered" under the Washington State Endangered Species Act since 1988, the subspecies has declined most precipitously in this state. There is no state recovery plan for spotted owls. Under the Washington State Forest Practice Rules, significantly different protections apply to northern spotted owls and their habitat depending on their location within or outside of designated Spotted Owl Special Emphasis Areas (SOSEAs). Conservation measures for northern spotted owls on private lands outside SOSEAs are "substantially less" than within SOSEAs (Ward 2006, Sweeden 2006). Even within SOSEAs, the designation does not prohibit detrimental forest practices so long as some environmental review takes place. The State of Washington and Weyerhaeuser Corporation were prosecuted for illegal "take" of northern spotted owls, resulting in a legal settlement that created a working group to recommend changes to Washington's Forest Practice Act. *See* Seattle Audubon Society v. Sutherland, 2:06−cv−01608−MJP, W.D. Washington. The federal court issued a preliminary injunction against further logging due to ongoing and threatened harm to spotted owls outside of SOSEAs. Id. The subsequent working group produced recommendations for changes to private lands logging in Washington to the state's forest practice board (Berg et al. 2009). The State of Washington's forest practice board has failed to act on those recommendations to the present day, and therefore spotted owls are still lacking adequate protections.

2. Federal Lands

While protections and conservation strategies are much better than on private and state lands, federal land management still poses many problems for spotted owls. All federal lands within the range of the northern spotted owl are currently managed under the provisions of the Northwest Forest Plan ("NWFP"). The NWFP was adopted in 1994, and it amended land management planning documents for nineteen National Forests and seven Bureau of Land Management districts throughout Washington, Oregon and California. The NWFP established a late-successional reserve (LSR) network and specified management standards and guidelines to further the recovery of northern spotted owls.

The 15-year report on the NWFP performance for spotted owls was recently released and it plainly shows that the plan is simply not enough to recover the species (Davis et al. 2011). The NWFP was based on overly optimistic assessments of spotted owl demographic performance (Franklin et al. 1999, Anthony et al. 2006). Demographic studies (Franklin et al. 1999, Anthony et al. 2006, Forsman et al. 2011, Davis et al. 2011) have demonstrated that the population declines are much greater rate than was anticipated across their range and particularly in Washington. In light of this decline, the Forsman et al. (2011) stressed the importance of retaining high quality owl habitat: "[i]n view of the continued decline of Spotted Owls in most study areas, it would be wise to preserve as much high quality habitat (i.e., late-successional forests) for Spotted Owls as possible, distributed over as large an area as possible."

The NWFP protected some of the remaining high quality owl habitat, but not the entirety of remaining high quality owl habitat was protected. In addition, recent estimates have shown that

only about 36% of late-successional reserves actually include late-successional forests, with the majority of the designated reserves expected to acquire such conditions over decades (Strittholt et al. 2006). Similarly, recent scientific literature suggests that the limited, bare minimum approach taken by the NWFP is inadequate to stabilize populations. Of particular note is the omission of all remaining nesting, roosting, and foraging habitat from reserves. While qualifying as late-seral the remaining nesting, roosting, and foraging habitat may not meet the standards of high quality habitat implicit in the Revised Recovery Plan (USFWS 2011). Thus, important owl habitat on federal lands will remain vulnerable to ongoing logging at a time when owl populations are declining more rapidly than anticipated, and risks are increasing from presumed competitive pressures from barred owls.

The NWFP noted that "certain thinning and salvage activities would be allowed in the reserves," however, thinning or other silvicultural treatments inside reserves theoretically are authorized "only if those treatments are beneficial to the creation of late-successional forest conditions" (USDA Forest Service and USDI BLM 1994). Some studies have indicated that spotted owls are somewhat resilient to low to mid-severity fire effects (Clark 2007, Bond et al. 2009). However, post-fire logging is often employed after fires, and a bigger threat to owls (Clark 2007, Bond et al. 2009, Hanson et al. 2010). Northern spotted owls remain vulnerable to post-fire logging even within late-successional reserves, as the NWFP is inadequate to protect owls from this threat. During the decades since original adoption of the NWFP, post-fire logging has become a more significant source of timber from federal lands, including late-successional reserves, and fire associated management (including thinning, suppression, and post-fire logging) has become a substantial emphasis of both the Forest Service and the Bureau of Land Management. As a result, supposedly protected owl habitat is at risk of fire-associated management (Hansen et al. 2009). This is particularly relevant on BLM lands in western Oregon, where the Secretary of Interior recently proposed a pilot process following active management guidelines in Johnson and Franklin (2009) that could extend thinning limits within reserves in dry forested regions from current 80-year limits to 120-years. Thus, active forest management designed to open forest canopies is increasing and could result in degrading additional owl habitat (Hanson et al. 2009, 2010).

E. Other natural or manmade factors affecting the continued existence of the species

1. Barred Owl

The barred owl (*Strix varia*), closely related species to spotted owls, has expanded its range from its original home in eastern North America into the Pacific Northwest, much to the detriment of spotted owls. (USFWS 2011, Campbell 1973, Hamer et al. 1994, 2001, Dark et al. 1998, Herter and Hicks 2000, Pearson and Livezey 2003, Livezey 2009a and 2009b). Recent studies report that barred owls have "increased dramatically" on the demographic study areas over the last two decades (Forsman et al. 2011).During the second half of the 20thcentury, barred owls expanded their range from eastern to western North America, and the range of the barred owl now completely overlaps that of the northern spotted owl (Gutierrez et al. 1995, Crozier et al. 2006).

Barred owls compete with northern spotted owls for habitat and resources for breeding, feeding, and sheltering, and the presence of barred owls has significant negative effects on northern spotted owl reproduction, survivorship, and successful occupation of territories. The loss of habitat has the potential to intensify competition with barred owls by reducing the total amount of resources available to the northern spotted owl and by increasing the likelihood and frequency of competitive interactions. Barred owls select very similar habitat to spotted owls for breeding, feeding, and sheltering, and loss of habitat has the potential to intensify competition between species. While conserving habitat will not alleviate the barred owl threat, Dugger et al. (2011) found that spotted owl occupancy and colonization rates decreased as both barred owl presence increased and available habitat decreased. These authors concluded that, similar to another case in which increased suitable habitat was required to support two potentially competing raptors, increased habitat protection for spotted owls may be necessary to provide for sustainable populations in the presence of barred owls (Dugger et al. 2011).

Maintaining high-quality habitat has been important since the northern spotted owl was initially listed as threatened in 1990, and this competitive pressure from barred owls has intensified the need to conserve and restore large areas of contiguous, high quality habitat across the range of the northern spotted owl (Dugger et al. 2011, Forsman et al. 2011, USFWS 2011). The Revised Recovery Plan states:

> Barred owls reportedly have reduced spotted owl site occupancy, reproduction, and survival. Limited experimental evidence, correlational studies, and copious anecdotal information all strongly suggest barred owls compete with spotted owls for nesting sites, roosting sites, and food, and possibly predate spotted owls. . . Because the abundance of barred owls continues to increase, the effectiveness in addressing this threat depends on action as soon as possible

(USFWS 2011, p. III-62). Barred owls initially proliferated in Washington and Oregon much more rapidly, but barred owls are becoming increasingly common in northern California (USFWS 2012, Dark et al. 1998, Kelly 2001, Kelly et al. 2003, Forsman et al. 2011).

The USFWS has recently embarked on a barred owl removal experiment, releasing a draft environmental impact statement in March 2012 that includes an exhaustive list of research and documentation outlining the threat posed by barred owls (USFWS 2012). While it encouraging that the USFWS will finally begin addressing the threat of barred owls, many researchers have questioned the utility of barred owl removal. Furthermore, given the landscape scale changes to Pacific Coast forests, and the rapid saturation of barred owls into these landscapes, a distinct question arises about USFWS' plans for addressing overall habitat changes in the range of the spotted owl. Regardless of whether the USFWS will address habitat loss and barred owls together, because it has taken 20 years for the USFWS to even begin addressing barred owls, whatever outcome may be too little too late for spotted owls across much of their historic range. Barred owls will likely always be present in the spotted owl's range, despite control efforts described by USFWS (2012).

Studies have clearly shown a negative impact on spotted owls due to direct displacement and occupancy of nesting sites and territories (Kelly et al. 2003, Olson et al. 2005). A negative impact on spotted owl fecundity (Olson et al. 2004). Forsman et al. (2011) found that the presence of barred owls has a negative effect on spotted owl recruitment, in turn affecting their survival and population trends. Of all the factors contributing to declines in the demographic rates of northern spotted owls, the presence of barred owls is the strongest and most consistent across study areas (Forsman et al. 2011, p. 75). Kelly et al. (2003) concluded that the presence of barred owls at historical northern spotted owl sites reduced spotted owl occupancy. Gremel (2005) determined that the presence of barred owls appeared to be reducing northern spotted owl occupancy at their historical sites and increasing the detection distance between spotted owls and their original site centers.

Crozier et al. (2006) showed that northern spotted owls have a reduced response rate in the presence of barred owls. While not the focus of the study, this provides evidence that barred owls may disrupt certain behaviors important to spotted owls. Vocalizations are an important part of the spotted owl's territorial behavior.

Barred owls will choose old or mature forests for nesting and compete for nest cavities with spotted owls (USFWS 2012, McGarigal and Fraser 1984, Mazur and James 1998, Carroll and Johnson 2008, Mazur et al. 1997, Buchanan et al. 2004). Barred owls prey upon the same species of small mammals that are the primary prey species of Spotted Owls (Forsman et al. 2001, Hamer et al. 2001). In addition, barred owls also prey upon a wider variety of prey not taken by spotted owls (Elderkin 1987, Bosakowski and Smith 1992, Hamer et al. 2001, Livezey et al. 2008). Further, annual home ranges of sympatric northern spotted owls were 3–4 times larger than those of barred owls in the western Cascade Mountains of Washington (Hamer 1988, Singleton et al. 2005), probably due to the more-varied prey base of barred owls (Hamer et al. 2001, Livezey 2007, Livezey et al. 2008). Barred owls also breed more regularly and have consistently larger broods than do spotted owls (Livezey and Fleming 2007).

Finally, barred owls are capable of exploiting younger forest stands, and semi-forested urban and suburban landscapes in the range of the northern spotted owl that are seldom used by spotted owls (Livezey and Fleming 2007) and use forests in the Pacific Northwest outside of the range of the spotted owl (Buchanan 2005). As a result, barred owls have large source populations that, with their greater dispersal capability (Gutiérrez et al. 2004, Livezey and Fleming 2007), can supplement numbers of barred owls within the range of the spotted owl. As expected, the overlap between barred and spotted owls in habitat and prey coupled with the larger size and more aggressive nature of the barred owl has resulted in significant concern for the long-term sustainability of the northern spotted owl. Livezey and Fleming (2007) concluded that barred owls have a competitive advantage over spotted owls.

VI. Recommended Management and Recovery Actions

- List the northern spotted owl as an endangered species within California under the California Endangered Species Act.

- Initiate a long-term planning process to create a northern spotted owl recovery plan based on the best available science. Such a plan should include the development of clear conservation goals for the recovery of northern spotted owls.

VII. Conclusion

Northern spotted owls are now facing extinction throughout a significant portion of their range. Continued habitat loss range-wide, the failure on non-federal lands to protect and restore spotted owl habitat, the invasion of the barred owl and additional threats listed above require that the California Fish and Game Commission immediately begin the process of listing the species as "threatened" or "endangered" under the CESA. Many populations of spotted owls have already been extirpated, and the remaining populations are reduced and declining. The best available scientific evidence is clear that the northern spotted owl is in danger of extinction throughout all or a significant portion of its range.

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State of California
Department of Fish and Wildlife

Memorandum

Date: August 8, 2016

To: Valerie Termini
Executive Director
Fish and Game Commission

From: Charlton H. Bonham
Director

Subject: **Petition to List Northern Spotted Owl (*Strix occidentalis caurina*); Department Review and Evaluation of Supplemental Materials and Comments Received by May 2, 2016**

At the request of the California Fish and Game Commission (Commission) at its April 2016 meeting, the Department of Fish and Wildlife (Department) provides the attached review of supplemental information submitted by:

- California Forestry Association (Calforests), dated May 2, 2016;
- Matt Greene, Registered Professional Forester, dated May 2, 2016;
- Bill Snyder, retired Deputy Director of the Department of Forestry and Fire Protection, dated April 22, 2016;
- Lisa Weger, Weger Ranch, dated April 29, 2016; and
- Craig Blencowe, Registered Professional Forester, dated April 29, 2016.

All submittals pertain to the Department's January 27, 2016 status review report, currently pending before the Commission, which recommends listing the Northern Spotted Owl (*Strix occidentalis caurina*) as threatened under the California Endangered Species Act (CESA).

The Department appreciates the comments and suggestions received. The supplemental information expresses a concern with the status review's representation of timber harvest as a threat to the Northern Spotted Owl, without acknowledging the protective measures implemented during timber harvest on private lands in California. As a general matter, the primary thrust of these submissions is about the characterizations regarding timber harvest and not necessarily the Department's underlying recommendation to list.

As stated in the Department's status review and in the attached response to comments, the Department acknowledges that regulations governing timber harvest on private lands in California have resulted in the protection of Northern Spotted Owl habitat at known owl territories throughout the species' range in California. However, in some cases, the Department finds that timber harvest likely continues to be a threat to Northern Spotted Owl habitat.

Importantly, and despite that finding, the Department also believes that timber harvest can play a role in enhancing owl habitat if applied at appropriate scales and sufficient habitat is retained to provide high quality Northern Spotted Owl breeding territories. Consequently, the Department believes this threat can be reduced through appropriate silvicultural practices and habitat management.

Some of the letters received expressed concern over financial impacts to nonindustrial landowners if the owl is listed under CESA, and opinions that the overall contribution to forest health by nonindustrial landowners was diminished in the status review. There is a suggestion that industrial and nonindustrial ownerships be considered separately if the Forest Practice Rules are revisited.

Having considered the supplemental information including any new information therein and comments submitted, the Department's previous recommendation to the Commission does not change - that is to recommend listing of the Northern Spotted Owl as threatened under the CESA.

As requested by the Commission, the Department is also submitting a draft Barred Owl working group structure and general communication framework. It is anticipated the Barred Owl team would consist of subject matter scientists working directly with, and advising the Department on, topics related to the threat posed by Barred Owl in California.

If you have any questions or need additional information, please contact Karen Miner, the Department's Acting Chief of the Wildlife Branch, at (916) 445-3685.

Attachment

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STATE OF CALIFORNIA
NATURAL RESOURCES AGENCY
DEPARTMENT OF FISH AND WILDLIFE

REPORT TO THE FISH AND GAME COMMISSION

Evaluation of Supplemental Information Received Regarding the Petition to List the Northern Spotted Owl (*Strix occidentalis caurina*) as Threatened or Endangered

August 2, 2016

At the request of the California Fish and Game Commission (Commission), the Department of Fish and Wildlife (Department) evaluated the following supplemental information submitted to the Commission on or before May 2, 2016 by:

- California Forestry Association (Calforests) (two new published papers and one new report attached), dated May 2, 2016
- Matt Greene, Registered Professional Forester, dated May 2, 2016
- Bill Snyder, retired Deputy Director of the Department of Forestry and Fire Protection, dated April 22, 2016
- Lisa Weger, Weger Ranch, dated April 29, 2016
- Craig Blencowe, Registered Professional Forester, dated April 29, 2016

The supplemental information relates to the Department's January 27, 2016 status review which recommends listing the Northern Spotted Owl (*Strix occidentalis caurina*) as threatened under the California Endangered Species Act (Fish & G. Code, § 2050 et seq.). At its April 14, 2016 meeting in Santa Rosa, the Commission asked the Department to accept additional information from representatives of the timber industry and other stakeholders, and to report on any new information at the June 23, 2016 Commission meeting in Bakersfield, California. The deadline for submission was noted as May 2, 2016; however, the Department did not receive three of the letters until June 9, 2016. Nonetheless, in order to adequately address these letters, submission of the Department's evaluation report was delayed until the Commission's next regularly scheduled meeting on August 25, 2016 in Folsom, California.

Calforests Comments

The California Forestry Association submitted two new published papers and one new report to the Department. These include:

1. A publication titled "Demographic response of Northern Spotted Owls to Barred Owl removal" (Diller et al. 2016).

   This publication describes a Barred Owl removal experiment conducted on Green Diamond Resource Company's land in the coastal redwood zone. Trends in vital rates were evaluated to investigate the demographic response of Northern Spotted Owls to the lethal removal of Barred Owls. The Department utilized multiple reports on Green

Diamond Resource Company's experimental Barred Owl removal study in preparing its status review, and Dr. Lowell Diller was one of the external reviewers of the Department's status review. Data from the Barred Owl removal study were also incorporated into the recent meta-analysis of demographic data (Dugger et al. 2016) which was discussed at length in the status review. Information related to this new publication is well represented within the status review (see Demographic Rates beginning on page 42 and Impacts of Barred Owls on Spotted Owls beginning on page 168 of status review).

2. A publication titled "Multistate models reveal long-term trends of Northern Spotted Owls in the absence of a novel competitor" (Kroll et al. 2016).

   This publication evaluates territory occupancy dynamics on a set of private timberlands in the coastal redwood zone in Mendocino County. The area evaluated is unique among the areas in which NSO occupancy has been studied in that Barred Owls had not yet become established at high densities at the time of data collection, and forests in the coastal redwood zone have been shown to support Northern Spotted Owl nesting habitat at younger age classes than elsewhere (40-60 years post-harvest; see pages 25, 34, 41 in status review). A report submitted by Campbell Global, LLC in 2014 as part of Calforests' *Northern Spotted Owl Science Compendium* materials provided a preliminary analysis of the data evaluated in the Kroll et al. 2016 publication. Results from the Campbell Global report were included in the Department's status review (page 57) and differ somewhat from those in the new publication. The Kroll et al. paper indicates a stable overall occupancy rate (including occupancy by single owls, pairs, and reproductive pairs), while finding a declining rate of occupancy for reproductive pairs alone. At two sites included in the study, occupancy rates for reproductive pairs declined by about 1% per year over the 25 year study, or about 20% over the study period. This decline in occupancy rate by reproductive pairs appears to have been steeper in the second half of the study period, when the rate of decline was about double that experienced over the full 25 year period. These results are consistent with a finding in the preliminary analysis reported by Campbell Global of a 16-30% decline in pair occupancy (page 57 in status review), although that report did not distinguish between reproductive and non-reproductive pairs. The Kroll et al. study found no decline in occupancy rate for single owls, which differs from the finding of declining occupancy in the Campbell Global report. It is unclear why preliminary results on occupancy by single owls differ from results in this new publication using largely the same data.

   In summary, results from the Kroll et al. paper show that a set of managed timberlands in the coastal redwood zone that have not been fully colonized by Barred Owls have not experienced large declines in Northern Spotted Owl occupancy rates. However, the number of breeding pairs appears to have declined, especially in the most recent 12 years. The Department acknowledges that similar areas on the southern coastal portion of the range might not have experienced large declines in occupancy rates as

demonstrated elsewhere in the range, and reported on an area in Marin County that has few Barred Owls and high occupancy rates (page 56 in status review).

3. A report by Sierra Pacific Industries titled "Northern Spotted Owls near Weaverville and Trinity Lake in Trinity County within the landscape survey strategy area (an interim report)" (SPI 2016).

   This report is an update to information the Department received from Sierra Pacific Industries in 2014 as part of Calforests' *Northern Spotted Owl Science Compendium* materials. This revised report provides two additional years of data (2014 and 2015), which resulted in the discovery of five additional owl territories and a higher crude density estimate. These reports are discussed in the Department's response to comments below.

In addition to the three documents above, Calforests also provided 20 pages of comments titled "Northern Spotted Owl supplemental information" (Calforests 2016). The Department has categorized these comments into three topic areas: (1) Calforests' concern that the Department inappropriately dismissed Calforests' data, (2) Calforests' Analysis of Occupied Activity Centers, and (3) Calforests' concern that timber harvest was over emphasized as a potential threat. These are covered below.

Calforests' Concern that the Department Inappropriately Dismissed Calforests' Data

In the comments submitted by Calforests (2016), it is suggested that the Department excluded information from the status review that had been previously submitted by the timber industry (e.g. The *Northern Spotted Owl Science Compendium* submitted by Calforests in 2014 in response to the Department's request for information) solely because the information was not gathered as part of a demographic study or because the information was not peer reviewed. This is not the case. In fact, the status review cites many sources of information that do not come from peer reviewed literature or were not from a demographic study. The Department does not suggest that the information submitted by Calforests has no utility, but the status review does point out that much of the information on occupancy in the information submitted by Calforests cannot be used to assess trends in occupancy rates over time. The reasons for this are provided in the status review and include: variable methods that are not accounted for in the analysis of data, limited description of the methods used, biased sampling, and a lack of incorporation of detection probability in estimates of occupancy (page 56 of status review). These reasons are not mutually exclusive.

The status review does report on occupancy trend assessments reported by Calforests (2014) when the data collection, reporting, and analysis are not hampered by the above limitations (page 56 of status review). These include information provided by the Green Diamond Resource Company, Mendocino Redwood Company, and Campbell Global, LLC. The Green Diamond Resource Company data are included in the rangewide demographic analysis that is discussed in detail in the status review. The occupancy trends reported by Mendocino Redwood Company

and Campbell Global both show declines over time, albeit not as severe as those reported at the three California demographic study areas (Dugger et al. 2016) and at a study area in the Klamath and Cascade mountains (Farber and Kroll 2012) where occupancy declines ranged from 40-49%. Campbell Global reported declines in pair occupancy rates of 16-30% on two separate ownerships in Mendocino County, and also reported declines in single owl occupancy rates (exact rates not reported; page 57 in status review). The data reported on by Campbell Global have been reevaluated in a recent publication and are discussed above (Kroll et al. 2016). The Mendocino Redwood Company reported a small decline in occupancy rates for data collected from 2001-2008, but this period does not include more recent years during which the local Barred Owl population has increased dramatically (page 56 in status review). The data that was available to the Department for assessment of trends in occupancy rates all showed declines, including those provided by Calforests. This does not necessarily mean that occupancy rates have declined across the entire range in California, but the available information suggests widespread declines. Unfortunately, for the reasons set forth herein (i.e. variable methods, limited description of the methods, biased sampling, lack of incorporation of detection probability), the data and analyses provided by many timber companies are not suitable for the evaluation of trends in occupancy.

Although the data provided by some of the timber companies are not collected or analyzed in a way that allows the generation of unbiased estimates of owl occupancy rates, the Department acknowledges that the information has increased the Department's knowledge of the distribution of Northern Spotted Owl territories in California (pages 15-16, 41 of status review) and of minimum occupancy rates for some areas. Much of the data is also useful in demonstrating compliance with the Forest Practice Rules or with take authorizations provided by the USFWS. However, most data collected for this purpose does not produce unbiased estimates of occupancy rates. For example, the Humboldt Redwood Company has an approved Habitat Conservation Plan (HCP) that allows for the harvest of Northern Spotted Owl habitat while achieving conservation measures for the species, and requires ongoing monitoring and reporting to ensure that the conservation measures being implemented are accomplishing the desired outcomes (page 103 of status review). The HCP requires a minimum number of occupied sites in any given year. Under the approved sampling methodology for the HCP, twenty percent of land quadrats must be surveyed each year, with the entire property surveyed every five years. However, a set of core sites are monitored annually, whereas other sites are sampled on a rotating basis. Core sites were established to represent activity centers that have had a history of occupancy and reproduction, and the HCP provides higher habitat retention requirements for these core sites. Therefore, sites which are monitored annually are those which meet more stringent habitat requirements and have a higher history of use by Northern Spotted Owls. Although this sampling method is adequate to ensure that the requirements of the HCP are met (e.g. a minimum number of occupied sites each year), it appears to be a biased sample that focuses on the sites with the highest quality habitat for Northern Spotted Owl rather than all sites or a random selection, and therefore cannot be used to reflect occupancy rate on the ownership as a whole. Reports from Humboldt Redwood Company show that additional sites are monitored each year beyond that required by the HCP, but the extent and level of effort at these additional sites is unclear.

The updated report submitted by Sierra Pacific Industries (SPI 2016) describes a survey strategy that appears to go well beyond the requirements of timber harvesting plan (THPs) compliance. The report includes limited description of survey methods; however, conversations with SPI staff suggest that the data have the potential to inform long-term occupancy rates on a large tract of land in Trinity County. Unfortunately, the analysis and presentation of results in the SPI (2016) report do not necessarily support the reported conclusion of a stable Northern Spotted Owl population. The report presents the total count of occupied sites over a period of five years (2003-2007) and compares this number to the count of occupied sites over a later five year period (2011-2015). The report also describes a dynamic site occupancy situation in which many Northern Spotted Owls shift locations between years. This leads to some uncertainty in whether the number of sites occupied over a 5-year period is reflective of the density of owls in the study area or the degree to which shifting owls use different sites over time. SPI (2016) also reports that the survey methods were modified for the second 5-year survey period, which should be accounted for through incorporation of detection probability in the analysis of data. This type of dynamic territory occupancy has been addressed in other studies that have conducted occupancy analyses (e.g. Kroll et al. 2016). The data presented in the SPI (2016) report appears to have been collected in a manner that allows for assessment of occupancy rates within years and over time, but additional analysis is needed to provide information on occupancy trends at this portion of the owl's range in the interior of California.

As mentioned above, one of the reasons some of the information submitted by Calforests in 2014 could not be used to assess trends in occupancy rates over time is a lack of incorporation of detection probability in estimates of occupancy. In comments by Calforests, the importance of detection probability in assessing occupancy rate is challenged. Calforests includes a quote from a publication (Welsh et al. 2013) that suggests biases in estimates of occupancy are similar in magnitude with or without incorporation of detection probability, and therefore questions the usefulness of accounting for detectability in occupancy estimation. This conclusion by Welsh et al. contradicts a large body of literature detailing the methods, benefits, and requirements of incorporating detection probability in order to obtain unbiased estimates of occupancy (e.g. Bailey et al. 2013; Guillera-Arroita et al. 2010; MacKenzie et al. 2002, 2003, 2006). Some of this literature is cited in the Department's status review to support the argument that detection probability is a highly accepted and necessary component of occupancy rate estimation (page 52 of status review), especially when comparing rates across years to assess trends. The Welsh et al. paper has been controversial, and in fact a rebuttal by some of the leading experts on occupancy estimation was published that re-examines the results of Welsh et al. (Guillera-Arroita et al. 2014). Guillera-Arroita et al. (2014) note that some of the analyses in Welsh et al. (2013) appear to contain errors, and that the key conclusion is incorrect except in the single narrow scenario considered by Welsh et al. (2013). The Department rejects the suggestion that incorporation of detection probability is not necessary in order to obtain trends in occupancy rates. Not only does a large body of literature demonstrate the importance of considering detection probability, but a large number of studies on Northern Spotted Owl occupancy rates have demonstrated that detection probability can vary by site, year, nesting

status, survey type, and presence of Barred Owls, among other factors (see page 53 of status review for a sample of references).

Calforests' Analysis of Occupied NSO Activity Centers

Calforests provided an assessment of data from the Department's Northern Spotted Owl database in an attempt to evaluate trends in the owl population. The Department had considered using this dataset to assess trends in the Northern Spotted Owl population, but concluded that the data available were not appropriate for assessment of abundance or trends (pages 41-42 in status review). The database is largely intended for use by timber harvesters and managers to track locations of Spotted Owl territories that may be impacted by harvest activities, and to inform the development of timber harvesting plans that avoid impacts to territorial owls. The status review includes a discussion of the available data and concludes that the data cannot represent population abundance. Limitations of the database that preclude use for analysis of abundance or occupancy rates include:

- Submission of survey data to the database is generally not required
- Positive detections of owls are inconsistently reported
- Negative detections are often not reported
- Historic database practices result in inaccurate associations of observations with activity centers
- Survey effort and area coverage vary annually
- Detection probability likely varies annually
- Survey methods are variable within years and change over time

Despite these limitations of the database, Calforests assessed the data to produce graphs showing the number of occupied activity centers per year for three groups of activity centers: all activity centers with positive detections, activity centers on federal land, and activity centers on private land. Based on these graphs, Calforests concluded that the number of occupied sites on private lands was stable over time.

Although the description of methods included in Calforests' comments was brief and in some cases difficult to interpret, the Department replicated the analysis to the extent possible. The Department was able to generate numbers of occupied sites for all three categories evaluated by Calforests (all sites, sites on federal land, and sites on private land), although results differed slightly from those presented in the Calforests letter. Calforests correctly points out that annual survey coverage influences the number of activity centers reported as occupied each year, and uses this to explain patterns in the graphs produced. The Department took this line of thinking a step further and corrected the annual number of occupied activity centers by the total number of sites reported as surveyed each year (i.e. incorporated sites with negative data reports in the database as a measure of annual survey effort). The resulting trends showed a different conclusion than that reached by Calforests, with a declining trend on private land and a stable

trend on federal land. Due to the limitations of the database listed above, the Department does not suggest that the results of either the Calforests analysis or the Department's modification should be interpreted to reflect actual trends in the owl population. However, the additional review shows that cursory analyses that do not address the limitations of the database can provide misleading results. In order to estimate occupancy rates, data needs to be collected and reported consistently, both spatially and temporally among the same sites, or differences need to be accounted for in analyses. Also, both positive and negative data would have to be consistently reported. Many of these requirements are unmet by the database.

The Calforests analysis also states that detection probability varies annually due to nesting status. While true, it should be noted that nesting status is only one factor leading to variation in detection probability; other factors affecting detection probability are described above. In addition to resolving the above issues with the data, this variation in detection probability would need to be addressed in occupancy analyses if the data are to be used to evaluate trends.

The Calforests letter also presented an evaluation of the Department's analysis of cumulative harvest at selected activity centers (see pages 90-93 and Appendix 3 in status review). Calforests' comments suggest that the analysis presented in the Department's status review concludes that harvest has led to impacts at all activity centers evaluated (17 interior and 14 coastal). However, the Department states that not all activity centers assessed rise to a level of concern, but those with either: 1) cumulative harvest of more than 50% (250 acres) in the core area (0.5 mile radius around the activity center for interior sites), 2) cumulative harvest of more than 2,000 acres in the 3,400 acre home range for interior sites, or 3) cumulative harvest of more than 50% (500 acres) in the core area for coastal sites (0.7 mile radius circle) had experienced elevated levels of proposed harvest resulting in the potential for negative effects on habitat quality. Based on these criteria, the status review identifies 7 of the 17 interior activity centers and 5 of 14 coastal activity centers that deserve a closer look for potential impacts. The Calforests letter evaluates 6 of the 31 activity centers that the Department assessed in the status review, including SIS319, SIS492, SIS554, TEH0037, HUM0622 and TRI0316. Only three of these activity centers met the Department's criteria, noted above, for elevated levels of harvest. The 3 activity centers in Siskiyou County (SIS319, SIS492, SIS554) do not meet the criteria and so are not discussed further here. Comments by Calforests state that the status review identified these three activity centers as having experienced timber operations that may have impacted owls, but this is not the case. Of the sites Calforests discusses in their comments, only 3 sites meet the criteria for elevated levels of harvest (TEH0037, HUM0622 and TRI0316), and therefore, we address these below.

TEH0037 – This activity center is given as an example of a site with potential harvest impacts to owls in the status review (see page 92). The Calforests letter states that this site is in deficit habitat in the years prior to harvest (meaning that it contains less than the required amount of nesting and roosting habitat) and therefore the land owner may not reduce habitat at this site. While it may be true that nesting and roosting habitat are limited and that harvest at this site was of non-habitat, the impact of harvesting much of the non-habitat is unclear without information

on why those areas were determined to be non-habitat. Also, eliminating young forests may preclude the growth and expansion of nesting and roosting habitat.

HUM0622 – This was the only coastal site evaluated by Calforests and was a site that met the Department's criteria for potential harvest impacts to owls. The Calforests letter suggests that harvest totals are complicated by differences in land ownership and HCP coverage, and the numbers reported in the status review are incorrect based on these factors. Given this, and the fact that the site has been consistently occupied by a pair and productivity is high, this may be a site where impacts of harvest are negligible. Again, the status review acknowledges that not all sites assessed may be impacted by harvest, and this site demonstrates that relationships between proposed harvest and impacts to owls will not be consistent across a sample of sites. Also, regrowth and habitat use within the coastal redwood region is somewhat different than drier interior regions. Coastal redwood forests grow and develop into Northern Spotted Owl habitat more quickly and thus, owls will use younger forests compared to older forests in the interior.

TRI0316 – This site only met the Department's criteria for potential harvest impacts to owls by one acre (noted harvest of 251 acres within the core area), and thus is borderline for inclusion in the "potential impact" category. The Calforests assessment differs somewhat from the Department's (see Table 1 below) largely due to proposed versus actual on-the-ground harvest, inclusion of unsuitable habitat, and double counting acres. Despite the differences, the proposed harvest evaluated by the Department and the actual harvested acreage reported by Calforests are similar. As stated in the status review, the Department only assessed proposed harvest, as this was the measure most readily available and consistently reported in THPs. The status review also suggests that to adequately assess impacts of cumulative harvest, actual acres harvested and harvest type would need to be reported and checked on the ground post-harvest. Given the amounts harvested, site TRI0316 would not necessarily be expected to have experienced declines in Northern Spotted Owl habitat quality, despite having exceeded the Department's stated criteria by a single acre of harvest.

Table 1. Total acres harvested for TRI0316 for the status review assessment and the Calforests assessment.

Activity Center TRI0316	Total Acres harvested within 0.5 mi	Total Acres harvested between 0.5-1.3 mi
Status Review	251	495
Calforests	196	555

Because Calforests presented an evaluation of only 3 of the 12 activity centers that met the Department's criteria for elevated levels of harvest, the Department performed a cursory evaluation of Northern Spotted Owl detection history at the remaining 9 activity centers. Of these, the Department identified 6 activity centers that appear to have experienced declines in occupancy following larger harvest events, although without more information on survey effort it is not possible to draw strong conclusions. Despite this, these results suggest that the Department's conclusion that harvest has led to impacts in some cases is accurate.

The status review also states that the analysis was not meant to represent harvest trends across the range, but rather was conducted to evaluate the potential for impacts at a selection of activity centers. It is acknowledged that inclusion of the habitat retained post-harvest, the type of habitat removed during harvest, as well as harvest prescription used, would improve the assessment of impact to Northern Spotted Owls. However, timber harvesting plans were generally inconsistent on how they reported the type of habitat planned for removal and how the harvest prescriptions were interpreted. Department staff was time and resource limited in preparing the status review, and thus a more thorough assessment was not possible. The Department acknowledged in the status review that a more thorough assessment would be needed to assess the extent of potential impacts to owls from cumulative harvest of owl habitat.

Representation of Threats

Calforests' letter states that the status review does not acknowledge that timber harvesting plans reviewed under the Forest Practice Rules are not approved unless they meet "no take" standards under the federal ESA. To the contrary, the report specifically addresses this aspect of the Forest Practice Rules on page 132:

> "Section 919.10 [939.10] of the Forest Practice Rules requires CAL FIRE to make a finding as to whether or not the proposed timber operations in a timber harvesting plan will avoid Northern Spotted Owl take. If CAL FIRE concludes take would occur, they must provide reasons why the determination was made according to criteria presented in section 919.10 [939.10], and recommend changes to the proposed THP to avoid take."

The Calforests letter describes three potential threats to Northern Spotted Owl: Barred Owl encroachment, loss of habitat due to wildfire, and pesticides associated with illegal marijuana plantations. These three threats are only a subset of those listed and discussed at length in the status review (see Threats section beginning on page 118 and Summary of Listing Factors, pages 184-195).

The Calforests letter also states that the threats section of the status review should prioritize the threats to the Northern Spotted Owl, and that all management efforts should be focused on the threats of Barred Owl and wildfire. The Department's charge is to assess and report on the breadth of threats to the species considering the best available scientific information. Multiple threats are assessed in the status review, and timber harvest is listed as one of the threats leading to habitat loss in general. Though the report does not prioritize each threat, it does acknowledge the main threats throughout the document, and summarizes these in the Executive Summary, page 1 of the report:

> "The primary threats to the continued existence of Northern Spotted Owl in California are the rapid expansion of a novel competitor, the Barred Owl, into the range of the Spotted Owl, a rapid and accelerating decline in population size and demographic rates (e.g., survival, reproduction, occupancy), and loss of habitat due to wildfire and timber harvest."

It seems the main concerns communicated by Calforests are that the Department represented timber harvest as a threat to the Northern Spotted Owl, and that new regulations may be applied to timber harvest on private lands if the owl is listed in California. The Department agrees that the Barred Owl has become the most important threat to Northern Spotted Owl in California. However, consistent with the USFWS revised recovery plan, the Department finds that habitat loss is also an important threat. The status review evaluates a number of causes of habitat loss, of which wildfire is the leading cause on federal lands and timber harvest is the leading cause on private land (see status review pages 119-126). The Department's evaluation of proposed timber harvest around a sample of owl territories suggest that harvest may have resulted in impacts to owls, at least in some cases (see status review pages 90-92, 126-132, and 185). The USFWS found that the Forest Practice Rules, as written, may not provide the necessary protection of important owl habitat surrounding activity centers, especially when considering repeated harvest events over time, and recommended new guidelines to be included in timber harvesting plans (USFWS 2009). The Department's status review describes the CAL FIRE response to new USFWS guidance, and states that additional work should be conducted to evaluate habitat retention requirements that have been included in timber harvesting plans and the response of territorial Northern Spotted Owls to harvest activity (see pages 185-186 in status review).

The Department acknowledges that regulations governing timber harvest on private lands in California are more protective than those in other states (page 184 in status review). These regulations have resulted in the protection of Northern Spotted Owl habitat at known owl territories throughout the range in California. Despite these regulations, the Department finds that timber harvest likely continues to be a threat to Northern Spotted Owl habitat in some cases. The Department also believes there is no reason that timber harvest must remain a realized threat moving forward, and in fact, the status review acknowledges that timber harvest may also play a role in enhancing owl habitat when applied at appropriate scales and with retention of sufficient nesting and roosting habitat (see status review page 131). The status review demonstrates that a mosaic of habitat types is beneficial within the core area of use, but extensive amounts of nonhabitat or elimination of most nesting and roosting components is detrimental (see status review page 60-61). The status review's management recommendations (page 196) state that the Department's role could include increased engagement in timber harvesting plan review and in post-harvest follow-up in order to ensure that the best science informs timber harvest planning and that outcomes of timber harvest are used to inform future activities through an adaptive process.

Matt Greene Comments

The Department received a May 2, 2016, letter from Registered Professional Forester and wildlife biologist Mr. Matt Greene, which included several assertions about the status review and the Department's role and intention regarding Northern Spotted Owls on private forest lands. Although Mr. Greene has significant expertise on Northern Spotted Owls and timber management, the specific comments provided in his May 2, 2016 submittal do not measurably add to or provide cause for a significant reexamination of the information and analyses the Department relied on when completing the status review.

Mr. Green's letter included several points which are briefly addressed below:

- Mr. Greene expressed concern that Department staff involved in developing the status review did not have backgrounds in timber management. However, the Department solicited input from subject-matter experts both within and outside of the Department including through the peer review process. The Department is confident in the input received through this process.
- Mr. Greene provided a history of the Department's engagement in Northern Spotted Owl issues in the 1990s, and claimed the Department had abandoned landowners and "left them to fend for themselves" and is only involved now due to a desire to increase staffing via funding available through AB1492. Mr. Greene also states that the status review omits the history of Department involvement in timber management; however, Appendix 9 of the status review provides a thorough description of this history. Contrary to Mr. Greene's assertion, the Department continued to play a role in forest management despite past funding shortfalls and staffing limitations. For example, the Department worked with USFWS and CAL FIRE to play a lead role in establishing and initially implementing the "Private Consulting Biologist" program, a precursor to the "Spotted Owl Expert" process.
- Mr. Greene asserts the lack of post-harvest monitoring of nest occupancy on small nonindustrial private timberlands renders conclusions regarding population trends "completely useless". Mr. Greene also asserts relying on data from the three demographic study areas in California is "bad science" as these areas are not representative of forest management regimes on nonindustrial private timberlands. Contrary to these statements, many researchers conducting these studies believe that results are in fact representative of federal lands and mixed federal/private lands throughout the range (see pages 42-43 of the status review). The study areas are well-distributed across the owl's range, cover 9% of the entire range in California, Oregon, and Washington, represent multiple forest and management types, and contain a mix of federal and private lands. The three study areas in California cover approximately 6% of the owl's range in California. The California Klamath and California Coast provinces are represented by these three study areas. In addition, a study area in southern Oregon can be used to draw inferences for the California Cascades Province. Further, the Department's status review includes population status information from other study areas across the entire range when available, including private timberlands on the coast and in the interior portion of the California range. Study areas throughout the entire range show declining Northern Spotted Owl populations. Although true that less data are available with which to evaluate trends on the smaller nonindustrial private ownerships, the available information demonstrates declines in the Northern Spotted Owl across a large part of the range in California.
- Mr. Greene cites the published study Kroll et al. 2016 as evidence to indicate that territory occupancy has not declined. As noted above, while this coastal redwood zone study has not experienced large declines in Northern Spotted Owl occupancy, the

number of breeding pairs appears to have declined, especially in the most recent 12 years. This area is also unique in that it has apparently not been colonized by Barred Owls.

- Mr. Greene asserts the Department is "unnecessarily throwing out 25 years of data collected by forest landowners." As discussed above, the Department does not suggest that owl survey data collected by landowners has no utility, but much of the data cannot be used to assess trends in occupancy rates over time for the variety of reasons described above.
- Mr. Greene identified "several fundamental issues" with the status review's assessment of Nonindustrial Timber Harvest Plans, citing them by page number. Rather than address each point-by-point here, generally the Department refutes most of these assertions as inaccurate or misrepresentative of the status review. One of the fundamental issues pointed out by Mr. Greene concerns a statement made on page 96 of the status review, in which the Department refers to "harvest at activity centers"; Mr. Greene points out that harvest does not occur at activity centers. Although Mr. Greene is technically correct, in reviewing this statement it is clear that the statement referred to harvest "around" an activity center, as had been discussed in the previous paragraph in the status review. Although this may have led to some confusion, in context the meaning is clear.
- In multiple locations Mr. Greene criticizes the Department's claim that access to NTMPs and associated Notices of Timber Operations (NTOs) has been variable. However, availability of documents has varied over time and across regions. NTMPs are electronically available for some, but not all locations; one NTMP in the Interior (CDFW Region 1) is available online for 1996 but the next available NTMP is from 2009. The Department is currently working with CAL FIRE to try to place all of the NTMPs in the electronic file system, but this is not yet completed. In recent years NTOs have been mailed to the Department but it is not known if this was always the case. In the Interior NTOs are e-posted only for NTMPs since 2009.
- Mr. Greene also discusses the status review's treatment of "economic analysis" and explains how listing of the Northern Spotted Owl will result in costs exceeding 50 million dollars due to changes in survey protocol, habitat typing, restriction on uses of herbicides and the delay in timber operations from an absence of a phased management approach for landowners. It is plausible that some adjustments to management will result from listing the Northern Spotted Owl, but it is currently unknown if and how management practices may deviate from those currently experienced by landowners.

In conclusion, Mr. Greene states that the Department misrepresented the facts in its status review of the Northern Spotted Owl, and ignored relevant information about the population. However, in many cases the comments by Mr. Greene have been inaccurate or misrepresent the status review. As demonstrated throughout this response to comments, the Department's status review represents the best available science on the species, and clearly and thoroughly

presents the trends in the Northern Spotted Owl population in California and the threats impacting the species.

Bill Snyder Comments

Mr. Snyder's comment letter dated April 22, 2016, was received by the Department on June 8, 2016. The letter included ten attachments:

- Attachments 1-4: Data summary tables for THP and NTMP analyses conducted by Mr. Snyder
- CAL FIRE Memo titled "Evaluation Process for Northern Spotted Owl Information to Determine Compliance with CCR § 919.9(g) [939.9(g)] and 919.10 [939.10]" (CAL FIRE 2008a)
- CAL FIRE document titled "CAL FIRE's Use of 14 CCR § 919.9(g) [939.9(g)] in Making Northern Spotted Owl Take Avoidance Determinations" (CAL FIRE 2009)
- CAL FIRE document titled "Northern Spotted Owl Disclosure and Impacts Analysis Using 14 CCR § 919.9(g) [939.9(g)]" (CAL FIRE 2011)
- USFWS document titled "Revised Attachment B: Take Avoidance Analysis-Interior" (USFWS 2008a)
- USFWS document titled, "Information Needed for US Fish and Wildlife Service Timber Harvest Plan – Northern Spotted Owl Technical Assistance Analysis" (USFWS 2008b)
- USFWS guidance document titled, "Regulatory and Scientific Basis for U.S. Fish and Wildlife Service Guidance for Evaluation of Take for Northern Spotted Owls on Private Timberlands in California's Northern Interior Region" (USFWS 2009)

The Department had obtained the memo and other documents attached to Mr. Snyder's letter from CAL FIRE and the USFWS while preparing the status review; and thus, these do not represent new information available to the Department. Mr. Snyder's letter challenges the Department's conclusion that timber harvest on private lands may impact Northern Spotted Owl, and suggests that the USFWS guidance for avoiding take of Northern Spotted Owl (USFWS 2008a) has been incorporated into timber harvesting plans reviewed by CAL FIRE, while asserting that the Department's conclusion relies on an assumption that THPs and NTMPs have used the habitat retention requirements in 14 CCR § 919.9(g) [939.9(g)] (referred to as option (g); see pages 84-85 and Appendix 9 in status review) of the Forest Practice Rules. Mr. Snyder also completed an analysis of habitat retention proposed in THPs from 2013 and NTMPs from 2011-2015, which contrasted with the analyses included in the status review.

Based on take avoidance guidelines and supporting documentation by USFWS (2008a, 2009), Mr. Snyder states that CAL FIRE concluded a fair argument had been raised pursuant to CEQA regarding potential for take of Northern Spotted Owl through use of the habitat retention measures in option (g) and definitions of habitat in § 895.1 of the Forest Practice Rules. This is consistent with the conclusion reached by the USFWS (2009) that the habitat retention requirements in the Forest Practice Rules may be insufficient to avoid take of Northern Spotted

Owl, and that reached in the Department's status review that the minimum habitat retention requirements may lead to habitat degradation around Northern Spotted Owl activity centers.

Mr. Snyder provided three CAL FIRE documents (CAL FIRE 2008a, 2009 and 2011) to support his conclusion that timber harvesting plans have incorporated the new USFWS take avoidance guidance. At the time the status review was drafted, the Department was in possession of these documents, as well as other CAL FIRE documents, and the status review references a number of them. In response to the 2008 USFWS guidance, CAL FIRE produced a report (CAL FIRE 2008b; cited in the status review) providing direction to plan proponents for addressing take of Northern Spotted Owl. For plans utilizing options (e) and (g), CAL FIRE suggested that plan proponents *should consider* use of Northern Spotted Owl habitat descriptions provided by the USFWS and *should consider* incorporating habitat protection measures recommended by the USFWS. However, in the same document CAL FIRE suggested that a plan should indicate that protective measures and habitat retention levels contained in Forest Practice Rules option (g) apply to any Northern Spotted Owl activity center. The following year, a 2009 CAL FIRE document described the use of option (g) in making Northern Spotted Owl take avoidance determinations, and stated, "CAL FIRE encourages RPFs proposing timber operations…to adhere to the USFWS guidelines where possible." However, the document also states, "For those THP submitters that propose something different than the USFWS guidelines, CAL FIRE requires them to meet or exceed the minimum standards contained in 14 CCR § 919.9(g) [939.9(g)]…" Here, CAL FIRE appears to be suggesting plan preparers may use the minimum standards contained in option (g) or may exceed them when proposing something different than the USFWS guidelines. The final CAL FIRE document provided by Mr. Snyder (CAL FIRE 2011) states that "Take avoidance strategies that propose the use of [option (g)] must meet the requirements of 14 CCR §§ 895.1 and 919.9(g) [939.9(g)], but are not required to meet the currently-recommended USFWS standards for activity center protection and post-harvest habitat retention", although the document also states that CAL FIRE may need additional information that demonstrates why the proposed measures avoid take. In conclusion, the CAL FIRE documents provided by Mr. Snyder do not support his conclusion that the take avoidance guidance provided by the USFWS has been incorporated into THPs and NTMPs in all cases, given the current requirements.

In the letter, Mr. Snyder contends that the Department's recommendation to modify the Forest Practice Rules is unnecessary since all future plans are expected to meet the USFWS guidelines regarding habitat definitions and retention requirements. Whether a plan proponent decides to include the protection measures, habitat definitions, and habitat retention levels described in option (g) of the Forest Practice Rules, or those provided by the USFWS in 2008, it is unclear how CAL FIRE will use the provided information in evaluating take of Northern Spotted Owl. The fact that the approach to THP submittal and review is contained in CAL FIRE reports and internal documents, and not in regulation, leads to a lack of certainty about the standards used by CAL FIRE in evaluation of take and whether the recommendations of the USFWS have been and will be implemented across the board. For this reason, the Department included a recommendation in the status review to coordinate with the USFWS, Board of

Forestry and CAL FIRE to develop scientifically-based and contemporary Forest Practice Rules (see recommendation #5 in the status review).

Mr. Snyder states that the Department's conclusion that habitat loss is occurring through timber harvest assumes that THPs are largely reliant on option (g). The Department did contrast the habitat definitions and retention requirements of option (g) with those in the USFWS guidance to show that the current minimum habitat retention in option (g) would likely lead to habitat degradation (pages 126-130 in status review). However, the status review acknowledges that the degree to which timber harvest around known activity centers would impact Northern Spotted Owl habitat quality depends on how the Forest Practice Rules are implemented when CAL FIRE assesses take (page 132 of status review). Because of this, the Department conducted an assessment of proposed harvest history at a sample of activity centers to evaluate proposed harvest over time. This assessment was not dependent on the option used to comply with the Forest Practice Rules (i.e. both option (e) and (g) plans were evaluated). Based on this assessment, the Department stated, "it is reasonable to conclude that some level of harvesting could be beneficial, but high levels of harvest, such as levels documented for some activity centers…can negatively impact Northern Spotted Owls" (page 132 in status review). Therefore, depending on how the Forest Practice Rules and the USFWS 2008 Guidance are implemented, management could result in a reduction in habitat quality around Northern Spotted Owl sites and could lead to declines in survival, productivity, and overall fitness.

Mr. Snyder conducted an assessment of proposed habitat retention in THPs and NTMPs. There are several discrepancies between his analysis and that in the status review, including a focus on habitat retention vs. proposed harvest, analysis of a single year (2013) for THPs vs. a cumulative assessment over many years, a different set of years evaluated for NTMPs, and a different proportion of plans assigned to option (g). Quantitative differences in number of plans and time periods assessed are summarized in Table 2 below.

Table 2. Differences between number of plans and time periods assessed in the status review and in Mr. Snyder's letter.

	Status Review		**Mr. Snyder's Letter**	
	THPs	**NTMPs**	**THPs**	**NTMPs**
Year(s) included	2013[a]	1991-2014	2013	2011-2015
Total Plan Count	175	578	113	28
Number associated with activity center(s)	115	492	Not reported	20
Option (e)/(g)	66/9	114/14[b]	70/1	27/1

[a] A broader set of years was included for a cumulative analysis of harvest around activity centers. Only THPs from 2013 are shown here for comparison with the dataset used in Mr. Snyder's letter.

[b] Only a subset of 131 NTMPs with readily available data were evaluated for Forest Practice Rules option used (mainly from the 2005-2014 time period). See status review for details.

Because Mr. Snyder reported a different number of harvest plans, and attributed plans differently with respect to Forest Practice Rules utilized, the Department reviewed the dataset used in the status review and found it to be accurate. Although it is unclear why there is a difference in the number of plans assessed, it could be due to a number of differences in the approach taken by Mr. Snyder in compiling plans. The Department used the WHR Northern Spotted Owl data layer to determine which THPs fell within the range of the owl, summarized all plans submitted (vs. those approved) in 2013 before focusing on those plans which were associated with owl activity centers, and evaluated a broad range of years for a cumulative analysis. If Mr. Snyder started with different assumptions in compiling a set of harvest plans (e.g. different owl range layer, evaluating only approved plans, only evaluating plans associated with activity centers), the numbers produced would differ from those produced by the Department. Also, based on the compilation of NTMPs and associated activity centers assessed in his Attachment 4, it appears that Mr. Snyder's analysis may have only considered coastal NTMPs. It is unclear why Mr. Snyder reports that only a single THP utilized option (g) in 2013 when the Department found nine, but his described approach suggests that he treated some plans that were submitted as option (g) as utilizing option (e) if the plans reported compliance with the habitat definitions and retention criteria in the 2008 USFWS guidance. The Department classified plans according to the option noted in the THP regardless of the details included in the plan.

Mr. Snyder's letter includes several additional points which are briefly addressed below:

- Mr. Snyder asserts that THP and NTMP analyses in the status review did not adequately address post-harvest retention values and that approved plans met or exceeded USFWS retention requirements, and thus the plans' implementation should not be expected to reduce habitat. Some aspects of Mr. Snyder's analysis affect its accuracy in assessing whether USFWS guidance has been met either in a single year or over longer time periods. For example, the analysis does not account for high vs. low quality habitat as required in the USFWS guidance or habitat retention in the core area, and includes assessment of THPs from only a single year. Therefore the analysis cannot truly assess whether USFWS guidance has been met either in a single year or over longer time periods. Unlike the assessment conducted by Mr. Snyder for a single year, the Department attempted to assess cumulative impact over time, and proposed harvest acreage was the simplest approach to doing that. Mr. Snyder acknowledges the complexities of assessing cumulative impacts which make a retroactive assessment difficult, and suggests it would be better to focus on potential cumulative impacts moving forward. The Department agrees this would be a worthwhile endeavor and recommended this in the status review (page 132, 195-196). However, to assess cumulative impacts for inclusion in the status review, the Department took the simpler approach of assessing proposed harvest retroactively, while acknowledging the shortcomings of this approach (see page 132 in status review). In the status review, the Department assessed only proposed acreages for harvest because that is what is noted in the plans. To determine the actual amount and type of habitat retention, an on-the-ground assessment would be needed. This type of assessment has not been possible given Department staffing and time limitations.

- Mr. Snyder's letter claims that the cumulative harvest analysis in the status review is over-simplistic when assessing harvest impacts to activity centers, because it did not include a forest regrowth component, the amount of suitable vs. unsuitable habitat removed, and the various silviculture prescriptions used. The status review does assess types of silviculture methods used (see pages 86-89, 95-96), though the Department acknowledges this type of assessment was not used for the cumulative harvest analysis associated with activity centers due to time and staffing limitations. Including a forest regrowth component to the cumulative harvest impact analysis to individual owl activity centers would be extremely complicated and time intensive, and it is unclear whether the necessary data for this type of analysis is available. Given this, the Department relied on the broad-scale habitat recruitment assessment in the Northwest Forest Plan. The analysis in the status review demonstrates potential cumulative harvest impacts to owl activity centers, and notes that a more thorough assessment would be required to assess actual cumulative harvest impacts across the range of the Northern Spotted Owl (page 132 in status review).
- Mr. Snyder's letter states that the Department failed to consider all NTMP data available via CAL FIRE online records. As discussed above, full records for NTMPs are only provided on CAL FIRE's data portal for 1996 NTMPs and 2009 forward. To obtain full NTMP records for plans submitted outside of this range, one would have to visit CAL FIRE in-person to locate and copy the NTMP files. Again, this was not possible given limited Department staff resources and the deadline associated with completion of the status review.
- Mr. Snyder claims that the Department failed to recognize the USFWS's role in the Technical Assistance process and the status review does not include an accurate assessment of take. Page 95 of the status review states, "Because the majority utilized option (e) (i.e., USFWS technical assistance letter) it is implied that the USFWS has been instrumental in providing consultation and guidance to NTMP submitters as it relates to protection measures for Northern Spotted Owl and their habitat." In this statement, the Department recognizes that option (e) was widely used and the USFWS was instrumental in providing consultation and guidance. As mentioned above, the status review also specifically acknowledges the take finding included in Section 919.10 [939.10] of the Forest Practice Rules (see status review page 132). Also, the status review does not evaluate whether timber harvest has led to "take" of Northern Spotted Owl, but rather evaluates whether timber harvest, as well as other potential threats, are impacting the species. The Department's recommendation is based on the status of the species and the ongoing threats posed from a variety of factors.
- Lastly, the letter asserts that economic impacts should be considered more fully as the costs associated with Forest Practice Act compliance are high, particularly for small landowners. As mentioned previously, the Department does recommend revisions to the Forest Practice Rules to incorporate the most up-to-date scientific information. However, it is unclear what, if any, regulatory changes would be made and how current management of the species would change with a state listing.

Mr. Snyder's letter makes several suggestions moving forward, assuming the species is listed under CESA. First, Mr. Snyder suggests a thorough analysis of the USFWS take avoidance recommendations needs to be conducted prior to modifying rules based off of these recommendations. As stated in recommendation #5 in the status review, the Department would coordinate broadly to assist the Board of Forestry and Fire Protection with development of scientifically-based and contemporary updates to Forest Practice Rules sections relevant to Northern Spotted Owl if this action was deemed a priority. The letter also asks that the USFWS and Department work on Safe Harbor Agreements for small landowners, the Department make a Consistency Determination on the USFWS guidance, and the Department work with USFWS to evaluate activity centers that may be considered abandoned or inactive. Though the Department may consider any or all of these actions in the future, doing so now would be premature and outside the scope of the status review.

Lisa Weger Comments

The comment letter received by Lisa Weger suggests that the status review diminished the role small nonindustrial landowners have played in maintaining owl habitat. Specifically, the letter references page 131 of the status review regarding the Department's analysis of NTMPs where it states that staff did not have time or resources to conduct a full NTMP analysis as was done with THPs. In addition, Ms. Weger claims that inferences were made in the status review about impacts to owl habitat based on the limited analysis conducted. As stated in the status review and discussed above, the Department would have preferred to give NTMPs the same level of analysis in the status review as THPs received. However, as explained above, all information on NTMPs is not readily available and would have required additional staff time and resources that were not available.

The letter asks that if the Northern Spotted Owl is listed, nonindustrial landowners be exempted from the same regulatory framework as larger industrial landowners or be provided a simple means to enter into safe harbor agreements. While the Department may consider these suggestions in the future if the owl is listed, doing so within the scope of the status review would be premature.

Craig Blencowe Comments

The comment letter received by Craig Blencowe suggests that there are likely more Northern Spotted Owls on the landscape than reported given their reduced calling behavior in the presence of Barred Owl. The status review acknowledges that Barred Owl presence negatively impacts Northern Spotted Owl detection, territory occupancy, reproduction and survival (see pages 168-173 in the status review). The recently revised Northern Spotted Owl Survey Protocol (USFWS 2012) was developed to account for Spotted Owl occupancy and detection probability given Barred Owl presence, though it is arguably uncertain how this may impact population estimates, if in fact population estimates were calculated. As stated in the status review, no range-wide estimate for abundance exists because "survey methods and effort conducted to date do not provide for reliable estimation of population size across the subspecies' range" (see page 40 of the status review).

The letter also states that omitting an economic impact analysis in the status review is unfair and the added regulatory burden from listing would penalize landowners who have done the "right thing" for spotted owls. As stated above, it is plausible that some adjustments to management will result from listing the Northern Spotted Owl under CESA, but it is currently unknown if and how management practices might change in the future from those currently required of landowners.

Mr. Blencowe also asks that nonindustrial landowners be differentiated from larger industrial landowners if the Forest Practice Rules are revisited, and agencies work to includes small landowners in safe harbor-type agreements and seek incentives to relieve regulatory burden. Again, the Department may consider these suggestions in the future if the owl is listed, but doing so now is premature.

List of additional information received by the Department, through May 2, 2016, and cited herein:

Blencowe, C. April 29, 2016. Letter to the Commission regarding the potential listing of the Northern Spotted Owl, Registered Professional Forester. 3 pp.

California Forestry Association (Calforests). 2016. Northern Spotted Owl supplemental information. Comments submitted to the California Department of Fish and Wildlife and the California Fish and Game Commission, May 2, 2016. 20 pp.

Diller, L.V., K.A. Hamm, D.A. Early, D.W. Lamphear, K.M. Dugger, C.B. Yackulic, C.J. Schwarz, P.C. Carlson, and T.L. McDonald. 2016. Demographic response of Northern Spotted Owls to Barred Owl removal. Journal of Wildlife Management 80(4):691-707.

Greene, M. May 2, 2016. Letter to the Commission regarding the listing of the Northern Spotted Owl, Registered Professional Forester. 5 pp.

Kroll, A.J., J.E. Jones, A.B. Stringer, and D.J. Meekins. 2016. Multistate models reveal long-term trends of Northern Spotted Owls in the absence of a novel competitor. PLoS ONE 11(4).

Sierra Pacific Industries (SPI). 2016. Northern Spotted Owls near Weaverville and Trinity Lake in Trinity County within the landscape survey strategy area (an interim report). Report submitted to the California Department of Fish and Wildlife dated January 2016. 5 pp + 7 figures.

Snyder, B. April 22, 2016. Letter to the Commission regarding Department of Fish and Wildlife Staff Report Findings Regarding the Potential for Take of NSO Attributable to Timber Harvesting on Non-federal Ownerships. 8 pp., plus attachments

Weger, L. April 29, 2016. Letter to the Commission regarding determination of whether the Northern Spotted Owl is warranted under CESA, and if so, how that determination will impact small nonindustrial landowners. 4 pp.

Additional references cited:

Bailey, L.L., D.I. MacKenzie, and J.D. Nichols. 2013. Advances and applications of occupancy models. Methods in Ecology and Evolution 5(12):1269-1279.

California Department of Forestry and Fire Protection (CAL FIRE). 2008a. Evaluation Process for Northern Spotted Owl Information to Determine Compliance with CCR § 919.9(g) [939.9(g)] and 919.10 [939.10]. Unpublished Memo. July 2008.

California Department of Forestry and Fire Protection (CAL FIRE). 2008b. Important Information for Timber Operations Proposed within the Range of the Northern Spotted Owl. Unpublished Report. February 2008.

California Department of Forestry and Fire Protection (CAL FIRE). 2009. CAL FIRE's Use of 14 CCR § 919.9(g) [939.9(g)] in Making Northern Spotted Owl Take Avoidance Determinations. Unpublished Report. August 2008.

California Department of Forestry and Fire Protection (CAL FIRE). 2011. Northern Spotted Owl Disclosure and Impacts Analysis Using 14 CCR § 919.9(g) [939.9(g)]. Unpublished Report. December 2011.

Dugger, K.M., E.D. Forsman, A.B. Franklin, R.J. Davis, G.C. White, C.J. Schwarz, et al. 2016. The effects of habitat, climate, and Barred Owls on long-term demography of Northern Spotted Owl. The Condor 118:57-116.

Farber, S.L., and A.J. Kroll. 2012. Site Occupancy Dynamics of Northern Spotted Owls in Managed Interior Douglas-Fir Forests, California, USA, 1995–2009. J. Wildl. Management 76(6):1145-1152.

Guillera-Arroita, G., J.J. Lahoz-Monfort, D.I. MacKenzie, B.A. Wintle, and M.A. McCarthy. 2014. Ignoring imperfect detection in biological surveys is dangerous: A response to 'Fitting and interpreting occupancy models'. PLoS ONE 9(7):1-14.

Guillera-Arroita, G., M.S. Ridout, and B.J. Morgan. 2010. Design of occupancy studies with imperfect detection. Methods in Ecology and Evolution 1(2):131-139.

MacKenzie D.I., J.D. Nichols, G.B. Lachman, S. Droege, J.A. Royle, et al. 2002. Estimating site occupancy rates when detection probabilities are less than one. Ecology 83:2248-2255.

MacKenzie, D.I., J.D. Nichols, J.E. Hines, M.G. Knutson, and A.D. Franklin. 2003. Estimating site occupancy, colonization and local extinction when a species is detected imperfectly. Ecology 84:2200-2207.

MacKenzie, D.I., J.D. Nichols, J.A. Royle, K.H. Pollock, L.L. Bailey, and J.E. Hines. 2006. Occupancy Estimation and Modeling: Inferring Patterns and Dynamics of Species Occurrence. New York: Academic Press.

Welsh, A.H., D.B. Lindenmayer, and C.F. Donnelly. 2013. Fitting and interpreting occupancy models. PLoS ONE 8(1):1-21.

U.S. Fish and Wildlife Service (USFWS). 2008a. Revised Attachment B: Take Avoidance Analysis-Interior. Unpublished Report. February 2008.

U.S. Fish and Wildlife Service (USFWS). 2008b. Information Needed for US Fish and Wildlife Service Timber Harvest Plan – Northern Spotted Owl Technical Assistance Analysis. Unpublished Report. February 2008.

U.S. Fish and Wildlife Service (USFWS). 2009. Regulatory and scientific basis for U.S. Fish and Wildlife Service guidance for evaluation of take for northern spotted owls on private timberlands in California's northern interior region.

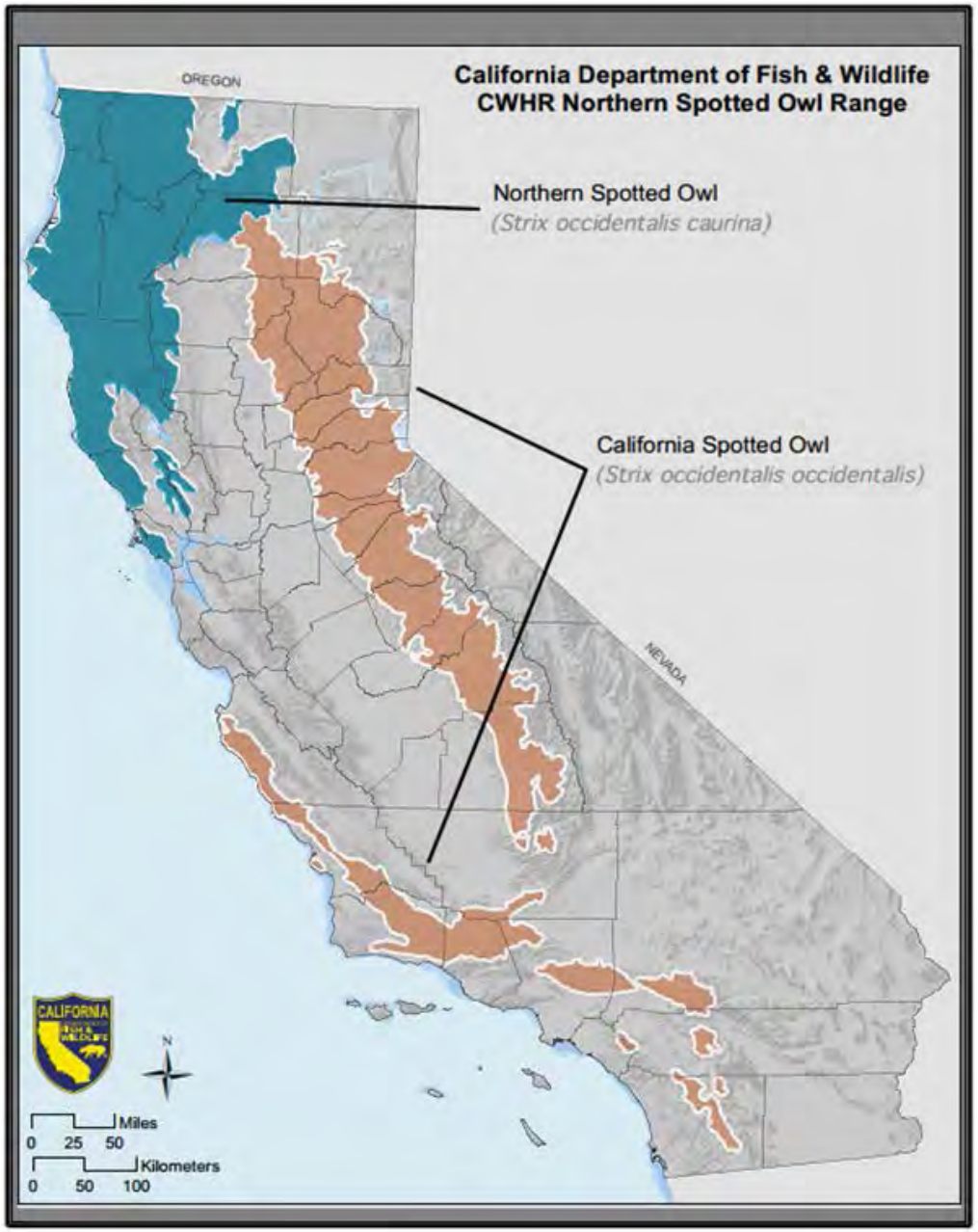
U.S. Fish and Wildlife Service (USFWS). 2012. Protocol for Surveying Proposed Management Activities that May Impact Northern Spotted Owls. Portland, Oregon.

Status Review for the Northern Spotted Owl (*Strix occidentalis caurina*) in California

Carie Battistone and Neil Clipperton
Senior Environmental Scientists
CDFW, Wildlife Branch
August 25, 2016

California Range

CDFW Photo © Culpepper



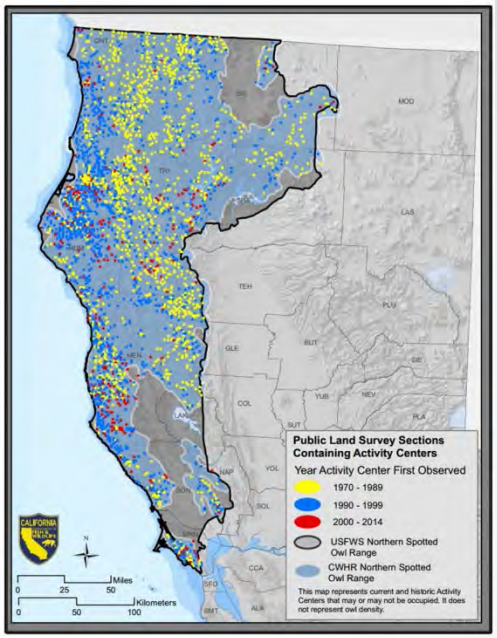
Habitat

- Nesting and Roosting
- Foraging
- Dispersal (not discussed here)

USFWS Photo

Status and Trends

- No range-wide population estimate exists
- All demographic study areas are showing declines in vital rates.



Study Area	Fecundity	Survival	Territory Occupancy	Population Change	% Population Change over time
NWC	↓	↓	↓	↓	-55%
HUP	↓	↓	↓	↓	-32%
GDR	↓	↓	↓	↓	-9% to -41%
CAS (OR)	No trend	↓	↓	↓	-44%

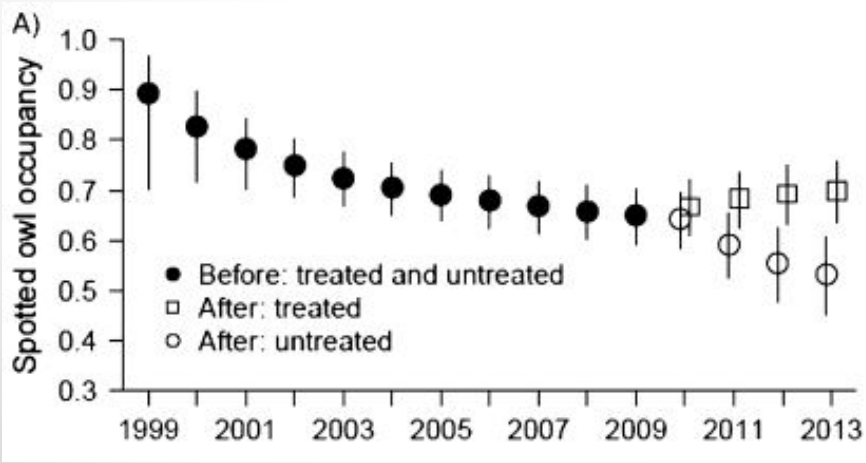
Threats

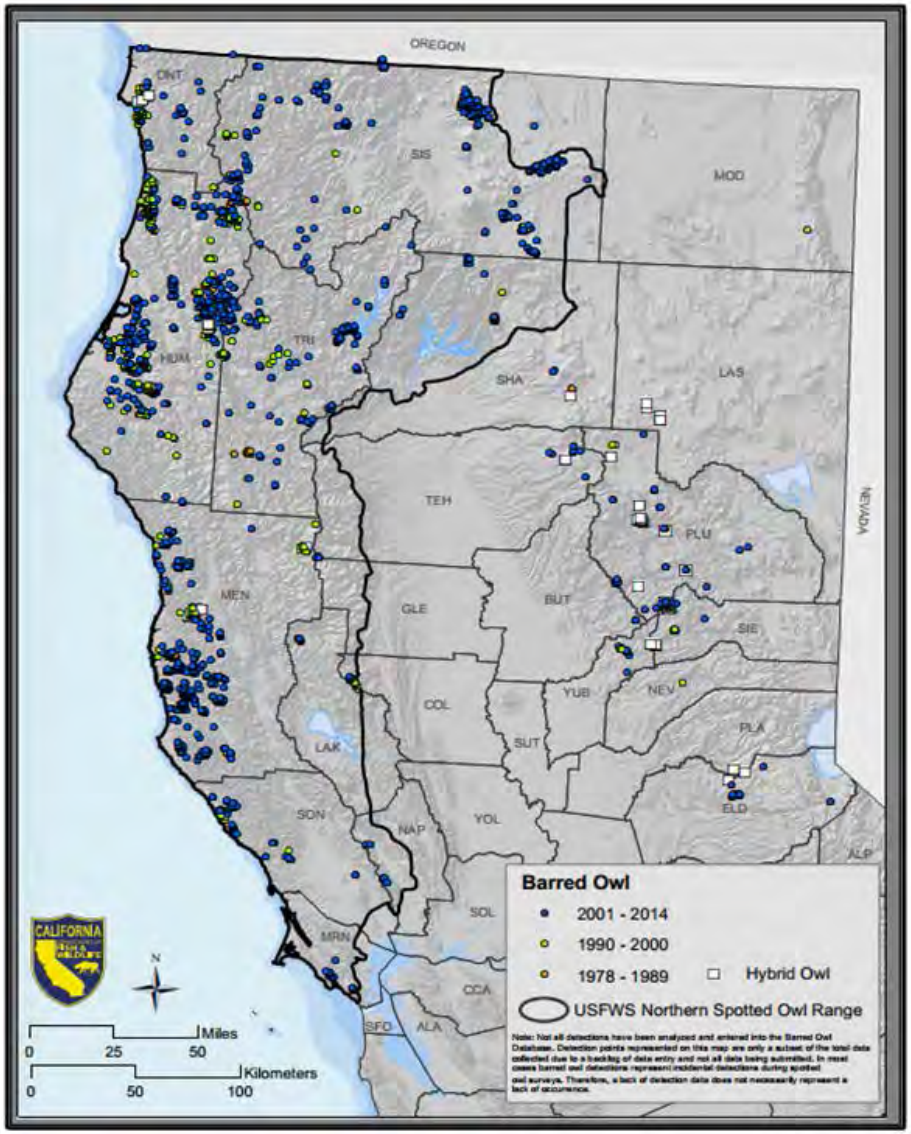
- Habitat Loss
  - Wildfire
  - Timber harvest (conifer and hardwood) and regulatory mechanisms
  - Climate Change – forest composition and structure
  - Sudden Oak Death
  - Marijuana cultivation
- Barred Owl
- Disease
- Climate Change – weather patterns
- Contaminants
- Predation
- Recreational Activity
- Loss of Genetic Variation

USFWS Photo

Threats - Barred Owl

- Expanded into western North America and now occur throughout California
- Barred Owls impact Spotted at multiple levels
- Experimental removals of Barred Owls show promise for reducing impact to Spotted Owls.





Diller et al. 2016

Recommendation

The best scientific information available indicates to the Department that the petitioned action is warranted, and the Department recommends to the Commission that the Northern Spotted Owl be listed as Threatened under the California Endangered Species Act.

At the last Commission meeting (April 14, 2016) the Commission delayed a decision to list and directed the Department to:

(1) consider new information from Stakeholders, and

(2) work with Stakeholders on a process or structure regarding the formation of a Barred Owl science team

The Department received several items by the May 2 deadline and met with the Stakeholders on May 23 to discuss this information and the formation of a Barred Owl team.

DRAFT Conceptual Communication Framework

NSO Stakeholder Forum (public)

Annual information sharing forum with broad stakeholder participation. More frequent meetings may occur if needed.

- Subject-specific subgroups may be formed as needed
- Agency updates
- Industry updates
- Conservation group updates
- Research updates
- Inform IWG and BOST topics

Subgroups

Address emerging topics as needed

NSO Interagency Working Group (gov. agency only)

IWG is a government agency group addressing all topics related to spotted owl.

- Product- and decision-based group
- Address policy/regulation topics as they arise
- To the extent possible, provide consistent feedback among agencies regarding processes to be followed (e.g. conservation planning, incentive programs, etc.)
- Address outreach and education to stakeholders and the general public as the need arises
- Conduct agency training (e.g. TA process)
- Report out to and request input from Stakeholder Forum and BOST regularly

Barred Owl Science Team (subject matter scientists)

BOST is a science /research focused group related to barred owl research in CA to promote NSO recovery

- Largely follows CDFW guidance for developing Ad Hoc Science Advisory Teams
- Cover topics related to both NSO and CSO impacts
- Review research proposals
- Develop standard methodologies
- Identify research needs
- Devise large-scale regional experimental removal study for California.
- Address outreach and education to stakeholders and the general public as directed by the IWG
- Reports out to and request input from Stakeholder Forum and IWG regularly

DRAFT Procedures for Convening Barred Owl Independent Science Team

Membership:

- Established by the Director, or delegate, upon program recommendation
- CDFW will determine required areas of scientific expertise among members
- selected based on scientific expertise and ability to fully participate
- CDFW staff may be ex officio members
- Other scientific experts may participate in meetings as ex officio members

Charge:

- Provide objective scientific review and recommendations to CDFW
- Responsible for collecting and reviewing the necessary information for providing scientific advice
- Ensure recommendations are based on the best available scientific information
- May establish subcommittees on specific topics
- Will provide updates and final report(s) of findings to CDFW

epic

Keeping Northwest California wild since 1977

Sent via e-mail to: director@wildlife.ca.gov on date shown

April 19, 2016

Charlton H. Bonham, Director
California Department of Fish and Wildlife
1416 9th Street, 12th Floor
Sacramento, CA 95814

RE: Development of Northern Spotted Owl Stakeholder Working Group

Dear Director Bonham and Department of Fish and Wildlife:

In light of direction received by the Department from the Fish and Game Commission regarding its desires to see the creation of a Northern Spotted Owl Stakeholder Working Group commence in advance of a final determination on EPIC's petition for listing under the California Endangered Species Act (CESA), we provide the following suggestions for development of the Working Group's outline and framework. We appreciate the opportunity to provide the Department with such input at this time.

Purpose and Need for a Stakeholder Working Group

Any Stakeholder Working Group must be designed to achieve the overarching goals of protecting, enhancing, maintaining, restoring, and conserving the northern spotted owl in California, consistent with Department's mission, and the requirements of CESA. To be clear, EPIC does not believe that creation of a Stakeholder Working Group can or should be used as a basis to avoid CESA listing, or for the Department to otherwise fail to discharge its statutory duties as the trustee agency for wildlife in the State of California, otherwise.

Any Stakeholder Working Group must be construed so as to focus on the actions necessary and advisable to meet the Department's legal and statutory obligations, regardless of the interests of any individual participant or sector of participants.

It is clear that there may be benefits to the creation of a Stakeholder Working Group, insofar as it can aid in communication and coordination of management actions, scientific research, and stakeholder outreach; however, there is also a very

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real danger that a Stakeholder Working Group could do more to stymie necessary and advisable management actions through endless debate and fruitless obfuscation of the best available scientific and commercial evidence with respect to the plight of the NSO, its needs, and the activities that may be necessary to ensure its survival and recovery in the wild.

EPIC therefore cautions the Department to very clearly outline the purpose of any potential Stakeholder Working Group, and also to ensure the ends of any such group process are designed to meet the needs of the species, and not any individual, or sector of stakeholder entities.

Working Group Structure, Members, Participation, and Leadership

Regarding membership, the Stakeholder Working Group should include all interested parties, including EPIC as petitioner, bird and wildlife advocacy groups, and others such as independent scientists and researchers, not merely the regulated industry and the Department in order to be genuinely reflective of the broad array of perspectives, interests, and assets offered by the available community at-large.

Consistent with this, EPIC strongly recommends that any participation and associated information provided or gathered be contingent upon the presumption of full and complete disclosure and availability of all information to all other members of any Stakeholder Working Group.

In terms of leadership, EPIC strongly recommends that the Department lead any Stakeholder Working Group effort directly, and not contract outside mediation consultants. Our experience through the development of the California Wolf Plan through the SWG process indicates to us that outside contractors hired for the purposes of mediation are not adequately schooled or prepared for the task or political and social environment likely to be encountered in any NSO Stakeholder Working Group, and that this lack of knowledge and experience with the many entities and individuals that are likely to engage is an innate disadvantage to the overall fluency and effectiveness of the process.

Activities and Focus of the NSO Stakeholder Working Group

The Department's Status Report for the NSO (CDFW 2016), found that without CESA listing, that the continued existence of the NSO is in "serious danger," due to three factors: 1) Present or threatened modification or destruction of its habitat; 2) Competition; and 3) Other natural occurrences or human-related activities. Accordingly, any Stakeholder Working Group process must be designed to explore the aggressive and immediate implementation of management activities that will address these three categories of significant threats to the NSO in order for the group to achieve its presumed intended goal of protecting, and ultimately, recovering the NSO in the wild in California. The best available scientific and commercial information clearly indicates that all three of these threat categories must be addressed simultaneously and aggressively, and that one cannot be

addressed separately or in the absence of any other. Therefore, the Department must take the initiative and the lead to address not only threats such as competition, fire, climate change, and toxic exposure, but must also address the problem of habitat loss and destruction, which a clear and well-documented present and ongoing threat to the NSO in California.

EPIC wishes to refer the Department to its management recommendations from the NSO Status Report, as well as the management recommendations of the federal Revised Recovery Plan for the NSO (USFWS 2011), as a foundational point of discussion and consideration for activities that may be considered as part of the Stakeholder Working Group process. Again, if the Stakeholder Working Group is not to be focused on actual actions intended to conserve the NSO in the wild in California, we must seriously question its value and utility and the benefits of participation over other avenues of advocacy.

Location of Stakeholder Working Group Meetings

Finally, EPIC suggests that any Stakeholder Working Group be based in the northern regions of the state, within the geographic range of the NSO, and within the primary range of the affected landscape and multitude of stakeholders mostly work and reside. Convening the Working Group elsewhere, such as in Sacramento, will result in extensive and expensive and unreasonable burden upon all Stakeholder Working Group participants. EPIC therefore strongly recommends that any Stakeholder Working Group or associated meetings and workshops be focused in regions of the state most likely to be affected by the management actions being contemplated and implemented.

Conclusion

Creation of a Stakeholder Working Group for the NSO is not a substitute for CESA listing, but clearly has the potential to be complementary and beneficial; however such a group also has the potential to serve as a point of muddle process and paralysis to obfuscate the issues surrounding the management and conservation of the NSO, and to stall out the implementation of necessary management and recovery measures. EPIC hopes that any such group developed by the Department will be designed as an action-based entity, and not a process-based entity.

Sincerely,

Rob DiPerna
California Forest and Wildlife Advocate
Environmental Protection Information Center
145 G Street, Suite A
Arcata, California 95521
Office: (707) 822-7711
Email: rob@wildcalifornia.org

Cc: Michael Yaun, Acting Executive Director, California Fish and Game Commission

Eric Sklar, President, California Fish and Game Commission

From: [redacted]
To: FGC
Subject: Northern Spotted Owl
Date: Monday, May 02, 2016 2:56:16 PM
Attachments: NSOCommentletterdocx.docx
Evaluation Process for NSO Info to Determine Compliance 919.9(g) and 919.10.pdf
CAL_FIRE_919.9g_Additional_Info_Explanation_Aug09.pdf
Revised USFWS Attachement B NSO Take Avoidance Analysis-- Interior 2-27-08.pdf
USFWS_ NSO_TakeAvoidanceGuidelines_ScienceSupportDocument_121409.pdf
USFWS_Info-for_NSO_TechnicalAssistance_020108.pdf
Revised_USFWS_Attachement_A_NSO_Take_Avoidance_Analysis--_Coast Redwood_3-15-11.pdf
NSO_Disclosure-and-Imapcts_Analysis_Interior_12.13.11.pdf
NSOAttach1.pdf
NSOAttach2.pdf
NSOAttach3.pdf
NSOAttach4.pdf

Please find attached my comments and associated attachments and documents on the DFW staff report.

Bill Snyder

Bill Snyder
[redacted]

April 22, 2016

Mr. Eric Silcar, President
California Fish and Game Commission
P.O. Box 944209
Sacramento, CA,

Subject: Department of Fish and Wildlife Staff Report Findings Regarding the Potential for Take of NSO Attributable to Timber Harvesting on Non-federal Ownerships

Dear President Silcar,

I appeared before you at the April 14, 2016 Fish and Game Commission hearing in Santa Rosa to provide comments on my review of the Department of Fish and Wildlife's (DFW) status review of the Environmental Protection Information Center's Petition to list the Northern Spotted Owl *(Strix occidentalis caurina)* as threatened or endangered pursuant to the California Endangered Species Act.

The DFW staff report concluded that the continued existence of NSO is threatened by listing factors associated with a present danger associated with modification or destruction of its habitat. Specifically, the DFW staff report concludes that operations under the current regulations which govern timber harvesting on non-federal timberlands on the state are not adequate to prevent the loss of habitat. The basis for this conclusion is that the existing rule language of 14CCR 919.9(g) and 939.9(g) in combination with definition of NSO habitat in 14CCR 895.1 are not adequate to prevent loss of habitat during implementation of a harvesting operation and that the current rules do not adequately address potential cumulative impacts associated with the loss of NSO habitat attributable to timber harvesting.

Time was too brief at the Commission hearing to provide my comments regarding the staff analysis and conclusions regarding habitat loss under the existing Forest Practice Regulations. As I stated at the Santa Rosa Commission hearing, I am offering the comments contained in this letter based on my knowledge of the Department of Forestry and Fire Protection's regulatory process and Timber Harvesting Plan Review having served as the Deputy Director of the Department of Forestry and Fire Protection with responsibilities for the Forest Practice program area. While at the Department, I oversaw the transition of a transfer of evaluation of potential impacts of timber harvesting from the United States Fish and Wildlife Service (USFWS) to Cal Fire. As part of that transfer, the USFWS provided Cal Fire staff with guidance on measures necessary to avoid take of NSO for inclusion in operational implementation of Timber Harvesting Plans and Nonindustrial Timber Management Plans. The USFWS also provided the scientific support documentation for the recommendations and, similar to the conclusion reached by DFW staff, advised Cal Fire that operations pursuant to 14CCR919.9(g) and 939(g) would not be adequate in all cases to avoid take of NSO. Copies of these documents are available on the Cal Fire website but are attached to this letter for your reference.

Based on the advice from the USFWS and supporting documentation regarding best available science supporting their recommendations for measures to avoid take of NSO, Cal Fire concluded that a fair

argument had been raised pursuant to CEQA regarding potential for take of NSO through use of 14CCR 919.9(g) or 939.9(g) where assessment of habitat impacts was based on the 14 CCR 895.1 definitions. Based on the fair argument raised by the USFWS regarding take avoidance using these rule sections and the reality that Cal Fire review staff did not have the same level of expertise in evaluating the potential for take of NSO, Cal Fire requested and the USFWS provided guidance for plan preparers and reviewers to utilize for incorporation into THPs and NTMPs to avoid take. These documents are also attached for your reference. Cal Fire supported this guidance and based on the requirements of Board of Forestry and Fire Protection rule section 14 CCR 896 and the need to ensure consistency with California Environmental Quality Act (CEQA) and the federal Endangered Species Act (ESA), recommended that plan preparers follow the advice provided by the USFWS and include information in THPS and NTMPs to avoid take. Take avoidance through this process was determined to be consistent with the provisions of 14 CCR 919.9(e) and 939.9(e). This option is commonly referred to in THPs and NTMPs as Option e or Alternative e. Plans that included this option and the required analysis were reviewed for consistency with the Technical Assistance letter provided to Cal Fire by the USFWS. The USFWS did agree to continue providing Technical Assistance for NTMPs which they had previously provided TA(s) and were available on a case by case basis to provide Technical Assistance at the request of Cal Fire on specific plan issues.

I do at this point want to make it clear that the following comments are not being made on behalf of anyone but myself and should not in any way be construed to represent Cal Fire's position regarding the DFW staff analysis or recommendations.

Potential for Habitat Loss Leading to Take

I want to commend DFW staff and the level of analysis of the THP and NTMP staff provided in the staff report regarding timber harvesting operations and the regulatory framework in place to avoid take of NSO. However, in reviewing the staff report I was disappointed to note that much of the support for the determination that timber harvesting on private ownerships conducted under plans approved by Cal Fire have the potential to result in loss of habitat that could result in take of NSO was based on a conclusion that THPs were still largely reliant on Option G of the Forest Practice Rules. This conclusion by DFW staff was based on evaluation of 2013 THPs as well as a group of NTMPs relative to Options (Alternatives) described in approved harvesting plans .

The extent to which DFW concluded Option g was being utilized was not consistent with my understanding of how RPFs and Cal Fire were responding to the arguments raised by the USFWS regarding use of Option g. While I am retired, I do have a continuing interest in forestry and resource management along with a commitment to ensuring that forest management is encouraged while at the same time assuring that other resource values are protected. DFW staff analysis indicated a level of use of Option g than I would have expected and also indicated that sequential harvesting of habitat in Activity Centers as leading to cumulative loss of NSO habitat.

To satisfy my need to understand what was going on with the process and specifically why DFW was identified so many THPs that used Option g, I requested and received from Cal Fire a list of 2013 THPs within the range of NSO as well as a listing of NTMPs. Utilizing this information, I summarized the following information for each of the 2013 THPs and all of the listed NTMPs for a period inclusive of 2011 through 2015:

1. THP/NTMP Landowner

2. Acreage
3. Silviculture
4. NSO Option utilized
5. Pre and Post-harvest Nesting and Roosting Habitat acres
6. Pre and Post-harvest Foraging acres
7. Pre and Post harvest non-habitat acres

If Option e was indicated or in those instances where Option g was utilized but the plan preparer indicated that the USFWS habitat definitions and retention standards would met, I also evaluated whether or not the habitat retention standards recommended by USFWS were being met in terms of total habitat retention post-harvest and whether limitation on removal of habitat in excess of the retention standard was less than the 1/3 removal level recommended. Analysis was further divided into small and large landowners based upon a criteria of ownership criteria of approximately 30,000 acres or greater for large ownerships.

There were a total of one hundred and thirteen 2013 Timber harvesting plans identified within the range of the NSO. Please refer to Attachment 1 for a list of the plans. Thirty plans were submitted for ownerships where take had been authorized under a federally approved Habitat Conservation Plan. For the remaining THPs a no take standard was applicable. THP take avoidance was demonstrated through compliance with the following Forest Practice Rule options

NSO Take Avoidance Option utilized	Number of 2013 Plans
Spotted Owl Management Plan	8
Spotted Owl Resource Management Plan	5
USFWS Technical Assistance-Option e	70*
Option g	1**
Habitat Conservation Plan	30

*Includes one THP with an Habitat Retention Agreement with USFWS
**One plan included in the list fell outside of the range of the NSO but was within 1.3 miles of the NSO range boundary

Data and information in the plans does not appear to support the conclusion reached in the DFW staff report relative to the use of Option g. It my observation that where Option g was cited in the discussion of NSO protection measures that USFWS habitat definitions were used and that plans and habitat analysis indicated retention of habitat and limitations on removal of suitable habitat in excess of USFWS recommendations.

Further analysis was conducted on all of the Option e plans to determine level of compliance with guidance provided by the USFWS for habitat retention. Each of the THPS or NTMPs was reviewed as they are posted in the Cal Fire THP Library. Since the DFW analysis focused primarily on habitat loss, information collected from each plan focused on habitat. It was noted that each of the plans appeared to contain detailed calling record information, database checks, operational limitations in terms of timing and distance from occupied activity centers consistent with the USFWS recommendations, but I did not summarize this information.

Given the limited time, I focused my review on analysis of whether the individual plans complied with the total habitat retention guidance recommended by USFWS. This included retention of 200 acres of

Nest/Roost habitat and 300 acres of foraging habitat within 0.7 miles surrounding the Activity Center for THPs/NTMPs in the coast and retention of 250 acres of Nest/Roost habitat and 1085 acres of foraging habitat within 1.3 miles of the Activity Center for the northern area. Coast and Northern District plans were categorized as being consistent with USFWS guidance if habitat retention exceeded the recommended habitat retention levels. Also, a plan was considered to be consistent with the guidance in those instances where habitat was deficit but no removal of existing habitat was proposed.

It is recognized that for the interior plans, habitat is further broken down into low quality and high quality habitat and High Quality N/R and N/R with minimum retention for habitat within 0.5 miles of the Activity Center and for the area between 0.5 miles of the Activity Center and 1.3 miles. Time did not permit me, given other obligations, to analyze compliance at this level. Instead the analysis focused on whether the total habitat retention indicated in the THP/NTMP were consistent with USFWS recommendations. Nest Roost Habitat represented a combination of High Quality Nest Roost/and Nest Roost represented within the 1.3 mile radius. Foraging habitat represented a combination of foraging and low quality foraging habitat.

Further, given DFW staff report concerns about operations reducing habitat to minimum recommended retention levels and the extent of disturbance to NSO habitat in the vicinity of the Activity Center, an analysis was also conducted to determine whether post-harvest retention levels met the recommendation that no more than 1/3 of the suitable habitat in excess of 500 acres within 0.7 miles of the Activity Center and 1335 acres within 1.3 miles for Northern District Plans be removed during the course of timber operations. THPS and NTMPs were considered to be consistent with the USFWS guidance if they met or exceeded the USFWS recommended standard.

Attachments 2, 3 and 4 provide summary data and results from information gathered for the THPs and NTMPs which utilized Option E with respect to compliance with USFWS guidance for total habitat retention within 0.7 miles for coast plans and 1.3 miles for northern plans.

A total of 28 NTMPs were included in the analysis. The included NTMPs are listed in Attachment 4. Eight of the 28 NTMPs did not include an include an analysis of NSO habitat because there were no NSO Activity Centers located within 0.7 miles (coast) or 1.3 miles (northern) of the NTMP boundary. Nineteen NTMPs did include habitat information associated with 45 NSO Activity Centers. In all instances approved NTMPs met or exceeded the USFWS habitat retention requirements and were consistent with recommended limitations on disturbance of suitable habitat in excess of the habitat retention recommended. Given current Cal Fire requirements for subsequent surveys and demonstration of ongoing conformance to the USFWS guidance, cumulative harvests under a series of Notice of Timber Operations, are not anticipated to reduce habitat in a manner which is inconsistent with USFWS guidance without further Technical Assistance. Cal Fire will continue to provide Notices of timber Operations to DFW staff.

For the small landowner Option e THP's included in Attachment 3, 30 plans were analyzed to summarize habitat data. Seventeen of these plans indicated there were no Activity Centers located within 0.7 miles (coast) or 1.3 miles (inland) of the plan area. Twenty-seven NSO Activity Centers were noted on 14 plans. It was noted that post-harvest retention of suitable habitat had been met for all plans included in the analysis. There was one noted deviation from the recommendations for limiting disturbance to suitable habitat in excess of the retention levels recommended by USFWS. In this instance, the information indicated that 40% of the habitat in excess of the minimum would be operated.

For the large landowner Option e plans included in Attachment 2, 31 plans were analyzed to summarize habitat data. Seven of the 31 plans indicated there were no NSO Activity Centers located within 0.7 miles (coast) or 1.3 miles (northern) of the plan area. Twenty-four plans summarized habitat information for 52 different Activity centers. At twelve of the Activity Centers, it was noted that NSO habitat was deficit prior to operations. The files for these plans indicated that no timber operations would be conducted in existing suitable habitat and Technical Assistance letters from the USFWS or Cal Fire were included for operations under the plans. One THP indicated harvest in excess of 1/3 of the habitat in excess of USFWS recommendations.

It is my conclusion based on analysis of the habitat data in these plans and NTMPs:

1. Approved plans which do not rely on HCP take authority, Spotted Owl Management Plans negotiated with the USFWS, or Spotted Owl Resource Plan are consistent with USFWS guidance regarding retention of NSO habitat and removal of habitat in excess through timber operations under Option (Alternative) e.
2. There has not been, nor is there likely to be the widespread use of Option g since 2008.
3. Given Cal Fire's current direction to plan preparers and to Review Team staff that THPs submitted in the future will be expected to demonstrate consistency with USFWS recommendations.
4. Habitat loss to timber harvesting on nonfederal lands is not likely to result in "take" of NSO except as authorized through a HCP.
5. Recommendations by DFW staff to modify BOF rules are not necessary at this time.

Cumulative Impacts

DFW expressed concern regarding the potential for cumulative impacts of harvesting operations on non-federal lands and developed data regarding cumulative timber operations within activity centers. It was not possible given the time available to evaluate the information to determine silviculture sequentially over time, and the extent to which suitable habitat was impacted by harvesting. It is likely, as the DFW staff report indicates, that some of the silviculture applied adjacent to these activities was selection where it should be expected, dependent on the cutting cycle length, that one or more harvest entries would have taken place over an approximately 25 year period. It is also likely that habitat quality for previously unsuitable habitat over this period would have changed as stands grow and individual stems increase in size. For these reasons the DFW staff analysis appears to be overly-simplistic and not accurate. While there are likely approaches that could be taken to do the type of habitat analysis that would be necessary to overlay changes in NSO habitat attributable to operations and forest growth, the complexities of this type of analysis should be recognized. A simpler approach would be to focus on the potential for cumulative impacts of individual timber harvesting plans moving forward under USFWS recommendations. An argument can be made that as long as the USFWS recommendations are followed, habitat will be retained adjacent to each Activity Center at each subsequent harvest entry. For the balance of the area available for harvest, habitat suitability will likely change over time, but under USFWS recommendations removal of suitable habitat would be limited to no more than 1/3 of the NSO habitat available in excess of the USFWS recommended retention. It is hard to visualize that cumulative impacts to suitable habitat would not be avoided at the Activity Center scale.

At a larger NSO range scale in California, It would also be worthwhile to evaluate change in vegetation over time within the range of NSO given the likelihood that growth will exceed harvests in the region on non-federal lands. Over time this should, in the absence of wildfire, lead to increasing tree sizes and higher levels of canopy density which will positively influence dispersal of owls and increase the overall

quantity of habitat. Sources of data to this analysis are available in FIA and from large companies within the region.

It is my conclusion based on a quick review of the 2013 THPs and the 2011-2015 NTMPs that:

1. Cumulative impacts under the current Option e are unlikely given the requirement that at each harvest entry, habitat retention requirements would need to be met.
2. Harvesting of suitable habitat in in excess of retention requirements is currently provided under the guidance provided by USFWS. However, harvesting is limited to no more than 1/3 of the suitable habitat. The analysis provided on page 95 of the staff report should focus on what is being retained but instead gives a false impression of the level of habitat removal by first assuming that all acres harvested are in suitable habitat, and that sequential harvesting over long periods of time has removed habitat to the extent that "take" would be likely. Neither conclusion can be supported by the information provided.
3. Additional analysis of vegetation types and projections of growth would likely indicate increasing trends in tree size and canopy cover over time.
4. Adequate information is provided in each approved plan to ensure that Timber Harvesting Plans will maintain existing habitat.

Analysis of NTMPs

The DFW staff report provides and evaluation of impacts of NTMPs without evaluating the ongoing role of the USFWS regarding providing Technical Assistance for NTMPs where Technical Assistance had been previously provided. In general this would apply to NTMPs approved prior to 2008. As noted previously, NTMPS approved sometime shortly after 2008 handoff to Cal Fire would be approved under BOF Rules. While this could have resulted in NTMPS being approved under Option g, the analysis of 2011-2015 NTMPs indicated this was not the case. For NTMPs approved prior there is a likelihood that the USFWS is continuing to provide Technical Assistance. To the extent that the DFW staff failed to recognize the USFWS role in providing ongoing Technical Assistance by DFW, the data and information report does not provide an accurate assessment of the potential for "take" associated with habitat modification or conduct of timber operations under NTOs submitted for approved NTMPs.

It is my conclusion after reading the DFW staff report that:

1. Adequate information is provided at approval of NTMPs to ensure that timber harvesting will meet USFWS habitat retention requirements, and subsequent Notices of Timber Operations (NTO) will need to demonstrate conformance with USFWS survey protocols and include sufficient information in the NTO to confirm that "take" will be avoided.
2. Contrary to the DFW staff report Cal Fire does provide copies of all NTOs to DFW and would be able to provide DFW copies of all support documentation of "take" avoidance/habitat retention analyses provided by the Registered Professional Forester.
3. The DFW staff report does not address the ongoing role of USFWS in providing ongoing Technical Assistance and in so doing, does not provide an accurate picture of "take" avoidance procedures related to NTOs.
4. The analyses of NTMPs should be revised to reflect the role of USFWS.
5. The analysis of the potential or habitat removal associated with NTMPs after 2008 should be revised to reflect habitat analyses under the appropriate BOF Option. Option selected for the 2011-2015 indicated that Option e or its equivalent was utilized in 100% of the NTMPs I reviewed.

Ongoing Role of USFWS

The USFWS has and continues to provide assistance in assisting Cal Fire with evaluating the potential for take of NSO. The initial guidance provided to Cal Fire in 2008 regarding the potential for take under Option g of the BOF rules, the take avoidance measures provided initially in 2008 and revised subsequently since, and the scientific basis for the habitat classification, retention standards, timing of timber operations, spatial limitation on timber harvesting operations during the breeding season, and other recommendations are important to the determination of whether operations approved by Cal Fire will result in "take" of NSO. Unfortunately, the DFW staff report does not discuss the efficacy of the guidance provided by the USFWS to avoid "take" under the state standard nor is an evaluation of the science supporting the USFWS recommendation offered. I would recommend that before a finding is made by the Fish and Game Commission that timber harvesting is modifying habitat and allowing disturbance of breeding NSO that would lead to take, that an analysis of the USFWS "take" avoidance recommendations and supporting science be conducted by DFW staff. Only then, with a based on a conclusion by DFW that the USFWS is in error, should a finding be made that timber harvesting on non-federal lands is a factor which threatens habitat or breeding o the extent that "take" is likely.

Conclusion

In reviewing the 2013 approved THPs and the 2011-2015 NYMPs within the range of the NSO, it is clear that THPs and NTMPs did not rely on Option g of the BOF. Given that a "fair argument' has been raised by the USFWS which found that Option g of the BOF rules would not in all cases avoid "take", it is expected that the use of Option g would be limited going forward as well. Without analysis and demonstration by DFW staff regarding the science used by USFWS to justify the recommendations for "take" avoidance in THPs and NTMPs, a finding by the FGC regarding the potential for timber harvesting on non-federal lands to cause "take" is not supported by fact. Hopefully, the FGC will request DFW staff to reexamine the analyses and evaluation of potential for "take" taking a prospective as opposed to retrospective approach. "Take" under the federal definition is intended to be avoided if USFWS guidance is followed. Based on the analyses of approved THPs and NTMPs included in Attachments 2, 3 and 4, this is the case, as THP and NTMP submitters are moving forward under the provisions of HCPs where take is allowed , SOMPs, SORPs or Alternative e. "Take" should not be occurring under approved plans.

Also, while I recognize that the DFW staff report is not required to consider economics, the costs associated with complying with the USFWS recommendations are significant, particularly to small landowners. For this reason I would encourage FGC to include in its findings a recommendation that DFW staff work with USFWS staff to develop an approach to a small landowner Safe Harbor Agreement approach that would be cost effective for the landowners and provide for protection of NSO habitat. The current Habitat Retention Area approach used by USFWS on some NTMPs should be a workable model. In addition it must be recognized that small landowners are impacted by the complexity of the THP/NTMP process in its current form. I would urge the FGC to request that DFW staff work as quickly as possible to make a "consistency determination" with the current USFWS guidance and supporting science. Making a consistency determination, if possible, will go a long way towards allaying the apprehension that many small landowners have regarding the state listing. Lastly, I would urge the FGC to include a finding to have DFW staff work with USFWS and private landowners to evaluate the existing database with the goal of inactivating NSO activity centers that no longer meet agreed upon criteria and can be considered either abandoned or inactive.

For your information in addition to Attachment 1 thru 4, I am attaching guidance documents from the USFWS along with their evaluation of the underlying science which was submitted to Cal Fire.

Sincerely,

Bill Snyder

M e m o r a n d u m

To: Unit Foresters
Forest Practice Inspectors
Regional Review Team Foresters

Date: July 7, 2008
R12

Telephone: (916) 653-4995

From: **Chris Browder, Deputy Chief, THP Administration**
California Department of Forestry and Fire Protection
(CAL FIRE)

Subject: Evaluation Process for Northern Spotted Owl Information to Determine Compliance with CCR § 919.9(g) [939.9(g)] and 919.10 [939.10]

Introduction

The following generally describes the information the California Department of Forestry and Fire Protection (CAL FIRE) will request from plan proponents, where that information should be put in the timber harvesting document (plan), and which CAL FIRE staff will be responsible for review of such information when making take avoidance determinations for the northern spotted owl (NSO) associated with timber operations.

First Review

The first review team is responsible for determining whether the submitted plan or amendment provides adequate information to evaluate compliance with 14 CCR §§ 919.9(g) [939.9(g)] and 919.10 [939.10]. In addition to ensuring that adequate information has been included in the plan, the first review team will ensure that all NSO activity centers (ACs) identified in the California Department of Fish and Game's NSO Database Management System (NSO database) Report # 2 have been addressed in the plan and that the pre- and post-harvest habitat analysis tables provided demonstrate retention of sufficient post-harvest suitable NSO habitat.

The seventeen items listed below under **Plan Contents** are similar to the information currently required by the U.S. Fish and Wildlife Service (USFWS) for NSO Technical Assistance (TA). CAL FIRE has determined that this same information may be needed to allow the Director to exercise discretion and make a determination based upon information that is sufficiently clear and detailed (14 CCR § 897(b)(3)). However, CAL FIRE recognizes that a Registered Professional Forester (RPF) may deviate from the specific plan contents outlined below and still provide sufficient information to

determine that the plan is in conformance with the rules, take of NSO has been avoided, and potential significant and cumulative impacts have been addressed.

Plan Contents relative to NSO take avoidance and § 919.9(g) [939.9(g)]:

Under Section II, the following should be provided--

1. Whether the plan is in the range of the NSO.
2. How the plan will comply with 14 CCR § 919.9(g) [939.9(g)].
3. Whether there are known NSOs on, or within 1.3 miles of, the plan.
4. How the plan will address and provide protection for a previously unknown NSO discovered after take avoidance determination.
5. Appropriate enforceable language stipulating no timber operations shall occur until such time as all surveys for the current, or immediately preceding, survey period are complete, the results have been provided to CAL FIRE, and the results of CAL FIRE's take avoidance determination have been incorporated into the plan, including any resultant changes in timber operations to avoid take, if necessary.
6. A description of habitat retention levels and operational protection measures for any known ACs within 500 feet, 1000 feet, 0.5-mile radius (interior only, USFWS-recommended measures), 0.7-mile radius, and 1.3-mile radius, including a description of such measures.

Under Section IV, the following should be provided--

7. Cumulative Impacts: Have cumulative effects to the NSO been adequately addressed?

Under Section V, the following should be provided--

8. A copy of the most recent NSO database inquiry and results, including the most current date and version utilized.
9. A map showing the NSO assessment area within 1.3 miles of the plan boundary.
10. A map showing nesting, roosting and foraging habitat out to 0.7 mile from the plan boundary or out to 0.25 mile for plans that will only operate in unsuitable habitat to verify placement of survey route.
11. Pre- and post-harvest habitat analysis maps for the 0.5 mile- (interior only--USFWS-recommended measures), 0.7 mile- and 1.3-mile radius circles around all known NSO ACs.
12. Tables indicating the acres of suitable pre- and post-harvest nesting, roosting and foraging habitat within the 0.5- (interior only, USFWS-recommended measures), 0.7- and 1.3-mile radius circles for each known NSO AC.
13. Survey summary sheets, including the survey date, the survey start time, the survey results, including explanation and justification for any reasonable exception to the protocols.

14. Description of the definitions used for nesting, roosting and foraging habitat (current USFWS recommended definitions, Forest Practice Rule definitions, or other).
15. A clarification of the priority ranking used relative to habitat retention areas.
16. Description of the size, shape and configuration of habitat patches.
17. For take avoidance strategies that meet or exceed the requirements of 14 CCR §§ 895.1 (habitat descriptions) and 919.9(g) [939.9(g)] (protection measures and post-harvest habitat retention levels around known ACs), but do not meet the currently recommended USFWS measures for AC protection and post-harvest habitat retention, an analysis by a qualified person, which clearly and substantively demonstrates why the proposed, site-specific protection measures and level and configuration of post-harvest habitat retention will avoid take of the NSO. This analysis will need to address how the proposal will not significantly impair or disrupt feeding, breeding, nesting, and sheltering of the NSO (please see 14 CCR § 919.10 [939.10]) and may be performed by a biologist in direct employ of the timberland owner.

Field Review

The forest practice inspector will be responsible for determining and documenting (in the pre-harvest inspection report) whether:

1. Pre- and post-harvest habitat analysis provided in the plan for ACs located on the plan and within 1.3 miles of the plan boundary is consistent with the habitat descriptions used, the level of habitat retention proposed, rules requirements and ground conditions. Tools include: a review of aerial photos, ortho-photos, Google Earth (or other available tools), and field review. The evaluation will include field review of the habitat analysis contained in the plan to:
    a. Ensure habitat definitions used in the analysis reflect ground conditions.
    b. Determine whether the retained habitat quantities described in the plan appear accurate.
    c. Evaluate the priority ranking of habitat retention areas.
    d. Assess the appropriateness of the size, shape, and configuration of habitat patches.
2. Protection measures for activity centers appear adequate and in conformance with the rules.
3. Surveys appear complete and in adherence to protocol, insofar as is possible.[1]
4. Proposed operations are in compliance with 14 CCR § 919.9(g) [939.9(g)].

Second Review & Director's Signature:

The second review team (and Director's designee for signature) will review the plan record to ensure the plan is in compliance with 14 CCR § 919.9(g) [939.9(g)] and apply the criteria identified under 14 CCR § 919.10 [939.10] to determine whether take of the NSO will be avoided.

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[1] Reference "Protocol for Surveying Proposed Management Activities That May Impact Northern Spotted Owls," Revised March 17, 1992 (Endorsed by the U.S. Fish and Wildlife Service); and "Northern Spotted Owl Survey Data Analysis," February 27, 2008 (U.S. Fish and Wildlife Service)

CAL FIRE's Use of 14 CCR § 919.9(g) [939.9(g)] in Making Northern Spotted Owl Take Avoidance Determinations

The Forest Practice Rules (FPRs) require the California Department of Forestry and Fire Protection (CAL FIRE) to disapprove any timber harvesting plan (THP) if project implementation would result in the taking of the northern spotted owl (NSO) (14 CCR § 898.2 (f)). CAL FIRE bases its determination of take avoidance on substantial evidence provided by the registered professional forester (RPF) and other sources during the review of the THP. The information on which CAL FIRE bases its determination comes in the form of one of the six alternatives contained in 14 CCR § 919.9(a)-(g) [939.9(a)-(g)].

14 CCR § 919.9(g) [939.9(g)] is meant to be used where an NSO nest site or activity center has been located within the THP boundary or within 1.3 miles of that boundary. When the Board of Forestry and Fire Protection (BOF) adopted the NSO-related FPRs, 14 CCR § 919.9(g) [939.9(g)] gave THP submitters a performance standard to apply to known owl sites. BOF records note:

> The performance standards are based on the current [U. S.] F[ish and] W[ildlife] S[ervice] guidelines regarding their authoritative position on the adequate level of protection which must be afforded a known site. (Page 9, Final Statement of Reasons, BOF Rulemaking File #135)

Thus, authoritative biological expertise is built into the measures contained in 14 CCR § 919.9(g) [939.9(g)] and, when applied to a known NSO nest or activity center, are supposed to ensure avoidance of take. This built-in biological expertise should allow the RPF to apply the protection measures and post-harvest habitat retention levels prescribed in 14 CCR § 919.9(g) [939.9(g)] to known sites and avoid take. Therefore, individual review of such proposals by either the U. S. Fish and Wildlife Service (USFWS) or the California Department of Fish and Game (DFG) is not necessary, because of the inherent biological surety built into the protection measures and habitat retention levels contained in the rule.

In addition, 14 CCR § 919.10 [939.10] requires CAL FIRE to evaluate the information provided per 14 CCR § 919.9(g) [939.9(g)] to determine if "harm" or "harassment," the primary actions associated with timber operations that may result in take of the NSO, may occur. "Harm" may occur when timber operations adversely modify NSO habitat, and "harassment" may occur when timber operations significantly disrupt essential NSO life processes. Given that the measures contained in 14 CCR § 919.9(g) [939.9(g)] are based on USFWS guidelines regarding adequate protection for a known site against harm and harassment, as long as CAL FIRE is able to verify the location of any known NSO site, ensure the prescribed measures are adequately applied and post-harvest habitat retention should be achieved, then take of the NSO should be avoided.

However, since the adoption of the NSO-related FPRs in the early 1990s, USFWS has indicated that use of the measures contained in 14 CCR § 919.9(g) [939.9(g)] may not

always ensure avoidance of take of the NSO based upon more recent input by spotted owl researchers. USFWS notes:

> …use of [California] W[ildlife] H[abitat] Relationship[s] habitat definitions in the FPRs is unlikely to avoid take. This is because the WHR types considered to be NSO habitat (4M & 4D) are widely variable, and at the lower end of size class/density are typically poor habitat or non-habitat. 4M and 4D MAY be NSO habitat, but also may not. If no evaluation is made as to the ACTUAL stand characteristics, a large overestimation of available habitat may occur, harvest of "excess" habitat is permitted, and functional habitat is reduced to the point that take is likely. In addition, harvest within 4D and 4M stands typically reduces habitat quality significantly, sometimes to the point where take is likely, even when the post-harvest structure still meets 4M or 4D criteria. (1-24-2008 Email from USFWS' Brian Woodbridge to CAL FIRE's Chris Browder)

Relative to the coastal portion of the range in California USFWS notes:

> 919.9,939.9(g)(1) Within 500 ft. of the active nest site or pair activity center the characteristics of functional nesting habitat must be maintained. No timber operations shall be conducted in this area during the breeding season unless reviewed by the Department of Fish and Game and approved by the Director as not constituting a take. Timber operations may be conducted in this area outside the breeding season if appropriate measures are taken to protect nesting habitat.
>
> First of all, "active nest site or pair activity center" is not inclusive enough to apply to all the sites entitled to protection under the [Federal] E[ndangered]S[pecies [A[ct]. But aside from that, this rule is way too vague. "Timber operations" refers to everything involved in a logging operation up to and including the removal of trees. When "timber operations" refers only to hauling on public roads, (g) is more restrictive than necessary to avoid take. I have often considered timber operations/hauling during the breeding season to be not likely to result in take even when within 500 feet of mainline, open year-round, public roads. Highway 20 is a good example of where this rule is impossible to enforce or be applicable.
>
> Of course, "timber operations" also refers to the removal of trees. Given the very wide variety of conditions in which spotted owl nests are found, I don't even bother to try to define "nesting habitat". It is virtually impossible for anyone to say exactly what characteristics of the habitat within 500 feet of an activity center the owls keyed in on when selecting the nest site. How then can an RPF, the DFG, the Director, or the Service for that matter determine what measures are appropriate to adopt to protect nesting habitat other than to prohibit tree removal? The Eureka office of the DFG recognized this over 10 years ago when in a Memorandum dated 6/20/98 their instructions to all PCBs included the harvest restriction within the 500 ft. radius of a tree containing an NSO nest. This document contains what became known as the "standard protection measures"

that are still in use today. I'd be happy to provide a copy of this document at your request.

919.9,939.9(g)(2) Within 500-1,000 ft. of the active nest site or a pair activity center, retain sufficient functional characteristics to support roosting and provide protection from predation and storms.

Again, besides not being inclusive enough to include all activity centers entitled to protection, this rule asks a non-biologist, the RPF, to determine what is sufficient in terms of functional characteristics to be provided post harvest. It does not even suggest the DFG or the Director need approve what the RPF considers "sufficient". Also, the rule does not take into consideration 1,000 foot circles that are shared by two adjoining landowners, and as the review process does not utilize any information from one landowner's plan to the next, it is quite possible you could have two unqualified RPFs making independent determinations regarding what is sufficient to retain within a single roost zone, and CAL FIRE would have no idea that half of the roost zone had already been reduced to the first RPF's idea of what is sufficient when it approves the second. Furthermore, considering the habitat fragmentation that has resulted from many decades of timber management, nest trees are often found nearer than 1,000 feet to the edge of blocks of habitat. With no requirement that the 1,000 foot circle contain even a minimum amount of habitat described in the rules as roosting prior to proposing operations within the circle, this rule could very easily result in the only actual roosting habitat contiguous with the nest tree being reduced to some RPFs idea of minimum functionality without benefit of review by DFG, the Director, or anyone else besides CAL FIRE. Highly possible that the removal of habitat necessary to provide sheltering would occur.

919.9,939.9(g)(3) 500 acres of owl habitat must be provided within a 0.7 mile radius of the active nest site or pair activity center, unless an alternative is reviewed by the Department of Fish and Game and approved by the Director as not constituting a take....

Again, besides not being inclusive enough to include all activity centers entitled to protection, this rule ignores the well documented fact (Zabel et. al., 2001, and subsequent publications by many of the same authors) that spotted owl territories require a combination of habitat types to provide habitat for breeding, feeding, and sheltering, be functional and retain occupancy. This rule would allow nearly 50% of the habitat within the entire 995 acre/0.7 mile circle to be removed completely, and the other 50% to be reduced to the lowest possible habitat quality still considered suitable, outside the 1,000 foot circle. I doubt that there is a single piece of peer reviewed literature anywhere that concludes that a landscape reduced to the minimums allowed by this rule provides enough of a variety of habitat types to sustain spotted owls. And lastly, on what would the DFG or the Director base a decision that not even retaining 500 acres of the worst possible

quality habitat within 0.7 mile of an activity center would not constitute a take? (4-3-2009 Email from USFWS' Ken Hoffman to CAL FIRE's Chris Browder)

Relative to the interior portion of the range in California USFWS notes:

Possibly the best way for me to begin a discussion of the Service's evaluation of the FPRs for northern spotted owls (NSO) is to strengthen the language you've used ("may not avoid take") to pose the question. Service staff in the Yreka Fish and Wildlife Office believe that application of the FPRs *typically does not* avoid or reduce the likelihood of take of NSO. This is because the habitat definitions and retention standards in the FPRs represent minimum values that are below the habitat parameters associated with reasonable levels of territory occupancy, survival, and reproduction by NSO. In our experience, "take avoidance" has been accomplished through technical assistance, which ensured that the actual quality and quantity of habitat retained in a THP was indeed adequate.

The draft report "Regulatory and Scientific Basis for U.S. Fish and Wildlife Service Guidance for Evaluation of Take for Northern Spotted Owls on Private Timberlands in California's Northern Interior Region" is in final review stage. This will provide detailed support for the conclusions I describe below.

Below I've inserted brief paragraphs (in bold) following the portions of the rules in question. My comments are in addition to those already provided by Ken Hoffman.

895.1 Definitions

Functional Foraging Habitat is dependent upon the presence and availability of prey on the forest floor or in the canopy; presence of accessible perching limbs; and adjacency to stands with canopy closures >40%. Average stem diameter is usually >6" D.B.H. for hardwoods and >11" D.B.H. for conifers among dominants, and codominants, and the total overhead canopy closure, including intermediate trees is at least 40%. Where overall canopy closure is >80%, foraging habitat is limited to areas with ample flight space below limbs and among stems. Foraging habitat in smaller size classes and lower percentage canopy closures must be justified by local information.

Functional Nesting Habitat means habitat with a dominant and codominant tree canopy closure of at least 40% and a total canopy (including dominant, codominant, and intermediates) of at least 60%. Usually the stand is distinctly multi-layered with an average stem diameter in dominant, and codominant conifers, and hardwoods >11" D.B.H. The stand usually consists of several tree species (including hardwoods) of mixed sizes. All nests, snags, down logs, and decadent trees shall also be considered as part of the habitat. Nesting substrates are provided by broken tops, cavities, or platforms such as those created by a hawk or squirrel nest, mistletoe broom, or accumulated debris. Owls are known

to occasionally nest in less than optimal habitat. Nesting areas may also be associated with characteristics of topographic relief and aspect which alter microclimates.

Functional Roosting Habitat during the territorial breeding season, consists of stands where average stem diameter is >11" D.B.H. among dominant and codominant trees. Hardwood and conifers provide an average of at least 40% canopy closure but the stand can have a high degree of variability. Stand size and configuration must be sufficient to provide multiple perch sites which are suitable for protection from various environmental conditions, including wind, heat, and precipitation.

The habitat definitions contained in 895.1 describe habitats typically considered unsuitable, or at best represent bare minimum conditions. Take may easily occur as repeated harvest entries reduce stand structure from whatever the owls originally occupied to the uniformly low values allowed under the Rules. For example, Functional Nesting Habitat is defined essentially as 4M/D or greater; however virtually all NSO research describes nesting habitat as consisting of stands of much larger trees, with nest sites associated with very dense clumps. The description of Functional Foraging Habitat suffers the same problem. In our review/assessment of NSO habitat relationships in the Interior zone, were unable to find any support for significant NSO use of habitat conditions allowed under the definitions in 895.1.

919.9, 939.9 Northern Spotted Owl

(g) Where a nest site or activity center has been located within the THP boundary or within 1.3 miles of that boundary, the RPF shall determine and document that the habitat described in (1)-(5) below will be retained after the proposed operations are completed:

(1) Within 500 ft. of the active nest site or pair activity center the characteristics of functional nesting habitat must be maintained. No timber operations shall be conducted in this area during the breeding season unless reviewed by the Department of Fish and Game and approved by the Director as not constituting a take. Timber operations may be conducted in this area outside the breeding season if appropriate measures are adopted to protect nesting habitat.

(2) Within 500-1000 ft. of the active nest site or pair activity center, retain sufficient functional characteristics to support roosting and provide protection from predation and storms.

There is strong evidence that habitat modification within the critical nesting core area is likely to result in take – this is partially the result of the low habitat quality allowed under the Rules (see comment above), but also because the actual habitat features selected by a given pair of NSO are unknown and likely associated with features such as dense clumps, deformed

trees, shading, aspect, water..etc that in combination form a nest site. Timber harvest typically disrupts, modifies, and removes these elements.

(3) 500 acres of owl habitat must be provided within a .7 mile radius of the active nest site or pair activity center, unless an alternative is reviewed by the Department of Fish and Game and approved by the Director as not constituting a take. The 500 acres includes the habitat retained in subsections (1) and (2) above and should be as contiguous as possible. Less than 50% of the retained habitat should be under operation in any one year, unless reviewed by the Department of Fish and Game and approved by the Director.

Studies of NSO territory occupancy and fitness relative to habitat quality and quantity strongly indicate that in the Interior zone, NSO rely on functional (= high quality) habitat at much larger scales than described in the Rules. The small patches of habitat within 500 – 1000' buffers (even if maintained well above the minimum "suitable habitat" definition) are much less than the 200-300-acre core areas associated with continued occupancy and reproduction by NSO. NSO nesting core areas often consist of multiple nest sites within a cluster of stands…not just one.

The 500 acre/0.7 mile COULD be an effective standard for take avoidance IF the retention acres were clumped closest to the nest and consisted of a balance of high-quality habitat. As written, however, 919.9(g)(3) allows harvest of virtually the entire core area down to unsuitable conditions.

(4) 1336 total acres of owl habitat must be provided 1.3 miles of each nest site or pair activity center, unless an alternative is reviewed by the Department of Fish and Game and approved by the Director as not constituting a take. The 1336 acres includes the habitat retained within subsections (1) - (3) above.

The buffer size and number of acres to be retained under 919(g)(4) are adequate. The problem here, as with (g)(3), is the poor quality habitat allowed under the definitions.

(5) The shape of the areas established pursuant to subsections (1) and (2) shall be adjusted to conform to natural landscape attributes such as draws and streamcourses while retaining the total area required within subsections (1) and (2) above.

This could be described as getting at the abiotic considerations in the FWS guidelines. Research on foraging behavior and nest-site selection demonstrate that NSO are strongly associated with landscape features such as lower slopes and stream courses The FPRs do not require any consideration of the spatial distribution of retained habitat; enabling harvest operations to occur in preferred areas where effects to NSO are relatively greater than, for example, upper slopes. (4-22-2009 Email from USFWS' Brian Woodbridge to CAL FIRE's Chris Browder)

In order to provide CAL FIRE with up-to-date guidance on how to avoid take of the NSO associated with timber operations, USFWS developed take avoidance scenarios and associated protection measures and post-harvest habitat retention levels. These are contained in USFWS documents entitled, "*Northern Spotted Owl Take Avoidance*

Scenarios," "*Attachment A: Take Avoidance Analysis-Coast*" and "*Attachment B: Take Avoidance Analysis-Interior*" (http://www.fire.ca.gov/resource_mgt/downloads/Revised%20USFWS%20Attachement%20B%20NSO%20Take%20Avoidance%20Analysis--%20Interior%202-27-08.pdf, http://www.fire.ca.gov/resource_mgt/downloads/U.S.%20Fish%20and%20Wildlife%20Service%20Review%20of%20THPs%20and%20NTMPs,%20Transition%20Documents%202-1-08.pdf and http://www.fire.ca.gov/resource_mgt/downloads/Revised%20USFWS%20Attachement%20A%20NSO%20Take%20Avoidance%20Analysis--%20Coast%202-27-08.pdf). The documents (USFWS guidelines) are meant to be used by CAL FIRE THP reviewers when assessing NSO take avoidance proposals, and by RPFs in designing NSO take avoidance strategies for inclusion in THPs. The USFWS documents indicate, in part:

> The following describes how the Fish and Wildlife Service determines whether take is likely to occur for spotted owls. While we believe this is the most effective manner in avoiding take, it is likely not the only manner in which take can be avoided. The [USFWS guidelines] are recommended tools to avoid take, but are not required approaches imposed by the Fish and Wildlife Service.

Clarifying the use of the take avoidance scenarios, USFWS notes:

> The guidelines describe how the U. S. Fish and Wildlife Service (Service) determines when take is likely at a course *[sic]* scale. That is, without any site-specific information, the guidelines outline the general methods that the Service employs to determine if take is likely. As stated in the guidelines, "while we believe [the guidelines are] the most effective manner in avoiding take, it is likely not the only manner in which take can be avoided."
>
> In years past, it was commonplace for our biologists to travel to the THP site and assess the habitat, conditions, local climate, habitat edge, and many other site-specific factors that aided in determining if take would be likely. We encourage your staff to adopt a similar approach in assessing THPs, as there are many instances when site-specific conditions provide insights that the guidelines cannot capture by virtue of their broad nature in describing the likelihood of take. The guidelines were not intended to be a hard rule for when take is likely; they simply describe how we evaluated the likelihood of take in a general manner.
>
> We encourage your staff to assess each THP in light of site-specific conditions and under the broader context of the guidelines we provided. (5-22-2008 letter from USFWS' Darrin Thome to CAL FIRE's Ruben Grijalva, http://www.fire.ca.gov/resource_mgt/downloads/USFWS%20Letter%20Regarding%20Clarification%20of%20Guidelines%20for%20Review%20of%20THPs%205-22-08.pdf)

Based on the guidelines and the subsequent clarification, CAL FIRE encourages RPFs proposing timber operations within the NSO evaluation area (synonymous with the range

of the NSO), or within 1.3 miles of a known NSO activity center outside of the NSO evaluation area, to adhere to the USFWS guidelines where possible. This is due to the USFWS' observation that following its guidelines "is the most effective manner in avoiding take." As stated, CAL FIRE recommends use of the USFWS guidelines, but, consistent with USFWS' statement that its guidelines are "likely not the only manner in which take can be avoided," CAL FIRE allows plan submitters to propose different NSO take avoidance strategies.

For those THP submitters that propose something different than the USFWS guidelines, CAL FIRE requires them to meet or exceed the minimum standards contained in 14 CCR § 919.9(g) [939.9(g)] and provide a site-specific analysis explaining how deviation from the USFWS Guidelines will still ensure take avoidance. This analysis must be performed by a qualified person and must clearly and substantively demonstrate why the proposed, site-specific protection measures and level and configuration of post-harvest habitat retention should avoid take of the NSO. This analysis has to address how the proposal should not significantly impair or disrupt feeding, breeding, nesting, and sheltering of the NSO. CAL FIRE believes that this approach is consistent with USFWS observations about the need to evaluate the actual timber stand characteristics and to assess each THP in light of site-specific conditions. This approach takes into account USFWS' observations that use of the measures contained in 14 CCR § 919.9(g) [939.9(g)] may not always ensure avoidance of take of the NSO and that its guidelines are "likely not the only manner in which can be avoided" and should not be viewed as regulation.

CAL FIRE believes that this approach is consistent with the requirements of the California Environmental Quality Act (CEQA). USFWS has presented a fair argument, based on substantial evidence, that use of the standards contained in the FPRs may not always avoid take of the NSO. CAL FIRE views this fair argument as applying to all THPs within the range of the NSO. Thus, CAL FIRE needs substantial evidence in the plan record that take of NSO has been avoided (PRC § 21081(a), 14 CCR §§ 15065(a)(1), 15091(a)(1) and (b)). By requiring THP submitters who propose deviations from the most recent guidance provided to CAL FIRE by USFWS to provide a site-specific data and analysis performed by a qualified person, CAL FIRE ensures that its decision is based on substantial evidence in light of the whole record.

The process that CAL FIRE goes through to determine that take of the NSO should be avoided is similar to that currently used by USFWS and private biologists. Details of the general process that CAL FIRE uses on THPs that propose to avoid take using 14 CCR § 919.9(g) [939.9(g)] is described in the July 7, 2008 CAL FIRE "*Evaluation Process for Northern Spotted Owl Information to Determine Compliance with 14 CCR §§ 919.9(g) [939.9(g)] and 919.10 [939.10]*" memorandum (http://www.fire.ca.gov/resource_mgt/downloads/Evaluation%20Process%20for%20NSO%20Info%20to%20Determine%20Compliance%20919.9(g)%20and%20919.10.pdf).

The process generally consists of:

a. Establishing historic activity center locations: CAL FIRE uses the DFG NSO database reports 1, 2 and 3 to identify activity centers on, and within 1.3 miles of, the plan area that require protection measures or habitat retention or both.

b. Assessing historic activity center habitat and protection measures:
   i. For activity centers (AC) located on the THP area, CAL FIRE evaluates each AC to ensure sufficient habitat is retained post harvest and appropriate protection measures are applied.
   ii. For activity centers located within 1.3 miles of the plan area (but not within the plan area), CAL FIRE evaluates each AC to ensure sufficient habitat is retained.

c. Confirming activity center locations and establishing new activity centers:
   i. CAL FIRE evaluates the most current year's survey results using the 3/17/92 "*Protocol for Surveying Proposed Management Activities that May Impact Northern Spotted Owls*" and any applicable USFWS technical assistance pertaining to survey protocol to confirm or change historic activity center locations and establish new activity centers.
   ii. If activity center locations change or new activity centers are identified, CAL FIRE requires the plan submitter to change the plan to reflect the new location(s) and apply necessary protection measures and retain sufficient habitat.

CAL FIRE uses the general process described above whether a THP submitter chooses to address the NSO using the protection measures and habitat retention levels recommended by USFWS or contained in the FPRs.

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Attachment B: Take Avoidance Analysis-Interior

I. Accuracy of NSO activity center location and status

1) Location
    a. Confirm plotted activity center location accuracy
        i. CDFG Reports 2 and 3
        ii. Data from adjacent landowners
        iii. Recent surveys
    b. Document deviations from CDFG locations
    c. Update habitat analysis maps as necessary
2) Status
    a. Valid site
        i. Review page 11 of protocol to determine
        ii. If not valid, report to CDFG for inclusion in next database update
    b. Current occupancy status
    c. Current reproductive status, if determined

II. Survey Effort

1) Coverage
    a. Surveys of nesting/roosting habitat out to 0.7 miles from THP boundary
        i. Use THP habitat map(s) to verify
2) Protocol survey
    a. Time of day
    b. Spacing between visits
    c. Number of surveys
    d. Survey dates
    e. Time spent at each call point
3) Follow up visit(s)
    a. Confirm that the area searched covers suitable habitat within response location/last known location within a logical distance.
    b. Time of follow up and duration of follow up
    c. Additional night surveys
        i. Review page 10 of protocol

III. Habitat

1) Typing
    a. Verify habitat typing with aerial photos, equivalent imagery, or field visits
    b. Changes to typing need to be reflected in the NSO habitat acres table and habitat analysis maps
    c. Post harvest typing

i. Post-harvest habitat typing must agree with the silviculture prescription

2) Definitions
   a. Nesting/roosting
      i. High Quality Nesting/roosting Habitat
         1. Basal Area = 210+ square feet, **and**
         2. ≥ 15" quadratic mean diameter (QMD) , **and**
         3. ≥ 8 trees per acre (TPA) of trees ≥ 26" in diameter at breast height (DBH) , **and**
         4. ≥ 60% canopy closure
      ii. Nesting/roosting Habitat
         1. A mix of basal areas ranging from 150-180+ square feet, **and**
         2. ≥ 15" QMD, **and**
         3. ≥ 8 TPA of trees ≥ 26" DBH, **and**
         4. ≥ 60% canopy closure
   b. Foraging
      i. Foraging Habitat
         1. A mix of basal areas ranging from 120-180+ square feet, **and**
         2. ≥ 13" QMD, **and**
         3. ≥ 5 TPA of trees ≥ 26" DBH, **and**
         4. A mix of ≥ 40%-100% canopy closure
      ii. Low Quality Foraging Habitat
         1. A mix of basal areas ranging from 80-120+ square feet, **and**
         2. ≥ 11" QMD, **and**
         3. ≥ 40% canopy closure

3) Quantities
   a. Within 1000 feet of activity center
      i. Outside breeding season (September 1 through January 31): no timber operations other than use of existing roads
      ii. During the breeding season (February 1 through August 31): no timber operations other than the use of existing, permanent, year-round roads

   b. Within 0.5 mile radius (502 acres) centered on activity center
      i. Retention of habitat should follow Section III. 4 of this document
      ii. At least 250 acres nesting/roosting habitat present, as follows:
         1. 100 acres High Quality Nesting/roosting Habitat, **and**
         2. 150 acres Nesting/roosting Habitat

      –AND–

      iii. At least 150 acres foraging habitat must be present, as follows:
         1. 100 acres Foraging Habitat, **and**
         2. 50 acres Low Quality Foraging Habitat
      iv. No more than 1/3 of the remaining suitable habitat may be harvested during the life of the THP

   c. Between 0.5 mile radius and 1.3 miles radius circles centered on activity center

i. Retention of habitat should follow Section III. 4 of this document
ii. ≥935 acres suitable habitat must be present, as follows:
    1. At least 655 acres Foraging Habitat, **and**
    2. At least 280 acres Low Quality Foraging, **and**
    3. No more than 1/3 of the remaining suitable habitat may be harvested during the life of the THP

4) Applying Habitat Definitions to Forest Stands
    a. Because the structural characteristics of forest stands used by Northern Spotted Owls are heterogeneous, management based on average values is unlikely to retain habitat suitability. For this reason, the habitat definitions provided under Section III.2.a and b. (above) are intended for application at the scale of roughly 20 acres (may be somewhat more or less depending on plot density or measurement technique). This means that within any given 20-acre area intended to serve as Nesting/Roosting or Foraging habitat, the values for QMD, basal area, TPA, and canopy closure should be variable, but stand averages should follow the standards provided under each habitat definition. Where ranges of values are provided (e.g. 150-180 ft^2 basal area), this means that the mean values can vary across the many 20-acre areas that make up a spotted owl core area and home range. It is important to recognize habitat quality will be compromised by timber harvesting that moves stand parameters towards uniformly low average values for stand density and tree size, even during multiple entries. This is particularly true at spotted owl territories with low (at or below quantities in Section III.3.a-c) amounts of habitat; in these cases the highest-quality habitat available should be identified and retained before treatment of other suitable habitat is considered.

5) Priority Ranking of Habitat Retention Acres
    d. Tree species composition
        i. Mixed conifer stands should be selected over pine dominated stands
    e. Abiotic considerations
        i. Distance to nest
            1. Nesting/roosting and foraging habitat closest to identified nest trees, or roosting trees if no nest trees identified
        ii. Contiguous
            1. Nesting/roosting habitat within the 0.5 mile radius must be as contiguous as possible
            2. Minimize fragmentation of foraging habitat as much as possible
        iii. Slope position
            1. Habitats located on the lower 1/3 of slopes provide optimal micro-climate conditions and an increased potential for intermittent or year-round water sources
        iv. Aspect
            1. Habitats located on northerly aspects provide optimal vegetation composition and cooler site conditions

v. Elevation
   1. Habitat should be at elevations of less than 6000 feet, though the elevation of some activity centers (primarily east of Interstate 5) may necessitate inclusion of habitat at elevations greater than 6000 feet.

6) Size and Shape of Habitat Patch
   a. Narrow strips of habitat (WLPZs, retention areas between clearcuts, etc.) may contain the characteristics of nesting/roosting habitat. However, when these narrow strips of habitat are surrounded by unsuitable or low quality habitats, they function as foraging habitat at best.
   b. Narrow strips of habitat (100m or less), provide for a lot of edge habitat and little to no interior habitat. Franklin et al (2000) describe interior habitats as the amount of spotted owl habitat ≥100m from an edge. They describe edge habitat as edge between spotted owl habitat and all other vegetation types.
   c. Because WLPZs, for example, are 100m or less in total width, they are considered edge habitats if surrounded by unsuitable habitat. Edge habitats do not provide for protection from predators nor do they provide the microclimates of interior habitats.

IV. Determination

1) If surveys are inadequate or do not meet the intent of protocol, take determination may not be possible.
2) If habitat typing is inadequate, take determination may not be possible.
3) If NSO home range habitat acres are below desired conditions (Section III. 2, 3, and 4), additional loss of suitable habitat can lead to take.
4) If NSOs are nesting, utilize seasonal restriction for all timber operations within 0.25 mile of nest (February 1 through August 31).
5) If effects are limited to noise disturbance (e.g., no suitable habitat in harvest units, but suitable habitat within 0.25 mile of units), a modified seasonal restriction may be used from February 1 through July 9
   a. Seasonal restriction applies to unsurveyed suitable habitat within 0.25 mile of unit boundary.
   b. If protocol surveys were conducted **and** did not detect reproductive NSOs, seasonal restrictions not warranted.
6) Multiple THPs located within a given NSO territory need to be considered collectively or a take determination may not be possible.

V. TA Letter Contents

1) Date of written TA request
2) Date request received
3) Note if previous TA(s) provided in past
4) Number of acres within THP units
5) Amounts and types of silviculture prescriptions

6) Location of THP
    a. Township, Range, and Section
    b. Meridian
    c. County
7) Identify NSO activity centers returned by CDFG reports
8) Surveys conducted and activity center status
9) Logic behind take determination
    a. Habitat considerations
        i. Acres, quality, and location of suitable habitat pre- and post-harvest
        ii. Effects of timber operations on suitable habitat
            1. Degrade: suitable habitat is harvested but still functions in the capacity it did pre-harvest (i.e. Foraging habitat before harvest functions as foraging habitat post-harvest, nesting/roosting habitat pre-harvest functions as nesting/roosting habitat post-harvest)
            2. Downgrade: pre-harvest nesting/roosting habitat becomes foraging habitat post-harvest
            3. Remove: nesting/roosting or foraging habitat is harvested such that it no longer functions as habitat post-harvest
    b. Proximity of activity center to operations
    c. Survey data
10) Sunset date and seasonal restrictions
    a. If 2 year protocol and surveys are current and negative, additional TA needed if operations not completed by February 1, *YEAR* (review protocol page 3).
    b. If 1 year protocol and surveys are current and negative, additional TA needed if operations not completed by February 1, *YEAR* (review protocol page 3).
    d. If NSOs detected in previous surveys and operations are not complete before February 1, surveys are required to determine location and status of NSOs prior to operations during each breeding season that operations are ongoing.
    e. If no owls within 1.3 miles of THP (CDFG reports), no suitable habitat within units, **and** no suitable habitat within 0.25 mile of units, additional technical assistance may not be required.
11) Name of agency person to contact if there questions regarding TA

Literature Cited

Franklin, A., D. Anderson, R. Gutierrez, and K. Burnham. 2000. Climate, Habitat Quality, and Fitness in Northern Spotted Owl Populations in Northwestern California. *Ecological Monographs,* 70(4), pp. 539-590

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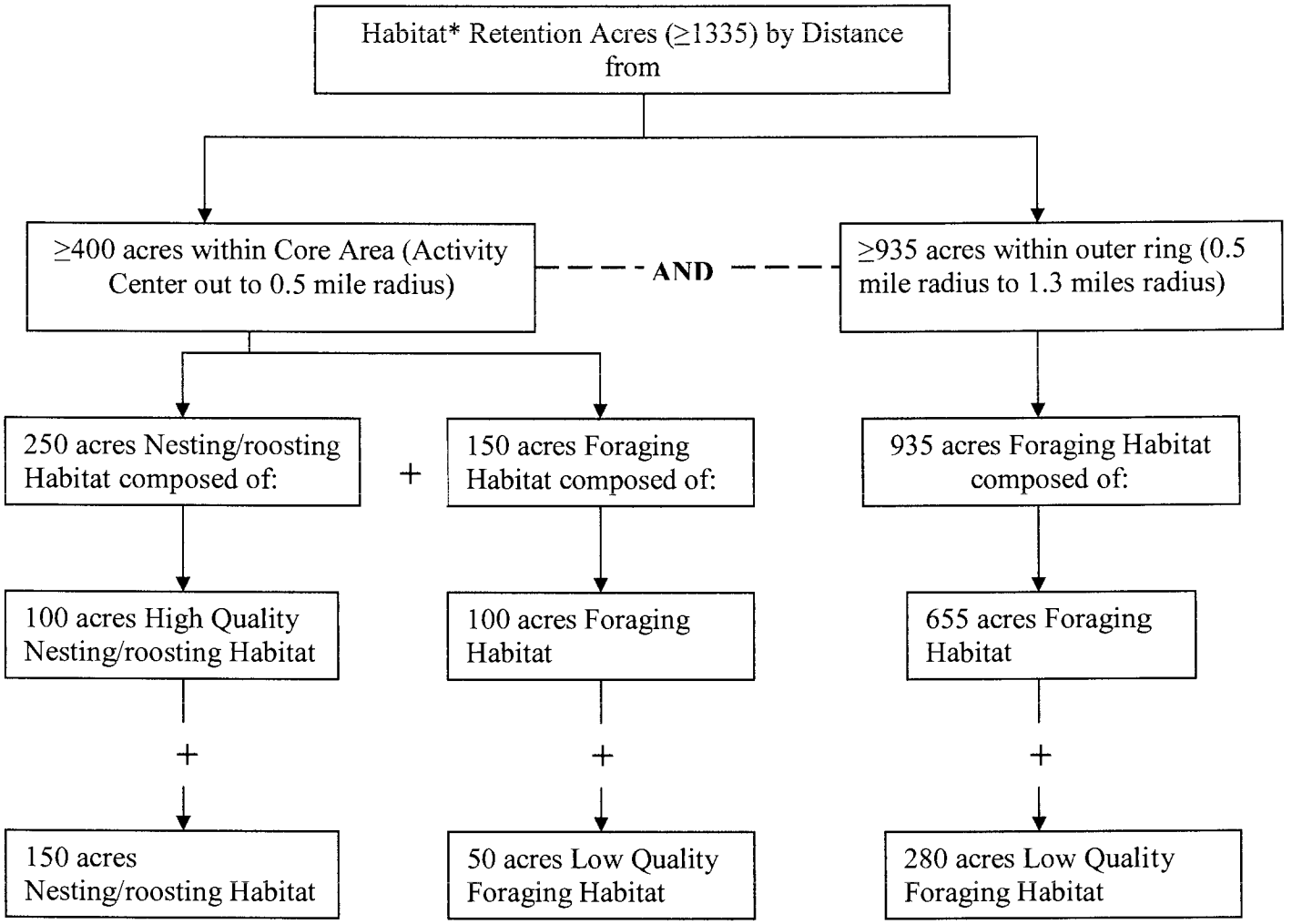

*See Section III.2 for habitat definitions

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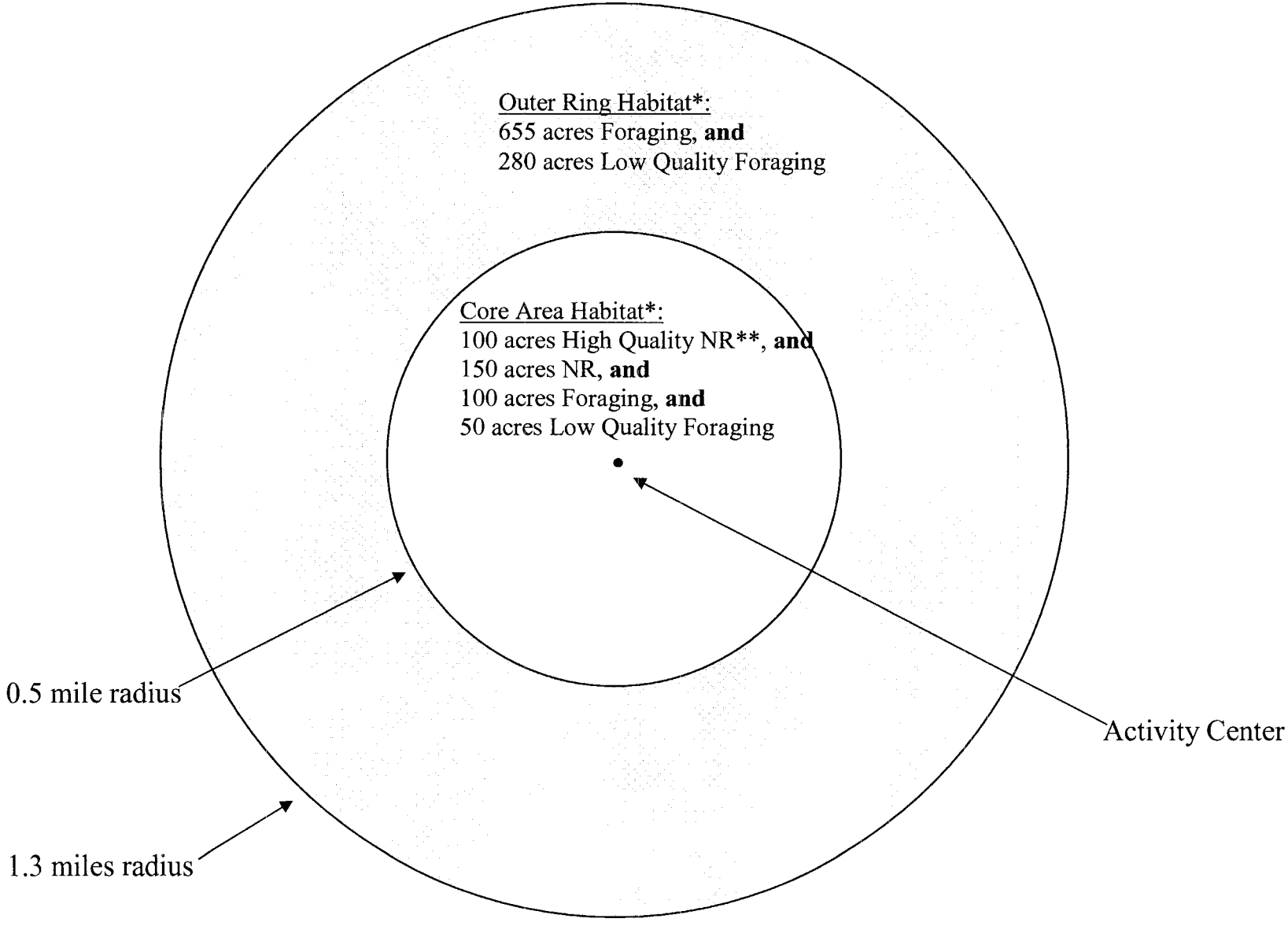
Habitat Retention within Core Area and 1.3 mile Home Range–Interior



*See Section III.2 for habitat definitions
**NR = Nesting/roosting

Regulatory and Scientific Basis for U.S. Fish and Wildlife Service Guidance for Evaluation of Take for Northern Spotted Owls on Private Timberlands in California's Northern Interior Region

Introduction

Section I: Regulatory and operational aspects of take evaluation guidelines
A. – Regulation and definition of "take" under Endangered Species Act
Regulatory authority
Regulatory definition of take
Process for estimating the likelihood of incidental take and establishing habitat retention guidelines
B. – Evidence indicating that regulatory guidance in the current Forest Practice Rules are not adequate to avoid incidental take of northern spotted owls
New information available
FWS experience in technical assistance process
Analysis indicating loss of territories under Forest Practice Rules

Section II: Summary of the FWS take evaluation guidelines

Section III: Scientific basis for NSO take evaluation guidelines
A. – Fundamentals of northern spotted owl habitat relationships
B. – Analysis areas
Home range
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C. –Quantity, distribution, and configuration of habitat
Home range
Core area
D. – Habitat definitions
Nesting/roosting habitat
Foraging habitat
Abiotic habitat characteristics
E. – Conclusions

Introduction

In 1999, the California Department of Forestry and Fire Protection (CALFIRE) requested that the U.S. Fish and Wildlife Service (FWS) review timber harvest plans (THP) and Non-industrial Timber Management Plans to ensure that such plans would not result in incidental take of northern spotted owls (NSO). For nearly a decade, the FWS

provided this technical assistance. At first, the criteria and thresholds employed by the FWS to make our take evaluations were based on habitat retention regulations in the California Forest Practice Rules (Title 14, California Code of Regulations) (FPRs), which were originally developed collaboratively by the FWS, California Department of Fish and Game (CDFG), CALFIRE, and the California Board of Forestry. However, as knowledge of the habitat relationships of this species increased after 1992, the FWS increasingly made use of new scientific information to guide our evaluations of the potential for incidental take. The accumulation of published research results, combined with direct field experience with management of NSO and their habitat, resulted in substantial changes in the quantity and quality of habitat the FWS considered necessary to maintain continued occupancy and reproduction at NSO territories.

In 2008, the FWS returned responsibility for THP review to CALFIRE, the authorized agency under the California Environmental Quality Act. As a part of this transfer, the FWS provided CALFIRE with documentation of the criteria and thresholds currently used by the FWS in making take evaluations. This documentation, hereafter called the FWS guidelines, represents the best scientific information available to the FWS upon which to base evaluations of the likelihood of incidental take resulting from timber harvest operations in the Northern Interior Region. The FWS guidelines are not regulations and are not intended to substitute for regulations; they do, however, provide the scientific and biological foundation for reviewing proposed projects and determining the likelihood of incidental take of NSO. In this report, we provide the scientific basis for the FWS guidelines.

The habitat descriptions within the FWS guidelines were developed to enable CALFIRE personnel (who may not have extensive experience with NSO biology and habitat associations) to evaluate the likelihood of take posed by a proposed THP. This process contrasts with the technical assistance process formerly conducted by the FWS, wherein NSO experts conducted detailed evaluations of stand structure, habitat quantities, and NSO survey results to support a determination of the likelihood of take. While the FWS believes that expert review should play a central role in these evaluations, it is also true that robust habitat retention guidelines may be used to avoid take. Application of habitat retention guidelines in the absence of expert review, however, may limit managers' flexibility to classify habitat based on specific local conditions and to design harvest proposals based on these conditions.

Evaluation of the scientific bases of the FWS guidelines for NSO in the Interior Region of California (Klamath Province) is dependant on understanding the concept and regulatory definition of take, the practical and operational considerations of determining the likelihood of take, and the information supporting our conclusion that existing habitat guidelines in the FPRs are not sufficient for avoiding take. It is also important to recognize the difference between the use of habitat guidelines in the determination of take versus descriptions of desired habitat conditions for conservation of NSO.

Section I: Regulatory and operational aspects of take evaluation guidelines

A. Regulation and definition of take under Endangered Species Act

Regulatory Authority

Section 9(a)(B) of the Endangered Species Act of 1973 (ESA) prohibits the take of listed species within the United States, except as provided in section 10 of the ESA, which allows for permitted incidental take on private lands. Section 9 is intended to protect individual members of listed species.

Regulatory definition of take

The ESA defines "take" as "…to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct." The term "harm" is further defined in 50 CFR 17.3:

> "Harm" in the definition of "take" in the Act means an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering.

Process for estimating the likelihood of incidental take and establishing habitat retention guidelines

Although the regulatory definition of take clearly expresses the intent of the ESA's Section 9, it does not provide any metrics or criteria upon which a determination of take should be made. Because our reviews of proposed projects under section 9 are

typically conducted prior to project implementation, our determination is an estimate of the likelihood of take, based on the predicted effects of the project. Habitat retention guidelines such as those in the FPRs are intended to provide guidance as to the amount and quality of habitat that must be retained in order to avoid incidental take of NSO at sites where the species is known to occur. When the FPR guidelines were adopted in 1992, data relating habitat variables to occupancy, reproduction, and survival of NSO were limited. The FPR guidelines for avoiding incidental take of NSO were therefore based on comparison of proposed post-harvest habitat conditions with the amount and quality of habitat observed at occupied NSO sites described in various studies. Under this standard, habitat modification potentially could result in substantial reduction of reproduction, survival, and occupancy at NSO activity centers without the appearance of take, because habitat conditions still resemble other lower-quality NSO territories. NSO are known to occupy low-quality sites where their reproduction and survival are substantially reduced (Franklin *et al*. 2000, Dugger *et al.* 2005); the existence of these low-quality sites suggests that reliance on habitat conditions corresponding to the presence or absence of owls at historic territories represents a low bar for determining habitat thresholds and take.

Recent results from demographic studies of NSO in the Klamath Province provide new insights into the relationships between habitat and NSO population rates (e.g., occupancy, reproduction, and survival). By developing predictive models of these relationships, Franklin *et al*. (2000) and Dugger *et al*. (2005) introduce the concept of habitat fitness potential (HFP); "the fitness conferred on an individual occupying a territory of certain habitat characteristics" (Franklin *et al.* 2000:558). Habitat fitness

potential is a function of both the survival and reproduction of individuals within a given territory. Evaluation of habitat parameters influencing these rates provides a more rigorous measure of "significant impairment of essential behavioral patterns such as breeding, feeding, or sheltering" that is readily incorporated into review of timber harvest plans. By incorporating the concept of HFP, the FWS can evaluate the predicted effects of habitat modification on fitness of NSO potentially affected by a project. Evaluation of incidental take based on habitat modification that measurably and significantly reduces the fitness of NSO within the project area (as estimated by HFP models) provides a quantitative element to our estimation of "significant impairment of breeding, feeding and sheltering" in Section 9 of the ESA. Furthermore, HFP models also provide information allowing determination of significant thresholds that may occur, such as average habitat conditions corresponding to HFP < 1.0 (territorial pair not replacing themselves).

Description of the structural characteristics of NSO habitat and delineation of the range of habitat conditions corresponding to essential activities such as nesting, roosting, and foraging is a critical element of developing guidelines for evaluating the likelihood of incidental take. Determination of the amount of suitable habitat that must be retained in order to avoid incidental take of NSO is strongly influenced by the range of forest conditions that are classified as suitable habitat. The HFP models of Franklin *et al.* (2000), Olson *et al.* (2004), and Dugger *et al.* (2005) contain a limited number of habitat variables and relatively coarse definitions of NSO habitat, and therefore must be supplemented with additional information on forest structural parameters that support classification of forest habitat as suitable for nesting and foraging. Because the

structural attributes of habitat immediately surrounding nests are easily quantified, data supporting classification of nesting habitat are readily available (see section III.C). Foraging habitat, on the other hand, is more variable and spatially extensive, requiring intensive radio-telemetry studies to measure use of various habitat conditions by NSO. In recent studies by the National Council for Air and Stream Improvement (NCASI), correlations between habitat data from detailed forest inventories and nocturnal locations of radio-tagged NSO and California spotted owls were used to estimate resource selection function (RSF) models (Irwin et al. 2007a,b) that quantify complex relationships between the owls and their environment. These models allow evaluation of the relative use of specific forest structural variables, such as tree size class distribution and stand density, by foraging NSO. The studies of Irwin *et al.* (2007), combined with other telemetry studies (Solis and Gutierrez 1990), provide the basis of our definitions of suitable foraging habitat for NSO in the Northern Interior Region.

Criticism of the THP review process is frequently focused on the use of "thresholds" that simplify complex gradients of habitat quality into a single value (e.g., 40% suitable habitat within 1.3 mile radius, or 185 ft^2 of basal area). The FWS has long recognized that many different combinations of habitat structure and amount may support a viable NSO territory; evaluation of these combinations by technical experts has been our primary role in technical assistance. However, to maintain consistency and incorporate new information it is necessary to implement unambiguous habitat standards and criteria (i.e., thresholds) that delineate conditions under which take is deemed unlikely. Thresholds do not represent arbitrary lines through consistent data sets; rather, they represent the preponderance of evidence derived from careful evaluation of the

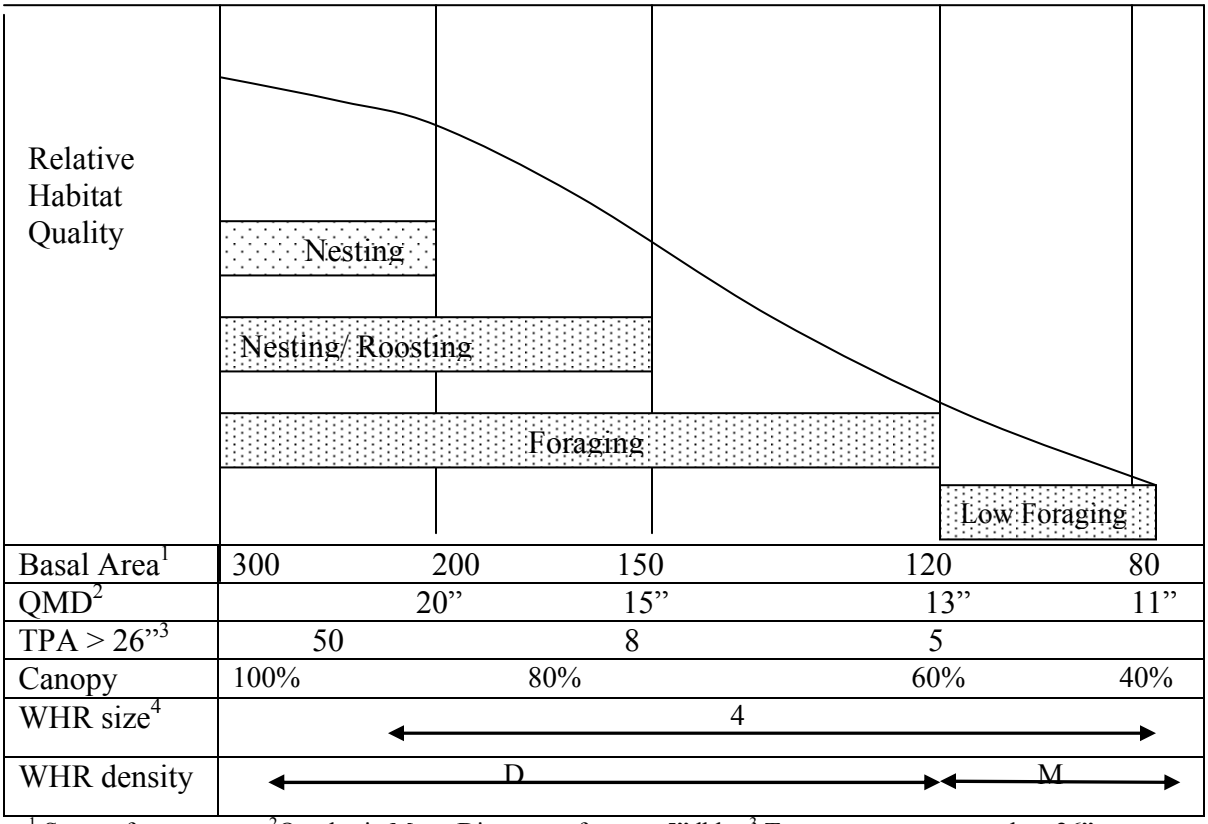
results and conclusions of many published studies, supplemented by data sets from credible sources.

Derivation of habitat thresholds from published studies consists of two consecutive steps. First, we consider the relationship or trend between habitat features and spotted owls. For example, most studies show that habitat use by foraging NSO is positively correlated with increasing tree size. These consistent, statistically significant relationships then serve as the foundation for subsequent choice of habitat values that correspond with viable NSO territories. We emphasize habitat parameters that receive disproportionate use by NSO, or are correlated with fitness. In this second step, we evaluate the pattern and distribution of data from a wide range of sources and attempt to identify ranges of values that correspond to consistent use. Deriving the central tendencies within complex, inconsistent data is a difficult task, and often requires input from the researchers responsible for published studies.

Despite consistent patterns of habitat selection by NSO, structural conditions of forest habitats occupied by NSO are highly variable, particularly in the diverse conifer-hardwood forests of the Klamath Province. We recognize that habitat retention guidelines must incorporate the range of habitat conditions used by NSO for nesting, roosting, and foraging, while at the same time ensuring that habitat conditions are not degraded to the point where significant impairment of breeding, feeding, and sheltering occurs. The FWS guidelines achieve this balance and provide a robust method for evaluating the likelihood of take because they describe a range of habitat conditions representing the central tendency for high-quality nesting habitat, nesting roosting

habitat, foraging habitat, and low-quality foraging habitat that may provide prey resources (Fig. I.A.1).

Figure I.A.1: Conceptual model of spotted owl habitat functions, relative habitat quality, and associated forest structural conditions.



[1] Square feet per acre, [2]Quadratic Mean Diameter of trees >5"dbh, [3] Trees per acre greater than 26" diameter at breast height, [4] California Wildlife Habitat Relationships System

This process must be distinguished from the simple application of "minimum habitat standards" that correspond to the lowest denominator of observed habitat use. To illustrate this, Figure I.A.1 depicts the relationship between California Wildlife Habitat Relationships system (WHR) class 4M and relative use of habitat by NSO. The FPRs classify 4M stands as suitable for nesting, roosting, and foraging by NSO. Although 4M encompasses a wide range of stand conditions, some of which may be suitable as

foraging habitat, it largely consists of stand conditions rarely used by NSO. For this reason, the use of existing minimum habitat standards such as those currently in the FPRs may result in take of NSO and are insufficient for programmatic use in take avoidance reviews of THPs.

B. Evidence indicating that regulatory guidance in the current Forest Practice Rules is not adequate to avoid incidental take of NSO

New information available

The current FPRs governing habitat retention for NSOs were developed in 1992 and predate much of the published research used in the FWS guidelines. In particular, studies correlating habitat and NSO fitness measures, and radio-telemetry studies of habitat use by foraging NSO (Irwin *et al*. 2007b) provide information directly applicable to evaluation of timber harvest-related impacts to NSO. During the past decade, the FWS has incorporated the results of new research into Technical Assistance on a plan by plan basis. However, with the February 2008 return of THP review to CALFIRE, the large number of recently published studies requires that a full synthesis of current knowledge be conducted and incorporated into updated take evaluation guidelines. This synthesis, and the habitat retention guidelines that it supports, are presented in section III of this report.

FWS experience in technical assistance process

The FWS' primary source of information regarding habitat conditions and NSO status on industrial timberlands in the Northern Interior Region has been our review of

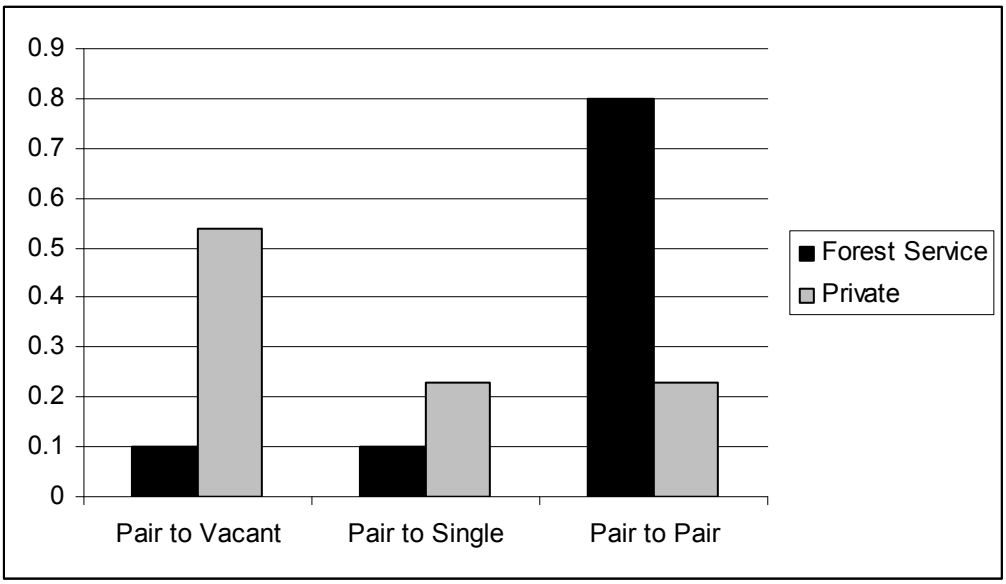
THPs. In the THP review process, FWS staff carefully evaluated historical NSO records and results of current surveys conducted in the plan area, as well as the habitat data provided in support of the THP. In cases where timber harvest was proposed in close proximity to an NSO activity center, the FWS evaluated habitat conditions in the field. The THP review process was conducted on a plan-by-plan basis, which does not permit systematic assessment of habitat conditions and NSO status across an entire ownership. However, our combined experience with hundreds of THPs indicates that the cumulative effects of repeated entries within many NSO home ranges has reduced habitat quality to a degree causing reduced occupancy rates and frequent site abandonment. In a large proportion of technical assistance letters to CALFIRE and industrial timberland owners during the past five years, we noted the lack of NSO responses at historic territories, and described habitat conditions considered inadequate to support continued occupancy and reproduction. This highlights the need for refined, objective criteria to determine the likelihood of NSO take when assessing THPs.

Analysis indicating loss of territories under Forest Practice Rules

To quantify the pattern of territory loss identified during the technical assistance process, we compared results of protocol surveys conducted at verified NSO territories supporting at least one year of occupancy by paired owls on Forest Service lands (N=196) with similar data from private timberlands (N=75) in Shasta and Trinity counties. The data set consisted of activity center status records in the California Department of Fish and Game's Spotted Owl Database (CDFG-NSO database), supplemented with territory locations and recent survey records received during technical

assistance. We first evaluated the validity of activity center records in the CDFG-NSO database, and eliminated 18 sites on private lands due to lack of verification of status. The remaining 57 private-land activity centers had verified NSO status in at least one year between 1989 and 2007; 44 of these sites had supported pairs during at least one year. Of these verified pair sites, 54% declined from pair status to no response, and an additional 23% declined from pair status to a territorial single owl during subsequent protocol surveys (Figure I.B.1). On Forest Service-administered lands, 80% of pair sites did not change status during the same time periods. While we recognize that annual variation in survey effort and results at this relatively coarse scale of resolution may influence this type of analysis, the strong differences in trends observed on private versus federal lands supports the contention that management on private timberlands is creating habitat conditions that do not support sustained occupancy by NSO.

Figure I.B.1. Status of valid historical northern spotted owl activity centers (pair sites only) when resurveyed after 5-10 years. Data are from U.S. Fish and Wildlife Service technical assistance records and USFS monitoring records



Section II: Summary of the FWS NSO Take Evaluation Guidelines

The FWS guidelines provide a step-by-step process for evaluation of the likelihood of incidental take posed by proposed THPs (Appendix A). The steps include: (1) verifying the accuracy of NSO activity center location and status; (2) reviewing survey coverage and results to determine whether protocol has been met; and (3) evaluating the quantities and quality of habitat to be retained at each NSO home range potentially affected by the proposed THP. To assist the reader, this section briefly summarizes the analysis areas, habitat quantities, and habitat definitions used in step (3) of the FWS guidelines. See Appendix A for the full take avoidance analysis guidance provided to CALFIRE.

The FWS guidelines specify three spatial scales that form appropriate analysis areas for evaluation of habitat at NSO home ranges. The fourth analysis area, the 'outer core' represents the area between the core area and the total home range area (Table II.1). Within each analysis area, the FWS guidelines describe the quantities of habitat that must be retained in each of four functional habitat categories to avoid incidental take of NSO. These categories are: (1) high-quality nesting/roosting habitat; (2) nesting/roosting habitat; (3) foraging habitat; and (4) low-quality foraging habitat (Table II.2). Descriptions of the stand structural attributes corresponding to each functional habitat category are given in Table II.3. Table II.4 provides additional considerations for use in prioritizing habitat areas for retention.

Table II.1: Spatial scales used to evaluate habitat conditions at northern spotted owl activity centers in the Northern Interior Region

Analysis Area	Radius	Area
Nest Site	1000 feet	70 acres
Core Area	0.5 mile	502 acres
Outer Ring	0.5 – 1.3 mile	2,908 acres
Home Range	1.3 miles	3,410 acres

Table II.2: Minimum quantities of habitat to be retained within four functional habitat types to avoid incidental take of northern spotted owls on private timberlands in the Northern Interior Region

Analysis Area	Functional Habitat Type				
	High-quality NR	Nesting/ Roosting	Foraging	Low-quality Foraging	Total Suitable
Core area	100 acres	150 acres	100 acres	50 acres	300 acres
Outer 'ring'			655 acres	280 acres	935 acres
Home range (total)	100 acres	150 acres	755 acres	330 acres	1335 acres

Table II.3: Values for selected stand structural parameters used to classify nesting/roosting and foraging habitat for northern spotted owls in the Northern Interior Region

Parameter	Functional Habitat Type			
	High-quality NR	Nesting/Roosting	Foraging	Low-quality Foraging
Basal area	≥ 210 ft^2 /acre	Mix ranging from 150 to ≥180 ft^2 /acre	Mix ranging from 120 to ≥180ft^2 /acre	Mix ranging from 80 to ≥120ft^2 /acre
Quadratic mean diameter	≥ 15 inches	≥ 15 inches	≥ 13 inches	≥ 11 inches
Large trees per acre	≥ 8	≥ 8	≥ 5	NA
Canopy closure	≥ 60%	≥ 60%	≥ Mix ranging from 40 to 100%	≥ 40%

Table II.4: Guidelines for prioritizing habitat to be retained to avoid incidental take of northern spotted owls on private timberlands in the Northern Interior Region

Tree Species composition	Mixed conifer stands should be selected over pine-dominated stands
Abiotic considerations	
Distance to nest	Nesting/roosting and foraging habitat closest to identified nest trees, or roosting trees if nest unknown
Contiguity	Nesting/roosting and foraging habitat within the 0.5 mile radius must be as contiguous as possible
	Minimize fragmentation of foraging habitat as much as possible
Slope position	Habitats located on the lower 1/3 of slopes provide optimal microclimate conditions and increased potential for intermittent or perennial water sources
Aspect	Habitats located on northerly aspects provide optimal vegetation composition and cooler microclimates
Elevation	Habitat should be at elevations < 6000 feet, lower elevations are preferred

Section III: Scientific Basis for NSO Take Evaluation Guidelines

A. Fundamentals of spotted owl habitat relationships

Northern spotted owls exhibit clear, consistent patterns of habitat association, and these associations must provide the foundation of habitat management guidelines. In the 1990 *Conservation Strategy for the Northern Spotted Owl,* the Interagency Scientific Committee (Thomas *et al.* 1990) stated that:

"With the exception of recent studies in the coastal redwoods of California, all studies of habitat use suggest that old-growth forests are superior habitat for northern spotted owls. Throughout their range and across all seasons, spotted owls consistently concentrated their foraging and roosting in old-growth or mixed-age stands of mature and old-growth trees....Structural components that distinguish superior spotted owl habitat in Washington, Oregon, and northwestern California include: a multilayered, multispecies canopy dominated by large (>30 inches dbh) conifer overstory trees, and an understory of shade-tolerant conifers or hardwoods; a moderate to high (60-80 percent) canopy closure; substantial decadence in the form of large, live coniferous trees with deformities- such as cavities, broken tops, and dwarf mistletoe infections; numerous large snags; ground cover characterized by large accumulations of logs and other woody debris; and a canopy that is open enough to allow owls to fly within and beneath it."

Fifteen years later, the conclusions of the Interagency Scientific Committee were echoed in the *Scientific Evaluation of the Status of the Northern Spotted Owl* (Courtney *et al.* 2004), who found that the habitat attributes identified by Thomas *et al.* (1990) remain important components of NSO habitat. Notably, positive relationships were found with the aforementioned attributes whether the samples of owl and random locations were

within old-growth forest, non-old growth forest, National Parks, public land, private land, or an Indian Reservation. In 2008, the *Recovery Plan for the Northern Spotted Owl* (USFWS 2008) again reiterated the association of NSO with older forest conditions, stating; "Spotted owls generally rely on older forested habitats (Carroll and Johnson 2008) because such forests contain the structures and characteristics required for nesting, roosting, and foraging." A major advance in our understanding of NSO habitat relationships from Thomas et al. (1990) to the present is that we now have a much better understanding of the spatial scale of habitat selection (Hunter et al. 1995), Meyer et al. 1998, Zabel et al. 2003) and relationships of habitat to owl fitness (Franklin et al. 2000, Dugger et al. 2005).

III.B: Analysis Areas

Management guidelines for territorial organisms are typically spatially explicit; that is, they apply to an area corresponding to the movements and activity patterns of the individuals occupying a territory. Spotted owls are territorial raptors that range widely in search of prey but are 'anchored' during the breeding season to a nest site (central-place forager). Evaluations of NSO habitat are usually conducted at two spatial scales; the home range and core areas. The home range is the "area traversed by the individual in its normal activities of food gathering, mating, and caring for young" (Burt 1943:351). Within home ranges, areas receiving concentrated use, typically surrounding the nest site and favored foraging areas, are called core areas. Because the size and pattern of NSO space use are typically unknown, estimates of use areas are derived from radio-telemetry studies. The analysis areas employed in the FWS guidelines are based on a subset of

estimates that describe the outer perimeter of NSO activity areas, thus incorporating the areal extent most likely to contain important resources. In this section we review and summarize information related to home range size and patterns of space use within home ranges by NSO.

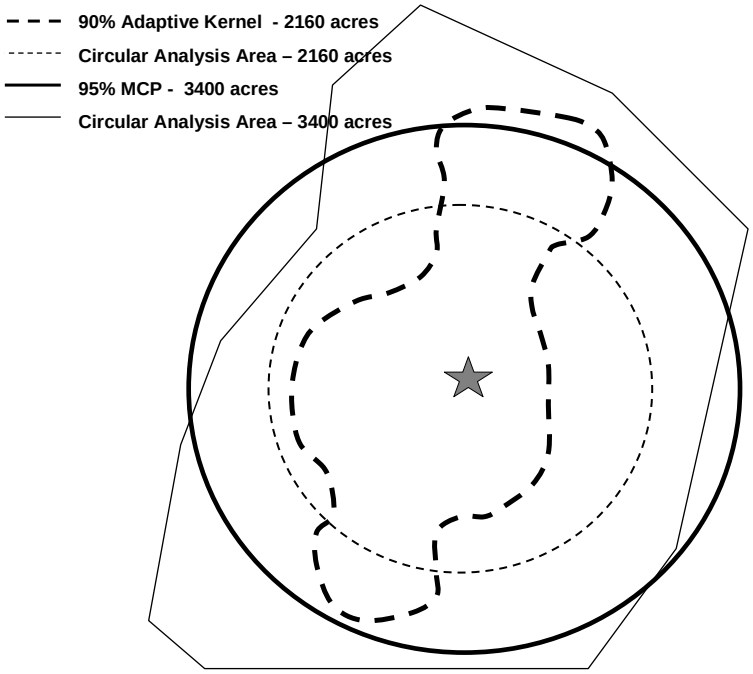
Home Range (1.3-Mile-Radius, 3,410-Acre) Analysis Area

The FPR guidelines for avoiding take of NSOs during timber operations in the Klamath Province indicate the amount of habitat to be retained within 1.3 miles of activity centers. The size of this area was originally based on estimated median annual home range sizes for NSO pairs in northern California, Oregon, and Washington (Thomas *et al.* 1990, USFWS 1992). There are numerous analytical techniques for estimating home range sizes based on animal locations (reviewed in Powell 2000). One of the most commonly used classes of home range estimators is the minimum convex polygon (MCP). Because MCP consists of a single polygon encompassing all or the majority of telemetry locations, this method may be viewed as providing a representation of the area *containing* the home range, including unused and infrequently used areas (Powell 2000, Laver and Kelly 2008). Generally biased large, MCP home range estimates provide relatively conservative values on which to base the size of habitat-analysis areas. Other home range estimators such as utilization distributions (e.g., kernel density estimates: see Powell 2000) de-emphasize areas less frequently used and typically yield smaller home range estimates that, when converted into circular analysis areas, may exclude distant, but potentially important, patches of habitat (see Figure 2.b.1). At the upper end of utilization distributions (e.g.; 90-100%), however, kernel estimates may resemble MCP polygons and circular analysis areas (Anthony and Wagner 1999).

Estimates of home range size are also important for developing management prescriptions and evaluating impacts of human activities on NSO. For the purpose of quantifying habitat and the impact of proposed modification of habitat, median home range estimates from radio telemetry studies are transformed into circular 'analysis areas' that are used as surrogates for actual home ranges (Fig. 2.b.1). Based on the median MCP home range estimate for NSO pairs in the Klamath Province, the FWS currently uses a circular analysis area of 1.3 mile radius (3,398 acres; Thomas *et al.* 1990, USFWS 1992). While this practice provides a practical and uniform method for quantifying NSO habitat, circular analysis areas will generally not correspond directly with areas actually used by NSO. Landscape pattern, both in terms of topographic features and vegetation pattern; prey distribution, abundance and availability; as well as distribution and/or abundance of competitors and predators are all likely to influence NSO territory and home range shape (Anthony and Wagner 1999).

Our understanding of space use by NSO is limited by lack of comparability among published studies due to variation in estimation methods, duration and seasonality of data collection, and whether estimates are for individuals or pairs. By looking for commonalities among studies and using a "strength of evidence" approach, however, we can evaluate whether the available information provides broadly modal values that are useful for conservation planning. Because the primary purpose of this review is to evaluate appropriate spatial scales for evaluation of effects to territorial paired NSO, we have focused on conservative estimates of year-round (annual) space use by NSO pairs.

Figure III.B.1: Comparison of MCP and adaptive kernel home range estimates with corresponding circular analysis areas at an actual northern spotted owl home range.



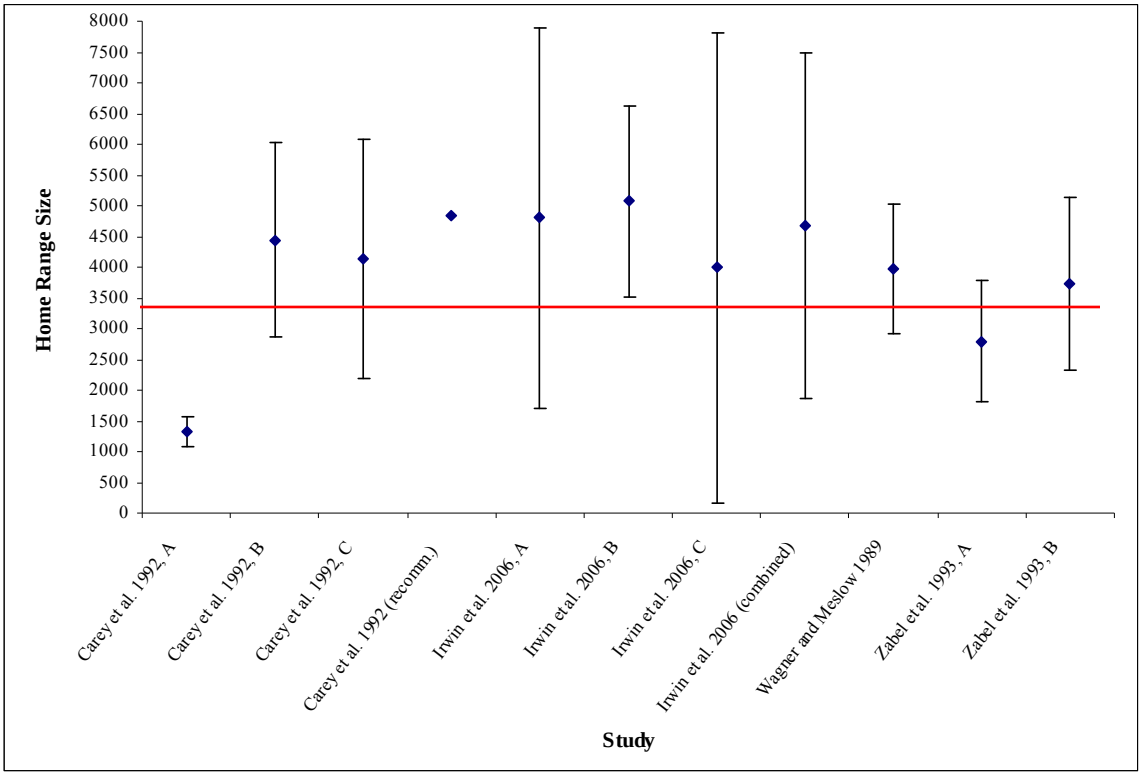
The sizes of NSO home ranges are influenced by a variety of factors, including geographic differences in diets and habitat characteristics (Carey *et al.* 1992, Zabel *et al.* 1995). Therefore, we restricted our assessment of the validity of the 1.3-mile-radius analysis area to home range studies conducted within the Klamath Province. Because the outer analysis area should be large enough to include habitat needed to meet all major life history requirements and should accommodate areas important to both members of most pairs, we largely restricted our evaluation to studies that provided MCP estimates of the sizes of home ranges used year-round by pairs or paired individuals.

Home range studies conducted in the Klamath Province after the FPR guidelines were formulated support the use of a 1.3 mile radius analysis area, as this distance is encompassed by the confidence intervals of nearly all the home range studies we

compiled. (see Figure III.B.2). Carey *et al.* (1992) found that the sizes of NSO pairs' home ranges were related to the type of forest and the degree of forest fragmentation (Table III.B.1). Pairs' home ranges in clumped, old forest were substantially smaller than the 1.3-mile-radius analysis area, whereas those in fragmented forest were somewhat larger than the analysis area. The authors suggested that management areas should be slightly larger than 1.3 miles, however, to encompass oblong-shaped home ranges. Zabel *et al.* (1993) provided estimates of 21 pairs' home ranges in two different study areas in the region (see Table III.B.2). They did not report the sizes of pairs' annual home ranges, but the average sizes of pairs' nonbreeding season home ranges were similar to the size of the FWS guidelines' outer analysis area. Pairs' annual home ranges would likely be larger than these values because their breeding- and nonbreeding-season home ranges probably do not completely overlap. In a different study, the mean cumulative pair MCP home range size for 9 pairs in the Medford, Oregon area was 3,971 acres (SD=1,063 acres), which is also similar to the 1.3-mile radius analysis area (Wagner and Meslow 1989). A fourth study by Irwin et al. (2006) showed greater mean home range sizes for 3 study areas in the region than the 1.3-mile radius analysis area used in the existing FWS guidelines (see Table III.B.3). The FWS recognizes that because of differences in methodology between these studies and those originally used to support the 1.3-mile radius analysis area (see Thomas *et al.* 1990, USFWS 1992), the results cannot be rigorously compared (see Powell 2000, Laver and Kelly 2008). Nonetheless, mean MCP values for home range area from more recent studies suggests that the outer analysis area should be somewhat larger than the 1.3-mile (3,410-acre) guideline (Figure III.B.2). We elected to retain the current guideline because, 1) the high degree of variability in MCP

estimates in Figure III.B.2 does not compel us to reject the home range estimate in our existing guidelines in exchange for any particular alternative size, and 2) disproportionately high use of habitats closer to nest sites by NSO (see core areas, below) leads us to emphasize habitat conditions closer to nests, rather than expanding home range area.

Figure III.B.2: Mean Minimum Convex Polygon home range sizes (acres) for northern spotted owls in the Klamath Province, CA and OR. Error bars represent ±1 standard deviation. Horizontal line shows the size of the Fish and Wildlife Service guidelines' outer analysis area (3,410 acres).



Carey et al. 1992 = pairs' annual home ranges, A = Klamath Mountains, clumped forest, B = Klamath Mountains, fragmented forest, C = Umpqua, fragmented forest; Irwin et al. 2006 = paired-individuals' annual home ranges, A = Hilt, B = Medford, C = Yreka; Zabel et al. 1993 = pairs' nonbreeding-season home ranges, A = Mad River, B = Ukonom.

Table III.B.1: Minimum Convex Polygon estimates of annual home range sizes (acres) for northern spotted owl pairs within different types of forest in the Klamath Province, Oregon (Carey *et al.* 1992)

Area*	No. Pairs	Mean	SE
MCC	3	1317	143
MCF1	5	4139	870
MCF2	6	4438	645
Recommended	-	4843	-

*MCC = mixed-conifer, clumped, Klamath Mountains old forest; MCF1 = mixed-conifer, fragmented, Umpqua River Valley, old forest; MCF2 = mixed-conifer, fragmented, Klamath Mountains old forest.

Table III.B.2: Minimum Convex Polygon (100%) estimates of home range sizes (acres) for northern spotted owls in the Klamath Province, California (Zabel *et al.* 1993)

Study Area	Mad River		Ukonom	
	Mean	SD	Mean	SD
Individuals				
NB*	1989	890	2572	857
B*	1043	447	1460	578
A*	2456	1124	2847	1374
Pairs				
NB*	**2787**	986	**3721**	1409
B*	1436	368	1900	756

*NB = nonbreeding season home range; B = breeding season home range; A = annual home range.

Table III.B.3: Estimated cumulative (100%Minimum Convex Polygon) home range sizes (acres) for selected* territorial individual northern spotted owls in the Klamath Province, California (Irwin *et al.* 2006)

Study Area	Yreka	Medford	Hilt	Combined
No. Individuals	7	9	10	26
Mean	3987	5073	4805	4678
SD	3819	1557	3098	2816

*Excludes owls that did not exhibit normal ranging behavior (i.e., moved to new territory, or influenced by active timber harvest).

Core Area (0.5-Mile-Radius, 500-Acre) Analysis Area

The FPR guidelines for avoiding take of NSO during timber operations specified the amounts of habitat to be retained within 0.7 mile (986 acres) of activity centers. The 0.7-mile-radius scale was adopted in the FPR guidelines based on a study by Thomas *et al.* (1990), who found that circles of this size surrounding NSO nest sites contained significantly more suitable habitat compared with random circles. This study, however, only illustrated the importance of suitable habitat, rather than the amount of habitat required by NSO or the appropriate scales for evaluating and managing habitat (Bart 1995). The results of studies conducted after the FPR guidelines were formulated (see below) have indicated that a 0.5-mile-radius (500-acre) area around activity centers is a more appropriate scale at which to evaluate the amounts of habitat required by breeding NSO in the Klamath Province. These studies provide three primary lines of support for the core area size used in the FWS guidelines; distribution of locations of radio-telemetered NSO, territorial spacing of NSO, and studies comparing relative habitat selection at different scales.

Resources such as food and breeding and resting sites are patchily distributed in heterogeneous landscapes, such as those prevalent within the Klamath Province. In such landscapes, animals are likely to disproportionately use areas that contain relatively high densities of important resources (Powell 2000). These disproportionately used areas are referred to as core areas. One of the most influential studies of wildlife core areas was focused on NSOs in northern California (Bingham and Noon 1997). Although this study's sample size was small, it used an unusually rigorous method for determining the sizes of core areas (Powell 2000). Bingham and Noon (1997) noted that the combined

size of NSO pair members' core areas is probably more meaningful than the sizes of individuals' core areas. Bingham and Noon (1997) estimated core areas by evaluating the ratio of total home range area to the area encompassing different adaptive kernel utilization distributions (UD), and found that individual NSO in northern California spent 60 to 75% of their time in their core areas, which comprised only 21 to 22% of their home ranges. The mean core area size for NSO pairs in the Klamath Province was 411 acres (166 ha; SE=26 ha; range=168-455 acres [68-184 ha]; n=7 pairs). Bingham and Noon (1997) also recommended that management guidelines attempt to meet the area requirements of most individuals in a population by accounting for variability in core area size; for example, by using the mean core area size plus one standard error. The addition of one standard error to the mean size of pairs' core areas totaled 475 acres (192 ha) for the Klamath Province data set. NSO core areas had diverse shapes due to variation in the distribution of foraging and roosting locations (Bingham and Noon 1997). However, assuming a circular shape for the purposes of evaluating and managing habitat, an area this size would have a radius of 0.49 mile. Carey and Peeler (1995) found remarkably similar results outside the Klamath Province, in southern Oregon.

We evaluated home range estimates from other studies in the Klamath Province in light of these patterns. By approximating Bingham and Noon's (1997) methodology, we evaluated kernel estimates in Irwin et al. (2004; Table 2) to estimate core area size (only 50%, 75% and 95% UD estimates were available). The 75 percent fixed kernel estimate accounted for 21 to 27 percent of the total (95%) home range, and the 75 percent adaptive kernel accounted for 23 to 30 percent, suggesting that a UD somewhat lower than 75 percent would yield core area estimates very similar to those obtained by Bingham and

Noon (1997). The addition of one standard error to individuals' mean 50 percent and 75 percent kernel density home range estimates from three different study areas in the province suggested that 500-acre analysis areas would include much of the important habitat for most breeding NSOs (Irwin *et al.* 2004, Table 2.b.4). Application of the same criteria to the results of a telemetry study in southwestern Oregon suggested that pairs used somewhat larger core areas than in other parts of the Klamath Province (Anthony and Wagner 1999, Table 2.b.5). Much of this study area is comprised of a checkerboard of public lands and industrial timberlands (Anthony and Wagner 1999, Dugger *et al.* 2005). To the extent that the amounts, quality, or contiguity of habitat have been reduced on these timberlands due to timber harvesting, NSO in this area may have larger area requirements than in parts of the province with less harvesting (Carey *et al.* 1990, 1992, Zabel et al. 1992, 1995).

Table III.B.4: Fixed kernel and adaptive kernel cumulative home range estimates (acres) for individual NSOs in the Klamath Province (Irwin *et al.* 2004).

Study Area	**Yreka**	**Medford**	**Hilt**	**Combined**
No. Individuals	9	10	11	30
No. Telemetry Points	3151	5041	2414	10606
50% Fixed Kernel				
Mean	128	210	147	162
SE	18	26	22	14
Mean + 1 SE	146	236	169	**176**
75% Fixed Kernel				
Mean	364	510	435	439
SE	38	47	54	29
Mean + 1 SE	402	557	489	**468**
50% Adaptive Kernel				
Mean	239	303	262	269
SE	47	39	42	24
Mean + 1 SE	286	342	304	**293**
75% Adaptive Kernel				
Mean	584	706	673	657
SE	124	68	91	54
Mean + 1 SE	708	774	764	**711**

Table III.B.5: Adaptive kernel home range estimates (acres) for NSO pairs in southwestern Oregon (Anthony and Wagner 1999).

Utilization Distribution	**50%**	**75%**
Mean	413	1443
SE	67	259
Mean + 1 SE	**480**	**1702**

The territorial spacing of NSO provides additional support for using a 0.5-mile-radius core area to evaluate and manage habitat for NSO in the Klamath Province. An individual's territory is thought to be the portion of the home range that both contains important resources and is economically defensible (Meyer *et al.* 1998). Therefore, average territory size provides a useful scale at which to evaluate core area habitat.

Wildlife biologists frequently use half the mean or median nearest neighbor distance to estimate the size of the defended portions of home ranges, or the portions of home ranges that are used exclusively by resident pairs (e.g., Reynolds and Joy 1998). Half the mean and median nearest neighbor distances for nesting NSO near Willow Creek were 0.49 mile (0.79 km: Hunter *et al.* 1995) and 0.44 mile (0.71 km: Franklin *et al.* 2000), respectively.

A third line of support for using a 0.5-mile-radius area for evaluating and managing habitat is provided by studies that modeled the habitat relationships of NSOs in the Klamath Province. Two studies in the region found that habitat within a 0.5-mile radius of nests differed more strongly from the general landscape compared with larger areas around nests (Hunter *et al.* 1995, Meyer *et al.* 1998, Zabel et al. 2003). While these results do not necessarily indicate that NSO are most selective of habitat at the 0.5-mile-radius scale, they do show that evidence of habitat selection by NSO is weaker at scales larger than this. Stronger support for the validity of assessing and managing habitat at the 0.5-mile-radius scale is provided by studies that modeled habitat-based fitness (Franklin *et al.* 2000, Dugger *et al.* 2005) and presence (Zabel *et al.* 2003) for NSO in the region. These studies found that important NSO-habitat relationships were well-captured at scales of 0.44 to 0.50 mile around activity centers.

III.C: Quantity, Distribution, and Configuration of Habitat

The FPR take-avoidance guidelines required that 40% of the 1.3-mile-radius analysis area and 50% of the 0.7-mile-radius analysis area be retained as suitable habitat. The FWS guidelines kept the 40% requirement because it is consistent with the results of

research in the Klamath Province. However, the FWS guidelines require greater concentration of habitat near the nest or activity center than did the FPR guidelines. This concentration occurs through: (1) a decrease in the size of the inner analysis area (from 0.7- to 0.5-mile radius; see *Analysis Areas*) and (2) requirement that part of the total amount of foraging habitat (see *Habitat Definitions*) in the home range be retained within the inner analysis area. These changes are supported by studies conducted in the Klamath Province after the FPR guidelines were formulated.

Several types of information are available for evaluating the quantities, distribution, and configuration of habitat that must be retained in order to avoid take of NSO. The strongest type of information relevant to evaluation of take relates the fitness of NSO to characteristics of their habitat (Franklin *et al.* 2000, Olson *et al.* 2004, Dugger *et al.* 2005). Habitat-based fitness, or habitat fitness potential (HFP), is "the fitness conferred on an individual occupying a territory of certain habitat characteristics" (Franklin *et al.* 2000:558). HFP is a function of both the survival and reproduction of individuals within a given territory. Habitat-based modeling that accurately predicts the presence ("occupancy") of breeding NSO (Zabel *et al.* 2003) is another important tool for evaluating the species' habitat relationships. This modeling assumes that NSO gravitate toward areas likely to confer high fitness but does not directly relate habitat characteristics to the survival and reproduction of owls. Descriptions of areas around nests, and comparisons between them and random areas, are additional sources of information for investigating NSO-habitat relationships. This approach provides information about the habitat associations and preferences of NSO but must be cautiously considered because it does not relate habitat descriptions to the fitness of owls. For

example, the average quantity of habitat around a sample of NSO nests could be higher than what is available around random locations, but still be lower than what is required for persistence of individuals or the population.

Comparisons among habitat studies can be problematic because researchers often define habitat differently and use different source data to classify vegetation (see Table III.C.1). Nonetheless, all studies in the Klamath Province have found that NSO exhibit strong relationships with older, more structurally complex, conifer-dominated forest classes. The concordance of these findings enabled the FWS to evaluate the guidelines relative to the quantities, distributions, and configurations of older forest within analysis areas. Spotted owls also forage within intermediate (younger and/or more open) forest classes (see *Habitat Definitions*, below). One study (Zabel *et al.* 2003; see below) found a positive association between NSO in the Klamath Province and moderate amounts of intermediate forest (see Table III.C.1) at the core area scale. This habitat class was based on conditions known to be used by foraging NSO. Other studies in the region have described the proportions of analysis areas comprised of intermediate forest classes but have not found positive associations between them and NSO. These forest classes often included conditions that receive little or no use by NSO, however, and are therefore not directly comparable with foraging habitat as defined by Zabel *et al.* (2003) and the FWS guidelines (see *Habitat Definitions*, below). There is currently no information for evaluating the proportion of intermediate forest that should be retained at the home range scale in order to avoid take of NSO in the Klamath Province.

Table III.C.1: Descriptions of suitable or selected habitat from studies of northern spotted owl-habitat relationships in the Klamath Province

Study	Location	Classification Method	Description of Selected or Suitable Habitat
USFWS 1992, Bart 1995	Washington, Oregon, northern California	research synthesis (various methods)	conifer-dominated forest with a multi-layered canopy, average DBH[1] >30 inches, ≥60% canopy cover, decadence (snags, logs, deformed trees)
Anthony and Wagner 1999	southwestern Oregon	aerial photographs, ground reconnaissance	conifer-dominated forest with a multi-layered canopy, ≥40% canopy cover, decadence, large snags and logs; characterized by trees ≥30 inches DBH and ≥200 yrs
Carey *et al.* 1992	southwestern Oregon	aerial photographs, forest inventory data, ground reconnaissance	multi-layered canopy, average DBH of dominant trees >39.4 inches, large snags and logs
Dugger *et al.* 2005	southwestern Oregon	aerial photographs, ground reconnaissance	conifer or mixed forest, ≥100 yrs; characterized by trees ≥13.8 inches DBH
Franklin *et al.* 2000	northwestern California	satellite imagery	forest comprised of ≥40% conifers, conifer QMD[2] ≥21 inches, hardwood QMD ≥6 inches, canopy cover ≥70%
Gutiérrez *et al.* 1998	northwestern California	satellite imagery	≥30% canopy cover, >50% of conifer basal area comprised of trees ≥21 inches DBH
Hunter *et al.* 1995	northwestern California	satellite imagery	≥30% canopy cover, >50% of conifer basal area comprised of trees ≥21 inches DBH
Meyer *et al.* 1998	western Oregon	aerial photographs	conifer-dominated forest, trees ≥80 yrs and/or multi-layered canopy
Ripple *et al.* 1997	southwestern Oregon	aerial photographs	conifer-dominated forest, average DBH ≥19.7 inches, canopy cover ≥60%
Solis and Gutiérrez 1990	northwestern California	timber type classification	average DBH >20.7 inches
Zabel *et al.* 1993	northwestern California	topographic maps, aerial photographs, and orthophotoquads	stands dominated (in terms of basal area) by trees >20.9 inches DBH; >20% canopy cover of dominant trees and >70% canopy cover of trees >5.1 inches DBH
Zabel *et al.* 2003	northwestern California	modified timber type classification, varied geographically	nesting-roosting habitat: for most locations average DBH ≥17 inches and average conifer canopy cover ≥60%; foraging habitat: in all locations average DBH ≥9.8 inches and average conifer canopy cover ≥40%, additional criteria in some locations

[1] DBH: Diameter at breast height
[2]QMD: Quadratic mean diameter

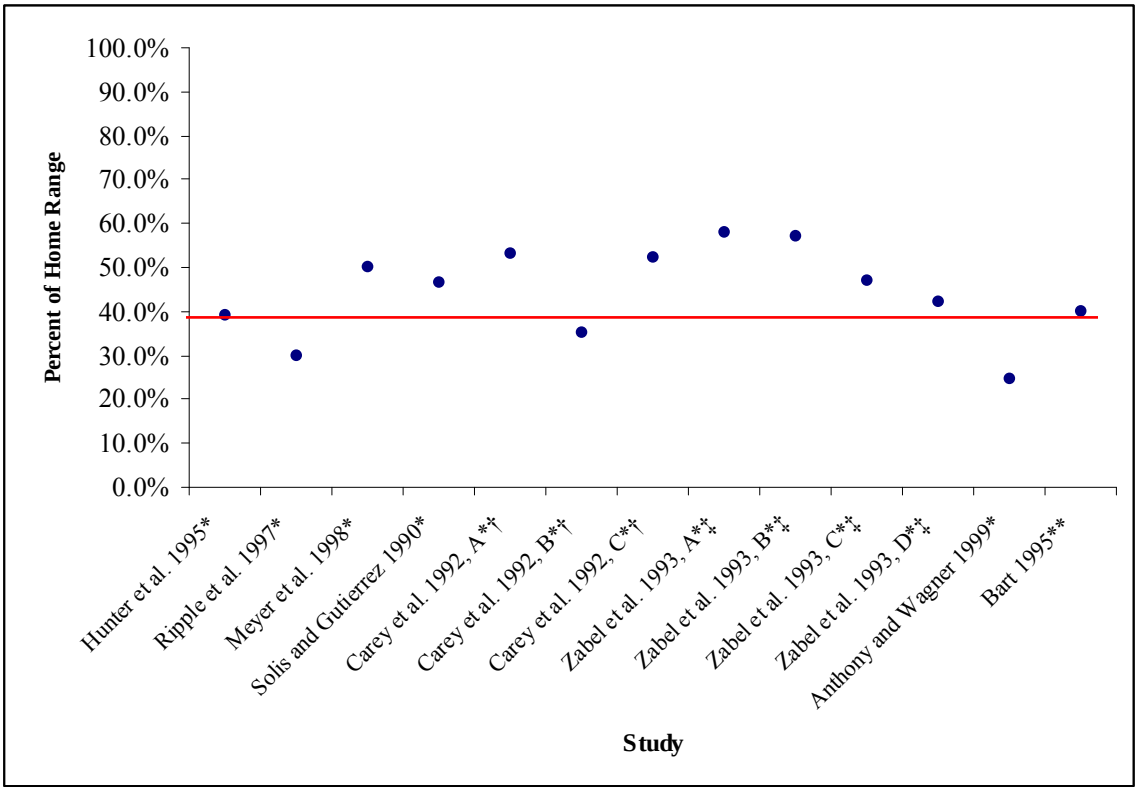
H*ome Range (1.3-Mile Radius)*

Bart (1995) evaluated the 1992 draft recovery plan's (USFWS 1992) requirement that at least 40 percent of the estimated home range be retained as suitable habitat. Using demographic data from throughout the NSOs' range, including the Klamath Province, he calculated that populations are stable when the average proportion of suitable habitat in home ranges is 30 to 50 percent. In a related comment on the FPR take-avoidance guidelines, Bart (1992:3) noted that "…lambda probably reaches 1.0 (stable population) when suitable habitat declines to somewhere between 40 and 55 percent. Since the Service must have good evidence that take did occur, not just that it might have occurred, using a value of 40 percent seems reasonable." Bart's (1992) conclusions continue to be supported by the results of recent research.

Studies have reported a wide range of mean proportions of older forest (ca. 24 - 58 percent; see Figure III.C.1) in home range-sized areas around NSO nests or roosts in the Klamath Province and adjacent areas (Solis and Gutiérrez 1990, Carey *et al.* 1992, Zabel *et al.* 1993, Hunter *et al.* 1995, Ripple *et al.* 1997, Meyer *et al.* 1998, Anthony and Wagner 1999). Variation in proportions of habitat was likely due to multiple factors, particularly differences in habitat classification (see Table III.C.1), but also including sizes of analysis areas and study season (i.e., breeding versus non-breeding), as well as geographic differences in the abundance and quality of habitat. Regardless, the central tendency of these means is about 45 percent; a somewhat higher percentage than the FWS guidelines. We retained the 40 percent threshold, however, because; 1) the FWS guidelines specify amounts of high-quality habitat, rather than a single 'suitable habitat'

category, and; 2) FWS guidelines incorporate a higher standard for classifying forest habitat as 'suitable' than was used in many of the studies in Figure III.C.1, and; 3).

Figure III.C.1: Proportions of older forest (see Table III.C.1) at home range scales around northern spotted owl territory centers in the Klamath Province, CA and OR. Horizontal line shows the proportion of older forest required by the Fish and Wildlife Service guidelines (40 percent).

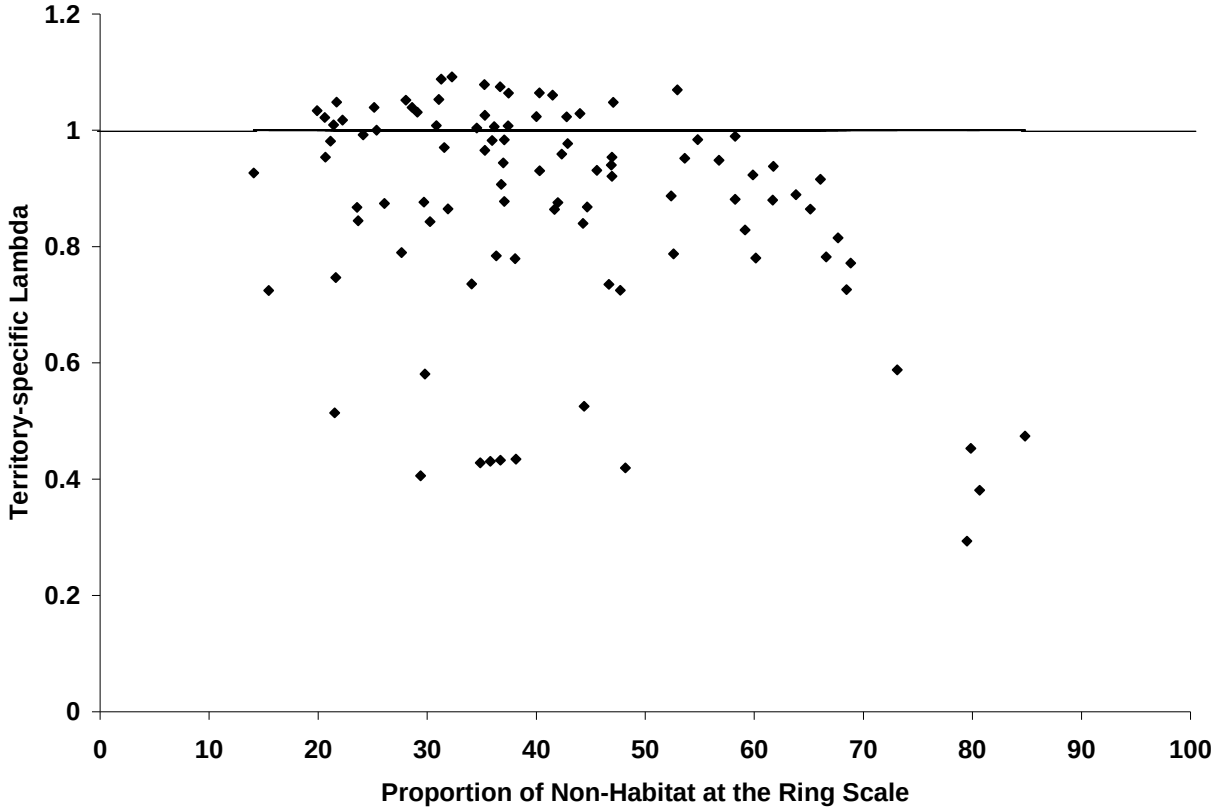


*Mean proportion. **Recommendation for take-avoidance guidelines. †Carey et al. 1992: A = Klamath Mountains, clumped forest, B = Klamath Mountains, fragmented forest, C = Umpqua, fragmented forest. ‡Zabel et al. 1993: A = Ukonom, breeding season, B = Ukonom, nonbreeding season, C = Mad River, breeding season, D = Mad River, nonbreeding season.

Research in the Klamath Province and adjacent areas indicates that NSO habitat should be concentrated at the core area scale around nests and interspersed with other land cover classes in the rest of the home range. For this reason, the FWS guidelines require retention of a higher proportion of the home range's total suitable habitat

(particularly nesting/roosting habitat) to be within the core area, and allow a wider range of forest conditions in the outer ring. A study in southwestern Oregon showed that HFP was optimal for NSO when the estimated home range beyond the core area (3,430-acre ring) was comprised of large amounts of forest (young, mature, and old classes) and an intermediate amount (ca. 38%) of "nonhabitat" (nonforest, early seral forest, heavily harvested forest) (Dugger *et al.* 2005; see Figure III.C.2). At this scale, HFP was below 1.0 at all territories with >50 percent nonhabitat. A similar study just outside the Klamath Province in southern Oregon found that high survival of NSO usually occurred with large proportions (ca. 70 percent was optimal) of conifer forest (average DBH >9.5 inches) in estimated home ranges (1,747 acres), whereas high reproduction was associated with large amounts of edge between "nonforest" (average diameter at breast height (DBH) <9.5 inches) and other vegetation classes (Olson *et al.* 2004). These findings suggest that HFP is highest when home ranges consist of large amounts of both forest and forest-edge. Zabel *et al.* (2003) found that the best large-scale (2,224-acre) model for probability of occupancy by NSO in northwestern California was an intermediate amount of old forest (≥24 inches DBH and ≥70 percent canopy cover) edge. Thus, both the demography and presence of NSO in the Klamath Province appear to be positively associated with an intermediate amount of horizontal heterogeneity at the home range scale.

Figure III.C.2: Association between habitat fitness potential (territory-specific lambda) and proportion of "nonhabitat" (nonforest, early seral stages, older forest receiving timber harvest entries removing >40 percent basal area in the portion of the estimated home range outside the estimated core area (3,430-acre ring) in southwestern Oregon (Dugger *et al.* 2005).



Core Area (0.5-Mile Radius)

The disproportionate importance of habitat conditions within NSO core areas is indicated by the species' concentrated use of areas close to the territory center (see *Analysis Areas* and *Habitat Definitions*). The core area's relevance has also been demonstrated by strong associations between habitat patterns and the demography (Franklin *et al.* 2000, Dugger *et al.* 2005) and occurrence (Zabel *et al.* 2003) of NSO.

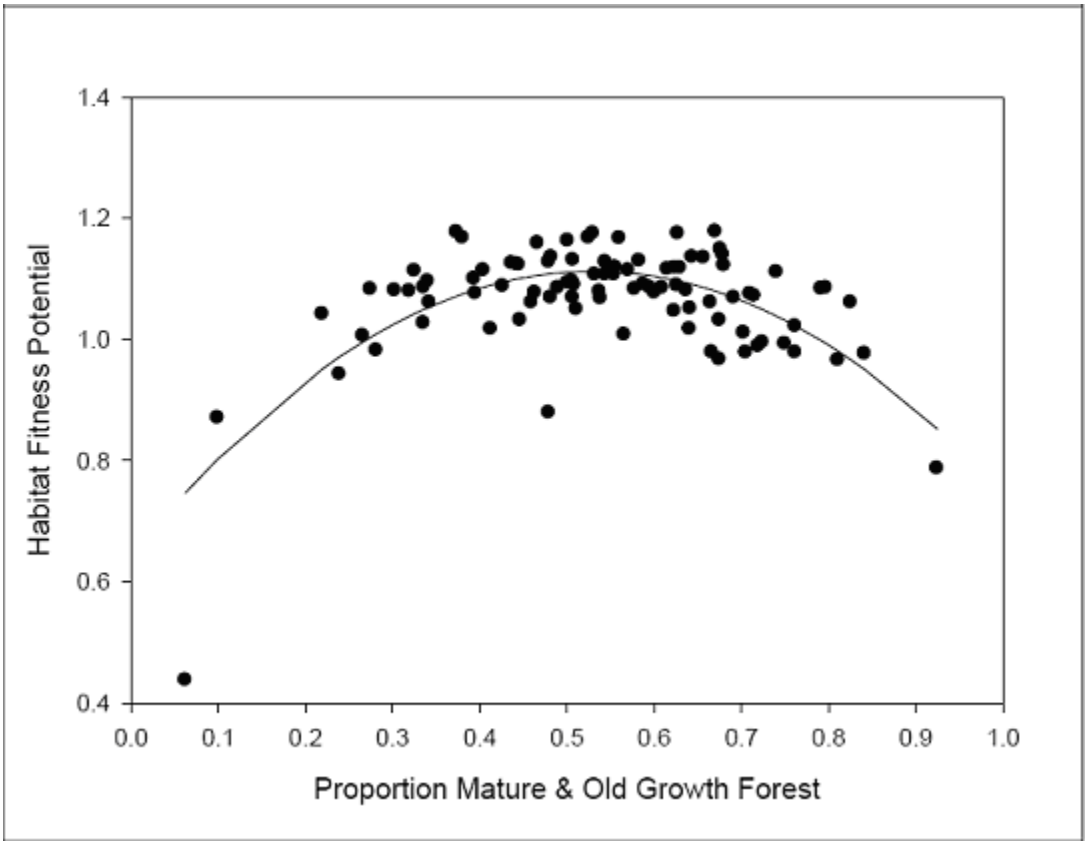
The results of two rigorous demographic studies of NSO in the Klamath Province (Franklin *et al.* 2000, Dugger *et al.* 2005) provide strong, consistent inferences regarding the relationship between habitat conditions and measures of NSO fitness such as adult survival and HFP at the core area scale. Although the habitat-based fitness models of Franklin *et al.* (2000) and Dugger *et al.* (2005) differ somewhat, both studies indicated that HFP for NSO in the Klamath Province was most likely to be $\geq$1 when at least 50% of the estimated core area was comprised of older forest (see Table III.C.1 for habitat criteria). An HFP of $\geq$1 indicates that a territory has the characteristics required for breeding females to replace themselves or contribute a surplus to the population (Franklin *et al.* 2000).

Franklin *et al.* (2000) found that territory-specific adult survival was strongly associated with the amounts of interior older forest in addition to the amount of edge between older forest and other vegetation types (see Table 7 in Franklin *et al*. 2000) at the core area scale (390 acres, 158 ha). Interior older forest was the amount of older forest 328 feet (100 m) from an edge and is not equivalent to the simple amount of older forest within a core. Interestingly, HFP declined overall when the core area contained more interior old forest. This was apparently due to a tradeoff between habitat characteristics associated with survival (amount of interior habitat and length of habitat edge) and reproduction (amount of habitat edge). High quality territories typically had core areas comprised of large patches of older forest with convoluted edges. Estimates of the amount of interior older forest that correlated with HFP >1 were provided to the FWS by Dr. Franklin (personal communication, September 19, 2005). The minimum proportion of interior older forest corresponding to HFP >1 was 41 percent; addition of

the older forest area within the 328-foot "edge buffer" yielded a proportion of 62 percent ("total core": Franklin 1997). Based on this evaluation, Dr. Franklin recommended that 60 percent of the core area be comprised of older forest (Franklin, personal communication, September 19, 2005). The FWS guidelines incorporate the apparent positive influence of moderate amounts of edge by 1) requiring that retention of high-quality habitat be concentrated at the core scale and 2) specifying amounts of older forest and foraging habitat in the core.

Data sets used in Franklin *et al.* (2000) were recently re-analyzed to evaluate the relationship between HFP and the simple proportion of older forest within NSO core areas (Franklin 2006). The results of this analysis, proposed in Appendix D of the 2007 Draft Recovery Plan for the Northern Spotted Owl (USFWS 2007), indicated a quadratic relationship between HFP and older forest, with optimum HFP occurring when 53 percent of the estimated core area consisted of older forest (Franklin *et al.* 2000; Figure III.C.3). More than half (55 percent) of the high-quality (HFP $\geq$1) territories had core areas comprised of 50 to 65% older forest. This pattern is consistent with the previously described recommendations of Dr. Franklin and the habitat retention guidelines developed by the FWS.

Figure III.C.3: Relationship between habitat fitness potential for northern spotted owls and proportion of older forest (see Table III.C.1) within 0.44 mile of territory centers in northwestern California (courtesy A. Franklin)



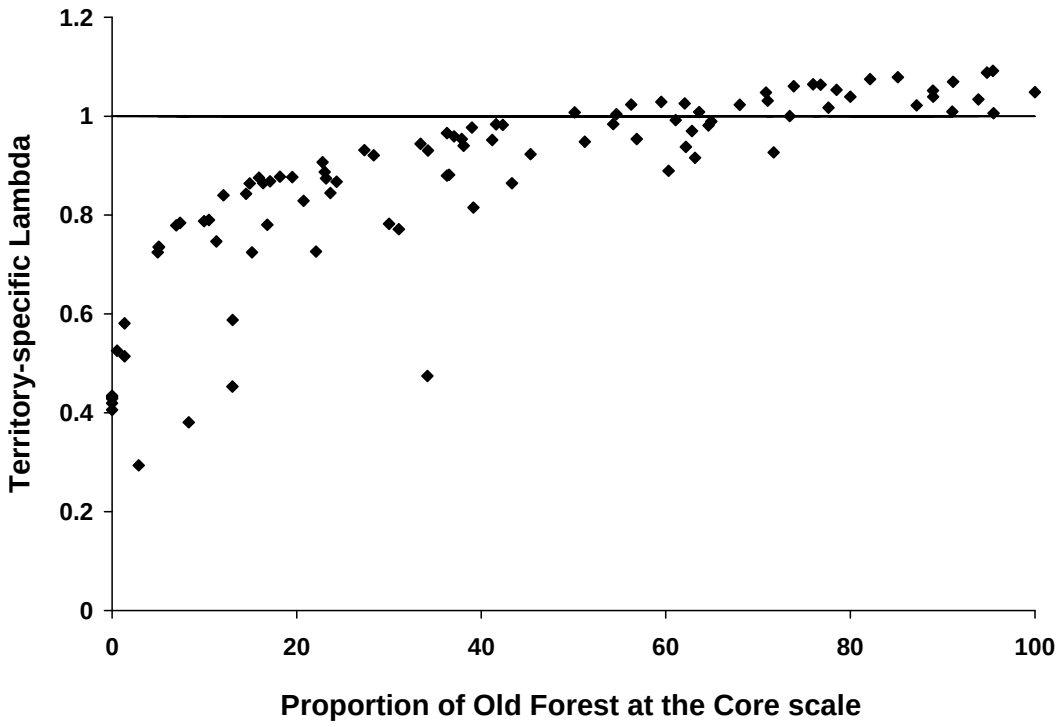
Because roughly 29 percent of high-quality territories (HFP ≥1) (Figure III.C.3) contained less than 50 percent old forest, some have suggested that a substantially lower habitat retention guideline would be adequate to avoid incidental take in timber harvest operations. Use of Franklin (2006) as the sole means of support for habitat retention guidelines is inappropriate (Franklin 2007) however, because the model estimating survival based on simple amounts of older forest was not well-supported and had only 3 percent of the weight in the model set (as opposed to 42.7 percent for the best-supported model which included interior old forest and amount of edge; see Table 7 in Franklin *et*

al. 2000). Use of the simple amount of older forest for evaluating take of NSO is inappropriate because it ignores the model selection process used in Franklin *et al.* (2000), which found that simple amounts of older forest alone did not explain variation in survival nearly as well as amounts of interior older forest and edges (Franklin 2007). Nichols and Pollock (2008) reviewed the use of HFP in the draft NSO Recovery Plan and concurred with Franklin (2007), stating that plots based on a single variable (percent old forest) instead of multiple covariates in the model of Franklin *et al.* (2000) are potentially misleading. Consequently, the analysis using solely percent old forest was deleted from the final 2008 NSO Recovery Plan, and was not used by the FWS to develop recent NSO habitat retention guidelines.

In a similar study in southern Oregon, Dugger *et al.* (2005) found that HFP was positively related to the proportion of older forest in the estimated core area (413 acres, 167 ha), although it became decreasingly sensitive to increased proportions (see Figure III.C.4; Dugger, unpub. data). Roughly 72 percent of core areas with HFP greater than 1.0 had more than 50 percent older forest; whereas cores with HFP less than 1.0 never contained more than 50 percent older forest. In contrast to the conclusions of Franklin *et al.* (2000), the correlation of HFP with proportion of older forest in the estimated core area was roughly linear; HFP did not decline at high levels of older forest. It is unclear why these studies found differences in the nature of the NSOs' relationships with quantities of older forest in the core area. Possible reasons for this dissimilarity include differences in the availability and quality of habitat in the study areas and in the studies' classifications of habitat (see Table III.C.1). For example, the area studied by Dugger *et al.* (2005) was strongly fragmented by industrial timberlands in a checkerboard pattern,

whereas the area studied by Franklin *et al.* (2000) was dominated by less-intensively managed federal lands. Regardless, both studies found that high quality territories typically had core areas comprised of at least 50 percent older forest.

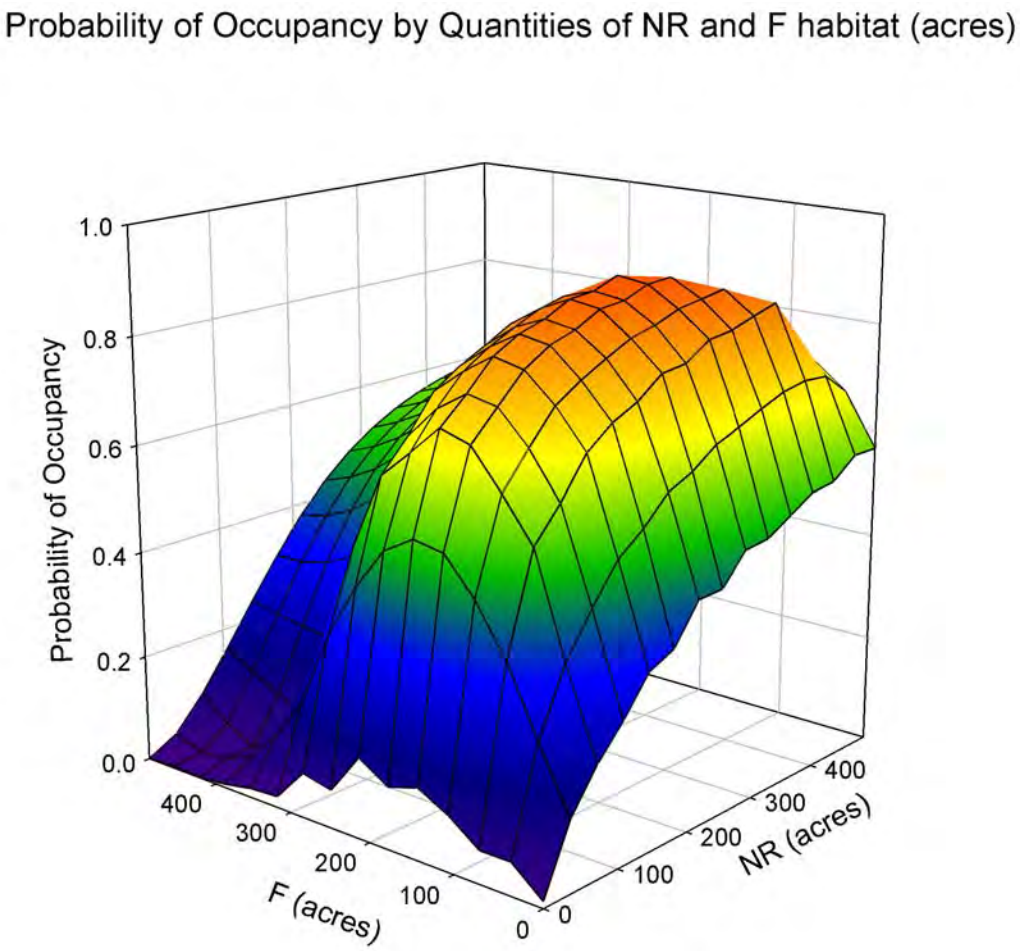
Figure III.C.4: Relationship between habitat fitness potential (territory-specific lambda) for northern spotted owls and proportion of older forest (see Table III.C.1) within 413 acres around territory centers in southwestern Oregon (courtesy K. Dugger)



Zabel *et al.* (2003) modeled the probability of occupancy for NSO in the Klamath Province based on habitat conditions at the core area scale (500 acres). The overall best model in this study indicated that the probability of NSO occurring in a given location was positively, albeit diminishingly, influenced by increased amounts of nesting-roosting habitat and by intermediate amounts of foraging habitat at the core area scale (see Table

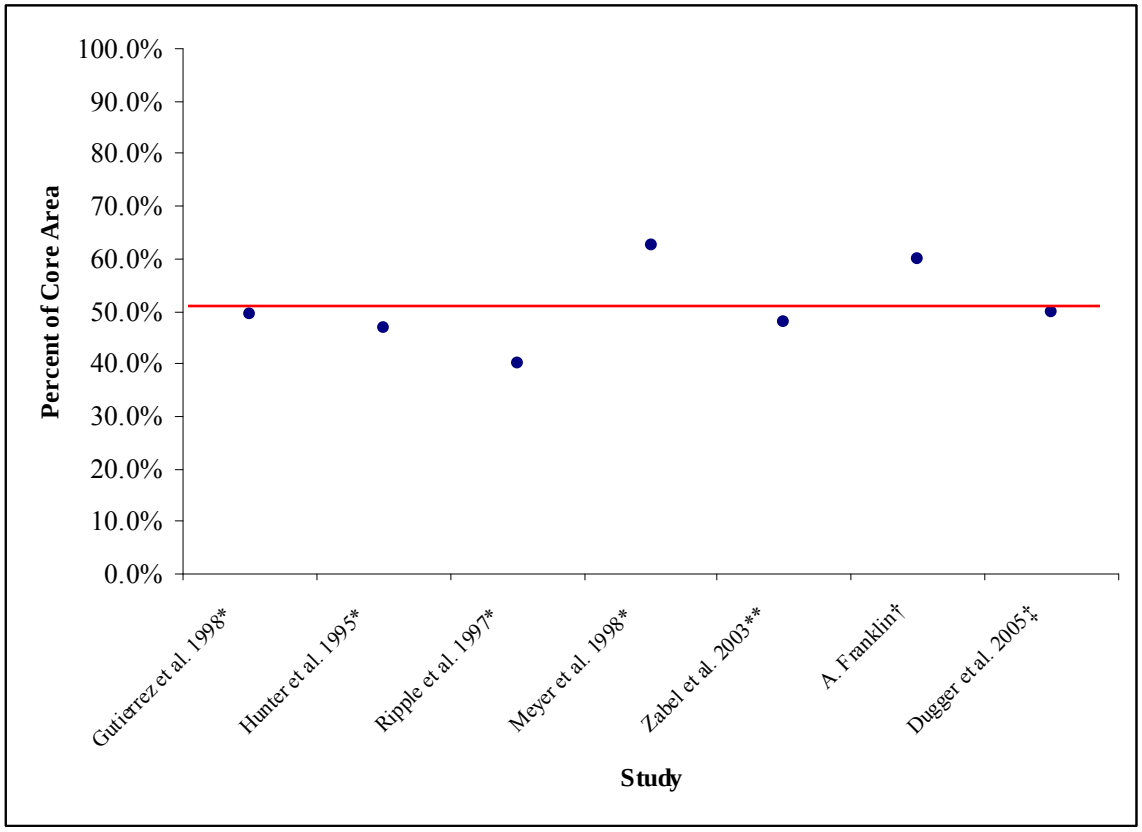
III.C.1 for habitat definitions). The highest probability of occupancy occurred when the core area scale consisted of 60 to 70 percent nesting-roosting habitat and 30 to 40 percent foraging habitat (see Figure III.C.5). The averages for all combinations of habitat associated with a high probability (≥0.70) of occupancy were 48 percent nesting-roosting habitat and 28 percent foraging habitat.

Figure III.C.5: Probability of northern spotted owl occupancy in the Klamath Province associated with amounts of nesting-roosting (NR) and foraging (F) habitats (see Table III.C.1) at the 500-acre (200 ha) scale (Zabel *et al.* 2003)



Researchers have reported a wide range of mean proportions of older forest (ca. 35-60 percent; see Figure III.C.6) at the core area scale around NSO nests in the Klamath Province and adjacent areas (Hunter *et al.* 1995, Ripple *et al.* 1997, Gutiérrez *et al.* 1998, Meyer *et al.* 1998). It is difficult to assess how much of this variation was due to differences in ecological setting, spatial scale, habitat classification, and individual variation among owls. Nonetheless, the central tendency of these results was roughly 50-60 percent, which is consistent with the FWS guidelines' requirement for proportion of nesting and roosting habitat (see *Habitat Definitions*) in the core area (see Figure III.C.6). The mean proportions of older forest at core area scales were higher than those around locations chosen for comparison (random or "unused" locations). Thus, NSO in the Klamath Province appear to select home ranges with large amounts of older forest concentrated around suitable nest locations.

Figure III.C.6: Proportions of older forest (see Table III.C.1) at core area scales around northern spotted owl territory centers in the Klamath Province, CA and OR. Horizontal line shows the proportion of older forest required by the FWS guidelines (50 percent)



*Mean proportion. **Mean proportion associated with ≥70% probability of occupancy. †Recommendation based on the combined proportions of interior and edge-buffer older forest associated with a habitat fitness potential greater than 1 (Franklin et al. 2000). ‡Approximate proportion of older forest associated with a habitat fitness potential of at least 1.

Taken together, the results of studies conducted in the Klamath Province support the conclusion that at least 50 percent of the core area should consist of older forest. Older forest is more likely than other vegetation classes to provide NSO with suitable structures for perching and nesting, a stable, moderate microclimate at nest and roost sites, and visual screening from both predators and prey (see *Habitat Definitions*).

Franklin *et al.* (2000) found that survival and HFP were highest when older forest occurred as large patches in the core area. Larger patches of forest likely buffer NSO from wind and heat associated with forest-opening edges (Chen *et al.* 1995) and predators and competitors associated with open or fragmented forest (e.g., great horned owls [*Bubo virginianus*]: Johnson 1993). Modeling by Franklin *et al.* (2000) also indicated that a balance of interior older forest and edge habitat in the core area is important to NSO in the region. The value of habitat edges for NSO might be related to the availability of woodrats and other prey species associated with more open, early-seral vegetation. The positive influence of large-bodied prey species such as woodrats on NSO reproductive success has been described in northwestern California (White 1996). However, habitat edges in the Franklin *et al.* study occurred wherever habitat was juxtaposed with other land cover classes, and was not necessarily related to the presence of woodrat habitat. In fact, the survival and reproduction of NSO did not appear to be influenced by woodrat habitat in the core area. Zabel *et al.* (2003) found that probability of occupancy by NSO was highest when the core area scale contained some foraging habitat, as well as nesting-roosting habitat. This result suggests that horizontal heterogeneity in the core area should be partially provided by a range of forest conditions suitable for use by NSO, dominated by older forest conditions, (see *Habitat Definitions*, below), not simply the juxtaposition of suitable and unsuitable habitat.

III.D: Habitat Definitions:

Determination of the amount of suitable habitat that must be retained in order to avoid incidental take of NSO is strongly influenced by the range of forest conditions that

are classified as suitable habitat. The HFP models of Franklin *et al.* (2000), Olson *et al.* (2004), and Dugger *et al.* (2005) contain a limited number of habitat variables and relatively coarse definitions of NSO habitat, and therefore must be supplemented with additional information on forest structural parameters that support classification of forest habitat as suitable for nesting and foraging. Description of the structural characteristics of NSO habitat and delineation of the range of habitat conditions corresponding to essential activities such as nesting, roosting, and foraging is a critical element of developing guidelines for evaluating the likelihood of incidental take. Because the structural attributes of habitat immediately surrounding nests are easily quantified, data supporting classification of nesting habitat are readily available (see section III.C).

Foraging habitat, on the other hand, is more variable and spatially extensive, requiring intensive radio-telemetry studies to measure use of various habitat conditions by NSO. In recent studies by the National Council for Air and Stream Improvement (NCASI), correlations between habitat data from detailed forest inventories and nocturnal locations of radio-tagged NSO and California spotted owls were used to estimate resource selection function (RSF) models (Irwin *et al.* 2007a,b) that quantify complex relationships between the owls and their environment. These models allow evaluation of the relative use of specific forest structural variables such as tree size class distribution and stand density by foraging NSO. The studies of Irwin *et al.* (2007a, b), combined with other telemetry studies (Solis and Gutiérrez 1990), provide the basis of our definitions of suitable foraging habitat for NSO.

NSO are generally associated with structurally complex conifer or mixed-conifer forests containing dense, multilayered canopies and significant components of large-

diameter trees and decadence in the form of deformed trees, snags, and down wood (Thomas *et al.* 1990, Gutiérrez 1996, Courtney *et al.* 2004, USFWS 2008). Variation in seral stage association has been reported for individuals within study areas and for populations in different study areas (Gutiérrez 1996). However, extensive use of younger forests by spotted owls tends to be reported in unusually productive forest types in coastal areas (Folliard *et al.* 1993, Thome *et al.* 1999) or in stands containing structural complexity retained from previous stands (Blakesley *et al.* 1992, Zabel *et al.* 1993, Carey and Peeler 1995, Irwin *et al.* 2000). In particular, NSO have been shown to nest and forage successfully in young redwood forests; in such areas their densities are among the highest on record (Diller and Thome 1999). Young redwood forests have also been associated with high reproduction in spotted owls (Thome et al. 1999). The ability of NSO to successfully occupy young redwood forests has been attributed to resource availability; young forests have been found to produce the highest abundance of woodrats in Douglas-fir/tanoak forests (Sakai and Noon 1993), and in the redwood/Douglas-fir zone, woodrats were most abundant in stands 5 to 20 years of age (Hamm et al. 2007: USDA Forest Service Gen. Tech. Rep. PSW-GTR-194). Ward et al. (1998) described the benefit of an energy rich woodrat diet; and White (1996) describes the positive influence of woodrat consumption on nesting success. The value of younger forest to NSO in the drier portions of the Klamath Province is poorly understood, whereas numerous studies in the Klamath Province and adjacent regions have demonstrated that NSO selectively use older, denser forest at a variety of spatial scales (e.g., Solis and Gutiérrez 1990, Bart and Forsman 1992, Blakesley *et al.* 1992, Carey *et al.* 1992, Hunter *et al.* 1995, Ripple *et al.* 1997, LaHaye and Gutiérrez 1999, Zabel *et al.* 2003) and that such forest is positively

associated with measures of reproduction and survival (e.g., Ripple *et al.* 1997, Meyer *et al.* 1998, Franklin *et al.* 2000, Olson *et al.* 2004, Dugger *et al.* 2005).

Although spotted owls are generally associated with and preferentially select older, denser forest, suitable habitat for the species can be viewed as a continuum of structural conditions. Owls tend to use parts of this continuum more frequently than others, and to focus their activities within certain parts of it for meeting particular life history needs. The FWS has classified this continuum into habitat categories based on the conditions' primary function and apparent quality for NSO (nesting/roosting or foraging habitat, high or low quality habitat; see Table III.D.1 and Figure III.D.1). The FWS recognizes that conditions within a habitat category may be used by NSO to meet multiple life history needs; for example, NSO may forage in nesting/roosting habitat or roost in foraging habitat. We also acknowledge that rigorous classification of habitat quality requires an understanding of the relationships between habitat conditions and the demography of NSO. However, because NSO are mobile animals with large home ranges, most studies have used low-resolution vegetation data and broad habitat categories to explore their habitat relationships (see Table III.C.1). These studies have greatly improved our understanding of NSO-habitat relationships but provide limited insight into the specific structural conditions used by owls.

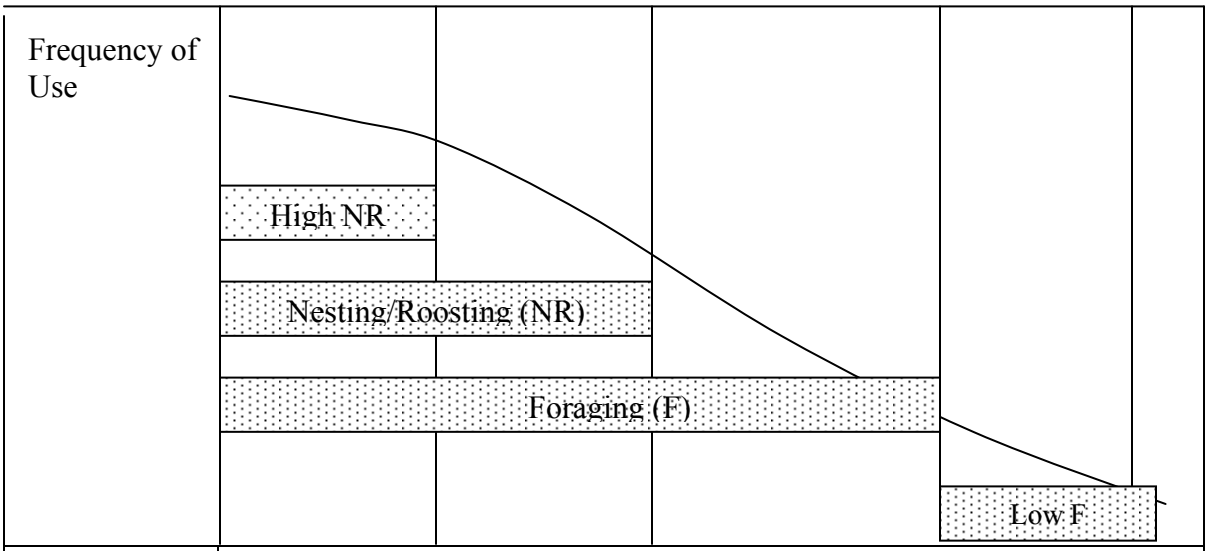
Table III.D.1: Values for selected structural parameters used in the Fish and Wildlife Service guidelines to classify nesting/roosting and foraging habitat for northern spotted owls.

Habitat category	Tree Size (QMD)[1]	Basal Area[2]	Trees > 26"dbh	Canopy closure
High nesting/roosting	≥ 15"	≥ 210 ft^2	8 per acre	≥60%
Nesting/roosting	≥ 15"	150–180+ ft^2	8 per acre	≥ 60%
Foraging	≥ 13"	120-180+ ft^2	5 per acre	≥ 60%
Low foraging	≥ 11"	80-120+ ft^2		≥ 40%

1: Quadratic Mean Diameter (inches) of trees > 5" diameter
2: Square feet per acre, trees > 5"

A few studies have provided plot-level descriptions of areas used by NSO. Habitat definitions in the FWS guidelines are primarily based on the statistical distributions of habitat parameters correlated with use by owls in these studies. Yet, the average conditions in small study plots around owl locations may poorly represent the inherent variability of stands and landscapes in owl territories. Therefore, the FWS guidelines distribute habitat categories in terms of ranges of values within analysis areas, rather than as stand averages. This approach ensures that a range of suitable habitat conditions is well-distributed at appropriate spatial scales, without being unrealistically or unreasonably prescriptive.

Figure III.D.1: Conceptual model of northern spotted owl habitat functions and associated forest structural conditions.



Basal Area	300+	200	150	120	80
QMD[1]	20”		15”	13”	11”
TPA > 26”[2]	50		8	5	
Canopy[3]	100%		60%		40%
Structure	Large tree/dense	Large/open to medium/dense		small/dense to open/brushy	

1: QMD= quadratic mean diameter of trees > 5 inches dbh
2: TPA>26”= trees per acres of trees >26 inches dbh
3: Canopy= percent cover of overstory trees

The FWS guidelines use a suite of structural metrics to classify NSO habitat (basal area, quadratic mean diameter, large-diameter [>26 inches DBH] trees per acre, and canopy cover) (Table III.D.1). We chose these metrics because they describe different aspects of stand structure that appear to be important to NSO and because they are commonly used by silviculturists to evaluate forest conditions. The FWS discourages the use of broad vegetation classification categories for defining habitat for NSO in the Klamath Province. These classification schemes are inappropriate for defining habitat in take-avoidance guidelines because they encompass broad ranges of vegetation parameters that often do not correspond to habitat used by NSO. For example, habitat class 4M in the CWHR system (average DBH 11 - 24 inches and average canopy cover 40-59 percent)

might describe anything from infrequently-used foraging habitat to nesting and roosting habitat. Furthermore, use of broad habitat classification schemes can mask the effects of habitat modification. For example, timber harvests could remove important habitat elements (e.g., snags, deformed trees, dense groups of large trees) while maintaining the minimum average canopy cover and tree diameter values in a given habitat category and masking the loss of habitat quantity and quality.

Habitats Used for Nesting and Roosting

The 2008 NSO Recovery Plan (USFWS 2008:50) stated that: "Features that support nesting and roosting typically include a moderate to high canopy closure (60 to 90 percent); a multi-layered, multi-species canopy with large overstory trees (with diameter at breast height [dbh] of greater than 30 inches); a high incidence of large trees with various deformities (large cavities, broken tops, mistletoe infections, and other evidence of decadence); large snags; large accumulations of fallen trees and other woody debris on the ground; and sufficient open space below the canopy for spotted owls to fly." The validity of applying this rangewide habitat definition to the Klamath Province has been supported by numerous studies in and adjacent to the region (e.g., Solis and Gutiérrez 1990, Blakesley *et al.* 1992, Carey *et al.* 1992, Hershey *et al.* 1998, LaHaye and Gutiérrez 1999), including on private timberlands (Self *et al.* 1991, SPI 1992, Farber and Crans 2000).

The characteristic structure of nesting/roosting habitat probably serves a variety of functions for NSO. NSO may partly favor older, more decadent forest for nesting because it frequently contains suitable nest structures. Nests are usually located in older, larger-

diameter, deformed, decadent, or diseased trees containing cavities or platforms (Forsman *et al.* 1984, Hershey *et al.* 1998, LaHaye and Gutiérrez 1999, North *et al.* 2000). Northern spotted owls may also nest and roost in older, denser forest because it tends to provide a more moderate, stable microclimate compared with other kinds of forest. NSO are less able to dissipate body heat than other owls and appear to compensate by nesting and roosting in relatively cool, humid sites (Barrows 1981, Ganey *et al.* 1993, Ting 1998, Weathers *et al.* 2001). NSO also appear to use dense, multilayered canopies for protection from cold, wet weather (Forsman *et al.* 1984, North *et al.* 2000). Northern spotted owls may also prefer nesting and roosting in denser forest because it provides visual screening from predators (Carey 1985, Buchanan *et al.* 1995).

High-quality nesting/roosting habitat

As defined by the FWS guidelines, high-quality nesting/roosting habitat occurs where structural conditions resemble or exceed those of most observed NSO nest sites in northern California (see Table III.D.2). To date, no Klamath Province study has directly compared plot-level vegetation data for nest and roost sites to the demography of NSO, so it is unknown if the average structural conditions used by owls in the region are associated with high reproduction and survival. Therefore, a definition of high-quality nesting/roosting habitat must account for variability in habitat-use patterns among individuals by ensuring that the range of habitat values associated with owl use are well-represented, rather than prescribing a single criterion based on mean values.

Nesting/roosting habitat

The FWS' definition of nesting/roosting habitat is similar to high-quality nesting/roosting habitat, but is intended to reflect both variability in the structure of sites used by nesting and roosting owls and the variability typical of forest stands or patches encompassing denser nest and roost sites (see Table III.D.1and III.D.2). The FWS guidelines' requirement for a mix of basal areas in nesting/roosting habitat allows land managers some operational flexibility but also discourages homogenization of stands during harvesting. Although it is more stringent than that used in the FPR guidelines, the FWS guidelines provide definitions of habitats used for nesting and roosting that consistent with the range of conditions found at many spotted owl nest cores on private timberlands.

Table III.D.2: Mean structural characteristics of areas used by spotted owls for nesting, roosting, and foraging (rounded to the nearest whole number). The habitat variables are basal area (BA), quadratic mean diameter (QMD), large trees per acre (TPA), and canopy cover (CC)

Source **Location**	**FWS Guidelines** Klamath Province	**White 1996** Klamath National Forest*	**Self et al.**** Klamath Province and So. Cascades	**Farber and Crans 2000** Klamath Province and So. Cascades	**Irwin et al. 2007** Northern Sierra Nevada (CSOs)	**L. Irwin, unpubl.** Medford, Klamath Province
Habitat Type **Plot Size** **BA (ft2/ac)** **QMD (in)** **TPA >26"** **TPA >35"** **CC%**	High-Quality Nesting/ Roosting - ≥210 ≥15 ≥8 - ≥60	Nest & Roost Sites 0.2-0.3 ac 246† 8 73	Nest Sites 1 ac 212‡ 16‡	Nest Sites 0.1 ac, 2.5 ac 210, 166† 14, 12† 70, 67	Roost Sites 216† 16† 8 75	
Habitat Type **BA (ft2/ac)** **QMD (in)** **TPA >22"** **TPA >26"** **TPA >32"** **CC%**	Nesting/ Roosting (High-Quality Foraging) mix >150 ≥15 - ≥8 - ≥60		Nest Patches 173‡ 16 4	Nest Stands 124† 13†	Foraging Locations 190 14 7 69	Foraging Locations 180† 20† 8
Habitat Type **BA (ft2/ac)** **QMD (in)** **TPA >26"** **CC%**	Foraging mix >120 ≥13 ≥5 mix ≥40					Foraging Locations (Lower 25%) 120 14 0
Habitat Type **BA (ft2/ac)** **QMD (in)** **CC%**	Low-Quality Foraging mix >80 ≥11 ≥40					Foraging Locations (Lower Values) See Figure III.D.2 See Figure III.D.3

*Excludes data from the Goosenest Ranger District in the southern Cascade Range. **SPI = Self *et al.* 1991, SPI 1992, and Table III.D.2. †All trees >5" DBH (lower cutoff reported for QMD, assumed for BA). ‡All trees >6" DBH (lower cutoff reported for QMD, assumed for BA).

Foraging Habitat

Foraging habitat encompasses nesting and roosting habitat but includes a broader range of structure and might not support successful nesting by NSO (Gutiérrez 1996, USFWS 2008). Foraging NSO generally use older, denser, and more complex forest than expected based on its availability, but they also use younger forest (Solis and Gutiérrez 1990, Carey *et al.* 1992, Zabel *et al.* 1993, Carey and Peeler 1995, Anthony and Wagner 1999, Irwin *et al.* 2007b). The FWS guidelines incorporate this structural variability by specifying retention of habitat in four functional categories of habitat suitable for NSO. High-quality nesting/roosting and nesting/roosting habitat provide the upper range of stand structure selected by foraging NSO; foraging habitat encompasses a broad range of structure, and low-quality foraging habitat includes younger and more open habitats that may be important for prey production (Tables III.D.1 and III.D.2; Figure III.D.1). Northern spotted owls may prefer older, denser forest for foraging because it often contains both abundant prey and suitable structural characteristics for hunting. Several important prey species, including flying squirrels (*Glaucomys sabrinus*) and western red-backed voles (*Clethreionomys californicus*) tend to be most abundant in older, denser forest (Carey *et al.* 1992; Waters and Zabel 1995, 1998). Other important prey species, such as woodrats, have been found to be most abundant in young sapling stands (Sakai and Noon 1993), but can also reach high abundances in dense, old forest (Carey *et al.* 1992, Sakai and Noon 1993). Spotted owls usually hunt by listening and scanning for prey from elevated perches (Forsman *et al.* 1984). Dense, multilayered forest might provide owls with hunting perches at a variety of canopy levels (North *et al.* 1999). Dense vegetation might also visually screen foraging NSO from predators and prey

(Carey 1985, Buchanan *et al.* 1995). Conversely, spotted owls require space for flying, which could place an upper limit on the understory density of suitable habitat (Irwin *et al.* 2007b).

Descriptions of habitat structure used by foraging NSO are typically based on studies employing radio telemetry to monitor owl movements. While the habitats associated with nocturnal telemetry locations are commonly termed 'foraging locations', some researchers point out that the owl locations simply indicate the distribution of movements, and may not correspond to sites and habitats actually used by actively foraging NSO. During radio telemetry studies in northwestern California, Diller (unpub. data), found that owls moved frequently during monitoring periods (7.5 minutes/perch for 6 males; 17.0 minutes/perch for 4 females), suggesting that the process of triangulating azimuths for each location was unlikely to detect a specific site used for foraging. Conversely, owls in this study also were stationary for long periods of time, possibly resting, preening, or other activities not associated with active foraging. For these reasons, the FWS recognizes that our descriptions of NSO foraging habitat likely represent the range of habitat conditions used by owls at night, and may not represent the specific habitat qualities of sites where NSO successfully obtain prey.

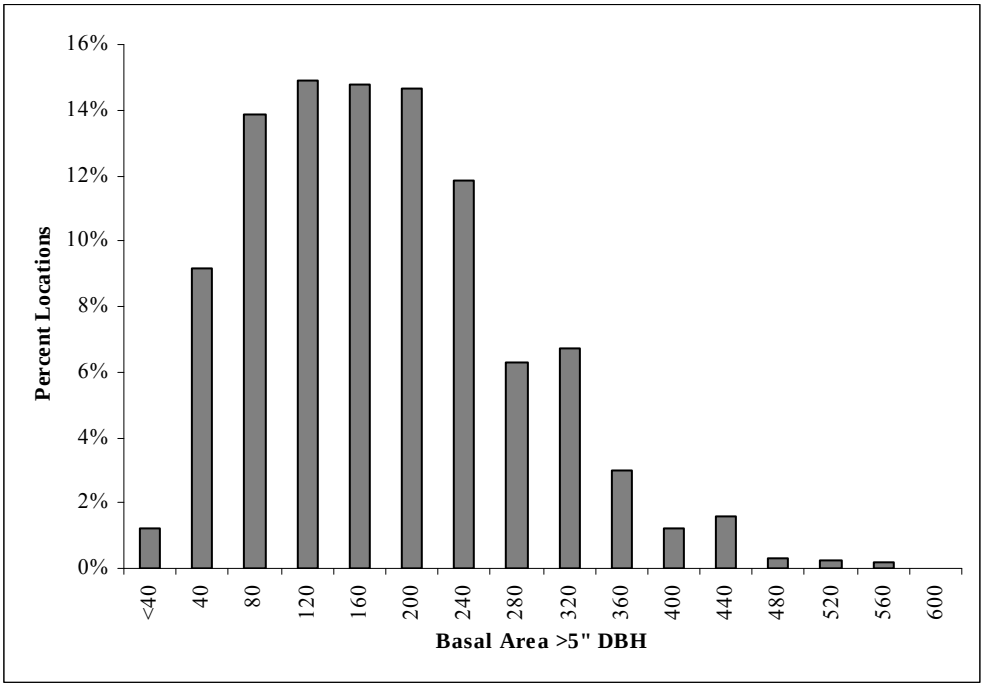
There are currently no published plot-based descriptions of NSO foraging habitat in the Klamath Province. We therefore strongly considered the results of both unpublished studies of NSO and a published study of California spotted owls (*Strix occidentalis occidentalis*, CSOs) in the northern Sierra Nevada (Irwin *et al.* 2007b) while formulating these habitat definitions. Much of the CSO study was conducted in a mixed-conifer/hardwood forest similar to forest types used by NSO in the Klamath Province.

Although spotted owls often selectively foraged in older forest, these telemetry studies show that they also use a relatively wide range of forest structure (Irwin *et al*. 2004, 2007).

The range of forest structure specified in the FWS guidelines is also based on the distribution of habitat use by foraging NSO in the Klamath Province. Analysis of radio-telemetry data from NSO in southern Oregon (L. Irwin, unpublished data) indicates that roughly 46 percent of nocturnal (foraging) locations occurred in nesting/roosting habitat (basal area ≥210 ft^2/acre), and 76 percent occurred in stands classified as foraging, nesting, and roosting habitat (Figure III.D.2). Only 14% of locations were in stands classified as low-quality foraging habitat. Thus, the functional habitat categories specified in the FWS guidelines capture about 90 percent of the observed distribution of actual use by NSO, but also require retention of the full range of structural conditions corresponding to nesting, roosting, and foraging.

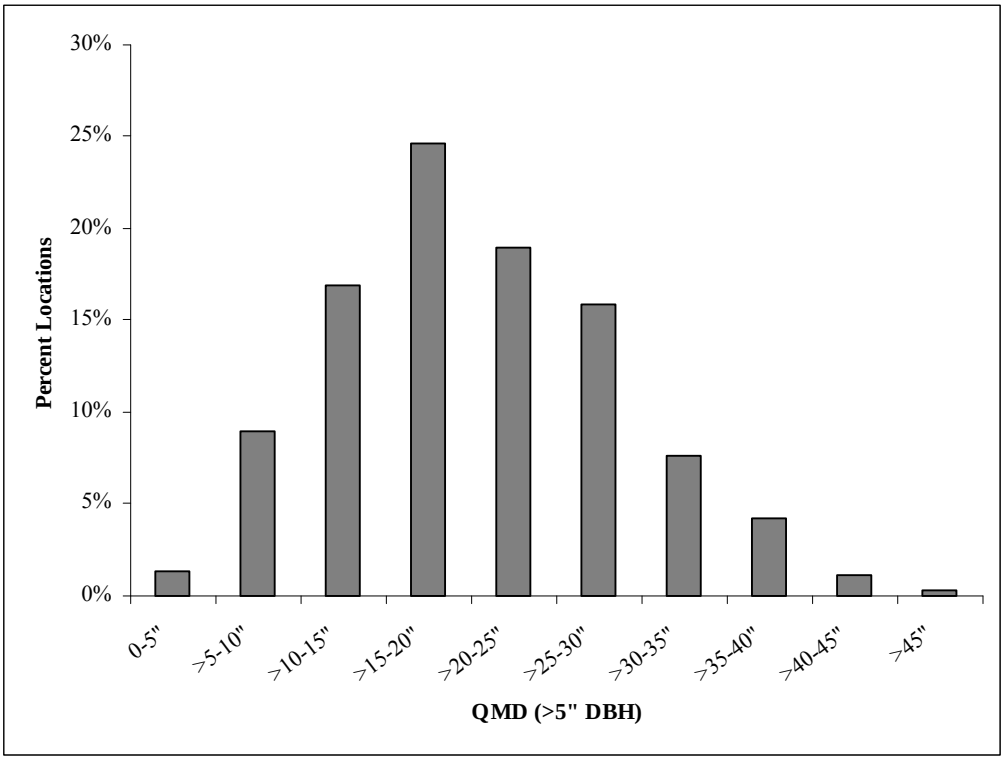
In addition to the structural characteristics addressed in the FWS guidelines, studies have indicated that certain conifer species such as Douglas-fir, as well as hardwoods and dead woody materials are important features of spotted owl foraging habitat (North *et al.* 1999, Irwin *et al.* 2000, Glenn *et al.* 2004, Irwin *et al.* 2007).

Figure III.D.2: Distribution of basal area at inventory plots near nocturnal telemetry locations for northern spotted owls in the Medford area of the Klamath Province (L. Irwin, unpublished data). This figure shows some of the range of basal area values used for foraging; it is does not show selection or avoidance of particular values since available conditions were not described.



DBH: diameter at breast height, in inches

Figure III.D.3: Distribution of quadratic mean diameter (QMD) at inventory plots near nocturnal telemetry locations for northern spotted owls in the Medford area of the Klamath Province (L. Irwin, unpublished data). This figure shows some of the range of QMD values used for foraging; it is does not show selection or avoidance of particular values since available conditions were not described.



DBH: diameter at breast height, in inches

Abiotic Habitat Characteristics

Habitat selection by breeding NSO is strongly influenced by spatial and topographic features such as proximity to nest, distance to water, slope position, and elevation. Termed 'abiotic considerations' in the FWS guidelines, these factors act to influence the habitat value of forest stands, and subsequently the importance of retaining habitat based on landscape position as well as stand structure. Abiotic considerations are explicitly incorporated into the FWS guidelines through a prioritization system that ranks habitat retention areas based on distance to nest, contiguity, slope position, aspect, and elevation.

Because the guidelines for abiotic considerations are less prescriptive than the guidelines for stand structure, they are more easily applied during habitat evaluations on a case by case basis.

Habitat selection by breeding NSO is strongly associated with proximity to the nest, as well as with vegetation characteristics (Carey and Peeler 1995, Rosenberg and McKelvey 1999, Glenn *et al.* 2004, Irwin *et al.* 2007b). Spotted owls appear to be central-place foragers, disproportionately using areas near the nest in order to minimize travel costs and maximize their energetic return from foraging (Carey and Peeler 1995, Rosenberg and McKelvey 1999). Home range studies have also indicated the importance of the territory center to spotted owls (see *Analysis Areas*). Combined, spatial patterns of habitat selection and habitat use suggest that NSO may be more sensitive to reductions of habitat in their core areas than in other parts of their home ranges. The FWS guidelines therefore emphasize retention of habitat at the core area scale.

Topography also appears to influence habitat use by NSO; which use lower slope positions more frequently than higher ones (Forsman *et al.* 1984, Blakesley *et al.* 1992, Hershey *et al.* 1998, LaHaye and Gutiérrez 1999, Irwin *et al.* 2007b). Lower slopes likely provide cooler, more humid microclimates for nesting and roosting and favor growth of the denser forest structure preferred by spotted owls. Furthermore, lower slope positions tend to have less frequent and severe fire regimes, potentially allowing trees to attain greater density, sizes and ages than on higher slopes (Beaty and Taylor 2001, Skinner *et al.* 2006). Spotted owls also appear to prefer areas close to streams, which often occur at the bottoms of slopes (Solis and Gutiérrez 1990, LaHaye and Gutiérrez 1999, Irwin *et al.* 2007b). Areas near streams likely tend to be more productive and have cooler, more

humid microclimates than upland areas. Additionally, prey abundance can be high in riparian areas (Carey *et al.* 1992, Anthony *et al.* 2003) and NSO may use streams for drinking and bathing (Forsman *et al.* 1984). Some studies have found that NSO in the Klamath Province selectively use northerly aspects, but others found different patterns or no pattern at all (Solis and Gutiérrez 1990, Blakesley *et al.* 1992, Carey *et al.* 1992, Zabel *et al.* 1993, Farber and Crans 2000). Suitable microclimates for nesting and roosting, and for the vegetation structure preferred by NSO, may occur more frequently on north-facing slopes than on other aspects. However, aspect does not appear to influence vegetation distribution as strongly in some areas as in others (e.g., Zabel *et al.* 1993). Elevation also seems to influence habitat-use by spotted owls (Solis and Gutiérrez 1990, Blakesley *et al.* 1992, Hershey *et al.* 1998, LaHaye and Gutiérrez 1999, Irwin *et al.* 2007b). This might be related both to spotted owls' disproportionate use of lower slope positions and to the influence of elevation on vegetation distribution. The productive vegetation types favored by NSO, such as mixed-evergreen forest, primarily occur at lower elevations in the Klamath Province (Sawyer 2007).

III. E. Conclusions:

The FWS has conducted a thorough review and synthesis of published literature, unpublished data sets, and direct communication with NSO researchers in support of a rigorous process for evaluating the effects of habitat management on NSO. It is important to recognize that the habitat conditions described in the document are intended for use in estimating the likelihood of take of individual NSO under the ESA; they do not represent habitat conditions required for population growth or recovery. The FWS

guidelines focus solely on individual NSO territories and do not incorporate larger-scale issues such as connectivity and dispersal habitat, wintering habitat, or longer-term habitat disturbance patterns. The FWS habitat evaluation guidelines that this science review document supports are complex; reflecting the complex nature of forest environments in the Klamath Province and the forest products industry's requirement to retain maximum flexibility to conduct timber harvests in the vicinity of occupied NSO territories.

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Appendix A: Full text of U.S. Fish and Wildlife Service Guidance for Evaluation of Take for Northern Spotted Owls on Private Timberlands in California's Northern Interior Region

I. Accuracy of NSO activity center location and status

1) Location
    a. Confirm plotted activity center location accuracy
        i. CDFG Reports 2 and 3
        ii. Data from adjacent landowners
        iii. Recent surveys
    b. Document deviations from CDFG locations
    c. Update habitat analysis maps as necessary
2) Status
    a. Valid site
        i. Review page 11 of protocol to determine
        ii. If not valid, report to CDFG for inclusion in next database update
    b. Current occupancy status
    c. Current reproductive status, if determined

II. Survey Effort

1) Coverage
    a. Surveys of nesting/roosting habitat out to 0.7 miles from THP boundary
        i. Use THP habitat map(s) to verify
2) Protocol survey
    a. Time of day
    b. Spacing between visits
    c. Number of surveys
    d. Survey dates
    e. Time spent at each call point
3) Follow up visit(s)
    a. Confirm that the area searched covers suitable habitat within response location/last known location within a logical distance.
    b. Time of follow up and duration of follow up
    c. Additional night surveys
        i. Review page 10 of protocol

III. Habitat

1) Typing
    a. Verify habitat typing with aerial photos, equivalent imagery, or field visits

b. Changes to typing need to be reflected in the NSO habitat acres table and habitat analysis maps
c. Post harvest typing
    i. Post-harvest habitat typing must agree with the silviculture prescription

2) Definitions
    a. Nesting/roosting
        i. High Quality Nesting/roosting Habitat
            1. Basal Area = 210+ square feet, **and**
            2. ≥ 15" quadratic mean diameter (QMD) , **and**
            3. ≥ 8 trees per acre (TPA) of trees ≥ 26" in diameter at breast height (DBH) , **and**
            4. ≥ 60% canopy closure
        ii. Nesting/roosting Habitat
            1. A mix of basal areas ranging from 150-180+ square feet, **and**
            2. ≥ 15" QMD, **and**
            3. ≥ 8 TPA of trees ≥ 26" DBH, **and**
            4. ≥ 60% canopy closure
    b. Foraging
        i. Foraging Habitat
            1. A mix of basal areas ranging from 120-180+ square feet, **and**
            2. ≥ 13" QMD, **and**
            3. ≥ 5 TPA of trees ≥ 26" DBH, **and**
            4. A mix of ≥ 40%-100% canopy closure
        ii. Low Quality Foraging Habitat
            1. A mix of basal areas ranging from 80-120+ square feet, **and**
            2. ≥ 11" QMD, **and**
            3. ≥ 40% canopy closure

3) Quantities
    a. Within 1000 feet of activity center
        i. Outside breeding season (September 1 through January 31): no timber operations other than use of existing roads
        ii. During the breeding season (February 1 through August 31): no timber operations other than the use of existing, permanent, year-round roads

    b. Within 0.5 mile radius (502 acres) centered on activity center
        i. Retention of habitat should follow Section III. 4 of this document
        ii. At least 250 acres nesting/roosting habitat present, as follows:
            1. 100 acres High Quality Nesting/roosting Habitat, **and**
            2. 150 acres Nesting/roosting Habitat

        –AND–

        iii. At least 150 acres foraging habitat must be present, as follows:
            1. 100 acres Foraging Habitat, **and**
            2. 50 acres Low Quality Foraging Habitat
        iv. No more than 1/3 of the remaining suitable habitat may be harvested during the life of the THP

c. Between 0.5 mile radius and 1.3 miles radius circles centered on activity center
    i. Retention of habitat should follow Section III. 4 of this document
    ii. ≥935 acres suitable habitat must be present, as follows:
        1. At least 655 acres Foraging Habitat, **and**
        2. At least 280 acres Low Quality Foraging, **and**
        3. No more than 1/3 of the remaining suitable habitat may be harvested during the life of the THP

4) Priority Ranking of Habitat Retention Acres
    a. Tree species composition
        i. Mixed conifer stands should be selected over pine dominated stands
    b. Abiotic considerations
        i. Distance to nest
            1. Nesting/roosting and foraging habitat closest to identified nest trees, or roosting trees if no nest trees identified
        ii. Contiguous
            1. Nesting/roosting habitat within the 0.5 mile radius must be as contiguous as possible
            2. Minimize fragmentation of foraging habitat as much as possible
        iii. Slope position
            1. Habitats located on the lower 1/3 of slopes provide optimal micro-climate conditions and an increased potential for intermittent or year-round water sources
        iv. Aspect
            1. Habitats located on northerly aspects provide optimal vegetation composition and cooler site conditions
        v. Elevation
            1. Habitat should be at elevations of less than 6000 feet, though the elevation of some activity centers (primarily east of Interstate 5) may necessitate inclusion of habitat at elevations greater than 6000 feet.

IV. Determination

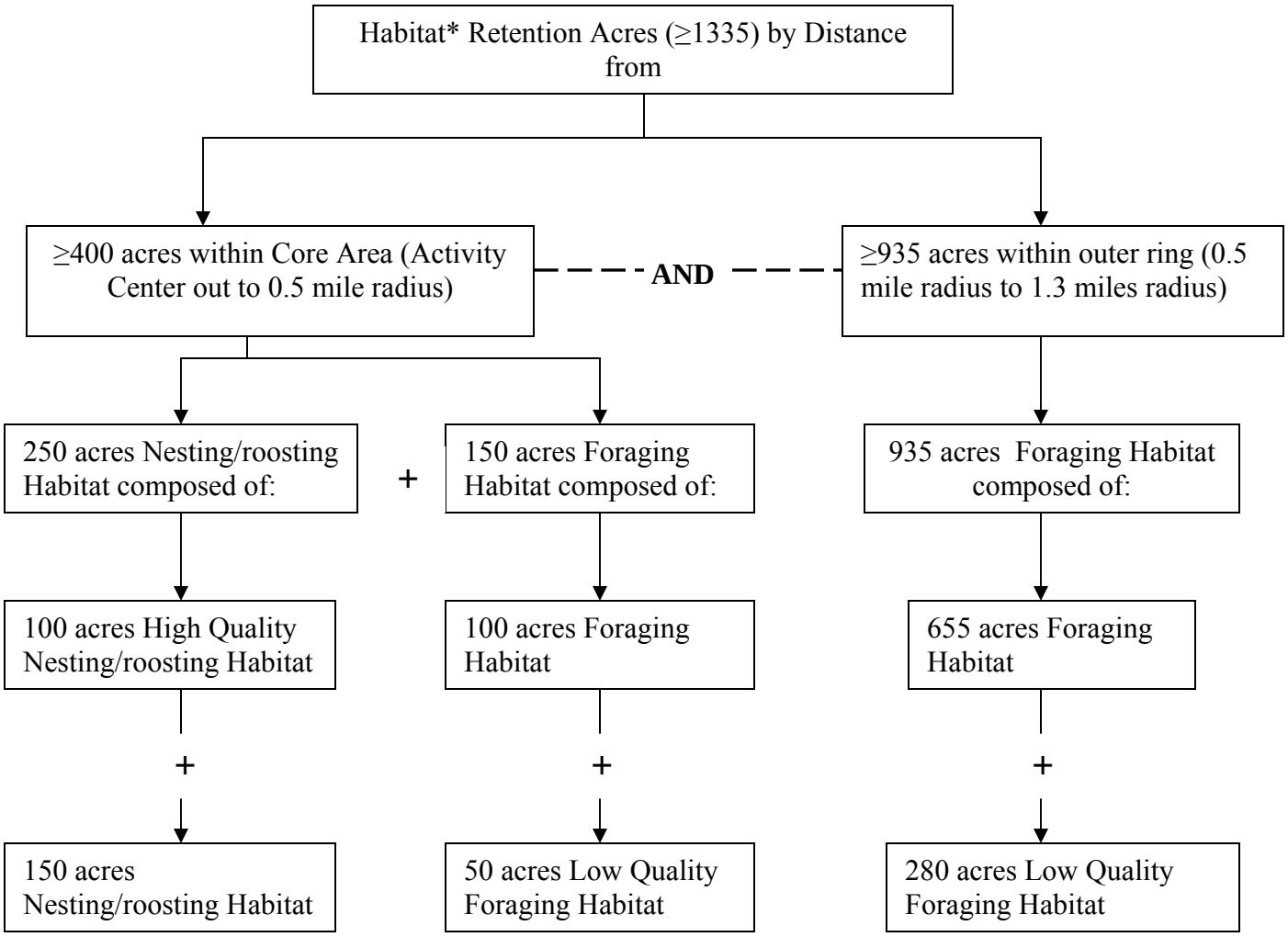
1) If surveys are inadequate or do not meet the intent of protocol, take determination may not be possible.
2) If habitat typing is inadequate, take determination may not be possible.
3) If NSO home range habitat acres are below desired conditions (Section III. 2, 3, and 4), additional loss of suitable habitat can lead to take.
4) If NSOs are nesting, utilize seasonal restriction within 0.25 mile of nest (February 1 through August 31).
5) If effects are limited to noise disturbance, a modified seasonal restriction may be used from February 1 through July 9

a. Harvest of unsuitable habitat, with unsurveyed suitable within 0.25 of unit boundary

6) Multiple THPs located within a given NSO territory need to be considered collectively or a take determination may not be possible.

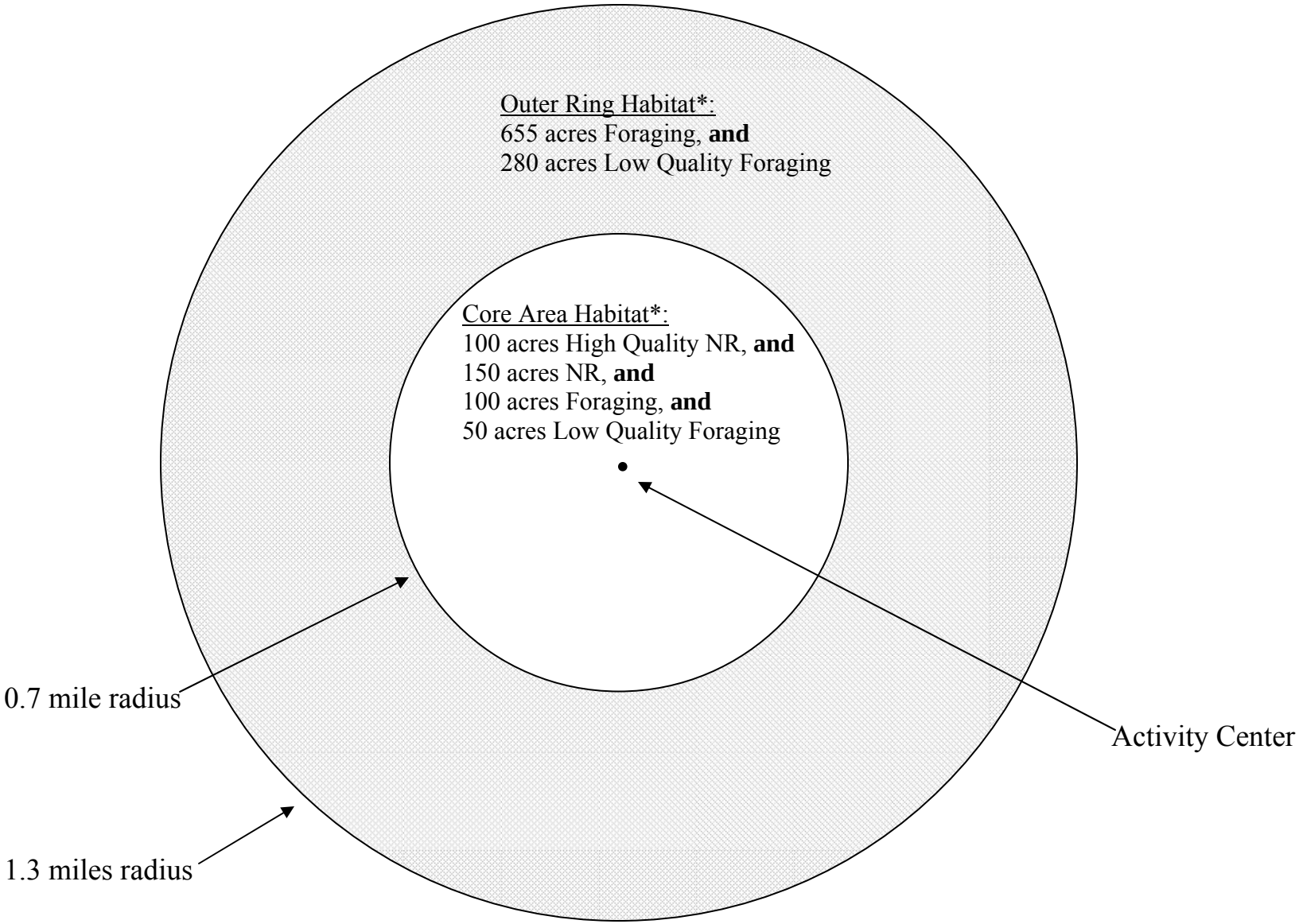
V. TA Letter Contents

1) Date of written TA request
2) Date request received
3) Note if previous TA(s) provided in past
4) Number of acres within THP units
5) Amounts and types of silviculture prescriptions
6) Location of THP
    a. Township, Range, and Section
    b. Meridian
    c. County
7) Identify NSO activity centers returned by CDFG reports
8) Surveys conducted and activity center status
9) Logic behind take determination
    a. Habitat considerations
        i. Acres, quality, and location of suitable habitat pre- and post-harvest
        ii. Effects of timber operations on suitable habitat
            1. Degrade: suitable habitat is harvested but still functions in the capacity it did pre-harvest (i.e. Foraging habitat before harvest functions as foraging habitat post-harvest, nesting/roosting habitat pre-harvest functions as nesting/roosting habitat post-harvest)
            2. Downgrade: pre-harvest nesting/roosting habitat becomes foraging habitat post-harvest
            3. Remove: nesting/roosting or foraging habitat is harvested such that it no longer functions as habitat post-harvest
    b. Proximity of activity center to operations
    c. Survey data
10) Sunset date and seasonal restrictions
    a. If 2 year protocol and surveys are current and negative, additional TA needed if operations not completed by February 1, *YEAR* (review protocol page 3).
    b. If 1 year protocol and surveys are current and negative, additional TA needed if operations not completed by February 1, *YEAR* (review protocol page 3).
    c. If NSOs detected in previous surveys and operations are not complete before February 1, surveys are required to determine location and status of NSOs prior to operations during each breeding season that operations are ongoing.
    d. If no owls within 1.3 miles of THP (CDFG reports) and no suitable habitat within units or 1.3 miles of units, additional technical assistance may not be required.
11) Name of agency person to contact if there questions regarding TA



*See Section III.2 for habitat definitions

Habitat Retention within Core Area and 1.3 mile Home Range–Interior



*See Section III.2 for habitat definitions

Information Needed for US Fish and Wildlife Service Timber Harvest Plan – Northern Spotted Owl Technical Assistance Analysis

1) All documentation submitted for Technical Assistance must be legible

2) Letter requesting technical assistance providing general information relevant to the Timber Harvest plan (THP):
    a. THP number
    b. Township-Range-Section location data
    c. Presence/absence of northern spotted owls (NSO)
    d. Other important information that might influence take determination, such as:
        i. Operating outside of breeding season
        ii. THP at high elevation (above 6000 feet)
        iii. Forest type or physiographic province

3) Overview map showing location of THP units in relation to NSO activity centers and detection locations

4) Silviculture information:
    a. Silviculture map(s) from THP showing location of THP units and type(s) of silviculture
        i. Silviculture prescription important in the case(s) where units are within 1.3 miles of NSO activity centers
    b. Description of silviculture from THP including number of acres of each silviculture prescription

5) Current California Department of Fish and Game (CDFG) California Natural Diversity Database (CNDDB)/Spotted Owl Viewer Reports 1, 2, and 3 for area extending 1.3 miles from THP boundary
    a. Report 1 is sufficient if no NSOs activity centers returned by query
    b. Version date (upper left corner) must correspond to the present rendition of the CDFG database
    c. If known NSO locations deviate from CDFG reports, submit documentation from landowner supporting placement of NSO activity centers and detections

6) Nesting/roosting and foraging habitat mapped out to 0.7 mile from THP boundary or out to 0.25 mile for THPs that will only operate in unsuitable habitat

7) Habitat typing maps pre- and post-harvest for each NSO activity center within 1.3 miles of THP boundary
    a. Extend typing to a 1.3 miles radius from the best-known location for NSO activity center(s)
        i. Not always be coincident with CDFG Report 2 or 3
        ii. Reasons for deviations from CDFG report documented
    b. Maps shall delineate 1000 foot, 0.5 mile, 0.7 mile, and 1.3 miles radii distances from activity center

8) Table listing number of acres of nesting/roosting and foraging habitat within 0.5 mile, 0.7 mile, and 1.3 miles of activity centers pre- and post-harvest based on maps provided for #6.

9) Survey data:
    a. Map of call route
    b. Survey forms or summary sheet including survey date, survey start time, and survey results
    c. Follow-up forms, if NSOs detected during surveys
    d. Maps of detection/response locations, if NSOs detected during surveys

10) For operations proposed within 1.3 miles of NSO activity centers, habitat typing must be verifiable
    a. Aerial photo coverage, or equivalent imagery, of the 1.3 miles area surrounding activity centers within which timber operations are proposed
    b. Include maps of timber operations within 1.3 miles of known NSOs that have occurred since the date of the aerial photo or equivalent imagery
    c. Include maps of approved timber operations within 1.3 miles of known NSOs

11) If requesting a determination of unoccupied status for an activity center, the following are also required:
    a. Activity center occupancy history
    b. Survey history
    c. Current condition of habitat
        i. Include discussion of past and approved timber operations and natural events such as fire that has or will alter the condition of the habitat.

Revised February 27, 2008
Replaces February 1, 2008 version

Attachment B: Take Avoidance Analysis-Interior

I. Accuracy of NSO activity center location and status

1) Location
    a. Confirm plotted activity center location accuracy
        i. CDFG Reports 2 and 3
        ii. Data from adjacent landowners
        iii. Recent surveys
    b. Document deviations from CDFG locations
    c. Update habitat analysis maps as necessary
2) Status
    a. Valid site
        i. Review page 11 of protocol to determine
        ii. If not valid, report to CDFG for inclusion in next database update
    b. Current occupancy status
    c. Current reproductive status, if determined

II. Survey Effort

1) Coverage
    a. Surveys of nesting/roosting habitat out to 0.7 miles from THP boundary
        i. Use THP habitat map(s) to verify
2) Protocol survey
    a. Time of day
    b. Spacing between visits
    c. Number of surveys
    d. Survey dates
    e. Time spent at each call point
3) Follow up visit(s)
    a. Confirm that the area searched covers suitable habitat within response location/last known location within a logical distance.
    b. Time of follow up and duration of follow up
    c. Additional night surveys
        i. Review page 10 of protocol

III. Habitat

1) Typing
    a. Verify habitat typing with aerial photos, equivalent imagery, or field visits
    b. Changes to typing need to be reflected in the NSO habitat acres table and habitat analysis maps
    c. Post harvest typing

i. Post-harvest habitat typing must agree with the silviculture prescription

2) Definitions
   a. Nesting/roosting
      i. High Quality Nesting/roosting Habitat
         1. Basal Area = 210+ square feet, **and**
         2. ≥ 15" quadratic mean diameter (QMD) , **and**
         3. ≥ 8 trees per acre (TPA) of trees ≥ 26" in diameter at breast height (DBH) , **and**
         4. ≥ 60% canopy closure
      ii. Nesting/roosting Habitat
         1. A mix of basal areas ranging from 150-180+ square feet, **and**
         2. ≥ 15" QMD, **and**
         3. ≥ 8 TPA of trees ≥ 26" DBH, **and**
         4. ≥ 60% canopy closure
   b. Foraging
      i. Foraging Habitat
         1. A mix of basal areas ranging from 120-180+ square feet, **and**
         2. ≥ 13" QMD, **and**
         3. ≥ 5 TPA of trees ≥ 26" DBH, **and**
         4. A mix of ≥ 40%-100% canopy closure
      ii. Low Quality Foraging Habitat
         1. A mix of basal areas ranging from 80-120+ square feet, **and**
         2. ≥ 11" QMD, **and**
         3. ≥ 40% canopy closure

3) Quantities
   a. Within 1000 feet of activity center
      i. Outside breeding season (September 1 through January 31): no timber operations other than use of existing roads
      ii. During the breeding season (February 1 through August 31): no timber operations other than the use of existing, permanent, year-round roads

   b. Within 0.5 mile radius (502 acres) centered on activity center
      i. Retention of habitat should follow Section III. 4 of this document
      ii. At least 250 acres nesting/roosting habitat present, as follows:
         1. 100 acres High Quality Nesting/roosting Habitat, **and**
         2. 150 acres Nesting/roosting Habitat

      –AND–

      iii. At least 150 acres foraging habitat must be present, as follows:
         1. 100 acres Foraging Habitat, **and**
         2. 50 acres Low Quality Foraging Habitat
      iv. No more than 1/3 of the remaining suitable habitat may be harvested during the life of the THP

   c. Between 0.5 mile radius and 1.3 miles radius circles centered on activity center

i. Retention of habitat should follow Section III. 4 of this document
ii. ≥935 acres suitable habitat must be present, as follows:
    1. At least 655 acres Foraging Habitat, **and**
    2. At least 280 acres Low Quality Foraging, **and**
    3. No more than 1/3 of the remaining suitable habitat may be harvested during the life of the THP

4) Applying Habitat Definitions to Forest Stands
    a. Because the structural characteristics of forest stands used by Northern Spotted Owls are heterogeneous, management based on average values is unlikely to retain habitat suitability. For this reason, the habitat definitions provided under Section III.2.a and b. (above) are intended for application at the scale of roughly 20 acres (may be somewhat more or less depending on plot density or measurement technique). This means that within any given 20-acre area intended to serve as Nesting/Roosting or Foraging habitat, the values for QMD, basal area, TPA, and canopy closure should be variable, but stand averages should follow the standards provided under each habitat definition. Where ranges of values are provided (e.g. 150-180 ft^2 basal area), this means that the mean values can vary across the many 20-acre areas that make up a spotted owl core area and home range. It is important to recognize habitat quality will be compromised by timber harvesting that moves stand parameters towards uniformly low average values for stand density and tree size, even during multiple entries. This is particularly true at spotted owl territories with low (at or below quantities in Section III.3.a-c) amounts of habitat; in these cases the highest-quality habitat available should be identified and retained before treatment of other suitable habitat is considered.

5) Priority Ranking of Habitat Retention Acres
    d. Tree species composition
        i. Mixed conifer stands should be selected over pine dominated stands
    e. Abiotic considerations
        i. Distance to nest
            1. Nesting/roosting and foraging habitat closest to identified nest trees, or roosting trees if no nest trees identified
        ii. Contiguous
            1. Nesting/roosting habitat within the 0.5 mile radius must be as contiguous as possible
            2. Minimize fragmentation of foraging habitat as much as possible
        iii. Slope position
            1. Habitats located on the lower 1/3 of slopes provide optimal micro-climate conditions and an increased potential for intermittent or year-round water sources
        iv. Aspect
            1. Habitats located on northerly aspects provide optimal vegetation composition and cooler site conditions

v. Elevation
   1. Habitat should be at elevations of less than 6000 feet, though the elevation of some activity centers (primarily east of Interstate 5) may necessitate inclusion of habitat at elevations greater than 6000 feet.

6) Size and Shape of Habitat Patch
   a. Narrow strips of habitat (WLPZs, retention areas between clearcuts, etc.) may contain the characteristics of nesting/roosting habitat. However, when these narrow strips of habitat are surrounded by unsuitable or low quality habitats, they function as foraging habitat at best.
   b. Narrow strips of habitat (100m or less), provide for a lot of edge habitat and little to no interior habitat. Franklin et al (2000) describe interior habitats as the amount of spotted owl habitat ≥100m from an edge. They describe edge habitat as edge between spotted owl habitat and all other vegetation types.
   c. Because WLPZs, for example, are 100m or less in total width, they are considered edge habitats if surrounded by unsuitable habitat. Edge habitats do not provide for protection from predators nor do they provide the microclimates of interior habitats.

IV. Determination

1) If surveys are inadequate or do not meet the intent of protocol, take determination may not be possible.
2) If habitat typing is inadequate, take determination may not be possible.
3) If NSO home range habitat acres are below desired conditions (Section III. 2, 3, and 4), additional loss of suitable habitat can lead to take.
4) If NSOs are nesting, utilize seasonal restriction for all timber operations within 0.25 mile of nest (February 1 through August 31).
5) If effects are limited to noise disturbance (e.g., no suitable habitat in harvest units, but suitable habitat within 0.25 mile of units), a modified seasonal restriction may be used from February 1 through July 9
   a. Seasonal restriction applies to unsurveyed suitable habitat within 0.25 mile of unit boundary.
   b. If protocol surveys were conducted **and** did not detect reproductive NSOs, seasonal restrictions not warranted.
6) Multiple THPs located within a given NSO territory need to be considered collectively or a take determination may not be possible.

V. TA Letter Contents

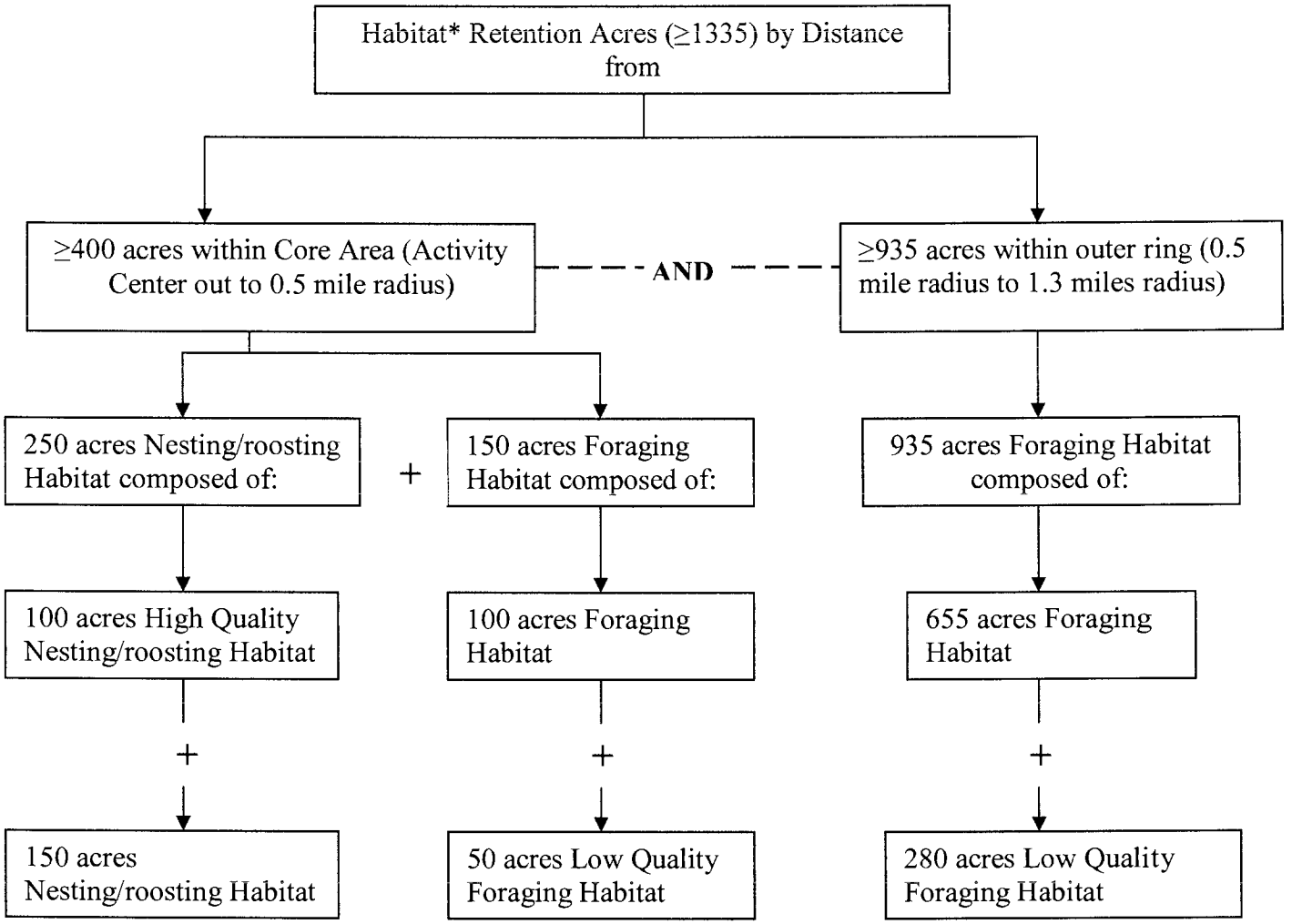
1) Date of written TA request
2) Date request received
3) Note if previous TA(s) provided in past
4) Number of acres within THP units
5) Amounts and types of silviculture prescriptions

6) Location of THP
    a. Township, Range, and Section
    b. Meridian
    c. County
7) Identify NSO activity centers returned by CDFG reports
8) Surveys conducted and activity center status
9) Logic behind take determination
    a. Habitat considerations
        i. Acres, quality, and location of suitable habitat pre- and post-harvest
        ii. Effects of timber operations on suitable habitat
            1. Degrade: suitable habitat is harvested but still functions in the capacity it did pre-harvest (i.e. Foraging habitat before harvest functions as foraging habitat post-harvest, nesting/roosting habitat pre-harvest functions as nesting/roosting habitat post-harvest)
            2. Downgrade: pre-harvest nesting/roosting habitat becomes foraging habitat post-harvest
            3. Remove: nesting/roosting or foraging habitat is harvested such that it no longer functions as habitat post-harvest
    b. Proximity of activity center to operations
    c. Survey data
10) Sunset date and seasonal restrictions
    a. If 2 year protocol and surveys are current and negative, additional TA needed if operations not completed by February 1, *YEAR* (review protocol page 3).
    b. If 1 year protocol and surveys are current and negative, additional TA needed if operations not completed by February 1, *YEAR* (review protocol page 3).
    d. If NSOs detected in previous surveys and operations are not complete before February 1, surveys are required to determine location and status of NSOs prior to operations during each breeding season that operations are ongoing.
    e. If no owls within 1.3 miles of THP (CDFG reports), no suitable habitat within units, **and** no suitable habitat within 0.25 mile of units, additional technical assistance may not be required.
11) Name of agency person to contact if there questions regarding TA

Literature Cited

Franklin, A., D. Anderson, R. Gutierrez, and K. Burnham. 2000. Climate, Habitat Quality, and Fitness in Northern Spotted Owl Populations in Northwestern California. *Ecological Monographs,* 70(4), pp. 539-590

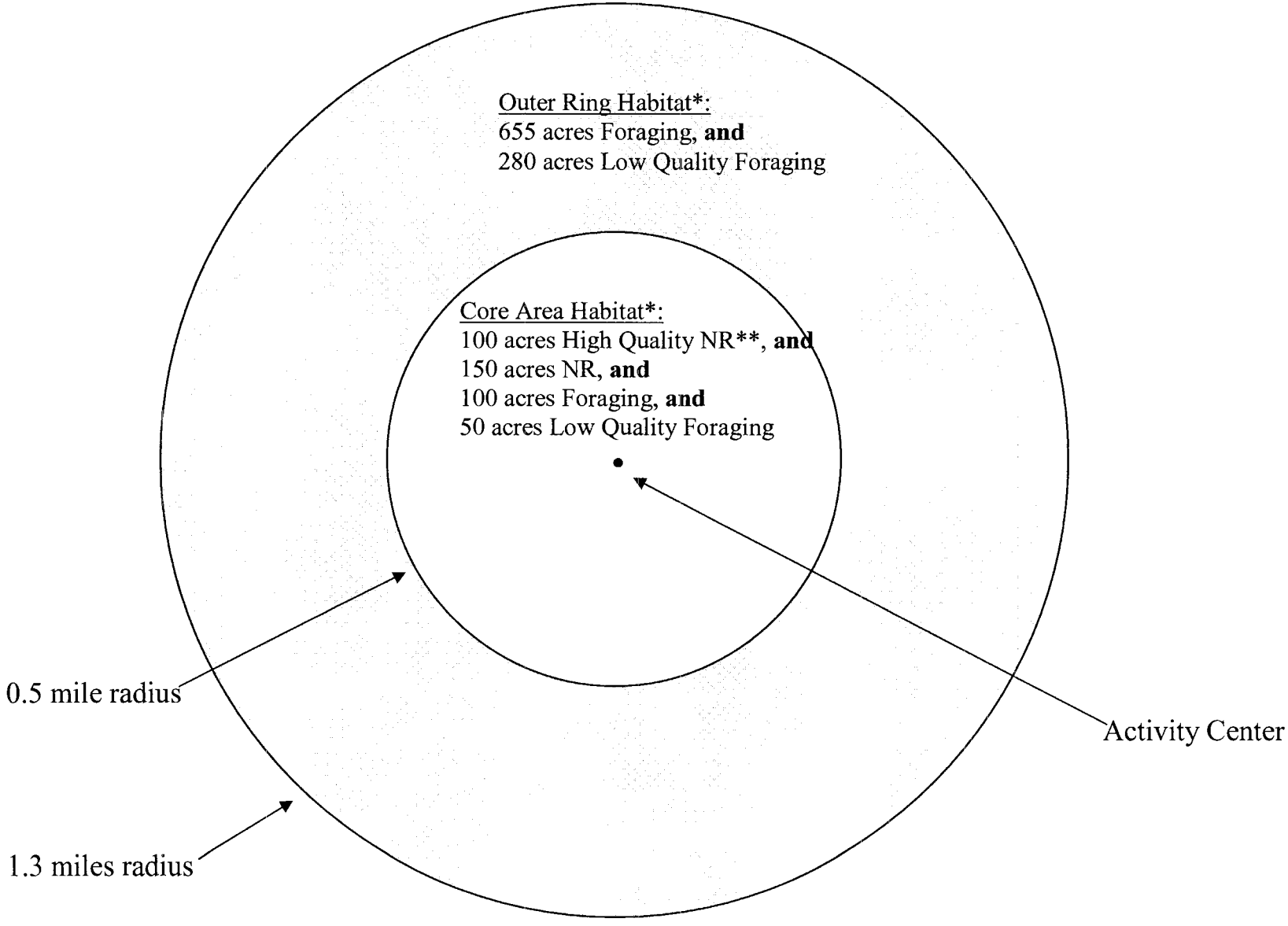
Revised February 27, 2008
Replaces February 1, 2008 version



*See Section III.2 for habitat definitions

Revised February 27, 2008
Replaces February 1, 2008 version

Habitat Retention within Core Area and 1.3 mile Home Range–Interior



*See Section III.2 for habitat definitions
**NR = Nesting/roosting

Northern Spotted Owl Disclosure and Impacts Analysis Using 14 CCR § 919.9(g) [939.9(g)]

The following impacts disclosure and analysis is intended for use in timber harvesting and non-industrial timber management plans that propose to avoid take of the northern spotted owl (NSO) through the use of 14 CCR § 919.9(g)[1] [939.9(g)]. The information may be needed in order for the California Department of Forestry and Fire Protection (CAL FIRE) to evaluate whether the proposed timber operations avoid take of the NSO per 14 CCR § 919.10 [939.10]. Take avoidance strategies that propose the use of 14 CCR § 919.9(g) [939.9(g)] must meet the requirements of 14 CCR §§ 895.1 and 919.9(g) [939.9(g)], but are not required to meet the currently-recommended U. S. Fish and Wildlife Service (USFWS) standards for activity center protection and post-harvest habitat retention. However, since USFWS has indicated that use of 14 CCR 919.9(g) [939.9(g)] may not avoid take of NSO[2], CAL FIRE may need additional information, which clearly and substantively demonstrates why the proposed, site-specific protection measures and the level and configuration of post-harvest habitat retention avoids take of the NSO. The following questions are meant to elicit the information that CAL FIRE may need to determine whether the proposed timber operations avoid take of the NSO.

NSO Habitat Definitions

1. Which definition of NSO habitat is used?

   ☐ 14 CCR § 895.1: Functional nesting, functional roosting and functional foraging habitat.

   ☐ USFWS Attachment B: High quality nesting-roosting, nesting-roosting, foraging and low quality foraging habitat.

   ☐ Other (provide basis):

2. If using functional nesting, roosting and foraging habitat contained in 14 CCR § 895.1 or "Other," discuss how using non-USFWS recommended habitat definitions will provide for the biological needs of the NSO:

NSO Activity Center Impacts Analysis

Complete the following tables and accompanying impacts analysis for <u>each</u> NSO activity center within 1.3 miles of the plan area and within 0.25 mile of appurtenant roads. The

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[1] This document is intended for use within the Coast and Northern Forest Districts wherever *Revised USFWS Attachment B Northern Spotted Owl Take Avoidance Analysis – Interior (2/27/08)* applies. It is not applicable to areas within the Coast Forest District where *Revised USFWS Attachment A NSO Take Avoidance Analysis – Coast Redwood 3-15-11* applies.

[2] See: http://www.fire.ca.gov/resource_mgt/downloads/USFWS_%20NSO_TakeAvoidanceGuidelines_ScienceSupportDocument_121409.pdf.

Habitat Summary in the following table presumes use of the owl habitat definitions of functional nesting, roosting and foraging habitat contained in 14 CCR § 895.1.

Activity center:			
Habitat Summary			
Within 0.5 mile radius (503 acres) of the activity center (acres)	**Pre-harvest**	**Post-harvest**	**Net change**
Nesting habitat			
Roosting habitat			
Foraging habitat			
Total owl habitat			
Non-habitat			
Within 0.7 mile radius (985 acres) of the activity center (acres)	**Pre-harvest**	**Post-harvest**	**Net change**
Nesting habitat			
Roosting habitat			
Foraging habitat			
Total owl habitat			
Non-habitat			
Within 1.3 miles radius (3398 acres) of the activity center (acres)	**Pre-harvest**	**Post-harvest**	**Net change**
Nesting habitat			
Roosting habitat			
Foraging habitat			
Total owl habitat			
Non-habitat			

Effect on USFWS Habitat					
Are timber operations proposed in NSO habitat that meets the USFWS definition of habitat within 0.5 mile of the activity center?			**If yes, provide the pre- and post-harvest habitat quantities and the net change in habitat (acres):**		
	No	**Yes**			
			Pre-harvest	**Post-harvest**	**Net change**
High quality nesting-roosting					
Nesting-roosting					
Foraging					
Low quality foraging					
Total owl habitat					

Effect on USFWS Habitat					
Are timber operations proposed in NSO habitat that meets the USFWS definition of habitat between 0.5 mile and 1.3 miles of the activity center?			**If yes, provide the pre- and post-harvest habitat quantities and the net change in habitat (acres):**		
	No	**Yes**			
			Pre-harvest	**Post-harvest**	**Net change**
High quality nesting-roosting					
Nesting-roosting					
Foraging					
Low quality foraging					
Total owl habitat					

Proposed Timber Operations			
During the NSO breeding season will timber operations occur within any of the following distances to an occupied or unsurveyed activity center?			**If yes, describe the type, timing and extent of timber operations:**
	Yes	**No**	
0 – 500 feet?			
500 – 1000 feet?			
1000 feet – 0.25 mile?			
0.25 – 0.5 mile? (Helicopter Use only)			
During the non-breeding season will timber operations occur within any of the following distances to the activity center?			**If yes, describe the type, timing and extent of timber operations:**
	Yes	**No**	
0 – 500 feet?			
500 – 1000 feet?			

Impacts Analysis

1. If the answer to any item under **Effect on USFWS Habitat** above is yes, address what measures have been incorporated into the plan in order to retain the best available habitat in light of the requirements of the Forest Practice Rules to avoid take of the NSO, the current USFWS recommendations regarding NSO habitat and the biological requirements for feeding, breeding, nesting and sheltering for the NSO:

2. If the answer to any item under **Proposed Timber Operations** above is yes, address whether the proposed timber operations have the potential to **harass** the NSO. Each item should demonstrate lack of direct and indirect impacts, and any conclusions will need to be supported by substantial evidence[3].

    a. Because the prey base or the ability to catch prey could be impaired, demonstrate how the proposed timber operations will avoid significantly disrupting feeding habits:

    b. Demonstrate how the proposed timber operations will avoid significantly disrupting breeding success:

    c. Because activities could be conducted near to the activity center, demonstrate how the proposed timber operations will avoid significantly disrupting nesting behavior:

    d. Because the ability to escape predators, survive severe weather, and find appropriate microclimes could be adversely altered, demonstrate how the proposed timber operations will avoid significantly disrupting sheltering, which includes roosting, nesting, and feeding:

3. If timber operations are proposed within 1.3 miles of an activity center, address the following relative to whether the proposed timber operations have the potential to **harm** the NSO. Each item should demonstrate lack of direct and indirect impacts, and any conclusions will need to be supported by substantial evidence.

    a. Because the prey base or the ability to catch prey could be impaired, demonstrate how the proposed timber operations will avoid significantly impairing feeding habits:

    b. Because of a possible reduction in surrounding owl habitat before the young have had an opportunity to successfully disperse from the activity center, demonstrate how the proposed timber operations will avoid significantly impairing breeding success:

[3] 14 CCR §15384(b): Substantial evidence shall include facts, reasonable assumptions predicated upon facts, and expert opinion supported by facts.

c. Because the activity center or adjoining area up to 500 feet from the activity center could be adversely altered, demonstrate how the proposed timber operations will avoid significantly impairing nesting behavior:

d. Because the ability to escape predators, survive severe weather, and find appropriate microclimes could be adversely altered, demonstrate how the proposed timber operations will avoid significantly impairing sheltering, which includes roosting, nesting, and feeding:

Attachment 1-2013 THPs Sorted by NSO option

HarvestDocument	landowner	District	Acreage	NSO Option
2-13-079-SHA	Wyntoon Timberlands	Northern	245	e-SOMP
2-13-075-SIS	Michigan-California Timber. Co.	Northern	753	e-SOMP
2-13-073-TRI	Michigan-California Timber Co.	Northern	312	e-SOMP
2-13-070-TRI	Michigan-California Timber Co.	Northern	237	e-SOMP
2-13-026-SIS	Wyntoon Timerlands, LLC	Northern	631	e-SOMP
				5
2-13-081-TRI	Sierra Pacific	Northern	401	e
1-13-059-HUM	Prior Family Trust	Coast	740	e
1-13-135-MEN	Usal Redwood Forest	Coast	214	e
1-13-133-MEN	Usal Redwood Forest	Coast	435	e
1-13-129-MEN	Hawthorne	Coast	14	e
1-13-125-MEN	Jackson Demonstration SF	Coast	240	e
1-13-122-HUM	Sierra-Pacific	Coast	125	e
1-13-119-MEN	Hawthorne	Coast	117	e
1-13-118-MEN	Jon Cook	Coast	76	e
1-13-117-MEN	Coastal Ridges	Coast	459	e
1-13-115-MEN	Coastal Ridges	Coast	550	e
1-13-112-HUM	Sierra-Pacific	Coast	383	e
1-13-102-LAK	Sanhedrin Holdings, LLC	Northern	2212	e
1-13-101-MEN	Jackson Demonstation SF	Coast	331	e
1-13-097-MEN	Hawthorne	Coast	186	e
1-13-096-MEN	City of Fort Bragg	Coast	8	e
1-13-095-HUM	Hunter Ranch, LLC	Coast	262	e
1-13-094-HUM	Fort Baker Ranch Company	Coast	649	e
1-13-093-MEN	Hawthorne	Coast	223	e
1-13-090-TRI	Jeff Bryant	Northern	44	e
1-13-089-TRI	Jeff Bryant	Coast	45	e
1-13-087-SON	Glen Proctor, et. Al	Coast	89	e
1-13-078-MEN	Hawthorne	Coast	98	e
1-13-077-SON	George and Lois Parmeter	Coast	104	e
1-13-076-HUM	Charles Mountain Ranch	Coast	618	e
1-13-069-HUM	FGF US	Coast	415	e
1-13-065-HUM	Robert Schroeder & Amalia Borga	Coast	8	e
1-13-063-HUM	L.D. O'Rourke Foundation	Coast	227	e
1-13-062-SON	Richardson Ranch, LLC	Coast	451	e
1-13-061-MEN	Gualala Redwoods	Coast	91	e
1-13-056-MEN	Hawthorne	Coast	220	e
1-13-053-HUM	Lois Peterson	Coast	22	e
1-13-049-MEN	Hawthorne	Coast	570	e
1-13-046-MEN	North Coast Management	Coast	20	e
1-13-042-MEN	Coastal Ridges, LLC	Coast	627	e
1-13-040-HUM	Russ Ranch and Timber Company	Coast	152	e
1-13-031-MEN	Hawthorne	Coast	565	e
1-13-030-HUM	FGF-US	Coast	545	e

1-13-029-HUM	Elizabeth Marshall	Coast	310 e	
1-13-026-HUM	Arthur Stover	Coast	101 e	
1-13-023-SON	Gualala Redwoods	Coast	170 e	
1-13-014-MEN	Hawthorne	Coast	157 e	
1-13-009-MEN	Hawthorne	Coast	365 e	
1-13-007-MEN	Jackson Demonstration SF	Coast	289 e	
2-13-103-SHA	Oxbow Timber I	Northern	520 e	
2-13-093-SHA	Bascom Pacific, LLC	Northern	568 e	
2-13-091-SIS	Oxbow Timber I	Northern	563 e	
2-13-090-SIS	T.C.&I. Shasta, LLC	Northern	1122 e	
2-13-076-SIS	Fruit Growers Supply Company	Northern	619 e	
2-13-074-SIS	Oxbow Timber I	Northern	603 e	
2-13-067-SIS	Sierra-Pacific Industries	Northern	888 e	
2-13-066-SIS	Oxbow Timber I	Northern	347 e	
2-13-064-TEH	Crane Mills	Northern	1202 e	
2-13-062-SHA	Sierra-Pacific Industries	Northern	502 e	
2-13-058-TRI	Sierra-Pacific Industries	Northern	455 e	
2-13-057-SHA	Bascom Pacific, LLC	Northern	913 e	
2-13-054-SHA	Oxbow Timber I	Northern	198 e	
2-13-049-SIS	Roseburg Resources Co.	Northern	181 e	
2-13-048-SIS	Rome Creek Timber LLC	Northern	423 e	
2-13-046-SHA	Sierra-Pacific Industries	Northern	233 e	
2-13-042-SHA	Russell Reiner	Northern	640 e	
2-13-040-SIS	Jon Burke	Northern	370 e	
2-13-035-TRI	Sierra-Pacific Industries	Northern	185 e	
2-13-034-SHA	Sierra-Pacific Industries	Northern	272 e	
2-13-032-SHA	Sierra-Pacific Industries	Northern	457 e	
2-13-018-TEH	Crane Mills	Northern	865 e	
2-13-016-SIS	T.C.&I., LLC	Northern	1893 e	
2-13-015-THE	Crane Mills	Northern	876 e	
2-13-003-SIS	Lawrence W Smith Living Trust	Northern	153 e	
2-13-022-SHA	Big Bend Hot Springs Project, LLC	Northern	13 e	
				70
1-13-134-HUM	Green Diamond	Coast	206 d-HCP	
1-13-130-HUM	Humboldt Redwoods	Coast	388 d-HCP	
1-13-128-HUM	Green Diamond	Coast	130 d-HCP	
1-13-127-HUM	Green Diamond	Coast	126 d-HCP	
1-13-124-HUM	Green Diamond	Coast	122 d-HCP	
1-13-120-HUM	Green Diamond	Coast	112 d-HCP	
1-13-116-HUM	Green Diamond	Coast	69 d-HCP	
1-13-114-DEL	Green Diamond	Coast	133 d-HCP	
1-13-106-HUM	Green Diamond	Coast	109 d-HCP	
1-13-103-HUM	Green Diamond	Coast	41 d-HCP	
1-13-100-HUM	Humboldt Redwood	Coast	53 d-HCP	
1-13-092-HUM	Green Diamond	Coast	88 d-HCP	
1-13-088-HUM	Green Diamond	Coast	106 d-HCP	
1-13-085-HUM	Green Diamond	Coast	107 d-HCP	

1-13-080-HUM	Green Diamond	Coast	120	d-HCP	
1-13-073-HUM	Green Diamond	Coast	50	d-HCP	
1-13-072-HUM	Green Diamond	Coast	116	d-HCP	
1-13-071-HUM	Green Diamond	Coast	226	d-HCP	
1-13-070-HUM	Humboldt Redwood	Coast	449	d-HCP	
1-13-067-HUM	Green Diamond	Coast	102	d-HCP	
1-13-047-HUM	Humboldt Redwood	Coast	280	d-HCP	
1-13-037-HUM	Green Diamond	Coast	70	d-HCP	
1-13-110-HUM	Green Diamond	Coast	184	d-HCP	
1-13-034-HUM	Green Diamond	Coast	71	d-HCP	
1-13-033-HUM	Humboldt Redwood	Coast	372	d-HCP	
1-13-032-HUM	Green Diamond	Coast	49	d-HCP	
1-13-025-HUM	Green Diamond	Coast	61	d-HCP	
1-13-022-HUM	Green Diamond	Coast	64	d-HCP	
1-13-011-HUM	Green Diamon	Coast	53	d-HCP	
2-13-011-SIS	Fruit Growers Supply Company	Northern	266	d-HCP	
					30
1-13-132-MEN	Mendocino Redwood	Coast	465	a-SORP	
1-13-111-MEN	Mendocino Redwood	Coast	450	a-SORP	
1-13-109-MEN	Mendocino Redwood	Coast	122	a-SORP	
1-13-064-MEN	Mendocino Redwood	Coast	304	a-SORP	
1-13-060-MEN	Mendocino Redwood	Coast	163	a-SORP	
1-13-044-MEN	Mendocino Redwood	Coast	1315	a-SORP	
1-13-019-MEN	Mendocino Redwood	Coast	586	a-SORP	
1-13-001-MEN	Mendocino Redwood	Coast	438	a-SORP	
					8
					113

Attachment 2-Large Landowner NSO
Option USFWS-Alternative-e

HarvestDocument	Activity Center	PreHNR	PreF	PostNR	PostF	Poat harv tothab surplus or deficit+ or-	PreHarv >500 or 1335	e-compliant	PreHarv % Harvested	e-compliant
1-13-122-HUM	None									
1-13-061-MEN	None									
1-13-049-MEN	None									
2-13-062-SHA	None									
2-13-058-TRI	None									
2-13-049-SIS	None									
2-13-032-SHA	None									
		0	0	0	0					
1-13-135-MEN	MEN0106	247	443	244	443	187	190	Yes	2%	Yes
1-13-133-MEN	MEN0098	303	471	274	458	232	274	Yes	15%	Yes
	MEN0106	256	449	247	443	190	205	Yes	8%	Yes
1-13-129-MEN	MEN0131	294	513	294	513	307	307	Yes	0%	Yes
1-13-119-MEN	MEN0111	403	320	403	314	217	223	Yes	3%	Yes
1-13-117-MEN	MEN0067	100	759	100	722	322	359	Yes	10%	Yes
1-13-115-MEN	MEN0197	201	632	201	517	218	333	Yes	35%	No
1-13-112-HUM	HUM0567	863	25	807	28	335	388	Yes	14%	Yes
	HUM0652	897	5	774	10	284	402	Yes	27%	Yes
	HUM0652a	778	86	748	86	334	364	Yes	8%	Yes
	HUM0774	768	70	721	95	316	338	Yes	7%	Yes
	HUM0939	734	74	706	75	281	308	Yes	9%	Yes
	HUM0966	730	25	671	26	197	255	Yes	23%	Yes
1-13-101-MEN	MEN639	355	371	343	383	226	226	Yes	0%	Yes
	MEN582	785	139	747	177	424	424	Yes	0%	Yes
	MEN550	576	246	424	398	322	322	Yes	0%	Yes
	Parlin Trib	689	208	541	356	397	397	Yes	0%	Yes
1-13-097-MEN	MEN0115	275	306	272	299	71	81	Yes	7%	Yes
	MEN0116	231	408	229	408	137	139	Yes	2%	Yes
	MEN0247	356	310	333	333	166	166	Yes	0%	Yes
1-13-093-MEN	MEN0082	386	375	372	371	243	261	Yes	7%	Yes
	MEN0114	305	149	302	149	-49	-46	Yes	-7%	Yes w/TA from Call Fire Biologist
1-13-078-MEN	MEN0320	441	235	441	235	176	176	Yes	0%	Yes
	MEN0539	381	296	381	296	177	177	Yes	0%	Yes
1-13-042-MEN	MEN0197	201	632	201	576	277	333	Yes	17%	Yes
	MEN098	202	563	200	455	155	265	Yes	42%	No
1-13-031-MEN	MEN0370	649	86	643	92	235	235	Yes	0%	Yes
1-13-023-SON	SON090	463	407	451	407	358	370	Yes	3%	Yes
	SON045	713	4	686	4	190	217	Yes	12%	Yes
	SON034	613	183	580	183	263	296	Yes	11%	Yes
	SON012	680	2	667	2	169	182	Yes	7%	Yes
1-13-014-MEN	MEN0146	233	387	233	387	120	120	Yes	0%	Yes
1-13-009-MEN	MEN0122-2012	380	168	360	188	48	48	Yes	0%	Yes
	MEN0232-2012	335	348	303	384	187	183	Yes	6%	Yes
	MEN0509-2012	350	212	297	236	33	62	Yes	45%	No
1-13-007-MEN	MEN585	608	190	451	348	299	298	Yes	0%	Yes
2-13-067-SIS	SIS0319	888	1419	877	1358	900	972	Yes	7%	Yes
2-13-064-THE	TEH030	411	366	411	366	-558	-558	w/TA from USFWS	0%	Yes
	TEH072	172	1191	172	1191	28	28	Yes	0%	Yes
	TEH0087	133	329	133	329	-873	-873	w/TA from USFWS	0%	Yes
	TEH0114	493	205	493	205	-637	-637	w/TA from USFWS	0%	Yes
	TEH0117	630	243	630	243	-462	-462	w/TA from USFWS	0%	Yes
2-13-046-SHA	SHA0106	433	1782	433	1710	808	880	Yes	8%	Yes
2-13-035-TRI	TRI0019	1098	1590	1098	1555	1318	1353	Yes	3%	Yes
2-13-034-SHA	SHA0037	496	2162	494	2077	1236	1323	Yes	7%	Yes
2-13-018-THE	TE030	361	154	361	154	-820	-820	w/TA from USFWS	0%	Yes
	TE037	551	161	551	161	-623	-623	w/TA from USFWS	0%	Yes
	TE101	319	167	319	167	-849	-849	w/TA from USFWS	0%	Yes
2-13-015-THE	TE038	278	405	278	405	-652	-652	w/TA from USFWS	0%	Yes
	TE114	493	138	493	138	-704	-704	w/TA from USFWS	0%	Yes
	RP01	638	327	638	327	-370	-370	w/TA from USFWS	0%	Yes
	TE037	551	135	551	135	-649	-649	w/TA from USFWS	0%	Yes
		24726	20871	23579	20918					

Attachment 3-Small Landowner NSO
Option-USFWS -Alternative e

HarvestDocument	Activity Center	PreHNR	PreF	PostNR	PostF	tothab+ or-	opt e Consistency	Pre-harvNR&F	Avail Harv	NR/F Harvested	%ofavail Harv	e-consistent
1-13-076-HUM	HU514	192	500	192	500	192	Y	692	192.00	0.00	0%	Yes
	HU558	180	715	180	715	395	Y	895	395.00	0.00	0%	Yes
1-13-069-HUM	HUM0239	678	266	678	266	444	Y	944	444.00	0.00	0%	Yes
	HUM0622	554	200	554	200	254	Y	754	254.00	0.00	0%	Yes
1-13-030-HUM	HUM0400	379	463	304	529	333	Y	842	342.00	9.00	3%	Yes
	HUM0405	445	399	336	457	293	Y	844	344.00	51.00	15%	Yes
	HUM0791	638	328	541	375	416	Y	966	466.00	50.00	11%	Yes
	HUM0792	313	578	236	625	361	Y	891	391.00	30.00	8%	Yes
1-13-063-HUM	HUM0565	376	545	331	549	380	Y	921	421.00	41.00	10%	Yes
	HUM0948	296	619	262	649	411	Y	915	415.00	4.00	1%	Yes
	HUM0997	378	511	364	511	375	Y	889	389.00	14.00	4%	Yes
1-13-040-HUM	HUM0816-Active	399	147	383	149	32	Y	546	46.00	14.00	30%	Yes
	HUM0816-histoirc	512	122	481	122	103	Y	634	134.00	31.00	23%	Yes
1-13-029-HUM	HUM0927	179	752	179	752	431	Y	931	431.00	0.00	0%	Yes
1-13-095-HUM	HUM098	521	168	521	168	189	Y	689	189.00	0.00	0%	Yes
	HUM308	552	266	479	303	282	Y	818	318.00	36.00	11%	Yes
	HUM442	767	72	680	117	297	Y	839	339.00	42.00	12%	Yes
1-13-102-LAK	LAK0011	589	1585	588	1542	795	Y	2174	839.00	44.00	5%	Yes
	LAK0013	1327	1390	1246	1381	1292	Y	2717	1382.00	90.00	7%	Yes
	MEN0055	835	1539	812	1539	1016	Y	2374	1039.00	23.00	2%	Yes
2-13-040-SIS	Panther Rock	398	1009	398	1009	72	Y	1407	72.00	0.00	0%	Yes
	Bugle	277	1595	277	1573	515	Y	1872	537.00	22.00	4%	Yes
2-13-042-SHA	SHA0024	364	2506	364	2388	1417	Y	2870	1535.00	118.00	8%	Yes
2-13-090-SIS	SIS0492	192	2189	192	2159	1016	Y	2381	1046.00	30.00	3%	Yes
	SIS0554	644	2150	644	2150	1459	Y	2794	1459.00	0.00	0%	Yes
1-13-062-SON	SON0008	696	53	596	53	149	Y	749	249.00	100.00	40%	No
1-13-077-SON	SON0061	282	476	268	484	252	Y	758	258.00	6.00	2%	Yes
	Totals	12963	21143	12086	21265							

1-13-118-MEN	None
1-13-094-HUM	None
1-13-090-TRI	2-Activity centersnoted within 1.3 miles-No suitable habitat
1-13-089-TRI	2-Activity centersnoted within 1.3 miles-No suitable habitat
1-13-087-SON	None
1-13-053-HUM	None
1-13-046-MEN	None
1-13-026-HUM	None
2-13-103-SHA	None
2-13-093-SHA	None
2-13-091-SIS	None
2-13-074-SIS	None
2-13-066-SIS	None
2-13-057-SHA	None
2-13-054-SHA	None
2-13-048-SIS	None
2-13-003-SIS	None

Attachment 4-NTMPs-2011-2015 NSO Habitat Analysis of Conformance with Option e

HarvestDocument	NSO Option	Activity Center	PreHNR	PreF	PostNR	PostF	Total Post Harv NR/F	Post harv opt e Consistency	NR/F Avail for Harv	NR/F Harvested	%ofavail NR/F Harvested	e-consistent
1-15NTMP-005	e	HU842	448	317	446	319	765	Yes	265	0	0%	yes
1-15NTMP-004	e	HUM488	386	515	383	518	901	Yes	901	0	0%	yes
1-14NTMP-011	e-N	HUM0155	382	1974	353	1990	2343	Yes	2343	13	1%	yes
	e-N	HUM0047	1834	1096	1623	1266	2889	Yes	2889	41	1%	yes
	e-N	HUM0152	1734	1236	1613	1342	2955	Yes	2955	15	1%	yes
1-14NTMP-010	e	MEN443	733	119	733	119	852	Yes	852	0	0%	yes
	e	MEN633	510	345	510	345	855	Yes	855	0	0%	yes
1-14NTMP-008	e	HUM522	616	182	547	251	798	Yes	798	0	0%	yes
	e	HUM525	539	255	520	274	794	Yes	794	0	0%	yes
1-14NTMP-007	e	HUM0645	305	489	305	489	794	Yes	794	0	0%	yes
	e	HUM0862	396	334	396	334	730	Yes	730	0	0%	yes
1-14NTMP-006	e	HUM0162	224	518	223	519	742	Yes	742	0	0%	yes
1-14NTMP-001	e	HUM0294	664	63	658	60	718	Yes	718	9	1%	yes
	e	HUM0455	580	108	569	107	676	Yes	676	12	2%	yes
	e	HUM587	609	90	592	79	671	Yes	671	28	4%	yes
1-13NTMP-005	e	MEN545	715	160	715	160	875	Yes	875	0	0%	yes
	e	MEN627	517	82	517	82	599	Yes	599	0	0%	yes
1-13NTMP-004	e	HUM225	526	294	474	346	820	Yes	820	0	0%	yes
1-13NTMP-002	e	HU 564	293	278	261	310	571	Yes	571	0	0%	yes
	e	HRC#351	397	237	371	263	634	Yes	634	0	0%	yes
		HU563	581	123	578	126	704	Yes	704	0	0%	yes
1-12NTMP-004	e	HUM100	576	209	459	318	777	Yes	777	8	1%	yes
	e	HUM948	693	205	648	250	898	Yes	898	0	0%	yes
	e	HUM997	479	378	401	445	846	Yes	846	11	1%	yes
	e	2011AC	541	300	238	481	719	Yes	719	122	17%	yes
1-12NTMP-001	e	HUM019	288	344	288	344	632	Yes	632	0	0%	yes
	e	BC-001	496	261	201	556	757	Yes	757	0	0%	yes
	e	HUM0330	354	498	354	498	852	Yes	852	0	0%	yes
	e	HUM0441	294	426	294	426	720	Yes	720	0	0%	yes
	e	HUM0742	364	419	364	419	783	Yes	783	0	0%	yes
	e	HUM926	288	241	288	241	529	Yes	529	0	0%	yes
1-11NTMP-013	e	New	370	220	370	220	590	Yes	590	0	0%	yes
1-11NTMP-011	e	New	370	220	370	220	590	Yes	590	0	0%	yes
1-11NTMP-009	e	SON105	609	194	554	249	803	Yes	803	0	0%	yes
1-11NTMP-007	e	MEN238	238	460	238	460	698	Yes	698	0	0%	yes
	e	CG09	207	234	207	234	441	Yes	441	0	0%	yes
	e	NEW XX	324	441	324	441	765	Yes	765	0	0%	yes
1-11NTMP-006	e	SPI40	128	1074	128	1074	1202	Yes	1202	0	0%	yes
	e	HU499	457	1376	457	1376	1833	Yes	1833	0	0%	yes
	e	HU782	874	2424	874	2424	3298	Yes	3298	0	0%	yes
	e	HU892	718	2346	718	2346	3064	Yes	3064	0	0%	yes
	e	HU980	1202	2128	1202	2128	3330	Yes	3330	0	0%	yes
1-11NTMP-003	e	MEN237	787	42	787	42	829	Yes	829	0	0%	yes
1-11NTMP-001	e	MD141	213	272	213	272	485	Yes	485	0	0%	yes
	e	MD461	426	93	426	93	519	Yes	519	0	0%	yes
			24285	23620	22790	24856						
1-15NTMP-002	e	None										
1-15NTMP-001	e	None										
1-14NTMP-009	e	None										
1-14NTMP-005	e	None										
1-13NTMP-006	g	None										
1-12NTMP-002	e	None										
1-11NTMP-012	e	None										
1-11NTMP-005	e	None										
			0	0	0	0						
			24285	23620	22790	24856						

From:	George Gentry
To:	FGC
Subject:	NSO comment
Date:	Tuesday, May 03, 2016 10:22:35 AM
Attachments:	image001.png image002.png SPIResearchNSODensityStudy.pdf Kroll_2016_stirx.pdf Diller et al 2-16-2016.pdf 160502 NSO supplement.pdf

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Attached is a comment and three new studies related to NSO. These were submitted yesterday to the Department per the Commission and Director Bonham's request. They are submitted to you as a courtesy, and to allow the Commissioners time to familiarize themselves with the material.

George "YG" Gentry
Vice President- Regulatory Affairs
California Forestry Association
P: 916.444.6592 / M: 916.584.2950

Northern Spotted Owls

Near Weaverville and Trinity Lake

In Trinity County

Within the Landscape Survey Strategy Area

(An Interim Report)

Sierra Pacific Industries
January 2016

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Sierra Pacific Research & Monitoring

Sierra Pacific Industries

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Northern Spotted Owls near Weaverville and Trinity Lake, Trinity County Within the Landscape Survey Strategy Area (An Interim Report)

January 2016

Introduction

In 2003, Sierra Pacific Industries (SPI) coordinated with the US Fish and Wildlife Service (Service) to design a comprehensive multi-year survey of northern spotted owls (NSO), which we called the Landscape Survey Strategy (LSS). It was designed to survey all suspected spotted owl nesting/roosting habitat within SPI lands and extending out 0.7 mile from SPI. The total area within the LSS was 307,408 acres, of which 142,279 acres (46%) belonged to SPI. Most of the neighboring lands are under the control of the Shasta-Trinity National Forest. This strategy established 474 permanent survey points (Figure 1) that were surveyed for the five years from 2003 through 2007.

In years previous to the 1990 listing of the NSO under the U.S. Endangered Species Act, SPI surveyed much of their ownership in Trinity County to the north and south of Weaverville to determine how many NSO activity centers (ACs) were present. Surveys were done using protocols existing at the time, but may not have been comprehensive in area coverage, and negative results were not compiled. In addition, ACs in older California Natural Diversity Data Base records were included in the SPI database.

Thus, while we had a good general idea of the extent and numbers of sites on SPI lands, we knew that we did not have an accurate estimate of the number of NSO occupied ACs. During the 1990s, our approximate estimate of ACs on or near the property was 52 (Figure 2), but that estimate was subject to several sources of error, especially inclusion of older sites from over a decade earlier (some from as early as 1974). We could not estimate how many of these met the protocol definition of occupied.

In the decade following the 1990 federal listing of the NSO, the ACs recorded prior to the listing were not surveyed systematically. Instead, most surveys during that period were project based (i.e., during THP prep for the THP area only). Through the 1990s and early 2000s, all THPs were surveyed and harvested under no-take guidance, according to the Forest Practice Rules (FPR) and to whichever agency process was in place at the time. We occasionally found occupied sites in new areas, but many older sites were not revisited over a period of several years. Birds were not marked by banding, so we could only speculate as to movements.

Also during the early 1990s, the Service designated five sites as abandoned. Three of these ACs had been subject to more extensive timber harvest prior to the listing, and they had not been found to be occupied at any time since the listing of the NSO (Figure 3).

Results

The number of occupied ACs found during the 2003 - 2007 surveys was 47 (Figure 3), of which nine were not known previously. Coincidentally, nine older ACs were not occupied during this five-year survey period. Most of the new ACs established by this LSS effort were near older, unoccupied ACs.

In 2011, we began annual re-surveys of the LSS stations. During this five year effort, we found 57 occupied ACs within the original LSS area, 17 of which were in new locations (Figure 4). One activity center occupied during the 2003-2007 surveys was destroyed by wildfire prior to 2011. In addition, one occupied AC has continued to make minor movements throughout the resurvey period and has since been relocated outside the LSS boundary. Due to this bird originally being located within the LSS boundary and since it was included in the baseline and '03-07 analysis, it was included in the density calculations for this survey period even though it now falls just outside the LSS boundary.

Again, new ACs were usually near now unoccupied older ACs. Despite the single AC lost to wildfire, the estimated population density is stable to increasing. The raw density of 57 occupied ACs found on the 173,316 acre survey area results in 0.2105 occupied ACs per square mile. Up from 0.1736 in 2003-2007 based upon 47 occupied ACs and up from an estimated 0.1551 occupied ACs per sq. mi. in 1989 based upon an estimated 42 occupied ACs (80% of 52 known ACs). See table below:

Year	1989	80% (Recovery)	1989 - 2003	2003 - 2007	2011 - 2015
Occupied ACs	52 (max known 1974-1989)	42	47 (max)	47	57
Crude Density[1]	Not Applicable	0.1551[2]	0.1736[2]	0.1736	0.2105
Comment	Assumed 100% occupancy from CNDDB and SPI surveys since protocol surveys were not conducted.	Assume the population was a fully recovered population. (80% occupancy per 2008 NSO Recovery Plan)	Max estimate. Assumed all ACs occupied. (Removed 5 abandoned sites with USFWS concurrence)	Occupancy determined at all sites	Occupancy determined at all sites

[1] Note: Crude density is based upon the 173,316 acre area within .5 mile of a survey station, since the larger area inside the general survey boundary includes the town of Weaverville and a significant area that as a result of wildfires or site quality would never be considered potential habitat. See Figure 7 for the estimated effective survey area.
[2] Grey highlighted numbers are the result of assumptions not actually measured/calculated.

In both of these survey periods, some ACs were determined to not have any responses and historically would have been declared abandoned by the USFWS. Service direction changed in this time period, and the 2012 protocol no longer included a definition for abandoning sites. Thus ACs from owls that may have moved on the landscape continue to increase in number while numbers of occupied ACs and density of owls increased.

In response to the Service's revision of the survey protocol in 2011, we switched to using electronic calling devices for these surveys, and also added over 180 new calling stations, extending geographic extent of the survey effort by about 40 percent, most of which is US Forest Service land within 1.3 miles of SPI ownership. This resulted in location of still more ACs outside the original LSS area; these sites have not been included in the summary

previously mentioned (Figure 5). Also, in 2011, we began banding all NSO on the ownership, so that in the future we will be able to ascertain whether birds in new locations are residents that have relocated, or whether they are immigrants. Since 2011, we have banded 178 NSO (118 adults/sub adults and 60 juveniles).

Reproduction

During this recent 2011- 2015 effort we were able to determine that 30 of these 57 occupied ACs were reproductive, producing at least 97 fledglings (Figure 6). This represents 60 individual successful nesting attempts as many of these AC's reproduced two to four times during this five year survey.

Summary and Conclusion

In summary, the uncertainty associated with the estimate of territories extant at the time of listing precludes precise comparison of numbers over the past 26 years. However, while we have seen some change in the location of occupied ACs, we see no indication of a population decline in the LSS area during the period between the 2003 - 2007 LSS surveys and the surveys being conducted now. While we recognize that this is a very small portion of the California population and our work is not a demographic study, it is worth noting that the LSS area apparently is not showing a similar decline as reported from the NSO demographics studies. The Willow Creek Study area (referred to as NWC) is the nearest USFS demographic study area to the LSS and they have an estimated annual decline of 3.0%. The current range wide demographic average is an estimated annual decline of 3.8% (Dugger et al, 2016).

Compared to those values our numbers of occupied ACs and density of owls appears to be increasing. If our study area NSOs were following these rates and assuming that our original 1989 AC count of 52 (minus those the service declared abandoned) we would have a 1989 starting estimate of 47 ACs. Applying the NWC demographic study estimated rate of decline our study area should have experienced a reduction to only 22.1 occupied ACs and based upon the NSO range wide estimated rate we should have only 18.1 occupied ACs today. Rather than those declines our LSS study area has had a net increase of 10 ACs from that estimated starting point.

Since the listing, over the past 26 years, all THPs have been conducted under no-take guidance in effect at the time of harvest. The increased survey effort, improved protocols, and initiation of banding should improve our understanding of the owl population in this area in the future.

In conclusion, to our knowledge, our LSS effort to determine the number of occupied ACs on a fixed area of land is the only existing dataset upon which to assess potential impacts over time of FPR - guided management on NSO density. This study shows that for the period from 2003 through 2015, despite active timber harvest, there has been only an increase in population density for this portion of the range of the NSO. While our current efforts have demonstrated movement of owls around this landscape, as described above, this has resulted in an increase in the number of ACs and a misleading percent occupied estimate. This resultant increase in overall AC count obscures the fact that actual numbers of "occupied" ACs and the density of owls have increased substantially since the listing of the owl.

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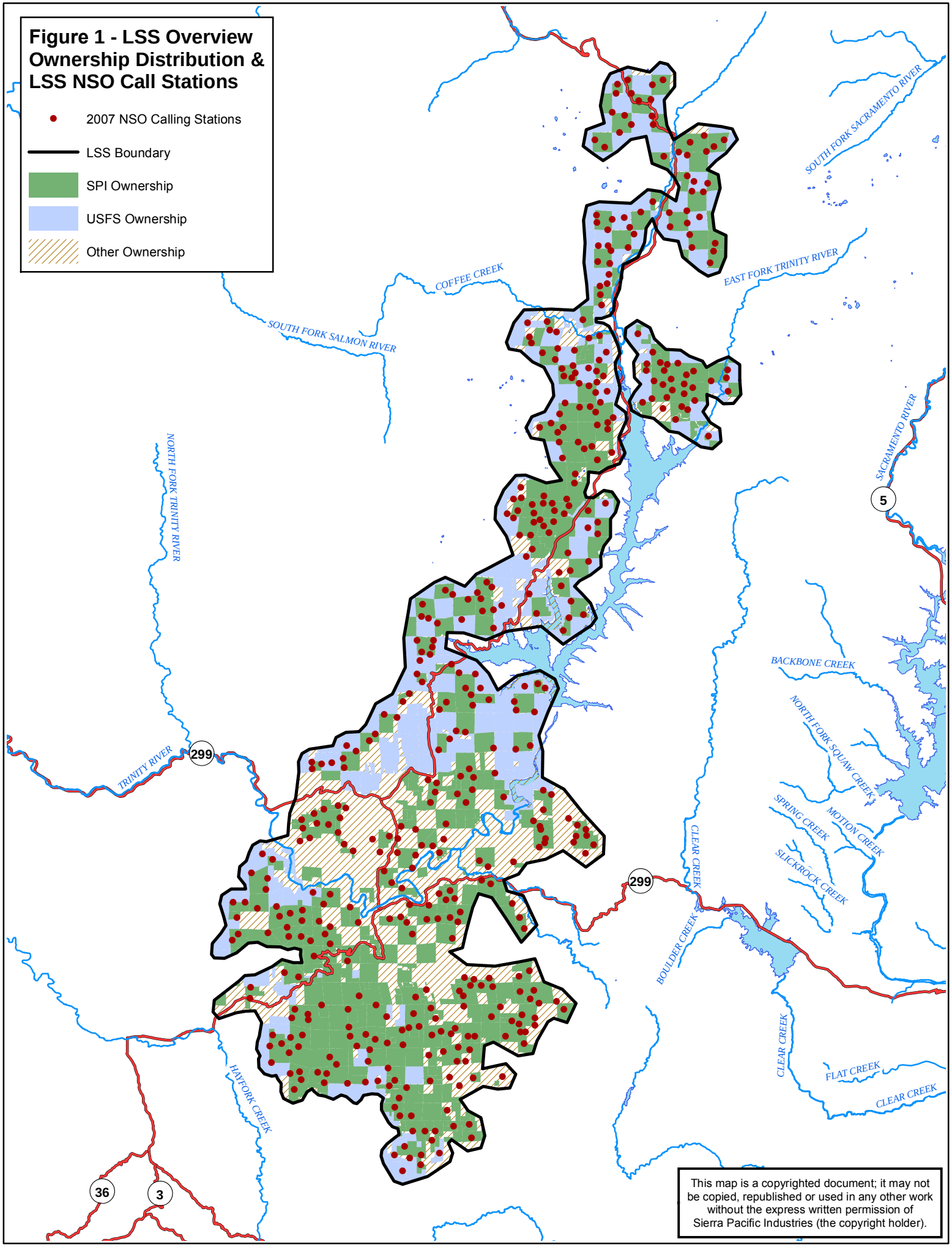
Figure 1 - LSS Overview
Ownership Distribution &
LSS NSO Call Stations
2007 NSO Calling Stations
LSS Boundary
SPI Ownership
USFS Ownership
Other Ownership
SOUTH FORK SACRAMENTO RIVER
EAST FORK TRINITY RIVER
COFFEE CREEK
SOUTH FORK SALMON RIVER
SACRAMENTO RIVER
5
NORTH FORK TRINITY RIVER
BACKBONE CREEK
NORTH FORK SQUAW CREEK
TRINITY RIVER
299
SPRING CREEK
MOTION CREEK
SLICKROCK CREEK
CLEAR CREEK
299
BOULDER CREEK
CLEAR CREEK
FLAT CREEK
CLEAR CREEK
HAYFORK CREEK
36
3
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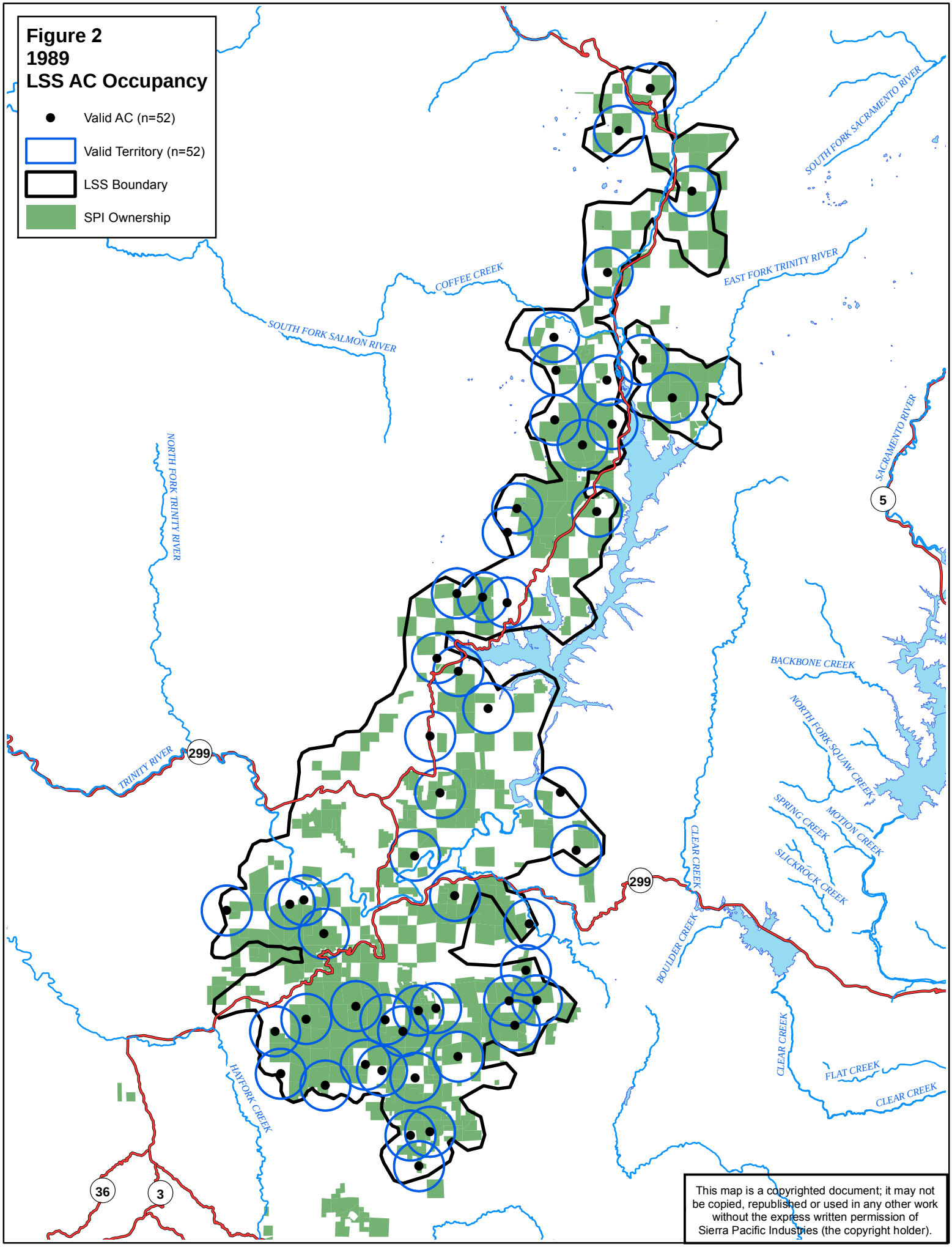

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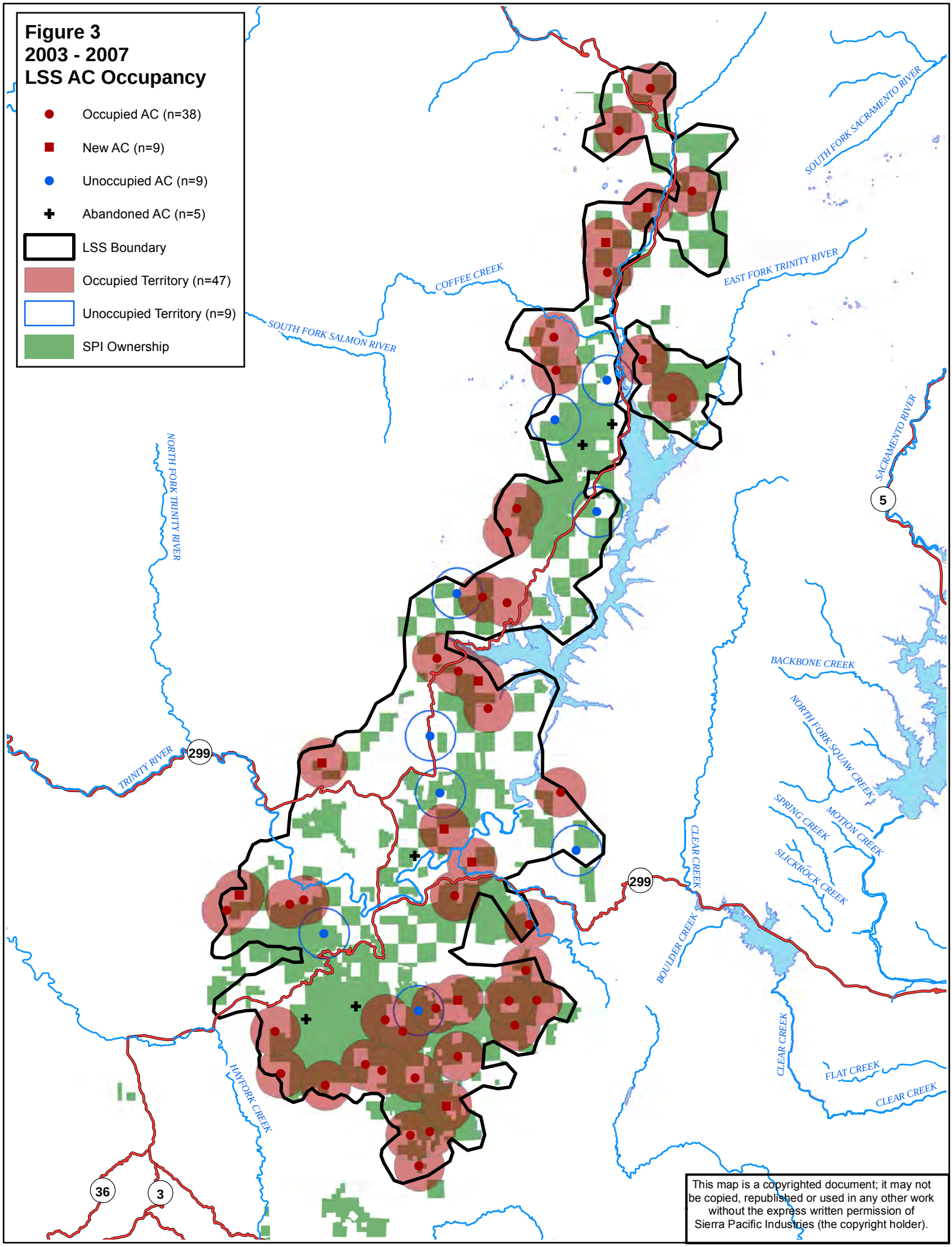
Figure 3
2003 - 2007
LSS AC Occupancy
Occupied AC (n=38)
New AC (n=9)
Unoccupied AC (n=9)
Abandoned AC (n=5)
LSS Boundary
Occupied Territory (n=47)
Unoccupied Territory (n=9)
SPI Ownership
SOUTH FORK SACRAMENTO RIVER
EAST FORK TRINITY RIVER
COFFEE CREEK
SOUTH FORK SALMON RIVER
NORTH FORK TRINITY RIVER
SACRAMENTO RIVER
5
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BOULDER CREEK
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36
3
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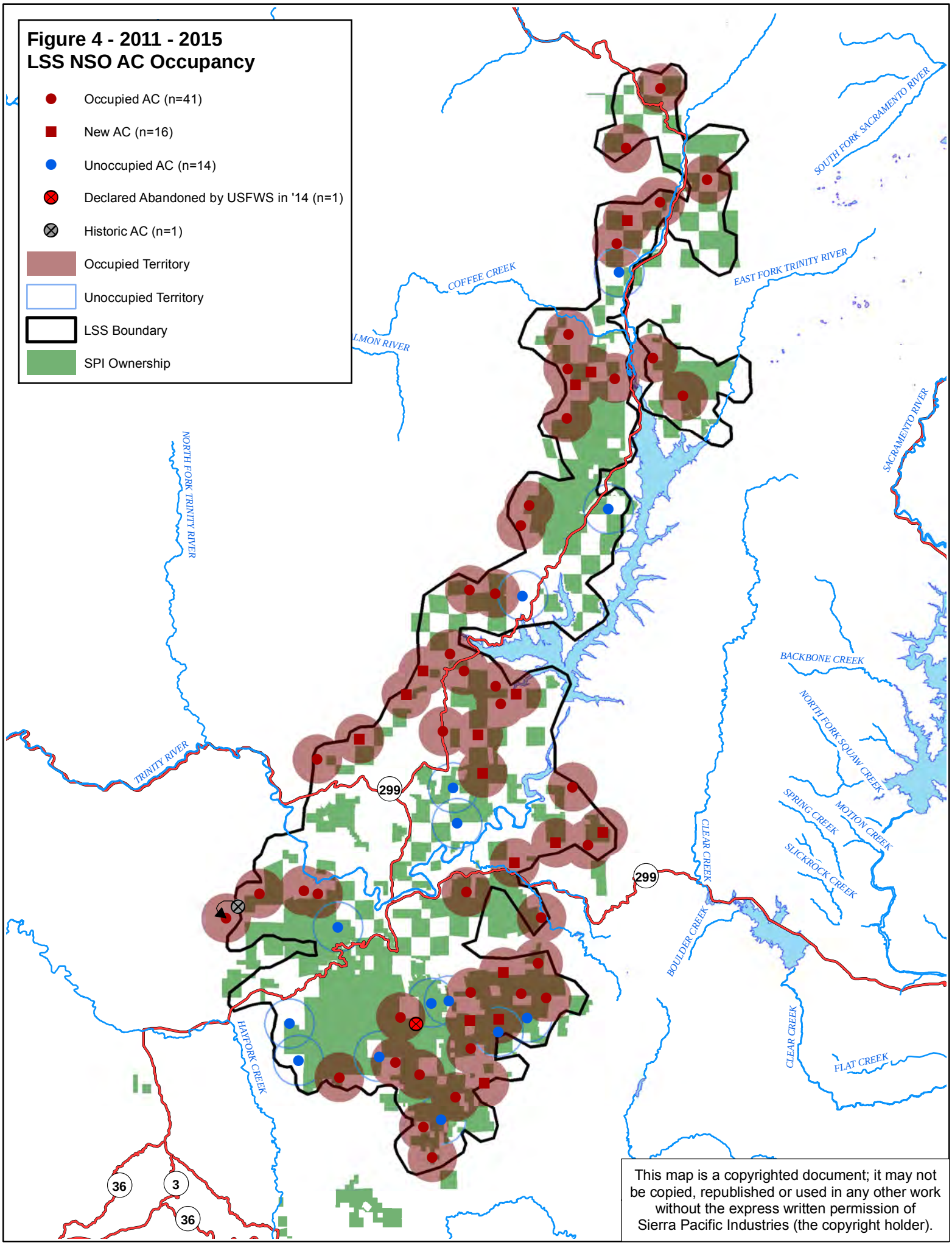

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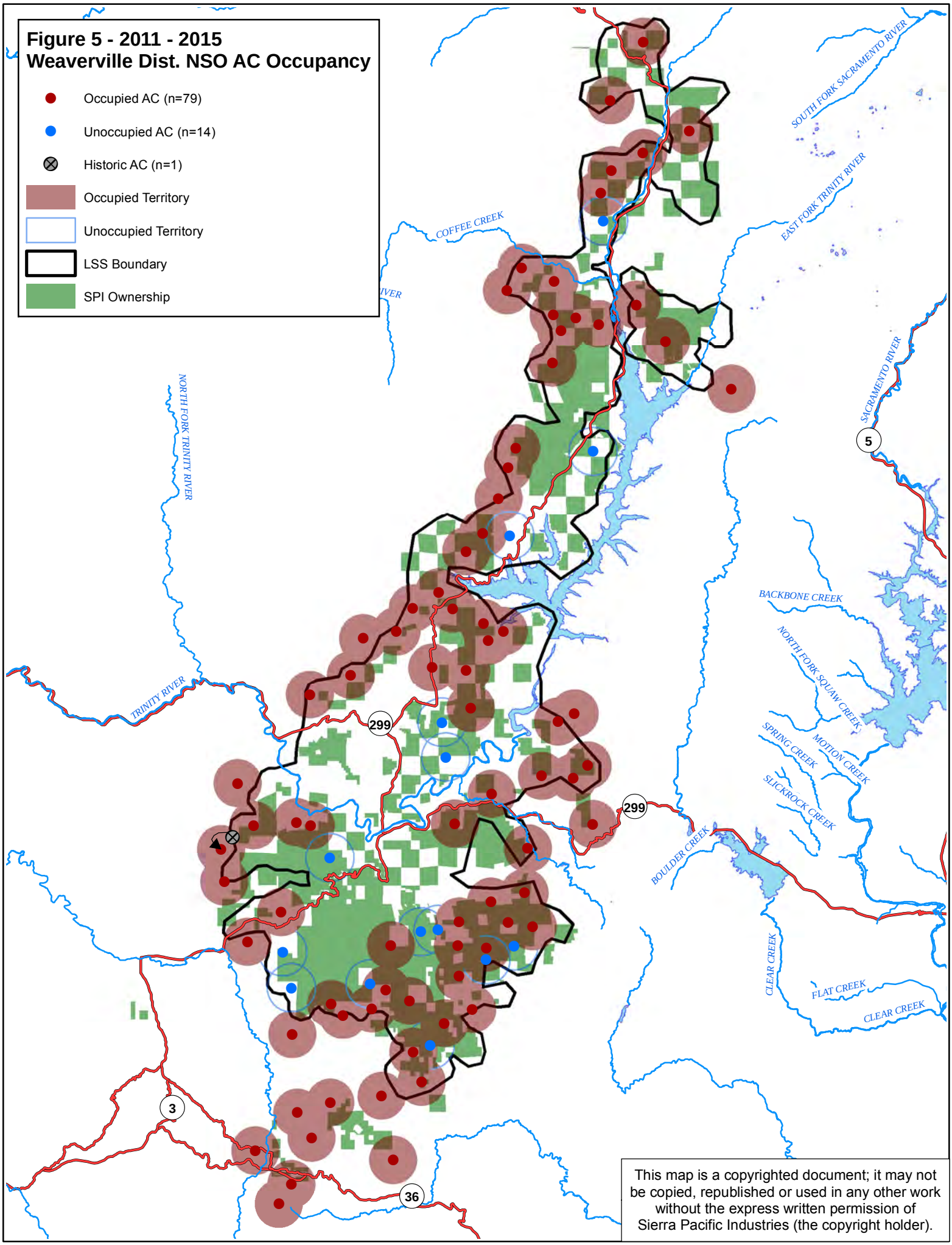

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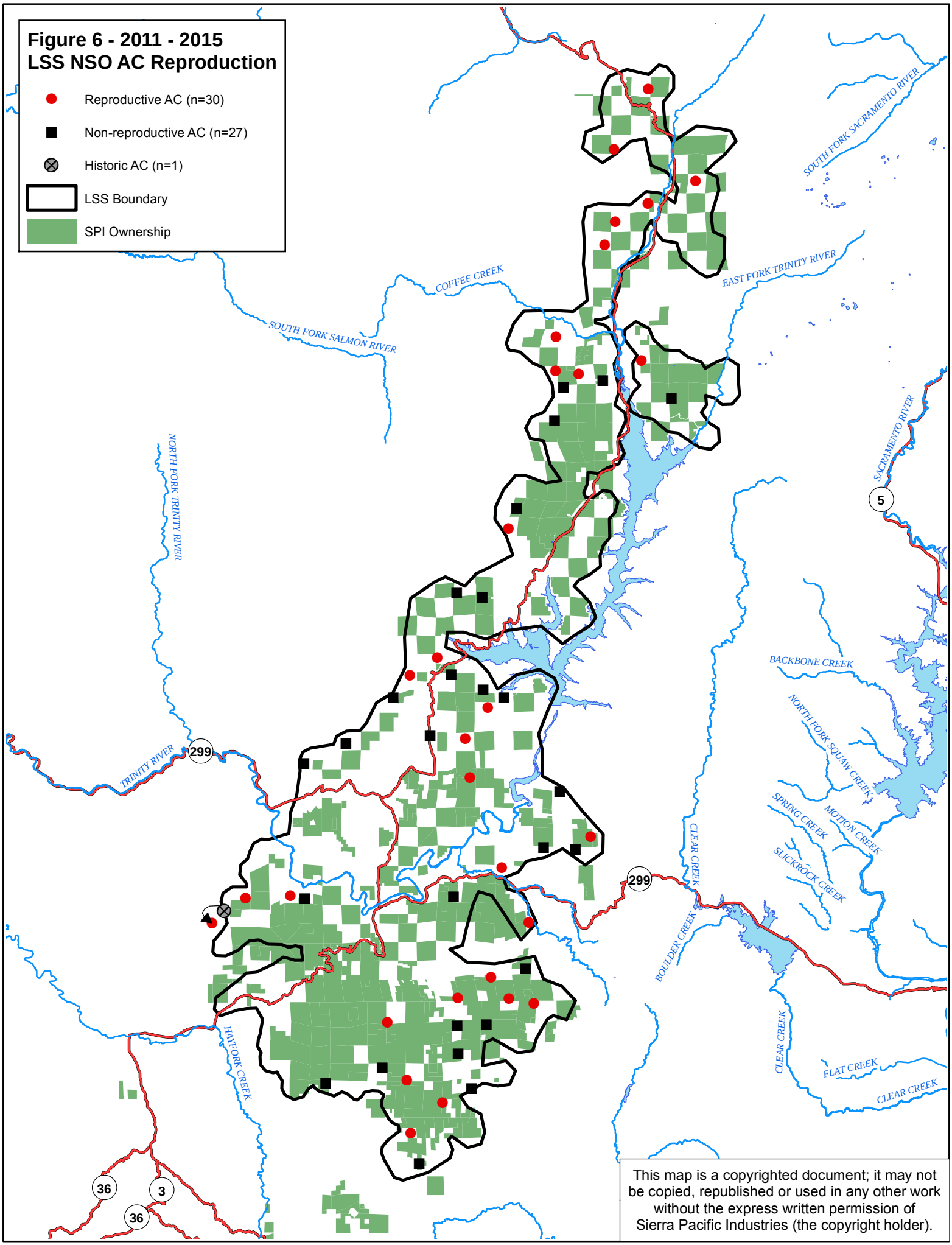

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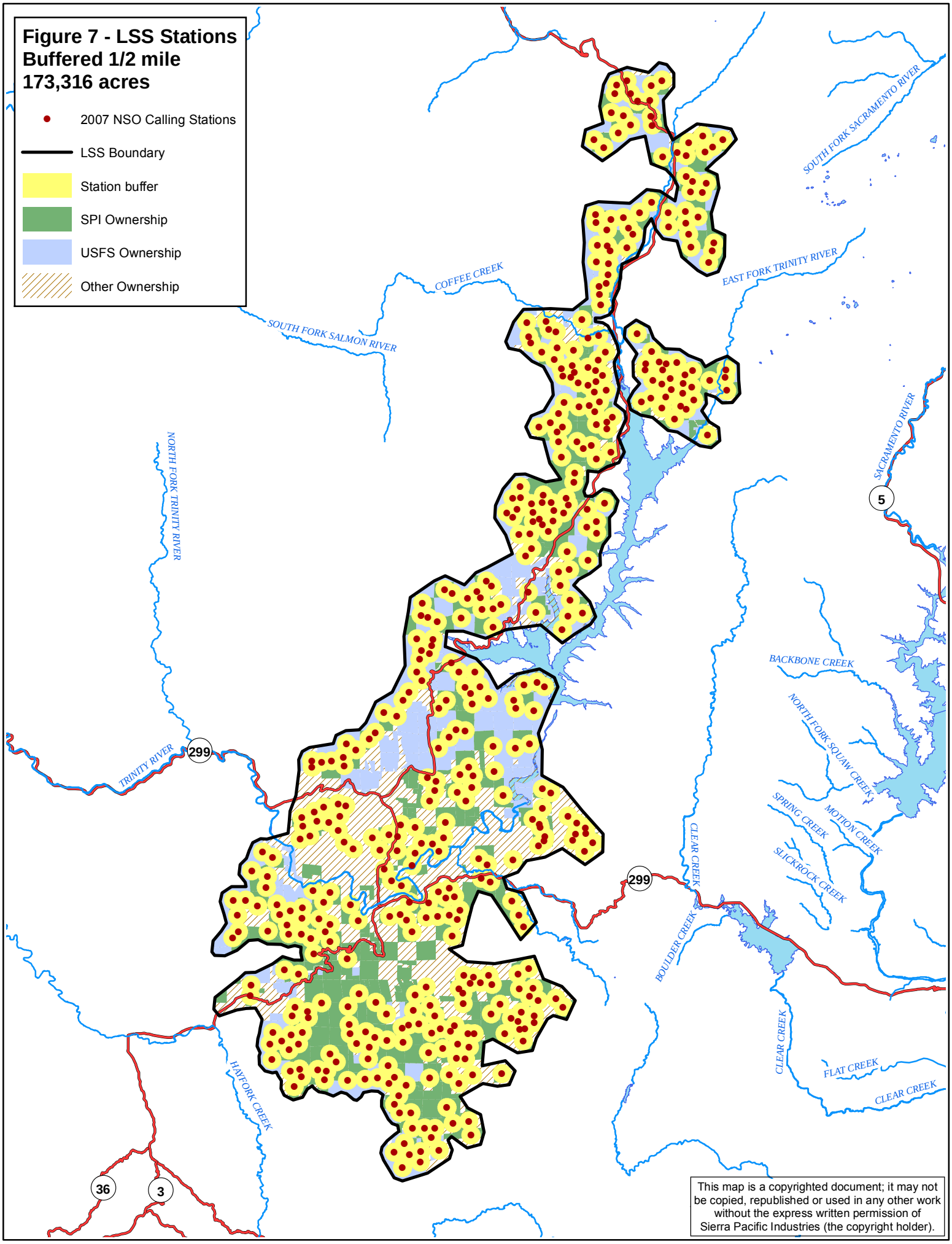
Figure 7 - LSS Stations
Buffered 1/2 mile
173,316 acres
2007 NSO Calling Stations
LSS Boundary
Station buffer
SPI Ownership
USFS Ownership
Other Ownership
SOUTH FORK SACRAMENTO RIVER
EAST FORK TRINITY RIVER
COFFEE CREEK
SOUTH FORK SALMON RIVER
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CLEAR CREEK
HAYFORK CREEK
36
3
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RESEARCH ARTICLE

Multistate Models Reveal Long-Term Trends of Northern Spotted Owls in the Absence of a Novel Competitor

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Abstract

Quantifying spatial and temporal variability in population trends is a critical aspect of successful management of imperiled species. We evaluated territory occupancy dynamics of northern spotted owls (*Strix occidentalis caurina*), California, USA, 1990–2014. The study area possessed two unique aspects. First, timber management has occurred for over 100 years, resulting in dramatically different forest successional and structural conditions compared to other areas. Second, the barred owl (*Strix varia*), an exotic congener known to exert significant negative effects on spotted owls, has not colonized the study area. We used a Bayesian dynamic multistate model to evaluate if territory occupancy of reproductive spotted owls has declined as in other study areas. The state-space approach for dynamic multistate modeling imputes the number of territories for each nesting state and allows for the estimation of longer-term trends in occupied or reproductive territories from longitudinal studies. The multistate approach accounts for different detection probabilities by nesting state (to account for either inherent differences in detection or for the use of different survey methods for different occupancy states) and reduces bias in state assignment. Estimated linear trends in the number of reproductive territories suggested an average loss of approximately one half territory per year (-0.55, 90% CRI: -0.76, -0.33), in one management block and a loss of 0.15 per year (-0.15, 90% CRI: -0.24, -0.07), in another management block during the 25 year observation period. Estimated trends in the third management block were also negative, but substantial uncertainty existed in the estimate (-0.09, 90% CRI: -0.35, 0.17). Our results indicate that the number of territories occupied by northern spotted owl pairs remained relatively constant over a 25 year period (-0.07, 90% CRI: -0.20, 0.05; -0.01, 90% CRI: -0.19, 0.16; -0.16, 90% CRI: -0.40, 0.06). However, we cannot exclude small-to-moderate declines or increases in paired territory numbers due to uncertainty in our estimates. Collectively, we conclude spotted owl pair populations on this landscape managed for commercial timber production appear to be more stable and do not show sharp year-over-year declines seen in both managed and unmanaged landscapes with substantial barred owl colonization and persistence. Continued monitoring of reproductive territories can determine whether recent declines continue or whether trends reverse as they have on four previous occasions. Experimental investigations

salaries for authors (AK,JJ). The specific roles of these authors are articulated in the 'author contributions' section.

Competing Interests: The authors' commercial affiliation does not alter their adherence to PLOS ONE policies on sharing data and materials. Hawthorne Timber Company and Usal Redwood Forest Company provided funding to complete this study.

to evaluate changes to spotted owl occupancy dynamics when barred owl populations are reduced or removed entirely can confirm the generality of this conclusion.

Introduction

Long-term ecological studies often investigate population dynamics as a function of habitat quality, competition, meta-population structure, and other factors. Collection of demographic data such as fecundity and survival can be challenging and costly, however, and limit their application in many instances. For long-lived species that exhibit strong site fidelity, evaluation of multiple occupancy states may be an effective alternative to support conservation and management programs. Collection of detection/non-detection data is relatively simple, and a broad array of sampling designs and statistical tools are available to analyze basic and applied questions [1, 2]. For species of particular conservation interest, utilizing these tools across multiple studies can provide strong inference about factors affecting population dynamics.

The northern spotted owl (*Strix occidentalis caurina*) is an endangered raptor which exhibits a strong association with structurally complex conifer forests in the Pacific Northwest, USA [3, 4]. The current endangered status of the spotted owl [5] results from population declines associated with reductions of preferred late-successional forest habitat due to timber harvesting. Management agencies proposed broad-scale conservation regulations under the assumption of continued declines in spotted owl populations until improved habitat conditions could support increasing populations [4]. However, recent, rapid expansion of barred owl (*Strix varia*) populations throughout much of the distribution of the spotted owl exacerbated population declines [6–9]. Although presence of this novel ecological competitor can have negative consequences for spotted owl productivity and adult survival [10, 11], Anthony et al. [10] found little support for a negative association between barred owl presence and spotted owl fecundity. Instead, barred owl presence may exert a negative effect on spotted owl territory occupancy [9, 10]. For example, recent analyses found strong associative evidence for interference competition between the two species and consequent negative effects on spotted owl territory occupancy [12, 13]. However, due to the near ubiquity of barred owls throughout the distribution of spotted owls, information is not available to evaluate the original premise that spotted owl populations would recover as habitat conditions improved and as conservation measures were implemented where active timber management continued to occur [4].

In this paper, we used a multistate occupancy model to evaluate northern spotted owl territory occupancy and reproductive dynamics in northern California, USA, 1990–2014. Our primary question was whether territory occupancy of reproducing spotted owls has declined over time, as in other populations of this species [11, 14, 15]? Our dataset and analysis are of broad interest for two reasons. First, we sampled territories in a landscape managed for timber production throughout the 25 year period of observation. Second, this portion of the spotted owl's distribution does not support breeding populations of the barred owl. Current investigations in other areas will evaluate if spotted owl occupancy dynamics change once barred owl populations are reduced or removed entirely [16]. As a result, our analysis provides unique insight into contemporary population dynamics of the spotted owl, and can complement on-going studies to inform management activities to conserve spotted owl populations.

Materials and Methods

Study Area & Management Descriptions

Our study area was located in Mendocino County, CA, USA (S1 Fig). Three generally contiguous blocks occurred from north to south: Blocks A (209 km^2), B (472 km^2), and C (107 km^2).

Elevations ranged from 0–915 m (3000 feet). The furthest inland extent of the study area was 33 km. The climate is characterized by cool, wet winters and hot, dry summers [17]. Fog is the most common source of precipitation during the summer months, particularly along the coast and in coastal valleys [17]. The study area contained a mix of Redwood, Douglas-fir, Montane Hardwood, and Montane Hardwood-Conifer forest vegetation types [18]. Dominant tree species included coast redwood (*Sequoia sempervirens*), as well as Douglas-fir (*Pseudotsuga menziesii*), grand fir (*Abies grandis*), and western hemlock (*Tsuga heterophylla*). Tanoak (*Notholithocarpus densiflorus*), Pacific madrone (*Arbutus menziesii*), and red alder (*Alnus rubra*) were the most common hardwood species, with tanoak and madrone dominant on xeric and higher elevation sites. Common understory shrub species included ceanothus (*Ceanothus* spp.), coyotebush (*Baccharis pilularis*), huckleberry (*Vaccinium* spp.), manzanita (*Arctostaphylos* spp.), poison-oak (*Toxicodendron diversilobum*), rhododendron (*Rhododendron macrophyllum*), and salal (*Gaultheria shallon*).

Commercial timber management has occurred in the study area for more than a century and all of the forest stands were either 2nd or 3rd-growth with most stands less than 80 years old. Numerous timber management techniques have been applied over the decades, including both even- and uneven-aged silvicultural prescriptions. As a result, the study area contained a mosaic of forest stands relative to species composition, stand structure, and age distribution. Late-successional forest structures occurred on the blocks only in the form of individual trees or clumps of residual trees.

Northern Spotted Owl Surveys & Territory Monitoring

The spotted owl population in this study area has been monitored since the late 1980s when public and private landowners began implementing standardized survey protocols to determine spotted owl presence and population status on their respective ownerships [19, 20]. In order to maintain compliance with state and federal "take avoidance" requirements, spotted owl surveys in this study area have followed the survey protocol current at the time [20–22]. When spotted owls were detected during surveys, we initiated follow-up monitoring [20] and applied standard protection measures for the spotted owl territory.

In general, we conducted spotted owl surveys between March 1st and August 31st across all three blocks. The exact count of survey visits to a single territory varied each year due to the timing and type of spotted owl detection, evidence of breeding effort, and proximity to timber management activities. We used one of two methodologies for each spotted owl survey visit: nighttime point-calling surveys in areas without known spotted owl territories and daytime walk-in surveys for known territories. In this analysis, we used data only from daytime walk-in surveys. As a result, our sample includes territories known to be occupied prior to 1990 as well as territories identified (during nighttime surveys) after 1990 with unknown status prior to 1990.

We used daytime surveys to determine occupancy status (i.e., single or pair) and reproductive status. Here, we define positive reproductive status as an owl pair provisioning nestlings, consistent with prior usage [23]. Daytime surveys were conducted in the historic territory site center(s) or in areas where spotted owls were detected during nighttime surveys. We conducted daytime surveys approximately two hours before sunset. Daytime surveys consisted of using spotted owl vocalizations to elicit an owl response and searching for evidence (i.e., pellets and white-wash) of owl presence.

We fed live mice to spotted owls located during daytime surveys to determine territory status and nesting activity. For surveys conducted before May 15th, if an owl cached or ate four mice on a minimum of two visits it was considered to be 'non-nesting'; if an owl took a mouse

to a nest it was considered to be 'nesting'. We suspended surveys for non-nesting owls after May 30th, with the exception of banding visits for un-banded individuals. We concluded young were present when owls took mice to the nest (reproductive status was positive).

Our dataset consisted of 104 territories monitored from 1990–2014. Eighteen, 62, and 24 territories occurred on Blocks A, B, and C, respectively. Although surveys occurred prior to 1990, we did not include those data because the survey program was still being developed and the study area had not been surveyed thoroughly. In any given year, we surveyed all known and active spotted owl territories. We discontinued surveys at previously active territories only after completing absence surveys under the USFWS protocol [21] or declared abandoned in consultation with USFWS. At the same time, we added new territories to the survey program once identified. An individual territory was considered eligible for inclusion in the database if it had at least one survey in a season, regardless of whether or not an owl was detected. We note that 73/104 (70%) of the territories were identified and surveyed in the first 3 years of the study (1990–1992). We surveyed an average of 67 territories (SD = 16; range = 36–94) with daytime visits in each year. Individual territories were surveyed from 1–15 times in each year (median = 3 surveys per year; average = 3.5; SD = 1.8), with a median range of 71 days between first and last visits (minimum = 0, maximum = 150). On Block C, we discontinued surveys after 2006. We recorded 25 barred owl detections on 11 territories (11%) during the duration of the study. Number of detections on these 11 territories ranged from 1–5. We detected seven barred owls from 1990–1992 and five barred owls from 2012–2014.

Analytical Approach for Estimating Multistate Occupancy Dynamics

We used the MacKenzie et al. [23] dynamic multistate occupancy model to examine trends in NSO occupancy states. This methodology allowed for estimation of state probabilities and across-year state transition probabilities, while accounting for imperfect state detection. In our analysis, we considered four possible states: unoccupied (state 1), occupied by single owl (state 2), occupied by non-reproducing pair (state 3), and occupied by reproducing pair (state 4).

We followed the state-space approach described in MacKenzie et al. [23], where the true state of a territory is taken to be a random vector $\mathbf{z}$. For example, if the true state of territory i at time t was occupancy by a non-reproducing pair (state 3), this would give $\mathbf{z}_{it}$ = [0 0 1 0]. The random vector $\mathbf{z}$ is assumed to arise from a single draw of a multinomial distribution. The initial state probabilities are denoted $\boldsymbol{\phi}_{\mathbf{0}} = [\phi_0^{[1]} \;\; \phi_0^{[2]} \;\; \phi_0^{[3]} \;\; \phi_0^{[4]}]$. Under the dynamic multistate occupancy model, state probabilities for subsequent seasons t (t = 1,.., T) depend on the true state in season t-1. As such, occupancy dynamics are incorporated in the model by considering transition probabilities from one true state to another across years. We denote the probability of transitioning from state m at time t to state n at time t+1 with $\phi_t^{[m,n]}$. A transition probability matrix (TPM) defines the probability of each true state at time t+1 given the possible true states at time t. For example, a four-state transition probability matrix may be represented as follows:

$$\boldsymbol{\Phi}_{\mathbf{t}} = \begin{bmatrix} \phi_t^{[1,1]} & \phi_t^{[1,2]} & \phi_t^{[1,3]} & \phi_t^{[1,4]} \\ \phi_t^{[2,1]} & \phi_t^{[2,2]} & \phi_t^{[2,3]} & \phi_t^{[2,4]} \\ \phi_t^{[3,1]} & \phi_t^{[3,2]} & \phi_t^{[3,3]} & \phi_t^{[3,4]} \\ \phi_t^{[4,1]} & \phi_t^{[4,2]} & \phi_t^{[4,3]} & \phi_t^{[4,4]} \end{bmatrix}$$

Each row in the TPM sums to 1, and represents the state probability vector at time t+1 given the row state at time t; i.e., the transition probabilities from time t to t+1 conditional on the state at time t. In all cases the true state of a territory is assumed to remain constant within a season.

We denote the probability of observing a territory in state n during survey j of year t, given a true occupancy state m as $p_{t,j}^{m,n}$. Uncertainty in observed states is assumed to be constrained such that $p_{t,j}^{m,n} = 0$ for any $n > m$. For example, if the true state were 2, we assume that it is not possible to detect the species in either state 3 or 4, but that either state 1 or 2 could be observed. A four state detection probability matrix (DPM) may then be defined as:

		1	**2**	**3**	**4**
TrueState	**1**	1	0	0	0
	2	$1 - p_{tj}^{2,2}$	$p_{tj}^{2,2}$	0	0
	3	$1 - p_{tj}^{3,2} - p_{tj}^{3,3}$	$p_{tj}^{3,2}$	$p_{tj}^{3,3}$	0
	4	$1 - p_{tj}^{4,2} - p_{tj}^{4,3} - p_{tj}^{4,4}$	$p_{tj}^{4,2}$	$p_{tj}^{4,3}$	$p_{tj}^{4,4}$

Under the MacKenzie et al. [23] model, the observed state of a territory is taken to be a random vector **y** which, conditional on the true state **z**, is assumed to arise as a single draw from a multinomial distribution. For example, if the true state of territory i in year t was a non-reproducing pair (state 3), then the multinomial probability vector for the observed state at visit j would be $[1 - p_{tj}^{3,2} - p_{tj}^{3,3}\ p_{tj}^{3,2}\ p_{tj}^{3,3}\ 0]$, so that the probability of observing a single owl in this case would be $p_{tj}^{3,2}$.

In our analysis of the spotted owl data, we did not include any covariates in the TPM or the initial state probabilities, as none were available and our goal was to estimate the number of territories and long-term trends. For the initial state probabilities, we specified a Dirichlet prior distribution with all parameters equal to 1, equivalent to a multivariate uniform distribution. Using random effects, we allowed for the values of $\phi_t^{[m,n]}$ to vary by season, yet also allow for similarity across seasons. For example, $\phi_t^{[m,n]}$ may tend to be low across most seasons for some values of m and n, while for other values of m and n it may tend to be moderate across most seasons. Similarly, some parameters $\phi_t^{[m,n]}$ may tend to show little variation over time, while others may tend to show a larger degree of variation over time. We incorporate this added structure via random effects using the multi-logit transformation (to ensure row probabilities sum to 1). Specifically, we assumed

$$\phi_t^{[m,n]} = \Pr(z_t = n | \mathrm{z}_{t-1} = m) = \frac{\exp(\beta_{0,t}^{[m,n]})}{1 + \Sigma_{l=2}^{4} \exp(\beta_{0,t}^{[m,l]})} \text{ for } n > 1, \text{ and}$$

$$\phi_t^{[m,n]} = \Pr(z_t = 1 | \mathrm{z}_{t-1} = m) = \frac{1}{1 + \Sigma_{l=2}^{4} \exp(\beta_{0,t}^{[m,l]})},$$

where the random effects (intercept only) were assumed to arise from a normal distribution:

$$\beta_{0,t}^{[m,n]} \sim N(\mu^{[m,n]}, \sigma^{[m,n]}) \text{ for } n > 1.$$

The random effects mean and variance, $\mu^{[m,n]}$ and $\sigma^{[m,n]}$, were specified with N(0, 2) and Gamma(2, 0.5) prior distributions, respectively, for all values of m and n. We chose these priors to provide broad prior distributions for the transition probability parameters $\phi_t^{[m,n]}$. The use of random effects provides improved precision of annual estimates of the TPM.

The dates on which owl surveys were conducted varied across owl territories and across years. To allow for within-season variability in detection probabilities, we parameterized each (non-constant) element of the DPM with linear and quadratic Julian date terms. Further, we allowed the date effects to vary across seasons by incorporating random effects for the

coefficients. Specifically, we assumed for $m > 1$ that:

$$p_{itj}^{[m,n]} = \Pr(y_{itj} = n | z_{it} = m) = \frac{\exp(\alpha_{0,t}^{[m,n]} + \alpha_{1,t}^{[m,n]} \cdot \mathrm{JD}_{ij} + \alpha_{2,t}^{[m,n]} \cdot \mathrm{JD}_{ij}^2)}{1 + \Sigma_{l=2}^{m} \exp(\alpha_{0,t}^{[m,l]} + \alpha_{1,t}^{[m,l]} \cdot \mathrm{JD}_{ij} + \alpha_{2,t}^{[m,l]} \cdot \mathrm{JD}_{ij}^2)} \quad \text{for } 1 < n \leq m, \text{ and}$$

$$p_{itj}^{[m,1]} = \Pr(y_{itj} = 1 | z_{it} = m) = \frac{1}{1 + \Sigma_{l=2}^{m} \exp(\alpha_{0,t}^{[m,l]} + \alpha_{1,t}^{[m,l]} \cdot \mathrm{JD}_{ijt} + \alpha_{2,t}^{[m,l]} \cdot \mathrm{JD}_{ijt}^2)},$$

with normal random effects for the intercept, linear and quadratic terms:

$$\alpha_{0,t}^{[m,n]} \sim N\left(\mu_0^{[m,n]}, \sigma_0^{2[m,n]}\right)$$

$$\alpha_{1,t}^{[m,n]} \sim N\left(\mu_1^{[m,n]}, \sigma_1^{2[m,n]}\right)$$

$$\alpha_{2,t}^{[m,n]} \sim N\left(\mu_2^{[m,n]}, \sigma_2^{2[m,n]}\right).$$

Here, y_{itj} is the observed state for visit j, year t, territory i; z_{it} is the true state of territory i in year t; and JD_{itj} is the Julian date for territory i during visit j in year t. We specified prior distributions for the DPM random effects mean and variance as N(0,2) and Gamma(2, 0.5), respectively. We centered and scaled Julian data prior to analysis.

We collected data for this analysis on territories distributed across three management blocks, each with its own management history (D. Meekins, pers. comm.). We allowed all parameters of our model to vary by block in order to obtain block-specific estimates of quantities of interest.

Although the dynamic multistate occupancy model is parameterized in terms of an initial state probability vector and transition probabilities, estimates of state probabilities may be obtained for any given season through the recursive matrix operation:

$$\phi_t = \phi_{t-1}\phi_{t-1}$$

An advantage of the state-space approach from MacKenzie et al. [23] is that the true state of a territory is imputed for each season, allowing for summaries of territory states for a given territory or across the population sample. For example, one can obtain posterior mean estimates of the number of reproductive territories during each season t, along with posterior credible intervals. In turn, the seasonal summaries allow for the estimation of long term linear or quadratic trends across seasons using, for example, orthogonal polynomial contrasts [24]. In our study, we calculated linear trends for number of reproductive territories using the estimator:

$$\tilde{T}_L = \frac{1}{S}\Sigma_{s=1}^{S} T_L^{(s)}, \text{ where } T_L^{(s)} = \frac{\Sigma_t N_t^{(s)}(Yr_t - \overline{Yr})}{\Sigma_t (Yr_t - \overline{Yr})^2}.$$

To calculate $\tilde{T}_{L,}$ a set of s = 1, . . ., S simulations were sampled from the posterior distribution. The quantity $N_t^{(s)}$ is the s-th sample of the total number of reproductive territories imputed at time t (does not include pair or single territories), Yr_t is the year at time t, and $\overline{Yr}$ is the mean year. $T_L^{(s)}$ is calculated from the s-th sample of the posterior distribution, and we take the average over all samples to calculate an estimate of the posterior mean. Credible intervals

may be calculated in a similar manner using sample quantiles for $T_L^{(s)}$. The estimator $\tilde{T}_{L,}$ is interpreted as the expected average change in the number of reproductive territories over each one year interval. For example, a value of -1.0 would indicate an average decline of 1 reproductive territory per year over the course of the study.

We fit the model using JAGS [25] called from R [26] using package R2jags [27]. We ran three chains of length 55,000 with a burnin of 5,000 and 1/100 thinning. Convergence was assessed using the Gelman-Rubin statistic [28] and visual inspection of the chains, with results consistent with Markov chain convergence. We used posterior predictive checks to assess agreement between the fitted model and the observed data, and these checks did not indicate problems with the fitted model (steps in S1 File; results in S1 Table). R code for specifying the JAGS model is included in S2 File. Data used in analyses are in S2 Table.

Ethics Statement

We conducted this research in compliance with all California and USA laws and regulations. The United States Fish and Wildlife Service (USFWS) approved all activities involving the sampling and handling of live vertebrate animals.

Results

We found substantial annual variation in the number of territories in States 3 and 4 while the number of territories in States 1 and 2 remained relatively constant across years (Fig 1). We note that use of naïve territory counts would have over-estimated the number of territories in State 2 in Block B (Fig 1). As a result, the number of territories occupied by pairs in a given year would have been underestimated. Estimated (linear) trends in the number of reproductive territories suggest an average decline of approximately 0.15 territories every year in Block A, and one half territory per year in Block B over the 25 years of this study (1990–2014; Table 1). The estimated per-year trend (-0.09) for Block C was also negative (Table 1). However, for Block C, 90% credible intervals contained zero, indicating uncertainty as to the direction of this trend. Trends in the combined number of pair and reproductive pair territories showed no clear evidence of an increase or decrease in any of the three study blocks. Estimates from 2002–2014 indicated that both Block A and Block B may have lost reproductive pairs, with an estimated decline of approximately 0.32 and 0.97 nesting pairs per year, respectively. However, in both cases the number of pair and reproductive pairs combined showed no clear trends during the same period (Table 1). We note that the size of the estimated decline in number of reproductive pairs was greater for Blocks A and B from 2002–2014 than from 1990–2014, suggesting that the magnitude of the decline increased in the second half of the study period.

In all three management blocks, we found substantial variation in probability of reproduction, depending on prior territory state (Fig 2). Averaged across all years of the study (using hyper-prior means), probability of reproducing in a current year given reproduction in a previous year was 0.30 (90% CRI: 0.13, 0.49), 0.50 (90% CRI: 0.40, 0.60), and 0.70 (90% CRI: 0.53, 0.85) across Blocks A, B, and C, respectively. In contrast, probability of reproducing in a current year, given non-reproduction in a previous year, was 0.30 (90% CRI: 0.16, 0.46), 0.34 (90% CRI: 0.25, 0.43), and 0.37 (90% CRI: 0.14, 0.60) across Blocks A, B, and C, respectively. Estimates for all blocks indicated that probability of reproduction (State 4) was rare if a territory was occupied by a single owl (State 2) in the previous year (Fig 2). Estimates for Block B indicated that probability of reproduction (State 4) was rare if a territory was unoccupied (State 1) in the previous year. Data were insufficient to estimate reproduction when the state in the previous year was unoccupied (State 1) for Blocks A and Block C.

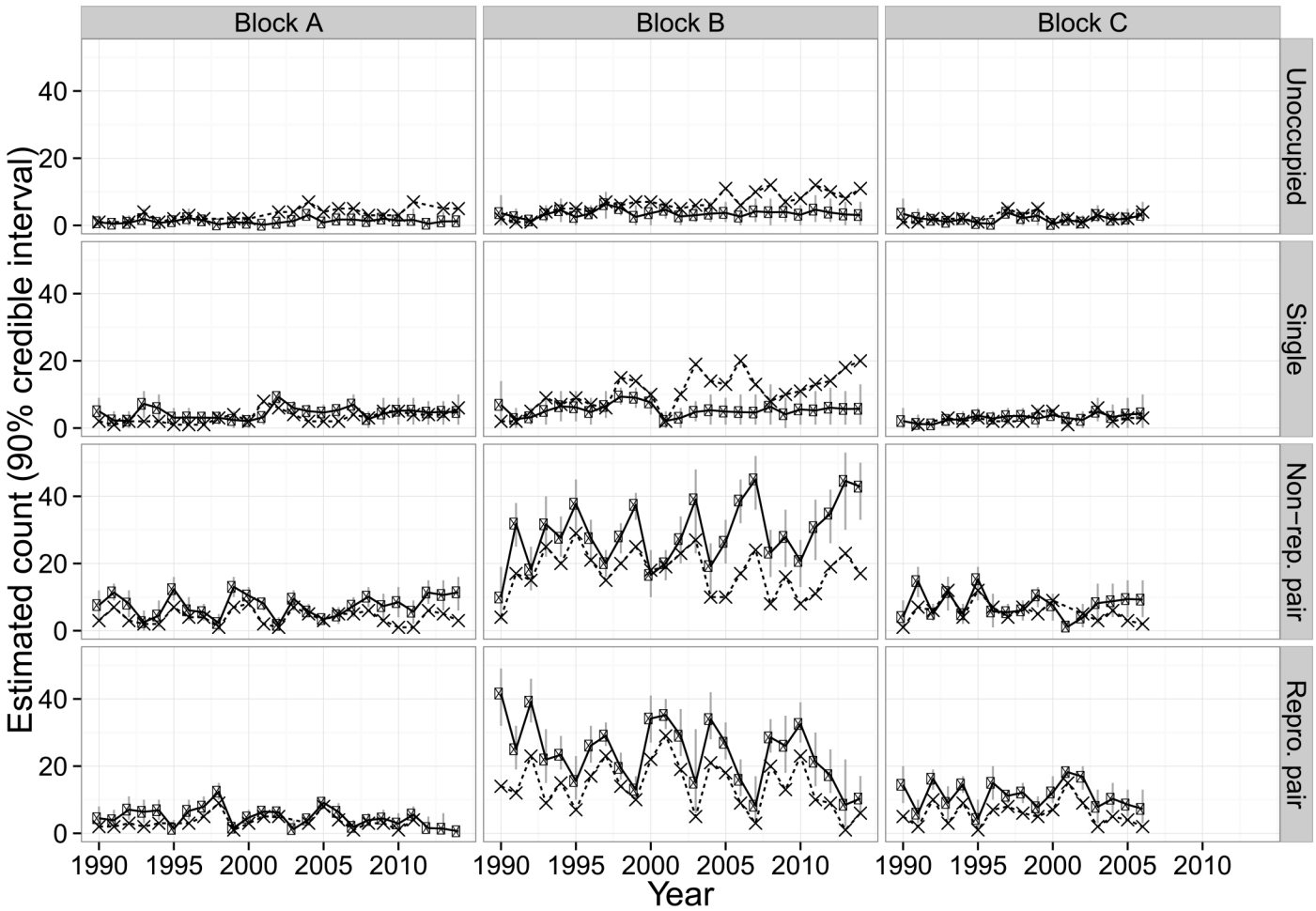

Fig 1. Estimated number of northern spotted owl territories ('•' symbol with 90% CRI) in each of four occupancy states by management block and year, Mendocino County, CA, USA, 1990–2014. Estimates shown with the '×' symbol are the naïve counts (i.e., unadjusted for imperfect detection) of territories in each occupancy state, and do not show credible intervals.

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Additionally, we found considerable variation in reproductive probability across years for owl pairs (Fig 2). For example, mean estimates of reproductive probability, with prior-year reproduction, in Block A ranged from a high of 0.76 to a low of 0.06, in Block B from 0.20 to 0.74, and in Block C from 0.25 to 0.92. Similar variability in reproductive probability was seen when the prior state was a non-reproductive pair. Although years with low reproductive probability were often followed by years with higher probability, this was not always the case; some 4–5 year spans have increasing estimates of reproduction, and other 4–5 year spans have decreasing estimates of reproduction (Fig 2).

Estimated probabilities of observing the true state were highest for reproductive pairs (State 4) and lowest for single owls (State 2; Fig 3). Similarly, the estimated probability of observing no owls was highest for single owls and lowest for reproductive pairs. The seasonal trend in detection probability was most pronounced for reproductive pairs, with the highest probability of detection occurring in the first week of August across all years. Survey-specific detection probabilities for State 2 were low ($\leq$ 0.25 for all years). However, all surveys included in this analysis occurred during the day (in order to assess reproductive status). Typical annual

Table 1. Trend estimates and 90% posterior credible intervals for the number of northern spotted owl territories occupied by reproductive pairs and pairs and reproductive pairs combined on three management blocks, Mendocino County, CA, USA, 1990–2014. We estimated contrasts from 1990–2002, 2002–2014, and 1990–2014. Block C was not surveyed after 2006. As a result, we estimated trends for Block C for 1990–2002 and 1990–2006 only. Mean estimates represent the expected change in territory count for a one year interval.

Management block	Years	State	Trend estimates (90% posterior interval)
A	1990–2002	Reproductive pairs only	0.10 (-0.12, 0.28)
B	1990–2002	Reproductive pairs only	-0.35 (-0.87, 0.17)
C	1990–2002	Reproductive pairs only	0.31 (0.01, 0.62)
A	1990–2002	Pairs and reproductive pairs	-0.02 (-0.23, 0.21)
B	1990–2002	Pairs and reproductive pairs	-0.15 (-0.48, 0.21)
C	1990–2002	Pairs and reproductive pairs	-0.06 (-0.30, 0.18)
A	2002–2014	Reproductive pairs only	-0.32 (-0.49, -0.14)
B	2002–2014	Reproductive pairs only	-0.97 (-1.6, -0.40)
C	2002–2006	Reproductive pairs only	NA
A	2002–2014	Pairs and reproductive pairs	0.24 (-0.04, 0.53)
B	2002–2014	Pairs and reproductive pairs	-0.19 (-0.61, 0.20)
C	2002–2006	Pairs and reproductive pairs	NA
A	1990–2014	Reproductive pairs only	-0.15 (-0.24, -0.07)
B	1990–2014	Reproductive pairs only	-0.55 (-0.76, -0.33)
C	1990–2006	Reproductive pairs only	-0.09 (-0.35, 0.17)
A	1990–2014	Pairs and reproductive pairs	-0.07 (-0.20, 0.05)
B	1990–2014	Pairs and reproductive pairs	-0.01 (-0.19, 0.16)
C	1990–2006	Pairs and reproductive pairs	-0.16 (-0.40, 0.06)

doi:10.1371/journal.pone.0152888.t001

surveys of NSO territories include a mix of day and night surveys and will likely be more effective at detecting both single and pairs of owls.

Discussion

Long-term datasets provide critical information about management and conservation options for imperiled species, including those affected by habitat loss and/or competition with invasive species. We did not find evidence to indicate that territory occupancy by northern spotted owl pairs declined substantially over a 25 year period on the Mendocino County, CA, study area. These results stand in marked contrast to other studies that also examined northern spotted owl occupancy dynamics over extended time frames and found evidence indicating significant declines [9, 11–15]. Although we estimated a declining trend in territory occupancy by breeding pairs, particularly over the last 12 years, we note that due to cyclical reproductive patterns long-term trends are influenced by the interval over which trends are estimated. For example, had monitoring began in either 1994 or 1995, and ended in 2010 or 2011, we would have concluded that territory occupancy by breeding pairs had remained constant or possibly increased. In addition, we note that similarly low numbers of reproductive pairs were observed in 1999, 2003, and 2007. Finally, consistent with most long-term datasets for northern spotted owls, the initial sample consisted of territories that were either occupied or had been occupied recently [11, 15], rather than a random sample from a 'population' of unoccupied and occupied northern spotted owl territories. As a result, our initial estimate of territory occupancy by breeding pairs may have been inflated compared to the background occupancy rate for this particular state.

Our study differs markedly from other long-term investigations of NSO populations in three ways: forest type, management prescriptions, and absence of barred owls. First, all three

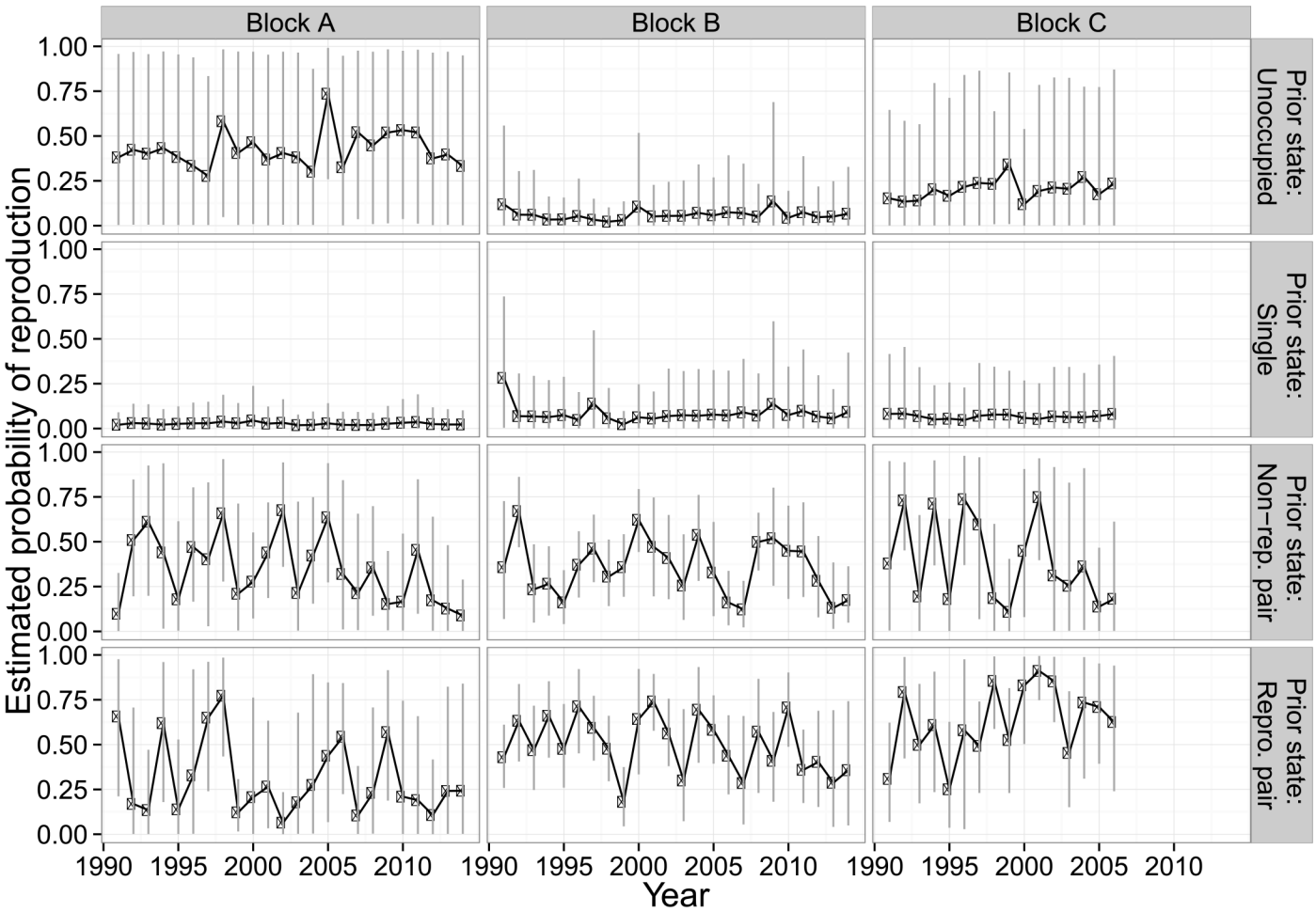

Fig 2. Estimated probability (90% CRI) of reproduction in each management block and year given the occupancy state of a territory in the previous year for northern spotted owls, Mendocino County, CA, USA, 1990–2014.

doi:10.1371/journal.pone.0152888.g002

study blocks occur in the coastal Redwood forest zone; other long-term occupancy studies have occurred in mixed conifer or western hemlock zones [29]. This forest type has different structural characteristics than other single-species dominated or mixed-conifer stands within the range of the northern spotted owl, including understory plant diversity and structure and potential to develop and retain large amounts of coarse woody debris [17, 18]. Second, stands on the three blocks have been managed intensively for timber production for over 100 years. As a result, the study area is dominated by stands less than 80 years in age. Other long-term NSO study areas are composed primarily of Federal lands managed for natural values [11, 12] and contain substantial amounts of late-successional forest, although some exceptions do exist [14]. Finally, we detected only 25 barred owls in 25 years of intensive surveys using the same methods that detect barred owls regularly throughout the range of the northern spotted owl. Given that 15 (60%) of these detections occurred from 1990–1999, when the range of the barred owl had not yet enveloped that of the northern spotted owl, we conclude that barred owls have had ample opportunity to colonize the three management blocks. We cannot determine why barred owls have not colonized our study area, although forest type, management history and contemporary practices, and climatic conditions–and interactions between all three factors–may influence this result. Similarly, we cannot preclude the possibility that barred owls

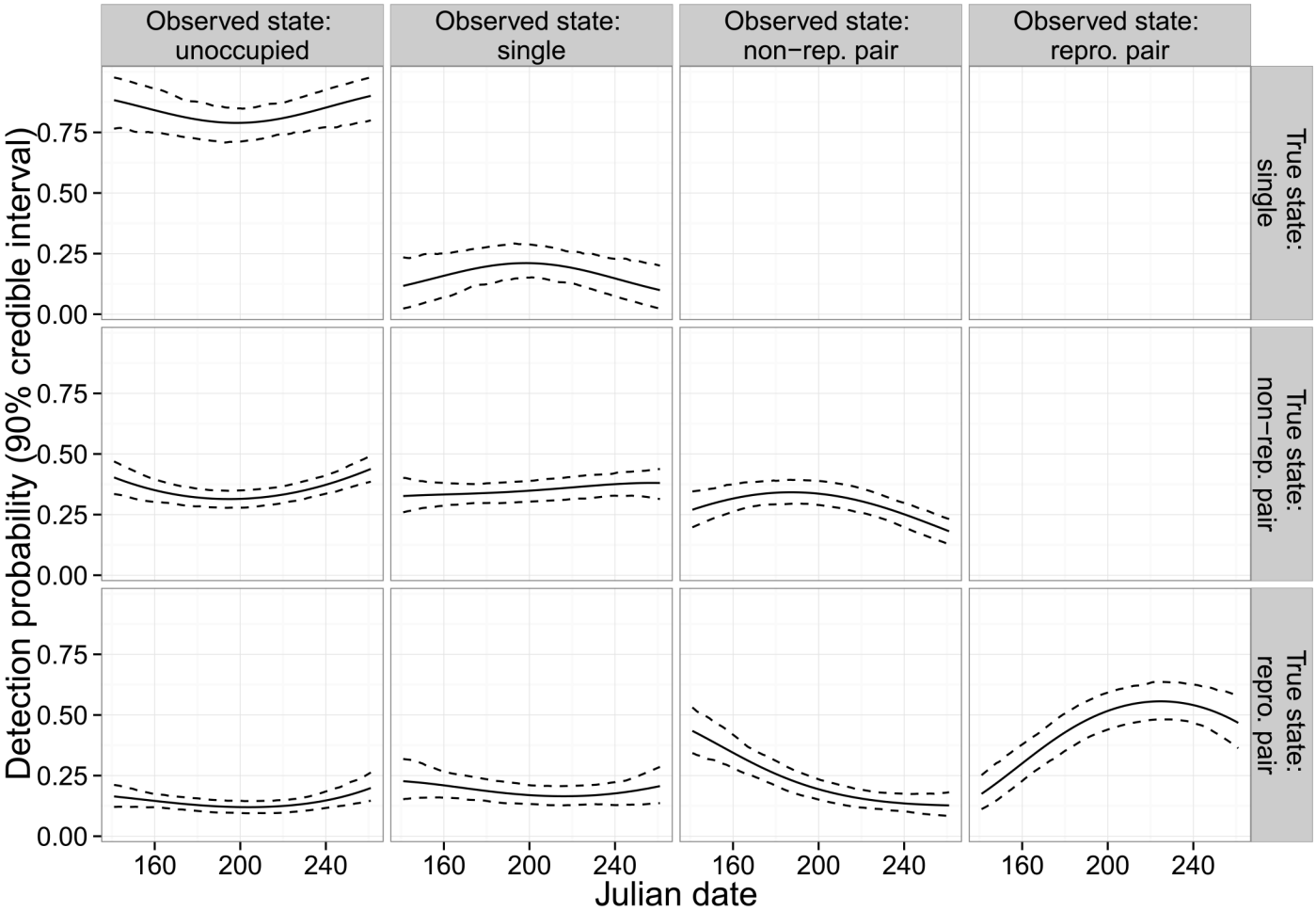

Fig 3. Estimated survey-specific detection probabilities (90% CRI) as a function of Julian date for northern spotted owls, Mendocino County, CA, USA, 1990–2014. We calculated estimates from a hierarchical model in which the quadratic parameters for Julian date varied by year using a random effects specification. The trends displayed in this graphic use the mean posterior random effects.

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will colonize some or the majority of the northern spotted owl territories in our study area in the future (as barred owls have done in other study areas).

Similar to other studies, we found a pronounced pattern in the annual reproductive activity of northern spotted owls [10, 23, 30]. In this case, the pattern was manifested as the regular transition of territories between States 3 and 4. Other studies have attributed this pattern to climatic variation early in the annual nesting cycle, usually elevated amounts of precipitation [30–32]. Given its immediate proximity to the Pacific Ocean, our study area can experience extremely variable spring precipitation [33]. Our data provide mixed support for the association between reproduction and local climatic variation. For example, occupancy of reproductive pairs was the lowest in 2003, 2007, 2013, and 2014; March precipitation in those four years was 14.9, 3.9, 8.1, and 21.5 cm, respectively, equating to 111, 29, 61, and 161% of the long-term average [34]. Annual variation in northern spotted owl reproductive effort has also been attributed to variation in prey abundance [35] and female age [30]. We did not include this covariate information in our modeling effort, but recognize that this information, as well as climatic variables, may have strong associations with occupancy states and recommend their inclusion in future analyses.

Occupancy and multi-season occupancy models [36, 37] that account for imperfect detection have become standard methods for the analysis of spotted owl data [11, 13, 15, 38]. We think that multistate occupancy modeling [23, 39] offers several advantages over other methods, and warrants serious consideration by researchers conducting spotted owl research when suitable data are available for analysis. For example, multistate modeling provides a more detailed picture of population dynamics, allowing for inference about processes such as reproductive dynamics. The state-space approach for multistate modeling imputes the number of territories for each nesting state, which in a longitudinal study allows for the estimation of longer-term trends in occupied or reproductive territories. A particular benefit of the multistate approach is the allowance for different detection probabilities by nesting state–to account for either inherent differences in detection or for the use of different survey methods for different occupancy states–as was done in this study. For example, our estimated probabilities for observing an unoccupied territory varied substantially across each of the three occupied states (Fig 3). Further, the estimated probability of observing a single-owl territory was higher for non-reproductive territories than for reproductive territories in our study. Such differences may lead to bias in studies for which multiple states are collapsed to a single level, e.g., so-called "simple" analyses [11, 15].

Although we found many benefits to the multistate approach, these models present substantial challenges. Our parameterization was relatively simple, in keeping with the goals of the analysis and the management history of the study territories. However, a researcher interested in the potential effects of multiple covariates may face difficult choices regarding how to parameterize the model. For example, in an analysis with M states, $M^*(M-1)$ free elements exist in the TPM and $M^*(M-1)/2$ free elements exist in the DPM. Each of these elements could include covariates, and the researcher must determine which covariates to include in each element as well as the functional form they would take. Another challenge relates to assessing adequacy-of-fit. We chose our approach (S1 File) to evaluate how well our model predicted observed patterns in *detected* states. Ultimately, we cannot disentangle process variation and detection probability with absolute confidence, meaning that such an approach may leave uncovered important problems with the model. Further development of adequacy-of-fit approaches and tests of closure for dynamic multistate occupancy models would help researchers undertake the important step of model checking.

Our results indicate that the number of territories occupied by northern spotted owl pairs remained relatively constant over a 25 year period in a landscape with an extensive legacy of historic, as well as contemporary, timber management. However, we cannot exclude small-to-moderate declines or increases in paired territory numbers due to uncertainty in our estimates. Given the stated close association of northern spotted owls with late-successional forest in other parts of their range [10, 40, 41], these results suggest that habitat per se may not be the only factor that determines population performance of this endangered raptor. For instance, a recent meta-analysis [9] found strong declines in northern spotted owl occupancy on study areas that contained substantial amounts of older forest as well as large populations of barred owls. Taken together, these results indicate that habitat conditions explain only some of the variation in northern spotted owl occupancy. Finally, given proposed removals of barred owls in other portions of the range of the northern spotted owl [9, 16], the Mendocino County population evaluated in this study serves as a control population. As such, it provides long-term insight into northern spotted owl occupancy states in the absence of an exotic congener known to exert significant negative effects, the barred owl.

Supporting Information

S1 Fig. Location of management blocks A, B, and C, northern spotted owl study area, Mendocino County, CA, USA, 1990–2014.
(EPS)

S1 File. Steps used to perform posterior predictive checks for model diagnostics.
(DOCX)

S2 File. R code for JAGS specification of the dynamic multistate occupancy model.
(DOCX)

S1 Table. Output from model diagnostics from simulation studies for dynamic multistate occupancy model.
(XLSX)

S2 Table. Data used in dynamic multistate occupancy model for northern spotted owls, Mendocino County, CA, USA, 1990–2014.
(XLSX)

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Author Contributions

Conceived and designed the experiments: AJK JEJ ABS DJM. Performed the experiments: AJK JEJ ABS DJM. Analyzed the data: AJK JEJ. Contributed reagents/materials/analysis tools: AJK JEJ ABS DJM. Wrote the paper: AJK JEJ ABS DJM.

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Research Article

Demographic Response of Northern Spotted Owls to Barred Owl Removal

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ABSTRACT Federally listed as threatened in 1990 primarily because of habitat loss, the northern spotted owl (*Strix occidentalis caurina*) has continued to decline despite conservation efforts resulting in forested habitat being reserved throughout its range. Recently, there is growing evidence the congeneric invasive barred owl (*Strix varia*) may be responsible for the continued decline primarily by excluding spotted owls from their preferred habitat. We used a long-term demographic study for spotted owls in coastal northern California as the basis for a pilot barred owl removal experiment. Our demography study used capture–recapture, reproductive output, and territory occupancy data collected from 1990 to 2013 to evaluate trends in vital rates and populations. We used a classic before-after-control-impact (BACI) experimental design to investigate the demographic response of northern spotted owls to the lethal removal of barred owls. According to the best 2-species dynamic occupancy model, there was no evidence of differences in barred or northern spotted owl occupancy prior to the initiation of the treatment (barred owl removal). After treatment, barred owl occupancy was lower in the treated relative to the untreated areas and spotted owl occupancy was higher relative to the untreated areas. Barred owl removal decreased spotted owl territory extinction rates but did not affect territory colonization rates. As a result, spotted owl occupancy increased in the treated area and continued to decline in the untreated areas. Prior to and after barred owl removal, there was no evidence that average fecundity differed on the 2 study areas. However, the greater number of occupied spotted owl sites on the treated areas resulted in greater productivity in the treated areas based on empirical counts of fledged young. Prior to removal, survival was declining at a rate of approximately 0.2% per year for treated and untreated areas. Following treatment, estimated survival was 0.859 for the treated areas and 0.822 for the untreated areas. Derived estimates of population change on both study areas showed the same general decline before removal with an estimated slope of −0.0036 per year. Following removal, the rate of population change on the treated areas increased to an average of 1.029 but decreased to an average of 0.870 on the untreated areas. The results from this first experiment demonstrated that lethal removal of barred owls allowed the recovery of northern spotted owl populations in the treated portions of our study area. If additional federally funded barred owl removal experiments provide similar results, this could be the foundation for development of a long-term conservation strategy for northern spotted owls. © 2016 The Wildlife Society.

KEY WORDS barred owl, competition, demography, northern spotted owl, removal experiment.

The northern spotted owl (*Strix occidentalis caurina*) is a medium-sized owl that inhabits structurally complex forests in the coastal and Cascade ranges from southwestern British Columbia to northern California. It is primarily a nocturnal forager of small mammals, has relatively large home ranges, and actively defends space around its nest and roosting area from conspecifics (Courtney et al. 2004). Extensive research on northern spotted owl habitat requirements, conducted during the past 4 decades, focused on understanding the structural characteristics and spatial requirements of nesting, roosting, and foraging habitat for this species. These studies

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have been conducted primarily in landscapes with significant amounts of mature or old forests, the principal seral stages used by this species in most areas where it has been studied (Courtney et al. 2004). The underlying ecological premise behind these habitat studies was that northern spotted owl populations were limited by the amount and distribution of habitat (Franklin et al. 2000, Olson et al. 2004, Dugger et al. 2005).

As early as 1990 when the United States Fish and Wildlife Service (USFWS) listed the northern spotted owl as a threatened species (USFWS 1990), barred owls (*Strix varia*) were recognized as a potential threat to spotted owl populations. Similar in appearance but somewhat larger in size, the barred owl is also a territorial forest owl that historically occurred east of the Great Plains in North America. Since the listing of the spotted owl, there has been ever increasing concern about the range expansion (Livezey 2009) and increasing local populations (Yackulic et al. 2012) of the closely related barred owl. The Revised Recovery Plan for the Northern Spotted Owl (USFWS 2011:vi) stated "... it is becoming more evident that securing habitat alone will not recover the spotted owl. Based on the best available scientific information, competition from the barred owl (*S. varia*) poses a significant and complex threat to the spotted owl."

Barred owls may negatively affect spotted owl detectability, site occupancy, reproduction, and survival. Barred owls decreased detectability of spotted owls (Olson et al. 2005, Crozier et al. 2006, Dugger et al. 2009, Wiens et al. 2011), and spotted owl occupancy was significantly lower in territories where barred owls were detected within 0.8 km of the territory center (Kelly et al. 2003). Other relationships between barred owl detections and reduced site occupancy by spotted owls have been reported (Pearson and Livezey 2003, Gremel 2005, Olson et al. 2005, Kroll et al. 2010, Dugger et al. 2009) and Olson et al. (2004) reported that spotted owls had lower reproductive success on sites where barred owls had been detected. A recent range-wide analysis by Forsman et al. (2011) reported that the barred owl covariate, an annual estimate of the proportion of spotted owl territories influenced by barred owls, entered the top models with a negative coefficient for survival and fecundity in some demographic study areas throughout the owl's range. Occasional hybridization between the species is also documented (Hamer et al. 1994, Kelly and Forsman 2004), but it is not considered to be a serious threat to spotted owl populations (USFWS 2011).

Barred owls are considered habitat and prey generalists (Mazur and James 2000, Hamer et al. 2001). However, they select the same habitat for roosting and nesting as spotted owls, use similar habitat for foraging, and have a high degree of dietary overlap with spotted owls (Wiens et al. 2014). Barred owls also have comparatively smaller home ranges, greater reproductive output, and occur in higher population densities in favorable habitats (Wiens et al. 2014). Because of the slightly larger size of the barred owl, their mutual territoriality (Van Lanen et al. 2011), and similar habitat use, current hypotheses and competition theory predict that barred owls may ultimately limit, and potentially extirpate, populations of spotted owls throughout their range (Gutiérrez et al. 2007, Yackulic et al. 2014).

As part of a monitoring commitment for a northern spotted owl Habitat Conservation Plan (HCP), Green Diamond Resource Company (Green Diamond) has conducted a demographic study for this species since 1990 within its approximately 1,600-km^2 ownership in northwestern California. A 2008 meta-analysis of northern spotted owl populations, including study areas from across the subspecies' range, concluded that the population on the Green Diamond study area was apparently stable or increasing until 2001, when it began to decline (Forsman et al. 2011). The 2008 meta-analysis could not determine cause and effect relationships. However, the presence of barred owls was negatively associated with fecundity and apparent survival of spotted owls. On the Green Diamond study area, the apparent decline in spotted owls coincided with an increase in barred owl numbers (Dugger et al. 2016).

Although it was the most probable hypothesis for the decline on our study area, experimental studies had not been conducted to isolate the effect of barred owls from other potential sources that may contribute to spotted owl population declines. A panel of scientists reviewed potential experimental designs and concluded that a demographic approach with a paired before-after-control-impact (BACI) experiment design where removal of barred owls was the treatment provided the greatest inference and statistical power (Johnson et al. 2008). The revised recovery plan for the northern spotted owl (USFWS 2011) expressed the need for such barred owl experimental removal experiments to be conducted.

We report the results from the first such barred owl removal experiment to address this critical research need. In 2009, the Green Diamond demographic study was partitioned into treated (barred owls lethally removed) and untreated (barred owls undisturbed) areas to estimate the impact of the treatment on spotted owl occupancy, fecundity, survival, and rate of population change. Green Diamond's demographic study has been ongoing since 1990, and they have contributed their data to the regularly conducted northern spotted owl meta-analysis since 1996 (Anthony et al. 2006, Forsman et al. 2011). Green Diamond's demographic data were also included in the most recent meta-analysis (Dugger et al., 2016) where appropriate, and where the treatment data did not compromise estimates of long-term trends. We report the specific analyses designed to test for treatment effects and integrate all of the results to draw conclusions on the effectiveness of barred owl removal for the benefit of northern spotted owls.

STUDY AREA

We conducted the study within Green Diamond's commercially managed timberlands in Humboldt and Del Norte counties, in coastal northern California. Green Diamond's lands of approximately 1,600 km^2 was composed predominantly of second- and third-growth stands of coast redwood (*Sequoia sempervirens*), Douglas-fir (*Pseudotsuga menziesii*),

and various hardwood species, including tanoak (*Lithocarpus densiflorus*), madrone (*Arbutus menziesii*), California bay (*Umbellularia californica*), and red alder (*Alnus rubra*). These forests were primarily harvested on a 50–70-year rotation. The primary silviculture was even-aged with historical incidental and current programmatic retention of mature and late seral elements. Light single tree selection harvest occurred within riparian zones and other sensitive areas that constituted close to 30% of the study area. Many forest stands occupied by spotted owls contained a substantial component of older, residual trees (Thome et al. 1999, Folliard et al. 2000). The entire study area was within 30 km of the Pacific Ocean, and elevation on the study area ranged from 5 m to 1,400 m. Additional details of the study area are included in Diller and Thome (1999).

Because we were interested in the effect of the barred owl invasion on spotted owls, we divided our study area into treated areas where barred owls were removed and untreated areas where they were not removed. To account for geographic differences in the history of timber harvesting, physiographic patterns, and density of barred and spotted owl sites, the relatively linear Green Diamond study area was divided into 3 roughly equivalently sized paired treated and untreated areas totaling 84,205 ha and 72,711 ha, respectively (Fig. 1). Given complications of lethal removal of barred owls with firearms, assignment of treated versus untreated areas was based on logistics and minimizing potential conflicts with adjacent landowners. As in virtually all field studies, it was impossible to ensure that all parameters such as mean density of spotted and barred owl territories of the treated and untreated areas were the same. However, this potential lack of complete symmetry was offset by 19 years of pre-treatment data such that post-treatment changes in trends or means of demographic parameters in the treated versus untreated areas could be reliably assigned to a treatment effect (i.e., barred owl removal).

METHODS

Field Methods

From 1990 to 2013, we monitored spotted owls by surveying the entire density study area (i.e., central contiguous areas where spotted owl population density could be estimated) with 100% survey coverage and territory-specific surveys for all the remaining peripheral owl sites in the demographic study area. The objectives of the surveys were to document occupancy status of owl territories, locate and confirm previously banded owls, band unmarked owls, and document the number of young produced by each territorial female (Lint et al. 1999, Reid et al. 1999). We conducted surveys using vocal imitations or playback of owl calls to incite the owls to defend their territories, thereby revealing their presence (Reid et al. 1999).

The number of surveys of each potential owl territory (i.e., owl site) in each study area was normally $\geq$3 per year, although fewer visits were allowed in cases where females were located that had no brood patch or showed no evidence of nesting during the period when they should have been incubating or brooding young. After we became familiar with the distribution of owl territories in our study areas, it was often possible to locate owls by simply calling quietly while visually searching for owls in their traditional roost or nest areas during the day. If these diurnal surveys were unsuccessful, we surveyed the entire territory at night by calling from survey stations distributed throughout the area according to standard survey protocol. The field methods to capture, mark, and resight individual owls and to determine number of young fledged per female was the standard protocol used in all the northern spotted owl demographic study areas (Forsman et al. 2011, Dugger et al. 2016).

The pilot barred owl removal experiment within our spotted owl demographic study area was initiated on 15 February 2009 working under a permit to California Academy of Sciences that allowed 20 barred owls to be collected. Following an evaluation by the USFWS of our removal data from this pilot study, we were authorized to continue lethal removal in 2010 of $\leq$70 barred owls over a 3-year period, with $\leq$30 individuals removed in any given year.

We detected barred owls as a consequence of standard surveys to locate spotted owls from 1990 to 2009, but because these surveys were designed for detecting spotted owls, we likely underestimated the number and location of barred owls (Wiens et al. 2011). Therefore, we began barred owl-specific surveys in 2009. Barred owl-specific surveys, with similar spacing and number of visits as spotted owl surveys, included playing recordings of barred owl calls broadcast by a commercially available, remotely controlled, high-quality digital wildlife caller (Wildlife Technologies KAS-2030ML and MA 15, Manchester, NH). To reduce the potential of initiating interspecific interactions between the 2 species, we broadcast spotted owl lure calls for 8 minutes before transitioning to the barred owl-specific survey calls. If no spotted owls responded to the initial spotted owl lure broadcasts, we broadcast barred owl lure calls for 10 minutes. Following removal of barred owls from a site, we conducted additional barred owl-specific surveys to assess recolonization by barred owls at removal sites (adapted from Forsman 1983 and Bierregaard et al. 2008).

If a barred owl was detected during any survey, we returned to the site to locate it. If that location was in a known spotted owl territory, we first broadcast spotted owl calls during these follow-up visits. If spotted owls were present, we did not attempt to lure barred owls. If spotted owls did not respond within approximately 400 m of our location, we assumed there were no spotted owls present at the local site. We then broadcast a repertoire of barred owl lure calls, generally starting with male and female 2-phrased (8-note) hoots and progressed to more agitated ascending (series) hoots, pair duets, or cackling calls (Odom and Mennill 2010). We attempted to lethally remove all barred owls continuously in treatment areas that behaved in a territorial manner except barred owls that potentially had dependent nestlings or fledglings. Territoriality was assessed by aggressive hooting, flying to the source of the lure call, stooping on the calling device, and limb crashing (i.e., landing with force on a limb such that it made a loud sound). We only removed territorial

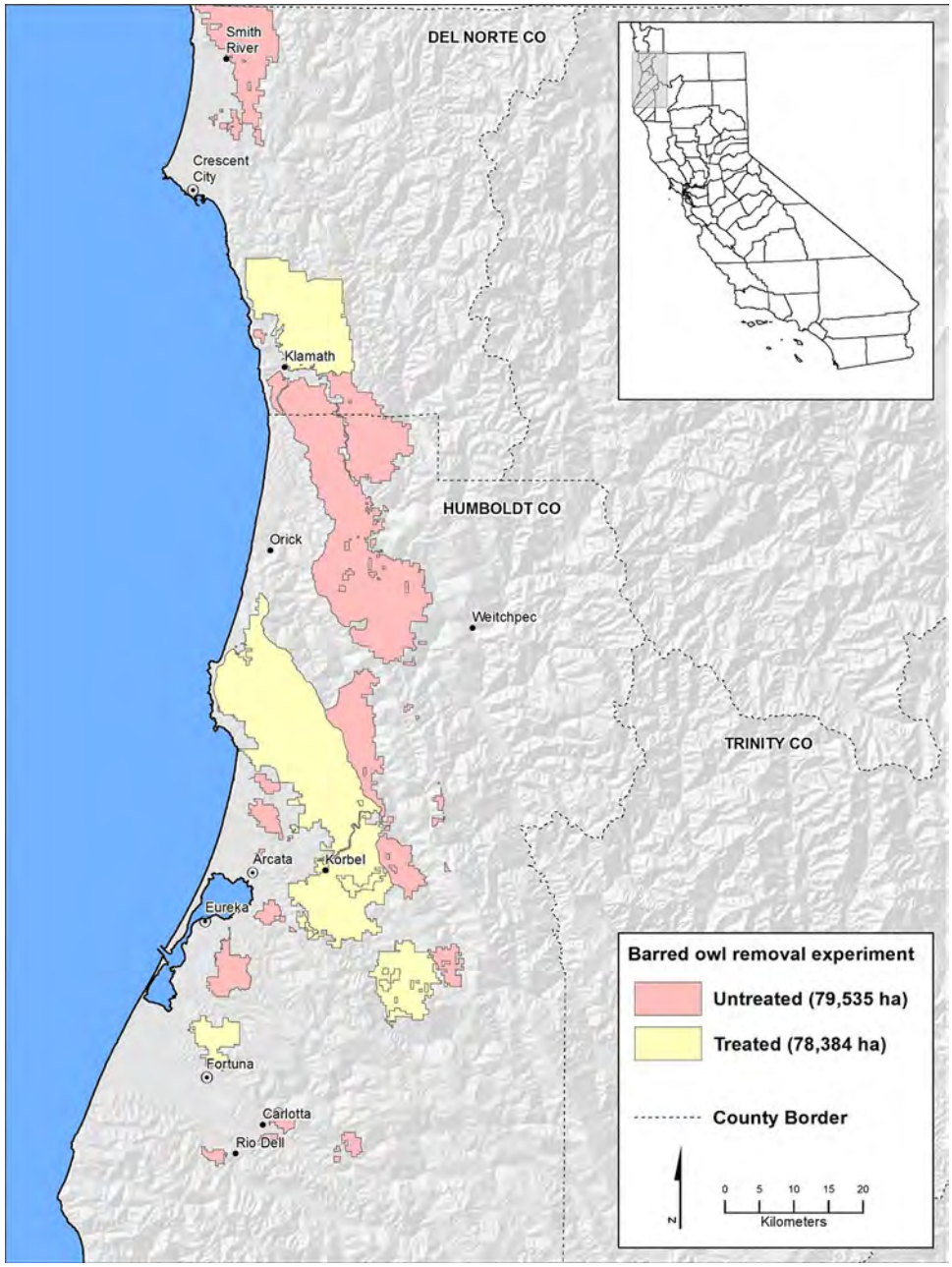

Figure 1. Treated (barred owls lethally removed) and untreated (barred owls undisturbed) areas on Green Diamond's northern spotted owl demographic study area in north coastal California, USA.

barred owls because our long-term goal was to assess impacts of territorial barred owls on spotted owls (Wiens et al. 2014) and our permits authorized a limited number of collections. We lethally removed barred owls as described in Diller et al. (2014). Lethal removal of barred owl was authorized by the following permits obtained in 2006 (USFWS permit no. MB103642-0 and California Department of Fish and Game [CDFG] permit no. SC-801126-05) issued to the California Academy of Sciences, 2009 (USFWS permit no. MB 680765-1 and CDFG permit no. SC-000687) issued to California Academy of Sciences, and 2010–2013 (USFWS no. MB 17356A-0 and CDFG Permit no. SC-000687) issued to L. V. Diller.

All territorial barred owls were continuously removed from the treated areas regardless of their proximity to known spotted owl territories. However, some barred owls occupied the same territory core, and sometimes even used the same nest site, from which the spotted owls were apparently displaced. These spotted owl sites were evaluated as case studies if the criteria were met in which a former spotted owl territory was occupied by barred owls (i.e., spotted owls no longer detected for at least a year) that inhabited the same territory center (nest or primary roost sites). In these situations, the site was surveyed at least once per month following the removal of the barred owls to determine the timing of potential re-occupancy by either barred or spotted

owls. We moused (i.e., placed a live laboratory mouse in a position to be taken by an owl; Forsman 1983) spotted owls that re-occupied (same individual owls resuming occupancy at a site that they previously occupied) or recolonized (new owls occupying a site previously occupied by different individuals) a site to determine their pair and nesting status and we captured and banded any new spotted owls.

Analytical Methods

Spatially delineated owl sites were important to the development of detection/non-detection data sets for our site occupancy analyses, and for estimation of habitat and barred owl covariates within study areas. We defined an owl site as a landscape patch that represented the cumulative area where a spotted owl or pair of spotted owls was detected. The process by which these sites were delineated using Thiessen polygons was described in Dugger et al. (2016).

Development of covariates.—We collected barred owl detection locations used in the population and site occupancy analyses incidentally during our annual northern spotted owl surveys. Barred owls were not specifically targeted during the calling surveys conducted as part of our long-term monitoring of spotted owls and detections associated with barred owl-specific surveys conducted with removal protocols were not used to develop this covariate. However, barred owls frequently responded to spotted owl calls during nocturnal surveys and, based on a calling experiment conducted by Wiens et al. (2011), we estimated that the cumulative annual detection probability of barred owls was >85% at territories in which we conducted ≥3 nocturnal surveys for spotted owls. For population (as opposed to occupancy) scale analyses, we calculated a barred owl covariate that was year-specific and reflected the proportion of spotted owl territories (i.e., Thiessen polygons) in which barred owls were detected ≥1 time per year. For occupancy analyses, we used detections at the site and survey scale to estimate barred owl detection probability and the probability of barred owl occupancy, colonization, and extinction at sites where barred owls may have been present but not detected.

We developed habitat covariates to represent the amount and distribution of northern spotted owl habitat within our study area. For population scale analyses, we calculated these covariates across the whole study area and they varied among years. For occupancy analyses, we calculated certain covariates at the scale of individual owl sites and they varied both spatially and temporally. For clarity, the covariates calculated at the population scale are capitalized and covariates calculated at the site scale are not. The covariates calculated were 1) the amount of northern spotted owl habitat (HAB for population scale; hab for individual owl site scale), 2) the change in the proportion of habitat during 3-year intervals prior to each survey year (HC/hc), 3) the proportion of the study area or owl site that contained ≥50% habitat within an 800-m-radius circle centered on each pixel in the study area (CORE/core), and 4) the total amount of edge habitat (in m; EDGE/edge), with edge as the interface between suitable owl habitat and all other cover types. Additional details on the development of the habitat covariates are in Dugger et al. (2016).

We used a variety of covariates to investigate possible effects of weather and climate on population-scale vital rates of northern spotted owls. All weather and climate covariates were time-specific and applied at the scale of the owl population on our study area. These variables included measures of seasonal and annual weather and long-term climatic conditions. Specific covariates included mean precipitation and temperature during various life-history stages, Palmer Drought Severity Index (PDSI), Southern Oscillation Index (SOI), and Pacific Decadal Oscillation (PDO; Franklin et al. 2000; Glenn et al. 2010, 2011*a*,*b*; Forsman et al. 2011). Additional details on the development of the weather and climate covariates are in Dugger et al. (2016).

Analysis of site occupancy.—Our analysis of site occupancy was based on 15 years (1999–2013) of detection data, including 10 years prior to initiation of treatment and 5 years during the treatment period. Detections occurred during surveys conducted from 1 March through 31 August within owl sites, but detection/non-detection was aggregated into 12 2-week periods. On a per survey visit basis, we defined a site as occupied by spotted owls when a mated pair was present. We considered a site unoccupied if no owls or only a single spotted owl was detected. However, we considered the site occupied by barred owls when 1 or a pair of territorial individuals were detected. The basis for this difference is that spotted owl pairs have the potential to reproduce and are the ecological sample unit of interest (i.e., sensu effective population size). However, either single or paired barred owls have the potential to negatively affect spotted owls; therefore, we estimated all territorial barred owls to fully quantify their impact. We used a multi-season 2-species occupancy model and Program MARK to generate estimates.

At the start of each breeding season, owl sites were in 1 of 4 mutually exclusive states: both species present (state 3), only northern spotted owls present (state 2), only barred owls present (state 1), and neither species present (state 0). As neither species was detected perfectly, the true state of a site was only known with certainty when both species were detected (state 3). When only a barred owl was detected (observed state 1), the site could also have been occupied by a spotted owl pair (state 3) or not (state 1). Likewise, when only a spotted owl pair was detected, the site could also have been occupied by barred owls (state 3) or not (state 2). When neither species was detected, the owl site could have been in any one of the 4 states.

We modeled the overall probability of detecting the state of a site, given its true state, using a matrix of probabilities, ρ, i, t, j, that varied by site (i), year (t), and sampling event (j). We assumed no false positives (e.g., detection of barred owl, but site is occupied by spotted owl only), reduced probabilities in the matrix, and modeled ρ as a function of 5 parameters that varied by site, year, and sampling event. Omitting subscripts for clarity, these 5 parameters were 1) detection probability of barred owls when spotted owls were not present, p^A (^{A} = barred owl), 2) detection probability of barred owls when spotted owls were present, r^A, 3) detection probability

of northern spotted owls when barred owls were not present, p^B (^{B} = northern spotted owl), 4) detection probability of northern spotted owls when barred owls were present and detected, r^{BA}, and 5) detection probability of northern spotted owls when barred owls were present but not detected, r^{Ba}. The reduced matrix was:

$$\rho = \begin{pmatrix} 1 & 0 & 0 & 0 \\ (1-p^A) & p^A & 0 & 0 \\ (1-p^B) & 0 & p^B & 0 \\ (1-r^{BA})(1-r^A) & (1-r^{Ba})r^A & r^{BA}(1-r^A) & r^{Ba}r^A \end{pmatrix}$$

where each row represents the probability of detecting a site in states 0 through 3 given that the true state is 0, 1, 2, or 3 (in descending order).

The 5 detection parameters could, theoretically, be modeled as independent of presence or absence of the other species; however, we assumed an additive effect on the logit scale of the presence or detection of the other species. In other words, if spotted owl detection probability in the absence of barred owls, p^B, is modeled as a function of a matrix of covariates, X, using a vector of betas, β, and an intercept, β_0:

$$logit(p^B) = \beta_0 + \boldsymbol{\beta X}$$

then detection probability of spotted owls when barred owls are present but not detected, r^{Ba}, is modeled as:

$$logit(r^{Ba}) = \beta_0 + \boldsymbol{\beta X} + \beta_A$$

where β_A is the additive effect of the presence of barred owls on detection of spotted owls. Previous work has suggested that spotted owls are less likely to be detected when barred owls co-occupy an area, even if barred owls are not actively responding (Yackulic et al. 2014). When barred owls do respond, the detection probability of spotted owls is expected to decline even further. This additive effect of the detection of a barred owl, β_{D^A}, in addition to the presence of a barred owl is included in the detection probability of spotted owls when barred owls are detected, r^{BA}, as follows:

$$logit(r^{BA}) = \beta_0 + \boldsymbol{\beta X} + \beta_A + \beta_{D^A}$$

For brevity, and because we only considered additive differences between detection parameters, hereafter we only refer to the betas, β_A or β_{D^A}, as opposed to the associated parameters, r^{Ba} and r^{BA}.

Hypotheses about differences before or after treatment in either the untreated or treated areas can be tested by including interactions between indicator variables and either β_A or β_{D^A}. For example, the hypothesis that detection probability of spotted owls when barred owls were present but not detected changed in the treatment area after treatment could be formulated as:

$$logit(r^{Ba}) = \beta_0 + \boldsymbol{\beta X} + \beta_A + \boldsymbol{R}\beta_{AR}$$

where $\boldsymbol{R}$ is an indicator variable determining whether a particular site was in the treatment group, and β_{AR} is the estimated difference in r^{Ba} on the logit scale associated with the treated group.

The model assumes the true state of each site did not change within breeding seasons; consequently, changes in state within a season could bias parameter estimates. In particular, removal of barred owls during the breeding season would violate this assumption. In other words, removal either changes the state from occupied by both species (state 4) to occupied by spotted owls only (state 2) or changes the state from occupied by barred owls only (state 1) to occupied by neither species (state 0). Therefore, at sites in the treated area, we considered only surveys within a breeding season that occurred prior to removal of the last barred owl to avoid biasing parameter estimates.

Between breeding seasons, sites transitioned between states according to a transition matrix, $\phi_{i,t}$, that varies depending on the covariates associated with owl site i at time t. As with detection parameters, we drop subscripts and model transition probabilities as functions of the following 8 parameters: 1) colonization probability for barred owls when barred owls were not present in the previous breeding season, γ^A, 2) colonization probability for barred owls when barred owls were present in the previous breeding season, γ^{AB}, 3) colonization probability for northern spotted owls when barred owls were not present in the previous breeding season, γ^B, 4) colonization probability for northern spotted owls when barred owls were present in the previous breeding season, γ^{BA}, 5) extinction probability for barred owls when spotted owls were not present in the previous breeding season, ε^A, 6) extinction probability for barred owls when spotted owls were present in the previous breeding season, ε^{AB}, 7) extinction probability for northern spotted owls when barred owls were not present in the previous breeding season, ε^B, and 8) extinction probability for northern spotted owls when barred owls were present in the previous breeding season, ε^{BA}. The full transition matrix, ϕ, was:

$$\begin{pmatrix} (1-\gamma^A)(1-\gamma^B) & \gamma^A(1-\gamma^B) & (1-\gamma^A)\gamma^B & \gamma^A\gamma^B \\ \varepsilon^A(1-\gamma^{BA}) & (1-\varepsilon^A)(1-\gamma^{BA}) & \varepsilon^A\gamma^{BA} & (1-\varepsilon^A)\gamma^{BA} \\ (1-\gamma^{AB})\varepsilon^B & \gamma^{AB}\varepsilon^B & (1-\gamma^{AB})(1-\varepsilon^B) & \gamma^{AB}(1-\varepsilon^B) \\ \varepsilon^{AB}\varepsilon^{BA} & (1-\varepsilon^{AB})\varepsilon^{BA} & \varepsilon^{AB}(1-\varepsilon^{BA}) & (1-\varepsilon^{AB})(1-\varepsilon^{BA}) \end{pmatrix}$$

where each row corresponds to the state at time, t, and each column corresponds to the state at time, t+1, and states in each dimension are ordered from 0 to 3.

We modeled the effects of conspecifics as additive on the logit scale. So, for example, if extinction of spotted owls in the absence of barred owls, ε^B, is modeled via an intercept, α_0, and the product of a vector of estimate coefficients, $\boldsymbol{\alpha}$, and a matrix of covariates, $\boldsymbol{X}$ according to:

$$logit(\varepsilon^B) = \alpha_0 + \boldsymbol{\alpha X}$$

then extinction probability in the presence of barred owls, ε^{BA}, would be modeled as:

$$logit(\varepsilon^{BA}) = \alpha_0 + \boldsymbol{\alpha X} + \alpha_A$$

where BA is the difference in extinction probability on the logit scale associated with barred owl occupancy. The primary hypotheses of interest regarding the effects of barred owl removal on spotted owl extinction probabilities are given below, after discussion of the background model.

Finally, the state of each owl site in the first year is modeled based on the probability of occupancy for barred owls, ψ_i^A, and spotted owls, ψ_i^B, where both probabilities vary based on site covariates, including potentially both habitat and pre-treatment groups. Although it is possible to differentiate between occupancy of spotted owls in sites where barred owls are present or absent, previous 2-species occupancy modeling of this dataset did not support this distinction, probably because of the low prevalence of barred owls at the beginning of the study period (Dugger et al. 2016).

Baseline model.—Dugger et al. (2016) analyzed data from our study area (and 10 other study areas) over the same time period but excluded sites in the treatment area after 2008. Their analysis tested a number of hypotheses about habitat covariates, interspecific interactions, and temporal trends in various parameters. We adopted their best model structure as the baseline model for all analyses presented here, and build on it to test hypotheses about the effects of barred owl removal. The baseline model identified by Dugger et al. (2016) contained the following sub-models: 1) barred owl detection probability included a linear temporal trend; 2) spotted owl detection probability included a year factor (i.e., year-specific intercepts), a within-year bi-week factor (different intercepts for each of the 12 2-week periods), a within-year survey effect (whether surveys had previously been done at the site in the same year), and differences depending on whether barred owls were present and not detected, β_A, or present and detected, β_{D^A}; 3) initial occupancy of barred owls did not vary between sites, 4) initial occupancy of spotted owls included the habitat change (hc) covariate, 5) barred owl colonization was a function of the edge covariate and a linear temporal trend, 6) spotted owl colonization was a function of the edge covariate, 7) barred owl extinction probability was a function of the hab covariate and whether spotted owls co-occupied the patch, β_B, and 8) spotted owl extinction was a function of the core covariate and whether barred owls co-occupied the patch, β_A.

Specific hypotheses tested in this analysis.—Past 2-species dynamic occupancy models for these species indicated that barred owls primarily affect northern spotted owl occupancy parameters by increasing local extinction rates in co-occupied patches (Yackulic et al. 2014, Dugger et al. 2016). Because barred owls were actively removed from sites in the treated area, we hypothesized that northern spotted owl extinction in the presence of barred owls would decline in the treated area to a level similar to northern spotted owl extinction in the absence of barred owls. Therefore, we modeled spotted owl extinction in the presence of barred owls using the following formula:

$$logit(\varepsilon^{BA}) = \alpha_0 + \boldsymbol{\alpha X} + \alpha_A + \alpha_{AR}\boldsymbol{R}$$

where X contained baseline covariates identified by Dugger et al. (2016) and hypothesized that α_{AR} would be negative with absolute magnitude approximately the same as α_A. We also hypothesized that removals would lead to an increase in barred owl extinction in the treated area regardless of whether spotted owls were present. In other words, given:

$$logit(\varepsilon^{A}) = \alpha_0 + \boldsymbol{\alpha X} + \alpha_R\boldsymbol{R}$$

$$logit(\varepsilon^{AB}) = \alpha_0 + \boldsymbol{\alpha X} + \alpha_B + \alpha_R\boldsymbol{R}$$

we hypothesized that α_R would be positive.

It was more difficult to predict the effects of barred owl removals on colonization of both species because of uncertainty regarding movement rates of both species. If movement between treated and untreated was common, we reasoned that treatment effects on colonization would be difficult to detect. In addition, barred owl occupancy was steadily increasing before treatment, and it was reasonable to assume barred owl colonization rates were increasing as well (Yackulic et al. 2012). Given these uncertainties, we tentatively hypothesized that barred owl colonization rates would be lower in the treatment area than in the untreated area but had no a priori hypothesis concerning overall trends in barred owl colonization post-treatment. In addition, we hypothesized that spotted owl colonization would increase in the treatment area.

In addition to the above hypotheses regarding the effects of treatment on different groups, we also tested for pre-existing differences between the group's initial occupancy, colonization, or extinction prior to treatment. We also considered hypotheses about how detection probability may have changed either in response to treatment or to the use of digitally broadcasted northern spotted owl calls beginning in 2009. We hypothesized that the improved quality of the broadcast calls would result in an increase in detection probabilities for barred owls. We also hypothesized that improved quality of broadcast calls might affect the probability of detecting spotted owls at sites also occupied by barred owls, but we did not have an a priori expectation concerning the sign of this effect. In addition, we hypothesized that the detection probability of northern spotted owls in previously co-occupied patches within the treated areas would increase as barred owls were removed.

Occupancy model selection.—We began by fitting a full model that included all background effects and hypotheses of interest (Table 1). We then sequentially removed effects (except those included in the baseline model) and observed changes in corrected Akaike's Information Criterion (AIC_c) values. We determined the order of potential removals a priori using the following steps: 1) determine which of the hypothesized treatment effects were supported in the detection parameters; 2) determine whether there is support for any differences between treatment groups prior to initiation of treatment in the initial occupancy, colonization, or extinction of either species; 3) determine whether parameters associated with colonization and extinction changed in the untreated area after initiation of treatment; and 4) determine if parameters associated with colonization and extinction differ between treated and untreated areas

Table 1. Unique model elements and information criterion statistics for the 2-species occupancy models fitted to data on Green Diamond's northern spotted owl demographic study area in north coastal California, 1999–2013. We modeled initial occupancy ($\hat{\psi}^B$, $\hat{\psi}^A$ [^{A} = barred owl; ^{B} = northern spotted owl]), colonization ($\hat{\gamma}^B$, $\hat{\gamma}^A$), extinction ($\hat{\varepsilon}^B$, $\hat{\varepsilon}^A$), and detection ($\hat{p}^B$, $\hat{p}^A$) for northern spotted and barred owls (BO). The full model includes parameters that allow different intercepts (β_0), effects of barred owl occupancy (β_A), effects of barred owl detections (β_{D^A}), and different trends (β_T) based on pretreatment differences (R') or changes post-treatment in either the treated (R) or untreated (U) areas. Some submodels also include hypotheses that a given parameter changed after treatment and that there was no differences between treated and untreated areas with respect to the change (U=R). We calculated differences in Akaike's Information Criterion (ΔAIC_c) both within each model set and overall and we also report the number of parameters (K) and the deviance (twice the negative log likelihood, 2NLL). All models included habitat covariates, interspecific effects, and temporal variation in various parameters already identified as important based on a previous analysis and referred to as the base model. Dash (–) indicates that no additional parameters were added from the base model. NS = model not supported; S = model supported

	Northern spotted owl					Barred owl								
	ψ_0^B	$\hat{\gamma}^B$	$\hat{\varepsilon}^B$	$\hat{p}^B$		ψ_0^A	$\hat{\gamma}^A$		$\hat{\varepsilon}^A$	$\hat{p}^A$				
Hypothesis tested	β_0	β_0	β_A	β_A	β_{D^A}	β_0	β_0	β_T	β_0	β_0	**Overall ΔAIC_c**	**Model set $\Delta AICc$**	K	**2NLL**
First model set: detection probability hypotheses														
Full model	R'	R', U, R	R', U, R	U, R	U, R	R'	R', U, R	U, R	R', U, R	U=R	17.8	5.0	67	12,620.8
$\hat{p}^A$ changes with digitally broadcasted recorders (NS).	R'	R', U, R	R', U, R	U, R	U, R	R'	R', U, R	U, R	R', U, R	—	16.4	3.6	66	12,621.5
$\hat{p}^B$ during surveys when BO are detected changes with digitally broadcasted recorders (NS).	R'	R', U, R	R', U, R	U, R	—	R'	R', U, R	U, R	R', U, R	—	12.8	0	64	12,622.1
$\hat{p}^B$ at sites where BO are present changes with treatment (S).	R'	R', U, R	R', U, R	U	—	R'	R', U, R	U, R	R', U, R	—	21.6	8.8	63	12,633.0
$\hat{p}^B$ at sites where BO are present changes with digitally broadcasted recorders (S).	R'	R', U, R	R', U, R	R	—	R'	R', U, R	U, R	R', U, R	—	15.0	2.2	63	12,626.4
Second model set: hypotheses concerning pretreatment differences between treated and untreated areas														
ψ_0^A differs between areas before treatment (NS).	R'	R', U, R	R', U, R	U, R	—	—	R', U, R	U, R	R', U, R	—	11.0	8.4	63	12,622.4
ψ_0^B differs between areas before treatment (NS).	—	R', U, R	R', U, R	U, R	—	—	R', U, R	U, R	R', U, R	—	9.7	7.1	62	12,623.2
$\hat{\gamma}^A$ differs between areas before treatment (NS).	—	R', U, R	R', U, R	U, R	—	—	U, R	U, R	R', U, R	—	8.2	5.6	61	12,623.8
$\hat{\varepsilon}^A$ differs between areas before treatment (NS).	—	R', U, R	R', U, R	U, R	—	—	U, R	U, R	U, R	—	6.5	3.9	60	12,624.2
$\hat{\gamma}^B$ differs between areas before treatment (NS).	—	U, R	R', U, R	U, R	—	—	U, R	U, R	U, R	—	4.4	1.8	59	12,624.2
$\hat{\varepsilon}^B$ at sites occupied by barred owls differs between areas before treatment (NS).	—	U, R	U, R	U, R	—	—	U, R	U, R	U, R	—	2.6	0	58	12,624.5
Third model set: hypotheses concerning changes in untreated area after treatment began														
$\hat{\gamma}^A$ intercept changes in untreated area (S).	—	U, R	U, R	U, R	—	—	R	U, R	U, R	—	11.2	9.2	57	12,635.2
$\hat{\gamma}^A$ trend changes in untreated area (S).	—	U, R	U, R	U, R	—	—	U, R	R	U, R	—	7.4	5.4	57	12,631.4
$\hat{\varepsilon}^A$ changes in untreated area (S).	—	U, R	U, R	U, R	—	—	U, R	U, R	R	—	5.8	3.8	57	12,629.8
$\hat{\gamma}^B$ changes in untreated area (NS).	—	R	U, R	U, R	—	—	U, R	U, R	U, R	—	2.5	0.5	57	12,626.4
$\hat{\varepsilon}^B$ in co-occupied sites changes in untreated area (NS).	—	R	R	U, R	—	—	U, R	U, R	U, R	—	2.0	0	56	12,628.1
Fourth model set: hypotheses concerning treatment effects on treated area														
$\hat{\gamma}^A$ intercept changes after treatment were different in treated area (S).	—	R	R	U, R	—	—	U=R	U, R	U, R	—	4.7	4.7	55	12,632.9
$\hat{\gamma}^A$ trend changes after treatment were different in treated area (NS).	—	R	R	U, R	—	—	U, R	U=R	U, R	—	0.4	0.4	55	12,628.6
$\hat{\varepsilon}^A$ changes after treatment were different in treated area (S).	—	R	R	U, R	—	—	U, R	U=R	U=R	—	11.3	11.3	54	12,641.6
$\hat{\gamma}^B$ changes in treatment area only (NS).	—	—	R	U, R	—	—	U, R	U=R	U, R	—	0	0	54	12,630.3
$\hat{\varepsilon}^B$ in co-occupied sites changes in treatment area only (S).	—	—	—	U, R	—	—	U, R	U=R	U, R	—	8.0	8.0	53	12,630.3

following initiation of treatment. Within each set, we decided a priori to always remove parameters related to barred owls before removing parameters related to northern spotted owls and we always removed parameters related to colonization before parameters related to extinction.

Analysis of fecundity.—We conducted analysis of fecundity on the number of female young produced per territorial female per year, defined as the number of young (M + F) produced per territorial female per year divided by 2 because the sex ratio of juvenile owls at hatching was assumed to be 1:1 (Fleming et al. 1996). Spotted owls are strongly territorial, with high site fidelity and detectability, even in years when they are not breeding (Franklin et al. 1996, Reid et al. 1999). Similar to other studies (Anthony et al. 2006, Forsman et al. 2011, Dugger et al. 2016), we assumed that sampling throughout the breeding season was not biased towards birds that reproduced, and that the sample of owls used in our analyses was representative of the territorial population. During 1990 to 2013 over all sites, 90% of fledged young were produced by adult females >2 years old (other age classes included 1% produced by first-year subadults (S1), 3% produced by second-year subadults (S2), and 6% produced by unknown age birds). In addition, the number of non-adult birds was low or 0 in some years, which reduced our ability to compare fecundity for these age classes. Consequently, we dropped non-adult age classes from analysis and considered only fecundity of adult females.

Similar to previous analyses (Anthony et al. 2006, Forsman et al. 2011, Dugger et al. 2016), we analyzed mean annual fecundity using standard regression based on a normal distribution. Analysis of average fecundity helped assure the homoscedastic error assumption inherent in normal models. Furthermore, the appropriate sample units for the analysis were geographical (the treated and untreated areas), not individual owls, because both experimental areas could respond annually to effects that influenced their entirety. In addition, by averaging over owl territories occupied by females and considering treatment areas as sampling units, we reduced ill-effects of autocorrelation in reproduction through time on individual owl territories (Dugger et al. 2016).

The distribution of the underlying data (no. fledglings/female; NYF) was consistent with a truncated Poisson or multinomial distribution because spotted owl pairs almost always raise 0, 1, or 2 young. However, annual fecundity averaged over territories was not Poisson (Forsman et al. 2011), and normal models are more accurate than Poisson models when data depart from Poisson (White and Bennetts 1996, McDonald and White 2010). In addition, normal models are just as accurate as multinomial models when averages are analyzed (McDonald and White 2010). Thus, we used regression models based on a normal distribution to model mean annual NYF for study area as described in Dugger et al. (2016).

Prior analysis has shown that the spatial covariance among territories tended to be small relative to temporal variance among years and other residual effects (Forsman et al. 2011). This justified disregarding spatial covariance because it would not seriously bias variance estimates. In addition, residual variation was relatively constant through time largely because residual variation was small relative to annual variation. Consistent with previous analyses (Anthony et al. 2006, Forsman et al. 2011, Dugger et al. 2016), we estimated the effect of barred owl removal and fit a large number of candidate models containing the effects of habitat, weather, climate, and various forms of interactions between study area (treated vs. untreated) and time period (pre-removal and post-removal). We determined the set of candidate models prior to estimation based on biologically plausible hypothesized effects. The full list included 574 models but we present only those models with a $\Delta AIC_c < 5$.

All models fitted here contained constraints on temporal trends pre- and post-removal that were, in fact, the primary goal of estimation. In addition to non-temporal covariates mentioned above, the models fitted here included year and treatment covariates that allowed the same, parallel, or non-parallel trends on the 2 study areas (treated and untreated) before treatment but parallel trends and differing magnitudes after treatment. If removal of barred owls on the treated area had no effect on average fecundity, the coefficient for the difference in magnitude between treated and non-treatment areas after removal would be 0. If the intercept coefficient measuring the mean difference post-treatment was not 0 (at $\alpha = 0.05$ level), we concluded the change in fecundity to be associated with removal of barred owls. That is, we concluded that fecundity on the 2 study areas was different following treatment.

Analysis of apparent survival.—We used capture–recapture (re-sighting) data to estimate capture probabilities and annual apparent survival probabilities of territorial owls using open population Cormack–Jolly–Seber models. We developed a set of models based on previous research and biological hypotheses (Dugger et al. 2016), and computed estimates of coefficients in those models using Program MARK (White and Burnham 1999). We considered both fixed and random effects models. Covariates considered in the fixed portion of the Cormack–Jolly–Seber model included sex and temporal effects. Covariates considered in the random portion of the model included reproduction, habitat, weather, climate, and generic time effects.

Based on the best-fitting fixed effects model, we included random effects to produce shrinkage estimates (Burnham and White 2002) of annual survival and standard error. Shrunk survival estimates were associated with the year of the field season that terminated the interval. For example, survival from field season 2011 to field season 2012 was associated with year 2012 for analysis. We discarded the final interval (2012–2013) because survival and capture were confounded during the final interval in time-dependent models (Forsman et al. 2011, Dugger et al. 2016).

We then tested for an effect of barred owl removal on survival. We exported the shrunk estimates of survival produced by the best fitting random effects model from MARK to R (R Foundation for Statistical Computing, Vienna, Austria) and used the estimates to test for an

association between survival and barred owl removal via the weighted linear model:

$$\varphi_{ij} = \beta_0 + \beta_1(Post_i) + \beta_2(Treated_j) + \beta_3(Post_i \times Treated_j) + \beta_4(Pre_i \times Year_i)$$

where φ_{ij} was the shrunk estimate of apparent survival between year i and (i+1) on study area j, $Post_i$ was an indicator function for all survival intervals after removal ($Post_i = 1$ for 2008–2009 through 2011–2012, 0 otherwise, with the final interval discarded as described above. $Treated_j$ was an indicator for survival estimates on the treated areas, $Year_i$ was year of the study, and Pre_i was an indicator function for years prior to barred owl removal (i.e., $Pre_i = 1$ for 1990 through 2007). Each estimate in this model was weighted by the inverses of the standard error for individual survival estimate. This model forced parallel trends on both study areas pre-removal, and no trend post-removal. The model was constrained to estimate no trend post-removal because of the small number of observations post-removal ($n = 4$ intervals post-removal). This model allowed the difference in survival on treated and untreated areas to differ pre- and post-removal, and this was considered the effect of interest.

That is, if removal of barred owls on the treated area had no effect on survival, the coefficient for $Post \times Treated$ (i.e., β_3) would be 0 because β_3 measures the difference of differences $(\bar{\varphi}_{pre,treated} - \bar{\varphi}_{pre,non}) - \left(\bar{\varphi}_{post,treated} - \bar{\varphi}_{post,non}\right)$. If β_3 differed from 0 (at $\alpha = 0.05$ level), we concluded removal of barred owls was associated with a change in survival.

Analysis of annual rate of population change.—We included all banded territorial birds (S1, S2, adults) in the analysis of finite rates of population change (λ) on our study areas, the same dataset used in the survival analysis, but we did not explicitly include age effects. We used the f-parameterization of the temporal symmetry models of Pradel implemented in Program MARK (Pradel 1996) to obtain a derived estimate of λ. The rationale for using this approach instead of Leslie matrix models was based on large natal dispersal distances of spotted owls relative to the size of our study area resulting in permanent but unknown emigration of fledglings from the population, and little ability to accurately estimate juvenile survival. We assumed this reparameterization of the Jolly–Seber capture–recapture model (λ_{RJS}) produced less biased estimates of λ compared to estimates from a Leslie matrix (Anthony et al. 2006, Forsman et al. 2011).

The Pradel (1996) method assumes that study area size does not change and that survey effort is relatively constant in each sampling interval such that owls are not gained or lost because of changes in survey effort or study area size. We used consistent, established protocols on our study area for marking and resighting spotted owls each year (Franklin et al. 1996, Lint et al. 1999) to ensure that we surveyed study areas with approximately equal effort each year. Although our study area boundary increased in 1998, we corrected for the expansion through modeling in Program MARK. Full details of how we applied the Pradel method to estimating λ in our study area are in Dugger et al. (2016).

Initial effects considered for parameters in the λ_{RJS} model were general time and sex effects on recapture rates (p), general time effects on survival (φ_t), and general time effects on recruitment (f_t). We retained the best structure on p, as evidenced by the lowest AIC_c, and estimated a constant (no effect) random effects model to produce derived estimates of annual population change λ_t. The purpose behind fitting the random effects model was to reduce the number of distinct parameters without forcing them to be equal over all years, and thus shrink derived estimates of λ_t toward their mean pre- and post-removal values on both the treated and untreated areas.

We then conducted additional analyses to test for an effect of barred owl removal on the annual rate of population change. Similar to analysis of survival, we exported shrunk estimates of λ_{ij} derived from the random effects models (Burnham and White 2002) from MARK to R and tested for evidence of association with barred owl removal. We conducted the test for association with barred owl removal by estimating the weighted linear model,

$$\lambda_{ij} = \beta_0 + \beta_1(Post_i) + \beta_2(Treated_j) + \beta_3(Post_i \times Treated_j) + \beta_4(Pre_i \times Year_i)$$

where λ_{ij} was population change between years i and ($i+1$) on study area j; $Post_i$, $Treated_j$, $Year_i$, and Pre_i were as in the previous section; and the individual estimates were weighted with the inverses of the individual estimate's standard error. This model forced parallel trends in λ on both study areas pre-removal, and estimated no trend post-removal because of the small number of observations post-removal ($n = 4$ years post-removal). Similar to the survival model, this model allowed the difference in population change on treated and untreated areas to differ pre- and post-removal, and this was considered the effect of interest.

If removal of barred owls on the treated area had no effect on λ_{ij}, the coefficient for $Post \times Treated$ (i.e., β_3) would be 0 because β_3 measured the difference of differences. If β_3 was different from 0 (at $\alpha = 0.05$ level), we concluded removal of barred owls was associated with a change in the rate of population change.

RESULTS

Site Occupancy

Based on the analysis of 281 sites (158 treated and 123 untreated) from 1999 to 2013, the best 2-species dynamic occupancy model included 8 parameters in addition to the base model (Table 1), 5 of which concerned changes in barred owl occupancy dynamics, 1 related to spotted owl extinction in sites also occupied by barred owls, and 2 related to detection of spotted owls at sites also occupied by barred owls. According to the best model, there was no evidence of differences between treated and untreated areas for any of the barred owl occupancy parameters prior to the initiation of the treatment (barred owl removal). After treatment, barred owl occupancy parameters changed as follows: 1) estimates of

occupancy rates substantially increased in the untreated areas, whereas they remained relatively constant and much lower in the treated areas (Fig. 2A); 2) colonization rates initially increased and then declined in both treated and untreated areas, but the increase was greater in the untreated areas (Fig. 2B); and 3) extinction rates increased in the treated areas but declined in the untreated areas (Fig. 2C).

Similar to barred owls, there was no evidence of different spotted owl occupancy rates between treated and untreated areas prior to the initiation of the treatment. Following treatment, there was a slow recovery in northern spotted owl occupancy in the treated areas even as occupancy continued to decline in the untreated areas (Fig. 3A). Barred owl removal decreased overall spotted owl extinction rates to levels equivalent to spotted owls sites that had never had barred owls present (Fig. 3B). The best model estimated spotted owl colonization rates at an average of 0.19 (95% CI: 0.15–0.24) and models with different spotted owl colonization rates in treated and untreated areas were not supported. Northern spotted owl detection probability at sites not occupied by barred owls varied over time but showed no differences between treatments or over time (Fig. 3C). On the other hand, spotted owl detection probability at sites also occupied by barred owls increased in the treated area to the point where detection probability was nearly the same as at sites where barred owls were not present. At the same time, spotted owl detection probability in the untreated area at sites occupied by barred owls decreased to lower levels than were found prior to treatment (Fig. 3C). In agreement with Dugger et al. (2016), barred owl detection probability was estimated to be slowly increasing over the course of the study but did not show different trends with respect to treatment.

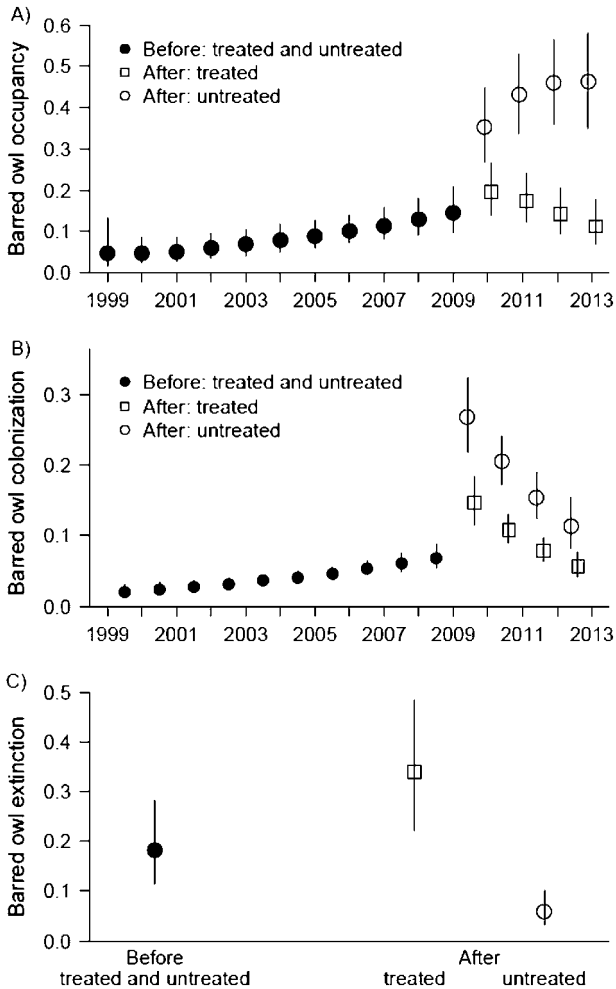

Figure 2. Changes in barred owl occupancy, colonization, and extinction on Green Diamond's northern spotted owl demographic study area in north coastal California, USA. (A) Trend in barred owl occupancy in treated and untreated areas before and after treatment (barred owl removal). (B) Trend in barred owl colonization in treated and untreated areas before and after treatment. (C) Barred owl extinction rate before treatment and after treatment in treated and untreated areas. Error bars represent 95% confidence intervals.

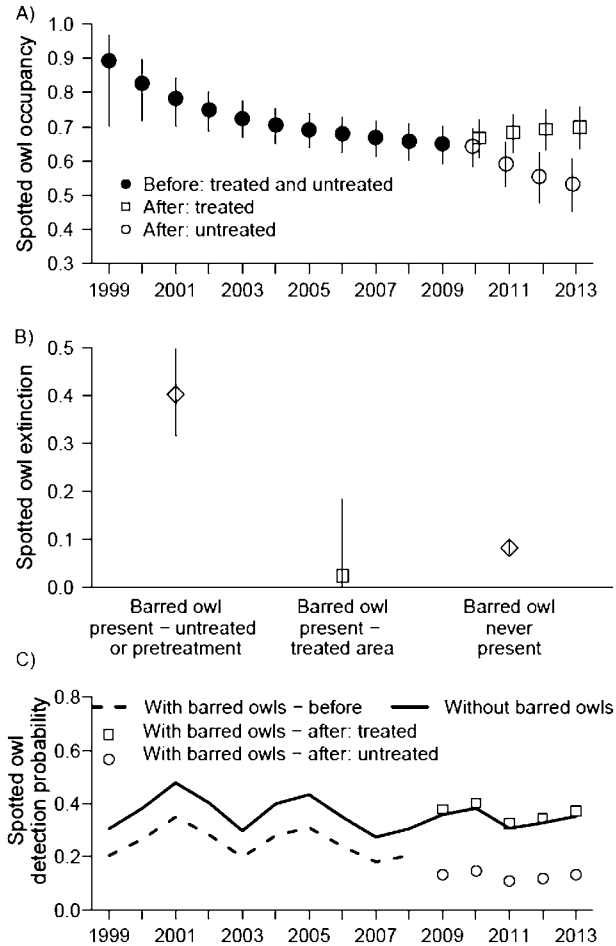

Figure 3. Changes in northern spotted owl occupancy, extinction, and detection probability on Green Diamond's demographic study area in north coastal California, USA. (A) Trend in spotted owl occupancy in treated and untreated areas before and after treatment (barred owl removal). (B) Spotted owl extinction rates when barred owls are present and not removed, barred owls are present and removed, and barred owls were never present. (C) Spotted owl detection probability with and without barred owls before treatment, without barred owls after treatment, and with barred owls after treatment in the treated and untreated areas. Error bars in panels A and B represent 95% confidence intervals.

Fecundity

Estimates of fecundity (no. of female young produced/adult female/year) from 1990 to 2013 were based on records of

964 nesting attempts by adult females on the untreated study area, and 807 nesting attempts by adult females on the treated study area, for 1,771 records.

There were 19 linear models with $\Delta AIC_c < 5$ fitted to mean annual fecundity (Table 2). The top 3 models with $\Delta AIC_c < 2$ all contained a negative effect of winter precipitation and an even-odd year effect. Two of the top 3 models contained a negative effect associated with increased winter temperatures, and another 2 contained a positive effect associated with increased amounts of edge habitat. The second and third ranked models led to the same conclusions as the top model, so we focused attention on the best-fitting model (Fig. 4). After considering the effects of habitat, climate, and even-odd year trends, prior to barred owl removal, there was evidence that fecundity decreased by an annual rate of 0.01 female young per adult female ($P = 0.021$) in both treated and untreated areas, but there was no evidence that average fecundity differed between treated and untreated areas ($P = 0.1895$). After removal of barred owls on the treated area in 2009, there continued to be no significant difference in average fecundity on the treated versus untreated areas ($P = 0.860$).

Apparent Survival

We used 4,733 encounters (captures, recaptures, and resightings, excluding multiple encounters of individuals in the same year) of 982 non-juvenile owls (162 S1, 228 S2, and 592 adults) to estimate apparent survival of spotted owls on our study areas. The weighted linear model fitted to shrunk estimates of survival showed no difference in survival pre-removal (estimated difference pre-removal = 0.0004; Fig. 5) but a marked increase in survival on the treated area relative to the untreated area post-removal ($\hat{\beta}_3 = 0.0366$, $P = 0.0162$). On both treated and untreated areas, prior to barred owl removal, survival was declining at a rate of approximately 0.2% per year ($\hat{\beta}_4 = 0.0019$, $P \leq 0.001$). Following treatment, estimated survival on the untreated area was 0.822 (95% CI = 0.801–0.844), whereas survival on the treated area was 0.859 (95% CI = 0.840–0.877).

Table 2. Models with a difference in Akaike's Information Criterion (ΔAIC_c) <5 from the 574 models fitted to fecundity data on Green Diamond's northern spotted owl demographic study area in north coastal California, 1990–2013. The covariates in the first parentheses indicate effects fitted to period before barred owl removal and the second parentheses indicate effects fitted after barred owl removal; effects outside parentheses were common to both periods. WT = mean winter temperature; WP = mean winter precipitation; EO = even-odd year effect; EDGE = proportion of edge habitat with the study area; T = linear time trend; Trt = treated area; CORE = amount of core high-use habitat in the study area; HAB = proportion of nesting and roosting habitat in the study area.

Model name	ΔAIC_c
WT+WP+EO+EDGE+(T+Trt)(Trt)	0
WT+WP+EO+(.)(Trt)	1.10
WP+EO+EDGE+(T+Trt)(Trt)	1.74
WT+WP+EO+CORE+(.)(Trt)	2.13
WP+EO+(.)(Trt)	2.45
WT+WP+EO+HAB+(.)(Trt)	2.58
WT+WP+EO+EDGE+(.)(Trt)	2.85
WT+WP+EO+(Trt)(Trt)	3.06
WT+WP+EO+CORE+(Trt)(Trt)	3.28
WT+WP+EO+(T+Trt)(Trt)	3.34
WP+EO+CORE+(.)(Trt)	3.46
WP+EO+HAB+(.)(Trt)	3.94
WT+WP+EO+HAB+(Trt)(Trt)	3.97
WP+EO+EDGE+(.)(Trt)	4.16
WP+EO+(Trt)(Trt)	4.41
WP+EO+CORE+(Trt)(Trt)	4.56
WT+WP+EO+HAB+(T+Trt)(Trt)	4.60
WT+WP+EO+EDGE+(Trt)(Trt)	4.64
WP+EO+(T+Trt)(Trt)	4.93

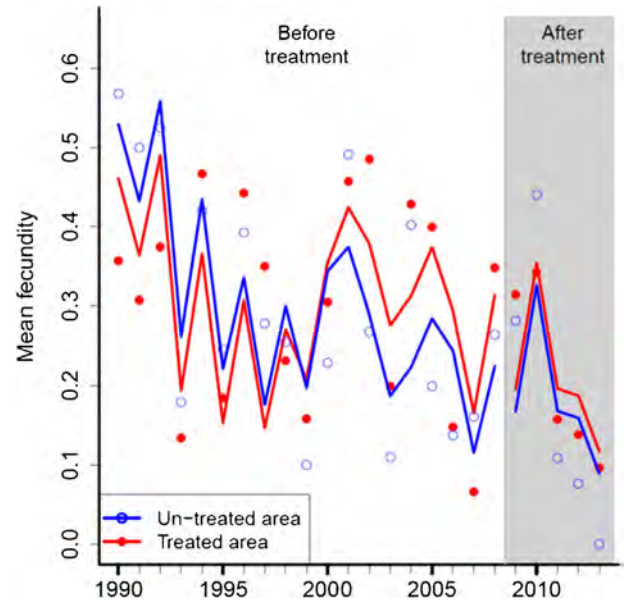

Figure 4. Observed and modeled fecundity from 1990 through 2013 on Green Diamond's northern spotted owl demographic study area in north coastal California, USA. Solid lines represent trends in fecundity estimated by the top-fitting linear model that included winter precipitation, winter temperature, an even-odd year effect, and the amount of edge habitat near the nest. An association between barred owl removal and fecundity was manifest as different lines post-treatment, but there was no evidence of an effect post-treatment ($P = 0.86$).

Annual Rate of Population Change

The best fitting λ_{RJS} model contained additive sex and time effects for capture probabilities (p), and general time effects in both survival (ϕ) and recruitment (f). Derived estimates of population change on both treated and untreated areas showed a general decline before removal of barred owls on the treated area (estimated slope pre-removal = –0.0036 per year, $P = 0.013$; Fig. 6). Following removal of barred owls on the treated areas, there was evidence that the rate of population change on the treated area increased relative to that on the untreated area (difference post-removal = 0.159, $P \leq 0.001$). Following removal of barred owls, the rate of population change averaged 1.029 (95% CI = 0.982–1.075) on the treated area, whereas the rate of population change averaged 0.870 (95% CI = 0.809–0.932) on the untreated area (Fig. 6).

Empirical Observations of Northern Spotted Owl Recolonization

We evaluated 7 known spotted owl sites that barred owls subsequently occupied for ≥1 year before removal as case

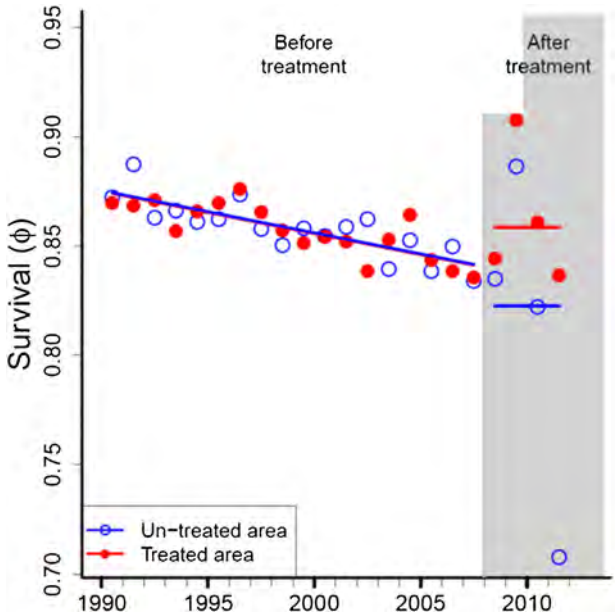

Figure 5. Shrinkage estimates of annual apparent survival from 1990 through 2013 on Green Diamond's northern spotted owl demographic study area in north coastal California, USA. Dots represent annual estimates of treated and untreated areas and trends are estimated from the weighted linear model. Survival on the treated area after removal of barred owls increased by 0.0366 (3.66%, $P = 0.016$) relative to survival on the untreated area.

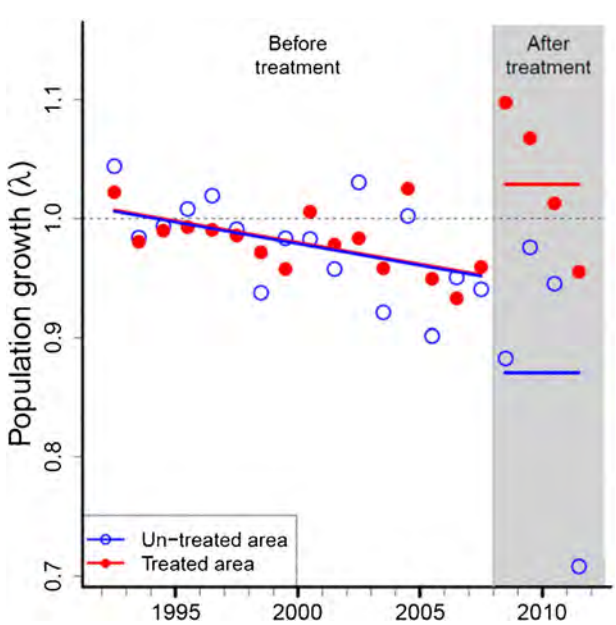

Figure 6. Shrinkage estimates of the rate of population change from 1990 through 2013 on Green Diamond's northern spotted owl demographic study area in north coastal California, USA. Shrinkage estimates are derived from the best-fitting reverse-time Cormack–Jolly–Seber model and calculated for treated and untreated areas (dots), with trends estimated from the weighted linear model. Dashed line represents a stable population, $\lambda = 1.0$. The rate of population change on the treated area increased by 0.159 ($P \leq 0.001$) after removal of barred owls relative to that on the untreated area.

studies. We documented that all were re-occupied by spotted owls with the time for re-occupation ranging from a minimum of 13 days to a maximum of 152 days after removal. Four of the sites were re-occupied by $\geq$1 of the previous resident spotted owls, including 1 female that had not been seen for 7 years. The remaining 3 sites were re-occupied by new or individuals of unknown status. Following re-occupation, the spotted owls were again displaced by barred owls at 3 sites.

There were additional barred owl removal sites that did not meet the criteria for a removal case study because the barred owls did not occupy the known spotted owl site, although they were immediately adjacent to occupied spotted owl nest sites or activity centers (i.e., the barred and spotted owl were neighbors with home ranges that likely overlapped). These neighbor case studies were more difficult to summarize, but the general pattern in all cases was for the spotted owls to either shift their territories away from the neighbor barred owls and not nest or become silent so that we had difficulty finding and determining the nesting status of the spotted owls.

DISCUSSION

The Revised Recovery Plan for the Northern Spotted Owl (USFWS 2011) noted the increasing threat of the barred owl on the northern spotted owl and called for removal experiments to quantify the impact of the invasive species on demographic parameters of spotted owls. A long-term demographic study of the spotted owl that spanned the interval when the expansion of barred owls transitioned from rare floaters on the landscape to occupying increasingly more of the available spotted owl habitat provided a unique opportunity to conduct a BACI removal experiment. However, relative to other northern spotted owl demographic study areas, the Green Diamond study area had among the lowest relative naive estimate of annual proportion of spotted owl territories with barred owl detections in Washington, Oregon, or California (Dugger et al. 2016). We hypothesized that this might reduce the magnitude of the treatment effect on all the demographic parameters, but it also facilitated the ability to remove resident barred owls from the treated areas because of their lower density compared to other areas within the range of the northern spotted owl (Diller et al. 2014).

Site Occupancy

In general, parameter estimates were consistent with our a priori hypotheses. Despite the potential for differences in physical and biological parameters, there were no differences between treated and untreated areas prior to initiation of treatment in the parameters governing either barred owl or northern spotted owl occupancy dynamics. This provides evidence that prior to treatment, the treated and untreated areas were sufficiently similar in important parameters such as occupancy, colonialization, and extinction that post-treatment differences could be assigned to the treatment effect (i.e., removal of barred owls). After the experimental removal experiment began, barred owl extinction rates

increased and barred owl occupancy rates declined in the treated areas as would be predicted given the continuous lethal removal of resident and immigrant barred owls. Occupancy of barred owls in the untreated areas continued to increase consistent with the increasing expansion of barred owls in the region (Yackulic et al. 2012, Dugger et al. 2016). The increase in barred owl colonization rates in treated and untreated areas when removal was initiated in 2009 was not expected. At the Tyee study area in Oregon, barred owl expansion proceeded slowly for many years before increasing rapidly (Yackulic et al. 2012). It is possible that treatment began just as local populations were starting to enter a similar period of rapid increases. Alternatively, environmental conditions may have been very favorable in the years prior setting the stage for a single year of high colonization. Following 2009, barred owl colonization probability declined in both treated and untreated areas. This could reflect either year-to-year variability in barred owl vital rates or could be a consequence of declines in overall regional occupancy coupled with the dependency of barred owl vitals rates on regional occupancy (Yackulic et al. 2012).

Barred owls had an impact on spotted owl territory extinction with rates approximately 4 times higher where barred owls were present at spotted owl sites compared to areas where they were never present. When barred owls were removed from sites where they co-occurred, spotted owl extinction rates became comparable to sites where barred owls were never present. This provides compelling evidence that barred owls were responsible for increases in spotted owl extinction rates and that removal efforts were effective at removing this impact. This large drop in extinction rates resulted in a slight recovery from the decline in spotted owl occupancy in the treated areas. Both the speed of any recovery in spotted owl occupancy and the expected spotted owl equilibrium occupancy are dependent on colonization rates in addition to extinction rates. Because spotted owl colonization rate did not increase in the treated area and is modest (0.19), recovery is likely to be protracted. Spotted owl colonization rates may not have increased because of low fecundity rates during this period on the study area (Fig. 4) and throughout the region (R. B. Douglas, Mendocino Redwood Company, unpublished report).

Fecundity

As observed in prior studies of northern spotted owl fecundity, we observed substantial annual variation that was primarily expressed as an even-odd year effect (Anthony et al. 2006, Forsman et al. 2011). This biennial cycle is almost certainly partly an expression of the tendency of spotted owls to be facultative nesters with most females breeding in alternate years. It is not known specifically what causes the synchronization, but the fact that winter precipitation and temperature entered the top fecundity models with a negative coefficient suggests that weather may be a major contributing factor. Weather may have also contributed to the declining trend in fecundity even in the early years of this study when the annual rate of population change was not significantly different from 1.0 and before barred owls were sufficiently abundant to affect the spotted owl population.

The lack of evidence of an effect of barred owl removal on spotted owl fecundity is likely to be at least partly caused by the high annual variation in fecundity. Furthermore, the competitive interaction between barred owls and spotted owls often results in the displacement of spotted owls (Wiens et al. 2014), and when this occurred, we were generally unable to detect the female spotted owls. This manifested itself as a reduction in occupancy in the untreated versus treated areas, but females that were not detected in a given year did not contribute to an estimate of fecundity. So although we did not find evidence of a change in the number fledged per breeding pair, the total productivity did appear to change in treated compared to untreated areas. Presumably due mostly to a reduction in the number of spotted owl sites, empirical counts of the number fledged at active (occupied at least once in the preceding 3 consecutive years) owl sites post treatment (2009–2014) indicated that only 36 fledglings were documented from an annual mean of 49.8 active owl sites in the untreated areas. In contrast, during the same period, 133 fledglings were observed from an annual mean of 104.2 active sites in the treated areas due at least partly to an increasing number of active sites following barred owl removal.

Apparent Survival

There is evidence of a pretreatment negative trend in apparent survival for spotted owls in both the treated and untreated areas. Following initiation of the removal experiment, there was evidence that survival rates recovered in the treated areas with the mean rate similar to the early years of the study when barred owls were still novel single floaters in the study area. Survival rate in the untreated areas continued to decline and was estimated at the lowest recorded level post-treatment.

The mechanism by which barred owls affect apparent survival of spotted owls is not known. Although we have observed physical attacks of barred owls on spotted owls, these attacks, although violent, did not appear to result in serious physical injury to the spotted owl. There is only one recorded case of a spotted owl purported to have been killed by a barred owl (Leskiw and Gutiérrez 1998). There is also the potential that barred owls could influence spotted owl survival through competition for mutually important prey species. Although barred owls have been shown to have substantial prey overlap with spotted owls in coastal Oregon (Wiens et al. 2014), there have been no studies of prey overlap in our study area in coastal California where spotted owls tend to specialize on dusky-footed woodrats (*Neotoma fuscipes*). Barred owls almost certainly do take some woodrats in our study area, but their more generalized food habits, relative low abundance in the study area even in the untreated areas, and the high abundance of woodrats in young managed timberlands (Hamm 1995, Hughes 2005) make it very unlikely that competition for prey could increase direct mortality or permanent emigration of spotted owls. A telemetry study of barred owls and spotted owls in coastal

Oregon indicated that interference competition for territorial space limited availability of spotted owls to their preferred habitat (Wiens et al. 2014). We also made anecdotal observations of spotted owls that no longer vocalized following occupation by barred owls at or near their territory core, but we could still observed them when they flew up to take a proffered mouse. Thus, we hypothesize that release from barred owl influence creates the appearance of increasing apparent survival by allowing displaced spotted owls in the floater population to regain a territory and become more readily detected. Our empirical observations of spotted owls recolonizing sites within as little as 13 days provides support for this hypothesis.

Annual Rate of Population Change

Because of a declining rate in both fecundity and apparent survival with apparently insufficient immigration to compensate, there was evidence of a pre-treatment negative trend in λ for spotted owls in both the treated and untreated areas. Following initiation of the removal experiment, λ significantly increased in the treated areas with the mean rate greater than 1.0, suggesting a stable or increasing population. The population continued to decline in the untreated areas and was estimated at the lowest recorded level post-treatment.

As previously noted, the Green Diamond dataset was also used in the 2013 northern spotted owl meta-analysis. One of those analyses converted estimates of λ_t to estimates of realized population change ($\widehat{\Delta}_t$). This method provided a visual portrayal of the population trajectory ($\Delta_t = N_t/N_x$) in each year of the study relative to population size in year x, the first year that λ_t was estimated. The results of that analysis for Green Diamond indicated that the treated and untreated spotted owl populations were generally stable (95% CI broadly overlapped 1) until 2005 when a sharp population decline ensued. Following initiation of the experimental removal on the treated area in 2009, the treated area started to rebound and the 95% confidence interval broadly overlapped 1, whereas the trend in the untreated area continued to decline with no overlap of the 95% confidence interval (Dugger et al. 2016)

If the sharp increase in λ seen in this study were the result of increases in fecundity and actual survival within the treated population, we would have expected a delay or lag of several years in the λ response. Instead, the immediate increase suggested that similar to the effect on survival, much of the increase was probably due to displaced spotted owls in the floater population regaining territorial status and being detected. Furthermore, creating an area free of barred owls may have increased the probability that floater spotted owls rebuffed in adjacent untreated areas could colonize the treated areas.

In other areas where barred owls have been present in large numbers for a longer period of time and the population of spotted owls has been more suppressed, the demographic response of spotted owls may be protracted or delayed. If spotted owl abundance has decreased to the extent that comparatively few individuals are available on the landscape to rapidly recolonize territories, we predict there would be a lag of several years in a positive spotted owl demographic response as survival and fecundity increases in the absence of barred owls. Furthermore, differences in habitat and climate associated with different physiographic provinces throughout the species range may play a role in the time or strength of a demographic response.

Empirical Observations of Northern Spotted Owl Recolonization

Although based on a small number of case studies ($n = 7$), these results suggested that northern spotted owls were likely to re-colonize their former territories following removal of barred owls. The very rapid re-colonization of 4 sites by the original resident spotted owls also indicated that, at least in some cases, the resident owls apparently remain in the vicinity of, or regularly investigate their former territory for years after being displaced by barred owls. These results also suggest that barred owls are not simply colonizing areas vacated by declining spotted owl populations, but rather that barred owls are actively displacing spotted owls as described by Wiens et al. (2014). The high and sometimes rapid rate of re-colonization by both original resident and new spotted owls following barred owl removal suggests that at least in some cases, barred owls were keeping the spotted owls from preferred, high quality sites. The sites that were colonized by barred owls also had high continuous occupancy by pairs of spotted owls with high reproductive success before barred owls invaded, which is further evidence that these sites were in high demand by spotted owls. For our study area, located within an intensively managed landscape where many of our spotted owls occupy young-growth sites that differed relative to other demographic study areas, the barred owls tend to occupy the sites with more classic late seral habitat elements.

MANAGEMENT IMPLICATIONS

The results from this study demonstrate that lethal removal of barred owls can allow the recovery of northern spotted owl populations. However, removal experiments may be more difficult to implement and recovery may be slower in other areas where barred owls have been present in large numbers for a longer period of time and the population of spotted owls has been more suppressed. Nevertheless, this experiment provides evidence that future management options may be developed to assist in the recovery of the northern spotted owl in at least the southern portions of its range. Unlike the substantial challenge of this removal experiment in which the objective was to continuously remove all territorial barred owls from the treated areas, long-term management options could be developed that would only require reducing barred owl population densities in selected conservation areas to allow coexistence with spotted owls. Presumably this could be done with much less cost and effort per unit area treated through an incremental decrease in adult barred owl survival or by implementing less controversial methods to decrease barred owl fecundity. At a minimum, this removal experiment provides evidence that if spotted owl populations continue to decline in the face of the barred owl threat,

refugia could be created so that extreme recovery actions like captive breeding would not be necessary while further management actions are developed and tested.

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NORTHERN SPOTTED OWL

SUPPLEMENTAL INFORMATION

Northern Spotted Owl

Barred Owl

California Department of Fish and Game

California Fish and Game Commission

May 2, 2016

May 2, 2016

Executive Summary

Attached are three new studies for your consideration:

Demographic Response of Northern Spotted Owls to Barred Owl Removal, Diller, et al, 2016

Northern Spotted Owls Near Weaverville and Trinity Lake In Trinity County, Sierra Pacific Ind., 2016

Multistate Models Reveal Long-Term Trends of Northern Spotted Owls in the Absence of a Novel Competitor, Kroll, et al, 2016

- **NSO Data**
  - Data previously submitted by Calforests (*"Northern Spotted Owl Science Compendium, 2014"*), should not have been considered unsatisfactory, solely because it was not a demographic study. Contrary to that determination, Calforests never contended that its information was a demographic study. It is, however, a robust index of long term trends covering over a quarter century of direct observation of harvest activity and NSO.

- **NSO Habitat**
  - The timber harvest threat section should include a more comprehensive analysis of timber harvest activities. It reviews acres proposed for operations, without delving into post-harvest habitat. A more comprehensive review would have provided more information about post-harvest condition, and spotted owl usage. In addition, this analysis assumes all harvest activity is negative. Harvesting can not only improve necessary edge relationships for prey base and foraging, many landowners engage in explicit harvesting activities to accelerate nesting, roosting, and foraging habitat.
  - The timber harvest threat analysis was based on a small sample of plans submitted in 2013. The analysis concluded that it was likely that habitat had been impacted. A quick review of the affected areas, however, shows that the owls associated with these harvests are thriving. Moreover, this sample, which was to be "evenly distributed" across counties was instead heavily weighted to certain areas, particularly Tehama County, which skews the results at best.

- **NSO Threats**
  - The timber harvest threat analysis does not explicitly acknowledge that plans reviewed under the auspices of the California Forest Practice Rules are not approved unless they meet "no take" standards under the federal Endangered Species Act, standards far in excess of state "no take" standards.
  - The threats section should prioritize the threats to Northern Spotted Owl. There is ample evidence in the record which shows that Barred Owl and wildfire are a far more important threat and impact to the NSO than harvest. All efforts related to NSO should be focused on these threats. This was demonstrated in a recent study by Diller, et. al. (2016). Inland, where barred owl effects are not yet realized, wildfire has accounted for the most significant impact.

Overview

After 25 years of surveying and tracking, NSO Pair Territory data for California suggests a healthy, well-distributed, dynamic yet stable NSO population on California timberlands. Over this period, in addition to the voluntary efforts of many California timberland owners that benefit NSO and their habitat, the acres of NSO habitat protected pursuant to the California Forest Practice Rules (FPR) and U.S. Fish and Wildlife Service (USFWS) guidance has increased as those Rules and Guidance have become more stringent. Between 1988 and 2012, the number of recorded NSO pair territorial sites increased from 950 to 3,061. The increase in such sites has been steady: as of 1992, 2,061 site had been recorded, and by 2003 2,699 sites had been recorded. It is too facile (and erroneous) to dismiss this territorial pair site data as simply reflecting increased survey effort and NSO pair movement in response to timber harvesting. While both of those factors are no doubt in play, an appropriate scientific and statistical analysis would recognize that this data evidences a dynamic yet stable NSO population. As explained by Dr. Kenneth P. Burnham, who is widely recognized as the pre-eminent wildlife population sampling and modeling authority in the Western Hemisphere, and as set forth more fully below:

> *"While the dramatic increase in known NSO pair territories since 1988 is likely due principally to more survey effort and more places surveyed, it is consistent with the dynamic but stable and robust NSO population evidenced by the data collected in the Compendium. Such a dynamic but stable, in the long term, and robust, population is also consistent with the long-lived character but variable reproductive success (due to weather and other environmental factors) of the species, discussed above."*

A recent meta-analysis of demographic data from 11 study areas indicates the northern spotted owl is declining at an annual rate of 3.8% over its entire range. The strength of this population decline, however, is strongest in the north and weakens southward through the range (Duggar, et al. 2016). In northwestern California, results from two of three demographic study areas show consistent pattern of declining fecundity, apparent survival, and finite rate of population change (Duggar, et al. 2016). Although the potential causes differ by study area, the only study from the redwood region indicated that declining trends in both apparent survival and fecundity were influenced by the increasing presence of barred owls (Strix varia). While the maintenance and growth of habitat is still a key aspect to spotted owl conservation (Diller et al. 2016), competition from the barred owl has been identified as the single-most pressing threat to the continued existence of the northern spotted owl throughout its entire range (USFWS 2011).

The threat in the interior of California is different, as widespread impact of barred owl has not been observed, as it has on the coast. Instead, wildfire has overrun a large number of the occupied ACs in northern California, leaving many in an undermined state.

Status Review

The Department's Status Review of the Northern Spotted Owl (*Strix occidentalis caurina*) in California (Review) discounted much of the Calforests Northern Spotted Owl Science Compendium (Compendium), for the following reasons:

> *In order for estimates of occupancy to be valid, survey methods should be consistent over time and the detection probability (the probability of detecting an owl if one is*

present) must be estimated; inconsistent survey effort can lead to high variation in detection probability which can bias estimates of occupancy and other vital rates if not accounted for in the modeling process.

In most cases the companies reported on counts of occupied sites or on naïve estimates of occupancy (the proportion of surveyed sites that are occupied in a given year) without consideration of detection probability (pg. 56)

The draft Review, prior to peer review, included more discussion of the data, but stated:

The variability in methods used by companies, the tendency to report on counts or naïve estimates of occupancy without consideration of detection probability, the sometimes inconsistent methods used over time, along with the sometimes limited description of methods, makes it difficult to interpret the reported occupancy rates and trends for most companies. This leads to some difficulty in comparing reported rates in timber company reports to other published estimates of occupancy and does not support a strong finding that occupancy rates have been stable across these ownerships over time.

The draft Review, as seen above, already had doubts about data in the Compendium, but included some of the results, including a table. The peer reviewers had the following comments on the draft.

Two reviewers advocated for removal. Gutierrez (in a letter to the department) recommended rejecting the information because it was not "peer reviewed". Dugger stated:

"a single sentence or 2 dismissing this report is probably all that's needed. Don't waste time discussing results that in the end are unreliable (and which you then acknowledge are unreliable)."

Three reviewers (Glenn, Hunter, Diller) had no comment on the data, and did not recommend its removal. Franklin did not advocate removal, but instead commented: "Incorporating detection probability would only make the estimates similar or higher". This is consistent with Dr. Burnham's observations about the data provided in the Compendium, as noted above and as set forth more fully below. As explained below, Dr. Burnham is an expert on statistical applications in biology.

The bottom line is that neither the "best available science" requirement of the California Endangered Species Act, nor statistical modeling and estimation standards/best practices, required the exclusion of occupancy data because it was not peer-reviewed. Indeed, wildlife statistics standards/best practices, dictate just the opposite – the more holistic, yet statistically rigorous, approach to the data sets taken by Dr. Burnham.

Demography and Detection Probability

Thus, much of the Compendium data was excluded on the basis of detection probability. Detection probabilities are a statistic model/method designed to account for non-detections if you are not taking a census of the whole population. The purpose is to allow reporting of occupancy (presence/absence rates). Such probabilities take into account individuals present but not counted. This means that a

modeled estimate would be higher than a naïve estimate that the companies have provided. Welsh, et.al. (2013) stated:

> *The fact that abundance is subject to detection error and hence is not directly observable, means that we cannot tell when bias is present (or, equivalently, how large it is) and we cannot adjust for it. This implies that we cannot tell which fit is better: the fit from the occupancy model or the fit ignoring the possibility of detection error.* ***Therefore trying to adjust occupancy models for non-detection can be as misleading as ignoring non-detection completely. Ignoring non-detection can actually be better than trying to adjust for it.***

In order to be effective, companies employ a survey methodology (approved and designed by the USFWS) which has a high probability of detecting the target species so that it can be protected from direct disturbance. Two characteristics of spotted owls make them easy to conserve on working landscapes: 1) they respond readily to vocal imitation or recorded conspecific calls; and 2) they exhibit high site-fidelity to the same general area over successive years (and sometimes generations). These behavioral patterns (which are known to be dampened by Barred Owl presence), combined with knowledge about their regional biology and habitat use, allow foresters and biologists to manage a landscape so that it can support the spotted owl's life-history requirements.

The Compendium was independently reviewed prior to submission by Dr. Kenneth Burnham, an emeritus professor at Colorado State, and a retired USGS Biologist and Statistician. He is the author (with David Anderson) of the seminal treatise for wildlife population sampling and modeling: Model Selection and Multimodel Inference: A Practical Information-Theoretic Approach. He has authored numerous publications specific to the NSO, and has been a co-author of all the demographic studies based on the 11 study areas. His NSO-specific publications include, for example, Burnham, K. P., D. R. Anderson and G. C. White, *Meta-analysis of vital rates of the northern spotted owl,* Studies in Avian Biology 17:92-101 (1996); Franklin, A.B., D.R. Anderson, R.J. Gutierrez, and K.P. Burnham, *Climate, habitat quality, and fitness in northern spotted owl populations in northwestern California,* Ecological Monographs 70:539- 590 (2000); and Forsman, Eric D., et al, *Population Demography of Northern Spotted Owls,* Studies in Avian Biology 40 (2011). In reviewing the NSO Science Compendium and its occupancy data, he stated:

> *"The NSO Science Compendium, taken as a whole, is a comprehensive collection of high quality data. Overall, the effort expended in monitoring and data collection on private timberlands as regards the NSO in California is, in my opinion, exemplary."*

And:

> *"Overall, just the quantity of evidence (call it that) is impressive, and shows that NSO occur all over their putative range in northwest CA (in a somewhat uniform manner). Assuming the 3,061 known NSO pair territories number is well-documented (and I believe it is), this is robust abundance. While the dramatic increase in known NSO pair territories since 1988 is likely due principally to more survey effort and more places surveyed, it is consistent with the dynamic but stable and robust NSO population in California evidenced by the data collected in the Compendium. Such a dynamic but stable, in the long term, and robust, population is also consistent with the long-lived*

character but variable reproductive success (due to weather and other environmental factors) of the species, discussed above."

It was not the intent of Calforests to submit a demography study, nor were we aware that such a standard was being applied to our submission. It was, however, our intent to show the data that has been collected over a quarter century of managing the Spotted Owl. That data clearly demonstrates that on managed lands, where active management and protection measures are applied, the population is stable and dynamic, except where barred owls have invaded.

Multistate Models Reveal Long-Term Trends of Northern Spotted Owls in the Absence of a Novel Competitor. Kroll, et al, 2016

A recent study evaluating Mendocino timberlands formerly owned by Hawthorne Timber Company (now Lyme) has recently offered contrary evidence to the trends noted in other demographic studies. It concluded that demographic data, while sometimes useful, are not necessary to draw inference about trends in the species:

> *"For long-lived species that exhibit strong site fidelity, evaluation of multiple occupancy states may be an effective alternative to support conservation and management programs. Collection of detection/non-detection data is relatively simple, and a broad array of sampling designs and statistical tools are available to analyze basic and applied questions**. For species of particular conservation interest, utilizing these tools across multiple studies can provide strong inference about factors affecting population dynamics**."*

Even more interesting, the study, based on 25 years of data held that population were stable, and attribute that fact to the absence of barred owl:

> *"Long-term datasets provide critical information about management and conservation options for imperiled species, including those affected by habitat loss and/or competition with invasive species. **We did not find evidence to indicate that territory occupancy by northern spotted owl pairs declined substantially over a 25 year period on the Mendocino County, CA, study area**. These results stand in marked contrast to other studies that also examined northern spotted owl occupancy dynamics over extended time frames and found evidence indicating significant declines."*
>
> *"Collectively, we conclude spotted owl pair populations on this landscape managed for commercial timber production appear to be more stable and do not show sharp year-over-year declines seen in both managed and unmanaged landscapes with substantial barred owl colonization and persistence."*

Sierra Pacific Industries (SPI) Landscape Survey Strategy Area (LSS), 2016

IN 2003, SPI and the US Fish and Wildlife Service (Service) designed a comprehensive multi-year survey of northern spotted owls (NSO), which is known as the Landscape Survey Strategy (LSS). It was designed to survey all suspected spotted owl nesting/roosting habitat within SPI lands in Trinity County and

extending out 0.7 mile from those lands. The total area within the LSS was 307,408 acres, of which 142,279 acres (46%) belonged to SPI.

Most of the neighboring lands are under the control of the Shasta-Trinity National Forest. This strategy established 474 **permanent survey points** that were surveyed for the five years from 2003 through 2007.

Prior to that time, surveys were done using USFWS mandated protocols existing at the time, but may not have been comprehensive in area coverage, and negative results were not compiled. In addition, ACs in older California Natural Diversity Data Base records were included in the SPI database. This provided a good general idea of the extent and numbers of sites on SPI lands, but could only provide an approximate estimate of ACs on or near the property, and was not a comprehensive census. Based on this information, and removing ACs that the Service considered abandoned, it was estimated that 47 valid AC's existed in the LSS, and were once occupied between 1990 and 2002. After a five year LSS survey period (2003 – 2007), SPI found the same number (47) of occupied ACs in the study area.

In 2011, SPI began annual re-surveys of the LSS stations. During this five year effort (2011-2015), SPI found 57 occupied ACs within the original LSS area. Also, in 2011, SPI began banding all NSO on the ownership so that in the future they will be able to ascertain whether birds in new locations are residents that have relocated, or whether they are immigrants. Since 2011, 178 NSO (118 adults/sub adults and 60 juveniles) have been banded. SPI has determined that 30 of these 57 occupied ACs were reproductive, producing at least 97 fledglings.

The Willow Creek Study area (referred to as NWC) is the nearest USFS demographic study area to the LSS and they have an estimated annual decline of 3.0%. The current range wide demographic average is an estimated annual decline of 3.8% (Dugger et al, 2016). If in the SPI study area NSOs were following these rates and assuming that the initial AC count of 47 ACs (as verified by the 2003-2007 surveys), by applying the NWC demographic study estimated rate of decline the study area should have experienced a reduction to only 22.1 occupied ACs and based upon the NSO range wide estimated rate there should have only 18.1 occupied ACs in the LSS area today.

It is worth noting that no statistical modeling can be as accurate as a true census, such as in the case of the LSS. This LSS study shows that for the period from 2003 through 2015, despite active timber harvest, there has been a documented increase in occupied activity centers for this portion of the range of the NSO from 47 to 57. All of the harvest conducted by SPI within the study area utilized Option G under the Forest Practice Rules, with technical assistance from the USFWS.

Analysis of NSO Occupied Activity Centers (State Wide)

Forest land managers generally survey for Northern spotted owls (NSO) on a project-by-project basis to support timber harvest plan preparation and implementation. These NSO management surveys comply with the federal Endangered Species Act and provide information necessary for the Director of Cal Fire to determine if a Timber Harvest Plan (THP) is in compliance with the California Forest Practice Rules. A THP cannot be approved without demonstrating that a federally-defined "take" of a state or federally listed species will not occur as a result of the harvest operations.

NSO management surveys that support a THP follow the most recent US Fish and Wildlife Service Survey Protocol (USFWS 2012, *Protocol for Surveying Proposed Management Activities That May Impact*

Northern Spotted Owls, January 9, 2012). The Protocol includes multiple visits over multiple years, and also defines when a site can be considered occupied in a given year and assigns a category for status of occupancy (for example, reproductive pair, pair, resident single, absent, etc.). NSO surveys from 1990 to the present have been conducted in accordance with the USFWS Protocols with review by Review Team Agencies and the USFWS, and confirmed and maintained by California Department of Fish and Wildlife (CDFW). We believe this data represents the best available yearly measurements of actual occupied ACs over the last 25 years, and should be considered as an important indicator of trends on managed lands, and not discarded because it is not a formal demographic study. As was previously stated, this information likely has a negative bias, which means the numbers are conservative (low).

It is these same survey protocols that also describe the surveying methodologies relied upon by NSO demographic study areas, including the Green Diamond and Hoopa/Willow Creek NSO demographic study areas. Within a demographic study area, spotted owls are surveyed each year, regardless of whether any harvesting will occur, to document site occupancy, locate owls, confirm colored leg bands of previously marked owls, leg band unmarked owls, and determine the number of young produced by territorial pairs. Each year, the status of birds within the study areas is reported to CDFW.

In contrast, NSO management surveys determine if NSO are present within 1.3 miles (or.7 miles for coastal lands) of a proposed harvesting operation. The USFWS 2012 Protocol is designed to provide a high probability of locating resident spotted owl territories and detecting owls that may be affected by timber harvest activity, thus minimizing the potential for unauthorized incidental take. As a result, there are multiple visits to an owl site and each is considered a survey. These management survey results on a visit-by-visit basis are also reported to the CDFW.

Since the CDFW Spotted Owl Database contains both management and demographic study area survey results, we analyzed the data for trends. We first sorted the CDFW database for only NSO data because it contains California Spotted Owl data as well. Then for each master owl ID (essentially an "activity center" (AC)) reported in the database, we followed the protocol rules to determine site occupancy on a year-by-year basis. Multiple positive detections or AC locations can occur in any one year, and these are individual records in the database. Where we had AC determination we used that year's location (latitude/longitude) reported by the surveyor. If there was no AC identified, we averaged the positive detection's latitude/longitude (indicating occupied) to establish a point to allow mapping for that year. To be clear, this methodology can only be used as an index, since different levels of survey in any given year can produce variability in the number of occupied activity centers, and there is no requirement to survey activity centers unless there was some planned activity that might affect that site. Under the assumption that over time harvest levels and activity will be approximately equal, even though each owl activity center is not surveyed or checked each year, this data can serve as an index.

Using this effort we produced a total annual occupied AC chart containing data from both federal and private lands portraying active owl sites from 1990 to 2014, on which we also plotted the reported NSO range-wide decline of -3.8% per annum. (See Total Graph attached). Again, this is an index, which assumed equal harvesting each year across the range, and stable levels of annual survey.

We know that survey levels were not similar on USFS and private ownerships because in 1993, the USFS dropped its timber harvest level in excess of 80%. This drop in timber management planning resulted in limiting the NSO survey efforts except for the demography study areas and proximate to their (many fewer) proposed projects.

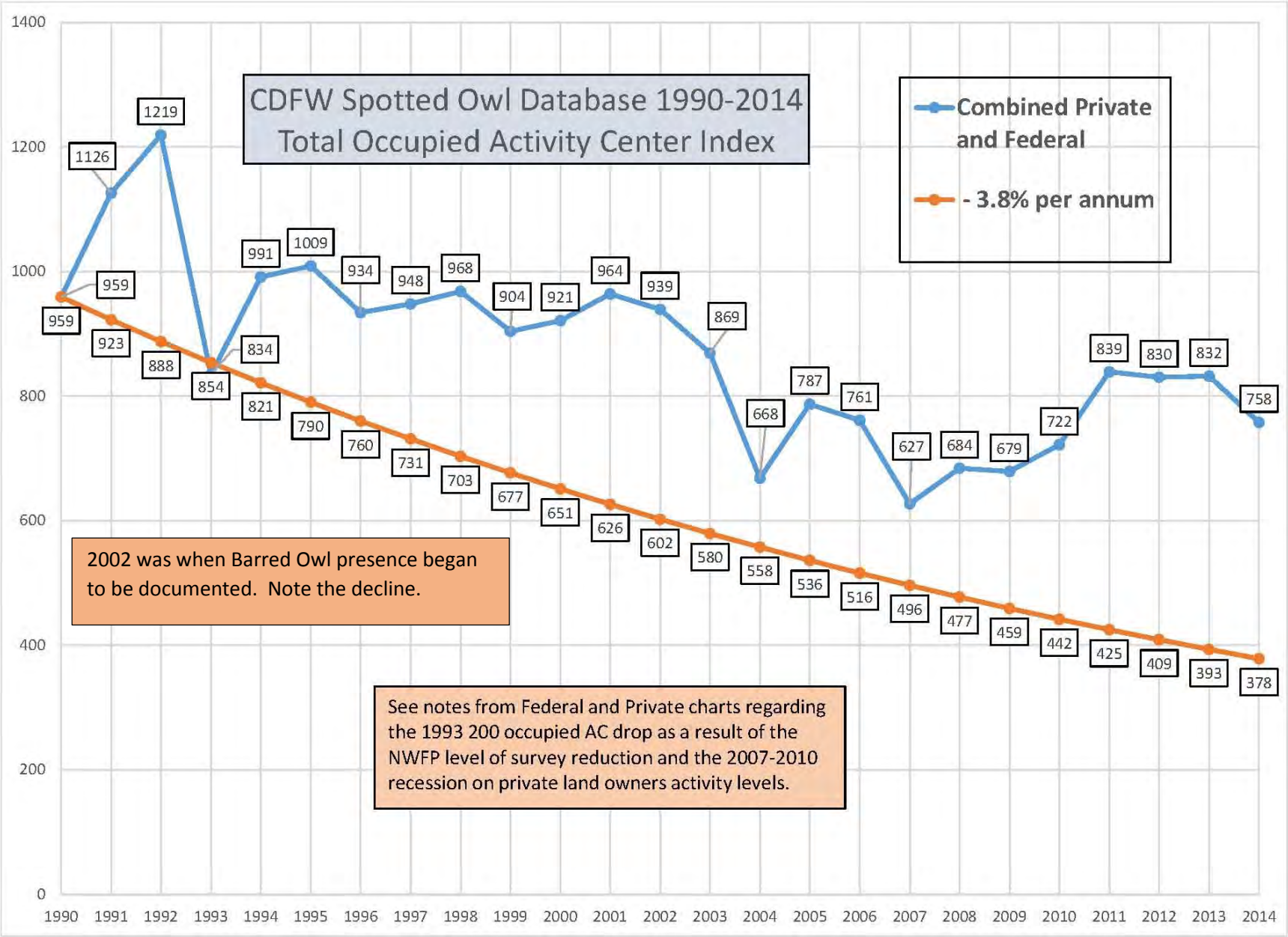
Using coordinates for occupied activity centers, we intersected them with an ownership layer to compare annually federal vs. private landowner positive NSO activity center location (essentially a minimum known occupied activity center value). This effort produced the Private (See Private Graph attached) and Federal (See Federal Graph attached) sites graphs. We then attempted to explain the fluctuations noted in the charts.

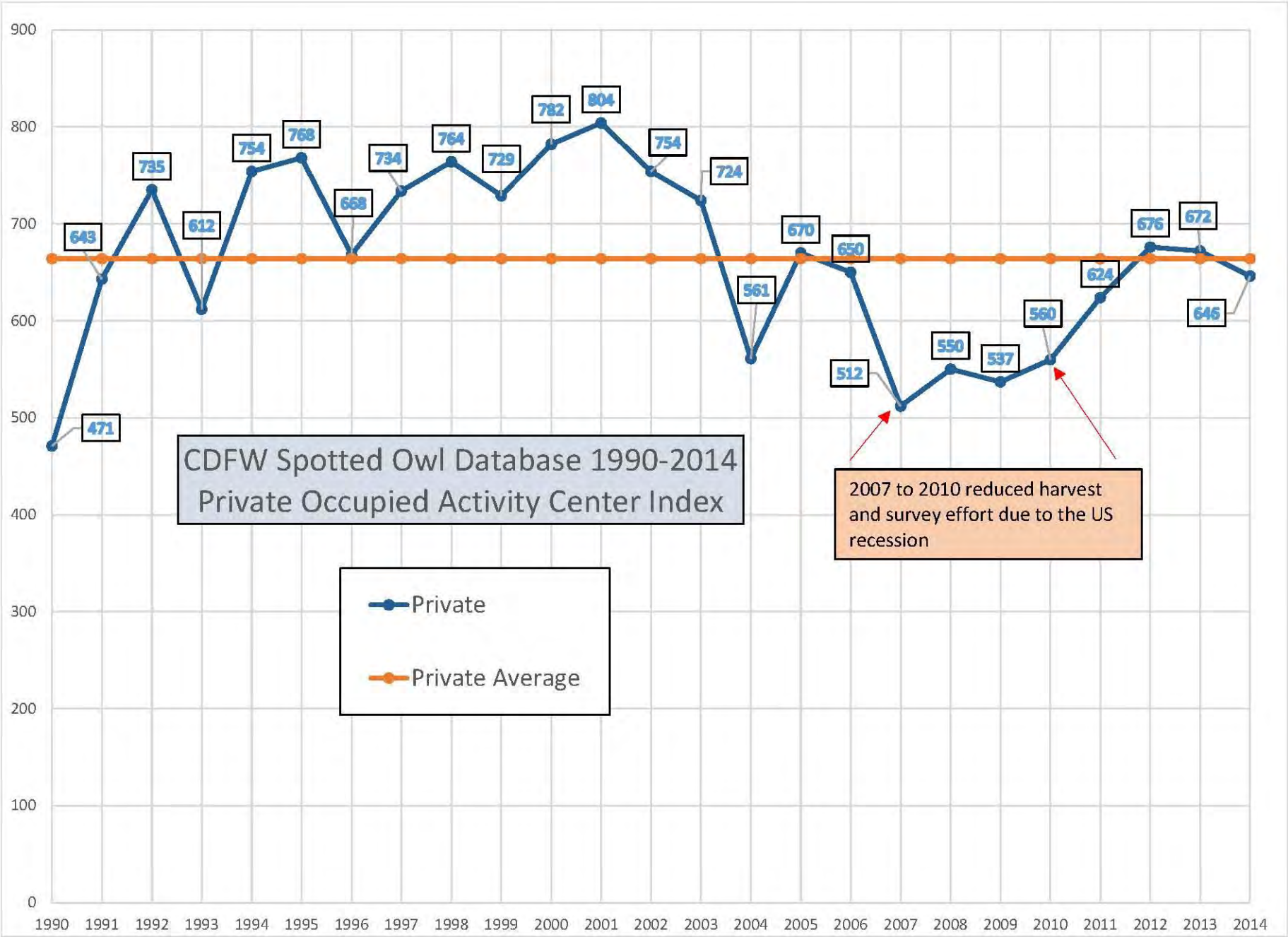
The CDFW database has not been updated for 2015 surveys, but this Private graph also shows that, as many timber company biologists reported, occupied activity centers on private lands were dynamic but stable. Since the protocol requires 3 years to determine occupancy, a particular site may be shown as occupied in one year and not occupied the next year, without an actual decline.

NSOs do not reproduce annually, but approximately once every two or three years. Because NSO are more territorial when they are nesting they also are more responsive to survey calling. The responsiveness during nesting years increases the probability of detecting NSOs in those years, which means that the detection probability of a particular activity center can fluctuate annually due to nesting status. Survey coverage will also cause the number of activity centers reported to vary. The survey coverage necessary to meet the survey protocol also varied due to the locations where THPs were being planned and implemented year to year. Logically, the variability introduced by owl nesting behavior and THP survey coverage would generally cause an annual fluctuation in occupied activity centers year over year. The Private land chart depicts such an annual fluctuation which is consistent with a dynamic yet stable number of occupied NSO activity centers from 1990 through 2014.

On the Federal lands the apparent decline of 262 occupied activity centers in 1992 to 1993 was clearly a result of a dramatic reduction in federal timber harvest and concomitant survey efforts. In fact, the variable number after 1993 reflects the work of adjoining private land owners who still needed surveys to provide required protection to owl activity centers on adjacent federal land and the ongoing surveys in the demographic study areas. The apparent decline in NSO on private land during 2007 through 2010 is reflective of the national economic recession which resulted in a steep reduction in the number of timber harvest projects on private lands that needed surveys during that period.

We conclude this analysis clearly indicates that timber harvest on private lands under the ESA and CFPR regulations is not a significant threat to the NSO. The number of occupied activity centers on private lands indicate a population that is dynamic but stable, and private lands have not experienced a 31 to 55% reduction in NSO as portrayed in the CDFW's NSO evaluation.


CDFW Spotted Owl Database 1990-2014
Total Occupied Activity Center Index
Combined Private and Federal
- 3.8% per annum
1400
1200
1000
800
600
400
200
0
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
959 1126 1219 854 991 1009 934 948 968 904 921 964 939 869 668 787 761 627 684 679 722 839 830 832 758
959 923 888 854 821 790 760 731 703 677 651 626 602 580 558 536 516 496 477 459 442 425 409 393 378
2002 was when Barred Owl presence began to be documented. Note the decline.
See notes from Federal and Private charts regarding the 1993 200 occupied AC drop as a result of the NWFP level of survey reduction and the 2007-2010 recession on private land owners activity levels.


CDFW Spotted Owl Database 1990-2014
Private Occupied Activity Center Index
Private
Private Average
2007 to 2010 reduced harvest and survey effort due to the US recession
471
643
735
612
754
768
668
734
764
729
782
804
754
724
561
670
650
512
550
537
560
624
676
672
646
900
800
700
600
500
400
300
200
100
0
1990
1991
1992
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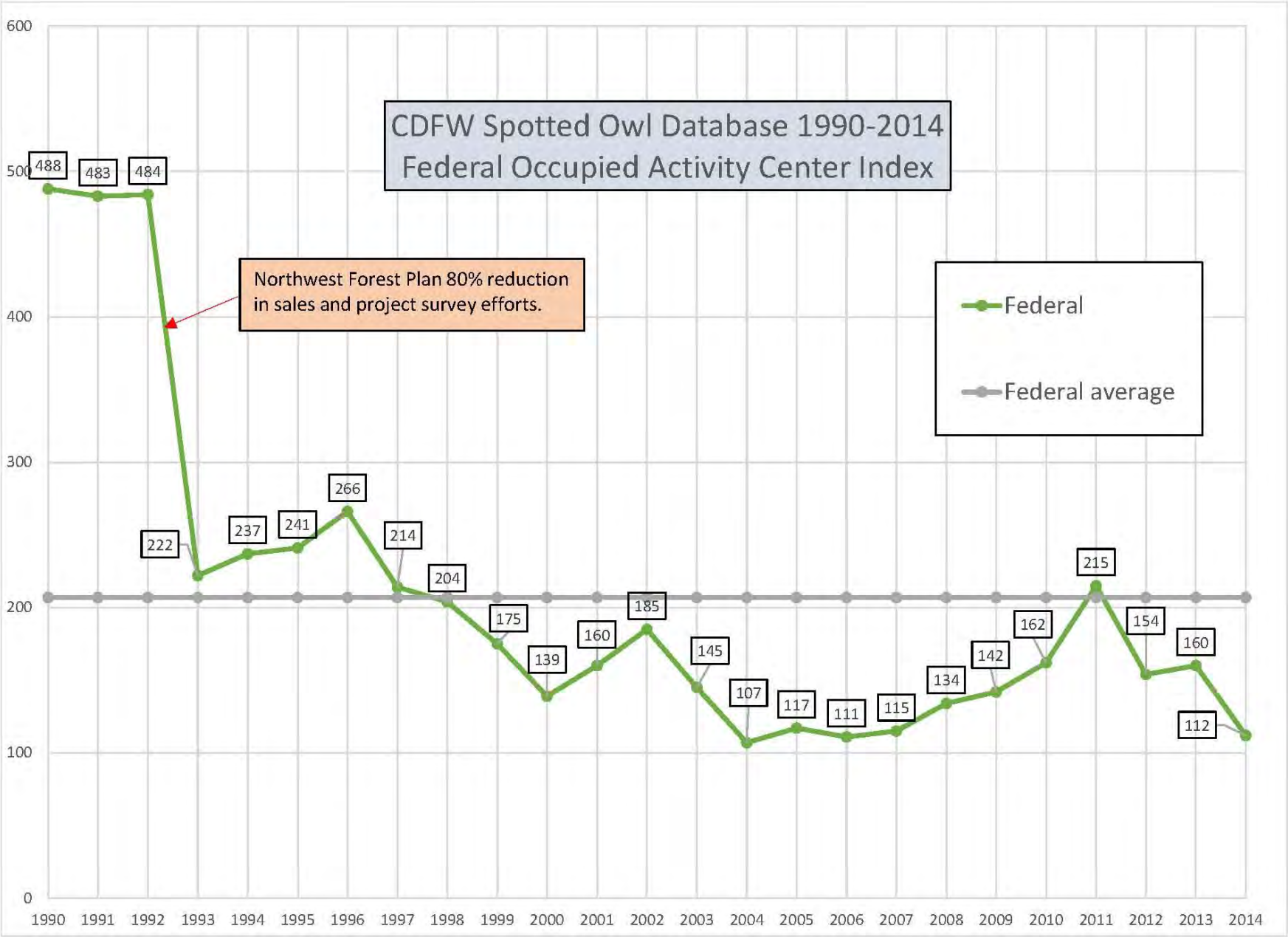
CDFW Spotted Owl Database 1990-2014
Federal Occupied Activity Center Index
Northwest Forest Plan 80% reduction in sales and project survey efforts.
Federal
Federal average
600
500
400
300
200
100
0
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
488
483
484
222
237
241
266
214
204
175
139
160
185
145
107
117
111
115
134
142
162
215
154
160
112

Timber Harvest Threat Analysis

In assessing threat from timber harvest, the Status review relies upon analysis of harvest activities around certain activity centers. The review states:

> *"The activity centers evaluated over time represent a sample that were selected from those that were associated with THPs submitted in 2013 that utilized options (e) or (g). Activity centers were chosen from all counties with THPs submitted in 2013 to provide results across the range.* ***An approximately even number of activity centers were chosen from each county****….."(pg. 90)*

Also from the status review:

> *"…it is apparent that some activity centers have experienced extensive habitat removal or modification over time….. (pg. 92)*

The CDFW Northern Spotted Owl Status Review attempted to assess the cumulative impact of habitat *removal* at individual activity centers (AC) over time by evaluating THPs submitted between 1986 and 2013 to determine the total amount of habitat proposed for harvest around a sample of ACs at various radii typically used for habitat assessment(NSO Status Review p.90). The Status Review goes on to state that *"It is reasonable to assume that high levels of harvest, such as shown for some activity centers in Tables 14 and 15, can negatively impact Northern Spotted Owls."* (NSO Status Review p.92).

However, this analysis can miss important information, because the acreage of habitat proposed for harvest in a THP cannot be assumed to be *"habitat removal or modification"* that negatively impacts the NSO. In addition, the analysis is not evenly distributed across counties as claimed in the review. Nine activity centers in Tehama were chosen versus only three from Shasta and Siskiyou each.

By using simple query methods (phone and e-mail) information regarding these activity centers was readily obtained.

SIS319, 492, 554

These ACs were identified as having had timber operations that may have had impacts to the owl. Again, it is important to analyze the post-harvest habitat. 319 and 492 both exist on National Forest. They have the required 500 acre habitat in the core area, but the National Forest Land around the AC is of poor quality. Neither of these ACs has had a detection since 1993. 554, in contrast, is on private ground, with almost half the core area in higher quality habitat. It has not only had positive detections, it has produced young.

THE0037

As mentioned above, this particular AC is reported to have had 379 acres harvested in the core area (.5 miles and 500 acres) and 2.221 acres harvested between .7 and 1.3 miles (2,900 acres). What isn't

mentioned is that this AC has been in deficit habitat for a number of years prior to these harvests, and is located on poorer Site III which is slow growing. Because of this, the land owner may not reduce habitat within this area, they may only engage in harvest activities that maintain habitat. Habitat has not been reduced in this AC as a result. Owl status for THE0037 is that a nesting pair exists and fledged young in 2015. This refutes a supposition that there has been a negative impact on the owl.

HUM0622 – HRC AC 125 Habitat Review

One of the ACs sampled is HUM0622, or Humboldt Redwood Co. AC # 125. According to the Status Review, Table 15 (p.92), between 1993 and 2013 there has been a total of 798 acres of cumulative harvest within the 0.7 – mile radius of the AC.

HRC owns 363 acres of the 985 acres within the 0.7 – mile radius buffer of HUM0622. Our records of HRC THPs on the ownership from 1995 – 2013 indicate that there has been a total cumulative harvest of 465 acres. This means that there has been an overlap in THPs during that time period of 102 acres.

Prior to implementation of the HRC Habitat Conservation Plan (HCP) in 1999 all THPs were submitted with northern spotted owl 'take' avoidance measures pursuant to site-specific consultation with CDFW and/or USFWS through individual THP consultation, a Spotted Owl Management Plan, or a Spotted Owl Resource Plan. Beginning in 1999, HRC THPs implemented northern spotted owl conservation measures contained in the HRC HCP.

Regardless of the specific THP process used, AC HUM0622 was afforded a no harvest core of at least 18 acres, an additional 54 acres of roosting habitat or better surrounding the no harvest core, and retention of greater than 1,336 acres of NRF habitat within a 1.3 – mile radius of the AC. Because the balance of 622 acres of the 0.7 – mile radius buffer of HUM0622 is under other ownership, it is highly likely that the THPs or NTMPs of adjacent landowners were required to follow CDFW and/or USFWS 'take' avoidance guidelines for northern spotted owl ACs occurring within 1.3 miles of their THP or NTMP.

Table 1 illustrates the silvicultural prescriptions applied to the THPs on HRC lands in the 0.7 – mile radius buffer of HUM0622. "No harvest" comprised 100 acres or 21.5% of the area, partial harvest was 262 acres or 56.5%, and the clear cut prescription was applied to 103 acres, or 22% of the total. Thus, while the clear cut acres could be considered habitat *removal* (although the area will grow back and return to suitable habitat in ~ 30-40 years), and more than half of the acres were *modified* (although retaining roosting and foraging habitat), more than 20% of the acreage was in *no harvest buffers* in order to retain nesting/roosting habitat, and in riparian buffers.

For the entire 0.7 – mile radius buffer of HUM0622 our 2015 habitat assessment indicates that there were 96 acres of nesting, 360 acres of roosting, and 183 acres of foraging habitat, totaling 639 acres of habitat of the 985 total (Table 2).

Table 1. Harvest type by area for THPs on HRC property, 1995-2013.

Silviculture	Acres	Percent of Total
Clear Cut	103	22
Group Selection	7	1.5
No Harvest	100	21.5
Selection	53	11
Commercial Thin	199	43
WLPZ	3	1
Total	465	100

Table 2. Northern spotted owl habitat by area within the 0.7 – mile radius buffer of HUM0622 (HRC 125).

Habitat Type	Acres
Nesting	96
Roosting	360
Foraging	183
Non-habitat	346
Total	985

The HUM0622 is one example of the ACs sampled by CDFW, but it is not a good example of negative impacts. Over the 21 year period from 1996 – 2016 our monitoring efforts at this AC resulted in 100% pair occupancy: a pair of northern spotted owls occupied the site every year. There were 9 successful nesting attempts during that period, which fledged 16 juvenile northern spotted owls. The HUM0622 (HRC 125) northern spotted owl AC has been consistently occupied and reproductively successful over time.

TRI0316

Between 1997 and 2013 five THPs had operations within the home range of TRI0316. All five THPs (Granite, Stone Mule, Kay-5, Dyno and Kay-13) were conducted under a Spotted Owl Management Plan approved by the U.S. Fish and Wildlife Service (USFWS), under Technical Assistance provided by the USFWS, or under Technical Assistance from Cal Fire granted to the agency by the USFWS. The current status analysis completed by the DFW in its Status Review (Tables 13 and 14) for the operations conducted under these plans between 1997 and 2013 does not describe habitat conditions on the ground. It is important to note that an extensive analysis takes place to avoid take before operations commence.

The most recent habitat analysis for TRI0316 shows there are 2,653 acres of habitat within the 1.3-mile home range (Table 1) and 347 acres of habitat with 0.5-mile core area (Table 2). DFW states there have been 251 acres harvested within the 0.5-mile core area and 495 acres harvested within the 0.5-1.3-mile range. Further analysis of the acres harvested within these two areas showed there have actually only

been 196 acres of harvest within 0.5 miles and 555 acres harvested between 0.5 and 1.3 miles of the Activity Center (Table 3). Each THP was approved and found to avoid take prior to operations. Most importantly, the take avoidance measures outlined in the plans were successful as the TRI0316 owl site has been occupied consistently between 2004 and 2015 with a pair occupying the site in 2015.

Table 1 Pre- and Post-Harvest Habitat condition within 1.3-mile radius of TRI0316 excerpted from Kay-13 THP approved in 2013.

Habitat within 1.3 mile radius	Pre-harvest acres	Post-Harvest Acres	Net change	Compliance Requirement 1336 acres
Total Owl Habitat	2688	2653		2653
High Quality Nesting habitat[1]	0	0	0	
Nesting-roosting habitat	1098	1098	0	
Foraging habitat	352	352	0	
Low quality foraging habitat	1238	1203	-35	
Unsuitable	707	742	35	

[1] The absence of high quality nesting Roosting habitat is largely a result of the USFWS's robust definition of this habitat type that exceeds the habitat conditions of most stands, except those that would traditionally be called "old growth" or primary older forest where no management footprint exists. These stands are not common in areas where historic or past management has been engaged by either Government or private land managers.

Note: There was no harvest proposed inside the 0.5 mile radius in the Kay-13 THP, so Table 2 below is included to show the most recent typed habitat amounts as determined in this THP.

Table 2 Pre- and Post-Harvest Habitat condition within a 0.5-mile radius of TRI0316 excerpted from Kay-13 THP approved in 2013.

Are timber operation proposed in NSO habitat that meets the USFWS definition of habitat within 0.5 miles of the activity center?			If yes, provide the pre- and post-harvest habitat quantities and the net changes in habitat (acres)		
	NO	YES	Pre-harvest	Post-Harvest	Net change
High Quality Nesting habitat[1]	x		0	0	0
Nesting-roosting habitat	x		68	68	0
Foraging habitat	x		1	1	0
Low quality foraging habitat	x		278	278	0
Unsuitable	x		155	155	0
Total Owl habitat			347	347	

[1] The absence of high quality nesting Roosting habitat is largely a result of the USFWS's robust definition of this habitat type that exceeds the habitat conditions of most stands, except those that would traditionally be called "old growth" or primary older forest where no management footprint exists. These stands are not common in areas where historic or past management has been engaged by either Government or private land managers.

Table 3. Acres Harvested

Acres Harvested in TRI0316 1997-2013	
Total Acres Operated w/in 0.5 mile	Total Acres Operated between 0.5-1.3 miles
196	**555**
Acres Reported in Status Review	Acres Reported in Status Review
251	**495**

DFW's analysis does not reflect the on-the-ground conditions and only counts the proposed acres associated with the project footprint. These numbers do not take into account operating unsuitable habitat (habitat not considered to be utilized by NSO), having post operation conditions left as habitat (WLPZs), and double counting acres harvested in multiple entries.

In a hypothetical situation, say a private landowner owned 100% of the land associated with an NSO AC (3395 acres). If that land owner conducted three commercial thins on the entire home range between 1997 and 2013, essentially improving the habitat and driving the QMD towards a better nesting condition, the Department's analysis would have reported this hypothetical AC had experienced 10,185 acres of harvest within the home range, however no habitat was lost but rather improved. Simply adding total acres harvested for a given time period does not provide the basis that timber harvest is a potential threat to the species.

Unregulated Threats to NSO Populations in California

Three potential threats to NSO populations have been identified in California: Barred Owl encroachment, loss of habitat due to catastrophic wildfire, and pesticides associated with illegal marijuana plantations.

Barred Owls

In the most recent review of the condition of NSOs, the Revised Recovery Plan for the Northern Spotted Owl (Revised Recovery Plan, 2011) identified habitat loss and competition from the recently arrived barred owls as the most pressing threats to the NSO. The Recovery Plan states: "Based on the best available scientific information, competition from the barred owl (S. varia) poses a significant and complex threat to the spotted owl".

The Revised Recovery Plan continues: "Barred owls reportedly have reduced spotted owl site occupancy, reproduction, and survival. Limited experimental evidence, correlational studies, and copious anecdotal information all strongly suggest barred owls compete with spotted owls for nesting sites, roosting sites, and food, and possibly predate spotted owls. Because the abundance of barred owls continues to increase, the effectiveness in addressing this threat depends on action as soon as possible."

Barred owls are native to eastern North America, but only recently arrived in the West. They were first documented in the range of the NSO in Canada in 1959 and in western Washington in 1973. The range of the barred owl in the western United States now completely overlaps with the range of the NSO. Observations suggest that as the number of barred owls detected in historical spotted owl territories increase, the number of spotted owl responses have decreased. In the Pacific Northwest, barred owl populations developed first in Washington and spotted owl populations have declined at the greatest rate in these areas. Barred owl detections in the coastal NSO habitat of California are increasing.

Given the continuing range expansion and population growth of barred owl populations in the western United States and concurrent decline in NSO populations, the USFWS has proposed Recovery Action 29 in the Revised Recovery Plan, which involves experimental control of up to 3,600 barred owls in 11 study areas to determine if these efforts would increase spotted owl site occupancy and improve population trends. Some coastal forest owners have also initiated/proposed barred owl control research projects.

Demographic Response of Northern Spotted Owls to Barred Owl Control

Dugger, et al, 2016 states:

> *"Based on our study, the removal of Barred Owls from the Green Diamond Resources (GDR) study area had rapid, positive effects on Northern Spotted Owl survival and the rate of population change, supporting the hypothesis that, along with habitat conservation and management, Barred Owl removal may be able to slow or reverse Northern Spotted Owl population declines on at least a localized scale."*

Diller, et al, 2016 also says:

> *"Barred owl control decreased spotted owl territory extinction rates but did not affect territory colonization rates. As a result, spotted owl occupancy increased in the treated area and continued to decline in the untreated areas. Prior to and after barred owl*

control, there was no evidence that average fecundity differed on the 2 study areas. However, the greater number of occupied spotted owl sites on the treated areas resulted in greater productivity in the treated areas based on empirical counts of fledged young."

From Kroll, et al, 2016:

"Collectively, we conclude spotted owl pair populations on this landscape managed for commercial timber production appear to be more stable and do not show sharp year-over-year declines seen in both managed and unmanaged landscapes with substantial barred owl colonization and persistence."

It is abundantly clear from this recent research that habitat in coastal California is not the limiting factor. Barred owl colonization, on the other hand, is having a profound effect. Unless this issue is prioritized, habitat recruitment and maintenance will be pointless.

Loss of Habitat from Wildfire

California's forests are largely ecosystems that have adapted over time from natural fire regimes. Fire exclusion and management (or non-management) practices have resulted in significant overly-dense forest conditions ripe for unnaturally large fire events. The potential values at risk to catastrophic wildfire include the stability and viability of spotted owl habitat.

For the Northern Spotted Owl Recovery Plan, a team of experts was convened the most current threats facing the species. The range of threat scores made by the individual experts was narrowest for barred owl competition and slightly greater for habitat threats, indicating that there was more agreement about the threat from barred owls.

The experts also ranked the threats by importance in each province. Among the 12 physiographic provinces, the more fire-prone provinces (Eastern Washington Cascades and Eastern Oregon Cascades, California Cascades, Oregon and California Klamath) scored high on threats from ongoing habitat loss as a result of wildfire and the effects of fire exclusion on vegetation change. The Recovery Plan notes:

"while spotted owls can make use of some post-fire landscapes, fire also reduces the function of some habitat and likely removes some from immediate usability, particularly in areas of high-severity fire"

This is particularly important, given that fire severity and size have dramatically increased over the last decade, owing to drought, increased fuel load, and climate change. CARB projects an increase of up to 55% in wildfire acres by the end of this century due to Climate Change induced temperature and drought increases.

The Westside Fire Recovery Project, which consisted of the Happy Camp Complex, Beaver, and Whites fires destroyed or damaged large amounts of habitat. 183,000 acres burned, and of these, 81,000 acres were classified as late successional reserve, presumably all high quality NSO habitat. It is estimated that 85 ACs were involved in this incident (source: U.S. Fish and Wildlife Service (FWS) Biological Opinion (BO) Westside Fire Recovery Project).

Pesticide from illegal land-uses

There is growing recognition of the potential for a new threat resulting from possible exposure to anti-coagulant rodenticide poisoning. Both legal and illegal marijuana grows on public and private lands have been found to use often use copious amounts of rodenticide in an attempt to prevent crop damage. In turn, the rodenticides can have both primary and secondary impacts on predators such as spotted owls (Thompson, et al 2013, Douglas 2013). In the redwood region, primary prey species of NSO include the dusky-footed woodrat (*Neotoma fuscipes*) and deer mice (*Peromyscus* spp.), which are also prey species of Pacific fisher and may be responsible for exposure of fishers to rodenticides used at grow sites. Further research on this issue using the carcasses of barred owls should shed light on this potential threat in the near term.

For all three of these threats, adapting and enhancing pro-active forest management practices to address these risks is critical to stability and viability of many wildlife species.

From: [redacted]
To: FGC
Subject: Comment Letter for FGC June 23, 2016 Meeting, Item #27
Date: Thursday, June 16, 2016 7:55:25 PM
Attachments: FLC&BuckeyeJtNSOLtrIMG_20160616_0001_NEW.pdf

Please see attachment for comments letter from Forest Landowners of California and The Buckeye Conservancy, regarding state listing of Northern Spotted Owl.

Thanks for your help in preparing for the meeting.
Sincerely,

Claire McAdams

Claire McAdams [redacted]

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Mr. Eric Sklar, President,
California Fish and Game Commission
1416 9th Street, Room 1320
Sacramento, CA 95814

Dear President Sklar and Members of the Commission:

RE: California NSO Listing

We are writing on behalf of Forest Landowners of California, representing several hundred small non-industrial forest landowners throughout California, and on behalf of The Buckeye Conservancy, representing roughly 200 Humboldt County working landscape owners of Northern Spotted Owl ("NSO") habitat. Our groups count as members many of the private forest landowners whose lands are home to Northern Spotted Owls. Non-industrial private forestland owners own over half of all NSO habitat in California.

So we ask that, if you approve state-level listing of the Northern Spotted Owl, please ensure that small non- industrial private forest landowners ("NIPFs") be included in the decision-making for the rules which will implement the listing. Individually these landowners are small, but small landowners are a very large portion of the NSO species range. The public and even some elected officials do not understand that family owned/NIPFs cannot afford NSO regulations designed for industrial timber companies, which can afford Habitat Conservation Plans ("HCP"s) that let them mitigate 'take' of NSOs. NIPFs are disproportionately impacted by NSO listing-related regulations - in cost, and in timbered acreage placed off limits to timber harvest by the NSO rules. The smaller the acreage owned, the more onerous and more economically impacting such listings seem to be. Many NIPFs have had all their merchantable timber 'frozen' in NSO activity centers, while others have lost the ability to harvest a large fraction of their timber. NIPFs adjacent to large industrial timber firms suffer when the industrial firms' clearcuts cause NSO "migration" onto neighboring properties. Neighboring NIPFs then lose more merchantable timber acres, as their NSO population swells with owls formerly belonging to their industrial neighbors.

Unless the State can afford to own all property with NSO activity centers, it needs to help protect and reward, not financially punish, private landowners whose lands contain NSO habitat. NIPFs' ability to harvest their trees and stay at least slightly profitable is key to NSO recovery. NSO regulation as it

occurs today works against NIPFs' ability to afford active management for fire protection and forest health. Already, some NIPFs with NSOs have given up and sold their forestlands- most often to marijuana growers, whose stewardship is notoriously poor, and whose presence has caused spikes in prices of forestland property that incentivize selling, threatening the future continuity and health of forests as a whole.

So we urge you, if you do list the NSO, to actively include NIPFs in the ongoing CDFW "Working Group", which currently consists only of agency staff. That working group was formed in response to The Buckeye's 2015 meetings with State and Federal agencies, and we ask that you read the attached suggestions (The Buckeye's Suggestions for NSO Habitat Management", 10/12/2015) which came out of those meetings as a brief overview of the issues. The working group will be attempting to improve the NSO database accuracy and management, and trying to coordinate with USFWS concerning who has authority to add and remove NSO centers from the database. It is our understanding that the CDFW working group is also looking into possible state support of the USFWS to enable it to perform a key function of providing NSO technical assistance to those with THP and NTMP forest management plans. USFWS has for several years stopped providing NSO technical assistance on new projects, causing hardship and limiting the opportunities of timberland owners in the management of their lands. The State is seeking ways to help, but the CDFW Working Group appears to consist now of agencies' staff exclusively.

We are asking you to please include stakeholders, especially Forest Landowners of California and The Buckeye Conservancy, which represent NIPFs, in the CDFW NSO Working Group. While NIPFs are small, they make up a huge proportion of those directly impacted by the state NSO listing. Large industrial firms do not speak for or share the needs of NIPFs. NSO regulation designed for large firms' budgets is punishing small non-industrial forest landowners and driving them to sell their land, weakening forest stewardship and NSO protection. So we again ask for a NIPF presence in any working groups and other regulatory processes that are to come after the listing.

Thank you for your focus and time, and we welcome your questions.

Respectfully,

Charll K. Stoneman

Charll Stoneman, President, Forest Landowners of California

Jim Able

Jim Able, President, The Buckeye Conservancy

ATTACHMENT: The Buckeye's Suggestions for NSO Habitat Management, October, 2015, Eureka.

The Buckeye's Suggestions for NSO Habitat Management 10/12/2015

Members of the Buckeye Forest Project have now had several meetings throughout 2015 with members of the following regulatory agencies regarding Northern spotted owl ('NSO') management: US Fish and Wildlife Service ('USFWS'), California Department of Fish and Wildlife ('CDFW'), and California Department of Forestry and Fire Protection ('Calfire'). We offer the following suggestions, requested by CDFW following the August 20, 2015 meeting, as a starting point for discussions around improving NSO regulatory processes, which would ideally include USFWS, CDFW, Calfire, and the small non-industrial forest landowners ('NIPFs') whose lands lie within the range of the NSO.

#1: **Create a technical assistance ('TA') program** under the wing of one agency, so TA is available to all landowners, regardless of type or age of harvest plan or prior TA existence.

Recent meetings with regulatory agencies have clarified that TA programs have been de-funded. However, the Buckeye strongly encourages regulatory agencies to maintain or re-establish TA programs for landowners. This is a high priority both for the landowners and for the NSO. Landowners who do not have Habitat Conservation Plans ('HCP's), which are not affordable for non-industrial landowners, are having difficulties receiving agency guidance regarding the current NSO regulations.

Because HCPs are unaffordable for non-industrial landowners, TAs should be provided to all landowners who need them, via permanent funding and staffing of an NSO-related program within one agency. This is the simpler and lesser cost solution to the TA dearth, from the Buckeye's perspective, and thus the most preferable for NIPFs. Additionally, agencies could pursue some version of statewide, government-provided non-industrial timber management plan Safe Harbor Agreements ('SHA's) (but with a 40-year term) similar to formerly-used Habitat Retention Agreements of the USFWS. We would also encourage the National Oceanic and Atmospheric Administration to develop internal mechanisms for SHAs in concert with USFWS, and perhaps to share implementation with, or delegate implementation to, CDFW.

#2. **Situate control of the NSO regulation process in one agency such as CDFW,** as current interagency sharing of database management and decision-making authority leaves landowners unable to obtain guidance and database corrections. Permanent funding and adequate staffing for this agency will be needed to achieve accurate database management and consistent decision-making authority.

#3. **Standardize interpretation of NSO regulations,** in particular recent confusion over landowner responsibilities in meeting "recovery standard' versus "no take" standard. Recent meetings have clarified that regulatory agencies are following Endangered Species Act requirements of "no take" standard (not recovery standard) for NSOs on private lands. This means that private landowners need to protect actual NSO utilized habitat (as defined by the ESA), not potential habitat. This is a relief to the members of The Buckeye but we are still concerned about potential inconsistencies in interpretation of standards, as reported by member RPFs and landowners.

#4. **Create a clear and written standard for NSO activity center abandonment with a basis in the Endangered Species Act**. The original NSO protocol identified when an activity center could be considered abandoned, but the current protocol gives substantial latitude by reviewing USFWS staff, and does not clarify what standards are being used.

#5. **Establish a process to clean up the NSO database, and to create periodic accuracy examinations and correction processes for the database.** This effort would be preceded by a written standard that defines abandonment, retention, abolishment and invalidation of NSO sites.

#6.**Establish a cap or maximum number of surveys needed to prove abandonment and/or invalidation or abolishment of a records NSO activity center.** NSO surveys are expensive, and jeopardize landowners' ability to continue to manage forest lands. We encourage **a maximum limit on the number of continued surveys required to prove the absence of NSOs.**

#7. **Revisit the protocol regarding the need to survey for two years (versus one).** We would like a return to the original NSO protocol or a 1 year protocol that incorporates recent survey history and site visits for all NSO sites. This would particularly enable forest landowners with Non-Industrial Timber Management Plans ('NTMP's) to respond to market conditions. While barred owl incursion has made NSOs less likely to respond to survey calling, this NSO reticence, once established, is likely to be repeated in the second of two survey years. NSO silence upon being called is ambiguous in meaning, and surveying during a second year does not add explanatory power.

#8. **Relieve some landowners' limitations regarding management within NSO sites, by allowing limited management activities within the 100-Acre Core**. The current 100 –acre core for NSO Activity Centers makes active timber management very difficult and in some instances impossible, particularly for landowners with small acreage. We would like to see consideration of policies that allow for some management activities during the non-breeding season, within that core.

#9.**Consider the value of temporally limited activities on sites where banded birds 'migrate' from adjacent HCP clearcuts** to prevent NIPFs from being penalized by the presence of banded NSOs escaping adjacent clearcut areas even if Safe Harbor Agreements are not established prior to migration. Many of these NSOs are banded, making identification of 'inherited' or migrated birds feasible, since banding occurs as part of HCP-related analyses and is beyond the financial scope of non-industrial forest landowners' management activities. Non-industrial forest landowners should not be penalized for maintaining desirable NSO habitat which becomes a 'draw' for displaced NSOs from adjacent lands.

#10**. Mitigate costs of LIDAR data for NIPFs**. As the agencies move toward LIDAR as a means to analyze NSO sites, third-party LIDAR primary data collection and analysis will further reduce the ability of many NIPFs to afford active management of their lands. The Buckeye invites the agencies to enter into discussions regarding ways in which LIDAR technology can be used for NSO issues without penalizing NIPFs financially. While this issue was not discussed at the August 20, 2015 meeting, it is relevant to NSO issues, and is included as a way to open discussion.

Parity of data collection and analysis, between the agencies' and NIPFs/consulting RPFs, will be necessary if NIPFs and their RPFs are to be able to have a 'level playing field' on which to discuss NSO sites in future. We would like to work with the State to help level the playing field of data collection and data availability.

Conclusions

The Buckeye offers these suggestions, in order to continue discussion regarding NSOs' impact on non-industrial forest landowners . NSO conservation is important for NIPFs, however, it has been and continues to be a hugely expensive undertaking for NIPFs. The case studies presented at the August 20, 2015 meeting showed significant proportions (37% to almost 100%) of NIPFs' total acreage are locked

up in NSO activity center set-asides. This threatens NIPFs' ability to survive economically, and has led some to sell their properties, resulting in land use conversions out of forest, often into marijuana production. There are also large disparities in NSO conservation standards being applied, depending on the vintage of one's forest management plan. Overall, NIPFs strongly prefer least-cost, simplest to implement alternatives, as those are the most likely to make their forest stewardship economically viable. Since over a quarter of the total forestland in California is owned by NIPFs, their economic survival is necessary to protect a significant portion of California's public trust resources. It is with this in mind that we offer our suggestions, along with our hope for fruitful continued discussion with the agencies. We thank you for allowing us to engage in this effort with you.

Respectfully,

The Buckeye Forest Project

The Northern Spotted Owl in California: Current Status and Threats

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May 7, 2015

Photograph courtesy of Peter Carlson.

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The Northern Spotted Owl in California: Current Status and Threats

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Introduction

This Independent Status Report was prepared pursuant to the California Endangered Species Act's (CESA) implementing regulations, specifically Cal. Code Regs., tit. 14, § 670.1 (h), which allows "interested parties . . . to submit a detailed written scientific report to the commission on the petitioned action." This same regulation explains that parties "may seek independent and competent peer review of this report prior to submission", and the author did so (see acknowledgements section at end of each chapter). Furthermore, to comply with the Fish and Game Code, section 2074.6, this report must be "based upon the best scientific information available."

This report was prepared by Wildlife Ecologist, Dan L. Hansen. His CV is attached, and a brief description of his qualifications is included herein (see *Project Author and Funding*).

This Independent Status Report was commissioned by the Environmental Protection Information Center (EPIC). However, its contents, conclusions, and management recommendations were exclusively developed by the author.

Executive Summary

This synthesis is organized into two parts. Part I consists of a single chapter: Status and Trends in California (Ch. 1). Part II covers four primary potential threats to northern spotted owls (*Strix occidentalis caurina*; NSOs) in California: Timber Harvesting (Ch. 2), Wildfires (Ch. 3), Barred Owls (Ch. 4), and Outdoor Marijuana Cultivation (Ch. 5). Following these chapters, a brief list of management recommendations is provided based on the information reviewed herein.

Chapter 1 is a review of the current status and trends of NSOs in California. Multiple types of information are available for evaluating the subspecies' status and trends in the state, including potential changes in its range, distribution, population densities, occupancy rates, demographic rates, metapopulation dynamics, and genetics. However, the most compelling information comes from long-term demographic studies in northwestern California (Forsman et al. 2011, Higley and Mendia 2013, Franklin et al. 2014, Green Diamond Resource Company 2014). These studies indicate that NSOs are declining in that portion of the state and that the rate of decline is accelerating. Competitive pressure from the congeneric barred owl (*S. varia*) appears to be the primary cause of increasing rates of population decline in the three demographic study areas. Occupancy data further support conclusions that NSOs in California's three demographic study areas are declining at an increasing rate and that the decline is largely driven by negative effects of barred owls (Franklin et al. 2014, Green Diamond Resource Company 2014). Less rigorous information is available for describing the NSO's current status and trends in California outside the state's demographic study areas. Only one published paper described occupancy in the eastern portion of the NSO's range in California (eastern Klamath and southern Cascades) (Farber and Kroll 2012). That paper described a substantial decline in occupancy by NSOs, which was likely associated with intensive timber harvesting and possibly, wildfires. Recent reports from demographic studies in southern Oregon further suggest that NSOs may be declining in relatively nearby and ecologically similar areas in California (eastern Klamath and southern Cascades) (Davis et al. 2013b, Dugger et al. 2014). Most of the other information for describing the subspecies' status and trends in California comes from monitoring reports by National Parks and industrial timber companies. NSOs appear to have been mostly displaced by barred owls in the Redwood National and State Parks (Schmidt 2013). In contrast, few barred owls have invaded National Park land in Marin County and occupancy by NSOs appears to be relatively stable in the area (Ellis et al. 2013). Industrial timber companies in California have uniformly concluded that NSO populations are stable on their lands (Calforests 2014). However, the available information for those ownerships does not support strong conclusions about the NSO's status or trends and some of the information actually appears to indicate at least gradual declines in occupancy.

Chapter 2 is a review of timber harvesting as a potential threat to NSOs in California. Habitat loss to timber harvesting was a primary impetus for listing the NSO under the federal Endangered Species Act (USFWS 1990). An estimated 60-88% of old forest was harvested within the NSO's range during the 19th and 20th centuries (USFWS 1990, Strittholt et al. 2006). Following federal listing of the NSO and adoption of the Northwest Forest Plan in the early 1990s, timber harvesting was dramatically curtailed on federal lands (Healey et al. 2008, Davis and Dugger 2011, Moeur et al. 2011, Kennedy et al. 2012). However, there is currently considerable interest among some ecologists, land managers, and agencies in use of widespread

forest thinning to reduce the risk of large severe wildfires on public lands (USFS and BLM 1994, USFWS 2008, 2011, 2012a, Franklin and Johnson 2012). The term thinning can encompass a wide array of silvicultural practices and prescriptions but the limited available evidence suggests that NSOs and their primary prey in California generally respond negatively to thinning and partial harvesting (see Ch. 2). Timber harvesting is still responsible for most habitat loss and degradation for NSOs on private lands (Davis and Dugger 2011). Habitat loss and degradation on private lands does not appear to be offset by habitat recruitment; even in California, which has more stringent habitat protection measures on private lands than do Oregon and Washington (Davis and Dugger 2011, Moeur et al. 2011). Although timber harvesting is generally accepted to have been the primary cause of the NSO's initial decline and federal listing, its effects on the subspecies are poorly known. Several rigorous studies in the southern part of the NSO's range, including in northwestern California, have found that the NSO's fitness (a function of survival and reproduction) is typically highest in landscapes with both a core concentration of mature and old forest and some degree of habitat heterogeneity (e.g., a moderate amount of habitat edge due to convoluted shapes of older forest patches) (Franklin et al. 2000, Olson et al. 2004, Dugger et al. 2005, Schilling et al. 2013). Timber harvesting that substantially reduces either of these habitat attributes could negatively affect NSOs (USFWS 2009). The U.S. Fish and Wildlife Service (2009) concluded that current habitat retention guidelines for NSOs on industrial timberlands in interior California (CAL FIRE 2014) are inadequate and are not based on a current understanding of the subspecies' ecology.

Chapter 3 is a review of wildfire as a potential threat to NSOs in California. Several studies have investigated responses of NSOs to wildfires but their inferences are limited due to small sample sizes, short time frames, confounding effects of post-fire salvage logging, or pooling of data from all three subspecies. This information is supplemented in Chapter 3 with reviews of studies of effects of fire on California spotted owls (*S. o. occidentalis*) and Mexican spotted owls (*S. o. lucida*). Inferences from those studies are similarly limited by small sample sizes, short time frames, confounding effects of post-fire salvage logging, or pooling of different kinds of fire (prescribed fires, wildfires, and wildfires allowed to burn under specified conditions). Currently available information indicates that spotted owls respond in variable and complex ways to fire. The species appears to be generally resilient to low-, moderate-, and mixed-severity or patchy fires (Ch. 3: Table 3.1). It is possible that fires such as these sometimes benefit spotted owls by temporarily increasing access to prey that respond positively to fire (Ream 1981, Zwolak and Foresman 2007, Zwolak 2009, Bond et al. 2013). In contrast, spotted owls appear to generally respond negatively to extensive severe wildfires (Ch. 3: Table 3.1). While some spotted owls may preferentially forage in or near severely burned areas, they rarely nest and roost in such areas and may generally avoid foraging deep within them (Ch. 3: Table 3.1). The limited available information suggests that post-fire salvage logging negatively affects spotted owls (Clark 2007 and Clark et al. 2013, Lee et al. 2012, 2013). Salvage logging could reduce prey availability after fires by removing important structures, such as snags, logs, and shrubs. Habitat suitability modeling projected that wildfires caused substantial loss, degradation, and fragmentation of nesting and roosting habitat for NSOs on federal lands during the first 15 years of the Northwest Forest Plan (Davis and Dugger 2011). Most of these habitat changes were caused by a small number of extensive severe fires in southern Oregon and northern California. There is scientific debate regarding recent versus historical frequencies of high severity fire in southern Oregon and northern California (e.g., Hanson et al. 2009, 2010 vs. Spies et al. 2010).

Nonetheless, it is clear that large wildfires are now relatively common within the NSO's range in California (CAL FIRE 2008, Davis et al. 2011), and that some recent wildfires have severely burned very large areas (e.g., 2002 Biscuit Fire). Climate change research generally projects that large wildfires will become more common in California (Westerling et al. 2006, Lenihan et al. 2008, Westerling and Bryant 2008, Littell et al. 2009, Moritz et al. 2012, Stavros et al. 2014). It is reasonable to assume that some of these large wildfires will include extensive areas of high-severity fire and will therefore continue to be a source of habitat loss for NSOs.

Chapter 4 contains an evaluation of the barred owl as a potential threat to NSOs in California. The available information suggests that barred owls are currently the primary threat to NSOs throughout their range, including in California. Information from long-term demographic studies indicates that barred owls have contributed to the NSO's population declines in multiple study areas (Forsman et al. 2011) and that the barred owl's presence and negative impacts on NSOs are continuing to increase (Davis et al. 2013b, Higley and Mendia 2013, Franklin et al. 2014, Dugger et al. 2014). A large body of research conducted across much of the NSO's range has also shown that barred owls are associated with declines in occupancy rates by NSOs (Kelly 2001, Kelly et al. 2003, Pearson and Livezey 2003, Gremel 2005, Olson et al. 2005, Kroll et al. 2010, Dugger et al. 2011, Higley and Mendia 2013, Franklin et al. 2014, Green Diamond Resource Company 2014). Barred owls negatively affect NSOs by competing for space, habitat, and food (Gutiérrez et al. 2004, 2007, USFWS 2013, Wiens et al. 2014). The barred owl appears to be a superior competitor to the NSO due to its larger size, more aggressive behavior, higher reproductive potential, higher population densities, and broader ecological niche (e.g., USFWS 2013, Wiens et al. 2014). The available information suggests that lethal control of barred owls is a viable management option for some areas, although there is ethical and emotional resistance to this within some segments of society (Diller et al. 2013, Higley 2014). The negative effects of habitat loss and fragmentation on NSOs can be exacerbated by the presence of barred owls (Dugger et al. 2011). Thus, the barred owl threat magnifies the importance of habitat conservation for NSOs, rather than reducing it.

Chapter 5 is a review of outdoor marijuana cultivation as an emerging potential threat to NSOs in California. Marijuana is one of California's largest cash crops (Gettman 2006) but little is known about the environmental effects of its cultivation. Recent research in northwestern California has shown that both fishers (*Pekania pennanti*) and barred owls are regularly exposed to anti-coagulant rodenticides used to protect marijuana plants from rodents (Gabriel et al. 2012, 2014). Multiple fishers are known to have died due to poisoning from anti-coagulant rodenticides (Gabriel et al. 2012, 2013). Fishers and barred owls have overlapping distributions, habitat associations, and diets with NSOs so it is likely that many NSOs in California are likewise exposed to these toxicants. This was supported by recovery of a dead NSO in Mendocino County, which tested positive for exposure to anti-coagulant rodenticides (Calforests 2014). Marijuana cultivation could also negatively affect NSOs through habitat changes caused by illegal and poorly planned logging, road construction, pollution, and water diversion (Gabriel et al. 2013, Bauer et al. 2015). Marijuana cultivation can particularly impact riparian areas. These impacts could indirectly affect NSOs, which often show a preference for nesting, roosting, and foraging in riparian areas (e.g., Hamer et al. 2007, Irwin et al. 2012). Safety concerns about encounters with armed marijuana growers are resulting in reduced conservation research and

monitoring effort and efficiency for NSOs and other sensitive wildlife species in California (Keane et al. 2011, Gabriel et al. 2013, D. Hansen pers. obs.).

Overall, this synthesis supports conclusions that NSOs in California are declining at an increasing rate (Ch. 1) and that they face an array of threats to their persistence (Chs. 2-5). Barred owls appear to pose the greatest current threat to NSOs (Ch. 4). If conservation of NSOs is to remain a priority then widespread barred owl removal programs may be necessary. Habitat protection also remains an important aspect of NSO conservation. Listing under the California Endangered Species Act, substantial changes to the California Forest Practice Rules habitat retention guidelines, and greater involvement by knowledgeable spotted owl biologists in the Timber Harvest Plan review process may be necessary to adequately protect habitat for NSOs on private lands in the state. The available information suggests that large severe wildfires pose a threat to NSOs on federal lands in California (Ch. 3). Some ecologists and land management agencies have proposed widespread use of forest thinning and prescribed fire to reduce this risk. However, the available information also suggests that spotted owls often respond negatively to thinning (Ch. 2). It is important for land managers to consider potential tradeoffs in costs and benefits of thinning in landscapes occupied by NSOs. Thinning could potentially be focused in areas that generally receive the least use by spotted owls and that have the highest fire risk, such as upper and southwesterly slopes (see Ch. 3). The limited information currently available suggests that post-fire salvage logging negatively affects NSOs and their prey (Ch. 2). Further research of this topic is needed but this practice does not appear to be generally concordant with conservation of NSOs in California. Marijuana cultivation appears to pose a substantial emerging threat to NSOs in California; particularly trespass operations on federal lands (Ch. 5). Increased research, law enforcement, and site cleanup and restoration efforts are likely needed to protect NSOs from negative effects of outdoor marijuana cultivation in California.

Methods

The northern spotted owl (*Strix occidentalis caurina*; NSO) has been a focus of conservation concern and research for more than three decades (see reviews in Courtney et al. 2004 and USFWS 2011a). Although substantial habitat protection measures exist for NSOs on federal lands, the subspecies has continued to decline across much of its range (Forsman et al. 2011). Indeed, the U.S. Fish and Wildlife Service (2015) recently concluded that uplisting the NSO from 'threatened' to 'endangered' under the federal Endangered Species Act may be warranted. The California Fish and Game Commission will soon decide whether or not to list the NSO under the California Endangered Species Act. The large body of research and monitoring information concerning the NSO can be challenging for natural resource agencies and policymakers to evaluate. In order to inform the California Endangered Species Act listing decision and other policy and management actions, I have endeavored to synthesize much of the available scientific information concerning the NSO's current status, trends, and threats in the state.

While writing this synthesis, I reviewed information from a variety of sources but generally gave greater weight to peer-reviewed publications, particularly those based on more rigorous field and analytical methods. For example, in Chapter 1, I attempted to carefully consider all available information about the NSO's current status and trends in California but gave greatest weight to results of long-term demographic studies. Some topics related to the NSO's ecology and conservation are scientifically and politically contentious; for example, whether wildfire constitutes a threat to the subspecies and, if so, whether or not it should be addressed through active management approaches, such as forest thinning (see Ch. 3). In these situations, or when published information was limited (e.g., regarding effects of forest thinning on NSOs: see Ch. 2), I treated research results as 'case studies' and described each study's methods and findings in more detail than is common in these kinds of reviews. Although this approach could have underweighted peer-reviewed publications, it allowed me to thoroughly search for patterns among numerous studies, draw tentative conclusions based on those patterns, and highlight gaps in available information about the topic. I also felt that it was important to carefully consider all available sources of information, rather than peer-reviewed publications alone, due to the tremendous variation in ecology and management history that exists within the NSO's range in California. For instance, I felt that it was especially important to evaluate timber industry and National Park monitoring data for portions of California outside the area that includes the state's three demographic studies (see Ch. 1: Figure 1.22 or USFWS 2011a Appendix C for California ecoregional boundaries). In all cases, I was transparent about my approach and the strengths and weaknesses of the available information.

Project Author and Funding

Dan Hansen is a freelance wildlife ecologist (see attached CV). He has an M.S. in animal behavior (conservation biology track) from the University of California at Davis and a B.A. in biology (ecology, evolution, and behavior emphasis) from the University of California at Santa Cruz. He has worked as a contractor for the U.S. Fish and Wildlife Service (USFWS) and U.S. Forest Service (USFS) through the Humboldt State University Sponsored Programs Foundation for most of the last decade. During this period, he primarily coordinated, wrote, and edited scientific syntheses aimed at informing public policy and land management decisions. Documents that Dan contributed to include the USFWS revised recovery plan for the northern spotted owl (critical habitat modeling and effects of forest thinning), the USFS conservation assessment for the northern goshawk in California (a peer-reviewed book to be published in 2015), a USFWS peer-reviewed white paper supporting changes to the California Forest Practice Rules habitat retention guidelines for northern spotted owls in interior northern California, and a USFWS 12-month finding on a petition to list two salamander species under the Endangered Species Act. In addition to working as a technical coordinator, writer, and editor, Dan has worked in the field researching or monitoring spotted owls, golden eagles, bald eagles, peregrine falcons, northern goshawks, carnivores, small mammals, marine mammals, and other wildlife. Prior to working at Humboldt State University, Dan co-managed a large study of California spotted owls in the northern Sierra Nevada.

This document was funded by the Environmental Protection Information Center (EPIC), a non-profit organization focused on environmental issues in northwestern California. EPIC filed a petition with the California Fish and Game Commission in September 2012 to list the northern spotted owl as 'threatened' or 'endangered' pursuant to the California Endangered Species Act. Although EPIC funded the following synthesis, they provided minimal feedback during its writing and were supportive of Dan's goal of producing an unbiased, peer-reviewed synthesis concerning the northern spotted owl's current status and threats in California. All conclusions and management recommendations in this synthesis are the author's alone and do not necessarily reflect those of EPIC or any of the document's reviewers.

Part I, Ch. 1: Status and Trends in California

Introduction

Several lines of evidence are available for evaluating the northern spotted owl's (*Strix occidentalis caurina*; NSO) status and trends in California. These include changes in the subspecies' geographic range and distribution, density and abundance, occupancy and demographic rates, meta-population dynamics, and genetics. The most reliable information available for examining the NSO's status and trends is provided by long-term demographic studies. Data from these studies are periodically analyzed together in meta-analyses for describing larger demographic patterns within ecoregions and rangewide. A new demographic meta-analysis is expected to be released later this year. This document will provide the best available information for determining the NSO's current status and trends. However, only a small portion of the NSO's range in California occurs within demographic study areas and those study areas all occur in relatively productive forests in the northwestern part of the state. It is therefore important to consider other sources of information, such as data collected for monitoring NSOs in National Parks and on industrial timber company lands and results of demographic studies in areas that ecologically resemble portions of interior northern California. The NSO's status and trends likely vary among regions, forest types, and ownerships and could be influenced by a host of factors, such as differences in forest ecology, management history, and stressors such as competition with invasive barred owls (*Strix varia*). It is also important to remember that available sources of information for evaluating the NSO's status and trends in California vary substantially in terms of their purpose and scientific rigor.

Range

The current range of the NSO includes southwestern British Columbia and the Cascade Mountains, coastal ranges, and intervening forests of Washington, Oregon, and California (USFWS 2011a). In California, the NSO's range extends from the Oregon border through the Northern Coast Ranges to Marin County, across the Klamath Mountains, and down the southern Cascades to the vicinity of the Pit River, where it contacts the range of the California spotted owl (*S. o. occidentalis*) (Figure 1.1).

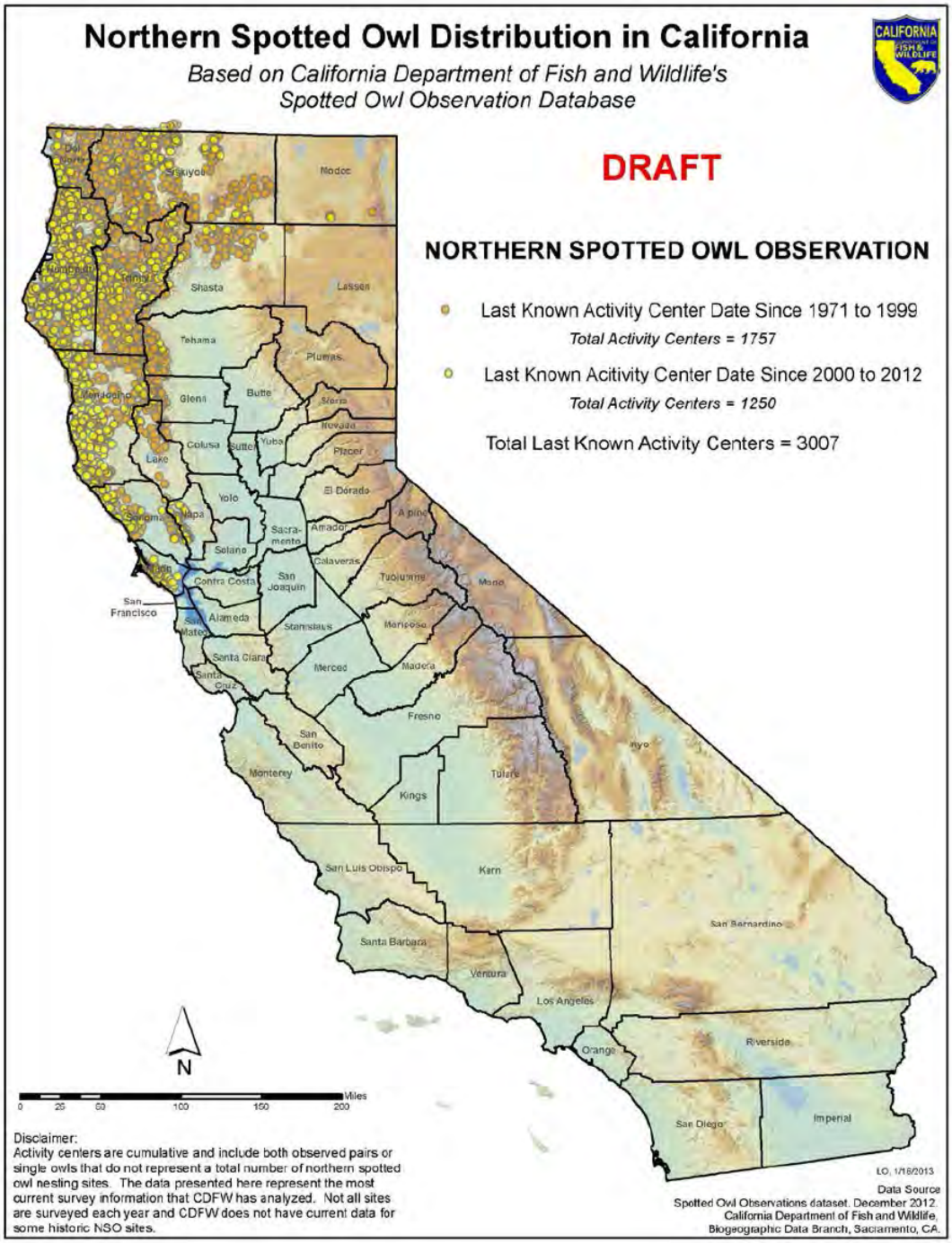
The precise historical range of the NSO is unknown. Thus, despite substantial loss, degradation, and fragmentation of NSO habitat (see Ch. 2 and 3), there is no evidence that the subspecies' range has contracted since Euro-American settlement (Thomas et al. 1990). However, British Columbia's NSO population has declined to very low numbers and is highly vulnerable to extirpation (Chutter et al. 2004). NSO populations in the Cascades and Olympic Peninsula of Washington and the Northern Coast Range of Oregon are also rapidly declining and may become vulnerable to extirpation (Forsman et al. 2011; see *Demography*, below). Loss of NSO populations could cause substantial contraction of the subspecies' range. For example, extirpation of NSOs from British Columbia alone would reduce the subspecies' range by approximately 8% (Cooper 2006).

Distribution

NSOs are thought to have been well distributed throughout most coniferous forests in the Pacific Northwest and northwestern California prior to Euro-American settlement (USFWS 2011a). The abundance and distribution of NSOs have likely declined due to removal of most (ca. 60-88%) old forest within its range (USFWS 1990; see Ch. 2). For example, the Puget Trough in Washington and the Willamette Valley in Oregon no longer support NSOs due to land conversion and timber harvesting and very few NSOs remain in British Columbia (Thomas et al. 1990, Courtney et al. 2004). The NSO's distribution has decreased in other areas of Washington and Oregon as well, due primarily to negative effects of timber harvesting, wildfires, and competition with barred owls (*Strix varia*) (Thomas et al. 1990, USFWS 2011a; see Ch. 2-4).

It is unknown if the NSO's distribution has changed in California. A difference is evident in the distribution of known historically (1971-1999) and recently (2000-2012) occupied activity centers (ACs) in the Eastern Klamath, Interior Northern Coast Ranges, and Southern Cascades regions of the state (Figure 1.1; see Figure 1.22 [left side] and USFWS 2011a Appendix C for ecoregional boundaries generally followed in this synthesis). It is unclear from these data, however, whether the distribution of NSOs has in fact decreased in these areas or if the apparent decline in distribution is due to some other factor such as decreased survey effort or reporting of detections. It is also possible that this difference is due to the greater number of years included in the historical period than in the recent period (29 vs. 13 yrs). However, the two periods are similar in length relative to federal listing of the NSO (10 vs. 13 yrs) when survey effort presumably became more intensive and widespread. Some portions of the Klamath, Interior Northern Coast Ranges, and Southern Cascades have experienced widespread intensive timber harvesting or large wildfires, which could have reduced the NSO's distribution (see Ch. 2 and 3). These forms of disturbance, along with competition with invasive barred owls, have likely contributed to declining occupancy by NSOs in some areas of California (see *Occupancy*, below). Nonetheless, the Klamath and Interior Northern Coast Ranges (but not the Southern Cascades) still appear to contain relatively large amounts of well connected suitable habitat and may function as crucial population sources for NSOs (Schumaker et al. 2014; see *Source-Sink Dynamics*, below). It is also possible that the distribution of NSOs has expanded at local or sub-regional levels in some portions of California due to increased distribution or density of suitable forest habitat in the absence of fire (Skinner 1995, Spies et al. 2006).

Figure 1.1: Distribution of northern spotted owl activity centers in the California Department of Fish and Wildlife's Spotted Owl Observation Database (from California Department of Fish and Wildlife 2013).



Density and Abundance

Species are rarely uniformly distributed across their range. Knowledge of variation in the density and abundance of NSOs is of potential conservation value because it can help identify areas where limited conservation resources should be focused. For example, while declines in low-abundance areas may be more likely to cause contraction of a species' range or distribution (see *Range* and *Distribution*, above), declines in high-abundance areas may disproportionately impact the species' probability of long-term persistence; particularly when high-abundance areas function as population sources (Pulliam 1988, Rodríguez 2002, Schumaker et al. 2014; see *Source-Sink Dynamics*, below).

Several studies have estimated either crude densities (owls or occupied territories per unit area) or ecological densities (owls per unit area of specified habitat class[es]) of NSOs in California (Blakesley et al. 2004; Table 1.1). These estimates are interesting in that they appear to reflect geographic variation in the ecology of NSOs (see below). However, they have limited utility for evaluating the NSO's status or trends in California. Available density estimates for the state are largely restricted to relatively mesic areas of northwestern California, which differ ecologically from drier interior forests (e.g., in terms of climate, forest productivity, and prey communities). Inferences from most density estimates are also limited because they are based on empirical counts of unmarked NSOs, which can bias estimates (Franklin et al. 1990, Diller and Thome 1999). Many of the currently available density and occupancy estimates for NSOs in California were provided by timber companies (Tables 1.1 and 1.2). While potentially useful for evaluating effects of management activities on timber company lands, these estimates do not describe population trends. Rigorous evaluation of NSO population trends require long-term statistically valid sampling designs from which estimates of abundance, or population growth rate with confidence intervals, can be repeatedly obtained within the same study area. In contrast, timber companies generally shift their NSO survey areas over time as timber harvest projects are completed in some areas and begun in others.

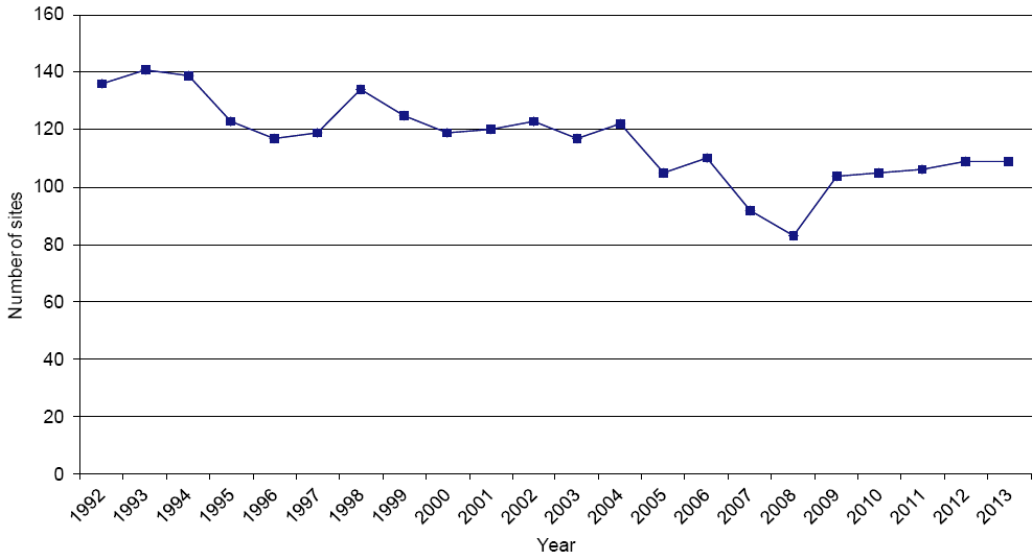
Based on limited information, both crude and ecological densities of NSOs appear to be substantially higher in northwestern California than in the Oregon Coast Ranges (Blakesley et al. 2004; Table 1.1). Lower densities in the Oregon Coast Ranges could be partially related to widespread intensive timber harvesting, which apparently contributed to a major decline in densities during the early 1990s (Thrailkill et al. 1998). Some areas of northwestern California have also experienced widespread intensive timber harvesting (see Ch. 2) but its effect on NSOs might have differed from that in the Oregon Coast Ranges. In general, NSOs in California primarily subsist on dusky-footed woodrats (*Neotoma fuscipes*) (in terms of biomass contribution to diets). NSOs that primarily subsist on dusky-footed woodrat often have smaller home ranges, and apparently occur at higher densities, than those that primarily rely on smaller-bodied prey (Carey et al. 1992, Zabel et al. 1995). Furthermore, in contrast with other primary prey species, such as northern flying squirrels (*Glaucomys sabrinus*) and tree voles (*Arborimus* spp.), dusky-footed woodrats seem to respond positively, albeit temporarily, to some forms of intensive timber harvesting (see Ch. 2).

Densities of NSOs are also thought to be higher in northwestern California than in the state's interior (Calforests 2014). However, there are apparently only two density estimates currently

available for interior northern California and both of these were for crude densities of occupied territories, rather than for individual owls as estimated by most studies in northwestern California (Table 1.1). These crude territory densities are substantially lower than those found on two timber companies' lands in the Redwood Region (Table 1.1). NSO densities may be relatively low in the Southern Cascades of California due to the prevalence of drier, less productive forests, a history of widespread intensive harvesting, and effects of recent large wildfires (see Ch. 2 and 3). Additional density estimates are needed for the Eastern Klamath of California. It is uncertain whether Sierra Pacific Industries' (2013) estimates are representative of densities across the region as a whole. Most ACs included in Sierra Pacific's density estimates were located near the margins of the company's lands or on adjacent ownerships, rather than within the interiors of the company's holdings (see Maps 2-5 in Sierra Pacific Industries 2013, which are copyrighted and cannot be reproduced without permission). This pattern suggests that densities could be higher on neighboring lands, such as the Shasta-Trinity National Forest, which have generally experienced less intensive management.

The California Forestry Association cited annual density estimates in timber company monitoring reports as evidence of stable or increasing NSO populations on private timberlands in the state (Calforests 2014). Reported crude densities on Humboldt Redwood Company, Mendocino Redwood Company, and The Conservation Fund lands in the Redwood Region were indeed relatively similar among years (Calforests 2014). However, it is unclear how changing survey methods and survey areas, as well as changing detectability of NSOs, influenced these companies' estimates over time (see Franklin et al. 1990). For example, recent adoption of survey protocols requiring more survey passes and use of electronic callers likely increased detection rates, and thus density estimates, on some of these lands. Estimates of crude densities of NSOs and numbers of ACs on Green Diamond Resource Company lands in the Redwood Region suggest that NSO densities have declined on that ownership (Figure 1.2; Table 1.1). The number of NSO ACs on Green Diamond lands briefly increased in 1998, apparently due to the company's acquisition of 70,000 acres of timberland that year (Green Diamond Resource Company 2014). Following a substantial decline during 2004-2008, the number of ACs began to gradually increase in 2009 (Figure 1.2). This increase appears to have been due to the company's adoption of a more rigorous survey protocol and implementation of a barred owl removal experiment during that same year (Green Diamond Resource Company 2014; see Ch. 4). Sierra Pacific Industries' (2013) density trends for its ownerships in the Eastern Klamath are difficult to evaluate and are therefore not included here. Sierra Pacific Industries' (2013) estimates are empirical, potentially influenced by changing survey effort and areas, mostly descriptive of ACs at the margin of or outside the company's ownership, and were compared among blocks of years, rather than annually.

Figure 1.2: Number of NSO activity centers ("sites") on Green Diamond Resource Co. lands during 1992-2013 (from Green Diamond Resource Co. 2014).



Rigorous ecological density estimates can be used to estimate population sizes for ecologically similar areas (Franklin et al. 1990). However, there are currently insufficient data for producing such an estimate for California or any of its regions. The California Forestry Association estimated that as many as 6,000 NSO territories currently exist in the state (Calforests 2014). This figure was based on an estimated statewide crude density of 0.28 territories per mile². This density estimate was, in turn, based on the cumulative number of known NSO ACs in California (see *Distribution*, above) and the proportion of "potential" habitat in the state that has been surveyed. The number of ACs known to have been recently occupied is substantially lower than the cumulative number that have been identified since the early 1970s (USFWS 2011a; see *Distribution*, above). This could be due to multiple factors, including declining occupancy rates (see *Occupancy*, below) and NSOs' use of different ACs over time. Thus, the timber industry's estimate provides little or no insight into the current number of NSOs or occupied ACs in the state. Furthermore, while reasonable projections of suitable habitat exist for NSOs in California (Davis and Dugger 2011, USFWS 2011a Appendix C, Schumaker et al. 2014), the California Forestry Association did not cite these data and it is unclear how it estimated the total and surveyed areas of suitable habitat in the state.

Table 1.1: Density estimates for NSOs in California and Oregon.

Study	Region	Owner	Method	Crude Density (owls/ mi²)*	Crude Density (occupied territories/ mi²)*	Ecological Density (owls/ mi²)**†
Diller and Thome 1999	N Redwood	Green Diamond	Mark-Recapture	0.54 (0.24-0.91)		0.97-2.72
Green Diamond Resource Co. 2014	N Redwood	Green Diamond	Empirical (marked)	0.34 (0.12-0.53)		
Tanner and Gutierrez 1995 cited in Diller and Thome 1999	N Redwood	Redwood National Park	Empirical	0.57		
Humboldt Redwood Co. 2013	N Redwood	Humboldt Redwood	Empirical	0.53-1.01	0.36-0.50	
Mendocino Redwood Co. 2014	N Redwood	Mendocino Redwood	Empirical	0.47-.077		
The Conservation Fund unpubl. data in Calforests 2014	N Redwood	The Conservation Fund	Empirical		0.29-.036	
Chow 2001	S Redwood	Public (Various)	Empirical	0.97		2.09
Franklin et al. 1990	W Klamath	Six Rivers National Forest, Other	Mark-Recapture	0.61		1.41-1.71
Sierra Pacific Industries 2013	E Klamath	Sierra Pacific Industries	Empirical		0.17-0.18	
Woodbridge and Cheyne 1995	So Cascades	Klamath National Forest	Empirical		0.05-0.20	
Thrailkill et al. 1998	OR Coast Ranges	Bureau of Land Management	Empirical	0.07-0.25		0.57-0.90
Anthony et al. 2000 cited in Blakesley et al. 2004	OR Coast Ranges	Oregon Dept. of Forestry	Empirical	0.13-0.27		

*Ranges = low-high survey areas (Woodbridge and Cheyn 1995, Thraillkill et al. 1998, Diller and Thome 1999, Anthony et al. 2000, Green Diamond Resource Co. 2014), low-high survey years (Humboldt Redwood Co. 2013, Mendocino Redwood Co. 2014). **Habitat definitions used to calculate ecological densities: Franklin et al. 1990: all conifer cover classes weighted by NSO use (based on telemetry), but mostly ≥20.6 in DBH; Diller and Thome 1999: all forest classes weighted by NSO use (based on nest locations) but mostly >40 yrs; Chow 2001: all forested area; Thrailkill et al. 1998: old, mature, old over young, mature over young. †Ranges of ecological densities: Franklin et al. 1990: with two different habitat definitions; Diller and Thome 1999: low-high survey areas.

Occupancy

NSO population trends are most directly evaluated with demographic data (see *Demography*, below). However, occupancy data are often more logistically and economically feasible to collect than demographic data and, with proper accounting of detection probability, can provide a useful index of spotted owl population rates (MacKenzie 2005, Olson et al. 2005, Mackenzie et al. 2012, Tempel 2014). Occupancy data that inadequately incorporate detection probabilities for spotted owls must be interpreted carefully since they can be strongly influenced by survey effort, habitat attributes, social and reproductive status of NSOs, presence of barred owls, and other factors (Mackenzie 2005, Olson et al. 2005). Recent research in NSO demographic study

areas suggests that competition with barred owls is driving NSOs to move large distances (several miles) between different territories within the same season (Davis et al. 2013, Higley and Mendia 2013). Higley and Mendia (2013) warned that occupancy estimates for unmarked populations may therefore be inflated (i.e., the same individual could appear to occupy multiple territories within the same season) and suggested using the presence of pairs, rather than individuals, to determine occupancy.

There is limited information available for describing occupancy trends for NSOs in California. Much of the available information is from annual monitoring reports provided by industrial timber companies (Table 1.2). These data show trends in annual proportions of known, surveyed, or previous year's ACs found to be occupied (see Table 1.2 footnote). It is important to acknowledge that much of the data presented in Table 1.2 provide only crude indices of occupancy in California and that most of them cannot be compared among ownerships due to differences in monitoring and analytical methods. Future efforts to evaluate the status of NSOs in California would benefit from greater consistency in occupancy monitoring and from reporting of modeled occupancy rates, which account for detectability of NSOs and other factors that can obscure occupancy trends (e.g., Figure 1.5).

Recent occupancy estimates are unavailable for the Redwood National and State Parks in the northern portion of the Redwood Region. The National Park Service has discontinued surveying most historical territories in these parks due to apparent widespread displacement of NSOs by barred owls (Schmidt 2013; see Ch. 4). In contrast with an apparently strong decline in occupancy in the Redwood National and State Parks, NSO occupancy rates on National Park Service lands in the southern portion of the Redwood Region have fluctuated annually but suggest a stable trend over time (Ellis et al. 2013; Table 1.2; Figure 1.3). Perhaps due to the area's geographic isolation, barred owls are still relatively uncommon the southern Redwood Region (Ellis et al. 2013; see Ch. 4). Occupancy by NSOs appears to be gradually declining on industrial timberlands in the northern Redwood Region (Table 1.2; Figures 1.2, 1.4, 1.5, and 1.7). Given the substantial and increasing presence of barred owls in NSO territories on these lands (see Ch. 4), it is surprising that more dramatic declines in NSO occupancy are not evident (e.g., see Table 1.2 for occupancy rates in Washington and Oregon). It is possible that NSOs respond differently to barred owls on these lands than elsewhere within their range. It is also possible that a more rapid decline is currently occurring than is indicated by the crude data presented in these companies' reports. Yet another possibility is that a more rapid decline will occur on these lands after a post-colonization lag period has elapsed or a critical threshold level of barred owl presence is reached (USFWS 2013).

NSO occupancy in the Northwestern California demographic study in the Western Klamath Region has declined dramatically in recent years (Franklin et al. 2013, 2014; Table 1.2). This decline has coincided with increasing barred owl presence in the study area, suggesting that NSOs are being displaced by barred owls (see Ch. 4). The recently increased rate of declining occupancy by NSOs in this study area appears to support the hypothesis that barred owls can have lag or threshold effects on NSO populations. Recent declines in occupancy in the Northwestern California study area may also be related to effects of multiple consecutive years of poor weather conditions on demographic rates (see *Demography*, below). Recent annual reports from the Hoopa demographic study did not include analyses of occupancy data for NSOs

(Higley and Mendia 2012, 2013). However, unmodeled occupancy rates in 2012 and 2013 were low (0.40 and 0.35, respectively). Low occupancy rates on the Hoopa Reservation may be related to substantial declines in numbers of NSOs, likely due to decreasing demographic rates (see *Demography*, below) and increasing numbers of NSO territories with barred owl detections (see Ch. 4). Greater declines in numbers of NSOs and increases in NSO territories with barred owl detections beginning in 2005 provide additional support for the hypothesis that barred owls have lag or threshold effects on NSOs.

There is currently no clear pattern in occupancy data available for the Eastern Klamath and Southern Cascades of California. Timber companies in those regions have reported evidence of stable occupancy rates (Sierra Pacific Industries 2013, Michigan-California Timber Company 2014; Figure 1.6; note: Sierra Pacific's estimates are not provided in Table 1.2 for reasons discussed in *Density and Abundance*, above). However, more rigorous, published research conducted primarily on industrial timberlands in the Eastern Klamath and Southern Cascades found substantial declines in both simple (total) and pair occupancy (Farber and Kroll 2012; Figure 1.7). The barred owl invasion appears to still be in the early colonization phase in the Eastern Klamath, where this study was primarily conducted (Farber and Kroll 2012; see Ch. 4). Thus, declining occupancy during the study was likely caused by some other factor, such as timber harvesting on the industrial timberlands that comprised much of the study area or wildfires on neighboring public lands (see Ch. 2 and 3). Research in other areas of the NSO's range indicates that occupancy can be negatively affected by habitat loss and fragmentation (Dugger et al. 2011, Sovern et al. 2014).

Table 1.2: Estimates and indices of occupancy by northern spotted owls in California, Oregon, and Washington.

Study	Region	Owner	Years	Number of Sites	Proportion Occupied (Total)	Proportion Occupied (Pairs)	Modeled Occupancy (Total)	Modeled Occupancy (Pairs)	Apparent Trend
Mendocino Redwood Company 2013	N Redwood	Private	2001-2013 (proportion); 2001-2008 (modeled)		0.75 - 0.69*		0.88 - 0.78*†		Declining (weak)
Humboldt Redwood Company 2014	N Redwood	Private	2003-2013		0.81 - 0.63*†				Declining (weak)
Green Diamond Resource Company 2014	N Redwood	Private	1999-2013 (no. sites); 2009-2013 (occupancy)	135 - 108*†	0.88 - 0.83*‡				Declining (weak)
Ellis et al. 2013	S Redwood	NPS	1999-2012		0.86 - 0.94*	0.72 - 0.87*			Stable
Franklin et al. 2002, 2003, 2010-2014	W Klamath	USFS, BLM, Private	2001-2013		0.67 - 0.37*	0.59 - 0.28*			Declining (strong)
Farber and Kroll 2012	E Klamath, S Cascades	Private, USFS	1995-2009				0.81 - 0.50*	0.75 - 0.46*	Declining (strong)
Michigan-California Timber Company 2014	E Klamath, S Cascades	Private	2000-2013		0.35 - 0.52 (2001-2013: 0.66 - 0.52)*†				Stable
Davis et al. 2013a	OR Klamath	BLM, State, Private	2001-2013		0.86 - 0.49*	0.62 - 0.30*			Declining (strong)
Dugger et al. 2011	OR S Cascades	USFS	1991/1992-2006				w/o barred owls: 0.86 - 0.71*†; w/ barred owls: 0.87 - 0.11*†		Declining (strong)
Kroll et al. 2010	WA E Cascades	NPS, USFS, Private	1990/1-2003				w/o barred owls: 0.83 - 0.64*†; w/ barred owls: 0.73 - 0.30*†	w/o barred owls: 074 - 0.36*†	Declining (strong)

*Start and end values. †Estimated from graph. ‡Occupancy of previous year's sites.

Figure 1.3: Occupancy status at monitored northern spotted activity centers on National Park Service lands in Marin County, California during 1999-2012 (from Ellis et al. 2013).

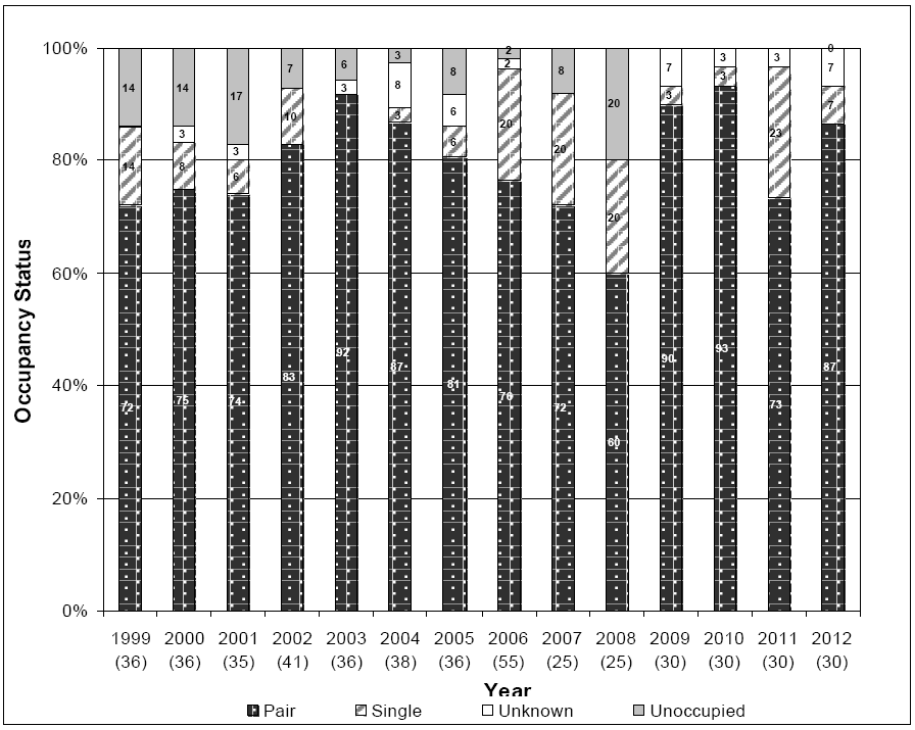


Figure 1.4: Annual numbers of known and occupied northern spotted owl activity sites (activity centers) on Humboldt Redwood Company lands during 2003-2013 (from Humboldt Redwood Company 2014).

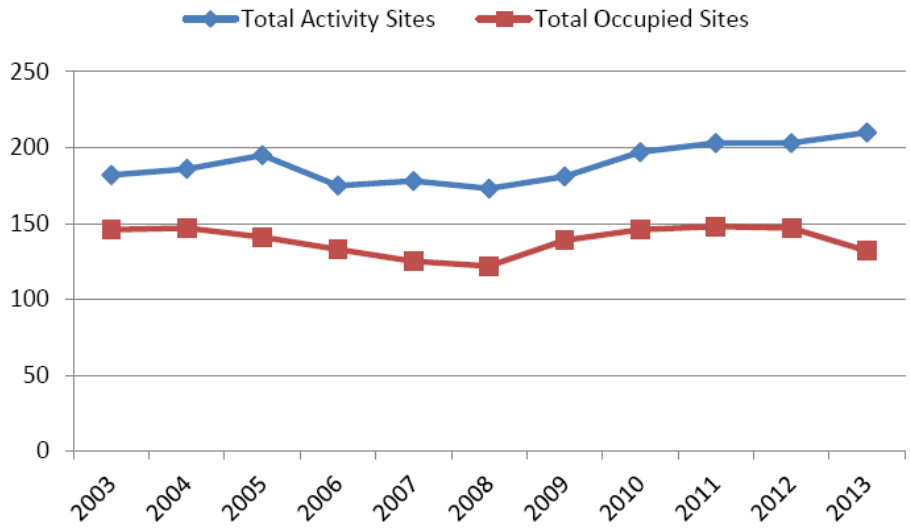


Figure 1.5: Annual proportion of northern spotted owl activity centers occupied (blue line) and modeled occupancy probability (red line) on Mendocino Redwood Company lands (from Mendocino Redwood Company 2013). Note the apparent decline in modeled occupancy compared with the lack of a clear trend in unmodeled occupancy.

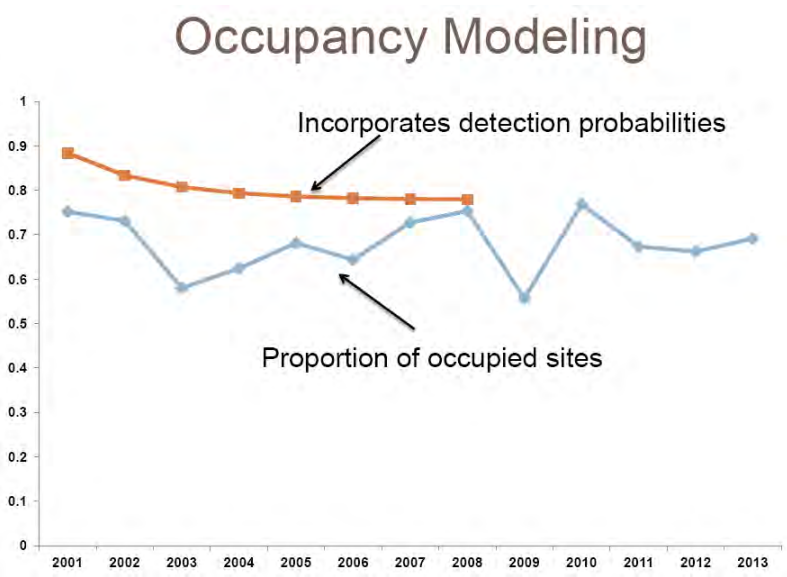


Figure 1.6: Percent of surveyed northern spotted owl sites occupied on Michigan-California Timber Company lands during 2000-2013 (from Michigan-California Timber Company 2014).

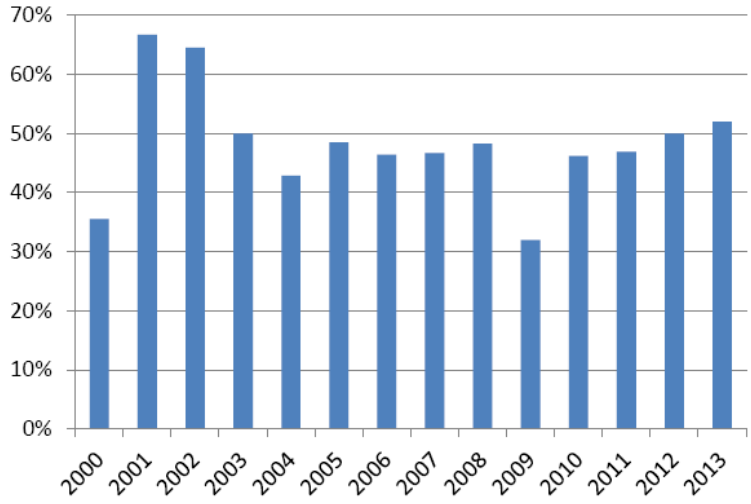
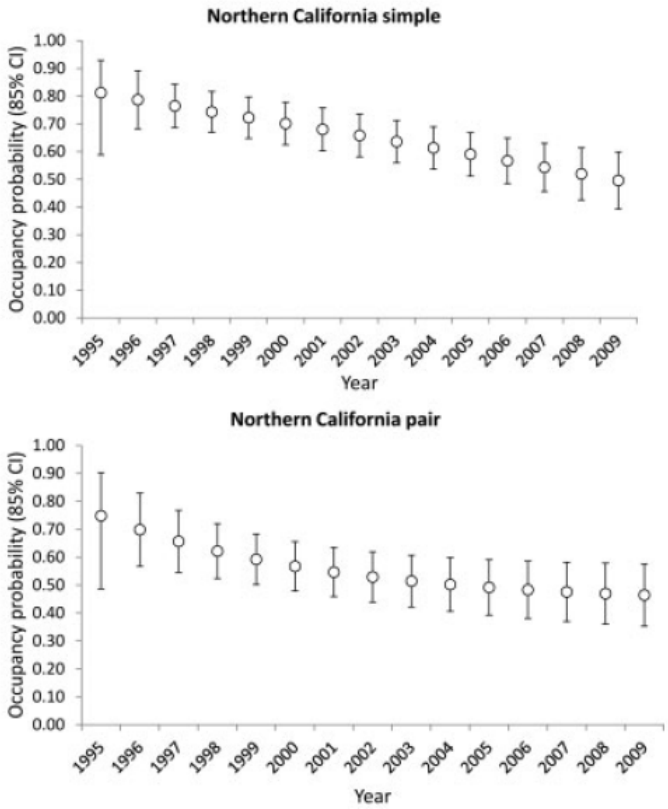


Figure 1.7: Estimated annual simple (total) and pair occupancy probabilities (with 85% confidence intervals) for northern spotted owls in the Eastern Klamath Region of California during 1995-2009 (from Farber and Kroll 2012).



Demography

Reproduction

Reproductive data are commonly collected as part of monitoring efforts for NSOs (e.g., Calforests 2014). They are easier and more cost-effective to obtain than those required for estimating survival or population trends. NSOs exhibit considerable annual fluctuations in reproduction (Forsman et al. 2011, Calforests 2014). Given often large annual fluctuations in reproduction, evaluation of trends in reproduction could require longer-term datasets than are available for many monitoring areas.

The 2011 demographic meta-analysis reported that fecundity of NSOs (number of female fledglings per female) significantly declined during 1985-2008 in four of 11 density study areas, may have declined in three other areas, and was stable in four areas (Forsman et al. 2011). Two of the four study areas with significant declines in fecundity were located in California (Northwestern California in the Western Klamath Region and Green Diamond in the Redwood Region). Two others were located in portions of southwestern Oregon (Klamath and South Cascades) that are nearby and ecologically similar to the Eastern Klamath and Southern Cascades of California (see USFWS 2011a Appendix C, USFWS 2012a, and Figure 1.22 [left side] for regions). Also, the one area in California with stable fecundity (Hoopa) had low fecundity estimates compared to other areas. Together these data, which represent the most

reliable evidence currently available, indicate that NSO reproduction could be declining across much of California and southwestern Oregon.

Annual fluctuations in fecundity were evident in all three demographic studies in California and were remarkably synchronous (Forsman et al. 2011; Figure 1.8). Forsman et al. (2011) found that variation in fecundity was associated with a variety of variables, including the age of breeding females, whether the year was even or odd, weather or climate (e.g., early nesting season temperature or precipitation), percent cover of suitable habitat, and the presence of barred owls. Franklin et al. (2013) noted a pattern of "good" and "bad" reproductive years in the Northwestern California demographic study area, which is likely associated with annual variation in weather during the early nesting season (also see Franklin et al. 2000). Franklin et al. (2013) also observed that particularly poor reproductive years have occurred in their study area at four-year intervals, suggesting that "some other extrinsic factor may be operating, such as seed production governing small mammal populations." Forsman et al. (2011) reported that barred owl presence was in the top models explaining fecundity in the Green Diamond study area, suggesting that competition with barred owls contributed to declining reproduction on that ownership. Reports from the Klamath and South Cascades demographic studies in southern Oregon noted negative associations between reproduction and rainfall during the early nesting season (Davis et al. 2013b, Dugger et al. 2014). Declining reproduction in these study areas also appears to be related to increasing presence of barred owls.

Following publication of the 2011 meta-analysis, California's demographic studies reported three consecutive years (2011-2013) of very low reproduction (Franklin et al. 2013, Higley and Mendia 2013, Green Diamond Resource Company 2014). This dip in reproduction might have been partially driven by high rainfall during the early nesting season during 2010-2012 (see below). Those three consecutive years of low reproduction exacerbated the negative long-term trend that was already occurring on Green Diamond lands (Green Diamond Resource Company 2014; Figure 1.9). Negative trends in reproduction also occurred in the Klamath and South Cascades demographic study areas subsequent to the end of the 2011 meta-analysis study period (Davis et al. 2013b, Dugger et al. 2014; Figures 1.10 and 1.11). Davis et al. (2013b) concluded that particularly poor reproduction during recent years "…may indicate potentially serious problems with maintaining a stable population. This is even more alarming since these results are following a long term downward trend."

Figure 1.8: Mean annual fecundity in California's three northern spotted owl demographic studies during 1985-2008 (from Forsman et al. 2011).

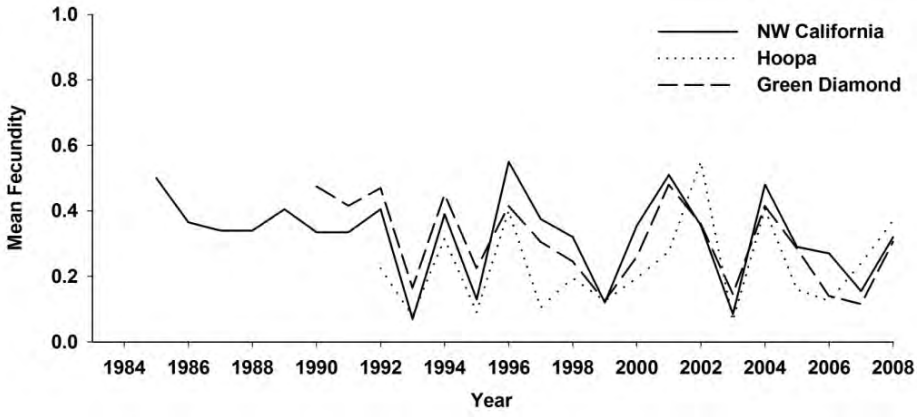


Figure 1.9: Number of fledglings produced per monitored pair of northern spotted owls on Green Diamond Resource Company lands during 1992-2013 (from Green Diamond Resource Company 2014).

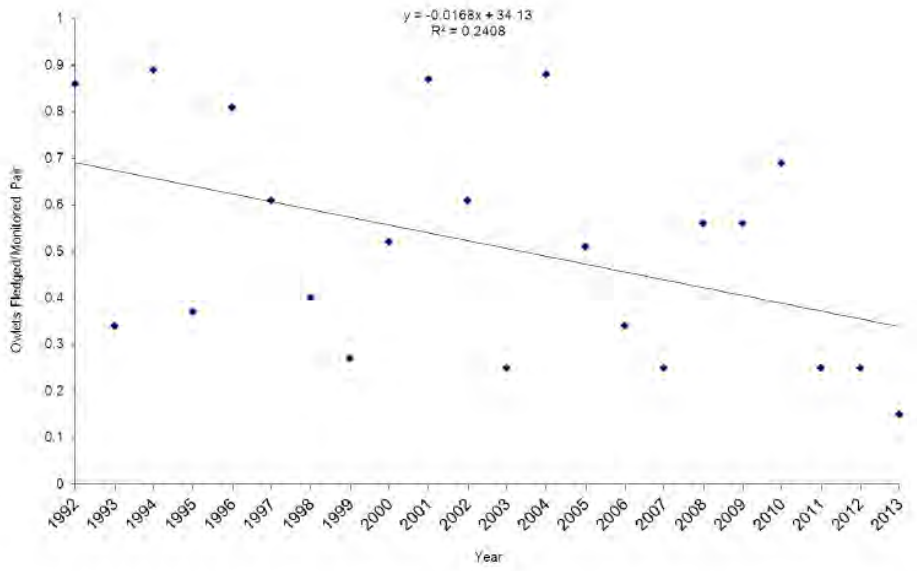


Figure 1.10: Fecundity of northern spotted owls ("STOC") in the Klamath demographic study area during 1990-2013 (from Davis et al. 2013a). Dashed line is a polynomial trend line ($r^2 = 0.419$). Vertical line represents the first year in which barred owls ("STVA") were detected in more than 10% of spotted owl territories.

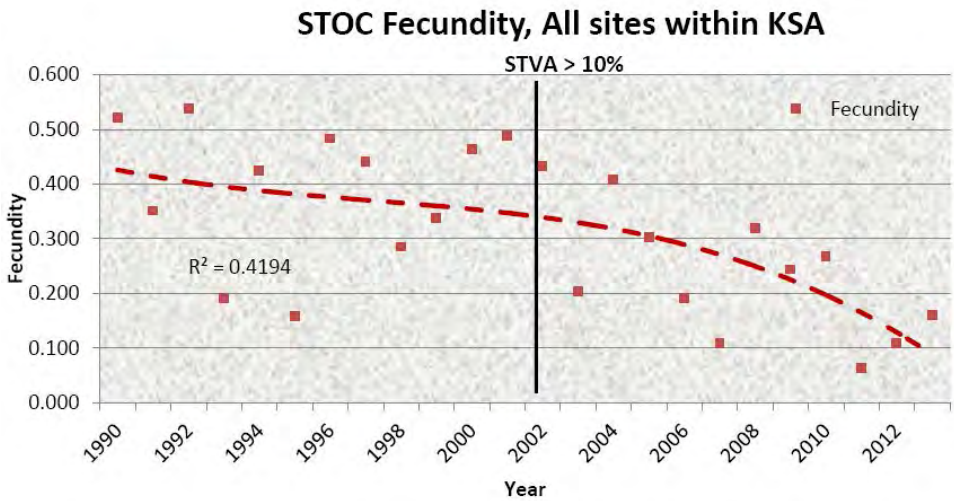
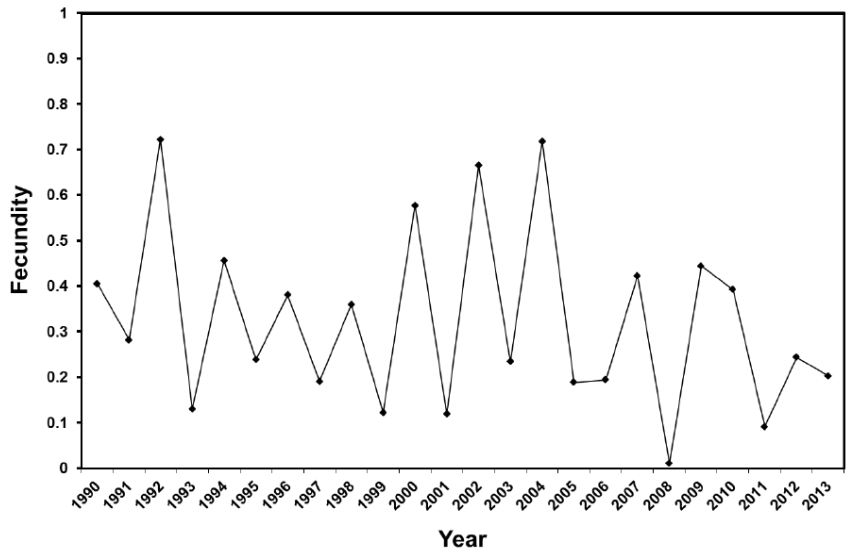


Figure 1.11: Fecundity of northern spotted owls in the South Cascades demographic study area during 1990-2013 (from Dugger et al. 2014).



Information is also available for describing recent trends in NSO reproduction in portions of California outside of demographic study areas. Ellis et al. (2013) found below average fecundity during 2007 and 2010-2012 on National Park Service lands in the southern Redwood Region (Figure 1.12). Humboldt Redwood Company (2013) and Mendocino Redwood Company (2014) likewise reported low reproduction during those years (Figures 1.13 and 1.14). These observations, along with those from demographic studies in California and southern Oregon described above, suggest that low reproduction during recent years was primarily driven by a factor that acted at a very large spatial scale, rather than at the scale of individual ownerships or ecological regions. As noted above, high rainfall during the early

nesting season was likely a primary cause of low reproduction during recent years. This apparent relationship is illustrated by the negative association between NSO reproductive success and early season rainfall observed on Mendocino Redwood Company lands (Figure 1.13).

Monitoring results suggest a stable long-term trend in reproduction on National Park Service lands in the southern Redwood Region (Figure 1.12). In the northern Redwood Region, Humboldt Redwood Company (2013) data likewise suggest little or no trend, although the period covered could be too short to capture long-term trends in reproduction (Figure 1.14). Mendocino Redwood Company (2014) provided a longer-term data set that suggests that a shallow decline in reproduction has occurred on their lands, primarily due to below average reproduction during seven of eight years during 2006-2013 (Figure 1.13). Data provided by the Fruit Grower's Supply Company (2014) suggests that a decline in reproduction occurred on their lands in the Eastern Klamath and Southern Cascades regions of California during 1990-2005 (Figure 1.15). It is important to note, however, that these are only descriptions of apparent trends based on patterns in relatively crude data. A more rigorous analysis of the data is needed to support strong conclusions about reproductive trends on industrial timberlands in California.

Figure 1.12: Fecundity of northern spotted owls on National Park Service lands in Marin County during 1999-2005 and 2007-2012 (from Ellis et al. 2013). The solid line indicates mean fecundity during these periods combined, the dashed lines are one standard deviation from the mean, error bars indicate ±1 standard error, and n is the total number of spotted owl territories.

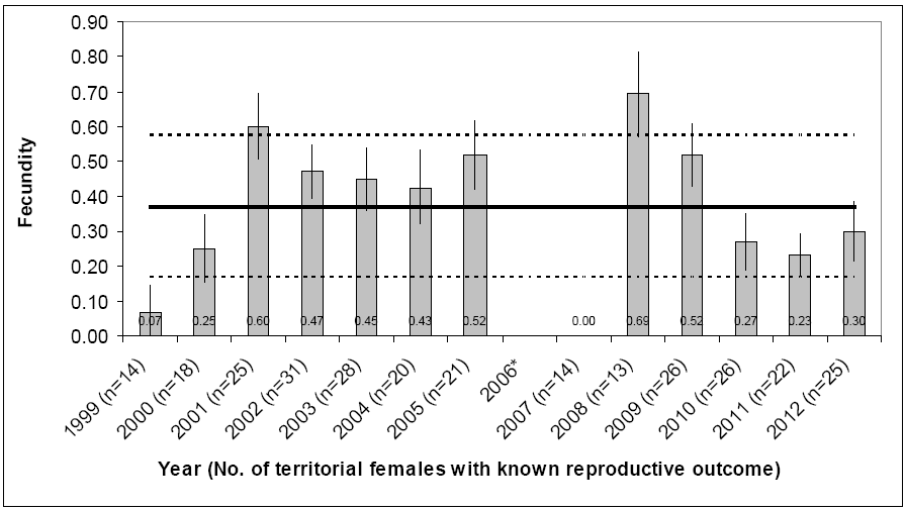


Figure 1.13: Reproductive success (average number of fledglings/pair) of northern spotted owls and amounts of rainfall during the early nesting season on Mendocino Redwood Company lands during 1989-2013 (from Mendocino Redwood Company 2014).

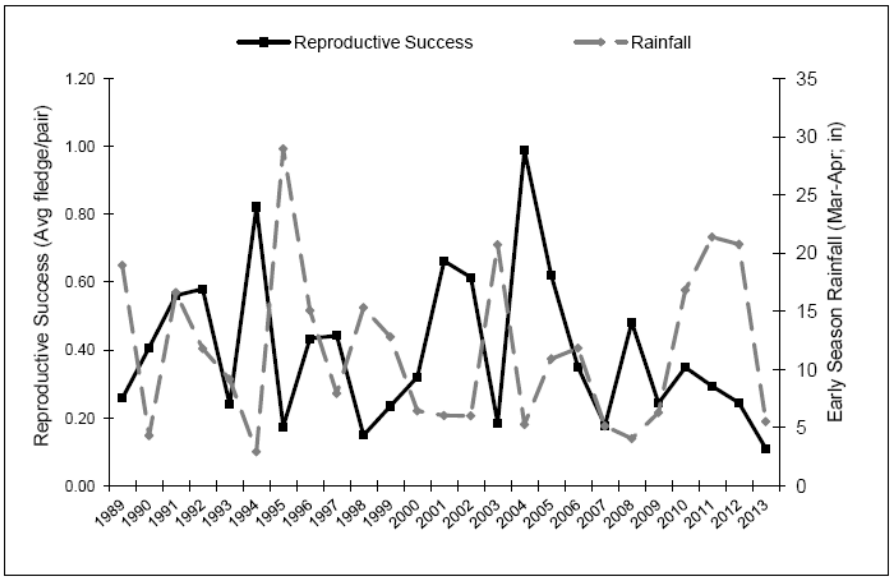


Figure 1.14: Reproductive rate and numbers of nesting pairs and juveniles on Humboldt Redwood Company lands during 2003-2012 (from Humboldt Redwood Company 2013).

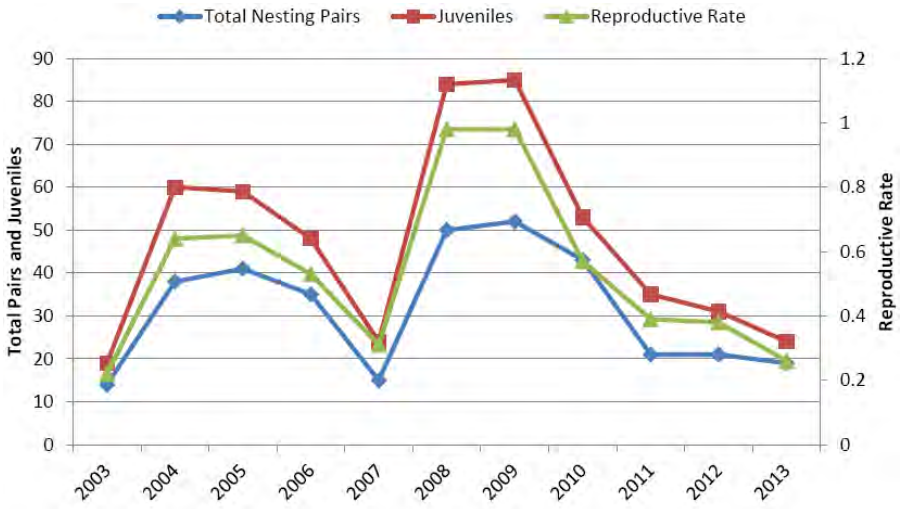
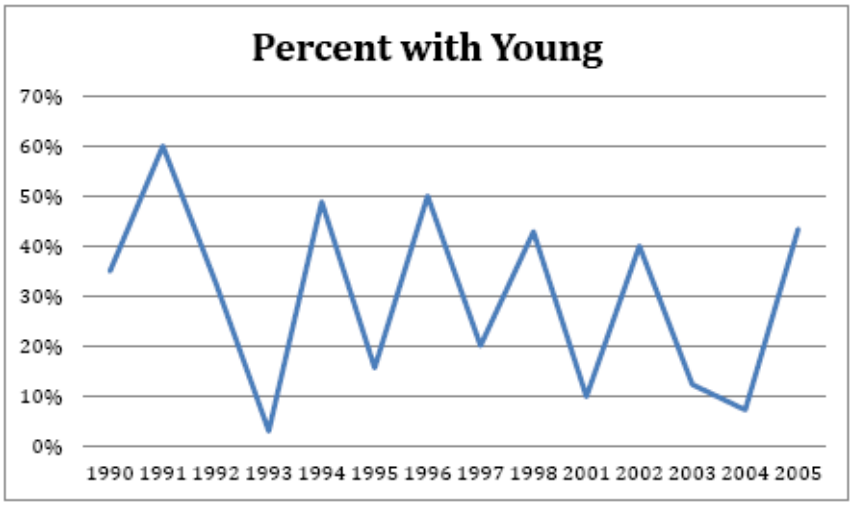


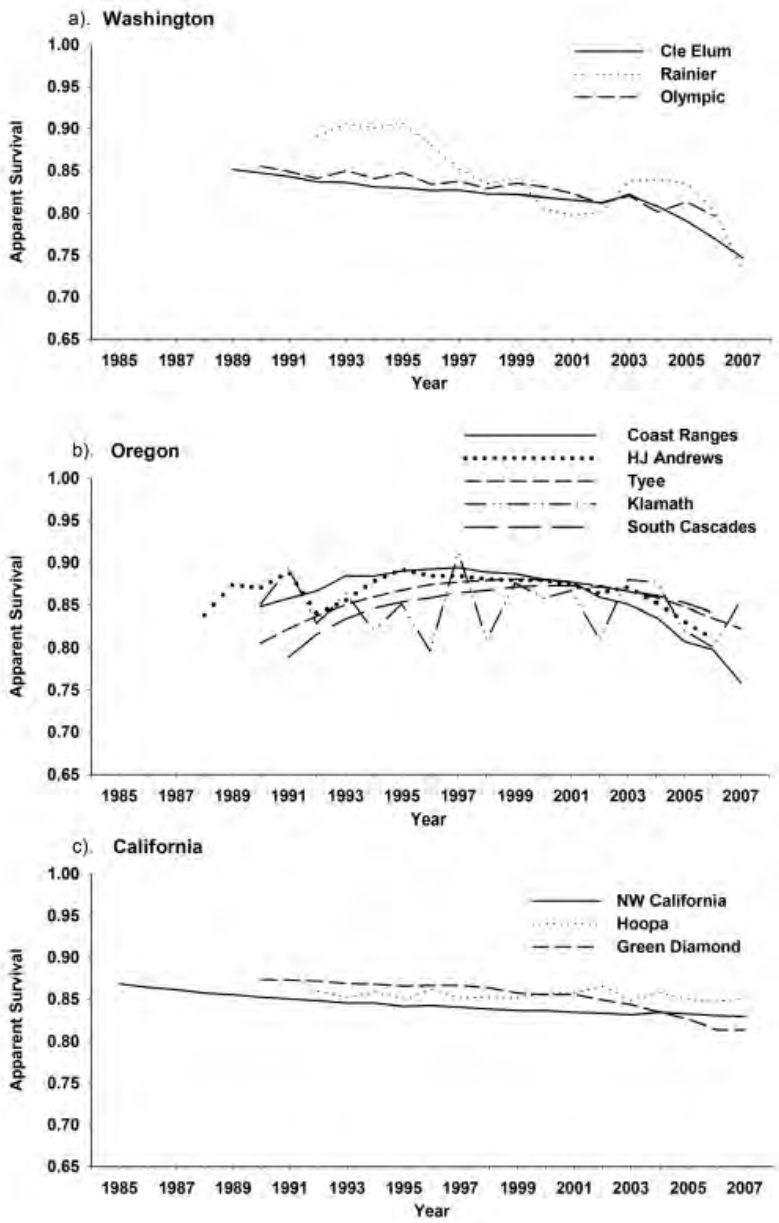
Figure 1.15: Fecundity of northern spotted owls on Fruit Growers Supply Company land during 1990-2005 (from Fruit Growers Supply Company 2014).



Survival

Available information concerning recent survival rates of NSOs is mostly limited to that provided in the 2011 demographic meta-analysis (Forsman et al. 2011). Survival data are not collected by timber companies other than Green Diamond Resource Company, which submits its data for analysis and reporting in the demographic meta-analyses. Forsman et al. (2011) reported statistically significant declines in apparent survival for 10 of 11 NSO demographic study areas, including all three study areas in California (Figure 1.16). Declines in many study areas were most precipitous during the last five years of the study period (i.e., 2003-2007 for survival; Figure 1.16). The Klamath in southern Oregon was the only study area that did not have a significantly declining survival rate through 2007. Forsman et al. (2011) stated that "collectively, the declines in apparent survival of Northern Spotted Owls across much of the subspecies' range are cause for concern because Spotted Owl populations are most sensitive to changes in adult survival rates (Noon and Biles 1990, Lande 1991)."

Figure 1.16: Model averaged estimates of apparent survival of adult female northern spotted owls three study areas in Washington (a), five study areas in Oregon (b), and three study areas in California (c) during 1985-2007 (from Forsman et al. 2011).



NSO demographic studies have largely deferred reporting of more recent survival data to the forthcoming meta-analysis, which is expected to be released in 2015. The limited information available prior to release of that meta-analysis suggests that survival has continued to decline since the 2011 meta-analysis study period. Davis et al. (2013b) reported that subsequent "…data regarding occupancy (in the Klamath study area) has shown a rapid decline, which suggests the stability of the survival rate may no longer be valid." Franklin et al. (2013) reported an alarming drop in apparent survival in 2011 on the Northwestern California demographic study area (Figure 1.17). Their subsequent annual report deferred reporting of 2012-2013 survival data to the forthcoming meta-analysis (Franklin et al. 2014). Higley and Mendia (2013) reported a statistically non-significant decline in survival of NSOs on the Hoopa Valley Indian Reservation in the Western Klamath (Figure 1.18). Their best model explaining survival of NSOs suggested that the decline was at least partially related to increasing numbers of barred owls in the study area.

Figure 1.17: Annual estimates (solid dots with 95% confidence intervals) of, and trend in (solid line), apparent survival for subadult and adult northern spotted owls in northwestern California during 1985-2012 (from Franklin et al. 2013).

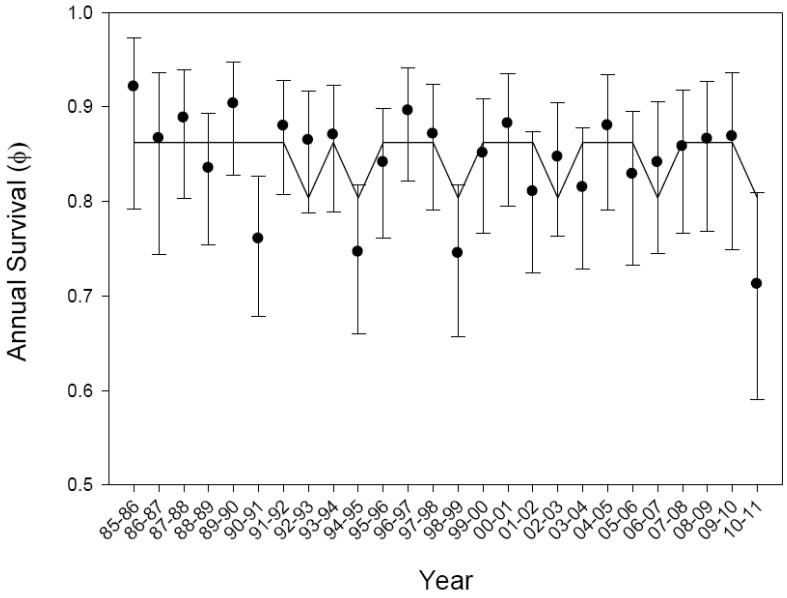
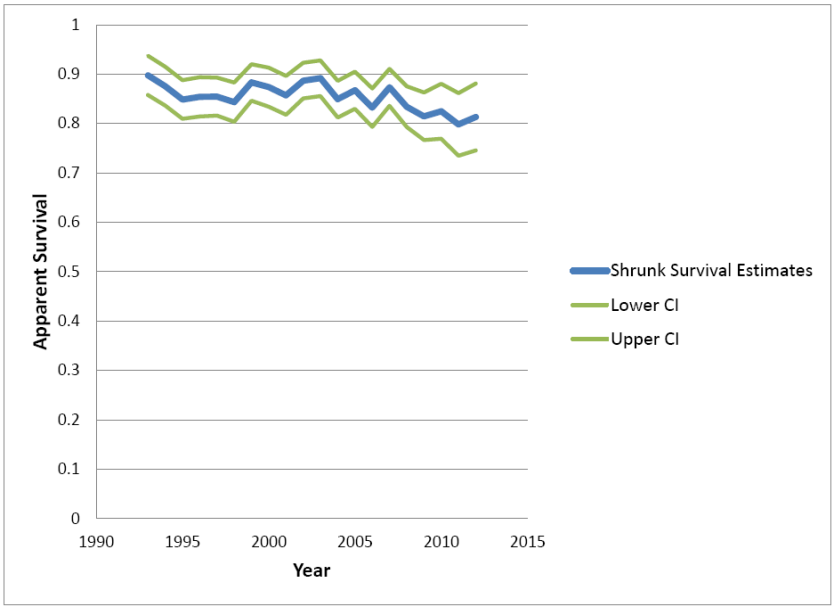


Figure 1.18: Estimates and 95% confidence intervals for NSO apparent survival on the Hoopa Valley Indian Reservation, Humboldt County, California during 1994-2012 (from Higley and Mendia 2013).



Forsman et al. (2011) reported that the presence of barred owls was included in the best model structures for several study areas, including the Green Diamond and Klamath, and was in a competitive model for Northwestern California (Forsman et al. 2011). Given evidence that barred owl presence continued to increase after the study period covered by Forsman et al. (2011) (see Ch. 4), it is likely that the forthcoming meta-analysis will report continued declines in apparent survival for many, if not all, demographic study areas. Franklin et al. (2013) noted that apparent survival in the Northwestern California study area, like reproduction, is influenced by annual variation in weather during the early spring. Thus, recent consecutive years with poor weather during the early spring further suggest that survival has likely continued to decline since the period analyzed by Forsman et al. (2011).

Population Change

A new demographic meta-analysis is expected to be released in 2015. Until then, the 2011 meta-analysis (Forsman et al. 2011) provides the most current available estimates of population change for NSOs across their range. Except for the Green Diamond Resource Company, which submits its data for analysis and reporting in periodic meta-analyses, timber companies do not estimate population change for NSOs. Forsman et al. (2011) stated that their results likely "…reflected conditions on federal lands and areas of mixed federal and private lands within the range of the Northern Spotted Owl because the study areas were (1) large, covering ≈ 9% of the range of the subspecies, (2) distributed across a broad geographic region and within most of the geographic provinces occupied by the owl, and (3) the percent cover of owl habitat was similar between our study areas and the surrounding landscapes." Only one of the study areas included in the meta-analysis was entirely located on private lands (Green Diamond). Thus, it is unclear whether results from the 2011 meta-analysis reflect demographic trends on private lands across the range of the NSO. Given weaker habitat conservation measures for NSOs on many private ownerships compared with federal lands, Forsman et al. (2011) stated that, "if anything, our results depict an optimistic view of the overall population status of the Northern Spotted Owl."

Forsman et al. (2011) reported estimates of the annual finite rate of population change (λ) for 11 study areas located across the NSO's range. Estimates of λ ranged from 0.929 to 0.996 (i.e., declines of 0.4 to 7.1% per year) for these study areas during the period of 1990-2006. There was strong evidence of population declines on seven of the study areas, including the Northwestern California (-1.7% per year) and Green Diamond (-2.8% per year) study areas in California. Negative population trends were also found on the Hoopa study area in California (-1.1% per year) and on the Klamath and South Cascades in southern Oregon (-1.0% and -1.8% per year, respectively) but they were not statistically significant. The weighted mean estimate of λ for all study areas combined was 0.971, indicating an average population decline of 2.9% per year during the study. Variables included in the best model in the meta-analysis of λ indicated effects of ecoregion (geographic location and major forest type) and the proportion of NSO territories with barred owl detections.

In addition to estimates of annual rate of population change, Forsman et al. (2011) provided estimates of realized population change, which describes population change over the study period (Figure 1.19). NSO populations in Washington and northern Oregon declined by approximately 40-60% during 1990-2006. Populations on the Northwestern California and Green Diamond study areas declined by 20-30% during the study period, although the 95% confidence intervals for these estimates slightly overlapped zero (Figure 1.19). Declines of 5-15% were evident on the Hoopa, Klamath and South Cascades study areas but these trends were not statistically significant (Figure 1.19).

Figure 1.19: Estimates of realized population change with 95% confidence intervals for northern spotted owls in California and southern Oregon (from Forsman et al. 2011).

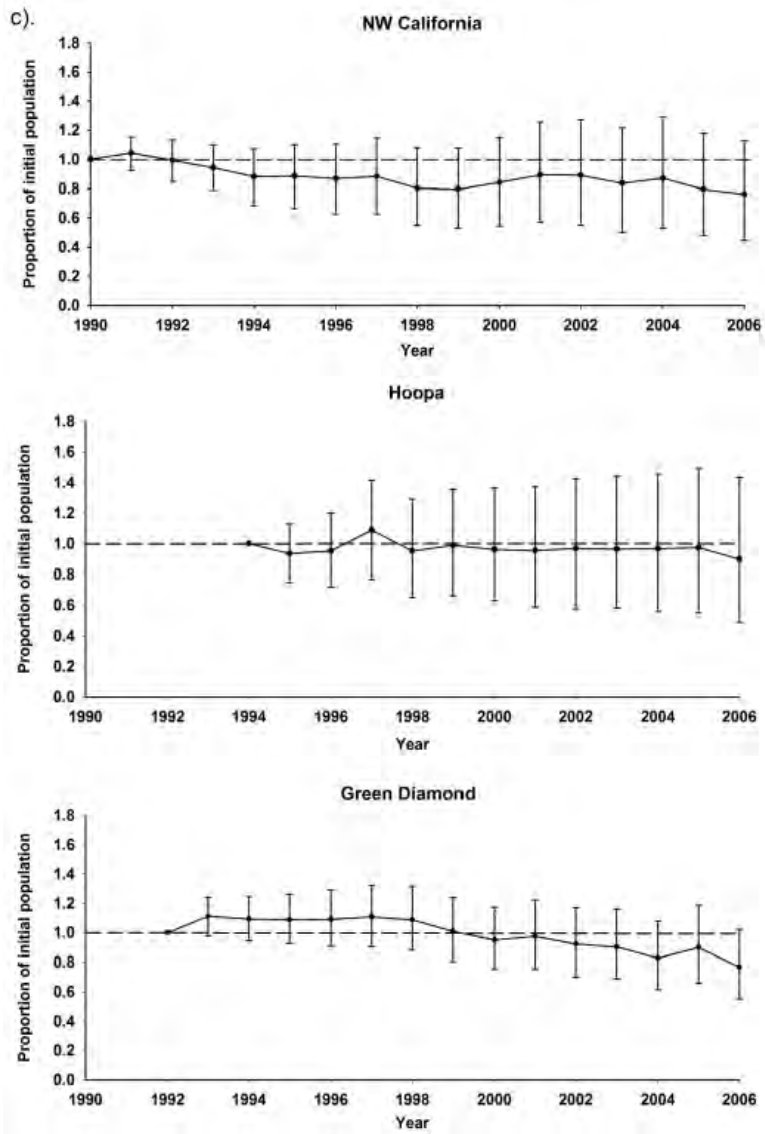
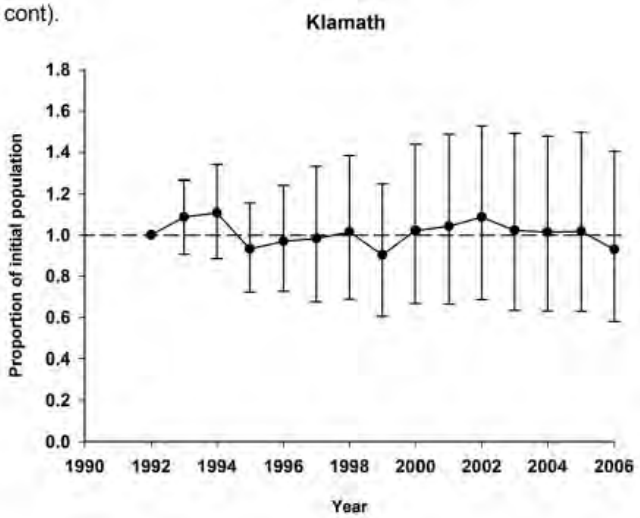
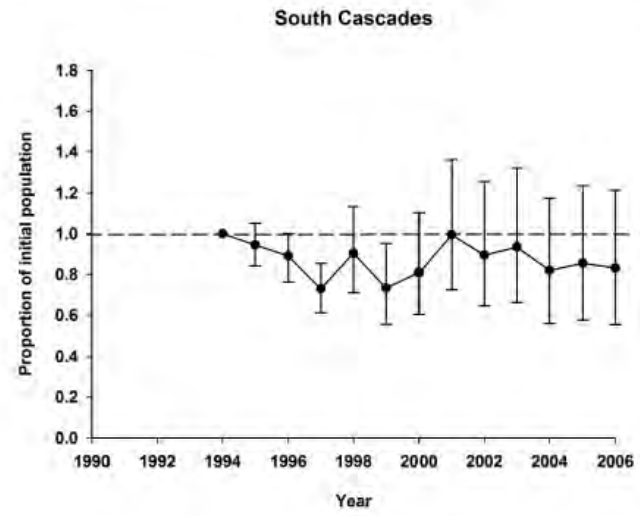


Figure 1.19 (cont.).

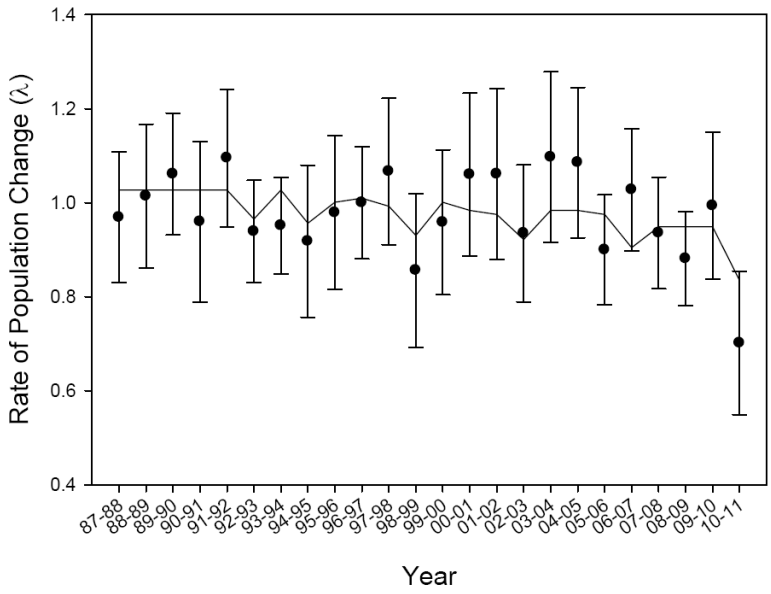
b cont).





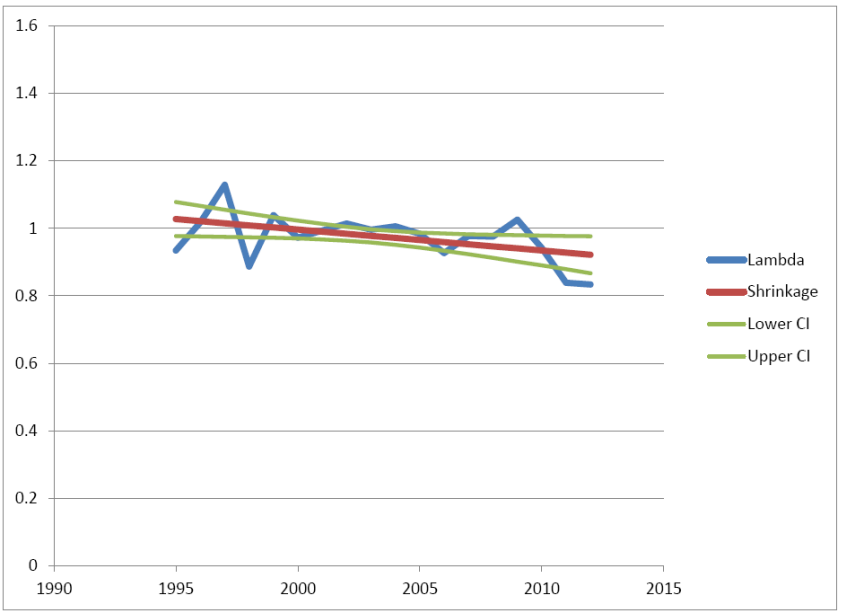
Following the 2011 meta-analysis study period (i.e., >2007), NSOs in the Northwestern California study area experienced a further decline in λ (mean = 0.978 or -2.2% per year) (Figure 1.20). The last year included in this analysis (2011) had the lowest annual estimate of λ found during the 24-year analysis period (Figure 1.20). The forthcoming meta-analysis should reveal whether the substantial drops in apparent survival and λ in the Northwestern California study area in 2011 were anomalous or indicative of an increased rate of population decline in the study area. Franklin et al. (2013) found that fecundity, apparent survival, and λ in the study area fluctuated during "good" and "bad" years, which was likely at least partially related to weather (see above). Annual rate of population change was also apparently negatively affected by increasing presence of barred owls. Given continued increases in barred owls (see Ch. 4), poor weather during the early spring during 2010-2012, and poor reproduction by NSOs during 2011-2013 (see above), it is likely that λ continued to decline on this study area and probably others in California and southern Oregon.

Figure 1.20: Annual estimates of (dots with 95% confidence intervals) and trend in (solid line) rate of population change in the Northwestern California study area (from Franklin et al. 2013).



Higley and Mendia (2013) reported that the estimate of λRJS (Jolly-Seber Capture-Recapture model) for the Hoopa demographic study during 1995-2012 was 0.977, indicating a mean annual population decline of 2.3%. The decline was statistically significant in 2011 and 2012 (point estimates of λRJS not included in the 95% CI; Figure 1.20). Higley and Mendia (2013) noted that "the recent decline in survival, the point estimate of λRJS and the actual number of birds detected this past season all point to a population that is in fact, declining. This apparent decline in spotted owls corresponds with an increase in total annual barred owl detections and proportion of spotted owl territories with barred owl detections." They further noted that the forthcoming meta-analysis will show that it is "...very clear that northern spotted owls are in decline across all 11 study areas and that in many cases the decline is accelerating."

Figure 1.21: Trend in rate of population change on the Hoopa Valley Indian Reservation, Humboldt County, California during 1994-2012 (from Higley and Mendia 2013).



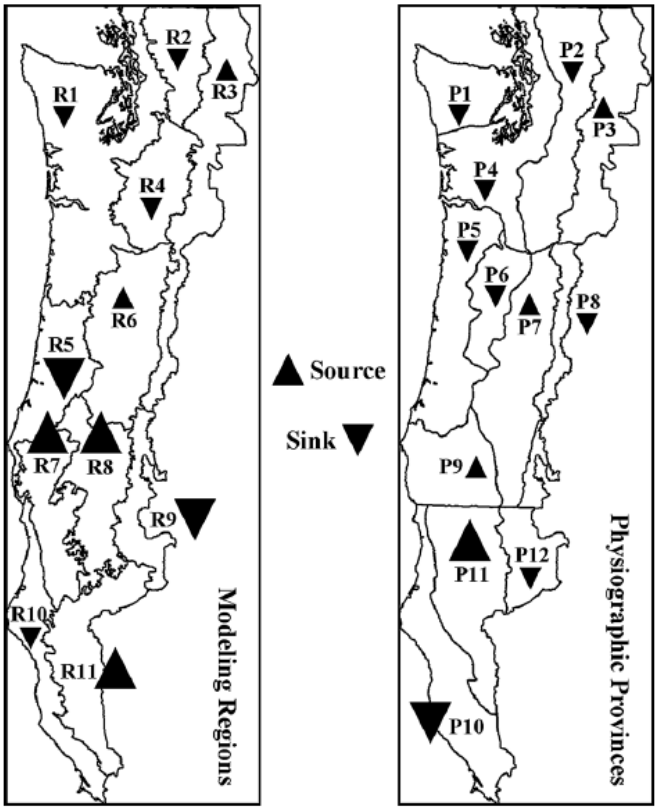
Source-Sink Dynamics

As described by Gutiérrez and Harrison (1996), source-sink dynamics exist for species "…that occupy both high-quality habitats (sources) where populations grow and produce emigrants, and low-quality habitats (sinks) where populations cannot sustain themselves in the absence of immigration." Population sinks potentially function as reservoirs for repopulation of sources that go extinct but may also reduce population growth rates (Pulliam 1988, Gutiérrez and Harrison 1996). Identifying source and sink areas is therefore, an important component of conservation research and planning. For example, identification of population sinks might be useful for determining where to focus habitat restoration or barred owl removal efforts. Empirical studies of relationships between NSO fitness and habitat attributes (Habitat Fitness Potential *sensu* Franklin et al. 2000) provide a rigorous measure of sources and sinks but only at the territory scale and within a given study area, rather than at population or regional levels (see Ch. 2 and 3 for further discussion of Habitat Fitness Potential). In the absence of direct empirical measures of large-scale source-sink dynamics, it may be useful to evaluate the results of source-sink simulation modeling based on empirical data.

Schumaker et al. (2014) recently published a rangewide study of source-sink dynamics for NSOs at the spatial scales of ecological regions and physiographic provinces. Their source-sink simulation modeling incorporated an array of regional data for NSO movement distances and rates, life history attributes, habitat suitability and connectivity, encounter rates with barred owls, and environmental stochasticity. Source-sink dynamics in this study emerged from simulated interactions between individual NSOs and landscapes, rather than being predefined based on habitat suitability as was done in previous studies. The simulation models by Schumaker et al. (2014) predicted that most ecological regions and physiographic provinces currently function as population sinks for NSOs (Figures 1.22 and 1.23). The study's results projected that the Klamath Provinces of California and Oregon and the Interior Northern Coast Ranges of California are the subspecies' strongest population sources (Figure 1.23). The Klamath

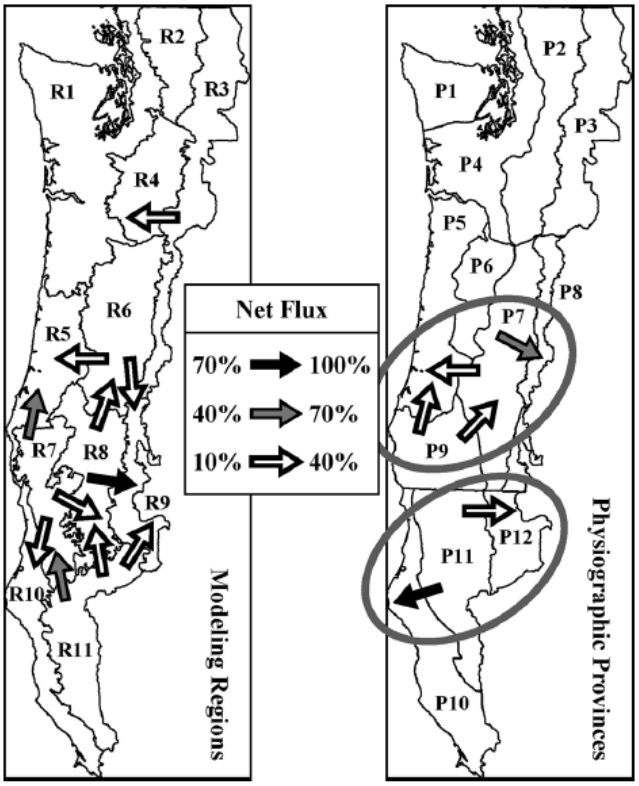
Provinces may be particularly important for maintaining NSO population stability due not only to being net population sources but to their high levels of population connectivity with multiple surrounding regions (Schumaker et al. 2014; Figure 1.23). The Redwood and Southern Cascades regions in California were both classified as moderate population sinks. Schumaker et al. (2014) identified the Klamath Provinces and California Cascades as areas in which it could be particularly important to focus habitat protection and restoration efforts, respectively.

Figure 1.22: Relative source and sink values in northern spotted owl modeling regions and physiographic provinces (from Schumaker et al. 2014). The sizes of symbols denote major versus minor or moderate sources and sinks.



R7: Klamath West, R8: Klamath East, R9: Eastern Cascades South, R10: Redwood Coast, R11: Inner California Coast Ranges, P10: California Coast Range, P11: California Klamath, P12: California Cascades. See Schumaker et al. (2014) for other modeling regions and physiographic provinces.

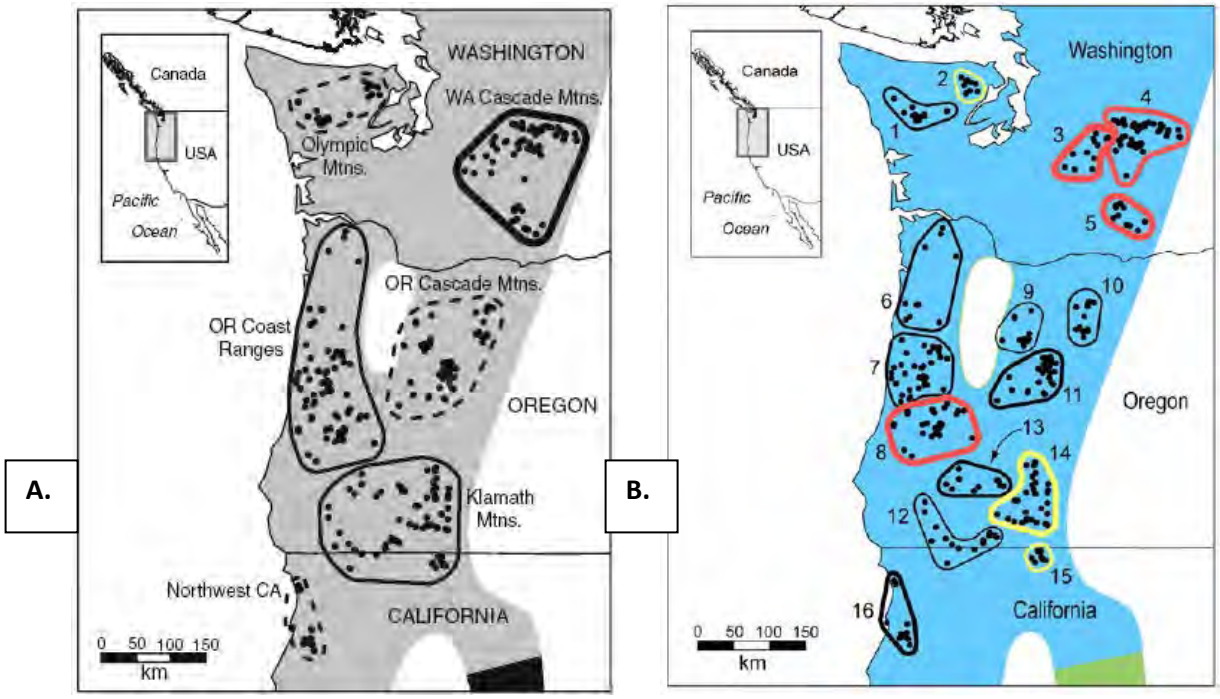
Figure 1.23: Graphical representation of net movement ("Net Flux") of individual (simulated) northern spotted owls from one modeling region or physiographic province to another (from Schumaker et al. 2014). The largest Net Flux values are shown in black, intermediate values in gray, and smallest values in white. Gray ovals highlight two areas with strong patterns of Net Flux.



Genetics

Funk et al. (2010) found statistically significant evidence that NSOs have experienced genetic bottlenecks during recent decades in the Washington Cascades, Oregon Coast Ranges, and "Klamath Mountains" of Oregon and California (Figure 1.24). An earlier report on this study indicates that evidence of a bottleneck in the Klamath Mountains analysis area was primarily driven by data from the southern Cascades of Oregon and California, rather than from the Klamath Provinces (Funk et al. 2008; Figure 1.24). Evidence of recent genetic bottlenecks in the Washington Cascades, Oregon Coast Ranges, and southern Cascades are concordant with recent demographic declines in these regions (Forsman et al. 2011; see *Demography*, above). Surprisingly, Funk et al. (2010) did not find evidence of a genetic bottleneck in the Olympic Mountains of Washington, where NSOs have recently experienced dramatic population declines (Forsman et al. 2011). However, they noted that their small sample size for this region limited their power to detect a genetic bottleneck if one occurred. Funk et al. (2010) did not find statistically significant evidence of a recent genetic bottleneck in northwestern California (Western Klamath and Redwood regions). They suggested that this could likewise have been due to low statistical power or to the relatively gradual population declines reported for that area at the time (see *Demography*, above). The analyses of Funk et al. (2010) did not address whether genetic bottlenecks were solely a result of population declines or were also contributing to them. Genetic declines can contribute to reduced demographic rates through effects of inbreeding depression and loss of adaptive genetic variation (reviewed in Funk et al. 2010).

Figure 1.24: Recent population bottlenecks in NSOs. Points represent 352 individual owls included in the analysis which are grouped into six (A) and 16 (B) regions. Statistically significant bottlenecks are represented by solid lines (A) or yellow ($p = 0.05$) and red ($p = 0.01$) lines (B). (A) represents significant bottlenecks under 5, 10, and 15% multi-step mutation models as solid bold lines and under 10 and 15% multi-step mutation models as finer solid lines (see Funk et al. 2010). (B) indicates greater magnitude bottlenecks with bolder lines. From Funk et al. 2010 (A) and 2008 (B).



Summary of Current Status and Trends

Rigorous long-term research has indicated that NSO populations are dramatically declining in Washington and northern Oregon and more gradually declining in southern Oregon and California (Forsman et al. 2011). Yet, while less precipitous than those in the northern portion of the NSO's range, the rapidity of population declines in southern Oregon and California are cause for grave concern regarding the subspecies' status and trends. A new demographic meta-analysis, which is due for public release during 2015, will replace the 2011 meta-analysis and provide the most reliable information for evaluating the NSO's current status and trends. Based on information available in annual research reports, it is clear that the forthcoming meta-analysis will show that populations in southern Oregon and California are declining more rapidly than was evident in the 2011 meta-analysis (Davis et al. 2013a, Franklin et al. 2013, Higley and Mendia 2013, Dugger et al. 2014, Green Diamond Resource Company 2014).

The NSO's status and trends are less clear in portions of California outside the state's three demographic study areas. Much of the information for these areas is provided by industrial timber companies, which have uniformly concluded that NSO populations on their lands are stable (Calforests 2014). However, the data provided by these companies are insufficient for drawing strong conclusions about the NSO's status and trends, and may in fact indicate declines in occupancy and reproduction on some ownerships (see *Occupancy* and *Demography*, above). Forsman et al. (2011) suggested that, due to weaker habitat

protection, NSO demographic trends could generally be worse on non-federal lands than on the federal and mixed federal/non-federal lands on which most demographic studies are conducted. This appears to be true in California, where NSOs experienced greater declines on Green Diamond Resource Company lands than on nearby tribal and Forest Service lands (Forsman et al. 2011; see *Occupancy* and *Demography*, above). However, the degree to which these differences were due to variation in land management, effects of competition with barred owls, or other factors is unclear.

It is likewise unclear if demographic trends in California's three demographic study areas accurately represent those in drier, less productive forests in the state's interior. An occupancy study in California's Eastern Klamath and Southern Cascades (Farber and Kroll 2012) and demographic studies in ecologically similar areas of southern Oregon (Davis et al. 2013a, Dugger et al. 2014) could provide the most reliable information currently available for evaluating NSO's status and trends in interior California (see *Occupancy* and *Demography*, above). These studies indicate that NSOs are currently declining in at least some portions of the Eastern Klamath and Southern Cascades regions (note: these regions cover portions of both California and southern Oregon as they are ecologically rather than politically defined; see USFWS 2011a Appendix C and Figure 1.22 [left side]). Evidence of population declines in the Klamath regions (Forsman et al. 2011, Farber and Kroll 2012, Davis et al. 2013a, and Franklin et al. 2013) are particularly concerning in light of the critical contributions these areas may provide to the NSO's long-term persistence (Schumaker et al. 2014; see *Source-Sink Dynamics*, above).

Although the Redwood Region is projected to currently function as a population sink, it still retains high densities and abundances of NSOs and is therefore important to the subspecies' conservation (Schumaker et al. 2014; see *Density and Abundance* and *Source-Sink Dynamics*, above). There is limited information available for evaluating the NSO's status and trends in portions of the Redwood Region outside of Green Diamond's lands. Monitoring on National Park Service lands and adjacent ownerships suggest that the population in Marin County is stable while NSOs in the Redwood National and State Parks have substantially declined. These differences appear to be largely due to negative effects of high barred owl densities in the Redwood National and State Parks and the relatively slow rate of the barred owl invasion in Marin County (see *Occupancy*, above). In contrast with the Green Diamond Resource Company, other timber companies in the northern portion of the Redwood Region have concluded that their NSO populations are stable (Calforests 2014). It is possible that NSOs have indeed fared better on these ownerships than on Green Diamond lands; for example, due to less intensive timber harvesting or more recent colonization by barred owls. However, the data provided by these companies are insufficient for drawing firm conclusions about the NSO's status and trends on these lands, and actually appear to indicate at least gradual declines in some areas. More consistent and rigorous monitoring (e.g., consistent survey areas and protocols; reporting of modeled occupancy rates) would assist future evaluations of the NSO's status and trends on industrial timberlands in California.

Acknowledgements

I am extremely grateful to Lowell Diller for his helpful review of this chapter and to Jeff Dunk for his comments on the *Source-Sink Dynamics* section.

Part II: Threats to Northern Spotted Owls in California

Forsman et al. (2011) concluded that habitat loss was partly responsible for declines in NSO fecundity, apparent survival, and/or populations observed in most demographic study areas. Due to a lack of a suitable habitat map at the time, they did not include a habitat variable in models for California. However, a substantial body of research has shown that stand- and landscape-level habitat attributes influence habitat selection, densities, occupancy, reproduction, survival, and metapopulation dynamics of NSOs in California and southern Oregon (e.g., Carey et al. 1992, Gutiérrez et al. 1998, Hershey et al. 1998, Thome et al. 1999, Franklin et al. 2000, Zabel et al. 2003, Carroll and Johnson 2008, Schumaker et al. 2014). Loss of approximately 60-88% of all old forest within the NSOs range during the 19th and 20th centuries was a primary reason for the subspecies' federal listing (USFWS 1990, Strittholt et al. 2006). Despite greater habitat protection following federal listing and implementation of the Northwest Forest Plan, intensive timber harvesting and large wildfires have continued to cause a downward trend in suitable habitat for NSOs and thus, continue to threaten the subspecies (Davis and Dugger 2011, USFW 2011). Yet, NSOs in California and southern Oregon may have complex relationships with these disturbances. For example, low-to-moderate or mixed severity wildfires could sometimes benefit NSOs in these areas by contributing to prey diversity and abundance, provided they do not excessively remove nesting and roosting habitat. In-depth reviews of these topics are provided in Chapters 2 and 3 of this volume.

Demographic analyses indicate that worsening NSO population declines in California and southern Oregon have been driven to a large degree by increasing competitive pressure from invasive barred owls (Forsman et al. 2011, Davis et al. 2013a, Franklin et al. 2013, Higley and Mendia 2013, Dugger et al. 2014, Green Diamond Resource Company 2014). A large body of quantitative and anecdotal information indicates that barred owls negatively affect NSOs in a variety of ways and that they currently pose one of the primary threats to the NSO's long-term persistence (USFWS 2013). These topics, with particular emphasis on information from California, are reviewed in Chapter 4.

Outdoor marijuana cultivation has dramatically increased in recent years and has emerged as a serious potential threat to NSOs in California (Gabriel et al. 2013, Calforests 2014). There is little quantitative information concerning impacts of outdoor marijuana cultivation on NSOs. However, published research of fishers (*Pekania pennanti*), which have overlapping home ranges, habitat associations, and diets with NSOs, suggests that anti-coagulant rodenticides and other pesticides used in outdoor marijuana cultivation currently pose a widespread risk to NSOs in California (Gabriel et al. 2012, 2013, Thompson et al. 2014). In addition to potential behavioral and demographic effects of pesticides on NSOs, outdoor marijuana cultivation could impact the subspecies through suppression of prey populations; ecological changes due to water diversion, clearcutting, and pollution; or habitat loss to wildfires ignited by growers (Gabriel et al. 2013, Bauer et al. 2015). Marijuana cultivation could also impact conservation of NSOs by reducing the ability of biologists to safely and efficiently conduct conservation research and monitoring (Gabriel et al. 2013). These topics are further discussed in Chapter 5.

The apparent effects of weather and climate variables on NSO demographic rates suggest that anthropogenic climate change could pose a major threat to the subspecies (Glenn et al. 2010). This hypothesis is further supported by projections of increased numbers of large wildfires in California under plausible climate change scenarios (see Ch. 3). Climate change could also impact NSOs in California through other climate or weather effects (e.g., increased frequency of droughts), outbreaks of insects and pathogens, large-scale redistribution of major vegetation types, and unpredictable effects on

prey communities (reviewed in USFWS 2012b). Due to limited time and funding, and the complex and ever-increasing body of science covering these topics, a synthesis of this information is not included in this document. State and federal agencies should thoroughly evaluate climate change as a potential threat to NSOs and other species prior to determining their conservation status.

Although not reviewed herein, the stressors described above and in the remainder of this document could have cumulative and interactive impacts on NSOs. For example, Dugger et al. (2011) found that barred owls and habitat fragmentation had an additive negative effect on NSO occupancy rates in southern Oregon. This finding suggests that habitat loss and fragmentation due to timber harvesting or severe wildfires can increase competitive pressure from barred owls. Decreasing population sizes, apparently due primarily to habitat loss and competition with barred owls, can increase risks posed to NSOs by other factors. For example, small NSO populations may become vulnerable to extinction due to chance events such as epidemics or extreme weather or climate events (Franklin et al. 2000). Decreasing population sizes may also have negative genetic effects on NSOs. For example, genetic bottlenecks could further reduce demographic rates through inbreeding depression and loss of adaptive variation (Funk et al. 2010). Also, hybridization between NSOs and barred owls could become more frequent in the future as NSOs become less able to find conspecific mates (Gutiérrez et al. 2007). Policymakers and land managers should acknowledge that, despite limited research of the topic, multiple past and current stressors for NSOs could have important cumulative and interactive impacts on the subspecies.

Ch. 2: Timber Harvesting

Introduction

Timber harvesting was a primary impetus for federal listing of the NSO and is still regarded as one of the major threats to the subspecies (Thomas et al. 1990, USFWS 1990, Courtney et al. 2004, USFWS 2011a). Timber harvesting can directly impact NSO populations by removing, degrading, or fragmenting habitat for them or their prey (reviewed below). Harvesting might also indirectly affect NSOs by increasing effects of other stressors, such as competitive pressure from barred owls (*Strix varia*) (Forsman et al. 2011, USFWS 2011a; see Ch. 4). However, timber harvesting likely has complex effects on NSOs in the southern part of their range due to divergent effects of habitat conditions on survival versus reproduction (Franklin et al. 2000, Olson et al. 2004, Diller et al. 2010). The information reviewed herein suggests that some forms and amounts of harvesting may be sustainable in northern California but that large-scale removal or fragmentation of habitat around activity centers can have strong negative impacts on NSOs (reviewed below and in USFWS 2009).

The kinds of habitat concentrations associated with high survival and fitness of NSOs may be limited in some parts of the subspecies' range due to removal of the majority of old forest during the 19th and 20th centuries (USFWS 1990, Strittholt et al. 2006). Harvesting has been substantially curtailed on federal lands since implementation of the Northwest Forest Plan (Healey et al. 2008, Davis and Dugger 2011, Moeur et al. 2011, Kennedy et al. 2012). However, removal of suitable NSO habitat continues on federal lands and is occurring at higher rates on non-federal lands (Davis and Dugger 2011). On non-federal lands, habitat loss to logging is only partially offset by recruitment of new habitat (Davis and Dugger 2011, Moeur et al. 2011; reviewed below). This is cause for concern since non-federal lands contain a considerable portion of remaining suitable breeding habitat for the subspecies (e.g., >30% of older forest in the Pacific Northwest and northwestern California currently exists on non-federal lands: Moeur et al. 2011) and because recovery of the NSO could partially depend on voluntary conservation efforts on these lands (USFWS 2011a). The timber industry has cited relatively strict harvest regulations in California as evidence that listing of the NSO under the California Endangered Species Act is unnecessary (Calforests 2014). Yet, contemporary harvesting has still resulted in a net loss of suitable breeding habitat for NSOs on non-federal lands in California (reviewed below). Furthermore, the U.S. Fish and Wildlife Service (2009) recently concluded that California's regulations for avoiding "take" of NSOs inadequately protect the subspecies and do not reflect the best available science. Inconsistent or poor implementation of existing regulations could further weaken protections for NSOs on private timberlands in California (reviewed below).

Responses of NSOs to Timber Harvesting

<u>Interior of Northern California and Southern Oregon</u>

NSOs in interior northern California show a strong general preference for relatively old, structurally complex forest. This is illustrated by studies describing both small-scale plots around NSO locations (Solis and Gutiérrez 1990, Rissler 1995, White 1996, Hershey et al. 1998; but see Irwin et al. 2013) and landscape-scale analysis areas around activity centers (Chávez-León 1989, Solis and Gutiérrez 1990, Hunter et al. 1995, Gutiérrez et al. 1998). This body of research can be used to inform conservation measures for NSOs in interior northern California (e.g., for evaluating appropriate habitat definitions in take-avoidance guidelines: USFWS 2009). However, the following review is focused on studies of associations between landscape-scale habitat attributes and NSO demography in interior forests

(Franklin et al. 2000, Olson et al. 2004, Dugger et al. 2005, Schilling et al. 2013). These studies are based on rigorous demographic data and provide the best available insight into potential effects of timber harvesting on NSO populations (USFWS 2009). This review is supplemented with information from studies of associations between landscape-level habitat characteristics in southern interior forests and NSO home range sizes and probability of occurrence (Carey et al. 1992, Carey and Peeler 1995, Zabel et al. 2003, Carroll and Johnson 2008, Schilling et al. 2013).

In the California Klamath, Franklin et al. (2000) found that NSO survival was highest when estimated breeding core areas (390 ac) contained large amounts of both interior (>326 ft from edge) older forest (conifer or mixed forest with conifer QMD ≥21 in and canopy cover ≥70%) and edge with other vegetation classes. In contrast, reproduction was typically highest with lower amounts of interior older forest and greater amounts of edge. Estimated breeding core areas supporting high fitness for NSOs (a function of both survival and reproduction) contained both a large concentration of interior older forest and considerable habitat edge provided by a mosaic of other vegetation patches with convoluted shapes. Franklin et al. (2000) emphasized the difference between total area of older forest versus area of interior older forest. For example, they noted that large amounts of older forest edge cannot occur with low total amounts of older forest. This study did not directly address effects of timber harvesting on NSOs. Vegetation other than older forest was combined into a single class and edges occurred wherever that class and older forest met. Franklin et al. (2000) noted, however, that the dominant silvicultural system in their study area at that time was large-scale clearcutting, which they concluded was unlikely to contribute to the kinds of habitat mosaics found in territories supporting high fitness.

In an unpublished report, Matthews et al. (2008) evaluated the demography of NSOs on the Hoopa Valley Indian Reservation in the California Klamath. Their best performing model explaining NSO survival indicated that survival increased with greater amounts of interior mature or old forest (>80 yrs with "heavy" canopy cover, ≥328 ft from edge) up to about half of a 200-acre analysis area around activity centers and then slightly declined with higher proportions. Survival also increased with increasing amounts of brushy pole-timber forest (conifer stands 10-20 yrs with a "heavy brush component", meant to represent dusky-footed woodrat [*Neotoma fuscipes*] habitat) within estimated territories (917 ac) up to about 16% of the area and then leveled off. Survival was negatively associated with pre-commercial thinning (prescription not described) of brushy pole-timber forest, which Matthews et al. (2008) attributed to a negative long-term effect of thinning on dusky-footed woodrat populations. The best performing model explaining patterns of NSO reproduction indicated that the influence of woodrat habitat on reproduction depended on whether it was a high or low reproduction year and on amounts of mature and old forest. During years with high reproduction, productivity was highest at sites with moderate amounts (19%) of woodrat habitat in a larger core analysis area around activity centers (517 ac), whereas woodrat habitat had little influence on NSO reproduction during low reproduction years. Furthermore, high amounts of mature and old forest apparently offset negative effects of low amounts of woodrat habitat on reproduction; possibly by providing access to alternative prey (e.g., northern flying squirrels) or greater protection from predators or inclement weather (Matthews et al. 2008).

In the interior of the Oregon Coast Range, Olson et al. (2004) found that NSO survival was positively associated with greater amounts of both "mid-seral" (9.5-31.5 in DBH) and "late-seral" (>31.5 in DBH) forest in landscapes around activity centers (≤4,921 ft) and lower amounts of early-seral forest and non-forest (<9.5 in DBH). Reproduction, in contrast, was negatively associated with area of mid- and late-seral forest and positively associated with edge between early-seral and non-forest and other vegetation classes. Olson et al. (2004) encountered technical difficulties with the habitat fitness potential portion of

their modeling but noted that territories supporting high fitness must contain attributes associated with both high survival and high reproduction. This was supported by diagrams made from aerial photos of landscapes around activity centers, which showed remarkably similar habitat mosaics to those presented by Franklin et al. (2000).

Dugger et al. (2005) found a positive association between NSO survival in the Oregon Klamath Province and greater amounts of mature and old forest (≥100 yrs) within estimated breeding core areas (413 ac) and a moderate amount of non-habitat (non-forest, early-seral vegetation, and older forest with harvest entries ≥40% basal area) in the landscape beyond the core area (3,430-ac ring). The specific contribution of timber harvesting (and of different harvest types and intensities) to the non-habitat class and thus, its effects on NSO fitness, were not reported. This study's findings differed from others in that reproduction was positively, rather than negatively, associated with greater amounts of older forest within estimated core areas. These findings suggest that widespread harvesting of older forest within NSO core areas would negatively affect both survival and reproduction in this area but that some level of harvesting might be sustainable in the broader landscape (to the degree that it contributes to "optimal" amounts of non-habitat in the 3,430-ac ring surrounding estimated core areas).

Schilling et al. (2013) found additional evidence of a positive influence of both older forest and habitat heterogeneity on NSO survival in the Oregon Klamath. Their best performing model indicated that monthly survival probabilities for NSOs were highest when home ranges (based on radio-telemetry) contained more patches of mature and old forest (≥20 in DBH and ≥40% canopy cover). The second best performing model indicated a positive association between survival and clustering of (i.e., close distances between) older forest patches. Unlike other studies, they did not find an association between survival and total amount of older forest. They noted that this could have occurred due to their small sample size or because most NSO home ranges in their study had amounts of mature and old forest (mean = 72%) that exceeded threshold amounts required for survival. A third competitive model suggested that survival was also positively associated with a moderate amount of edge between forest (mean DBH ≥5 in) and other cover classes; thus providing additional support for the value of habitat heterogeneity for NSOs in southern interior forests.

Zabel et al. (2003) modeled probability of NSO occurrence (i.e., habitat suitability) across interior northern California based on habitat conditions at an estimated core area scale (500 ac). The best performing model in their study indicated that the probability of NSOs occurring in a given location was highest with large amounts of suitable nesting-roosting habitat (generally ≥17 in DBH and canopy cover ≥60%) and intermediate amounts of foraging habitat (≥10 in DBH and canopy cover ≥40%) at the core area scale. The second and third best performing models at the core area scale included habitat edge. The results of this modeling study provide further support for conclusions that a combination of both a large concentration of suitable habitat and some form of habitat heterogeneity is important to NSOs in interior northern California.

Carroll and Johnson (2008) also modeled probability of NSO occurrence in interior northern California. Based on their best model, predicted abundance of NSOs in the area was highest when most of the landscape (5,930-ac areas) consisted of mature and old forest (>50 yrs). However, predicted abundance slightly declined when area of mature and old forest increased beyond about 80% of the landscape. This study therefore, provides evidence of at least a slight positive effect of other vegetation classes on probability of NSOs occurring in a given area. These results contrasted with the study's findings for more northern parts of the NSO's range, where the probability of occurrence continued to increase (albeit diminishingly) with greater amounts of older forest.

Studies of home range sizes provide another line of evidence concerning habitat and harvesting influences on NSOs in interior southern forests. Home range studies in the Oregon Klamath found that home range size increased with habitat fragmentation (Carey et al. 1992, Schilling et al. 2013). NSOs in the area are known to use regenerating harvest units for foraging, particularly when closer to the activity center or outside the breeding season (Carey and Peeler 1995, Irwin et al. 2013). However, Carey and Peeler (1995) concluded that the energetic benefit of increased access to dusky-footed woodrats in heavily fragmented forest is often outweighed by the energetic cost of increased travel.

In summary, studies in interior northern California have found that NSOs in the region benefit from both large amounts of older forest concentrated around activity centers and some form of habitat heterogeneity (Franklin et al. 2000, Zabel et al. 2003, Carroll and Johnson 2008, Matthews et al. 2008). Similar results have been found in the Klamath (Dugger et al. 2005, Schilling et al. 2013) and interior Coast Range of Oregon (Olson et al. 2004). These findings suggest that NSO populations in southern interior forests can tolerate some level of timber harvesting provided suitable breeding habitat is retained in sufficiently large concentrations around activity centers (USFWS 2009). However, whether and how timber harvesting contributes to beneficial habitat heterogeneity in interior southern forests is unclear. Available studies differed in their findings of types, amounts, and locations of beneficial heterogeneity and did not directly evaluate whether timber harvesting contributed to it. In contrast, it is clear from research of associations between landscape-level habitat attributes and the demography, presence, and home range sizes of NSOs that harvesting within core concentrations of suitable habitat has the potential to negatively affect populations in southern interior forests (USFWS 2009).

Redwood Province

Most of the literature concerning NSOs in the Redwood Province pertains to research on intensively harvested lands owned by the Green Diamond Resource Company. Studies on these lands found a preference among NSOs for landscapes with greater amounts of intermediate-age or older forest than expected based on general availability of those forest classes (Thome et al. 1999, Folliard et al. 2000, Keithley and Motroni 2000, Gonzales 2005, Diller et al. 2010). However, site fidelity and reproduction on these lands were positively associated with presence of younger forest classes and measures of habitat heterogeneity (e.g., edge) (Thome et al. 1999, 2000, Diller et al. 2010). Studies of the habitat associations of dusky-footed woodrats on these lands appear to provide additional support for the value of younger forest and habitat heterogeneity to NSOs in the area (Hamm et al. 2007, Hamm and Diller 2009). Unpublished but relatively rigorous modeling of associations between landscape-level habitat attributes and NSO fitness and population growth rate has confirmed that NSOs on Green Diamond lands have complex relationships with timber harvesting (Diller et al. 2010). NSOs on Green Diamond lands indeed appear to benefit from some level of habitat heterogeneity, which is currently maintained through "small-patch" ($\leq$20 ac) clearcutting (Diller et al. 2010). Yet, habitat quality on these lands (measured as habitat fitness potential, *sensu* Franklin et al. 2000) is positively associated with protection of suitable breeding habitat, and both habitat quality and population growth rate are negatively associated with harvesting of suitable habitat (Diller et al. 2010). Thus, appropriate management of NSOs on Green Diamond lands appears to include avoiding take, setting aside suitable habitat from harvesting, and focusing economically-driven harvest requirements in relatively homogeneous blocks of unsuitable forest created by past large-block clearcutting. Diller et al. (2010) did not describe habitat conditions associated with habitat fitness potential $\geq$1 (i.e., conditions associated with NSOs replacing themselves or contributing to a population surplus). Peer reviewed reporting of these conditions could

be used to refine current take-avoidance guidelines for the Redwood Province (see USFWS 2011b, CAL FIRE 2014).

There does not appear to be any published information concerning the ecology and appropriate management of NSOs on other ownerships within the Redwood Province. Habitat conditions available to and selected by NSOs appear to differ among public and private ownerships (Keithley and Motroni 2000), industrial timber company ownerships (Appendix 2.1), and industrial versus non-industrial timberland ownerships (K. Hoffman, pers. comm.). This variability could reflect differences among forest types (e.g., redwood vs. mixed-evergreen), management regimes (e.g., intensive even-age, intensive uneven-age, and low-intensity uneven-age), and natural disturbance regimes (e.g., pre-settlement fire return intervals in northern vs. southern forests) (see Stuart and Stephens 2006, Sawyer 2007).

The USFWS (2011a, 2012a) recently conducted habitat suitability modeling based on attributes of landscapes (494 ac) surrounding 392 activity centers distributed across much of the Redwood Province. The model selected for the region included a suite of habitat variables and performed well in terms of its ability to discriminate between areas around NSO activity centers and random sites. The resulting map of relative habitat suitability was incorporated into the USFWS (2012a) process for designating critical habitat for NSOs but has limited utility for characterizing habitat selection by the subspecies. However, "deconstruction" of the habitat suitability modeling outputs (cf. Dunk and Hawley 2009, Woodbridge et al. 2012, Zielinski et al. 2012) allows evaluation of associations between habitat suitability and the full range of candidate variables, including ones not included in the best performing model. Deconstruction of the habitat modeling output for the Redwood Province shows that the probability of NSOs occurring in a given area in the region increases with larger amounts of forest with relatively dense canopy cover and large diameter trees (Appendix 2.2). Compared with those in the lowest suitability class, landscapes in the highest suitability class contained an average of 1.8 times more nesting-roosting habitat; 2.4 times higher basal area of conifers ≥20 inches DBH; 2.3 times higher basal area of live trees ≥30 inches DBH; and 2.0, 1.8 and 1.9 times higher densities of conifers ≥20, 30, and 39 inches DBH, respectively. There was a high degree of variability (standard deviation) in terms of structural attributes within habitat suitability classes, particularly for rare habitat elements such as very large diameter trees. As noted above, this variability likely reflects the high diversity of forest types, management histories, and natural disturbance regimes in the region (see Stuart and Stephens 2006, Sawyer 2007). Nonetheless, consistent patterns of association between habitat suitability and mean amounts of these variables are evident. In addition, variability in amounts of many of these habitat attributes (coefficient of variation) declined with increasing habitat suitability, further indicating that they are often important to NSOs in the province. These results suggest that timber harvesting that reduces availability of these structural attributes would generally reduce the probability of NSOs occurring in a given area within the Redwood Province. Changes in availability of these structural attributes can occur with a variety of silvicultural approaches and are not solely caused by even-age harvesting.

Effects of Uneven-Age Harvesting and Thinning

Some private landowners in northern California currently emphasize uneven-age regeneration or management, which typically cause less visually dramatic changes to forests than does even-age harvesting. These forms of harvesting, particularly intensive uneven-age regeneration, nonetheless have the potential to cause substantial changes to forest structure or composition. For example, intensive selective logging of Douglas-fir (*Pseudotsuga menziesii*) has resulted in extensive conversion of mixed-evergreen forest to hardwood-dominated forest in parts of the Redwood Province (Sawyer 2006).

Relatively little harvesting has occurred on federal lands within the NSO's range since adoption of the Northwest Forest Plan (Davis and Dugger 2011, Moeur et al. 2011, Kennedy et al. 2012; see below). However, federal agencies have expressed support for widespread thinning to reduce wildfire risk, restore wildlife habitat, and meet economic objectives in the Plan area (USFS and BLM 1994, USFWS 2011a, 2012a).

Effects of contemporary uneven-age harvesting and thinning on NSOs are difficult to evaluate due to the paucity of rigorous research on the topic. Most of the available information about NSO responses to these silvicultural systems is based on the behavior of very small numbers of telemetered owls and was gathered in an opportunistic fashion during studies of other topics (reviewed in Hansen and Mazurek 2010, USFWS 2011a; see below). Evaluation of this topic is further complicated by poor descriptions of harvest methods, locations and intensities and, perhaps more importantly, post-harvest habitat conditions. The terms uneven-age harvesting and thinning encompass a tremendous variety of harvest types, objectives, and effects (e.g., Graham et al. 1999). Harvesting described in relation to NSO telemetry consisted of a variety of commercial thinning or partial harvesting (leaving residual trees) prescriptions, including understory thinning of various intensities, removal of most trees up to a relatively large diameter class, and shelterwood harvests prior to or without removal of residual trees (see Hansen and Mazurek 2010). The effects of thinning and uneven-age harvesting on NSOs may also be influenced by the condition of the landscape surrounding the harvest unit (e.g., amount, contiguity, and location of suitable NSO habitat), which could be affected by climate, soils, natural disturbance regimes, and past harvesting.

In a synthesis prepared for the 2011 revised recovery plan for the NSO (USFWS 2011a), Hansen and Mazurek (2010) provided detailed summaries of data concerning responses of both NSOs and California spotted owls (*S. o. occidentalis*; CSOs) to uneven-age harvesting, partial harvesting, and thinning. This information was gleaned from both peer-reviewed and gray literature and was based on small sample sizes. The authors therefore, opted to review each data source as a "case study" so that relatively detailed descriptions of harvesting and post-harvest conditions could be provided and so that the methodological strengths and weaknesses of studies could be evaluated. Their review is summarized below, with the addition of thee citations: Matthews et al. 2008, Gallagher 2010, and Tempel et al. *in press*.

All of the reviewed studies that described habitat use patterns by NSOs or CSOs documented at least some use of areas harvested with uneven-age harvesting, partial harvesting, or thinning. At least four of the studies found owls nesting in harvest areas (Forsman et al. 1984, Zabel et al. 1992, King 1993, and Buchanan et al. 1995) and at least five recorded roosting in them (Solis 1983, Sisco 1990, King 1993, Hicks et al. 1999, and Meiman et al. 2003). It is important to note, however, that older-forest structural attributes had been retained or regenerated in most of the harvest areas used for nesting or roosting. Three of the four studies that documented nesting in harvest areas described the nest stands as mature or old forest or an equivalent classification (USFS Region 5 "suitable habitat"; "understory reinitiation phase…of stand development"). The other study did not describe the harvest area used for nesting (King 1993). Harvest areas used for roosting in three studies likewise were either classified as mature or old forest (Solis 1983) or contained some older-forest structural characteristics, such as relatively high basal area or dense canopy cover (King 1993, Meiman et al. 2003). Two studies observed roosting in harvested stands that appeared to differ from this pattern; but one of the authors thought that the deaths of three spotted owls that roosted in them were due to higher predation risk in the more open stands (Sisco 1990, Hicks et al. 1999).

Most of the reviewed studies found that spotted owls foraged to some degree in uneven-age harvested, partially harvested, or thinned areas. Irwin et al. (2005, 2008) stated that some NSOs in their study areas selectively used certain harvest units but not others. However, they did not provide quantitative comparisons of prescriptions, post-harvest conditions, or proximities of harvest units to activity centers. Two other studies found that spotted owls generally avoided foraging in areas that recently experienced moderate to intensive partial harvesting or thinning, whereas use of lightly harvested areas varied among individuals (Anthony and Wagner 1999, Gallagher 2010). Anthony and Wagner (1999) found that NSOs (n = 15) in southern Oregon foraged in heavy and moderate partial-cuts less than expected (old stands with ≥30-40% of the original basal area removed and ≥"moderate" canopy cover reduction [not described]). Light partial-cuts (old forest with ≤20% of the original basal area removed and "small" reductions of "crown cover" [not described]) were used more than expected by two owls, as often as expected by five, and less than expected by eight. In the northern Sierra Nevada, Gallagher (2010) found that CSOs (n = 9) used heavily thinned "defensible fuel profile zones" (canopy cover reduced to 40%, removal of trees <30 in DBH, reduction of tree density and ladder and surface fuels) less than expected based on availability. She also reported a near-significant tendency ($p = 0.08$, n = 5) for avoidance of areas recently treated with understory thinning. Use and availability of harvest areas varied among individuals. Most individuals exhibited avoidance of defensible fuel profile zones and areas treated with understory thinning but one male showed strong selection for thinned areas (primarily understory thinning). It is possible that understory thinning improved prey availability or otherwise benefited this male. However, Gallagher (2010) noted that thinning treatments were located unusually close to this male's activity center, which potentially increased his likelihood of using them due to central place foraging. She also noted that an unusually large proportion of understory thinning units in the male's home range were also treated with prescribed fire, which could have temporarily increased abundances of deer mice (*Peromyscus* spp.) or other prey that tend to respond positively to fire (see Ch. 3).

The limited available information suggests that thinning and uneven-age harvesting causes some spotted owls to increase their home range sizes, which could impose energetic costs on individuals (Meiman et al. 2003, Gallagher 2010). Meiman et al. (2003) reported that a male NSO's breeding season home range in the Oregon Coast Range was slightly larger before commercial thinning than afterward but that its nonbreeding season home range was 2.3 times larger afterward. The individual also appeared to shift its breeding season core area to include less of the thinned area. In the northern Sierra Nevada, Gallagher (2010) found that the home range sizes of CSOs (n = 9) significantly increased with greater total area of fuels treatments (defensible fuel profile zones and understory thinning). She also reported near-significant trends of increasing home range size with greater area of defensible fuel profile zone ($p = 0.08$) and group selection harvesting ($p = 0.06$).

Four studies reported that thinning or partial harvesting near nests or roosts displaced spotted owls from those areas (Forsman et al. 1984, King 1993, Hicks et al. 1999, Meiman et al. 2003; also J. Reid, pers. comm.). The only study to describe this effect for more than two NSOs suggested that pairs' responses to harvesting near their nests depended on the intensity of the harvest, whether or not habitat in the nest area was excluded from harvesting, and whether or not suitable alternative habitat was available within the home range (Forsman et al. 1984).

At least two studies have evaluated potential relationships between spotted owl demographic rates and forest thinning. On the Hoopa Indian Reservation in the Western Klamath region of California, Matthews et al. (2008) found a negative association between survival of NSOs and pre-commercial thinning (prescription not described) of brushy-poletimber forest (conifer forest 10-20 yrs with a dense

brush layer). The researchers attributed this finding to a long-term negative effect of thinning on dusky-footed woodrat populations in the area (see below regarding timber harvest effects on spotted owl prey). Tempel et al. (*in press*) examined associations between CSO demographic rates at 70 territories in the central Sierra Nevada and area of "medium-intensity" harvesting (generally, retention of trees ≥30 in DBH and 40% mean DBH, reduction of fuels). Their best performing model explaining reproduction included a negative effect of medium-intensity harvesting, although evidence for this was statistically weak (95% CI of the beta coefficient broadly overlapped zero).

A recent study modeled recruitment of habitat for NSOs under a particular wildfire and forest thinning scenario in the Klamath and "dry Cascades" regions and concluded that negative effects of thinning on NSOs will outweigh potential benefits to the subspecies due to reduced risk of severe wildfire (Odion et al. 2014). Some of this study's assumptions do not appear to reflect the current scientific understanding of spotted owl-habitat relationships and wildfire and thinning effects on the species. For example, recruitment of NSO habitat was broadly defined in the study (recruitment of forest with basal area ≥120 ft^2/ac) and does not reflect the subspecies' relationships with other structural attributes, such as canopy cover, canopy layering, and large diameter trees. This study was also based on an assumption that commercially thinned and severely burned areas are always unsuitable for NSOs. NSOs are known to nest, roost, and forage in thinned areas (see above) and patchy severe fire appears to benefit NSOs in some areas, provided it does not result in extensive loss or degradation of nesting and roosting habitat (see above and Ch. 3). This study was further based on an assumption that federal agencies will blindly apply thinning to landscapes, including substantial areas of NSO habitat, rather than strategically locating treatments in areas more likely to burn at high severity and less likely to be used by NSOs (e.g., upper slopes, southwesterly aspects, densely-canopied young forest: Skinner and Taylor 2006, Skinner et al. 2006, Irwin et al. 2012). Modeling simulations have suggested that thinning can be strategically applied to relatively small portions of landscapes to reduce fire risk while minimizing negative short-term effects on spotted owls (Ager et al. 2007, Lehmkuhl et al. 2007, Prather et al. 2008).

Federal agencies have expressed support for widespread thinning to reduce the risk of severe wildfire in dry forests within the NSO's range (USFS and BLM 1994, USFWS 2011a, 2012a). The review provided in Chapter 3 suggests that spotted owls are often resilient to wildfire, and may benefit from some amount of low-to-moderate severity, mixed severity, or patchy fire in interior forests in southern Oregon and California, but that extensive severe fire can negatively affect the species by reducing amounts and contiguity of nesting and roosting habitat. This conclusion might appear to support widespread thinning to reduce the risk of large severe fires in NSO home ranges. However, preliminary findings of negative effects of thinning on spotted owls and the overall lack of reliable information on the topic suggest that rigorous research is needed to determine how best to balance tradeoffs for habitat conservation and fuels reduction objectives. If thinning is applied prior to conducting rigorous research of its effects on NSOs, research of the subspecies' habitat and prey relationships suggests that it should generally be located well away from activity centers and focused in young, closed-canopy stands with poorly developed brush layers. Thinning in these stands has the potential to increase habitat heterogeneity and accelerate development of complex, older-forest structure for NSOs and their prey (Carey 2006; but see below regarding effects of thinning on primary prey species). Planning of treatments should also integrate regional or local information about relationships between wildfires and topography (see Ch. 3), the composition of NSO diets or prey communities, and other ecological factors that could influence how thinning affects wildfires and NSOs.

Timber Harvest Effects on Prey

The primary prey for NSOs in California are dusky-footed woodrats, northern flying squirrels (*Glaucomys sabrinus*), and tree voles (*Arborimus* spp.) (Zabel et al. 1995, White 1996, Ward et al. 1998, Farber and Whitaker 2005, Diller et al. 2010, Klamath National Forest, unpubl. data). Other important prey in the state (either in terms of frequency or biomass contributions to diets) include other voles (*Myodes californicus*, *Phenacomys* spp., and *Microtus* spp.), deer mice (*Peromyscus* spp.), pocket gophers (*Thomomys* spp.), broad-footed moles (*Scapanus latimanus*), and juvenile brush rabbits (*Sylvilagus bachmani*) and snowshoe hares (*Lepus americanus*). These species have a broad array of habitat associations and thus, likely respond quite differently to timber harvesting and other forest disturbances. The review below focuses solely on timber harvest effects on the three primary prey species for NSOs in California. It is important to acknowledge, however, that NSOs typically have broad diets (see diet studies cited above) and that other prey species may also influence spotted owl demographic rates (Ward and Block 1995, Rosenberg et al. 2003).

Dusky-footed woodrats can occur in relatively high abundances in old forest, particularly in riparian areas and other locations with a well developed understory or brush layer (Carey et al. 1992, 1999). However, they generally reach their highest abundances in stands of brushy poletimber that develop following severe disturbances (Carey et al. 1992, 1999, Sakai and Noon 1993, Anthony et al. 2003, Hamm et al. 2007). Thus, intensive harvesting of intermediate-age stands could potentially result in temporary increases in abundance of dusky-footed woodrats. There is little information regarding effects of less intensive harvesting on dusky-footed woodrats. Hamm and Diller (2009) rarely found dusky-footed woodrats in thinned stands on Green Diamond Resource Company lands in the Redwood Region. They suggested that thinning without prescribed burning was insufficient for promoting growth of the disturbance-adapted shrubs locally favored by the species (see Ch. 3 regarding short-term effects of fire on prey). Matthews et al. (2008) did not directly evaluate effects of thinning on dusky-footed woodrats in the California Klamath. However, they suggested that the negative association between NSO survival and pre-commercial thinning of brushy-poletimber forest in their study was likely due to long-term declines in woodrats following thinning.

Densities and demographic rates of northern flying squirrels are positively associated with habitat elements found in forests (e.g., arboreal lichens, truffles, and snags: Rosenberg and Anthony 1992, Carey 1995, Waters and Zabel 1995, Gomez et al. 2005, Meyer et al. 2005, Lehmkuhl et al. 2006). Thus, they are likely to respond negatively to intensive forms of timber harvesting (e.g., Waters and Zabel 1995). Northern flying squirrels are also generally sensitive to habitat fragmentation caused by intensive harvesting (Smith 2007). For example, Rosenberg and Raphael (1986) found that densities of northern flying squirrels in the California Klamath Province were substantially lower in the smallest and most insular habitat patches (due to surrounding clearcut harvesting) than in the largest and best connected patches.

Research concerning the effects of thinning and other lower-intensity forms of harvesting on northern flying squirrels has generated inconsistent results (e.g., Carey 2000, Ransome and Sullivan 2002, Ransome et al. 2004, Gomez et al. 2005, Manning et al. 2012). Some of the inconsistency appears to be due to whether treated young stands are compared with structurally simple young stands (e.g., Gomez et al. 2005), structurally complex young stands (e.g., Carey 2000), or stands that have not recently experienced harvesting (Holloway and Smith 2011). The available research suggests that treated stands are more likely to contain relatively low abundances of northern flying squirrels when compared with structurally complex or mature and old stands, whereas they may exhibit similar or even higher

abundances when compared with structurally simple young stands. Harvest intensity and levels of retention appear to be another major determinant of thinning effects on northern flying squirrels, with higher intensity thinning (lower retention levels) having stronger negative effects (Meyer et al. 2007, Holloway and Smith 2011, Manning et al. 2012; but see Ransome et al. 2004). Whether thinning is patchy or uniform (in terms of location and intensity) might also be important. For example, thinning can reduce the availability of truffles, the northern flying squirrel's primary food, for more than 10-20 years; but variable-density thinning appears to be less harmful than commercial thinning (Waters et al. 1994, Colgan et al. 1999, Luoma et al. 2003, Meyer et al. 2005).

Tree voles generally occur at higher densities in old forests than in young forests (reviewed in Sztukowski and Courtney 2004, USFWS 2011c) and selectively use forests containing higher concentrations of habitat elements typically found in older stands (e.g., older stand age, larger diameter downed wood, greater basal area: Dunk and Hawley 2009). Tree voles are thought to be highly vulnerable to logging and other disturbances that reduce the extent and contiguity of old forests (Carey 1991, Huff et al. 1992, Hayes 1996, Adam and Hayes 1998, USFWS 2011c). Some tree vole populations occur in intensively managed landscapes with little or no old forest (e.g., Thompson and Diller 2002). However, the U.S. Fish and Wildlife Service (2011b) noted that "the limited evidence available suggests that tree vole occupation of younger forest stands may be relatively short-lived (Diller 2010, pers. comm.) or intermittent (Hopkins 2010, pers. comm.)." Based on the natural histories of these species, reducing or fragmenting older forest could negatively affect them; but retention of older Douglas-fir (*Pseudotsuga menziesii*) trees and patches of well-connected canopy might ameliorate those impacts (Hayes 1996, Adam and Hayes 1998, USFWS 20011b). Clear-cutting and other severe disturbances should have the strongest effects on tree voles, due to the species' diet, nesting habitat associations, arboreal mode of travel, and apparently poor mobility (USFWS 2011c). However, for these same reasons, thinning could also negatively affect tree voles (Wilson and Forsman 2013).

Habitat Lost to Past Timber Harvesting (1800s to 1994)

Rigorous research has shown that the fitness of NSOs in the southern part of their range is highest in landscapes with large concentrations of suitable breeding habitat (reviewed above). The following review shows that the current availability of suitable breeding habitat was strongly affected by past timber harvesting, which removed or modified the majority of old forest that existed historically.

There do not appear to be any existing estimates of the amount of suitable NSO habitat that existed at the time of Euro-American settlement (early to mid-1800s). Nesting-roosting habitat for NSOs generally occurs in relatively old, structurally complex conifer forest (Blakesley 2004). It is therefore, reasonable to evaluate historical trends in old conifer forest as a rough proxy for changes in amounts of suitable NSO habitat (USFWS 1990). Estimates reviewed for the NSO's federal listing determination indicated that approximately 18-24 million acres of old forest existed in western Oregon and Washington and northwestern California during the early to mid-1800s (USFWS 1990). These estimates did not include all regions or potentially suitable forest types within the subspecies' range. After including all regions and conifer forests, Strittholt et al. (2006) estimated that about 40 million acres of old conifer forest (>150 yrs) existed at the time of Euro-American settlement (Table 2.1). This is a crude approximation, as it is based on incomplete historical information and an assumption that nearly all pre-settlement conifer forest was old (i.e., had not experienced severe disturbance within the previous 150 years). However, Strittholt et al. (2006) noted that their regional estimates closely matched previous estimates for similar regions and forest types, suggesting that they provide a reasonable baseline for comparison with contemporary forest conditions.

Using satellite imagery, Strittholt et al. (2006) estimated that 11.5 million acres of old conifer forest existed in 2000 (Table 2.1). Thus, an estimated 72% of old conifer forest was lost in the Pacific Northwest during the 19th and 20th centuries (Table 2.1). This estimated post-settlement loss of old conifer forest is similar to earlier estimates of 60-88% reviewed in the NSO's federal listing determination (USFWS 1990). Strittholt et al. (2006) did not provide estimates of old forest declines for California alone. Old conifer forests declined by 62% in the Klamath provinces ("Klamath-Siskiyou Forests") and 79% in the eastern Cascades provinces ("Eastern Cascades Forests"), both of which substantially overlap with the NSO's range in northern California. Other than in two small regions surrounding major population centers in Washington and Oregon, declines in old conifer forest were primarily caused by widespread intensive logging (Strittholt et al. 2006). Mountainous terrain in the Klamath and eastern Cascades limited timber harvesting compared with more accessible areas but major losses of old conifer forest nonetheless occurred in those areas (Strittholt et al. 2006). Strittholt et al. (2006) did not evaluate trends in amounts of old forest for the Redwood Province but other sources estimated that 85-96% of old redwood forest was lost to intensive timber harvesting during the post-settlement period (USFWS 1992).

Table 2.1: Area (ha) of Pacific Northwest ecoregions and estimated historical (early to mid-1800s) and contemporary (2000) extents of old (>150 yrs) and mature (50-150 yrs) conifer forest within them (from Strittholt et al. 2006).

	Cascade Mountain Leeward Forests	*North Cascades Forests*	*Puget Lowland Forests*	*Central Pacific Coastal Forests*	*Central & Southern Cascades Forests*	*Eastern Cascades Forests*	*Klamath-Siskiyou Forests*	*Willamette Valley Forests*
Ecoregion area	1,600,444	1,278,056	1,719,726	4,267,988	4,481,279	5,398,139	5,033,181	1,487,769
Historical old conifer area	960,279	766,844	1,289,794	3,627,790	3,361,005	3,238,883	2,516,625	371,942
Percentage of ecoregion	60	60	75	85	75	60	50	25
Current old conifer area	420,394	511,396	67,353	668,281	1,328,796	687,836	946,394	34,993
Percentage of historical old conifer	44	67	5	18	39	18	38	9
Percent change	−56	−33	−95	−82	−61	−79	−62	−91
Mature conifer area	285,441	203,994	229,634	683,098	899,266	947,215	1,239,586	270,362
Percentage of historical old conifer	30	27	18	19	27	25	49	73
Combined area	705,835	715,391	296,987	1,351,379	2,228,063	1,635,051	2,185,980	305,355
Percentage of historical old conifer	74	93	23	37	66	43	87	82

Strittholt et al. (2006) reported that the majority of old (78%) and mature (50%) conifer forest in 2000 existed on public lands. Nearly all of the remaining old redwood forest likewise occurs on public lands, such as California state parks. Much of the current difference among ownerships in amounts of older forest and suitable breeding habitat is due to past timber harvest rates. For example, loss of forest to harvesting during the 1970s through early 1990s occurred at substantially higher rates on private timberlands than on federal lands (e.g., >2 times faster in western Oregon) (Cohen et al. 2002, Staus et al. 2002, Healey et al. 2008). Nonetheless, an estimated 32% of suitable breeding habitat for NSOs occurred on non-federal lands at the time of the Northwest Forest Plan's implementation (1994), so conservation efforts for NSOs on non-federal lands remain important.

Although timber harvesting was substantially curtailed on federal lands following implementation of the Northwest Forest Plan (Healey et al. 2008, Kennedy et al. 2012; reviewed below), biologists noted the possibility that NSOs would continue to decline for many years due to lag effects of past harvesting (Courtney et al. 2004). The NSO has a relatively low reproductive rate and might therefore be unable to

immediately recover following removal or reduction of threats (Noon and Biles 1990). Furthermore, substantial recruitment of old forest and suitable nesting-roosting habitat could take multiple decades in areas that formerly experienced widespread intensive harvesting (Moeur et al. 2011; see below). Past harvesting could therefore be among the causes of continuing poor demographic performance of some NSO populations (Courtney et al. 2004). Forsman et al. (2011) noted, however, that some populations are declining on lands not previously subjected to widespread intensive timber harvesting (e.g., some National Parks). Based on this observation, they concluded that lag effects of past timber harvesting poorly explain continuing population declines. Yet, it is possible that historical timber harvesting does continue to contribute to population declines but that this effect is obscured by that of other stressors, such as competition with invasive barred owls (see Ch. 4). Regardless of potential lag effects of historical harvesting on NSOs, timber harvesting continues to occur at high rates on private lands and is one of the primary sources of habitat loss for the subspecies (Davis and Dugger 2011, Moeur et al. 2011, Kennedy et al. 2012; reviewed below).

Habitat Lost to Contemporary Timber Harvesting (1994-2007)

Davis and Dugger (2011) estimated NSO habitat trends following implementation of the Northwest Forest Plan. Their analyses were mostly limited to federal lands within the Plan area but they also estimated habitat trends on non-federal lands, as reported in the 2011 revised NSO recovery plan (USFWS 2011a). In addition to these analyses, the following review includes results of research by Moeur et al. (2011), which provide additional insight into recent habitat trends for NSOs on non-federal lands. This review does not include habitat trend estimates based on federal ESA Section 7 consultation records (Bigley and Franklin 2004, USFWS 2012b). These records provide a less consistent and complete data source than those used by Davis and Dugger (2011) (see Bigley and Franklin 2004). They may also overestimate habitat changes since they evaluate effects of planned projects, which may be greater than what is actually implemented (Bigley and Franklin 2004).

Davis and Dugger (2011) used remotely sensed (satellite imagery) and forest inventory plot vegetation data to model changes in habitat suitability for NSOs during the first 15 years of the Northwest Forest Plan (1994-2007 in California and 1996-2006 in Oregon and Washington). They modeled habitat suitability based on habitat attributes surrounding thousands of NSO pair locations. Suitable breeding habitat was defined as having both a probability of owl presence greater than expected based on random chance and environmental conditions typical of those found around nesting and roosting pairs. Habitat loss was defined as a change in suitability rank from suitable or highly suitable to marginal or unsuitable due to vegetation changes caused by forest disturbances. Davis and Dugger (2011) did not estimate recruitment of, or net changes, in breeding habitat. They felt that their remotely sensed data poorly captured the kinds of slow and subtle habitat changes that occur during development of intermediate-aged and older stands. However, Moeur et al. (2011) estimated trends in mature and old forests during the same time period, which could provide insight into net changes in breeding habitat for NSOs.

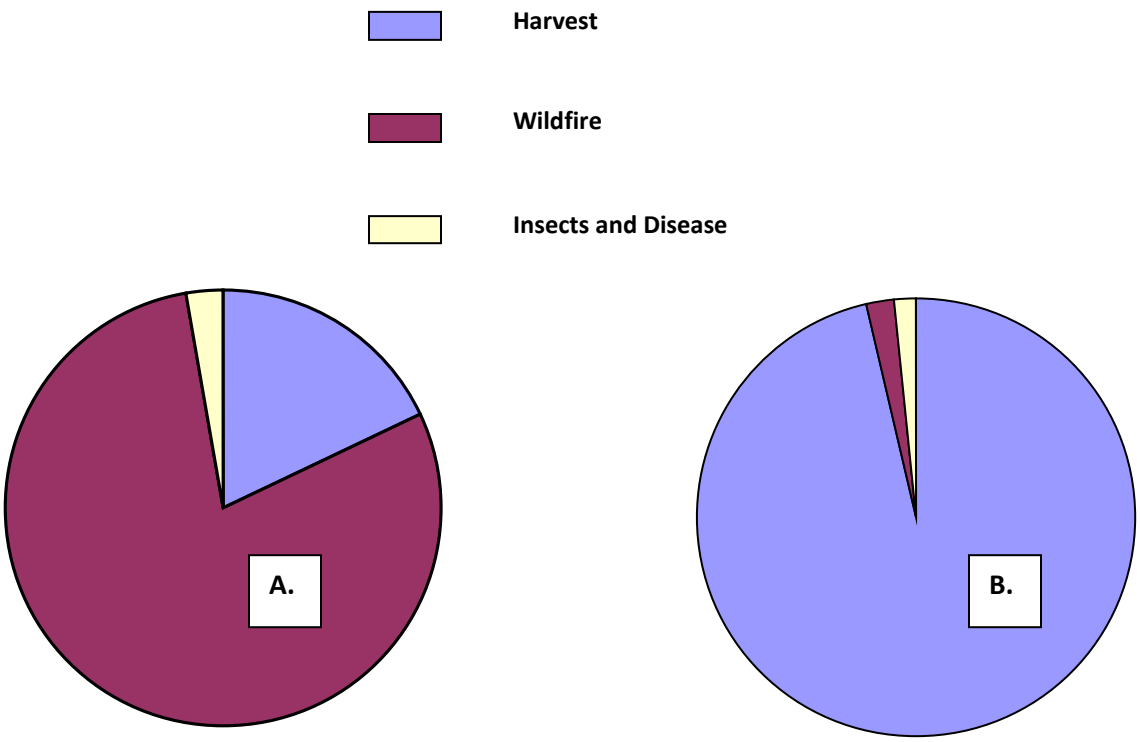
Table 2.2 shows estimated gross losses of suitable NSO breeding habitat to timber harvesting on federal and non-federal lands during the first 15 years of the Northwest Forest Plan (Davis and Dugger 2011, USFW 2011a). Timber harvesting was responsible for a gross loss of about 54,000 acres (0.6%) of suitable breeding habitat on federal lands. This loss likely had little rangewide effect on NSOs but could have impacted the subspecies at local or regional scales. For example, harvesting resulted in a 3% gross loss of suitable breeding habitat on federal lands in the California Cascades, where habitat was already relatively limited. Approximately 92% of total suitable breeding habitat lost to timber harvesting occurred on non-federal lands. In contrast with federal lands, nearly all estimated gross habitat loss on

non-federal lands was due to timber harvesting rather than natural disturbances (Figure 2.1; see Ch. 3). In just 11-13 years, timber harvesting caused an estimated rangewide gross loss of 625,600 acres (15%) of suitable breeding habitat on non-federal lands. The largest losses on non-federal lands occurred in Oregon (301,200 ac, 22%) and Washington (234,200 ac, 19%). Non-federal lands in California experienced lower gross losses of suitable breeding habitat to harvesting (90,200 acres, 6%). Nonetheless, losses in all three states were substantial given the short time frame during which they occurred and the likelihood that little of the loss was offset by recruitment of suitable breeding habitat during that period (see below).

Table 2.2: Estimated gross losses of suitable NSO breeding habitat on federal and non-federal lands due to timber harvesting during 1994-2007 in California and 1996-2006 in Oregon and Washington (adapted from Davis and Dugger 2011, USFWS 2011a).

State	Ownership	Province	1994/1996 Ac	Harvest Ac	Harvest %
California	**Federal**	CA Cascades	213,200	6,500	3.0%
		CA Klamath	1,489,800	4,400	0.3%
		CA Coast	145,400	300	0.2%
		CA Federal Total	**1,848,400**	**11,200**	**0.6%**
	Non-Federal		**1,556,700**	**90,200**	**5.8%**
	Combined		**3,405,100**	**101,400**	**3.0%**
Oregon	**Federal**	OR Coast Range	611,200	3,300	0.5%
		Western OR Cascades	2,258,700	13,900	0.6%
		Eastern OR Cascades	402,900	5,800	1.4%
		Willamette Valley	3,400	100	2.9%
		OR Klamath	985,000	6,800	0.7%
		OR Federal Total	**4,261,200**	**29,900**	**0.7%**
	Non-Federal		**1,382,400**	**301,200**	**21.8%**
	Combined		**5,643,600**	**331,100**	**5.9%**
Washington	**Federal**	Olympic Peninsula	763,100	500	0.1%
		Eastern WA Cascades	673,600	8,100	1.2%
		Western WA Cascades	1,283,000	3,700	0.3%
		Western WA Lowlands	24,700	400	1.6%
		WA Federal Total	**2,744,400**	**12,700**	**0.5%**
	Non-Federal		**1,258,900**	**234,200**	**18.6%**
	Combined		**4,003,300**	**246,900**	**6.2%**
Rangewide	**Federal**		**8,853,800**	**53,800**	**0.6%**
	Non-Federal		**4,198,000**	**625,600**	**14.9%**
	Combined		**13,051,800**	**679,400**	**5.2%**

Figure 2.1: Proportions of suitable breeding habitat loss attributed to harvesting, wildfire, and insects and diseases on (A) federal lands and (B) non-federal lands during 1994-2007 (adapted from Davis and Dugger 2011 and USFWS 2011a).



The USFWS (2011a) and Davis and Dugger (2011) did not describe regional habitat trends for non-federal lands. However, insight into regional habitat trends on non-federal lands can be obtained from trends in mature and old forest during the same time period. Moeur et al. (2011) reported substantial gross losses of mature and old forest (mean DBH ≥20 in) on non-federal lands during the first 15 years of the Northwest Forest Plan. The largest gross losses, in terms of acreage, occurred in the Western Washington Lowlands (387,200 ac, 49%), Oregon Coast Range (362,500 ac, 50%), and California Coast Range (259,000 ac, 35%). All provinces and states within the NSO's range experienced large proportional losses, ranging from 31% in the Eastern Washington Cascades to 48% and 52% in the Klamath and Eastern Cascades of Oregon. Confirming the results of Davis and Dugger (2011; Figure 2.1), Moeur et al. (2011) found that gross losses of mature and old forest on non-federal lands were almost entirely due to timber harvesting (also see Kennedy et al. 2012).

Moeur et al. (2011) reported that gross loss of mature and old forest was substantially offset by recruitment into that habitat class. They noted, however, that given the short length of the monitoring period (10-14 yrs), recruitment was "likely due to incremental stand growth over the 20-in diameter threshold, or from understory disturbances that removed smaller diameter trees and raised the average stand diameter above the threshold, rather than from an increase in forests of much larger and older trees." Thus, it is unlikely that there was substantial recruitment of suitable and highly suitable breeding habitat for NSOs during this time period. This conclusion is supported by Davis and Dugger (2011), who found that most of the detectable habitat recruitment during their monitoring period occurred in the marginal suitability class, which more closely resembled their definition for dispersal habitat than for breeding habitat. Even if all mature and old forest recruited during the first 15 years of the Plan provided suitable breeding habitat for NSOs, non-federal lands in California still experienced a net decline in area of mature and old forest during that period, and those in Washington and Oregon fared substantially worse (Moeur et al. 2011).

Future Harvesting in California

It is impossible to provide reliable projections of future timber harvesting or its effects on NSOs in California. Federal agencies have expressed support for widespread thinning to address wildfire risk on public lands in the state but there do not appear to be any projections of future harvest volume or effects on NSOs from these activities (USFS and BLM 1994, USFWS 2011a, 2012a). Documents associated with Habitat Conservation Plans for private timberlands in California project substantial impacts of harvesting on some ownerships and relatively low impacts on others. Many landowners, in the state, including some large industrial timber companies, conduct timber harvesting outside of Habitat Conservation Plans. The state requires evaluation of potential environmental impacts of all Timber Harvest Plans but both landowners and responsible agencies have used inconsistent methods for conducting these evaluations. For example, some entities have strictly adhered to the state's Forest Practice Rules (CAL FIRE 2014), others have relied on poorly described and vetted variants of those rules (e.g., "option g+"), and still others have opted to follow the Yreka or Arcata U.S. Fish and Wildlife Service Offices' (2009, 2011b) recommendations. Based on an in-depth review of research concerning the NSO's habitat and spatial relationships, the U.S. Fish and Wildlife Service Yreka Office (2009) recommended sweeping changes to NSO habitat retention guidelines in the Forest Practice Rules for California's northern interior. These recommendations are more scientifically supportable than are habitat retention guidelines in the Forest Practice Rules (CAL FIRE 2014), as they incorporate the large body of research of NSO-habitat relationships conducted since 1992 when guidelines in the Forest Practice Rules were created. In addition they were designed to enable CAL FIRE personnel lacking expertise with NSO-habitat relationships to properly determine if take would occur. However, the state

has not officially adopted these recommendations or any other changes that incorporate the tremendous body of research and biological expertise concerning NSO-habitat relationships developed since 1992 (USFW 2009). Furthermore, since 2008, when the US Fish and Wildlife Service largely ceased providing technical assistance with timber harvest reviews in northern California, relatively few Timber Harvest Plans have been reviewed by personnel with sufficient biological expertise to evaluate whether or not take will occur. Lacking reliable harvest and take projections, and barring a major change in the legal or regulatory framework protecting NSOs, there is currently no reason to conclude that timber harvest effects on NSOs in California will substantially decline in the near future.

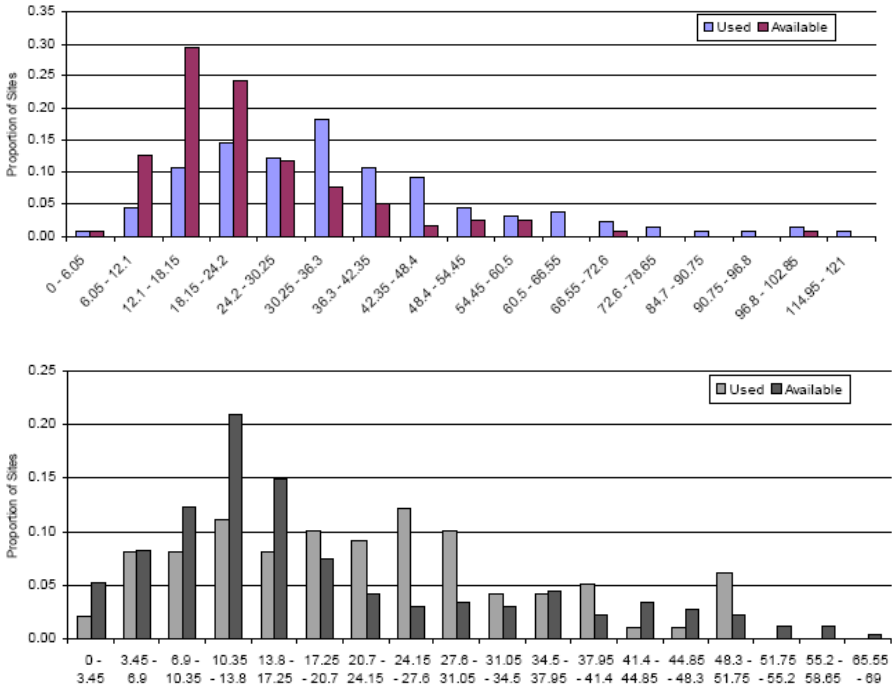
Acknowledgements

I am grateful to Ray Davis and Ken Hoffman for their insightful reviews of this chapter.

Appendix 2.1

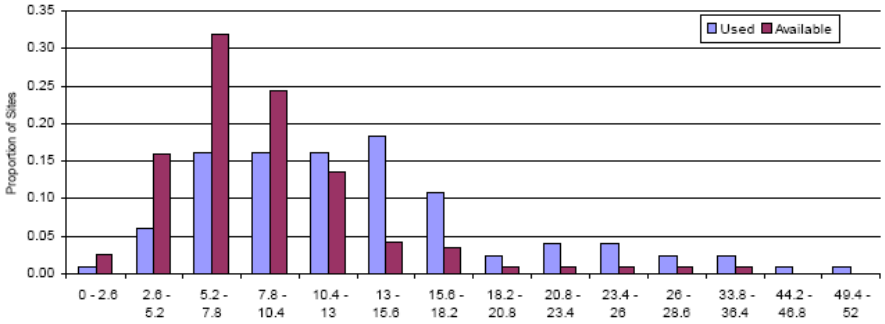
USFWS GNN (see USFWS 2011a) histograms showing use by NSOs versus availability of select habitat attributes at a landscape-scale (200 ha, 494 ac) on Mendocino Redwood Co. (left column) and Green Diamond Resource Co. lands (right column).

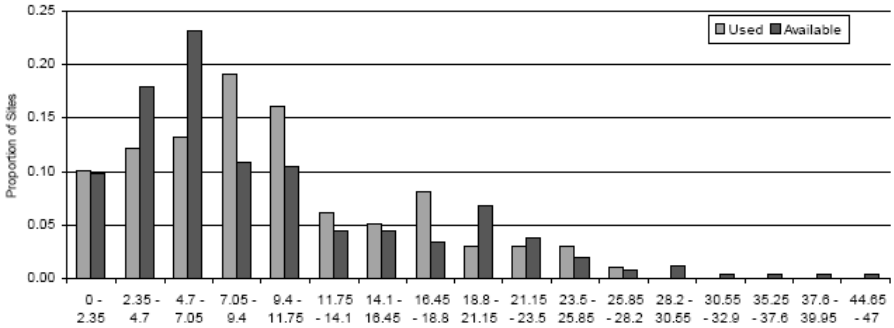
Live conifer trees per hectare ≥20 inches DBH:



Appendix 2.1 (continued)

Basal area of live conifers ≥20 inches DBH:

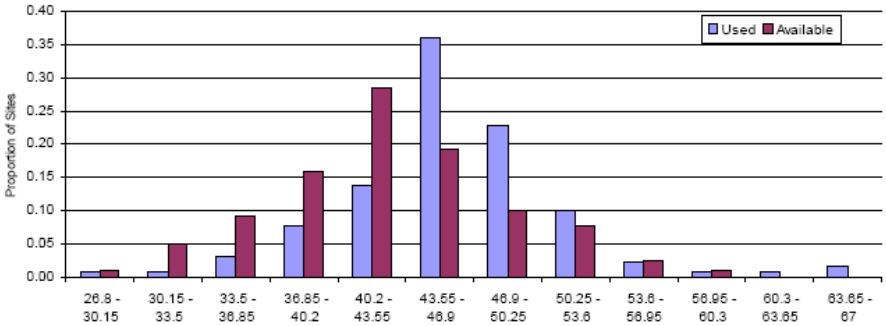


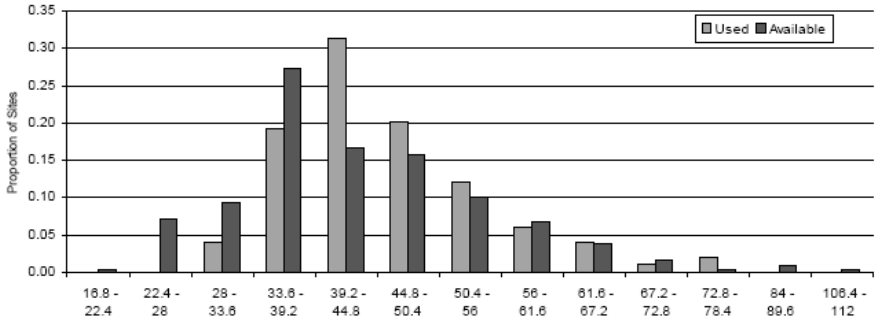


Appendix 2.1 (continued)

USFWS GNN (see USFWS 2011a) histograms showing use by NSOs versus availability of select habitat attributes at a landscape-scale (200 ha, 494 ac) on Mendocino Redwood Co. (left column) and Green Diamond Resource Co. lands (right column).

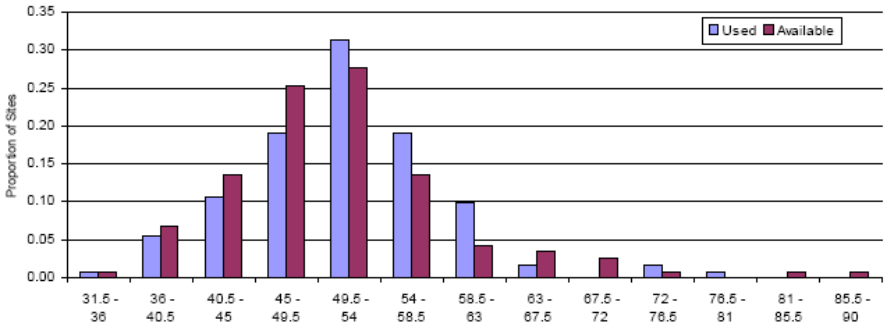
Basal area weighted mean diameter of all live conifers:

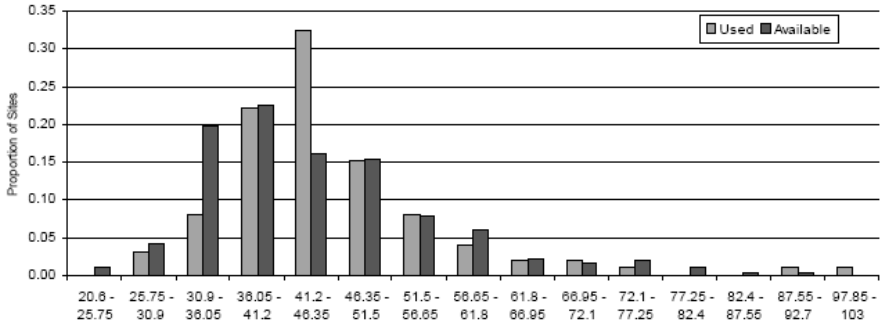




Appendix 2.1 (continued)

Basal area weighted stand age:

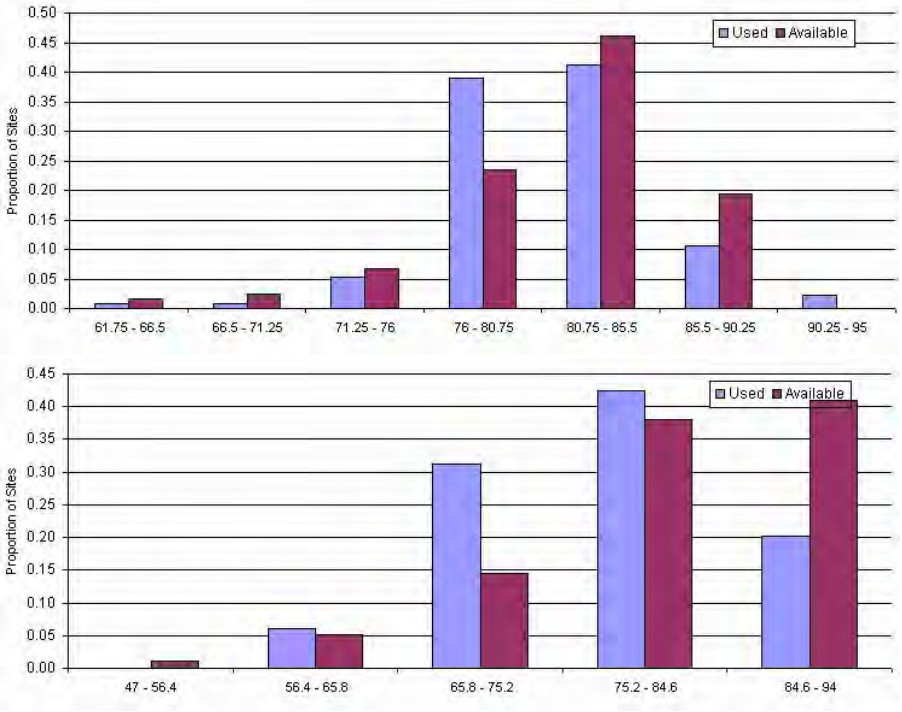




Appendix 2.1 (continued)

USFWS GNN (see USFWS 2011a) histograms showing use by NSOs versus availability of select habitat attributes at a landscape-scale (200 ha, 494 ac) on Mendocino Redwood Co. (left column) and Green Diamond Resource Co. lands (right column).

Canopy cover:



Appendix 2.2

"Deconstructed" habitat suitability modeling (see text) for NSOs in the Redwood Province showing mean (SD, CV) values of select habitat structural attributes at the 200 ha (494 ac) scale by relative habitat suitability rank (USFWS 2011a, unpubl. data).

Variable	Relative Habitat Suitability					
	Very Low	**Low**	**Med. Low**	**Med.**	**Med. High**	**High**
Strength of Selection*	-9.2	-2.9	-1.3	1.6	3.2	8.6
Percent of Region	16.3	24.5	26.2	22.4	9.7	0.9
Nesting-Roosting (ha)	57.9 (43.2, 75)	69.4 (40.8, 59)	79.9 (37.3, 47)	87.6 (33.6, 38)	94.3 (31.1, 33)	105.5 (30.8, 29)
Canopy Cover All Trees (%)	71.2 (23.2, 33)	75.2 (20.7, 28)	78.9 (18.1, 23)	81.0 (16.2, 20)	82.1 (15.5, 19)	82.9 (15.7, 19)
Canopy Cover Conifer (%)	43.9 (31.8, 72)	48.8 (30.0, 61)	53.4 (28.3, 53)	57.4 (27.2, 47)	61.4 (26.5, 43)	64.6 (26.4, 41)
BA Conifers ≥50 cm (m^2/ha)	10.6 (20.7, 195)	12.5 (23.0, 184)	14.1 (24.8, 176)	15.2 (25.6, 168)	17.6 (30.1, 171)	25.2 (45.9, 182)
BA Live Trees ≥75cm (m^2/ha)	7.3 (17.6, 241)	8.5 (20.1, 236)	9.3 (21.8, 234)	9.3 (22.4, 241)	10.4 (27.1, 261)	17.0 (44.0, 259)
Density Trees ≥50 cm (no./ha)	32.3 (37.3, 115)	36.1 (38.4, 106)	39.8 (40.0, 101)	42.5 (42.1, 99)	45.4 (44.5, 98)	50.0 (46.1, 92)
Density Trees ≥75 cm (no./ha)	8.2 (14.8, 180)	9.2 (15.6, 170)	9.9 (16.0, 162)	10.0 (15.5, 155)	10.4 (15.3, 147)	12.8 (16.8, 131)
Density Conifers ≥50 cm (no./ha)	22.1 (34.7, 157)	25.5 (36.4, 143)	28.9 (38.3, 133)	32.6 (40.7, 125)	37.3 (43.6, 117)	43.1 (45.6, 106)
Density Conifers ≥ 75 cm (no./ha)	6.6 (14.5, 220)	7.6 (15.4, 203)	8.4 (15.7, 187)	8.7 (15.2, 175)	9.4 (15.1, 161)	12.0 (16.7, 139)
Density Conifers ≥100 cm (no./ha)	2.5 (7.7, 308)	2.9 (8.4, 290)	3.2 (8.8, 275)	3.1 (8.3, 268)	3.2 (8.5, 266)	4.7 (10.4, 221)
Mean DBH Conifers by BA (cm)	42.8 (34.5, 81)	48.5 (35.5, 73)	51.7 (35.4, 68)	52.1 (34.0, 65)	52.9 (36.1, 68)	60.8 (51.1, 84)
QMD Dominant/Codominant Conifers (cm)	35.7 (29.1, 82)	40.2 (29.9, 74)	42.7 (29.7, 70)	42.6 (28.3, 66)	42.7 (29.7, 70)	48.1 (41.5, 86)

*Calculated as the proportion of activity centers in a habitat suitability class divided by the proportion of the modeling region in that class.

Ch. 3: Wildfire and Salvage Logging

Introduction

Recent status reviews have identified wildfire as a primary threat to the recovery of the NSO (Courtney et al. 2004, Davis et al. 2011, USFWS 2011a). Much of this concern was based on recent loss of suitable breeding habitat to wildfires and to the risk of extensive severe fires occurring in the future (Davis and Dugger 2011, USFWS 2011a). Other researchers and stakeholders have questioned the scientific basis of claims that wildfires pose a threat to NSOs and have expressed distrust of agency recommendations for widespread use of forest thinning to reduce fire risk (e.g., Hanson et al. 2009, Heiken 2010, DellaSala et al. 2013).

There is currently limited information with which to evaluate responses of spotted owls to wildfires and post-fire salvage logging. This research suggests that wildfires have variable and complex effects on the species (Table 3.1; reviewed below). This is unsurprising given differences in wildfires, research methods, study areas, and spotted owl subspecies and populations. Nonetheless, patterns are evident in the literature concerning spotted owl responses to wildfires and salvage logging and these can be evaluated in light of the species' habitat and prey relationships. Currently available research suggests that low-to-moderate, mixed-severity, or patchy wildfires have limited effects on spotted owls (Table 3.1). In fact, such fires may benefit NSOs in the southern portion of their range by contributing to landscape-level habitat heterogeneity associated with high fitness (Franklin et al. 2000). In contrast, large-scale severe (stand-replacing) wildfires appear to have strong negative effects on spotted owls (Table 3.1; reviewed below). This likely occurs when fires excessively modify, reduce, or fragment concentrations of suitable nesting, roosting, and foraging habitat needed for survival and reproduction (Franklin et al. 2000, Dugger et al. 2005, Schilling et al. 2013; reviewed below and in Ch. 2). Negative effects of extensive severe wildfires appear to be exacerbated by post-fire salvage logging, which structurally simplifies burned areas and removes important habitat legacies for prey (Clark 2007, Lee et al. 2012, 2013, Clark et al. 2013, Comfort 2013; reviewed below).

Regardless of scientific uncertainty concerning spotted owl responses to wildfire, it is clear that recent large wildfires have caused tremendous loss, degradation, and fragmentation of suitable breeding habitat for NSOs on federal lands (Davis and Dugger 2011, USFWS 2011a; also see Healey et al. 2008, Moeur et al. 2011). This is cause for concern because recovery of the subspecies largely relies on habitat protection on federal lands (USFWS 2011a). Furthermore, much of the climate change research indicates that wildfires will be an increasing source of large-scale habitat change in California and other western states during coming decades (Westerling et al. 2006, Lenihan et al. 2008, Westerling and Bryant 2008, Littell et al. 2009, Moritz et al. 2012, Stavros et al. 2014). These concerns have prompted ecologists and federal agencies to advocate widespread forest thinning and other forms of active management to reduce wildfire risk within the range of the NSO (USFS and BLM 1994, USFWS 2008, 2011a, 2012a, Franklin and Johnson 2012). However, the limited information currently available suggests that spotted owls often respond negatively to forest thinning in the short-term (reviewed in Hansen and Mazurek 2010, USFWS 2011a; see Ch. 2); and possibly in the long-term as well (Matthews et al. 2008, Tempel et al. *in press*). Further research is needed to determine how best to balance

potential tradeoffs in objectives for NSO conservation and fuels reduction at multiple spatial and temporal scales. Currently available information suggests that spotted owls tolerate and possibly benefit from low severity, mixed severity, or patchy fire, suggesting that prescribed fire and allowing wildfires to burn under favorable conditions is compatible with conservation objectives for the species (Bond et al. 2002, 2009, Roberts and van Wagtendonk 2006, Roberts et al. 2011, Keane et al. 2011, 2012, Lee et al. 2012, 2013, Comfort 2013, Eyes 2014).

Wildfire Effects on Spotted Owls

Indirect Evidence

Research of associations between landscape-scale habitat attributes and the demography and presence of NSOs has consistently found that the subspecies benefits from some form of habitat heterogeneity in the southern portion of its range (e.g., ecotones or edges between different vegetation classes) (Franklin et al. 2000, Zabel et al. 2003, Olson et al. 2004, Dugger et al. 2005, Carroll and Johnson 2008, Diller et al. 2010, Schilling et al. 2013; reviewed in Ch. 2, including studies' definitions of spotted owl habitat). Yet, these same studies have also strongly demonstrated the importance of large concentrations of suitable breeding habitat around activity centers (reviewed in Ch. 2). Based on this research, wildfires likely have positive effects on NSOs in California when they contribute to beneficial forms of habitat heterogeneity and negative effects when they substantially reduce or degrade suitable habitat around breeding season activity centers. Extensive stand-replacing wildfires have the potential to remove or fragment core concentrations of suitable breeding habitat across multiple NSO territories. These fires, therefore, have the greatest likelihood of substantially impacting NSO populations. Smaller, less severe, or patchy wildfires may impact fewer NSO territories and have weaker negative effects on populations, burn in a manner that contributes to beneficial forms of habitat heterogeneity, or have variable effects among territories.

Direct Evidence

Several studies have investigated responses of NSOs to wildfires (Table 3.1). These studies provide crucial information for evaluating wildfire as a potential threat to the subspecies. However, their inferences are limited due to small sample sizes and short time frames in all cases, the confounding effects of post-fire salvage logging in one case, and pooling of data from all three spotted owl subspecies in another case (Table 3.1; see below). In order to supplement these studies, research of wildfire effects on California spotted owls (*S. o. occidentalis*; CSOs) and Mexican spotted owls (*S. o. lucida*; MSOs) is also included in the following review (Table 3.1). Because inferences from these studies are likewise limited, and given differences among fires, spotted owl subspecies and populations, and research methods, each project is reviewed as a "case study". Relatively thorough descriptions of these studies allow identification of patterns in the literature, which could provide insights into general effects of wildfires on the species.

Table 3.1: Apparent effects of wildfires on spotted owls. See text for additional descriptions of study methods and findings.

Response Metric	Study†	Subspecies	Location*	Apparent Effect**	Notes/Caveats
Survival	*Bond et al. 2002*	NSO, CSO, MSO	CA, AZ, NM	0	Only one post-fire survey season
	Clark et al. 2011	NSO	OR KLA	-	Likely cumulative effect of timber harvesting, severe fire, and salvage logging
Productivity	Gaines et al. 1997	NSO	E WA CAS	0	Apparently no decline but possibly obscured by low reproduction year across population; Possibly lower total reproduction in burned landscapes due to lower pair occupancy; Only one post-fire season
	Bond et al. 2002	NSO, CSO, MSO	CA, AZ, NM	0	Only one post-fire season
	Clark 2007	NSO	OR KLA	0	Apparently no decline but low statistical power; Possibly lower total reproduction in burned landscapes due to lower pair occupancy
	Roberts and van Wagtendonk 2006	CSO	CA SIERRA	+	Apparent higher productivity by four pairs nesting in low-to-moderate severity burns than by 18 pairs in unburned areas
Site Fidelity	*Bond et al. 2002*	NSO, CSO, MSO	CA, AZ, NM	0	Site fidelity similar to other studies
Occupancy	Elliot 1985	CSO	CA COAST	-	Apparent abandonment by two pairs
	Gaines et al. 1997	NSO	E WA CAS	-	Post-fire occupancy was lowest found during five-year study; Only one post-fire season
	Jenness et al. 2004	MSO	AZ, NM	-	Near-significant negative trend; Pooled all fire types and severities
	Keane et al. 2011, 2012	CSO	CA SIERRA/CAS	-/0	Extensive high severity fire apparently had a strong negative effect; Extensive low severity fire apparently had a neutral or weak negative effect; Possibly confounded by salvage logging
	Roberts et al. 2011	CSO	CA SIERRA	-	Modeled-occupancy lower in burned areas but not statistically analyzed; Pooled all fire types and severities
	Lee et al. 2012	CSO	CA SIERRA	0	Similar occupancy at burned vs. unburned
	Lee et al. 2013	CSO	SO CA	-/0	Similar occupancy at burned vs. unburned; Significant reduction with extensive high severity fire in core area
	Clark et al. 2013	NSO	OR KLA	-	Cumulative effect of timber harvesting, severe fire, and salvage logging
	Tempel et al. In Press	CSO	CA SIERRA	-	Site colonization probability negatively associated with area of wildfire; Relatively large sample size and long time frame
Home Range	Clark 2007	NSO	OR KLA	-	Larger home ranges post-fire
	Bond et al. 2013	CSO	CA SIERRA	0	Similar home range sizes to unburned areas
Roosting	King et al. 1997	NSO	E WA CAS	-	Apparent avoidance of moderate and severe burns
	Bond et al. 2009	NSO	CA SIERRA	-	Significant avoidance of moderate and severe burns during breeding season
Foraging	Clark 2007	NSO	OR KLA	+	Apparent weak selection of moderately burned suitable habitat; Possible weak selection for severely burned suitable habitat; Very low use and availability of both moderately and severely burned suitable habitat
	Bond et al. 2009	NSO	CA SIERRA	+	Significant selection of severe burns
	Eyes 2014	CSO	CA SIERRA	-/+	Preference for edges created by fire (particularly high contrast); Avoidance of severely burned areas
Roosting and Foraging	Comfort 2013	NSO	OR KLA	-/+	Preference for small patches of severely burned/salvage logged and avoidance of larger patches; Weak preference for low contrast edges created by fire

†Peer-reviewed publications shown in italics. * Locations: California Klamath (CA KLA); Eastern Washington Cascades (E WA CAS); Oregon Klamath (OR KLA); California, Arizona and New Mexico (CA, AZ, NM); California Central Coast Range (CA COAST); California at margin of northern Sierra Nevada and southern Cascades (CA SIERRA/CAS); California Sierra Nevada (CA SIERRA); southern California San Bernardino and San Jacinto Mountains (SO CA). **Apparent Effect: negative (-), positive (+), neutral (0), varied with fire severity and/or scale (/)—see Notes column and text for further explanations.

Survival

Wildfires may influence spotted owl survival in both the short- and long-term. For example, spotted owls, like other wildlife, could be injured or killed by smoke during fires (Singer and Schullery 1989, Smith 2000). Due to their poor mobility, young spotted owls with undeveloped flight feathers may be at particular risk of mortality during wildfires (Smith 2000). In addition to potential immediate effects, extensive moderate or severe wildfires might influence spotted owl survival over the longer-term by modifying habitat for roosting, foraging, or prey (see below).

Only two studies are currently available for evaluating effects of wildfires on spotted owl survival rates (Bond et al. 2002, Clark et al. 2011; Table 3.1). Bond et al. (2002) reported that 18 of 21 (86%) marked spotted owls were resighted one year after wildfires occurred in California, Arizona, and New Mexico. This minimum survival rate was similar to survival estimates found by long-term studies of the three spotted owl subspecies in unburned landscapes (Seamans et al. 1999, Franklin et al. 2000, W.S. LaHaye unpubl. data). Of the eight territories for which fire severity was mapped, two experienced severe fire within 50-88% of their areas, two experienced 36-50% severe fire, and the remaining four experienced <36% severe fire. Thus, mixed severity wildfires did not appear to have a substantial effect on spotted owl survival in this study one year post-fire.

Clark et al. (2011) found evidence of a negative effect of wildfires and/or post-fire salvage logging on survival of 23 NSOs in the Oregon Klamath Province. Severe fire and/or post-fire salvage logging occurred in 30% and 41% of suitable NSO habitat in the two study areas (suitability score >25: Davis and Lint 2005 [essentially nesting-roosting-foraging habitat; QMD generally > ca. 12 in]). Estimated mean annual survival rates for NSOs located inside fire perimeters (0.69) and apparently displaced by fires and post-fire salvage logging (0.66) were lower than in areas just outside the fire perimeters (0.85) and in an unburned reference study area in the neighboring southern Cascades (0.85: Anthony et al. 2006). The degree to which post-fire salvage logging in the study areas influenced NSO survival rates is unknown. The study's occupancy analyses indicated that pre-fire timber harvesting, high severity wildfire, and post-fire salvage logging cumulatively impacted NSOs through reductions of suitable breeding habitat (Clark et al. 2013; see below).

The findings of Bond et al. (2002) and Clark et al. (2011) regarding effects of moderate-to-extensive amounts of severe wildfire (>36% of the area in half of the territories: Bond et al. 2002; 30-41% of the study area: Clark et al. 2011) appear to be contradictory. Several factors may explain this apparent inconsistency. The most obvious difference between the studies is that the areas studied by Clark et al. (2011) experienced post-fire salvage logging while those studied by Bond et al. (2002) did not. The limited available information suggests that salvage logging negatively affects spotted owls (reviewed below). Additionally, the populations studied by Clark et al. (2011) may have been particularly sensitive to habitat loss to wildfires due to intensive pre-fire timber harvesting across a checkerboard ownership. It should also be noted that Bond et al. (2002) only examined wildfire effects one year post-fire. Fire injuries and post-fire outbreaks of insects and pathogens can continue to result in tree mortality for up to several years after a wildfire (Ryan and Amman 1996, Gaines et al. 1997, Hood et al. 2007).

Reproduction

The spotted owl is a relatively long-lived species (up to 12-17+ yrs in the wild: Gutiérrez et al. 1995) that exhibits a bet-hedging life history strategy (Noon and Biles 1990, Franklin et al. 2000). This means that individuals often forego breeding during poor environmental conditions in order to maximize their chance of surviving and reproducing in the future. Given the species' life history strategy, spotted owl reproductive rates are likely sensitive to environmental changes, including those brought about by wildfires. However, annual fluctuations in spotted owl reproduction caused by variation in weather, prey populations, or breeding condition could obscure effects of wildfires or other factors on reproduction (e.g., Franklin et al. 2000).

At least four studies have examined potential effects of wildfires on spotted owl reproduction (Gaines et al. 1997, Clark 2007, Bond et al. 2002, Roberts and van Wagtendonk 2006 [also Roberts 2008]; Table 3.1). None of these studies found substantive evidence of a wildfire-induced decline in reproduction by the species and one indicated a potentially positive effect. In the eastern Washington Cascades, Gaines et al. (1997) found little or no difference in productivity (number of young per pair) at burned (0.2; n = 5 or 6/ yr) and unburned sites (0.3; n = 13-17/yr) one year after a predominantly moderate to severe wildfire. However, the post-fire survey season clearly occurred during a poor reproduction year, potentially making it difficult to detect a difference between burned and unburned sites. Clark (2007) found no significant differences in productivity in burned areas in the Oregon Klamath Province (n = 31 territories) and an unburned study area in the neighboring southern Cascades (Anthony et al. 2006). He noted, however, that his study likely lacked the statistical power to detect a difference if one occurred. Bond et al. (2002) found that seven pairs of spotted owls produced an average of 1.0 offspring during a single breeding season following wildfires in California, Arizona, and New Mexico. This was similar to productivity rates found in unburned areas during long-term studies of the three spotted owl subspecies (Seamans et al. 1999, Franklin et al. 2000, W.S. LaHaye unpubl. data). In the Sierra Nevada of California, Roberts and van Wagtendonk (2006) reported that four CSO pairs in areas that experienced extensive low-to-moderate severity fire produced eight fledglings, compared with 17 fledglings produced at 18 nests in unburned areas (i.e., burned = 18% of pairs and 32% of fledglings). The authors did not statistically analyze the apparent positive effect of low-to-moderate severity fire on productivity (note: it is possible that Roberts [2008] statistically analyzed this effect but I was unable to obtain a copy of her dissertation for inclusion in this synthesis).

Currently available studies suggest that wildfires generally have minimal short-term effects on spotted owl reproduction and that primarily low-to-moderate severity fire could positively affect reproduction (Gaines et al. 1997, Bond et al. 2002, Roberts and van Wagtendonk 2006, Clark 2007). As noted above, it might be difficult to capture fire effects on spotted owl reproduction (whether positive or negative) during short-term studies, particularly with only a single year of post-fire data (Franklin et al. 2000). In addition, it is possible that solely comparing productivity (e.g., offspring per pair) in burned and unburned areas could obscure a change in total reproduction in burned areas. Studies in Washington and Oregon reported post-fire declines in occupancy by pairs, suggesting that extensive severe fires can reduce reproductive opportunities for spotted owls (Gaines et al. 1997, Clark 2007; see below).

Occupancy

Potential wildfire effects on NSO population rates are most directly evaluated with measures of survival and reproduction. However, occupancy data are often more logistically and economically feasible to collect than are demographic data and could provide an early indication of population trends (MacKenzie 2005, Olson et al. 2005). Spotted owl occupancy is sensitive to environmental factors (Blakesley et al. 2005, Olson et al. 2005) so it is a potentially valuable measure of wildfire effects on the species. Nonetheless, occupancy data must be interpreted carefully since they can be strongly influenced by survey effort, analytical methods, and the presence of barred owls (*Strix varia*) (Olson et al. 2005).

I evaluated 10 studies of wildfire effects on spotted owl occupancy (Table 3.1). As summarized below and in Table 3.1, eight of these provided evidence of a negative effect of either severe wildfires or wildfires in general.

Two studies indicated potentially negative effects of wildfires on spotted owl occupancy but included few territories (Elliot 1985, Gaines et al. 1997). In Monterey County, California, informal yearly surveys suggested that two pairs of CSOs abandoned their territories for at least four years following a wildfire (Elliot 1985). The author did not describe the fire other than noting that it was extensive and caused substantial damage to understories and oaks in the previously occupied areas. In the eastern Washington Cascades, Gaines et al. (1997) found that two of six NSO sites were occupied one year after a predominantly moderate to severe wildfire. This was the lowest occupancy rate found during the five-year study period.

Two studies found statistically weak evidence of a negative effect of fire on spotted owl occupancy, but their methods may have precluded detection of stronger effects (Jenness et al. 2004, Roberts et al. 2011). Jenness et al. (2004) found a statistically insignificant tendency (p = 0.11) for higher occupancy rank (in ascending order: no owls, singles, pairs, reproductive pairs) in unburned sites than in paired burned sites in Arizona and New Mexico (paired sites were close to each other and had similar habitat and topography). Of the 29 paired-site comparisons, 14 (48%) had a higher occupancy rank in unburned sites, 6 (21%) had a higher rank in burned sites, and 9 (31%) were tied. In the Sierra Nevada of California, Roberts et al. (2011) found lower occupancy rates for CSOs in burned areas than in unburned areas, but the difference was not statistically analyzed (modeled-occupancy = 0.46 in burned and 0.72 in unburned). Modeling by both studies indicated that spotted owl occupancy was more strongly influenced by habitat composition or structure than by whether or not fire had recently occurred in territories. However, both studies may have underestimated the impacts of severe wildfires due to pooling of diverse fire types and severities for analysis (including prescribed fires, wildfires, and wildfires allowed to burn under prescribed conditions).

Another study found stronger evidence of a negative effect of wildfires on occupancy by CSOs. Tempel et al. (*in press*) collected occupancy data at 74 CSO territories during long-term (1993/1997-2012) density and regional studies in the central Sierra Nevada. Twelve (16%) territories experienced wildfire during the studies, including nine (12%) that were affected by a mostly-severe wildfire in 2001. The best performing model explaining site colonization during the studies included area of wildfire within estimated territories (988 ac). In this model, wildfire

had a strong negative effect on the probability of colonization, even though relatively few territories were affected by fire. Only three site colonization events were observed in burned territories during six post-fire years. However, CSOs exhibited variable responses to wildfire. For example, five of the territories affected by a largely severe wildfire in 2001 were occupied every year post-fire.

Two studies found evidence of strong declines in occupancy in areas recently burned by extensive severe wildfire but both may have been confounded by post-fire salvage logging (Keane et al. 2011, 2012, Clark et al. 2013). In southwestern Oregon, Clark et al. (2013) examined how extensive wildfires and subsequent salvage logging affected occupancy dynamics of NSO pairs. In their first analysis, the authors compared pre- and post-fire occupancy dynamics in a burned study area in the Oregon Klamath Province (n = 22) to those in an unburned area in the nearby southern Cascades (Anthony et al. 2006). Combined, high severity fire and salvage logging removed or modified 26% of suitable habitat (suitability score >25: Davis and Lint 2005 [essentially nesting, roosting, and foraging habitat; generally QMD > ca. 12 in DBH in study area] in landscapes surrounding NSO activity centers in this area. The burned and salvage-logged study area experienced a 64% reduction in site occupancy during the post-fire period, compared with a 25% reduction in the unburned study area (difference not statistically analyzed). In the second analysis, the authors examined possible effects of severe wildfire and salvage logging on occupancy dynamics in 40 territories located in three burned study areas in the Oregon Klamath Province. In these areas, 19-26% of suitable habitat was burned at high severity and/or salvage logged. During the study's three-year post-fire period, site extinction probabilities were as high as 72% in two combined study areas and 92% in the third area. Site extinction probabilities in the burned study areas were best explained by a model that included extents of high severity fire, salvage logging, and early seral forest. Models that included these variables separately were not competitive with the model containing all three variables, suggesting that NSO occupancy declined due to cumulative habitat loss from severe fire and pre- and post-fire timber harvesting (see Table 6 in Clark et al. 2013). The relative influence of these factors on occupancy is unknown, but the role of severe wildfire cannot be dismissed. For example, the highest extinction probability (92%) occurred in a study area with little salvage logging (<2%) of previously suitable habitat.

Keane et al. (2011, 2012) estimated occupancy of CSOs in two recently burned study areas near the margin of the Sierra Nevada and southern Cascades of California. One wildfire complex, and an unreported amount of post-fire salvage logging, resulted in an almost complete loss of potentially suitable CSO habitat in the area (forest with mean canopy cover ≥40% and mean DBH ≥11 comprised 70% of the area pre-fire vs. 6% post-fire). Pre-fire occupancy in this study area was unknown but the Forest Service identified 23 CSO activity centers in the area prior to the fires. Rigorous landscape survey coverage by Keane et al. (2011, 2012) confirmed occupancy in only one territory within the fire perimeter during each of two post-fire years, whereas approximately seven to nine territories were found post-fire in a surrounding one-mile survey buffer (total survey area and buffer survey area sizes not reported). The other area studied by Keane et al. (2011, 2012) primarily burned at low severity (ca. 60% of the area). Pre-fire occupancy was likewise unknown in this area but Forest Service pre-project surveys indicated the presence of about 10 territories. Surveyors confirmed occupancy of six territories in this area during the first and second years post-fire. However, the number of occupied

territories in this study area could have been higher during the second post-fire season as survey effort was hindered by safety concerns associated with extensive illegal marijuana cultivation (see Ch. 5 for further discussion of this topic). While the study's findings are preliminary and may have been influenced by post-fire salvage logging, they suggest that effects of large wildfires on CSOs are dependent on the extent of high severity wildfire.

Another study provided further evidence that effects of wildfires on spotted owl occupancy depend on the extent and location of high severity wildfire. Lee et al. (2013) compared occupancy dynamics of CSOs in 71 recently burned sites and 97 unburned sites in the San Bernardino Mountains and San Jacinto Mountains of southern California. An average of 23% of the forest within burned "core areas" (500 ac around activity centers) experienced high severity fire (this percent is based on an assumption that the amount of pre-fire forest in burned core areas was the same as that reported for burned and unburned core areas combined). Mean annual probability of occupancy was 0.48 in unburned sites and 0.31 in burned sites. This difference was not statistically significant. However, Lee et al. (2013) did detect a statistically significant negative effect on occupancy when high severity fire burned more than 125 acres of forest within estimated core areas.

Two studies found that wildfires had little or no effect on spotted owl occupancy (Bond et al. 2002, Lee et al. 2012). Bond et al. (2002) calculated site fidelity for spotted owls in 11 territories burned by wildfires in California, Arizona, and New Mexico. The fires burned most of the area within each estimated territory (territory size = half the nearest neighbor distance in each study area, based on previous studies). Half of the eight territories for which fire severity was mapped primarily burned at low to moderate severity (<36% high severity) and the other half experienced moderate to extensive amounts of severe fire (36-88%). Of 21 color-banded owls in the study, 18 (86%) were resighted the year after the fires and 16 (89%) of these were located in their pre-fire territory. Site fidelity in this study was comparable to that in long-term studies of the three subspecies in unburned areas (Seamans et al. 1999, Franklin et al. 2000, W.S. LaHaye unpubl. data). In the Sierra Nevada, Lee et al. (2012) compared post-fire occupancy in 41 recently burned and 145 unburned historical CSO territories. An average of 32% of forest in burned territories experienced high severity fire. The authors found no significant association between CSO occupancy and whether or not territories had recently experienced wildfire within a 494-acre circle around activity centers (mean occupancy was 0.76 at unburned sites and 0.80 at burned sites).

The studies reviewed above are not directly comparable due to differences in methods, spotted owl subspecies and populations, fire extents and severities, and the presence or absence of post-fire salvage logging. The preponderance of evidence suggests that spotted owls in dry, fire-prone forests are generally resilient to wildfires (Bond et al. 2002, Jenness et al. 2004, Roberts and van Wagtendonk 2006, Keane et al. 2011, 2012, Roberts et al. 2011, Lee et al. 2012, 2013). However, wildfires that severely burn large areas of potentially suitable habitat can substantially impact spotted owl occupancy, particularly when they occur in breeding-season core areas (Elliot 1985, Gaines et al. 1997, Clark et al. 2013, Keane et al. 2011, 2012, Lee et al. 2013, Tempel et al. *in press*). Post-fire salvage logging appears to increase the negative effects of extensive severe wildfires on spotted owl occupancy, most likely by reducing suitability of burned areas for prey and foraging (Lee et al. 2012, 2013, Clark et al. 2013, Comfort 2013; reviewed below).

Home Range Size and Habitat Use

Changes in the behavior of individual spotted owls may provide insight into the mechanisms by which wildfires affect populations. For example, post-fire changes in home range size may reflect wildfire effects on spotted owl energy budgets through changes in travel distances and prey availability. Changes in energy intake and output could, in turn, influence survival, reproduction, and occupancy of spotted owls. Patterns of habitat use may also be informative. For example, selection or avoidance of burned areas may reflect changes in availability of prey or roosting habitat, which could, in turn, influence occupancy, reproduction, or survival of spotted owls.

To my knowledge, only two studies have evaluated spotted owl home range sizes in relation to wildfires (Clark 2007, Bond et al. 2013; Table 3.1). Clark (2007) found that annual home range sizes of NSOs inside two fire perimeters in the Oregon Klamath Province were larger after wildfires than before them (n = 14 owls pre-fire and 20 post-fire). He attributed this difference to owls expanding their home ranges in response to habitat fragmentation caused by severe wildfire and post-fire salvage logging. This hypothesis is supported by other research in the region, which found that NSOs had larger home ranges in fragmented forests than in areas with larger, more intact patches of habitat (Carey et al. 1992, Schilling et al. 2013). Another study in the region suggested that the energetic cost of increased travel in fragmented forest was greater than the energetic benefit of increased access to prey associated with early-successional habitats (Carey and Peeler 1995).

Bond et al. (2013) compared the breeding season home ranges of seven CSOs (from four territories) during a single post-fire year in the Sierra Nevada of California with those in other studies during the same year in other parts of the subspecies range (D. Call, T. Munton, and G. Zimmerman unpubl. data). An average of 23% of forest burned at moderate severity and 9% at high severity within a 1.2 mile radius of the four nests. Pre-fire home range sizes were unknown but CSOs in the four territories did not appear to have unusually large home ranges following predominantly low to moderate severity wildfire.

At least five studies have described patterns of habitat use by spotted owls in burned areas (King et al. 1997, Clark 2007, Bond et al. 2009, Comfort 2013, Eyes 2014; Table 3.1).

King et al. (1997; also Bevis et al. 1997) described initial effects of wildfires on NSOs in two territories in the eastern Washington Cascades. One territory primarily experienced low to moderate severity fire and the other mostly burned at high severity. Both territories experienced an unreported amount of salvage logging in “unsuitable” or severely burned habitat. Most NSO locations (84% and 89%) in the two territories were daytime roosts. In the territory primarily burned at low to moderate severity, 80% of the pair’s post-fire locations were in unburned habitat, 16% were in low severity burns, and 4% were in moderate severity burns. The pair did not appear to roost in severely burned areas. The second territory studied by King et al. (1997) was occupied by a single male. After the wildfire, the male shifted his activity to an unburned area two to three miles away but continued to occasionally use areas near his former activity center. Of those locations, 74% were in unburned habitat, 17% were in low severity burns, 5% were in moderate severity burns, and 4% were in high severity burns. Maps of burn severity

classes and NSO locations indicate that owls in these two territories strongly selected unburned areas for roosting.

Clark (2007) evaluated habitat selection by 12 NSOs (7 territories) inside a wildfire perimeter in the Oregon Klamath Province. NSO locations were primarily nocturnal and may therefore, have largely represented foraging activity. Individuals in this area used all habitat classes, including moderate and severe burns and areas that had been salvage logged. However, when the data from individuals were pooled for analysis, the owls exhibited a strong preference for nesting-roosting habitat (suitability score >50: Davis and Lint 2005 [QMD generally > ca. 27 in DBH in study area]) that was unburned or burned at low severity (unburned and low severity were combined into a single class for analyses). NSOs in the study also selectively used moderately burned, previously-suitable habitat; although both use and availability of this habitat class were low compared with unburned or lightly burned habitat. Owls' use of burned areas was concentrated closer to activity centers, which was expected, given that spotted owls are central place foragers during the breeding season (see Rosenberg and McKelvey 1999).

In the Sierra Nevada, California, Bond et al. (2009) described the habitat associations of seven CSOs from four territories during a single post-fire season. Of the four nests found during the study, one was approximately 0.3 mile outside the fire perimeter, one was in forest burned at low severity, and two were in forest burned at moderate severity. One of the two nest trees found in moderate severity burns was apparently killed by the fire and one produced the only fledgling detected during the study. It is unclear from the paper whether these events occurred at the same nest or different nests. The four pairs roosted in all burn severity classes but exhibited statistically significant selection of low severity burns and avoidance of moderate and high severity burns. Only one of 60 roost sites was located in a high severity burn. Burned roost sites generally resembled unburned roost sites (>60% canopy cover and large-diameter trees). Bond et al. (2009) also evaluated CSO selection of foraging habitat in the area. Probability of use for foraging was highest when sites were burned and within 0.6 mile of nests or roosts. Probability of use was also positively associated with presence of edge between burn severity classes. Five of the owls foraged in high severity burns within 0.9 mile of nests or roosts more often than in other burn severity classes. Bond et al. (2009) suggested that CSOs in these four territories selectively foraged in high severity burns in order to access abundant prey in those areas. This hypothesis was supported by their finding that high severity burns had the highest herb and shrub cover and highest basal area of snags of any burn severity class, including unburned. These features are key resources for spotted owl prey communities (Carraway and Verts 1991, Carey et al. 1999, Holloway and Smith 2011).

Comfort (2013) evaluated habitat selection (roost and foraging locations combined) by 23 NSOs in a burned area in the Oregon Klamath Province. Her best performing model for explaining habitat selection included habitat suitability, disturbance severity, high contrast edge, and low contrast edge. Habitat selection varied with spatial scale but NSOs exhibited a strong preference for higher habitat suitability and avoidance of patches affected by higher severity disturbance (high severity wildfire and/or salvage logging). NSOs showed a preference for high contrast edge at small spatial scales (2-8 ac) and avoidance at medium and large scales (32-2,049 ac). NSOs also exhibited a weak preference for low contrast edge. Comfort (2013) concluded that patchy, mixed severity fire (small patches of high severity fire within a matrix of unburned and

low-to-moderate severity fire) created conditions favored by NSOs in her study, whereas large patches created by high severity fire and subsequent salvage logging were strongly avoided. Salvage logging apparently contributed to conditions avoided by NSOs by structurally homogenizing burned areas, which increased the sizes of high severity patches and amounts of high contrast edge (Comfort 2013). However, the relative influence of high severity wildfire and post-fire salvage logging on habitat selection by NSOs in this study is unknown.

Eyes (2014) evaluated foraging habitat selection by 13 CSOs (8 territories) during three breeding seasons in a recently burned landscape (1-15 yrs prior) in Yosemite National Park in the Sierra Nevada. On average, 25% of the home range (minimum convex polygon) had recently experienced low severity fire, 16% moderate severity fire, and 4% high severity fire. Three of Eye's (2014) four best performing models explaining habitat selection by foraging CSOs included a fire severity metric (Fire Severity Index). These models indicated that the probability of an area's use by foraging CSOs decreased with increasing fire severity. However, foraging CSOs were more likely to use edge sites than non-edge sites and exhibited a tendency for greater use of high contrast edges created by severe fire than for lower contrast edges created by low/moderate severity fire or other disturbances. Eye's (2014) findings that CSOs avoided the interiors of high severity burns and favored high contrast edges created by severe fire is consistent with Comfort's (2013) findings at smaller spatial scales around NSO locations.

The limited available information concerning spotted owl habitat use following wildfires indicates that the species avoids roosting in moderate and high severity burns (King et al. 1997, Clark 2007, Bond et al. 2009). This finding is concordant with the spotted owl's close association with densely-canopied older forest for roosting (Blakesley 2004). Little is known about the effects of wildfire on selection of nest sites. Bond et al. (2009) found three CSO nests in forest recently burned at low and moderate severity, and young fledged from one nest in a moderate severity burn. Moderate severity fire killed one of the four CSO nest trees in their study. Eyes (2014) found a CSO nest adjacent to a high severity burn but the nest failed during her study. Based on the species' nesting habitat requirements (Blakesley 2004), long-term use of severely burned areas for nesting is likely uncommon. Three studies specifically examined selection of foraging habitat by spotted owls. All three found use of all burn severity classes, but Clark (2007) and Eyes (2014) found a preference for foraging in unburned to moderately burned areas (also see Comfort 2013, which combined foraging and roost locations in analyses) while Bond et al. (2009) found a preference for severe burns. It is unclear if this difference was due to differences in the studies' methods, effects of fire and timber harvesting on vegetation, or the composition of prey communities and spotted owl diets. Findings by Comfort (2013) and Eyes (2014) suggest that foraging spotted owls avoid large patches recently burned by high severity fire but benefit from some amount of high contrast habitat edge created by patchy high severity fire.

Wildfire Effects on Prey

In New Mexico, Ganey et al. (2014) found that species richness, relative abundance, and biomass of small mammals were greater in four MSOs' burned wintering areas than in their nest core areas. Abundances of deer mice, pocket gophers (*Thomomys* spp.), and other "pioneer" or "early-successional" prey often increase following fires (Ream 1981, Zwolak and Foresman

2007, Zwolak 2009, Bond et al. 2013). Dusky-footed woodrats appear to initially respond negatively to severe fires (Schwilk and Keeley 1998, Smith 2000) but not to patchy low severity fire, although loss of nest houses might have a brief negative effect on reproduction (Lee and Tietje 2005). However, it is possible that severe fire benefits dusky-footed woodrats over longer time periods (e.g., ≥5-20 yrs) through creation of brushy habitat. Stand-replacing fires should negatively affect abundances of prey associated with well-canopied forest, such as northern flying squirrels and tree voles. These taxa, along with dusky-footed woodrats, are the primary prey for NSOs in California (reviewed in Ch. 2). Low severity fires could also have negative effects on northern flying squirrels and other prey associated with closed canopy forests by reducing dead woody materials, fire-intolerant understory plants, and truffles (Lehmkuhl et al. 2006, Meyer et al. 2007). Thus, wildfires likely have complex effects on NSO prey communities, depending on local or regional differences in prey community composition; wildfire size, severity, and configuration; and the length of time vegetation has had to regenerate following fire.

Post-Fire Salvage Logging

While salvage logging might be judiciously used to meet certain conservation objectives (e.g., generating downed wood to minimize erosion or create wildlife habitat), it is generally conducted to meet economic goals or remove hazard trees (Peterson et al. 2009). Intensive or poorly planned salvage logging can have a variety of negative effects on ecosystems, such as soil compaction, increased erosion, and impacts on insectivorous and cavity-nesting and -denning animals (reviewed in McIver and Starr 2000, Noss et al. 2006, Peterson et al. 2009).

At least three studies have directly evaluated effects of post-fire salvage logging on spotted owls (Clark 2007 and Clark et al. 2013, Lee et al. 2012, 2013). Clark (2007) conducted a radio-telemetry study in areas recently burned by wildfires in the Oregon Klamath Province. He recorded limited use of salvage logged areas; presumably for foraging since locations were primarily nocturnal. Use of salvage logged areas was slightly lower than expected based on its abundance in territories (not statistically analyzed), indicating weak avoidance of salvage logged areas by NSOs. However, avoidance might have been stronger since some of the study's telemetry locations were potentially recorded prior to the occurrence of salvage logging. Most (60%) NSO locations in salvage logged areas occurred in riparian buffers, thinned areas, and patches of wildlife leave trees, rather than intensively salvaged areas. During the same study, Clark et al. (2013) found that post-wildfire declines in NSO occupancy were best explained by a model that included extents of pre-fire timber harvesting, severe wildfire, and post-fire salvage logging. Models that included these factors separately were not competitive with this model, indicating that severe fire and pre- and post-fire harvesting collectively contributed to declines in NSO occupancy; most likely through cumulative habitat loss or degradation.

In the Sierra Nevada, Lee et al. (2012) recorded occupancy for eight CSO territories that experienced wildfire and post-fire salvage logging. Seven of the territories were occupied during the two-year period between the occurrence of wildfire and post-fire salvage logging, whereas none of the territories were occupied following salvage logging.

Lee et al. (2013) evaluated effects of salvage logging on CSOs in the San Bernardino and San Jacinto Mountains of Southern California. They noted that salvage logging in their study area was modest compared with commercial salvage logging typically employed in the Pacific Northwest and Sierra Nevada (salvage logging in their study area mostly consisted of firewood cutting on private in-holdings and hazard tree removal along Forest Service roads). Lee et al. (2013) did not find a statistically significant effect of post-fire salvage logging on CSO occupancy dynamics. However, site extinction probability was slightly higher, and mean annual probability of occupancy was slightly lower, in salvage logged areas than in other burned areas. Weak negative effects of light salvage logging were apparent during all eight post-fire study years.

The limited available evidence suggests that salvage logging decreases the probability that spotted owls will use burned areas (Comfort 2013) and increases the probability that they will abandon their territories following wildfires (Clark 2007, Lee et al. 2012, 2013, Clark et al. 2013). This could occur because salvage logging reduces suitability of burned areas for foraging spotted owls and their prey. Stands recently burned by moderate or severe fire often contain high biodiversity due to the presence of both early-successional conditions and key biological legacies in the form of snags, logs, and residual live trees (Noss et al. 2006). Due to fire suppression and salvage logging, stands with these conditions are currently rare in many fire-prone forests within the spotted owl's range (Noss et al. 2006). Selective use of burned areas for foraging is likely due to spotted owls exploiting short-term increases in prey associated with both early-successional vegetation (e.g., shrubs) and legacy habitat elements (e.g., large diameter snags, logs, and live trees) (Ream 1981, Zwolak 2009, Bond et al. 2013). Salvage logging removes legacy elements, while associated use of herbicides reduces shrubs and grasses important to many prey species (Bond et al. 2013, Comfort 2013). In the longer-term, spotted owls can continue to benefit from the contributions of legacy habitat elements to regenerating stands. For example, large legacy snags, trees, and logs can provide valuable habitat elements for northern flying squirrels and other prey (Holloway and Smith 2011). Removal of these elements through salvage logging could therefore reduce the value of subsequent regenerating stands as prey habitat. Harvesting of legacy snags and live trees could also directly affect spotted owls by reducing availability of foraging perches in the short-term and suitable nest trees during later successional stages.

Summary of Direct Evidence Concerning Wildfire and Salvage Logging Effects

Inferences from studies of direct effects of wildfires and salvage logging on spotted owls are limited due to inclusion of only a small number of spotted owls or territories. The preponderance of currently available evidence indicates that spotted owls are often resilient to low-, moderate-, or mixed-severity wildfires but can be strongly impacted by extensive severe wildfires. Following wildfire, many spotted owls may remain in their territories, exploit short-term increases in prey in burned areas, and continue to reproduce at reasonably high rates. However, wildfires that result in substantial loss or fragmentation of suitable habitat, particularly within breeding core areas, can cause spotted owls to increase their home range sizes, abandon their territories, and possibly, emigrate from burned landscapes or die of starvation or disease. Negative effects of severe wildfires appear to be greatest when suitable habitat is already limited

(e.g., due to widespread intensive timber harvesting) and when post-fire salvage logging reduces suitability of burned areas for foraging and prey.

Wildfire Effects on Recent Habitat Trends

Past and continuing habitat loss was a primary reason for listing the NSO under the federal Endangered Species Act (USFWS 1990). At the time of listing, the Fish and Wildlife Service estimated that 60-88% of the subspecies' habitat had already been lost (USFWS 1990; also see Ch. 2). They attributed most of this loss to widespread intensive timber harvesting. Since listing of the NSO and subsequent adoption of the Northwest Forest Plan, timber harvesting has declined and wildfire has been identified as the primary source of forest disturbance and habitat loss on federal lands (Courtney et al. 2004, Healey et al. 2008, Davis and Dugger 2011, Moeur et al. 2011, USFWS 2011a, Kennedy et al. 2012). Nonetheless, timber harvesting continues to be the primary source of habitat loss on non-federal lands (Healey et al. 2008, Davis and Dugger 2011, Moeur et al. 2011, Kennedy et al. 2012; see below).

Estimates of recent trends in amounts of NSO habitat, and of older forest in general, have been produced as part of monitoring efforts for the Northwest Forest Plan; and are therefore, largely restricted to the Plan's area and time span (Davis and Lint 2005, Moeur et al. 2005, 2011, Healey et al. 2008, Davis and Dugger 2011). I have focused on estimates by Davis and Dugger (2011) because they replaced those of Davis and Lint (2005) and are more specific to NSO habitat than those of Moeur et al. (2005, 2011) and Healey et al. (2008). I did not review habitat trend estimates based on federal ESA Section 7 consultation records (Bigley and Franklin 2004, USFWS 2012b) due to greater scientific uncertainty and methodological bias associated with those data (see Bigley and Franklin 2004). Trends described by Bigley and Franklin (2004), Moeur et al. (2005, 2011), Healey et al. (2008), and the US Fish and Wildlife Service (2012b) quantitatively differ from those of Davis and Dugger (2011) but similarly indicate that wildfires have been the primary source of recent habitat loss on federal lands.

Davis and Dugger (2011) used remotely sensed vegetation data (satellite imagery) to model changes in habitat suitability across the NSO's range during the first 15 years of the Northwest Forest Plan (1994-2007 in California and 1996-2006 in Oregon and Washington). Habitat suitability was based on characteristics surrounding thousands of NSO pair locations across the Plan area. Suitable breeding habitat was defined as having both a probability of owl presence greater than expected based on random chance and environmental conditions typical of those found around nesting and roosting pairs. Estimated habitat trends included gross loss of both suitable breeding ("nesting/roosting") habitat and interior ("core") suitable breeding habitat (>330 ft from edge). Davis and Dugger (2011) considered habitat loss to have occurred when an area classified as suitable at the beginning of Northwest Forest Plan was later downgraded to a lower suitability rank (unsuitable or marginal) due to vegetation changes caused by forest disturbances. Davis and Dugger (2011) did not estimate recruitment of, or net changes in, breeding habitat because their remotely sensed data was incapable of accurately capturing relatively slow and subtle habitat changes during development of intermediate-aged and older stands. They did, however, estimate net trends in NSO dispersal habitat, which they defined as forest with a mean conifer canopy cover of at least 40% and a mean conifer DBH of at least 11 inches. Recruitment of dispersal habitat was more detectable than that of breeding habitat due to

more rapid and measurable growth in younger forest (some recruitment also occurred due to degradation of suitable breeding habitat by forest disturbances).

Estimated gross losses of suitable breeding habitat on federal and non-federal lands are presented in Tables 3.2 and 3.3, respectively. During the first 15 years of the Northwest Forest Plan, wildfires were responsible for an estimated gross loss of 236,700 acres (2.7%) of suitable breeding habitat on federal lands rangewide and 13,100 acres (0.3%) on non-federal lands (1.9% of federal and non-federal lands combined). Estimated habitat loss on federal lands was similar to that expected at the time of the Northwest Forest Plan's implementation; however, relatively high rates of habitat loss in relatively dry, fire-prone regions have been a source of conservation concern for NSOs in those areas (Davis and Dugger 2011). In California, wildfires removed an estimated 75,500 acres (4.1%) of suitable breeding habitat on federal lands and 5,600 acres (0.4%) on non-federal lands (2.4% combined). Approximately 70% of habitat loss to wildfires on federal lands occurred within the Oregon and California Klamath Provinces (Table 3.2). Most of this habitat loss was caused by the 1999 Megram Fire and 2002 Biscuit Fire (Table 3.4). Fires in the Eastern Cascades Provinces of Washington, Oregon, and California contributed less to total habitat loss than did fires in the Klamath Provinces, but were often more destructive in terms of proportion of suitable habitat lost within individual fire perimeters. In contrast with federal lands, wildfires were responsible for very little habitat loss on non-federal lands; rather, timber harvesting accounted for most losses in these areas (Figure 3.1).

Table 3.2: Estimated gross losses of suitable NSO breeding habitat on federal lands due to wildfires during 1994-2007 in California and 1996-2006 in Oregon and Washington (adapted from Davis and Dugger 2011, USFWS 2011a).

State	Province	Initial Acres	Acres Lost	Percent Lost
California	CA Cascades	213,200	1,800	0.8%
	CA Klamath	1,489,800	71,600	4.8%
	CA Coast	145,400	2,100	1.4%
Oregon	OR Coast Range	611,200	0	0.0%
	Western OR Cascades	2,258,700	28,900	1.3%
	Eastern OR Cascades	402,900	17,800	4.4%
	Willamette Valley	3,400	0	0.0%
	OR Klamath	985,000	93,600	9.5%
Washington	Olympic Peninsula	763,100	200	0.0%
	Eastern WA Cascades	673,600	20,000	3.0%
	Western WA Cascades	1,283,000	700	0.1%
	Western WA Lowlands	24,700	0	0.0%
Rangewide Total		8,854,000	236,700	2.7%

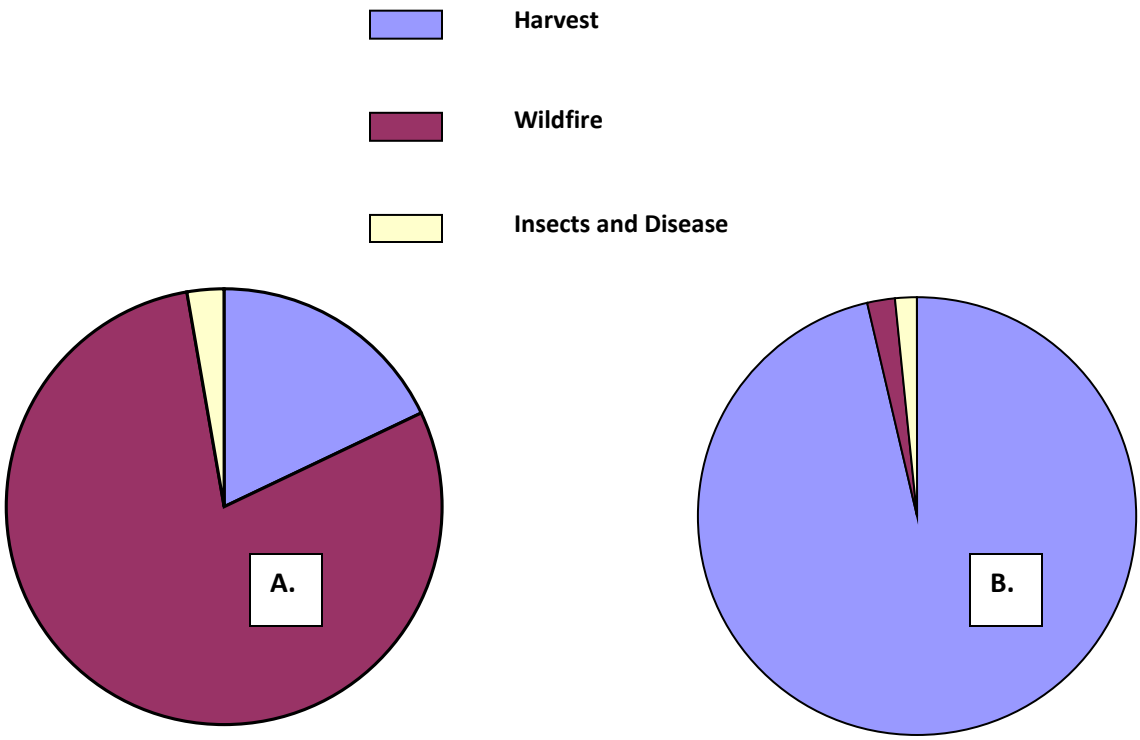
Table 3.3: Estimated gross losses of suitable NSO breeding habitat on non-federal lands due to wildfires during 1994-2007 in California and 1996-2006 in Oregon and Washington (adapted from Davis and Dugger 2011, USFWS 2011a).

State	Initial Acres	Acres Lost	Percent Lost
California	1,556,700	5,600	0.4%
Oregon	1,382,400	5,100	0.4%
Washington	1,258,900	2,400	0.2%
Total	4,198,000	13,100	0.3%

Table 3.4: Estimated gross losses of suitable NSO breeding habitat to individual wildfires during 1994-2007 (note: "habitat degraded" describes areas downgraded from highly suitable to suitable; from Davis and Dugger 2011).

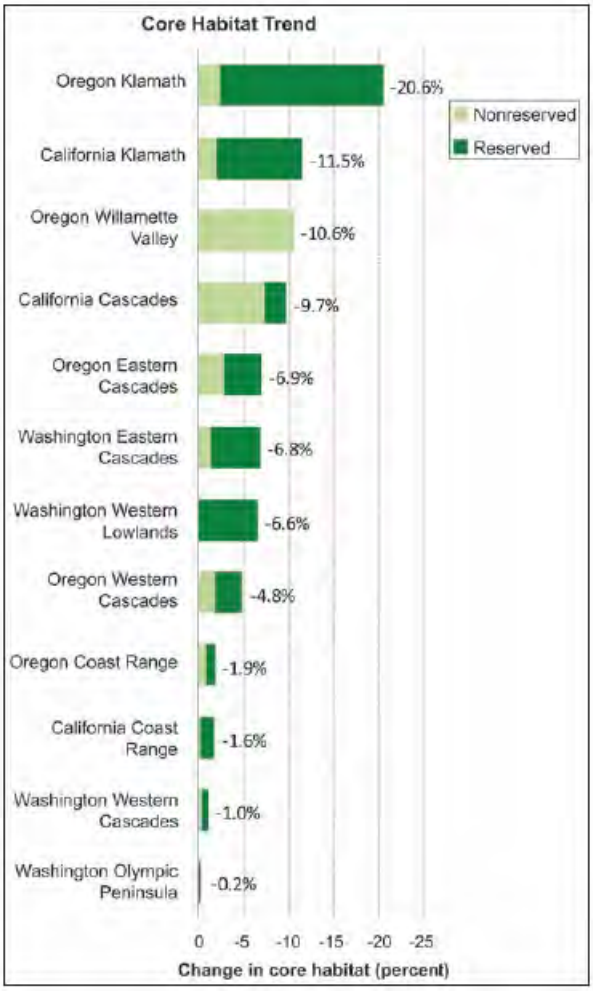
Fire name	Year	Broad physiographic province	Habitat in wildfire perimeter	Habitat lost		Habitat degraded	
			Acres	*Acres*	*%*	*Acres*	*%*
Biscuit Fire	2002	Klamath Mountains	226,230	93,730	41	12,019	5
Megram Fire	1999	Klamath Mountains	76,337	27,520	36	4,589	6
B&B Complex	2003	East Cascades	26,269	16,403	62	907	3
Bake-oven Fire	2006	Klamath Mountains	23,946	8,873	37	581	2
Boulder Fire	2002	West Cascades	34,059	8,460	25	2,074	6
Davis Fire	2003	East Cascades	8,050	6,943	86	5	0
Pigeon Fire	2006	Klamath Mountains	13,896	5,634	41	327	2
Rex Complex	2001	East Cascades	8,548	4,750	56	278	3
Timbered Rock	2002	West Cascades	10,216	4,539	44	569	6
Spring Fire	1996	West Cascades	13,504	3,931	29	858	6
Deep Harbor Fire	2004	East Cascades	5,761	3,930	68	64	1
Hancock Fire	2006	Klamath Mountains	12,712	3,132	25	336	3
Apple Fire 2	2002	West Cascades	12,227	2,810	23	928	8
Fischer Fire	2004	East Cascades	4,479	2,340	52	34	1
Fork Fire	1996	Klamath Mountains	2,962	2,113	71	14	0
Needles Fire	2003	East Cascades	1,946	874	45	1	0
Trough Fire	2001	Klamath Mountains	1,851	798	43	4	0
Hunter Fire	2006	Klamath Mountains	2,236	789	35	40	2
Deer Point Fire	2002	East Cascades	505	380	75	0	0
Tatoosh Complex	2006	East Cascades	666	378	57	0	0

Figure 3.1: Proportions of suitable breeding habitat loss attributed to harvesting, wildfire, and insects and diseases on (A) federal lands and (B) non-federal lands during 1994-2007 (adapted from Davis and Dugger 2011 and USFWS 2011a).



Davis and Dugger (2011) reported substantial losses of interior (>330 ft from edge) breeding habitat on federal lands during the first 15 years of the Northwest Forest Plan (Figure 3.2). These losses primarily occurred in reserved areas. Changes in ratios of interior and edge habitat classes indicated that increased fragmentation of suitable breeding habitat on federal lands was greatest in the Oregon and California Klamath Provinces and California Cascades Province (see Table 3-3 in Davis and Dugger 2011). Increased fragmentation in these regions was primarily due to wildfires.

Figure 3.2: Gross losses of interior suitable breeding habitat on reserved and non-reserved federal lands during 1994-2007 in California and 1996-2006 in Oregon and Washington (from Davis and Dugger 2011).



Davis and Dugger (2011) estimated a 5.2% net gain in NSO dispersal habitat. Much of this gain was due to succession in young forests in non-reserved lands at the margins of federal forests. However, accounting for forest connectivity and NSO dispersal distances, Davis and Dugger (2011) reported a 1% net loss of "dispersal-capable landscape". Much of the loss of dispersal-capable landscape in the Klamath and Eastern Cascades Provinces was due to large wildfires,

whereas timber harvesting on non-federal lands was responsible for much of the loss in other regions.

Loss and fragmentation of breeding habitat to wildfires was likely at least partially offset by recruitment of new habitat through succession of mature and old forest. However, Davis and Dugger (2011) found that detectable recruitment of breeding habitat primarily occurred in the marginal suitability class. This finding was supported by Moeur et al. (2005), who found that about 90% of recruitment of older forest (mature and old-growth combined) during the first 10 years of the Northwest Forest Plan was at the lower end of the class' diameter range (i.e., mean DBH 20-30 in). In their subsequent report, Moeur et al. (2011) noted that given the short length of the monitoring period (10-14 yrs), recruitment was "likely due to incremental stand growth over the 20-in diameter threshold, or from understory disturbances that removed smaller diameter trees and raised the average stand diameter above the threshold, rather than from an increase in forests of much larger and older trees." It is likely that some newly recruited mature forest provides suitable habitat for NSOs but much if it could lack the canopy layering, large diameter snags and logs, and other structural attributes typical of nesting and roosting habitat (Blakesley et al. 2004).

Loss and fragmentation of suitable breeding habitat does not necessarily equate to negative impacts on NSOs (Franklin and Gutiérrez 2002; e.g., Bond et al. 2002, 2009, Lee et al. 2012). Studies in southern Oregon and northern California found that the presence and fitness of NSOs are generally highest in landscapes with a mix of both large amounts of suitable breeding habitat and other habitat classes, such as foraging habitat or "non-habitat" (Franklin et al. 2000, Zabel et al. 2003, Olson et al. 2004, Dugger et al. 2005; reviewed above and in Ch. 2 [see Ch. 2 for studies' habitat definitions]). Fitness is also generally highest when suitable breeding habitat occurs in large or clustered patches with large amounts of ecotone or edge between vegetation classes (Franklin et al. 2000, Dugger et al. 2005). This combination of conditions is important because it provides NSOs with a balance of resources needed for both survival and reproduction (Franklin et al. 2000). Active fire regimes in dry forests within the NSO's range in California (e.g., mixed-conifer and interior mixed-evergreen) historically contributed to these conditions by generally sparing older forest and maintaining some form of habitat heterogeneity at both stand and landscape scales (Skinner and Taylor 2006, Skinner et al. 2006, Stuart and Stephens 2006). Some contemporary wildfires may still burn in this manner and thereby continue to perform an important ecosystem function in these forests. However, large severe wildfires have contributed, along with fire suppression and timber harvesting, to homogenization of some forests in interior northern California (Skinner et al. 2006). Thus, large severe wildfires may impact NSOs in California through loss of habitat heterogeneity, as well as reduced amounts and connectivity of suitable breeding habitat.

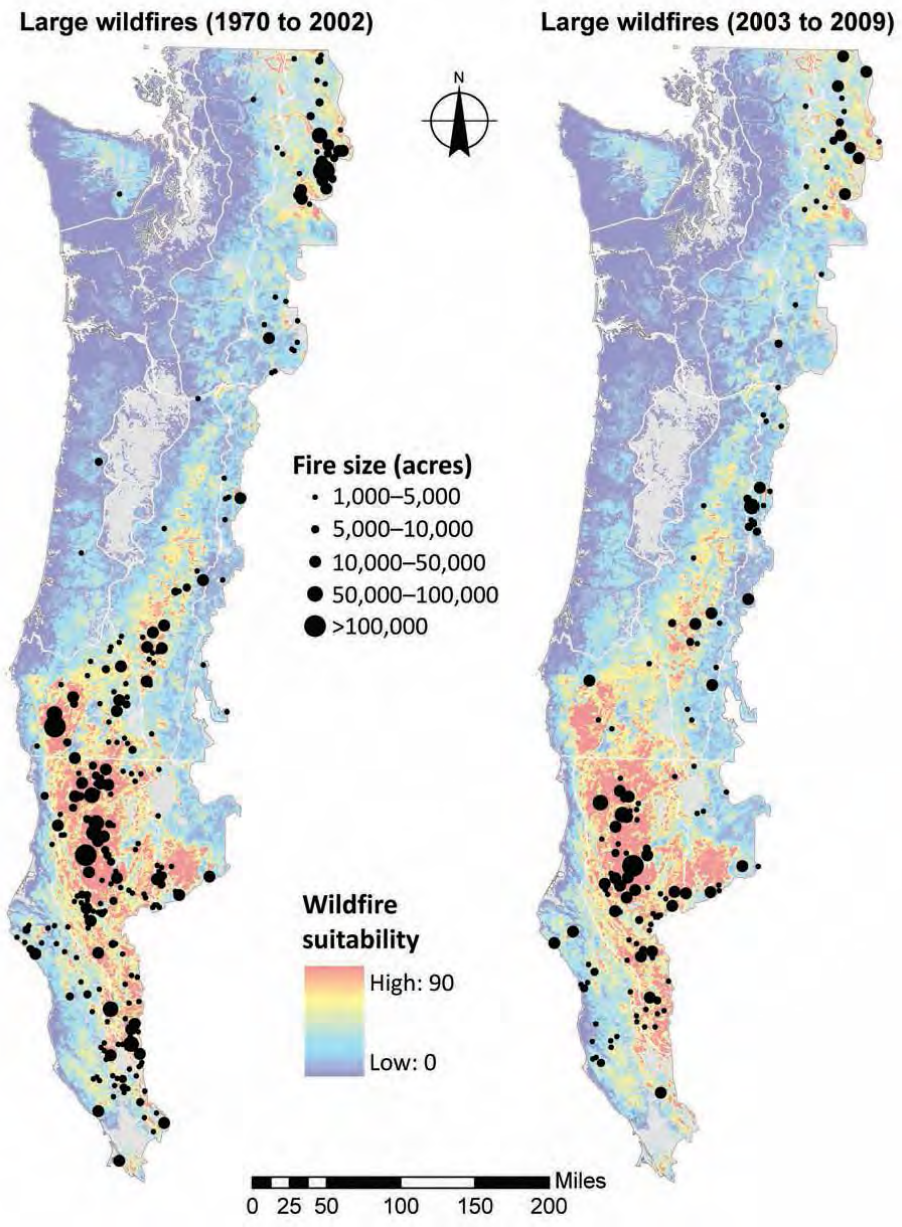
Fire Risk in California

Prior to Euro-American settlement, dry forests in California generally experienced relatively frequent, low-to-moderate or mixed severity fire regimes (Skinner and Taylor 2006, Skinner et al. 2006, Stuart and Stephens 2006, Van de Water and Safford 2011). Mean pre-settlement fire return intervals in California were 11 years in yellow pine forests (e.g., *Pinus ponderosa*, *P. jeffreyi*), 11-16 years in mixed-conifer forests, and 29 years in mixed-evergreen forests (Van de

Water and Safford 2011). Mean fire return intervals in redwood forests south of Del Norte County were also relatively frequent (6-44 yrs: Stuart and Stephens 2006). Frequent fire during the pre-settlement period generally maintained forests with less dense and more clumped tree distributions, higher proportions of fire-resistant trees (i.e., larger size classes and more fire-tolerant species), and lighter and less continuous fuel beds than occur today (Skinner and Taylor 2006, Skinner et al. 2006, Stuart and Stephens 2006). In northern California, this characteristic fine-scale structural heterogeneity was often overlaid with coarser variability created by effects of elevation, terrain, soils, and other physiographic factors on fire and vegetation patterns (Skinner and Taylor 2006, Skinner et al. 2006, Sawyer 2007). For example, in areas of deeply incised terrain in the Klamath Mountains and southern Cascades of California, upper slopes and south and west facing aspects typically experienced more frequent and severe fire than did other areas (Skinner and Taylor 2006, Skinner et al. 2006). Due to fire suppression, early-successional vegetation communities formerly maintained by frequent, small-scale severe wildfire have greatly declined in some areas of California (Skinner 1995, Nagel and Taylor 2005). Overall, research indicates that fire suppression and other human activities have led to decreased forest heterogeneity at both stand and landscape scales and have contributed to substantial changes in fire regimes in California's dry forests (Skinner and Taylor 2006, Skinner et al. 2006, Stuart and Stephens 2006).

Due to fire suppression, fire-free periods have dramatically increased in California's interior forests (Skinner and Taylor 2006, Skinner et al. 2006). For example, fire rotation near Hayfork in the Klamath Mountains increased more than 10-fold (from 19 to 238 yrs) during the post-settlement period (Taylor and Skinner 2003). Abnormally long fire-free periods have facilitated increased accumulation and continuity of fuels in dry, fire-prone forests (Skinner and Taylor 2006, Skinner et al. 2006, Stuart and Stephens 2006). When wildfires do occur there is often an increased risk of them becoming very large and for suppression forces to be overwhelmed by their size and number (e.g., CAL FIRE 2008). As in other dry forests across the western U.S., the mean and maximum sizes of wildfires, and the total annual area burned, significantly increased in California's dry montane forests during the 20th and early 21st Centuries (Miller et al. 2009, 2012). CAL FIRE (2008) noted that more than half of the 26 largest fires recorded in California during 1932-2008 occurred during the last eight years of that period. Based on recent (1970-2002) fire behavior, most of northern California's interior can be classified as highly prone to large (>1,000 ac) wildfires (Davis et al. 2011; Figure 3.3).

Figure 3.3: Relative probability of large (>1,000 ac) wildfires ("wildfire suitability") across the NSO's range (from Davis et al. 2011). Modeling was based on landscape and climatic characteristics of locations at which large wildfires occurred during 1970-2002 (left) and was compared with subsequent (2003-2009) locations (right).



Studies of recent trends in extents of high severity wildfire in California have found conflicting results. For example, Miller et al. (2009) and Miller and Safford (2012) reported a substantial increase in the extent of high severity wildfire in the Sierra Nevada and southern Cascades of California during 1984-2010; while Hanson and Odion (2014) did not find an increase in the Sierra Nevada during the same period. Similarly conflicting results have been found for the California Klamath Province. Hanson et al. (2009) found a significant increase in high severity wildfire in the California and Oregon Klamath Provinces during 1984-2005; whereas Miller et al. (2012) did not find an increase in the California Klamath Province during a similar period (1987-2008). Scientific debate ensued regarding the appropriateness of methods used in various studies to determine trends in high severity fire (e.g., Hanson et al. 2009, 2010 vs. Spies et al. 2010).

Differences in findings regarding trends in high severity wildfire are related to variation in studies' temporal and spatial scales of analysis, as well as in methods for determining fire severity (Courtney et al. 2008, Miller et al. 2012, Hanson and Odion 2014). For example, Miller et al. (2012) noted that both their own study and those of Odion et al. (2004, 2010) may have underestimated trends in high severity wildfire in the California Klamath Province due to inclusion of unusual fire years. Studies by Odion et al. (2004, 2010) were based on fire effects during a single year (1987), which Miller et al. (2012) described as unusual. Large areas burned at below-average severity during 1987 due to abnormally strong inversions, and the fact that some of the wildfires burned well into fall when conditions often favor lower severity fire. Miller et al. (2012) also noted that their own ability to detect a trend in wildfire severity could have been compromised by inclusion of both this year and 2008, which likewise experienced unusually large, low severity wildfires. Differences in the area analyzed could also affect evaluations of trends in high severity wildfire. For example, the Biscuit Fire, which was predominantly located in Oregon, included extensive areas of high severity fire and therefore could have influenced results of trends analyses for the Oregon and California Klamath Provinces combined versus the California Klamath alone (Miller et al. 2012).

Regardless of whether or not the extent of high severity wildfire increased in California during the last two decades, large severe wildfires have recently occurred in these areas, and they were responsible for most loss, degradation, and fragmentation of suitable breeding habitat for NSOs on federal lands (Davis and Dugger 2011, Davis et al. 2011; see above). These data cannot be used to project how fires in the future will affect NSOs since they do not necessarily represent past or future fire conditions or effects. However, it is highly unlikely that wildfires will cease to be a major source of habitat loss for NSOs in the future. Rather, climate change research has generally projected a continued increase in the number and sizes of wildfires and the annual area burned in California and other western states during coming decades (Westerling et al. 2006, Lenihan et al. 2008, Westerling and Bryant 2008, Littell et al. 2009, Moritz et al. 2012, Stavros et al. 2014). There is scientific uncertainty regarding recent and future trends in the extent of high severity wildfire in California. Nonetheless, large severe wildfires will at least occasionally occur in the future and will continue to be a source of habitat loss and modification for NSOs in the state.

Increases in the number and sizes of wildfires, and effects of wildfires on NSO habitat trends, have led to calls for widespread use of thinning and other forms of active management in dry, fire-prone forests within the Northwest Forest Plan area (USFS and BLM 1994, USFWS 2008,

2011, 2012a, Franklin and Johnson 2012). Some researchers and stakeholders, however, have expressed doubts regarding estimates of wildfire risk and effects on NSOs, concerns about potential effects of thinning on NSOs, and distrust of federal agency intentions (Hanson et al. 2009, Heiken 2010, DellaSala et al. 2013, Odion et al. 2014). As discussed in Chapter 2 (also Hansen and Mazurek 2010, USFWS 2011a), there is currently little known about the effects of forest thinning on spotted owls but the preponderance of evidence indicates that commercial thinning can have negative short-term effects on the species (also see Tempel et al. *in press* regarding potential long-term effects). Federal agencies should carefully consider this information, as well as apparent effects of wildfires on NSOs, when formulating land management policies and prescriptions aimed at reducing wildfire risk in landscapes occupied by the subspecies. Land managers should also consider greater use of prescribed fire and allowing wildfires to burn under favorable conditions; particularly at lower elevations in the California Klamath Province, where summertime inversions often minimize fire severity (Miller et al. 2012).

Acknowledgements

I am grateful to Ray Davis and Derek Lee for their helpful comments on earlier drafts of this chapter. I recognize that many of the topics reviewed in this chapter are scientifically or politically contentious. The approach and conclusions in this review are my own and do not necessarily reflect those of the reviewers.

Ch. 4: Barred Owls

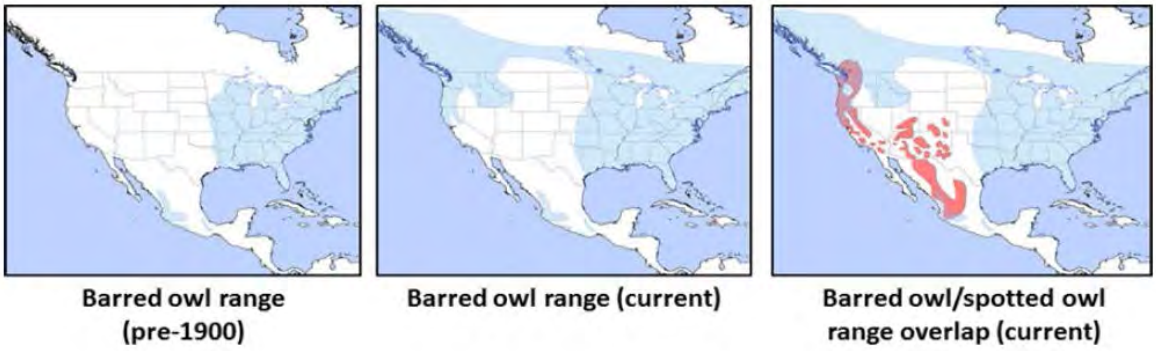
Introduction

At the time of the NSO's federal listing, the barred owl was recognized as a potential threat to the subspecies (USFWS 1990, Thomas et al. 1990). Since then, barred owls have continued to invade the range of the NSO and are apparently increasing in numbers (USFWS 2013). As reviewed herein, a large body of correlational and anecdotal evidence, supplemented by preliminary findings from barred owl removal experiments, indicates that barred owls are negatively impacting NSO populations across their range and that this is due to competition between the two species for space, habitat, and food. Research reviewed below indicates that the barred owl is a superior competitor to the NSO due to its larger size, more aggressive behavior, higher reproductive potential, higher population densities, and broader ecological niche (e.g., USFWS 2013, Wiens et al. 2014). The USFWS (2011a) recently listed the barred owl invasion as one of three main threats currently faced by NSOs (along with timber harvesting and wildfires). The USFWS (2011a) described this threat as "extremely pressing and complex" and "requiring immediate consideration." Information reviewed below suggests that lethal control of barred owls is a viable management option for some areas, although it may be difficult to overcome emotional and ethical resistance to killing one charismatic species to save another (Diller et al. 2013, Higley 2014). Habitat conservation for NSOs appears to be of increasing importance because the negative effects of habitat loss and fragmentation on NSOs can be exacerbated by the presence of barred owls (Dugger et al. 2011).

The Barred Owl's Expansion

Prior to the mid-1900s, the barred owl's range was confined to southeastern Canada, the eastern U.S., and portions of Mexico (Gutiérrez et al. 2004, 2007; Figure 4.1). By the mid-20th century the barred owl's range began expanding westward across North America and currently includes the southern boreal forest zone and British Columbia in Canada and the northern Rocky Mountains, Pacific Northwest, and northern California in the U.S. (Livezey 2009, USFWS 2013; Figure 4.1). The barred owl's range now completely overlaps that of the NSO and partially overlaps that of the California spotted owl (*S. o. occidentalis*) (Figure 4.1). It is unclear whether the barred owl's westward range expansion occurred via the Great Plains or Canada's boreal forests (USFWS 2013). It is also uncertain whether this range expansion was facilitated by natural factors, human activities, or a combination of the two. Hypotheses concerning the cause of the barred owl's range expansion include increased adaptation by the species to coniferous forests; natural climate change; environmental changes associated with widespread intensive timber harvesting; and conversion of open areas to forest due to fire suppression, planting parks and woodlands, removal of keystone species, or other human activities (Gutiérrez et al. 2004, USFWS 2013).

Figure 4.1: Historical and current range of the barred owl and comparison of the current ranges of the barred owl and spotted owl (from USFWS 2013).



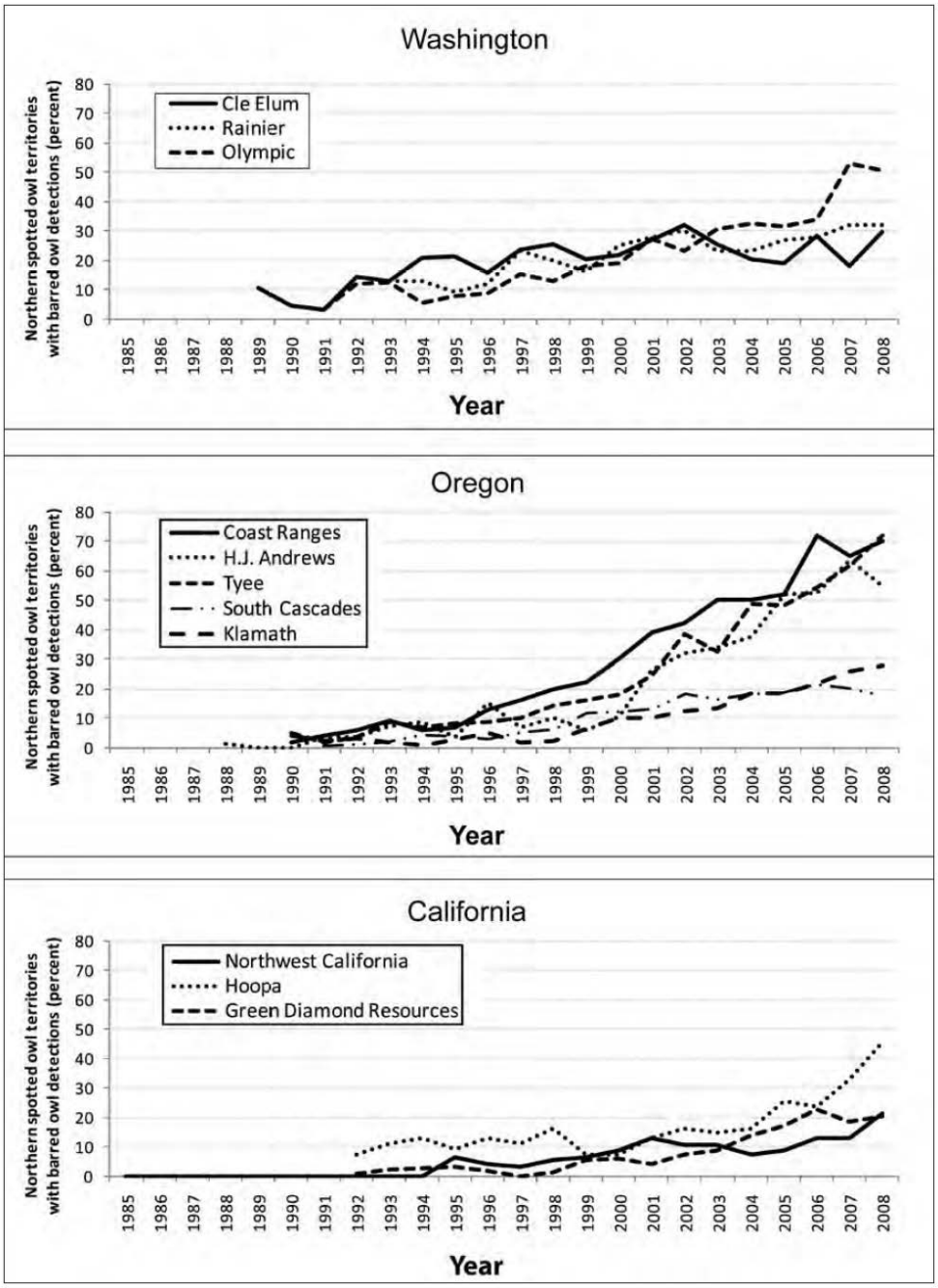
Reliable data concerning current barred owl densities and population trends are unavailable. Most information about barred owl trends in the Pacific Northwest and California is based on incidental detections during surveys for spotted owls (USFWS 2013). Researchers have estimated that only 1/2 to 2/3 of barred owls present are detected during NSO surveys (Gutiérrez et al. 2004, Bailey et al. 2009, Wiens et al. 2011). Researchers have only recently begun to systematically survey for barred owls within the range of the NSO and only in limited areas. In California, the Northwest California, Green Diamond, and Hoopa NSO demographic studies initiated systematic surveys for barred owls in 2009 (Franklin et al. 2014, Green Diamond Resource Company 2014).

Some early studies of barred owls within the NSO's range likely overestimated barred owl numbers by focusing on cumulative and nighttime detections (Gutiérrez et al. 2004). However, barred owl trends are now more frequently evaluated in terms of the number of spotted owl territories in which barred owls have been detected (USFWS 2013; e.g., Forsman et al. 2011, Calforests 2014). Reports of the number of spotted owl territories with barred owl detections probably underestimate barred owl densities and population trends (USFWS 2013). Barred owls often have substantially smaller home ranges than spotted owls so it is possible for a single spotted owl home range to encompass multiple barred owl home ranges (Singleton et al. 2010, Wiens 2012; see below). Without color-banding or follow-up surveys to determine the identity and occupancy status of barred owls, it is often unclear if multiple detections within spotted owl territories represent one or multiple barred owls. Furthermore, a lack of barred owl-specific surveys in many areas has likely led to underestimates of barred owl presence. For example, in 2013, NSO-specific surveys on the Hoopa reservation in northwestern California indicated that barred owls were present in 43% of NSO territories on the reservation, whereas barred owl-specific surveys revealed that barred owls were present in 75% of NSO territories (Higley and Mendia 2013).

Despite uncertainty regarding barred owl densities and population trends, incidental detections clearly indicate that the species rapidly expanded its range into that of the NSO (USFWS 2013). For example, barred owls expanded their range from western Washington to northern California in less than 10 years (Gutiérrez et al. 2004). Incidental detections also suggest that barred owl densities are continuing to increase within the range of the NSO. From 1985-2008, the

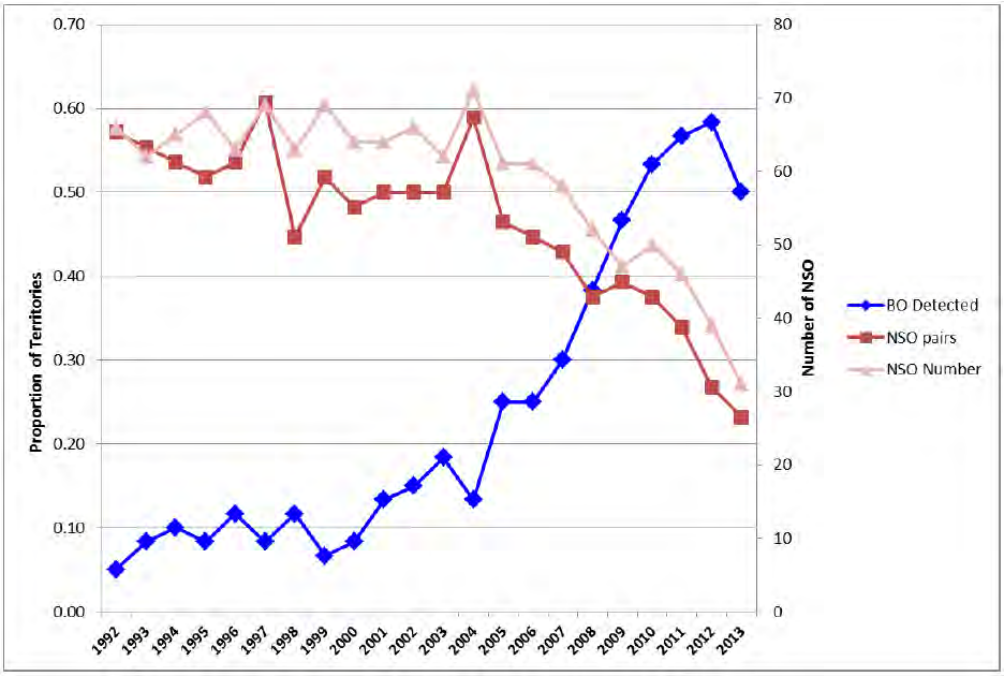
proportion of NSO territories with known barred owl presence increased in demographic study areas throughout the NSO's range, suggesting increasing barred owl populations (Forsman et al. 2011; Figure 4.2). Until the mid-2000s, barred owl increases in Washington and Oregon were steeper than those in California (Forsman et al. 2011; Figure 4.2), which is consistent with the species' later colonization of California (USFWS 2013). However, barred owls are currently increasing at an accelerated pace in at least some portions of northwestern California (see below).

Figure 4.2: Annual proportion of northern spotted owl territories with barred owl detections (≤0.62 mi from spotted owl activity center) on demographic study areas in Washington, Oregon, and California (from Dugger and Davis 2011, adapted from Forsman et al. 2011).



Recent reports from California's demographic studies indicate that barred owls continued to increase in numbers and to invade additional NSO territories during 2009-2013 (Higley and Mendia 2013, Franklin et al. 2014, Green Diamond 2014). As noted above, California's demographic studies initiated barred owl-specific surveys in 2009. The Green Diamond Resource Company also began a barred owl removal experiment in a portion of their demographic study area during the same year (see below). Detection and occupancy data reported here for 2009-2013 are not directly comparable to previously collected data, except for from the Hoopa demographic study, which separately reported data from NSO- and barred owl-specific surveys. In the Northwest California demographic study area and nearby Regional Study Area, the number of NSO territories with barred owl detections increased by 76% (from 21 to 37) during 2009-2013 and the estimated number of barred owl sites increased by 170% (10 to 27) (Franklin et al. 2014). On Green Diamond Resource Company lands, the total estimated number of barred owl sites increased by 57% (numbers not reported) during 2011-2013 (Green Diamond 2014). In the Hoopa demographic study area, NSO-specific surveys indicated that the percent of NSO territories with barred owl presence increased from 47% to 58% during 2009-2012 and dropped to 50% in 2013 for unreported reasons (Higley and Mendia 2013; Figure 4.3).

Figure 4.3: Total number of northern spotted owls detected (NSO Number), percentage of territories occupied by spotted owl pairs (NSO Pairs) and percent of historical spotted owl territories with at least one barred owl detection (BO Detected) received during spotted owl surveys, annually within the Hoopa Valley Indian Reservation demographic study area during 1992-2013 (from Higley and Mendia 2013).



Cumulative detections in the California Natural Diversity Database (CNDDB) from 1978 through 1990, 1998, 2006, and 2013 provide a crude picture of the barred owl's expansion in California (Figure 4.4). These detection data suggest that the species expanded its range into the state along the northern coast and southern Cascades and more rapidly increased in wetter regions (Figures 4.4 and 4.5). Earlier and more rapid colonization of relatively mesic forests by barred owls is consistent with observations from studies in Washington (Gutiérrez et al. 2007). While cumulative detections cannot be used to evaluate the abundance or densities of barred owls, they suggest that the species is relatively abundant along the coast and in the adjacent Six Rivers National Forest and vicinity (including the Northwest California and Hoopa demographic study areas), whereas they appear to still be in the process of colonizing the Mendocino, Klamath, and Shasta-Trinity National Forests and other interior areas of northern California. However, it is possible that this pattern is biased by the fact that most barred owl detections occur during surveys for spotted owls, which may be more densely concentrated or better surveyed in northwestern California. Concentrations of barred owl detections in northwestern California may be partly associated with intensive survey effort for spotted owls in the region's three demographic study areas. Furthermore, the Six Rivers National Forest conducted forest-wide surveys for NSOs in 2010 and subsequently continued to survey large areas associated with forest projects. Barred owls have a broader ecological range than do spotted owls, so they may be more widely distributed than is shown in Figure 4.4 (USFWS 2013).

Figure 4.4: Cumulative northern California barred owl detections in the California Natural Diversity Database from 1978 through A) 1990, B) 1998, C) 2006, and D) 2013 (note: dark red symbols denote higher concentrations of detections).

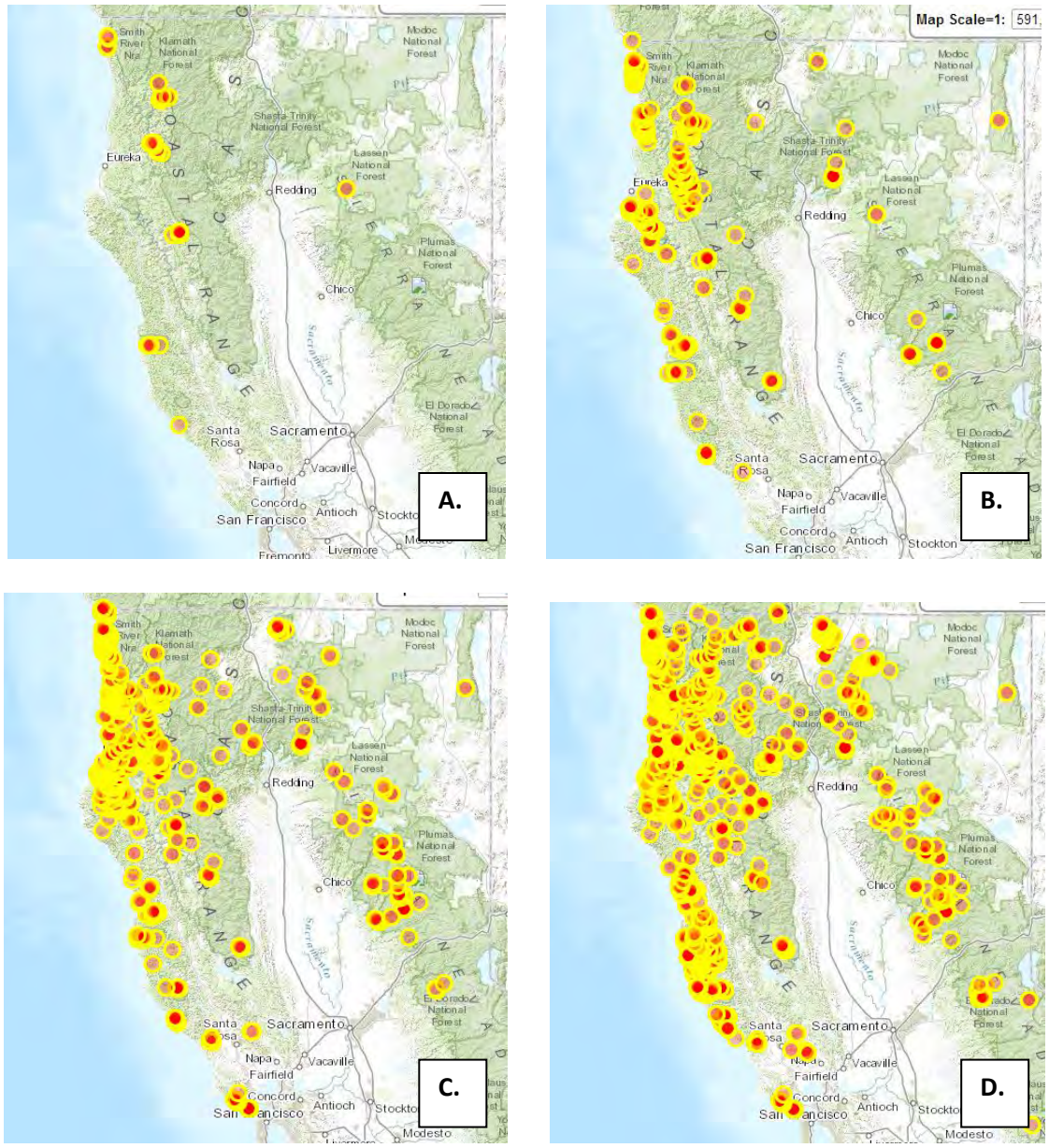
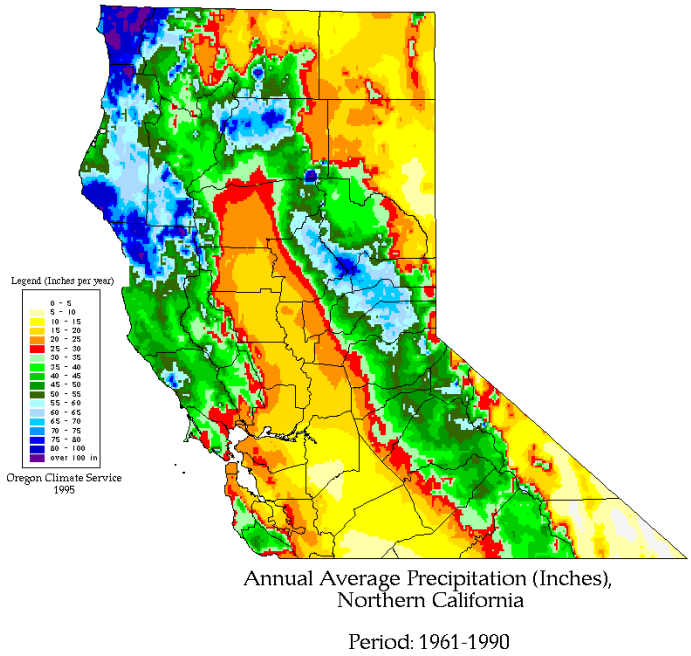


Figure 4.5: PRISM precipitation map for northern California (1961-1990) (Western Regional Climate Center).



Barred owls have increased dramatically in California's Redwood National and State Parks (Gutiérrez et al. 2004). In 2012 alone, NSO surveyors detected at least 17 barred owls at 10 different sites (Schmidt 2013). In contrast, NSOs were detected at only four historical territories in 2012. It is possible that more NSO territories were active during that year as relatively little of the landscape was surveyed. However, Schmidt (2013) noted that the Redwood National and State Parks have discontinued surveying many areas due to what appears to be almost complete displacement of NSOs by barred owls. Based on clusters of barred owl detections ($\leq$1 mi apart) during 1993-2012, Schmidt (2013) estimated that the Redwood National and State Parks contain a total of 58 barred owl territories. Barred owls have only recently invaded National Park lands in Marin County, California and have been slow to increase in numbers thus far (Ellis et al. 2013). Barred owls were first detected in Marin County in 2002 and were detected at only four (13%) NSO monitoring sites in the area in 2012 (Ellis et al. 2013). Ellis et al. (2013) hypothesized that the barred owl's expansion into Marin County has been limited due to extensive agricultural and urban lands surrounding the area. They also stated however, that barred owl numbers would likely continue to increase in the area over time and could eventually pose a substantial conservation problem for this small and relatively isolated population.

Most information about barred owls on private timberlands in California is from ownerships in the Redwood Province. Data provided by the Green Diamond Resource Company are described above, along with those from other NSO demographic studies in California. Reports from both the Humboldt Redwood Company (Humboldt County) and Mendocino Redwood Company (Mendocino and Sonoma Counties) suggest that barred owls are currently rapidly increasing on those lands. Despite a marked decline in annual numbers of nighttime NSO surveys, Humboldt

Redwood Company (2013) found an overall increase in barred owl detections within 0.5 mile of NSO activity centers during 2003-2013 (Figure 4.6). However, some of the increase in barred owl detections between 2010 and 2011 could have been due to greater survey effort associated with adoption of the USFWS (2012c) revised survey protocol for NSOs. Mendocino Redwood Company (2014) data suggest that barred owls increased substantially on their lands during 2005-2013 (Figure 4.7). Barred owls were detected within one mile of 47 (45%) NSO activity centers on these lands in 2013. The number of NSO territories with barred owl detections increased by 113% during 2010-2013. Mendocino Redwood Company (2014) noted that barred owls have been detected within one mile of 71 NSO activity centers on their lands since 2005. The Conservation Fund (in Calforests 2014), which manages lands in Mendocino and Sonoma Counties, stated that barred owls have been detected "across their ownership" since 2009. They currently have four sites at which barred owls are "regularly detected" and another area in which they are "occasionally detected".

Figure 4.6: Number of barred owl detections within 0.5 mile of northern spotted owl activity centers on Humboldt Redwood Company lands during 2003-2013 (from Humboldt Redwood Company 2013).

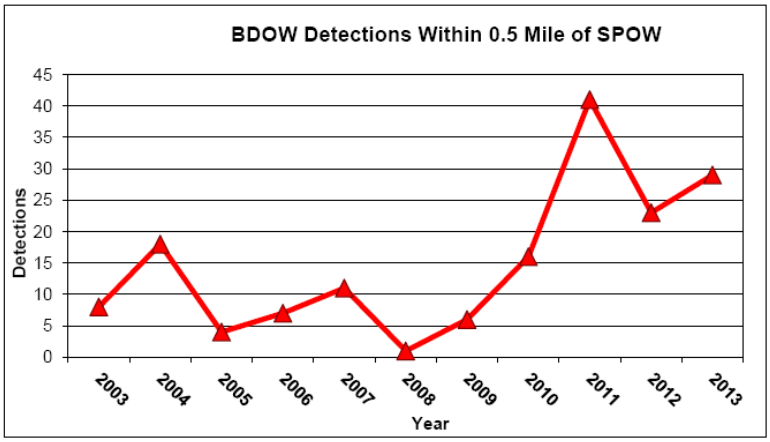
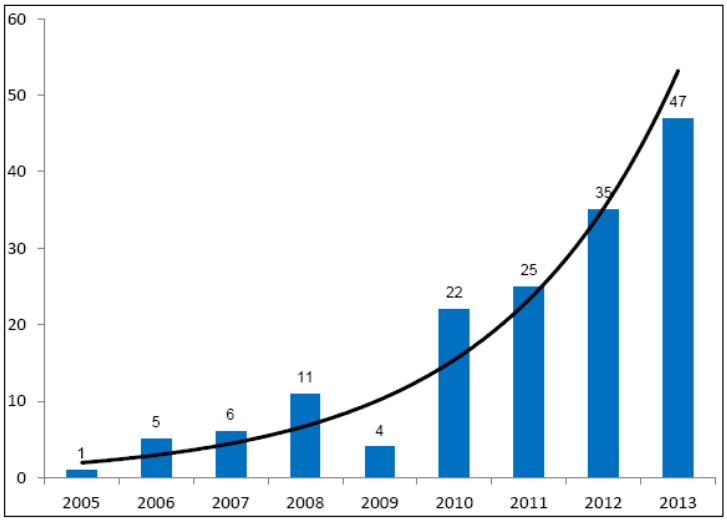


Figure 4.7: Percent (y-axis) and number of northern spotted owl territories (1 mi radius around activity centers) on Mendocino Redwood Company lands with barred owl detections during 2005-2013 (note: the apparent decline in NSO territories with barred owl detections in 2009 coincided with a substantial dip in NSO survey effort) (from Mendocino Redwood Company 2014).



There is relatively little information concerning barred owl numbers on private timberlands in California's Eastern Klamath and Southern Cascade regions. In 2013, Sierra Pacific Industries confirmed barred owl occupancy at 14 of 28 known/historical barred owl sites within their Redding and Weaverville Districts (eastern Klamath and Southern Cascades regions) and located two additional sites (SPI 2014). I was unable to locate any reports of barred owl presence or trends within NSO territories on Sierra Pacific lands. Fruit Growers Supply Company (in Calforests 2014) reported barred owl detections within or "nearby" (distance not reported) five NSO activity centers in Siskiyou County. It was unclear whether these numbers were cumulative or from 2013 alone. Michigan-California Timber Company (in Calforests 2014) reported that barred owls were detected at one site on their lands in Siskiyou County in 2010 and 2012 and two sites in 2009 and 2013. Crane Mills (in Calforests 2014) has detected only one barred owl on their lands in Shasta County. Roseburg Resource Company (in Calforests 2014) has never detected a barred owl during their NSO surveys on lands in Siskiyou and Shasta Counties. The low numbers of barred owl detections on some private timberlands in California's Eastern Klamath and Southern Cascades regions is surprising given the numbers of detections on the Shasta-Trinity and Klamath National Forests and on Sierra Pacific Industries lands in those regions (Figure 4.4), as well as in the Klamath and Southern Cascades demographic study areas in southern Oregon (Davis et al. 2013, Dugger et al. 2014). It is unclear if this is due to differences in survey effort, ecological conditions, management histories, or other factors.

In summary, the barred owl's range now completely overlaps the NSO's range and partially overlaps the California spotted owl's range. Barred owls rapidly expanded their range southward from British Columbia, through Washington and Oregon, and into northern California. The species' range expansion into California appears to have occurred first and most rapidly in northern coastal forests and near the margin of the southern Cascades and northern Sierra

Nevada. The available information suggests that there is currently a high potential for interactions between NSOs and barred owls throughout much of NSO's range in California. The barred owl invasion does not appear to have peaked in the state. Rather, the information reviewed above suggests that the species is continuing to expand into drier, interior portions of California and that their presence in NSO territories is increasing at accelerating rates in the Western Klamath and Redwood regions.

Effects on NSOs

Scientific Uncertainty

There is currently little reliable information concerning trends in barred owl densities or population numbers. Most of what is known about the potential for barred owl interactions with NSOs is based on incidental detections of barred owls during NSO surveys (USFWS 2013). Reliance on NSO surveys limits many studies' inferences concerning barred owl numbers. Gutiérrez et al. (2004) noted that some studies found large numbers of historical NSO territories apparently vacant of both NSOs and barred owls. It is unclear if these vacancies were primarily due to inadequate survey effort for one or both species or if they were caused by some other factor (Gutiérrez et al. 2004). Some of this uncertainty has been reduced due to increased survey effort required by revised survey protocols for NSOs (e.g., USFWS 2012c) and implementation of barred owl-specific surveys in some areas. Inferences from studies of barred owl effects on NSOs are further limited by the observational and retrospective nature of most research of this topic (Livezey and Fleming 2007, USFWS 2013). Most studies of barred owl effects on NSOs have examined correlations between changes in NSO occupancy or demography and barred owl presence near NSO activity centers (see below). These studies do not definitively prove that barred owl presence causes changes in NSO occupancy or demography. However, preliminary results of barred owl removal experiments more directly support conclusions that barred owl presence negatively affects NSOs in a variety of ways (see below).

Hybridization

At the time of the NSO's listing there was concern among some researchers that hybridization between spotted owls and barred owls would lead to the loss of the spotted owl as a distinct species (Gutiérrez et al. 2004). Despite genetic, morphological, ecological, and behavioral differences between spotted owls and barred owls, there appear to be few strong isolating mechanisms to prevent them from interbreeding (Gutiérrez et al. 2007). Yet, hybridization between the two species appears to be relatively rare. For example, an extensive review of NSO survey and banding records from 1970-1999 in Oregon and Washington found reports of only 47 NSO-barred owl hybrids (Kelly and Forsman 2004). Hybridization therefore appears to pose little threat to NSOs compared with the effects of competition (Kelly and Forsman 2004; see below). However, hybridization could become a more serious issue in the future as NSOs continue to decline and become less able to locate conspecific mates (Gutiérrez et al. 2007).

Demography

Forsman et al. (2011) evaluated demographic trends for NSOs in 11 demographic study areas during 1985-2008. They found that NSO reproduction (fecundity) was negatively associated with the presence of barred owls (≤0.62 mi from NSO activity centers) in four study areas, including Green Diamond's in California. Inclusion of the barred owl covariate in one of the best performing models in the meta-analysis of reproduction across all study areas provided weak support for an effect of barred owl presence on reproduction throughout the NSO's range (Forsman et al. 2011). The negative association between reproduction and barred owl presence was likely underestimated since researchers often cannot relocate NSOs displaced by barred owls, and many displaced NSOs may be unable to find new territories and reproduce (Forsman et al. 2011). Apparent survival of NSOs was negatively associated with the presence of barred owls in six of the study areas, including Northwest California and Green Diamond (95% confidence intervals did not overlap zero or only slightly overlapped zero). The meta-analysis for all study areas showed a negative association between barred owl presence and apparent survival and recruitment, although the evidence for an effect on recruitment was statistically weak. Populations in seven study areas, including Northwest California and Green Diamond, declined during the latter portion of the study period (95% confidence intervals did not overlap zero or only slightly overlapped zero for these areas). Model selection results for the meta-analysis of population change indicated support for models that included the barred owl covariate. Forsman et al. (2011) noted that, of the various factors evaluated for potential effects on NSO vital rates, negative associations with the presence of barred owls were the strongest and most consistent among study areas. Forsman et al. (2011) also noted that they likely underestimated these negative associations by applying the barred owl covariate at the population scale rather than the territory scale. Studies of associations between NSO occupancy rates and barred owl presence suggest that the territory is a more appropriate spatial scale for detecting effects of barred owls on NSOs (see below).

Annual reports from NSO demographic studies in the southern portion of the subspecies' range indicate that negative effects of barred owls on NSO demographic and occupancy rates continued to increase following the study period covered by Forsman et al. (2011) (Davis et al. 2013b, Higley and Mendia 2013, Dugger et al. 2014, Franklin et al. 2014, Green Diamond Resource Company 2014; see Ch. 1). The Northwest California and Hoopa study areas experienced dramatic declines in demographic rates subsequent to the end of the 2011 meta-analysis study period and the declines appeared to be largely driven by increasing competition from barred owls (Higley and Mendia 2013, Franklin et al. 2014). Strong negative effects of barred owls on NSO demography will likely be evident for most or all demographic study areas in the forthcoming meta-analysis, which is due for release in 2015.

Occupancy

Numerous studies distributed across the NSO's range have found evidence of a negative effect of barred owl presence on occupancy by the subspecies (Kelly 2001, Kelly et al. 2003, Pearson and Livezey 2003, Gremel 2005, Olson et al. 2005, Kroll et al. 2010, Dugger et al. 2011, Higley and Mendia 2013, Franklin et al. 2014, Green Diamond Resource Company 2014). These findings

suggest that barred owls are causing large-scale displacement of NSOs and that negative effects of barred owls are largely due to interference competition between the two species (see below).

Gremel (2005) found that occupancy by pairs of NSOs in the Olympic National Park in Washington declined significantly at sites with barred owl presence, whereas pair occupancy remained stable at sites without barred owl detections. During 1992-2003 in this study area, the number of barred owl detections in NSO sites per number of survey days increased by 15% per year. During the same period, mean occupancy by NSOs declined from 61% to 42% in sites with barred owl detections.

In the southwestern Washington Cascades, Pearson and Livezey (2003) found a 9% annual increase in the number of barred owl detections relative to the number of NSO detections during 1982-2003. Unoccupied historical NSO core areas (500 ac) had significantly more barred owl activity centers at three spatial scales (0.5, 1.0, 1.8 mi) than did occupied core areas.

Kelly et al. (2003) evaluated potential effects of barred owl presence on NSO occupancy in five demographic study areas in Washington and Oregon. Their analyses indicated that barred owls had a stronger negative effect on NSO occupancy when located closer to activity centers than when farther away. Occupancy by NSOs exhibited a highly significant decline when barred owls were detected within 0.5 mile of activity centers ($P = 0.001$), compared with a lower tendency to decline when barred owls were detected farther away ($P = 0.06$).

Olson et al. (2005) examined associations between NSO occupancy dynamics and the presence of barred owls near activity centers (distance not reported) in three study areas in western Oregon. Barred owl presence was low (detected near <10% of NSO sites each year) in all three study areas during the first eight years of the study (1990-1997), increased substantially in one of the study areas thereafter (maximum of 28% of sites in 2001), and more gradually in the other two (ca. 10% of sites in 2001). Despite relatively low barred owl presence (e.g., compared with Forsman et al. 2011, Figure 4.2), site occupancy probabilities for NSO pairs decreased by 5-15% with increasing barred owl presence.

In one of the western Oregon demographic study areas evaluated by Olson et al. (2005) (Tyee), Bailey et al. (2009) found no evidence of an effect of barred owl presence on NSO occupancy during 2002-2003. They cautioned however, that their study's inferences were weak since barred owl presence was relatively low at the time of the study (detections in <12% of NSO territories based on Olson et al. 2005). Just five years after their study period ended, barred owls were detected in 70% of NSO territories (0.62 mi around activity centers) in the study area (Forsman et al. 2011; Figure 4.2).

In the eastern Cascades of Washington, Kroll et al. (2010) found that the mean probability of occupancy by NSOs was significantly lower for sites with barred owl presence (0.50) than without it (0.76) (presence not spatially defined in the paper). Although the percent of NSO sites with barred owl detections was moderate compared with some areas (max. ca. 33% [estimated from graph] vs. Figure 4.2), site occupancy probabilities for NSOs declined by about 50% during 1990-2003.

In the southwestern Cascades of Oregon, Dugger et al. (2011) found significant differences in mean annual occupancy for NSO pairs with nearby barred owl detections (presence not spatially defined) than in those without. During the latter 13 years of the study, mean annual site occupancy was approximately 10-15% at sites with barred owl presence compared with about 58-78% at sites without barred owl presence (estimated from graph).

Both the Northwest California and Hoopa demographic studies reported dramatic recent declines in NSO occupancy coincident with rapid increases in the percent of NSO territories with barred owl presence (Higley and Mendia 2013, Franklin et al. 2014; e.g., Figure 4.3). Both studies reported sharp declines in NSO numbers and occupancy in the mid-2000s subsequent to a longer period of gradual decline (e.g., Figure 4.3). These observations suggest that the barred owl expansion and its effects on NSOs in the Western Klamath rapidly changed after a post-colonization lag period elapsed or when a crucial threshold in barred owl density was reached.

Green Diamond Resource Company is currently conducting an experiment to evaluate the effects of lethally removing barred owls from NSO territories in California's Redwood Province. Preliminary results from this study suggest that removal of barred owls results in rapid recolonization of sites by NSOs. Green Diamond Resource Company (2014) reported a 43% increase in the number of sites occupied by NSOs in their treatment (barred owl removal) area during the first year (2008 to 2009) and an additional 9% increase the following year (2009 to 2010). In contrast, the number of sites occupied by NSOs in an adjacent control portion of the study area (no barred owl removal) was virtually unchanged from 2008 to 2009 and declined by 23% from 2009 to 2010. However, the degree to which barred owl removal positively affected NSO occupancy in this study is difficult to evaluate. The beginning of Green Diamond's removal study roughly coincided with implementation of a new survey protocol which likely resulted in greater detections of both NSOs and barred owls. Future analyses from this study should provide clearer insight into the effects of barred owl presence and removal on NSO occupancy.

Habitat Use

Dugger and Davis (2011) stated that "the relationship between spotted owl fitness and habitat characteristics may have become disconnected through interspecific competition with barred owls." They based this hypothesis on their finding that mean habitat suitability at NSO pair locations within the Northwest Forest Plan area decreased by approximately 9% between 1994/1996 and 2006/2007 (Davis and Dugger 2011). This decline in mean habitat suitability at NSO pair locations did not appear to be solely due to a loss of suitable breeding habitat, which declined by about 3% in this area during the study period. This hypothesis is also supported by findings that NSOs in the northern portion of their range are often displaced by barred owls into steeper and higher elevation areas (Pearson and Livezey 2003, Gremel 2005, Hamer et al. 2007). Hamer et al. (2007) suggested that displacement of NSOs to higher elevation forests could result in reduced survival or reproduction during years with severe winters. Wiens et al. (2014) found a high degree of overlap in the habitat associations of NSOs and barred owls in western Oregon (e.g., strong selection of old conifer forest). Their best model of habitat use indicated that NSOs were less likely to use locations within or in close proximity to the core-use area of a barred owl.

This finding provides further evidence that barred owls displace NSOs from their preferred habitat.

Territorial Behavior

Barred owl presence and calling is associated with reduced responsiveness of spotted owls to conspecific calls, including survey broadcasts (Olson et al. 2005, Crozier et al. 2006, Bailey et al. 2009, Kroll et al. 2010). This is partially of interest to researchers and land managers because it influences the field and analytical methods required for measuring occupancy by NSOs (Olson et al. 2005, USFWS 2012c). Reduced vocalizing by NSOs in the presence of barred owls is also of concern because NSOs rely on vocalizations to defend their territories, locate vacant territories and potential mates, form pair bonds, and announce prey deliveries (Gutiérrez et al. 1995). Widespread disruption of these activities could impact NSO demographic rates.

Interspecific Competition

Gutiérrez et al. (2004) described the ecological and morphological separation that exists among sympatric owls worldwide. Their review found that species within the same genus are generally segregated by geographic range or habitat associations. It also showed that sympatric congeneric owls are usually strongly divergent in size, which varies with diet and possibly, hunting mode. Spotted owls and barred owls are both members of the genus *Strix*. Gutiérrez et al. (2004) noted that the two species only differ in body mass by 18%, which is likely too little to allow coexistence. A building body of evidence indicates that barred owls indeed negatively affect spotted owls (reviewed above), and that this occurs through both direct (interference) and indirect (exploitative) competition (Gutiérrez et al. 2004, 2007, USFWS 2013; see below). Wiens (2012) stated that "when viewed collectively, the behavioral and life history traits exhibited by barred owls may give them a significant advantage over spotted owls when competing for critical resources such as space, habitat, and food."

Surveyors have observed barred owls attacking spotted owls and have themselves been attacked while imitating spotted owl calls (Gutiérrez et al. 2004). There is also limited evidence of barred owl predation of NSOs. Leskiw and Gutiérrez (1998) provided strong circumstantial evidence that a barred owl killed and partially consumed an NSO in Redwood National Park, California. Johnston (2002 cited in Gutiérrez et al. 2004) found circumstantial evidence of barred owl predation of a juvenile NSO in the southern Oregon Cascades. However, most cases of barred owl aggression toward NSOs appear to be a related to territorial defense, rather than predation (USFWS 2013).

Studies in Washington found that barred owl home ranges are relatively small and tend to have little overlap, which is consistent with aggressive territorial behavior (Hamer et al. 2007, Singleton et al. 2010). In contrast, neighboring NSO home ranges often broadly overlap, particularly during winter (Hamer et al. 2007). There is limited anecdotal evidence of spotted owls aggressively interacting with barred owls (Gutiérrez et al. 2004), and spotted owls appear to reduce detection probabilities for barred owls (Bailey et al. 2009). Nonetheless, barred owls generally exhibit higher levels of vocal and physical aggression than do NSOs and are typically dominant during interactions between the two species (Van Lanen et al. 2011). Significantly

reduced detection probabilities for NSOs in the presence of barred owls provides further evidence of the larger, more aggressive barred owl's behavioral dominance over NSOs (see above).

Barred owls are dietary generalists compared with NSOs (USFWS 2013, Wiens et al. 2014). As dietary generalists, barred owls may be better able to colonize a wider variety of habitats than NSOs and may be more resilient to fluctuations in prey populations (USFWS 2013). The barred owl's generalist diet is likely a primary reason for the species' relatively small home ranges and associated ability to occur at high densities (see below). Furthermore, because barred owl diets overlap with those of NSOs, it is possible that they negatively affect NSOs by depressing populations of key prey, such as northern flying squirrels and woodrats (Gutiérrez et al. 2007, USFWS 2013).

The barred owl's habitat associations in the Pacific Northwest and California are poorly understood. As discussed earlier, most barred owl detections are incidental to spotted owl surveys so relatively little is known about the ecology of barred owls outside of areas occupied by spotted owls. Early studies of the barred owl's habitat associations in the Pacific Northwest suggested that the species is more associated with younger forest types than are NSOs (Gutiérrez et al. 2007). However, subsequent research has found that barred owls use a variety of habitats and, like NSOs, often show a preference for old forest (Gutiérrez et al. 2007, USFWS 2011a, Wiens et al. 2014). Thus, barred owls appear to be capable of occupying a broader variety of habitat types than NSOs but the two species likely compete for access to mature and old forest. The two species may also compete for nest sites since they both rely on the same kinds of pre-existing nest structures (Gutiérrez et al. 2007). Together, overlapping habitat associations with NSOs, use of a broader range of habitat types, and the ability to occur at relatively high densities allows barred owls to form large source populations in close proximity to NSOs (USFWS 2013).

Perhaps due to their generalist diet, barred owls often have substantially smaller home ranges than do NSOs (Gutiérrez et al. 2007, USFWS 2013). Estimates of barred owl home ranges in Washington were three to nine times smaller than those of NSOs in the state (Hamer et al. 2007, Singleton et al. 2010). Barred owl home ranges in the Oregon Coast Ranges were two to four times smaller than those of NSOs (Wiens et al. 2014). There does not appear to be any existing research comparing the home range sizes of barred owls and NSOs in California (Gutiérrez et al. 2007). Annual home range sizes for NSOs (100% minimum convex polygon) in the California and Oregon Klamath Provinces varied among studies and with forest types and contiguity but were similar to or somewhat larger (0-60% larger) than those for barred owls in the Oregon Coast Ranges (Sisco 1990, Carey et al. 1992, Zabel et al. 1993, Irwin et al. 2006). The NSO's smaller home ranges in California suggest that they may have lower encounter rates with barred owls than occurs in Oregon and Washington. However, it is possible that barred owls also have smaller home ranges in California. Estimates of barred owl home range sizes in California are needed.

Wiens et al. (2014) found that barred owls in the Oregon Coast Ranges had a slightly higher annual survival probability than sympatric NSOs (0.92 vs. 0.81; not statistically significant) and that pairs produced an average of 4.4 times as many young. Barred owls have a wider range of clutch sizes than NSOs (1-5 vs. 1-3), are capable of laying additional clutches within a season if

the first is lost, and appear to exhibit lower annual fluctuations in reproduction (USFWS 2013). The USFWS (2013) noted that "the ability of barred owls to forage on a wider diversity of prey species and in a wider diversity of habitats may explain their reproductive success in comparison with spotted owls." There is a need for further research of the barred owl's natural history and ecology within the range of the NSO (Gutiérrez et al. 2007, Livezey and Fleming 2007). However, the currently available information indicates that the demographic performance of barred owls is superior to that of NSOs.

Overall, barred owls appear to primarily impact NSOs through interference competition for space, habitat, and food, although they may also indirectly affect NSOs by depressing prey populations (Gutiérrez et al. 2007, Hamer et al. 2007, Van Lanen et al. 2011, USFWS 2013, Wiens et al. 2014). Barred owls are generally superior competitors to NSOs in terms of size, aggression, demographic performance, and ability to exploit a wider array of habitats and prey (Gutiérrez et al. 2007, USFWS 2013, Wiens et al. 2014).

Barred Owl Management

The information reviewed above indicates that barred owls pose a serious and increasing threat to NSOs throughout their range, including in California. Barred owl presence in NSO territories has continued to increase across the NSO's range and appears to have strongly contributed to declining NSO demographic and occupancy rates. Barred owl presence can also reduce the ability of biologists and land managers to effectively locate and conserve NSOs. Given the negative effects of barred owls on NSOs, it is clear that policymakers and land managers must address the barred owl threat if successful recovery of the NSO is to remain a conservation priority. Current proposals for addressing the barred owl threat include barred owl removal and habitat conservation.

Some researchers have expressed concern that barred owl removal experiments would be costly, ineffective, and distracting (Livezey 2010, Rosenberg et al. 2012). However, preliminary results from barred owl removal experiments indicate that lethal removal of barred owls is effective, relatively inexpensive, and conforms to animal welfare standards (Diller 2013, Diller et al. 2013, Higley 2014). Other objections to barred owl removal are primarily ethical or emotional (Gutiérrez et al. 2007, Diller 2013). There is substantial emotional resistance to lethal removal of barred owls, even among scientists and land managers involved with barred owl removal experiments (e.g., Diller 2013). Relocation of barred owls to zoos or their native forests in the eastern U.S. is logistically and politically unfeasible, so killing barred owls appears to be the only viable removal option (USFWS 2013). Primary ethical concerns regarding barred owl removal include whether or not it is appropriate to remove or control a native species or to intervene in its potentially natural range expansion (USFWS 2013). The USFWS (2013) reviewed scientific literature regarding the barred owl's status as a native or nonnative species and whether its range expansion was natural or human caused. It found that the literature was inconclusive regarding both issues. However, it concluded that humans are responsible for intervening in the barred owl's expansion because the NSO's vulnerability to barred owl competition and other stressors is due to timber harvesting and other past and continuing human activities. Regardless, the currently available evidence suggests that NSOs will continue to

decline, and could ultimately become extinct, without widespread or strategic barred owl control measures.

The barred owl's increasing impact on NSOs in Late Successional Reserves, National Parks, and other reserved lands demonstrates that habitat protection alone is insufficient for addressing the barred owl threat (Gutiérrez et al. 2004). Nonetheless, habitat conservation remains crucial to the NSO's conservation (USFWS 2011a). The importance of retaining suitable breeding habitat for NSOs has been well demonstrated at individual, territory, and population scales (e.g., Solis and Gutiérrez 1990, Franklin et al. 2000, Forsman et al. 2011; see Ch. 2). Habitat conservation might also be important for minimizing barred owl impacts on NSOs (USFWS 2011a). Habitat loss and fragmentation due to timber harvesting or other disturbances could intensify competition between NSOs and barred owls by bringing them into closer proximity (Gutiérrez et al. 2007, USFWS 2011a). Dugger et al. (2011) found some support for this hypothesis in their study of NSO occupancy in southern Oregon. Their results indicated that barred owl presence and landscape-level habitat characteristics have additive effects on NSO occupancy rates. Specifically, the presence of barred owls appeared to exacerbate the negative effects of habitat loss and fragmentation on NSO occupancy. The USFWS (2011a) suggested that retaining and restoring habitat may provide displaced or recruited NSOs with refugia from negative interactions with barred owls (USFWS 2011a). Dugger et al. (2011) did not find direct support for this hypothesis. In their study, higher amounts and lower fragmentation of older forest did not reduce the negative effects of barred owls on NSO occupancy. However, they noted that some NSOs in their study continued to survive and successfully reproduce in areas with barred owl presence, possibly indicating that there are ecological conditions under which the two species can coexist. Additional and more direct research of the potential value of habitat refugia for NSOs is needed.

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Ch. 5: Outdoor Marijuana Cultivation

Introduction

Although marijuana is perhaps the largest cash crop in California (Gettman 2006), little is known about environmental effects associated with its cultivation. Recent research has indicated that outdoor marijuana cultivation is currently having widespread and profound environmental impacts in California (Gabriel et al. 2012, 2013, Thompson et al. 2014, Bauer et al. 2015). Negative impacts of outdoor marijuana cultivation include wildlife deaths caused by pesticide exposure and poaching; habitat degradation caused by logging, road construction, pollution, and water diversion; and heightened safety concerns for research and resource personnel (Gabriel et al. 2012, 2013, Thompson et al. 2014, Bauer et al. 2015). The specific effects of outdoor marijuana cultivation on NSOs are unknown. Recent findings of widespread pesticide exposure among fishers (*Pekania pennanti*) and barred owls in northwestern California suggest that NSOs within the state are likewise exposed and could be experiencing the same effects seen in fishers (Gabriel et al. 2012, 2014). NSOs could also be directly affected by environmental degradation from outdoor marijuana cultivation via habitat modification (e.g., clearing or logging) or suppression of rodent populations (poisoning), or indirectly affected through ecological changes caused by reduced streamflows or pollution (e.g., impacts on vegetation or prey from reduced water availability). Safety concerns associated with illegal marijuana cultivation may also be impacting NSOs and other wildlife through reduced research and survey efficiency and effort (Gabriel et al. 2013).

Pesticides

Pesticide application is usually intended to suppress populations of rodents, insects, mollusks, and other agricultural and urban pests, but can have inadvertent negative impacts on humans, pets, and other non-target animals (Erickson and Urban 2004, Albert et al. 2010, Mnif et al. 2011, Gabriel et al. 2012). Widespread secondary exposure to pesticides has been reported for raptors, carnivores, and other wildlife that consume poisoned rodents around farms and human dwellings (Albert et al. 2010, Murray 2013). Researchers have generally assumed that pesticides pose little threat to wildlife outside of agricultural and urban areas (Gabriel et al. 2013). However, a recent publication reported that 79% of fishers tested in two study areas on federal and tribal forest lands in California had been exposed to anticoagulant rodenticides (ARs), including four that died from lethal toxicosis (Gabriel et al. 2012; note: at least two more fishers in California died from AR poisoning following publication of this study: Gabriel et al. 2013). Most fishers in the study had been exposed to multiple AR compounds (range = 1-4, mean = 1.6). These findings not only raised concern for the West Coast fisher population, which the U.S. Fish and Wildlife Service recently proposed to list as threatened under the federal Endangered Species Act, but for the NSO, which overlaps the fisher in terms of distribution, habitat associations, and diet (Gabriel et al. 2013, Calforests 2014, USFWS 2014). Subsequently, ARs have been detected in a dead NSO recovered in Mendocino County (Calforests 2014) and 34 of 84 (40%) barred owls tested for exposure in Humboldt County (Gabriel et al. 2014). Although barred owls were tested as a proxy for NSOs, NSOs may be more widely exposed to ARs given their greater dietary specialization on rodents (see USFWS 2013). Strong circumstantial evidence implicates pervasive illegal outdoor marijuana cultivation

as the primary source of pesticide exposure for forest predators in California (Gabriel et al. 2012, 2013, Thompson et al. 2014).

ARs detected in fishers in northwestern California include brodifacoum, bromadiolone, chlorophacinone, diphacinone, and warfarin (Gabriel et al. 2012). Brodifacoum and bromadiolone are classified as second-generation anticoagulant rodenticides (SGARs). SGARs were introduced in the 1970s due to widespread development of resistance among rodents to first-generation anticoagulant rodenticides (FGARs), such as warfarin, chlorophacinone, and diphacinone (Buckle et al. 1994). SGARs are more acutely toxic than FGARs and generally require only a single dose to kill rodents (Erickson and Urban 2004). However, rodents usually survive 5-10 days after consuming a lethal dose, during which time they may continue to consume additional rodenticide and remain available to predators (Cox and Smith 1992, Erickson and Urban 2004). SGARs are more persistent in animal tissues than FGARs and insecticides, which are more rapidly metabolized and excreted (Erickson and Urban 2004). Thus, exposure to FGARs and other non-SGAR pesticides is more difficult to detect than for SGARs and exposure to them could be underestimated (Albert et al. 2010, Thompson et al. 2014). Rodents, such as dusky-footed woodrats (*Neotoma fuscipes*) and deer mice (*Peromyscus* spp.), may be the primary source of AR exposure for NSOs because they are targeted by AR application and because they generally comprise most of the biomass in NSO diets (Forsman et al. 2004). Insects may be an additional source of AR exposure for NSOs and other wildlife. In terms of frequency of consumption, insects can substantially contribute to NSO diets regionally, locally, or seasonally (e.g., 1-14% of prey items in various regions of Oregon: Forsman et al. 2004). Insects are not killed by ARs and may therefore continue to accumulate them in their tissues, essentially becoming small "packets" of AR (Gabriel et al. 2014).

Large quantities of ARs, particularly SGARs, are often spread across large areas in and around illegal outdoor marijuana grow sites (Gabriel et al. 2012, Thompson et al. 2014; Figure 5.1). Gabriel et al. (2012) noted that thousands of pounds of pesticides were found at illegal outdoor marijuana grow sites in California in 2008 and that 150 pounds of pesticide were found during a single three-week eradication operation on the Mendocino National Forest in 2011. Three sites raided in Humboldt County in 2013 contained a total of at least 17 pounds of SGAR bait, which researchers estimated was sufficient to kill 2,753 woodrats, 14 fishers, or five spotted owls (Humboldt County Sheriff's Office press release). Other pesticides, such as organochlorine, organophosphate, and carbamate insecticides, some of which are banned in the U.S., are also frequently found at illegal outdoor marijuana grow sites (HSVTC 2012, Thompson et al. 2014). Pesticides are often applied along with large quantities of fertilizer at the base of marijuana plants grown outdoors (Thompson et al. 2014; Figure 5.1), suggesting that marijuana and surrounding plants may be taking up pesticidal compounds from the soil. If this occurs, then rodents and insects may accumulate pesticides through consumption of plants as well as pesticidal bait. Investigation of pathways of pesticide exposure for NSOs, as well as levels of exposure and potential physiological, behavioral, and population impacts, is needed.

Figure 5.1: (A) Rodenticide and other pesticides found at a trespass outdoor marijuana grow site in Humboldt County (photo: Humboldt County Sheriff's Office) and (B) rodenticide bait and dry fertilizer strewn together below approximately 2,000 marijuana plants at a trespass outdoor grow site in Humboldt County (from Gabriel et al. 2012).

ARs are vitamin K antagonists, which cause impairment of the blood's ability to clot (Murray 2013). A lethal dose of AR causes animals to die from hemorrhage (Erickson and Urban 2004). Animals may also exhibit weakness prior to death or with a sublethal dose (Erickson and Urban 2004). Rodents exposed to ARs show altered behavior, such as spending more time in the open, freezing rather than bolting when threatened, and staggering (Cox and Smith 1992). These behaviors may increase predation risk for affected rodents and the opportunity for secondary exposure of predators to ARs (Cox and Smith 1992). Owls and other raptors with sublethal secondary exposure to ARs may often have reduced blood-clotting activity and can die from minor wounds such as those commonly inflicted by prey (Erickson and Urban 2004, Murray 2013, Thompson et al. 2014). Non-AR pesticides have a variety of physiological effects, such as disrupting endocrine function or damaging the central nervous system (Grue et al. 1997, Mnif et al. 2011). Chronic or sublethal exposure to carbamate or organophosphate pesticides has been shown to reduce immune response, cause neurological disorders, reduce thermoregulatory control, and impair anti-predator behavior in wildlife (Grue et al. 1997; reviewed in Thompson et al. 2014). Pesticides can also have additive or synergistic effects on animals (Larsen et al. 2003 cited in Mnif et al. 2011, Relyea 2009). This is a source of additional concern for NSOs and

other forest predators active near outdoor marijuana cultivation sites, where multiple types of pesticide are often present (HSVTC 2012, Thompson et al. 2014). Mortalities associated with exposure to pesticides are likely underestimated because carcasses are often predated or scavenged before biological samples can be obtained and because sublethal exposure can predispose wildlife to death from other causes (Albert et al. 2010).

There is no information available concerning population-level impacts of secondary pesticide exposure for NSOs in California. As reviewed above, secondary exposure to pesticides can kill raptors and other wildlife both through lethal toxicosis and by increasing the risk of mortality due to other factors such as predation, hypothermia, disease, parasites, or injury. NSO population rates are particularly sensitive to changes in adult survival (Noon and Biles 1990) so it is possible that direct and indirect mortalities associated with pesticide exposure could contribute to population declines (Sibly et al. 2000, Thompson et al. 2014). Pesticide exposure could also negatively impact NSO reproduction. Gabriel et al. (2012) noted that fisher mortalities caused by AR poisoning occurred between mid-April and mid-May. The timing of these deaths coincided with the planting phase of outdoor marijuana cultivation, when seedlings are most vulnerable to rodent pests and AR use is likely highest (Gabriel et al. 2012). This time of year is also when NSOs incubate and brood young (Gutiérrez et al. 1995). Reduced parental care during this phase, for example due to compromised behavior or death of one or both parents, could result in death of offspring due to exposure, undernourishment, or predation (Grue et al. 1997). NSO populations could also be negatively impacted by pesticide suppression of prey populations or changes in community ecology caused by reductions of insects, small mammals, carnivores, raptors, amphibians, and aquatic animals. For example, pesticide impacts on plants, herbivores, or predators could cause wider ecological effects through trophic cascades (Relyea and Diecks 2008).

Other Environmental Effects

Activities related to outdoor marijuana cultivation can have a variety of environmental impacts beyond exposure of wildlife to pesticides, including negative effects of illegal and poorly planned water diversion, logging, and road construction; pollution of water and soils; poaching of wildlife; and ignition of wildfires (reviewed below). Negative impacts occur on both public and private lands (Gabriel et al. 2013, Bauer et al. 2015). However, the potential environmental impacts of marijuana cultivation could vary considerably, depending on the operation's location, scale, and practices. For example, some marijuana industry organizations and growers advocate growing practices aimed at minimizing environmental damage from outdoor cultivation (e.g., http://emeraldgrowers.org/). There does not appear to be any information available at this time regarding effects of ecological degradation from marijuana cultivation on NSOs. Negative effects on NSOs are possible given the subspecies' sensitivity to habitat modification (see Ch. 2 and 3) and close association with riparian areas (e.g., Hamer et al. 2007, Irwin et al. 2012), where the impacts of marijuana cultivation are often concentrated. Furthermore, safety concerns associated with marijuana cultivation can substantially impact the ability of land managers to effectively survey and manage spotted owls and other sensitive wildlife (Keane et al. 2011, Gabriel et al. 2013, D. Hansen pers. obs.; see below).

Personnel with the California Department of Fish and Wildlife recently estimated hydrologic impacts of marijuana cultivation in northwestern California using high-resolution aerial imagery in Google Earth (Bauer et al. 2015; e.g., Figure 5.2) and marijuana industry estimates of marijuana plant water requirements. Using these methods, they estimated that more than 112,000 marijuana plants were cultivated in 2011/2012 in just four watersheds in Humboldt and Mendocino Counties (Table 5.1). Based on estimated numbers of marijuana plants and assumed water usage of 6 gallons per day per plant, they calculated that marijuana cultivation uses between 2% and 173% of the water that flows in the Redwood Creek and Salmon Creek watersheds per day during periods of minimum streamflow (Table 5.2). Although based on several assumptions (marijuana cultivation water sources and usage, complete visibility of cultivation sites in aerial imagery, complete usage of greenhouses), these estimates have raised considerable concern about potential negative impacts of marijuana cultivation on watershed health and aquatic animals. NSOs often exhibit a preference for nesting, roosting, and foraging in and near riparian areas (e.g., Hamer et al. 2007, Irwin et al. 2007). Thus, it is plausible that ecological changes caused by widespread water diversion for marijuana cultivation have negative indirect effects on NSOs.

Figure 5.2: Outdoor (A) and greenhouse (B) marijuana cultivation sites identified with Google Earth (from S. Bauer, unpubl.).

Table 5.1: Estimated numbers of outdoor marijuana plants, marijuana greenhouses, marijuana plants in greenhouses, total number of marijuana plants, and water use per day for marijuana cultivation in four watersheds in Humboldt and Mendocino Counties (from Bauer et al. 2015).

Watershed	Outdoor Plants	Green-houses (counted)	Total area, m^2 (Green-houses)	Estimated Plants in Green-houses	Estimated Total Plants in Watershed	Estimated Water Use per Day (Liters)
Upper Redwood Creek	4,434	220	20749.4	18,612	23,046	523,144
Salmon Creek	11,697	302	20557.5	18,440	30,137	684,110
Redwood Creek South	10,475	324	18703.9	16,777	27,252	618,620
Outlet Creek	15,165	266	18651.1	16,730	31,895	724,016

Table 5.2: Estimated percent of low stream flow used for marijuana cultivation in four watersheds in Humboldt and Mendocino Counties (from Bauer et al. 2015).

Watershed	Area (km^2)	Plants per km^2	Demand as percent of seven-day low flow	
			Percent of low flow maximum	Percent of low flow minimum
Upper Redwood Creek	175.3	131.6	2%	23%
Salmon Creek	95.1	316.9	36%	173%
Redwood Creek South	64.7	421.2	34%	165%
Outlet Creek	419.1	76.1	17%	>100%*

* The seven-day low flow minimum was measured as 0.0 CMS at the gage.

Marijuana growers on both public and private lands often illegally clearcut vegetation in order to create growing space for marijuana plants and room for artificial ponds and other structures (Gabriel et al. 2013, Bauer et al. 2015; Figure 5.3). Illegal cutting, along with creation of roads to access grow sites, can increase sedimentation in streams and creeks and thereby degrade habitat quality for aquatic and amphibious animals (Bauer et al. 2015). The effect of illegal vegetation clearing on NSOs is unknown. Given the close association of both marijuana cultivation and NSOs with riparian areas and surrounding uplands (e.g., Hamer et al. 2007, Irwin et al. 2007), it is plausible that widespread marijuana cultivation results in habitat loss or fragmentation for NSOs.

Figure 5.3: Areas cleared for outdoor marijuana cultivation on private and public lands, respectively.

Unidentified source.

C. Thompson.

Widespread outdoor marijuana cultivation can further damage watershed health by polluting water and soils. In addition to pesticides, tremendous quantities of fertilizer are often applied at marijuana grow sites (HSVTC 2012, Thompson et al. 2014). Fertilizers, along with low flows caused by drought conditions and water diversion, might contribute to algae blooms and reduced oxygen levels in creeks and rivers. Other pollution, including human waste, trash, and spilled diesel fuel from generators, is also frequently observed in and around streams at raided outdoor marijuana grow sites (HSVTC 2012, C. Thompson, pers. comm.). Like water diversion and increased stream sedimentation, pollution from outdoor marijuana cultivation is primarily a source of concern for aquatic and amphibious animals but could have indirect ecological effects on NSOs and other wildlife.

Multiple recent wildfires in California have been attributed to marijuana growers. For example, in 2014, a marijuana grower was indicted on charges of starting the Nicolls Fire that burned

nearly 1,700 acres in the Sequoia National Forest (SacBee 2014b). This grower allegedly set multiple fires in an attempt to avoid capture by other growers that he claimed were trying to kill him. Another marijuana grower was recently arrested for igniting the 2014 Bully Fire that burned nearly 13,000 acres in Shasta County (SacBee 2014a). This fire was apparently started when the grower's rental truck ignited dry grass when driven off-road in order to deliver soil amendments to a grow site. In 2009, a marijuana grower's camp stove ignited the 90,000-acre La Brea Fire in the Los Padres National Forest in southern California (inciweb). Large wildfires (e.g., thousands of acres) can burn through multiple NSO territories and can negatively affect NSOs in a variety of ways, particularly when they burn large areas at moderate to high severity (see Ch. 3).

Illegal marijuana growers are often heavily armed in order to protect their crops and for poaching wildlife for food or to prevent wildlife damage to plants, equipment, or food caches (Gabriel et al. 2013, Boehm 2014; Figure 5.4). Many biologists and other field personnel working in California's forests have been interrogated, pursued, or shot at by marijuana growers (Gabriel et al. 2013, D. Hansen pers. obs.). Safety concerns associated with widespread illegal marijuana cultivation can substantially curtail the ability of researchers and land managers to effectively locate, study, and manage spotted owls and other wildlife. For example, Six Rivers National Forest biologists were repeatedly excluded from entire pre-project NSO survey units in 2013 due to evidence of trespass outdoor marijuana cultivation (D. Hansen pers. obs.). Similarly, Keane et al. (2011) stated that their California spotted owl (*S. o. occidentalis*) survey crew was excluded from large portions of a study area in the Sierra Nevada in 2010 due to extensive illegal marijuana cultivation operations. Gabriel et al. (2013; M. Gabriel unpubl. data) estimated that safety concerns due to trespass outdoor marijuana cultivation resulted in exclusion of researchers from 15-25% of one fisher study area in California and a projected additional cost of $500,000-750,000 for the life of the combined budgets of two of California's fisher research projects. Wildlife surveyors who were able to work alone in the past must now frequently work in pairs for safety reasons, reducing survey efficiency and increasing project costs (Gabriel et al. 2013, D. Hansen pers. obs.). Exclusion from study areas can also compromise the ability of researchers to properly design and complete research investigating important conservation issues, such as effects of pesticides on fishers (Gabriel et al. 2013) and wildfires on spotted owls (Keane et al. 2011).

Figure 5.4: Armed marijuana growers posing in front of a poached deer (from Gabriel et al. 2013).

Magnitude and Location of Threat

Estimates of marijuana production and value are generally based on either federal marijuana seizure data (e.g., assuming that seizures represent 10 or 15% of the total amount produced) or marijuana consumption surveys and estimates of plant yields and market value (Gettman 2006) (reviewed in PBS 2014). Estimates from both of these methods indicate that California is, by far, the primary marijuana-producing state in the U.S. and that most of this production is from outdoor cultivation (NDIC 2011, Gettman 2006). Gettman (2006) estimated that, in 2006 alone, California produced an estimated 8.6 million pounds of marijuana with a value of more than 13.8 billion dollars. An estimated 89% of this product and value was from outdoor cultivation. If correct, marijuana is the largest cash crop in California (Gettman 2006), which is remarkable given that California is the most productive agricultural state in the U.S. (USDA 2014).

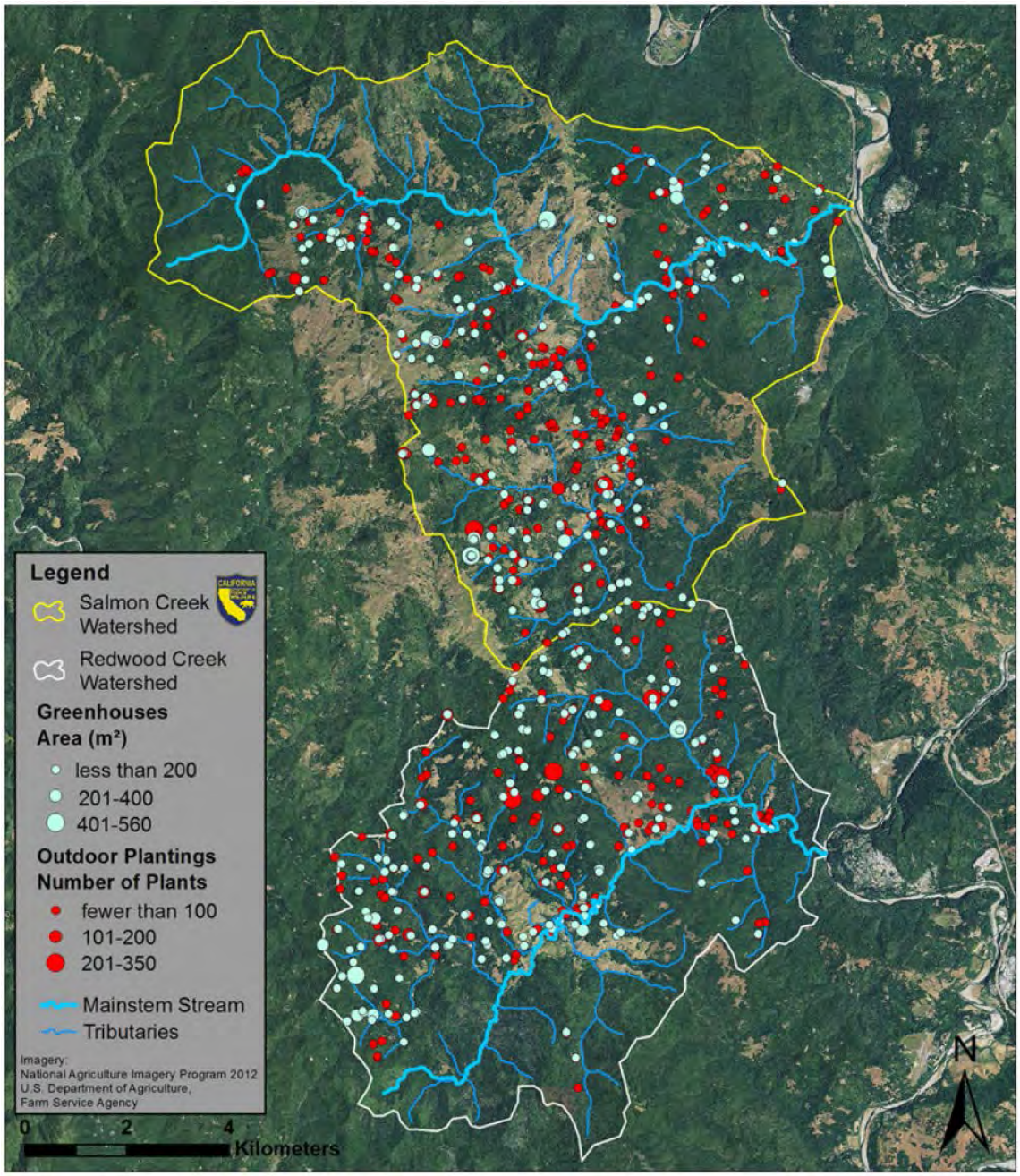
Outdoor marijuana cultivation in California has increased dramatically in recent years, including on both public and private lands (NDIC 2011, S. Bauer, unpubl. data). This rapid growth was due to increased demand for domestically grown marijuana; possibly driven by state legalization of marijuana for medical use, changes in public perception of health or legal risk associated with marijuana use, or reduced imports from other countries due to tighter border control measures implemented after 9/11 (NDIC 2007, 2011, SacBee 2012). However, rapid growth of marijuana production in California apparently outstripped consumer demand in the last few years, particularly following federal crackdowns on medical marijuana dispensaries in the state (SacBee 2012). Desire among growers to maintain high profits in the face of increasing supply and decreasing prices could be a factor driving recent increases in the size and intensity (e.g., use of pesticides, fertilizer, and water) of many outdoor marijuana cultivation operations.

The number of outdoor marijuana plants eradicated in the U.S. increased by 250% between 2005 and 2010 (NDIC 2011). Federal eradication data suggest that trespass outdoor marijuana cultivation is increasing particularly rapidly on National Forests in California (NDIC 2011).

Between 2005 and 2013, over 16 million marijuana plants were eradicated at approximately 3,356 sites on National Forests in California (Boehm 2014). Federal agencies have largely attributed increased numbers of trespass outdoor marijuana cultivation sites to expansion of operations by international drug trafficking organizations (e.g., Mexican drug cartels) into remote mountainous areas (particularly in northern California) in order to avoid detection by law enforcement personnel (NDIC 2007, Boehm 2014). However, the degree to which increases in amounts of eradicated or seized marijuana reflect increased production versus increased drug enforcement effort is unclear, as is the scale of international drug trafficking organizations' role in outdoor marijuana cultivation in California (NDIC 2010).

Outdoor marijuana production in California is also growing rapidly on private lands (NDIC 2007, S. Bauer, unpubl. data). Personnel with the California Department of Fish and Wildlife (S. Bauer, unpubl. data) used aerial imagery in Google Earth to estimate changes in the number and sizes of marijuana cultivation operations in four watersheds in Humboldt and Mendocino Counties during 2009-2012. In 2011 and 2012 they identified nearly 1,300 outdoor grow sites and more than 1,100 greenhouses likely used for marijuana cultivation in these watersheds (Table 5.1, S. Bauer, unpubl. data; e.g., Figure 5.5). The number and size of marijuana cultivation operations identified increased in all four watersheds by 68-104% between 2009 and 2012 (S. Bauer, unpubl. data). The total number of greenhouses and the number of greenhouses greater than 1,000 ft^2 increased by 69% and 87%, respectively. Continued use of aerial imagery and flyovers will shed greater light on the number, size, and location of outdoor marijuana operations on both public and private lands. For example, the California Department of Fish and Wildlife (2012) noted that law enforcement officers spotted more than 200 new marijuana grow operations in the Mattole Watershed in Humboldt County during a single flyover.

Figure 5.5: Locations and sizes of marijuana cultivation operations identified in the Salmon Creek and Redwood Creek South Watersheds using aerial imagery in Google Earth (from Bauer et al. 2015).



Summary and Management Implications

There is currently little direct information regarding potential impacts of illegal outdoor marijuana cultivation on NSOs. However, widespread application of ARs and other toxicants at outdoor grow sites are negatively impacting fishers, which have overlapping home ranges and

diets with NSOs in northwestern California (Gabriel et al. 2012, 2013, Thompson et al. 2014). There is also evidence of widespread exposure to toxicants among barred owls in Humboldt County, and an NSO from Mendocino County recently tested positive for ARs (Calforests 2014, Gabriel et al. 2014). Thus, it is likely that NSOs in California are widely exposed to toxicants applied at illegal outdoor marijuana grow sites. ARs and other pesticides can directly kill owls and other raptors or increase their vulnerability to other sources of mortality such as predation, disease, parasites, hypothermia, or injury (reviewed above). Furthermore, illegal outdoor marijuana cultivation is apparently causing widespread environmental degradation through toxicant exposure in other animals, reduced streamflows, pollution, poorly planned logging and road construction, and wildlife poaching (Gabriel et al. 2013, Bauer et al. 2015). Safety concerns associated with the widespread presence of heavily armed marijuana growers may also be impacting conservation of spotted owls and other wildlife by reducing the efficiency and effectiveness of research and survey efforts (Keane et al. 2011, Gabriel et al. 2013, D. Hansen pers. obs.).

Increased funding and effort are needed for evaluation of effects of outdoor marijuana cultivation on NSOs, other wildlife, and ecosystems. Greater funding and coordination are also needed for interdiction, clean-up, and restoration at illegal outdoor grow sites. These efforts require a substantial, multi-agency law enforcement presence, experts capable of identifying and properly disposing of toxicants, personnel and equipment for removing large amounts of trash and other material, and natural resource specialists for rehabilitating or restoring sites (Gabriel et al. 2013, Boehm 2014). Even if marijuana is legalized in California, tremendous resources, effort, and coordination may still be needed to regulate the industry and to continue to locate, clean up, and restore abandoned or interdicted illegal grow sites. Only a small portion of interdicted outdoor grow sites in California have been cleaned up thus far and even less have been restored. Many of these sites may continue to pose an environmental threat long after they are abandoned by growers (Gabriel et al. 2013). For example, water-resistant packaging can keep ARs and other toxicants viable for years, which bears can eventually find and open, allowing further poisoning and exposure of wildlife even after growing operations have ceased at the site (HSVTC 2012, M. Gabriel, pers. comm.).

The Environmental Protection Agency (EPA) and California Department of Pesticide Regulation (CDPR) have recently taken steps to reduce threats from SGARs to wildlife, children, and pets. Since 2011, EPA regulations have prohibited the sale of SGARs to the general consumer. Under EPA regulations, SGARs may only be purchased at agricultural stores, in bait station form rather than as loose pellets, and in relatively small quantities (Bradbury 2008). Most AR manufacturers quickly complied with these regulations and brought replacement products to market containing FGARs or neurotoxins, rather than SGARs (CDPR 2013, Murray 2013). However, the EPA only recently reached an agreement with Reckitt Benckiser to end distribution of their popular d-Con® products containing SGARs and sold without a protective bait station by March 31, 2015 (EPA 2014). On July 1, 2014, the CDPR further limited access to SGAR products in California by classifying them as restricted materials (California Department of Consumer Affairs 2014). In California, products containing SGARs can only be purchased from CDPR-licensed pest control dealers by certified applicators (California Department of Consumer Affairs 2014). Increased restrictions on public access to products containing SGARs should help to reduce exposure of wildlife to these compounds. However, considering that banned pesticides are

commonly found at trespass outdoor marijuana cultivation sites (HSVTC 2012, Gabriel et al. 2013, Thompson et al. 2014) growers will likely continue to widely apply SGARs in forests occupied by NSOs, fishers, and other sensitive wildlife. Furthermore, reduced availability of SGARs could simply contribute to greater application of other pesticides, including newly emerging toxicants or large amounts of legal FGARs.

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Management Recommendations

Below I provide a brief list of management recommendations and research needs. This list is solely based on information reviewed in this report. Additional management and research needs may exist for northern spotted owls (*Strix occidentalis caurina*; NSOs). Furthermore, land managers, land agencies, and policymakers may need to consider other management information and objectives alongside those for NSOs. These recommendations are mine alone and do not necessarily reflect the positions of the Environmental Protection Information Center (EPIC) or any of the document's reviewers.

1. The NSO is rapidly declining across its range. The subspecies' rate of decline has recently accelerated in California. The NSO faces an array of threats to its persistence in California and elsewhere within its range. Therefore, I recommend that:
    a. The California Fish and Game Commission list the NSO as threatened or endangered under the California Endangered Species Act.
    b. The U.S. Fish and Wildlife Service uplist the NSO from threatened to endangered under the federal Endangered Species Act.

2. Habitat retention guidelines for NSOs in the California Forest Practice Rules (CAL FIRE 2014) should be revised. The U.S. Fish and Wildlife Service's (2009) recommended guidelines for portions of California outside the redwood zone should be adopted as soon as possible. The U.S. Fish and Wildlife Service's (2011b) recommendations for the redwood zone are based on less extensive and rigorous scientific information but also appear to reflect a more accurate and current understanding of the NSO's ecology than do the California Forest Practice Rules. Recommendations for the redwood zone could potentially be revised based on modeling of Habitat Fitness Potential (Diller et al. 2010), as were those for the state's northern interior (USFWS 2009).

3. The California Department of Fish and Wildlife should continue to hire biologists with expertise in NSO-habitat relationships to assist with reviews of Timber Harvest Plans. I am under the impression that few CAL FIRE biologists have specialized knowledge of raptor ecology and conservation. Qualified wildlife biologists with the U.S. Fish and Wildlife Service formerly consulted on Timber Harvest Plans but the agency has not been regularly involved in the review process since 2008.

4. Industrial timber companies required to monitor NSOs (e.g., as part of Habitat Conservation Plans) should, whenever possible, provide modeled occupancy rates that account for detectability of NSOs and other factors that can obscure occupancy trends (e.g., see Ch. 1, Figure 1.5). Unmodeled occupancy rates are frequently cited as evidence of stable NSO populations on industrial timberlands in California (Calforests 2014). Claims of population stability or increase on industrial timberlands conflict with evidence from more rigorous research projects that have found declines in occupancy and population vital rates on federal, tribal, and private lands in northwestern California (Forsman et al. 2011, Franklin et al. 2013, 2014, Higley and Mendia 2013, Green Diamond Resource Company 2014); interior northern California (Farber and Kroll 2012);

and the Oregon Klamath and southern Cascades (Forsman et al. 2011, Davis et al. 2013, 2014, Dugger et al. 2014).

5. Barred owl removal experiments should be continued and more widespread removal programs should be planned for both public and private lands. Without barred owl removal programs, the NSO is likely to continue to spiral toward extinction, regardless of habitat protection measures.

6. Rigorous studies of effects of forest thinning and partial harvesting on NSOs and their key prey (especially dusky-footed woodrats) are needed (e.g., using a before-after-control-impact study design and an adequate sampling framework). Ideally, the silvicultural prescriptions would resemble those proposed for widespread use on federal lands. Meanwhile, land managers should assume that commercial thinning and partial harvesting negatively affect NSOs and their primary prey in California; as the currently available information generally supports this assumption. If land managers or agencies deem that thinning is necessary to address wildfire risk or meet other objectives, it should be focused outside of core patches of mature and old forest (i.e., those surrounding NSO activity centers). Thinning and other fuels reduction activities could potentially be focused in portions of the landscape that are least likely to receive use by NSOs and that are most likely to experience fire (e.g., upper and southwesterly slopes).

7. Additional research is needed to evaluate effects of severe wildfires on NSOs. This issue is scientifically and politically contentious; although there is fairly broad consensus that extensive severe fires pose a threat to NSOs in dry, fire-prone forests, such as those that occur within much of northern California outside the redwood zone (USFWS 2011a). Land agencies could better support research of wildfire effects on spotted owls by avoiding or postponing post-fire salvage logging in burned study areas. The confounding effects of salvage logging are often cited as reason to ignore research indicating that extensive severe wildfires negatively affect spotted owls. Both territory and population/landscape level and multi-year studies of severe fire effects would be useful.

8. Additional research is needed to investigate effects of post-fire salvage logging on NSOs. However, the limited available evidence suggests that salvage logging negatively affects both spotted owls and their prey. Salvage logging does not appear to be generally concordant with conservation of NSOs, as it removes important biological legacies and structurally simplifies burned areas.

9. Prescribed fire appears to have neutral or positive effects on spotted owls and therefore, appears to be consistent with the species' conservation. Allowing wildfires to burn under favorable conditions could also hold promise for reducing understory densities and reducing risk of severe fire, fostering growth of fire-adapted vegetation favored by NSO prey communities, and maintaining or restoring habitat heterogeneity in landscapes homogenized by fire suppression and timber harvesting. Favorable conditions could often exist early or late in the season or in areas where deeply incised topography creates inversions that trap smoke and minimize risk of severe fire.

10. Studies evaluating effects of marijuana cultivation on NSOs are needed. Potential research topics include investigating exposure to anti-coagulant rodenticides and other toxicants, determining effects of rodenticides on prey populations around grow sites, and examining whether or not marijuana growing on private lands potentially affects NSOs (e.g., proximity to activity centers, potential negative effects of illegal water diversion and logging on riparian areas and watersheds used by NSOs).

11. Increased financial and logistical support is likely needed for interdiction, clean-up, and restoration at trespass marijuana grow sites on public lands. Increased law enforcement could also potentially alleviate financial strains and safety concerns for NSO research and monitoring projects.

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Tom Wheeler <tom@wildcalifornia.org>

NSO in CA Reviews

Dan Hansen [redacted] Fri, Jul 3, 2015 at 4:14 PM
To: Tom Wheeler <tom@wildcalifornia.org>

Tom,

I'm also pasting email contents in some emails as they also contain comments from the reviewers.

Dan

Hi Dan,

I did not have much to comment on this one. Again, you did a very thorough review of the information out there, and your summary of the work I've been involved with (on both timber and fire) was good. I added a few minor clarifications here and there. I suggested one more paper by Wilson and Forsman, this link:

http://www.fs.fed.us/pnw/pubs/pnw_gtr880/pnw_gtr880_009.pdf

On both papers, I recommend you be careful in the use of the general term "habitat" as it can mean many different things, and tends to confuse the issue if used without providing good definitions.

Good luck on this and best regards,

Ray

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Hi Dan,

Attached is my review and comments of your wildfire writeup. I'm still reviewing the timber writeup and will aim to get that to you by this afternoon.

Overall, a very thorough review, but there are a few more articles that I would add. In particular a paper by Tempel et al (in press). Effects of forest management on California Spotted Owls:

implications for reducing wildfire risk in fire-prone forests. Ecological Applications. Other papers that might provide good info:

1. Dennison, P. E., S. C. Brewer, J. D. Arnold, and M. A. Moritz (2014), Large wildfire trends in the western United States, 1984–2011, Geophys. Res. Lett., 41, 2928–2933

2. Moritz, M. A., M.-A. Parisien, E. Batllori, M. A. Krawchuk, J. Van Dorn, D. J. Ganz, and K. Hayhoe. 2012. Climate change and disruptions to global fire activity. Ecosphere 3(6):49.

3. Stavros et al. 2014. Regional projections of the likelihood of very large wildland fires under a changing climate in the contiguous Western United States. Climatic Change

4. Mallek, C., H. Safford, J. Viers, and J. Miller. 2013. Modern departures in fire severity and area vary by forest type, Sierra Nevada and southern Cascades, California, USA. Ecosphere 4(12):15

5. Ganey et al. 2014. Relative abundance of small mammals in nest core areas and burned wintering areas of Mexican spotted owls in the Sacramento Mountains, New Mexico. The Wilson Journal of Ornithology 126(1):47–52

6. Willey and Ripper. 2014. Home range characteristics of Mexican spotted owls in the Rincon Mountains, Arizona. The Wilson Journal of Ornithology 126(1):53–59

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Tom Wheeler <tom@wildcalifornia.org>

NSO in CA Reviews

Dan Hansen [redacted] Fri, Jul 3, 2015 at 4:19 PM
To: Tom Wheeler <tom@wildcalifornia.org>

Diller emails pasted below....

Hi Dan,

I completed the review of the barred owl chapter and I hope to complete the timber section by Saturday. Overall, I thought you did a great job with a thorough and comprehensive review of the barred owl issues in the NW. I have some specific comments on the attached copy, but they mostly related to the emphasis on certain publications. In particular, Dave Wiens study in the Oregon coast range is the best data available on habitat use, competitive interactions, food habits and reproduction. It is superior to any other study to date, because he had radio transmitters on both species simultaneously using the same landscape meaning we know they had equal opportunity to select habitat, prey and etc. When you wrote this, you only had it available in the more cumbersome dissertation, but you could now use the recently published monograph.

Good luck with this.

Lowell

I agree that the old meta-analysis (Forsman et al. 2011) is very dated at this point. I would rely on the annual reports from all the various study areas to provide the best current status.

Lowell

Hi Lowell,

I have a quick question about the site density estimates in Green Diamond's 2014 report. Would you call them empirical or mark-recapture estimates? Although most of the owls were likely banded, I didn't see any mention of mark-recapture methods for estimating density as was done in Diller and Thome 1999.

Thanks!

Hi Dan,

Yes, they were empirical counts based on marked birds. So the marking prevents double counting birds, which could happen frequently for non-nesting birds that move around a lot, but the empirical counts don't account for missed birds due to less than perfect detection probabilities. So these empirical counts of marked owls is equivalent to what used to be called "minimum number alive." However, spotted owls have such high detection probabilities that the estimate from using mark-recapture techniques would only provide a minor inflation of the empirical counts. The trends from spotted owls on Green Diamond will be available soon from the most recent 2015 meta-analysis.

Lowell

Hi Dan,

I reviewed the status and trends chapter, and like the barred owl chapter, I thought it was very thorough and well written. I inserted some comments for you to consider, but I didn't have any major concerns. Probably my most substantial comment is that I think modeling exercises are primarily useful for developing testable hypotheses, and although I haven't actually reviewed it in detail, I don't put a lot of credence in the source-sink model you cited. Obviously, you could really benefit from the new meta-analysis, but you pretty much guessed what it is going to say.

Lowell

Tom Wheeler <tom@wildcalifornia.org>

NSO in CA Reviews

Dan Hansen [redacted] Fri, Jul 3, 2015 at 4:33 PM
To: Tom Wheeler <tom@wildcalifornia.org>

Hi Rob,

I've marked this doc up in track changes and with comments. I assume you're trying to say fire is a real threat as part of your listing petition, but you should reconsider that position.

I read most of the section you sent me, but was irritated by the overall bias and anti-fire tone throughout, and gave up with my careful review about 1/3 of the way through. It didn't read like an objective review of existing owl and fire data. It seemed the author assumed fire could only be bad for owls. It also failed to properly weigh studies according to sample size and whether or not they were peer-review publications. There were too many instances where stats in a paper said something (or said there was no effect there), then the author used an anecdote to refute the stats and advance a 'fire is bad' position. Also, author speculation in discussion sections shouldn't be reported as results.

I feel it also mischaracterized the risk of severe fire as a forgone conclusion with some minor uncertainty, while completely ignoring the threats posed by logging in the name of fire risk reduction. If the threat from logging is expounded upon in other sections, it should also reverberate in the wildfire and salvage section. Furthermore, the author fails to establish whether fuels thinning projects have any effect on fire severity during the extreme fire weather that accompanies the vast majority of big fires (typically they don't).

I think continuing in the current anti-fire tone might alienate potential allies of your petition in the environmental and scientific communities. I suggest a focus on logging as the main threat of the past, and the continued threat of the present even though it is now sold as 'fuels thinning'.

Best,
-Derek Lee

Tom Wheeler <tom@wildcalifornia.org>

NSO in CA Reviews

Dan Hansen [redacted] Fri, Jul 3, 2015 at 4:34 PM
To: Tom Wheeler <tom@wildcalifornia.org>

Dan,

Attached is the draft that you sent a while back. With a few edits. Not many, I think you did a pretty good job of outlining the potential risks given the lack of information available. I couldn't really comment much on the environmental degradation issues, only pesticide exposure. I tried to fill in a number of your citations and made a few changes to the text. I do have a number of photos as well, if you want to highlight anything.

Craig

Craig Thompson

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Barred Owls

Introduction

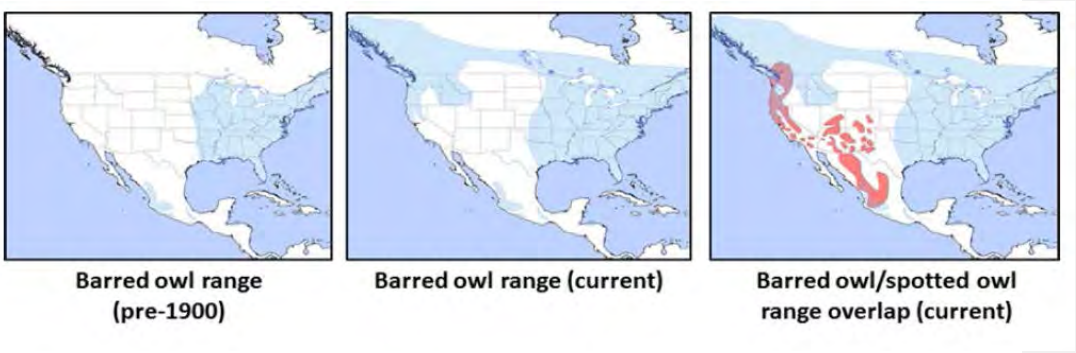
At the time of the northern spotted owl's (*Strix occidentalis caurina*; NSO) federal listing, the barred owl was recognized as a potential threat to the subspecies (USFWS 1990, Thomas et al. 1990). Since then, barred owls have continued to invade the range of the NSO and are apparently increasing in numbers (USFWS 2013). As reviewed herein, a large body of correlational and anecdotal evidence, supplemented by preliminary findings from barred owl removal experiments, indicates that barred owls are negatively impacting NSO populations across their range and that this is due to competition between the two species for space, habitat, and food. Research reviewed below indicates that that the barred owl is a superior competitor to the NSO due to its larger size, more aggressive behavior, higher reproductive potential, and broader ecological niche. The USFWS (2011) recently listed the barred owl invasion as one of three main threats currently faced by NSOs (along with timber harvesting and wildfire). The USFWS (2011) described this threat as "extremely pressing and complex" and "requiring immediate consideration." Information reviewed below suggests that lethal control of barred owls is a viable management option for some areas, although it may be difficult to overcome emotional and ethical resistance to killing one charismatic species to save another. Habitat conservation for NSOs appears to be of increasing importance because the negative effects of habitat loss and fragmentation on NSOs can be exacerbated by the presence of barred owls (Dugger et al. 2011).

Comment [LVD1]: It may not have been available when you were writing this, but the Wiens et al. 2014 monograph would be a good citation here.

The Barred Owl's Expansion

Prior to the mid-1900s, the barred owl's range was confined to southeastern Canada, the eastern U.S., and portions of Mexico (Gutiérrez et al. 2004, 2007; Figure 1). By the mid-20th century the barred owl's range began expanding westward across North America and currently includes the southern boreal forest zone and British Columbia in Canada and the northern Rocky Mountains, Pacific Northwest, and northern California in the U.S. (Livezey 2009, USFWS 2013; Figure 1). The barred owl's range now completely overlaps that of the NSO and partially overlaps that of the California spotted owl (*S. o. occidentalis*) (Figure 1). It is unclear whether the barred owl's westward range expansion occurred via the Great Plains or Canada's boreal forests (USFWS 2013). It is also uncertain whether this range expansion was facilitated by natural factors, human activities, or a combination of the two. Hypotheses concerning the cause of the barred owl's range expansion include increased adaptation by the species to coniferous forests; natural climate change; environmental changes associated with widespread intensive timber harvesting; and conversion of open areas to forest due to fire suppression, planting parks and woodlands, removal of keystone species, or other human activities (Gutiérrez et al. 2004, USFWS 2013).

Figure 1: Historical and current range of the barred owl and comparison of the current ranges of the barred owl and spotted owl (from USFWS 2013).



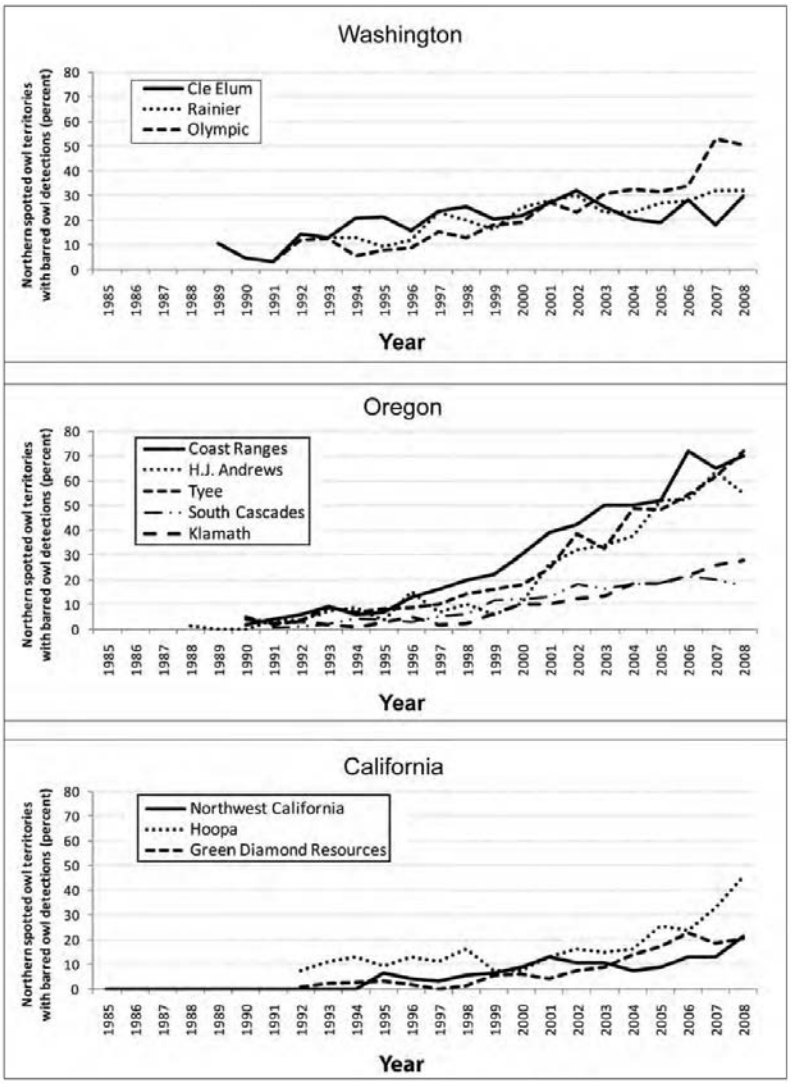
Reliable data concerning current barred owl densities and population trends are unavailable. Most information about barred owl trends in the Pacific Northwest and California is based on incidental detections during surveys for spotted owls (USFWS 2013). Researchers have estimated that only 1/2 to 2/3 of barred owls present are detected during NSO surveys (Gutiérrez et al. 2004, Bailey et al. 2009, Wiens et al. 2011). Researchers have only recently begun to systematically survey for barred owls within the range of the NSO and only in limited areas. In California, the Northwest California, Green Diamond, and Hoopa NSO density studies initiated systematic surveys for barred owls in 2009 (Franklin et al. 2014, Green Diamond Resource Company 2014, *Hoopa citation*).

Some early studies of barred owls within the NSO's range likely overestimated the species' numbers by focusing on cumulative and nighttime detections (Gutiérrez et al. 2004). However, barred owl trends are now more frequently evaluated in terms of the number of spotted owl territories in which barred owls have been detected (USFWS 2013; e.g., Forsman et al. 2011, Calforests 2014). Reports of the number of spotted owl territories with barred owl detections

probably underestimate barred owl densities and population trends (USFWS 2013). Barred owls often have substantially smaller home ranges than spotted owls so it is possible for a single spotted owl home range to encompass multiple barred owl home ranges (Singleton et al. 2010, Wiens 2012; see below). Without color-banding or follow-up surveys to determine the identity and occupancy status of barred owls, it is often unclear if multiple detections within spotted owl territories represent one or multiple barred owls.

Despite uncertainty regarding barred owl densities and population trends, incidental detections clearly indicate that the species rapidly expanded its range into that of the NSO (USFWS 2013). For example, barred owls expanded their range from western Washington to northern California in less than 10 years (Gutiérrez et al. 2004). Incidental detections also suggest that barred owl densities are continuing to increase within the range of the NSO. From 1985-2008, the proportion of NSO territories with known barred owl presence increased in density study areas throughout the NSO's range, suggesting increasing barred owl populations (Forsman et al. 2011; Figure 2). Barred owl increases in Washington and Oregon have been steeper than those in California (Forsman et al. 2011; Figure 2), which is consistent with the species' later colonization of California (USFWS 2013). More recent information suggests that barred owl increases are also currently accelerating in northwestern California (see below).

Figure 2: Annual proportion of northern spotted owl territories with barred owl detections (≤0.62 mi from spotted owl activity center) on density study areas in Washington, Oregon, and California (from Dugger and Davis 2011, adapted from Forsman et al. 2011).



Recent reports from California's density studies suggest that barred owls continued to increase in numbers and to invade additional NSO territories during 2009-2013 (Franklin et al. 2014, Green Diamond 2014, *Hoopa citation*). As noted above, California's density studies initiated barred owl-specific surveys in 2009. The Green Diamond Resource Company *(and Hoopa?)* also began a barred owl removal experiment in a portion of their density study area during the same year (see below). Thus, detection and occupancy data from 2009-2013 are not directly comparable to previously collected data. In the Northwest California density study area and nearby Regional Study Area, the number of NSO territories with barred owl detections increased by 76% (from 21 to 37) during 2009-2013 and the estimated number of barred owl sites increased by 170% (10 to 27) (Franklin et al. 2014). On Green Diamond Resource Company lands, the total estimated number of barred owl sites increased by 57% (numbers not reported) during 2011-2013 (Green Diamond 2014). *Hoopa 2009-2013 information…* The degree to which estimated increases in barred owl sites and NSO territories with barred owl detections reflect growing barred owl populations as opposed to increased and cumulative survey effort is unclear. However, the available data indicate that barred owls are continuing to invade NSO territories in California's density study areas and that this is occurring at an increasing rate.

Comment [LVD2]: Hoopa's study was initiated in September 2013 following signing of the ROD for the barred owl removal experiment. Their study is one of four planned for the FWS removal experiments, but lack of funding has delayed the implementation of the other study areas until this year (2015).

Comment [LVD3]: There are still comparable surveys that are being done using the original protocol and those data are kept separate from new barred owl-specific surveys.

Cumulative detections in the California Natural Diversity Database (CNDDB) from 1978 through 1990, 1998, 2006, and 2013 provide a crude picture of the species' expansion in California (Figure 3). These detection data suggest that barred owls expanded their range into the state along the northern coast and southern Cascades and more rapidly increased in wetter regions (Figures 3 and 4). Earlier and more rapid colonization of relatively mesic forests by barred owls is consistent with observations from studies in Washington (Gutiérrez et al. 2007).

While cumulative detections cannot be used to evaluate the barred owl's densities or population trends, they suggest that barred owls are relatively abundant along the coast and in the adjacent Six Rivers National Forest, whereas they appear to still be in the process of colonizing the Mendocino, Klamath, and Shasta-Trinity National Forests and other interior areas of northern California. However, it is possible that this pattern is ~~due to~~biased by the fact that most barred owl detections occur during surveys for spotted owls, which may be more densely concentrated or better surveyed in northwestern California. Concentrations of barred owl detections in northwestern California may be partly associated with intensive survey effort for spotted owls in the Green Diamond, Northwest California, and Hoopa density study areas. Furthermore, the Six Rivers National Forest conducted forest-wide surveys for NSOs in 2010 and 2011 and subsequently continued to survey large areas associated with forest projects (cite). Barred owls have a broader ecological range than do spotted owls, so they may be more widely distributed than is shown in Figure 3 (USFWS 2013).

Comment [LVD4]: The detections can be used to establish general trends, but they don't allow for estimates of population density or abundance.

Comment [LVD5]: THP surveys throughout the region are also reporting barred owl detections.

Figure 3: Cumulative northern California barred owl detections in the California Natural Diversity Database from 1978 through A) 1990, B) 1998, C) 2006, and D) 2013 (note: dark red symbols denote higher concentrations of detections).

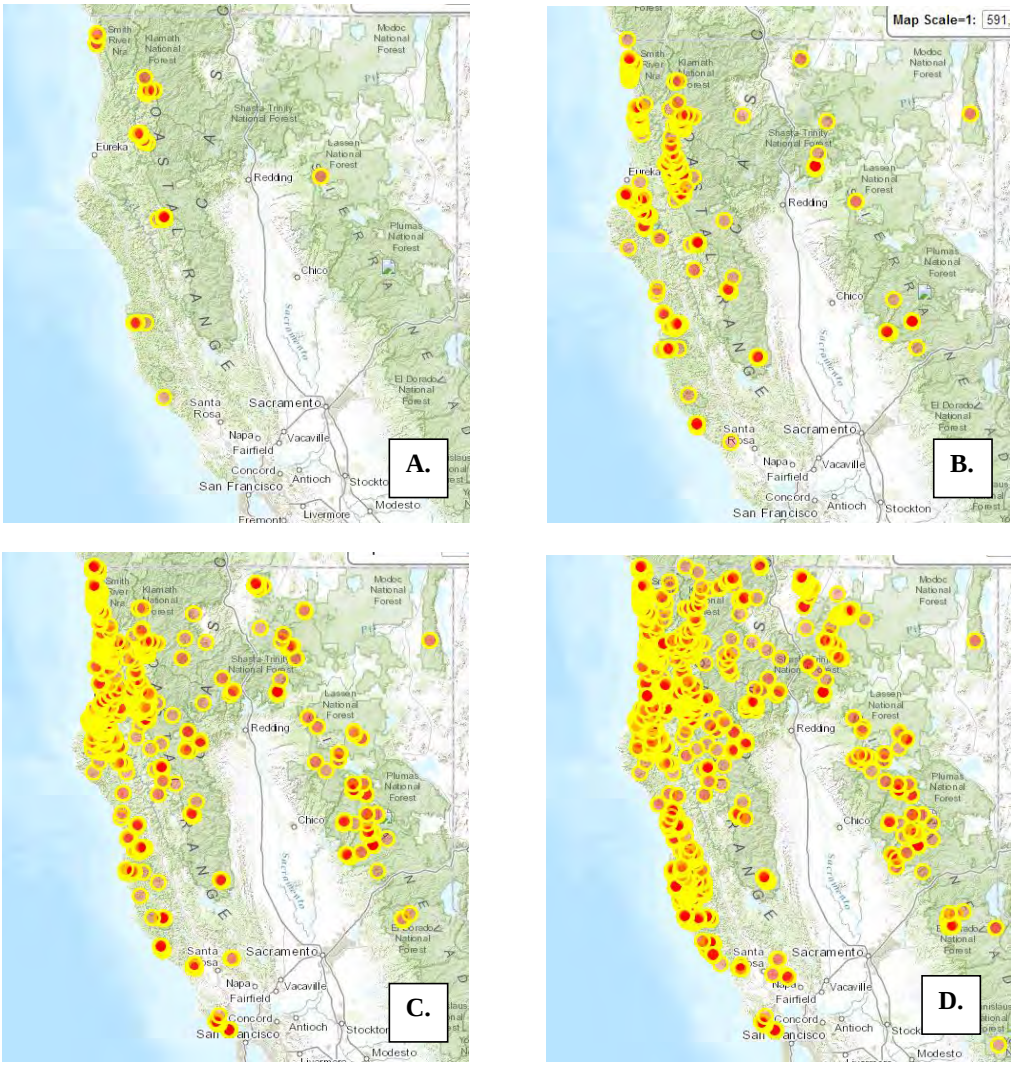
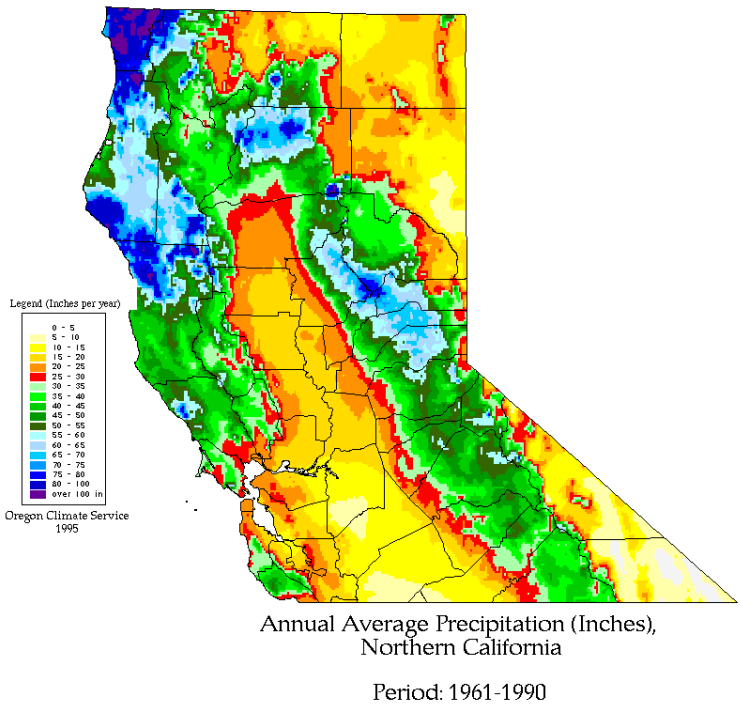


Figure 4: PRISM precipitation map for northern California (1961-1990) (Western Regional Climate Center).



Barred owls have increased dramatically in California's Redwood National and State Parks (Gutiérrez et al. 2004). In 2012 alone, NSO surveyors detected at least 17 barred owls at 10 different sites (Schmidt 2013). In contrast, NSOs were detected at only four historical territories in 2012. It is possible that more NSO territories were active during that year as relatively little of the landscape was surveyed. However, Schmidt (2013) noted that the Redwood National and State Parks have discontinued surveying many areas due to what appears to be almost complete displacement of NSOs by barred owls. Based on clusters of barred owl detections ($\leq$1 mi apart) during 1993-2012, Schmidt (2013) estimated that the Redwood National and State Parks contain a total of 58 barred owl territories. Barred owls have only recently invaded National Park lands in Marin County, California and have been slow to increase in numbers thus far (Ellis et al. 2013). Barred owls were first detected in Marin County in 2002 and were detected at only four (13%) NSO monitoring sites in the area in 2012 (Ellis et al. 2013). Ellis et al. (2013) hypothesized that the barred owl's expansion into Marin County has been limited due to extensive agricultural and urban lands surrounding the area. They also stated however, that barred owl numbers would likely continue to increase in the area over time and could eventually pose a substantial conservation problem for this small and relatively isolated population.

Most information about barred owls on private timberlands in California is from ownerships in the Redwood Province. Data provided by the Green Diamond Resource Company are described above, along with those from other NSO density studies in California. Reports from both the Humboldt Redwood Company (Humboldt County) and Mendocino Redwood Company (Mendocino and Sonoma Counties) suggest that barred owls are currently rapidly increasing on those lands. Despite a marked decline in annual numbers of nighttime surveys, Humboldt

Redwood Company (2013) found an overall increase in barred owl detections within 0.5 mile of NSO activity centers during 2003-2013 (Figure 5). However, some of the increase in barred owl detections between 2010 and 2011 was likely due to greater survey effort associated with adoption of the USFWS (2012) revised survey protocol for NSOs. Mendocino Redwood Company (2014) data suggest that barred owls increased dramatically on their lands during 2005-2013 (Figure 6). Barred owls were detected within one mile of 47 (45%) NSO activity centers on these lands in 2013. The number of NSO territories with barred owl detections increased by 113% during 2010-2013. Mendocino Redwood Company (2014) noted that barred owls have been detected within one mile of 71 NSO activity centers on their lands since 2005. The Conservation Fund (in Calforests 2014), which manages lands in Mendocino and Sonoma Counties, stated that barred owls have been detected "across their ownership" since 2009. They currently have four sites at which barred owls are "regularly detected" and another area in which they are "occasionally detected".

Figure 5: Number of barred owl detections within 0.5 mile of northern spotted owl activity centers on Humboldt Redwood Company lands during 2003-2013 (from Humboldt Redwood Company 2013).

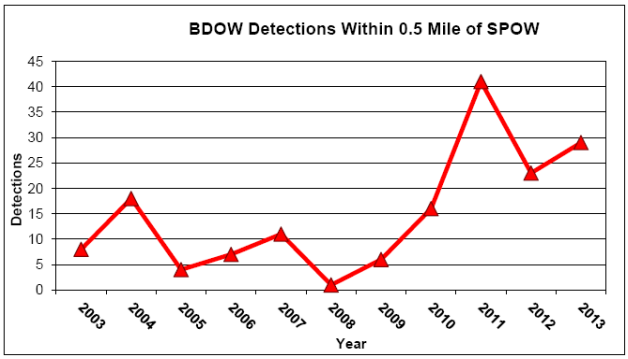
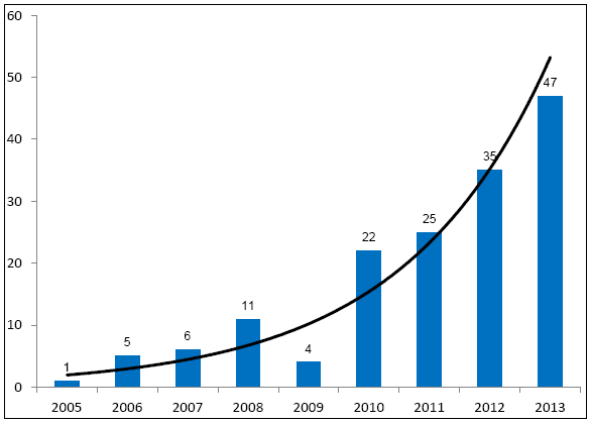


Figure 6: Percent (y-axis) and number of northern spotted owl territories (1 mi radius around activity centers) on Mendocino Redwood Company lands with barred owl detections during 2005-2013 (note: the apparent decline in NSO territories with barred owl detections in 2009 coincided with a substantial dip in NSO survey effort) (from Mendocino Redwood Company 2014).



There is relatively little information concerning barred owl numbers on private timberlands in California's eastern Klamath and Southern Cascade regions. In 2013, Sierra Pacific Industries confirmed barred owl occupancy at 14 of 28 known/historical barred owl sites within their Redding and Weaverville Districts (eastern Klamath and Southern Cascades regions) and located two additional sites (SPI 2014). We are unaware of any reports of barred owl trends or presence in NSO territories on Sierra Pacific lands. Fruit Growers Supply Company (in Calforests 2014) reported barred owl detections within or "nearby" (distance not reported) five NSO activity centers in Siskiyou County. It was unclear whether these numbers were cumulative or were from 2013 alone. Michigan-California Timber Company (in Calforests 2014) reported that barred owls were detected at one site on their lands in Siskiyou County in 2010 and 2012 and two sites in 2009 and 2013. Crane Mills (in Calforests 2014) has detected only one barred owl on their lands in Shasta County. Roseburg Resource Company (in Calforests 2014) has never detected a

barred owl during their NSO surveys on lands in Siskiyou and Shasta Counties. The low numbers of barred owl detections on some private timberlands in California's eastern Klamath and Southern Cascades regions is somewhat surprising given the numbers of detections on the Shasta-Trinity and Klamath National Forests and on Sierra Pacific Industries lands (Figure 3). It is unclear if this is due to a difference in survey effort, ecological conditions, management history, or some other factor.

In summary, the barred owl's range now completely overlaps the NSO's range and partially overlaps the California spotted owl's range. Barred owls rapidly expanded their range southward from British Columbia, through Washington and Oregon, and into northern California. The species' range expansion into California appears to have occurred first and most rapidly in northern coastal forests and near the margin of the southern Cascades and northern Sierra Nevada. However, it is unclear if these patterns actually reflect the species' expansion or are merely an artifact of higher survey effort for spotted owls in these areas. Regardless, the available information suggests that there is currently a high potential for interactions between NSOs and barred owls throughout much of NSO's range in California. The barred owl invasion does not appear to have peaked in the state. Rather, the information reviewed above suggests that the species is continuing to expand into drier, interior portions of the Klamath and Southern Cascades Provinces and that their presence in NSO territories is increasing at accelerating rates in the Redwood Province and western Klamath.

Comment [LVD6]: I don't think there is any doubt that it is a reflection of the species' expansion, because it mimics what happened in WA and OR as well. That said, I agree that the magnitude of the expansion is likely somewhat biased by the greater survey effort on the coast.

Effects on NSOs

Scientific Uncertainty

As discussed above, there is currently little reliable information concerning trends in barred owl densities or population numbers. Most of what is known about the potential for barred owl interactions with NSOs is based on incidental detections of barred owls during NSO surveys (Gutiérrez et al. 2004). Reliance on NSO surveys limits many studies' inferences concerning barred owl numbers. Gutiérrez et al. (2004) noted that some studies have found large numbers of historical NSO territories apparently vacant of both NSOs and barred owls. It is unclear if these vacancies were primarily a reflection of inadequate survey effort for one or both species or if they are caused by some other factor (Gutiérrez et al. 2004). Some of this uncertainty has been reduced due to increased survey effort required by revised survey protocols for NSOs (e.g., USFWS 2012) and implementation of barred owl-specific surveys in some areas. Inferences from studies of barred owl effects on NSOs are further limited by the observational and retrospective nature of most research of this topic (Livezey and Fleming 2007). Most studies of barred owl effects on NSOs have examined correlations between changes in NSO occupancy or demography and barred owl presence near NSO activity centers (see below). These studies do not definitively prove that barred owl presence causes changes in NSO occupancy or demography. However, preliminary results of barred owl removal experiments more directly support conclusions that barred owl presence negatively affects NSOs in a variety of ways (see below).

Comment [LVD7]: That assessment is over 10 years out of date, and as rapidly as the barred owl science is advancing, I would not consider it appropriate to cite for scientific uncertainty. You should be using the barred owl EIS, Wiens et al. 2014 and other more recent studies.

Comment [LVD8]: This is way out of date and irrelevant at this point.

Comment [LVD9]: But the Wiens study does – you could cite his dissertation or the 2014 monograph.

Hybridization

At the time of the NSO's listing there was concern among some researchers that hybridization between spotted owls and barred owls would lead to the loss of the spotted owl as a distinct species (Gutiérrez et al. 2004). Despite genetic, morphological, ecological, and behavioral differences between spotted owls and barred owls, there appear to be few strong isolating mechanisms to prevent them from interbreeding (Gutiérrez et al. 2007). Yet, hybridization between the two species appears to be relatively rare. For example, an extensive review of NSO survey and banding records from 1970-1999 in Oregon and Washington found reports of only 47 NSO-barred owl hybrids (Kelly and Forsman 2004). Hybridization therefore appears to pose little threat to NSOs compared with the effects of competition (Kelly and Forsman 2004; see below). However, hybridization could become a more serious issue in the future as NSOs continue to decline and become less able to locate conspecific mates (Gutiérrez et al. 2007).

Demography

Forsman et al. (2011) evaluated demographic trends for NSOs in 11 density study areas during 1985-2008. They found that NSO reproduction (fecundity) was negatively associated with the presence of barred owls ($\leq$0.62 mi from NSO activity centers) in four study areas, including Green Diamond's in California. Inclusion of the barred owl covariate in one of the best performing models in the meta-analysis of reproduction across all study areas provided weak support for an effect of barred owl presence on reproduction throughout the NSO's range (Forsman et al. 2011). The negative association between reproduction and barred owl presence

was likely underestimated since researchers often cannot relocate NSOs displaced by barred owls, and many displaced NSOs may be unable to find new territories and reproduce (Forsman et al. 2011). Apparent survival of NSOs was negatively associated with the presence of barred owls in six of the study areas, including Northwest California and Green Diamond (95% confidence intervals did not overlap zero or only slightly overlapped zero). The meta-analysis for all study areas showed a negative association between barred owl presence and apparent survival and recruitment, although the evidence for an effect on recruitment was statistically weak. Populations in seven study areas, including Northwest California and Green Diamond, declined during the latter portion of the study period (95% confidence intervals did not overlap zero or only slightly overlapped zero for these areas). Model selection results for the meta-analysis of population change indicated support for models that included the barred owl covariate. Forsman et al. (2011) noted that, of the various factors evaluated for potential effects on NSO vital rates, negative associations with the presence of barred owls were the strongest and most consistent among study areas. Forsman et al. (2011) also noted that they likely underestimated these negative associations by applying the barred owl covariate at the population scale rather than the territory scale. Studies of associations between NSO occupancy rates and barred owl presence suggest that the territory is a more appropriate spatial scale for detecting effects of barred owls on NSOs (see below).

Occupancy

Several studies distributed across the NSO's range have found evidence of a negative effect of barred owl presence on occupancy by the subspecies (Kelly 2001, Kelly et al. 2003, Pearson and

Livezey 2003, Gremel 2005, Olson et al. 2005, Kroll et al. 2010, Dugger et al. 2011, Green Diamond Resource Company 2014, *Hoopa citation*). These findings suggest that barred owls are causing large-scale displacement of NSOs and that negative effects of barred owls are largely due to interference competition between the two species (see below).

Gremel (2005) found that occupancy by pairs of NSOs in the Olympic National Park in Washington declined significantly at sites with barred owl presence, whereas pair occupancy remained stable at sites without barred owl detections. During 1992-2003 in this study area, the number of barred owl detections in NSO sites per number of survey days increased by 15% per year. During the same period, mean occupancy by NSOs declined from 61% to 42% in sites with barred owl detections.

In the southwestern Washington Cascades, Pearson and Livezey (2003) found a 9% annual increase in the number of barred owl detections relative to the number of NSO detections during 1982-2003. Unoccupied historical NSO core areas (500 ac) had significantly more barred owl activity centers at three spatial scales (0.5, 1.0, 1.8 mi) than did occupied core areas.

Kelly et al. (2003) evaluated potential effects of barred owl presence on NSO occupancy in five density study areas in Washington and Oregon. Their analyses indicated that barred owls had a stronger negative effect on NSO occupancy when located closer to activity centers than when farther away. Occupancy by NSOs exhibited a highly significant decline when barred owls were detected within 0.5 mile of activity centers ($P = 0.001$), compared with a lower tendency to decline when barred owls were detected farther away ($P = 0.06$).

Olson et al. (2005) examined associations between NSO occupancy dynamics and the presence of barred owls near activity centers (distance not reported) in three study areas in western Oregon. Barred owl presence was low (detected near <10% of NSO sites each year) in all three study areas during the first eight years of the study (1990-1997), increased substantially in one of the study areas thereafter (maximum of 28% of sites in 2001), and more gradually in the other two (ca. 10% of sites in 2001). Despite relatively low barred owl presence (e.g., compared with Forsman et al. 2011, Figure 2), site occupancy probabilities for NSO pairs decreased by 5-15% with increasing barred owl presence.

In one of the western Oregon density study areas evaluated by Olson et al. (2005) (Tyee), Bailey et al. (2009) found no evidence of an effect of barred owl presence on NSO occupancy during 2002-2003. They cautioned however, that their study's inferences were weak since barred owl presence was relatively low at the time of the study (detections in <12% of NSO territories based on Olson et al. 2005). Just five years after their study period ended, barred owls were detected in 70% of NSO territories (0.62 mi around activity centers) (Forsman et al. 2011; Figure 2).

In the eastern Cascades of Washington, Kroll et al. (2010) found that the mean probability of occupancy by NSOs was significantly lower for sites with barred owl presence (0.50) than without it (0.76) (presence not spatially defined). Although the percent of NSO sites with barred owl detections was moderate compared with some areas (max. ca. 33% [estimated from graph] vs. Figure 2), site occupancy probabilities for NSOs declined by about 50% during 1990-2003.

In the southwestern Cascades of Oregon, Dugger et al. (2011) found significant differences in mean annual occupancy for NSO pairs with nearby barred owl detections (presence not spatially defined) than in those without. During the latter 13 years of the study, mean annual site occupancy was approximately 10-15% at sites with barred owl presence compared with about 58-78% at sites without barred owl presence (estimated from graph).

Green Diamond Resource Company (2014) is currently conducting an experiment to evaluate the effects of lethally removing barred owls from NSO territories in California's Redwood Province. Preliminary results from this study suggest that removal of barred owls results in rapid recolonization of sites by NSOs. Green Diamond reported a 43% increase in the number of sites occupied by NSOs in their treatment (barred owl removal) area during the first year (2008 to 2009) and an additional 9% increase the following year (2009 to 2010). In contrast, the number of sites occupied by NSOs in an adjacent control portion of the study area (no barred owl removal) was virtually unchanged from 2008 to 2009 and declined by 23% from 2009 to 2010. However, the degree to which barred owl removal positively affected NSO occupancy in this study is difficult to evaluate. The beginning of Green Diamond's removal study roughly coincided with implementation of a new survey protocol which likely resulted in greater detections of both NSOs and barred owls. Future analyses from this study should provide clearer insight into the effects of barred owl presence and removal on NSO occupancy.

Add Hoopa barred owl removal preliminary results if obtainable…

Habitat Use

Comment [LVD10]: You should include Wiens dissertation or the recent monograph in the section on habitat use.

Dugger and Davis (2011) stated that "the relationship between spotted owl fitness and habitat characteristics may have become disconnected through interspecific competition with barred owls." They based this hypothesis on their finding that mean habitat suitability at NSO pair locations within the Northwest Forest Plan area decreased by approximately 9% between 1994/1996 and 2006/2007 (Davis and Dugger 2011). This decline in mean habitat suitability at NSO pair locations did not appear to be solely due to a loss of suitable breeding habitat, which declined by about 3% in this area during the study period. This hypothesis is also supported by findings that NSOs in the northern portion of their range are often displaced by barred owls into steeper and higher elevation areas (Pearson and Livezey 2003, Gremel 2005, Hamer et al. 2007). Hamer et al. (2007) suggested that displacement of NSOs to higher elevation forests could result in reduced survival or reproduction during years with severe winters.

Territorial Behavior

Barred owl presence and calling is associated with reduced responsiveness of spotted owls to conspecific calls, including survey broadcasts (Olson et al. 2005, Crozier et al. 2006, Bailey et al. 2009, Kroll et al. 2010). This is partially of interest to researchers and land managers because it influences the field and analytical methods required for measuring occupancy by NSOs (Olson et al. 2005, MacKenzie et al. 2006, USFWS 2012). Accurate assessments of occupancy are needed for evaluating effects of barred owls and other potential stressors on NSOs, and for avoiding inappropriate management activities, such as timber harvesting near nests in occupied territories.

Comment [LVD11]: This is true, but reduced detection probabilities don't necessarily mean reduced ability to detect NSO. The number of surveys required have been increased so that overall detection probabilities are >95%.

Reduced vocalizing by NSOs in the presence of barred owls is also of concern because NSOs rely on vocalizations to defend their territories, locate vacant territories and potential mates, form pair bonds, and announce prey deliveries (Gutiérrez et al. 1995). Widespread disruption of these activities could impact NSO demographic rates.

Interspecific Competition

Gutiérrez et al. (2004) described the ecological and morphological separation that exists among sympatric owls worldwide. Their review found that species within the same genus are generally segregated by geographic range or habitat associations. It also showed that sympatric congeneric owls are usually strongly divergent in size, which varies with diet and possibly, hunting mode. Spotted owls and barred owls are both members of the genus *Strix*. Gutiérrez et al. (2004) noted that the two species only differ in body mass by 18%, which is likely too little to allow coexistence. A building body of evidence indicates that barred owls indeed negatively affect spotted owls (reviewed above), and that this occurs through both direct (interference) and indirect (exploitative) competition (Gutiérrez et al. 2004, 2007, USFWS 2013; see below). Wiens (2012) stated that "when viewed collectively, the behavioral and life history traits exhibited by barred owls may give them a significant advantage over spotted owls when competing for critical resources such as space, habitat, and food."

Surveyors have observed barred owls attacking spotted owls and have themselves been attacked while imitating spotted owl calls (Gutiérrez et al. 2004). There is also limited evidence of barred owl predation of NSOs. Leskiw and Gutiérrez (1998) provided strong circumstantial evidence

that a barred owl killed and partially consumed an NSO in Redwood National Park, California. Johnston (2002 cited in Gutiérrez et al. 2004) found circumstantial evidence of barred owl predation of a juvenile NSO in the southern Oregon Cascades. However, most cases of barred owl aggression toward NSOs appear to be a related to territorial defense, rather than predation (USFWS 2013).

Studies in Washington found that barred owl home ranges are relatively small and tend to have little overlap, which is consistent with aggressive territorial behavior (Hamer et al. 2007, Singleton et al. 2010). In contrast, neighboring NSO home ranges often broadly overlap, particularly during winter (Hamer et al. 2007). There is limited anecdotal evidence of spotted owls aggressively interacting with barred owls (Gutiérrez et al. 2004), and spotted owls appear to reduce detection probabilities for barred owls (Bailey et al. 2009). Nonetheless, barred owls generally exhibit higher levels of vocal and physical aggression than do NSOs and are typically dominant during interactions between the two species (Van Lanen et al. 2011). Significantly reduced detection probabilities for NSOs in the presence of barred owls provides further evidence of the larger, more aggressive barred owl's behavioral dominance over NSOs (see above).

Barred owls are dietary generalists compared with NSOs (USFWS 2013). As dietary generalists, barred owls may be better able to colonize a wider variety of habitats than NSOs and may be more resilient to fluctuations in prey populations (USFWS 2013). The barred owl's generalist diet is likely a primary reason for the species' relatively small home ranges and associated ability to occur at high densities (see below). Furthermore, because barred owl diets overlap with those

of NSOs, it is possible that they negatively affect NSOs by depressing populations of key prey, such as northern flying squirrels and woodrats (Gutiérrez et al. 2007, USFWS 2013).

The barred owl's habitat associations in the Pacific Northwest and California are poorly understood. As discussed earlier, most barred owl detections are incidental to spotted owl surveys so relatively little is known about the ecology of barred owls outside of areas occupied by spotted owls. Early studies of the barred owl's habitat associations in the Pacific Northwest suggested that the species is more associated with younger forest types than are NSOs (Gutiérrez et al. 2007). However, subsequent research has found that barred owls use a variety of habitats and that some individuals prefer densely canopied mature and old forest (Gutiérrez et al. 2007, USFWS 2011). That is, barred owls appear to be capable of occupying a broader variety of habitat types than NSOs but the two species likely compete for access to mature and old forest. The two species may also compete for nest sites since they both rely on the same kinds of pre-existing nest structures (Gutiérrez et al. 2007). Together, overlapping habitat associations with NSOs, use of a broader range of habitat types, and the ability to occur at relatively high densities allows barred owls to form large source populations in close proximity to NSOs (USFWS 2013).

Comment [LVD12]: The only real definitive data on habitat use of NSO and BO is the Wiens study, because he was radio tracking both species simultaneously on the same landscape. This study showed that the two species have almost identical selection for different aged stands with the only difference being that BO tend to use riparian areas more than NSO.

Perhaps due to their generalist diet, barred owls often have substantially smaller home ranges than do NSOs (Gutiérrez et al. 2007, USFWS 2013). Estimates of barred owl home ranges in Washington were three to nine times smaller than those of NSOs in the state (Hamer et al. 2007, Singleton et al. 2010). Barred owl home ranges in the Oregon Coast Ranges were two to four times smaller than those of NSOs (Wiens 2012). There does not appear to be any existing research comparing the home range sizes of barred owls and NSOs in California (Gutiérrez et al.

2007). Annual home range sizes for NSOs (100% minimum convex polygon) in the California and Oregon Klamath Provinces varied among studies and with forest types and contiguity but were similar to or somewhat larger (0-60% larger) than those for barred owls in the Oregon Coast Ranges (Sisco 1990, Carey et al. 1992, Zabel et al. 1993, Irwin et al. 2006). The NSO's smaller home ranges in California suggest that they may have lower encounter rates with barred owls than occurs in Oregon and Washington. However, it is possible that barred owls also have smaller home ranges in California. Estimates of barred owl home range sizes in California are needed.

Wiens (2012) found that barred owls in the Oregon Coast Ranges had a higher annual survival probability (0.92 vs. 0.81) and produced over six times as many young as sympatric NSOs. Barred owls have a wider range of clutch sizes than NSOs (1-5 vs. 1-3), are capable of laying additional clutches within a season if the first is lost, and appear to exhibit lower annual fluctuations in reproduction (USFWS 2013; but see Mazur and James 2000). The USFWS (2013) noted that "the ability of barred owls to forage on a wider diversity of prey species and in a wider diversity of habitats may explain their reproductive success in comparison with spotted owls." There is a need for further research of the barred owl's natural history and ecology within the range of the NSO (Gutiérrez et al. 2007, Livezey and Fleming 2007). However, the currently available information indicates that the demographic performance of barred owls is superior to that of NSOs.

Overall, barred owls appear to primarily impact NSOs through interference competition for space, habitat, and food, although they may also indirectly affect NSOs by depressing prey

populations (Gutiérrez et al. 2007, Hamer et al. 2007, Van Lanen et al. 2011, Wiens 2012, USFWS 2013). Barred owls are generally superior competitors to NSOs in terms of size, aggression, demographic performance, and ability to exploit a wider array of habitats and prey (Gutiérrez et al. 2007, USFWS 2013).

Barred Owl Management

The information reviewed above indicates that barred owls pose a serious and increasing threat to NSOs throughout their range, including in California. Barred owl presence in NSO territories has continued to increase across the NSO's range and appears to be partially responsible for declining NSO demographic and occupancy rates. Barred owl presence can also reduce the ability of biologists and land managers to effectively locate and conserve NSOs. Given the negative effects of barred owls on NSOs, it is clear that policymakers and land managers must address the barred owl threat if successful recovery of the NSO is to remain a conservation priority. Current proposals for addressing the barred owl threat include barred owl removal and habitat conservation.

Some researchers have expressed concern that barred owl removal experiments would be costly, ineffective, and distracting (Livezey 2010, Rosenberg et al. 2012). However, preliminary results from barred owl removal experiments indicate that lethal removal of barred owls is effective, relatively inexpensive, and conforms to animal welfare standards (Diller 2013, Diller et al. 2013, *Hoopa/other experiment area citations*). Other objections to barred owl removal are primarily ethical or emotional (Gutiérrez et al. 2007, Diller 2013). There is substantial emotional

resistance to lethal removal of barred owls, even among scientists and land managers involved with barred owl removal experiments (e.g., Diller 2013). Relocation of barred owls to zoos or their native forests in the eastern U.S. is logistically and politically unfeasible, so killing barred owls appears to be the only viable removal option (USFWS 2013). Primary ethical concerns regarding barred owl removal include whether or not it is appropriate to remove or control a native species or to intervene in its potentially natural range expansion (USFWS 2013). The USFWS (2013) reviewed scientific literature regarding the barred owl's status as a native or nonnative species and whether its range expansion was natural or human caused. It found that the literature was inconclusive regarding both issues. However, it concluded that humans are responsible for intervening in the barred owl's expansion because the NSO's vulnerability to barred owl competition and other stressors is due to timber harvesting and other past and continuing human activities. Regardless, the currently available evidence suggests that NSOs will continue to decline, and could ultimately become extinct, without widespread or strategic barred owl control measures.

The barred owl's increasing impact on NSOs in Late Successional Reserves, National Parks, and other reserved lands demonstrates that habitat protection alone is insufficient for addressing the barred owl threat (Gutiérrez et al. 2004). Nonetheless, habitat conservation remains crucial to the NSO's conservation (USFWS 2011). The importance of retaining suitable breeding habitat for NSOs has been well demonstrated at individual, territory, and population scales (e.g., Solis and Gutiérrez 1990, Franklin et al. 2000, Forsman et al. 2011; see *Threats: Timber Harvesting*). Habitat conservation might also be important for minimizing barred owl impacts on NSOs (USFWS 2011). Habitat loss and fragmentation due to timber harvesting or other disturbances

could intensify competition between NSOs and barred owls by bringing them into closer proximity (Gutiérrez et al. 2007, USFWS 2011). Dugger et al. (2011) found some support for this hypothesis in their study of NSO occupancy in southern Oregon. Their results indicated that barred owl presence and landscape-level habitat characteristics have additive effects on NSO occupancy rates. Specifically, the presence of barred owls appeared to exacerbate the negative effects of habitat loss and fragmentation on NSO occupancy. The USFWS (2011) suggested that retaining and restoring habitat may provide displaced or recruited NSOs with refugia from negative interactions with barred owls (USFWS 2011). Dugger et al. (2011) did not find direct support for this hypothesis. In their study, higher amounts and lower fragmentation of older forest did not reduce the negative effects of barred owls on NSO occupancy. However, they noted that some NSOs in their study continued to survive and successfully reproduce in areas with barred owl presence, possibly indicating that there are ecological conditions under which the two species can coexist. Additional and more direct research of the potential value of habitat refugia for NSOs is needed.

Acknowledgements

Xxxx

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Outdoor Marijuana Cultivation

Introduction

Although marijuana is perhaps the largest cash crop in California (Gettman 2006), its cultivation is largely unregulated and little is known about ~~its~~ environmental effects associated with its cultivation ~~environmental effects~~. Recent research has indicated that outdoor marijuana cultivation is currently having widespread and profound environmental impacts in California (Bauer cite, Gabriel et al. 2012, 2013, Thompson et al. 2014). Negative impacts of outdoor marijuana cultivation include wildlife deaths caused by pesticide exposure and poaching; habitat degradation caused by logging, road construction, pollution, and water diversion; and heightened safety concerns for research and resource personnel (Bauer cite, Gabriel et al. 2012, 2013, Thompson et al. 2014). The specific effects of outdoor marijuana cultivation on northern spotted owls (*Strix occidentalis caurina*; NSOs) are unknown. Recent findings of widespread pesticide exposure among fishers (~~*Martes*~~ *Pekania pennanti*) and barred owls (*Strix varia*) in northwestern California suggest that NSOs ~~in~~ within the state are likewise exposed and could be ~~negatively affected at both territory and population levels~~experiencing the same effects seen in fishers (~~Gabriel cite, Gabriel et al. 2012; reviewed below~~). NSOs could also be directly affected by environmental degradation from outdoor marijuana cultivation, ~~such as through~~via habitat modification ~~or suppression of rodent prey populations~~, or indirectly affected through ecological changes caused by reduced streamflows or pollution. Safety concerns associated with illegal marijuana cultivation may also be impacting NSOs and other wildlife through reduced research and survey efficiency and effort (Gabriel et al. 2013).

Comment [MWG1]: The plant itself is not hazardous, it's the activities associated with its cultivation.

Comment [MWG2]: New genus for the species.

Comment [MWG3]: Anticoagulant Rodenticide Exposure in Barred Owls, a Proxy for the Northern Spotted Owl in California Managed Forests: Implications of Food Web Contamination

Gabriel, M.W.1*, L. Diller2, J. Dumbacher3, J.M. Higley4, G.M. Wengert1, S. Mendia4, D. Lamphear2, D. Early2,K. Hamm2, and R. Poppenga5.
1*

The exposure of wildlife to anticoagulant rodenticides (AR) has been well documented in non-forest settings. Until recently with the discovery of rampant use of ARs within trespass marijuana sites, exposure to ARs in remote forest wildlife was unknown and unexpected. We investigated the landscape-wide AR contamination in 84 Barred Owls, a proxy species for the Northern Spotted Owl (NSO), within NSO suitable habitat on northwestern California managed timberlands. Additionally, we investigated whether owl prey sampled in owl habitat were exposed to ARs. A total of 40% of all tested owls were exposed to ARs while 37 rodents sampled within NSO habitat were negative. However, all invertebrate samples (100%) from trespass grows were positive for ARs. Due to the inherent and swift lethality of ARs, negative rodent data was anticipated; however this is the first report of AR exposure to field collected invertebrates. These results demonstrate that AR contamination within NSO populations in NW California is likely and that food web contamination for these owls and numerous forest wildlife species is concerning.

The Wildlife Society Presentation: Humboldt State University 2014

Comment [MWG4]: Will still need to cite it as unpublished presented data.

Comment [MWG5]: Mentioned above

Comment [MWG6]: How would NSO be affected by reduced wateflows? They do not use inverts >10% of their diet. Barred owls, possible, but NSO impact's due to streamflow's would need to have some substantial premise to make this point.

Pesticides

Pesticide application is usually intended to suppress populations of rodents, insects, mollusks, and other agricultural and urban pests, but can have inadvertent negative impacts on humans, pets, and other non-target animals (Erickson and Urban 2004, Albert et al. 2010, Mnif et al. 2011, Gabriel et al. 2012). Widespread secondary exposure to pesticides has been reported for raptors, carnivores, and other wildlife that consume poisoned rodents around farms and human dwellings (Albert et al. 2010, Murray 2013, ~~Thompson et al. 2014).~~ Researchers have generally assumed that pesticides pose little threat to wildlife outside of agricultural and urban areas (Gabriel et al. 2013). However, a recent publication reported that 79% of fishers tested in two study areas on federal and tribal forest lands in California had been exposed to anticoagulant rodenticides (ARs), including four that ~~apparently~~ died from lethal toxicosis (Gabriel et al. 2012; note: at least two more fishers in California died from AR poisoning following publication of this study: Gabriel et al. 2013). Most fishers in the study had been exposed to multiple AR compounds (range = 1-4, mean = 1.6). These findings not only raised concern for the West Coast fisher population, which the U.S. Fish and Wildlife Service recently proposed to list as threatened under the federal Endangered Species Act, but for the NSO, which has an overlapping distribution and diet with the fisher (Gabriel et al. 2013, Calforests 2014, USFWS 2014). Subsequently, ARs have been detected in a dead NSO recovered in Mendocino County (Calforests 2014) and xx of xx (xx%) barred owls tested for exposure in Humboldt County (Gabriel cite). Although barred owls are being tested as a proxy for NSOs (Gabriel cite), NSOs may be more widely exposed to ARs given their greater dietary specialization on rodents (see

Comment [MWG7]: Cite primary literature, Gabriel and Thompson are primary for fisher but not for other species.

Comment [MWG8]: More of habitat characteristics and some diet overlap.

Comment [MWG9]: See above presentation

USFWS 2013). Strong circumstantial evidence implicates pervasive illegal outdoor marijuana cultivation as the primary source of pesticide exposure for forest predators in California (Gabriel et al. 2012, 2013, Thompson et al. 2014).

ARs detected in forest predators in northern California include brodifacoum, bromadiolone, difethialone, chlorophacinone, diphacinone, warfarin, and coumachlor (Gabriel cite, Gabriel et al. 2012). Brodifacoum, bromadiolone, difethialone are classified as second-generation anticoagulant rodenticides (SGARs). SGARs were introduced in the 1970s due to widespread development of resistance among rodents to first-generation anticoagulant rodenticides (FGARs), such as warfarin, chlorophacinone, and diphacinone (Buckle et al. 1994). SGARs are more acutely toxic than FGARs and generally require only a single dose to kill rodents (Erickson and Urban 2004). However, rodents usually survive 5-10 days after consuming a lethal dose, during which time they may continue to consume additional rodenticide and remain available to predators (Cox and Smith 1992, Erickson and Urban 2004). SGARs are more persistent in animal tissues than FGARs and insecticides, which are more rapidly metabolized and excreted (Erickson and Urban 2004). Thus, exposure to FGARs and other non-SGAR pesticides is more difficult to detect than for SGARs and exposure to them could be underestimated (Albert et al. 2010, Thompson et al. 2014). Rodents such as dusky-footed woodrats (*Neotoma fuscipes*) and deer mice (*Peromyscus* spp.) are likely the primary source of AR exposure for NSOs because they are targeted by AR application and because they generally comprise most of the biomass in NSO diets (Forsman et al. 2004). Insects may be an additional source of AR exposure for NSOs and other wildlife. In terms of frequency of consumption, insects can substantially contribute to NSO diets regionally, locally, or seasonally (Forsman et al. 2004). Insects are not killed by ARs

Comment [MWG10]: Not all were detected, see 2012 Plos paper

Comment [MWG11]: Are they? I would rewrite with a general blanket statement that rodents are the primary source, however the main rodents most likely affected are…

Comment [MWG12]: Please see John Weins 2012 dissertation and publication https://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/28475/WiensJohnD2012.pdf?sequence=2

Comment [MWG13]: See weins study of minimal insect use by NSO

and may therefore continue to accumulate them in their tissues, essentially becoming small "packets" of AR (~~C. Thompson, pers. comm~~This would be primary data from Gabriel un published.).

Large quantities of ARs, particularly SGARs, are often spread across large areas in and around illegal outdoor marijuana grow sites (Gabriel et al. 2012, Thompson et al. 2014; Figure 1). Gabriel et al. (2012) noted that thousands of pounds of pesticides were found at illegal outdoor marijuana grow sites in California in 2008 and that 150 pounds of pesticide were found during a single three-week eradication operation on the Mendocino National Forest in 2011. Three sites raided in Humboldt County in 2013 contained a total of at least 17 pounds of SGAR bait, which researchers estimated was sufficient to kill 2,753 woodrats, 14 fishers, or five spotted owls (Humboldt Sentinel August 2, 2013). Other pesticides, such as organochlorine, organophosphate, and carbamate insecticides, some of which are banned in the U.S., are also frequently found at illegal outdoor marijuana grow sites (HSVTC 2012, Thompson et al. 2014). Pesticides are often applied along with large quantities of fertilizer at the base of marijuana plants grown outdoors (Thompson et al. 2014; Figure 1), suggesting that marijuana and surrounding plants may be taking up pesticidal compounds from the soil. If this occurs, then rodents and insects may accumulate pesticides through consumption of plants as well as pesticidal bait. Investigation of pathways of pesticide exposure for NSOs, as well as levels of exposure and potential physiological, behavioral, and population impacts, is needed.

Comment [MWG14]: Primary source was Humboldt county sheriffs office which we provided them the data for the press release. Cite HCSO

Figure 1: (A) Rodenticide and other pesticides found at a trespass outdoor marijuana grow site in Humboldt County (photo: Humboldt County Sheriff's Office) and (B) rodenticide bait and dry fertilizer strewn together below approximately 2,000 marijuana plants at a trespass outdoor grow site in Humboldt County (from Gabriel et al. 2012).

ARs are vitamin K antagonists, which cause impairment of the blood's ability to clot (Murray 2013). A lethal dose of AR causes animals to die from hemorrhage (Erickson and Urban 2004). Animals may also exhibit weakness prior to death or with a sublethal dose (Erickson and Urban 2004). Rodents exposed to ARs show altered behavior, such as spending more time in the open, freezing rather than bolting when threatened, and staggering (Cox and Smith 1992). These behaviors may increase predation risk for affected rodents and the opportunity for secondary exposure of predators to ARs (Cox and Smith 1992). Owls and other raptors with sublethal secondary exposure to ARs may often have reduced blood-clotting activity and can die from

minor wounds such as those commonly inflicted by prey (Erickson and Urban 2004, Murray 2013, Thompson et al. 2014). Non-AR pesticides have a variety of physiological effects, such as disrupting endocrine function or damaging the central nervous system (Grue et al. 1997, Mnif et al. 2011). Chronic or sublethal exposure to carbamate or organophosphate pesticides has been shown to reduce immune response, cause neurological disorders, reduce thermoregulatory control, and impair anti-predator behavior in wildlife (Grue et al. 1997; reviewed in Thompson et al. 2014). Pesticides can also have additive or synergistic effects on animals (Larsen et al. 2003 cited in Mnif et al. 2011, Relyea 2009). This is a source of additional concern for NSOs and other forest predators active near outdoor marijuana cultivation sites, where multiple types of pesticide are often present (HSVTC 2012, Thompson et al. 2014). Mortalities associated with exposure to pesticides are likely underestimated because carcasses are often predated or scavenged before biological samples can be obtained and because sublethal exposure can predispose wildlife to death from other causes (Albert et al. 2010).

There is no information available concerning population-level impacts of secondary pesticide exposure for NSOs in California. As reviewed above, secondary exposure to pesticides can kill raptors and other wildlife both through lethal toxicosis and by increasing the risk of mortality due to other factors such as predation, hypothermia, disease, parasites, or injury. NSO population rates are particularly sensitive to changes in adult survival (Noon and Biles 1990) so it is possible that direct and indirect mortalities associated with pesticide exposure could contribute to population declines (Sibly et al. 2000, Thompson et al. 2014). Pesticide exposure could also negatively impact NSO reproduction. Gabriel et al. (2012) noted that fisher mortalities caused by AR poisoning occurred between mid-April and mid-May. The timing of

these deaths coincided with the planting phase of outdoor marijuana cultivation, when seedlings are most vulnerable to rodent pests and AR use is likely highest (Gabriel et al. 2012). This time of year is also when NSOs incubate and brood young (Gutiérrez et al. 1995). Reduced parental care during this phase, for example due to compromised behavior or death of one or both parents, could result in death of offspring due to ~~chilling~~exposure, undernourishment, or predation (Grue et al. 1997). NSO populations could also be negatively impacted by pesticide suppression of prey populations or changes in community ecology caused by reductions of insects, small mammals, carnivores, raptors, amphibians, and aquatic animals (Relyea and Diecks 2008).

Comment [MWG15]: Why would NSO populations decrease if a carnivore population decreases, or for the other examples mentioned. It is plausible for the small mammals due to them being prey items. Explain for the reader

Other Environmental Effects

Activities related to outdoor marijuana cultivation can have a variety of environmental impacts beyond exposure of wildlife to pesticides, including negative effects of illegal and poorly planned water diversion, logging, and road construction; pollution of water and soils; poaching of wildlife; and ignition of wildfires (reviewed below). Negative impacts occur on both public and private lands (Bauer cite, Gabriel et al. 2013). However, the potential environmental impacts of marijuana cultivation could vary considerably, depending on the operation's location, scale, and practices. For example, some marijuana industry organizations and growers advocate growing practices aimed at minimizing environmental damage from outdoor cultivation (e.g., http://emeraldgrowers.org/). ~~No~~ there does not appear to be any information available at this time regarding effects of ecological degradation from marijuana cultivation on NSOs. Negative effects on NSOs are possible given the subspecies' sensitivity to habitat modification (see *Timber Harvesting* and *Wildfires*, this volume) and close association with riparian areas (e.g.,

Hamer et al. 2007, Irwin et al. 2012), where the impacts of marijuana cultivation are often concentrated. Furthermore, safety concerns associated with marijuana cultivation can substantially impact the ability of land managers to effectively survey and manage spotted owls and other sensitive wildlife (Keane et al. 2011, Gabriel et al. 2013, D. Hansen pers. obs.; see below).

Personnel with the California Department of Fish and Wildlife (Bauer cite) recently estimated hydrologic impacts of marijuana cultivation in northwestern California using high-resolution aerial imagery in Google Earth™ (e.g., Figure 2) and marijuana industry estimates of marijuana plant water requirements. Using these methods, they estimated that more than 82,000 marijuana plants were cultivated in 2012 in just four watersheds in Humboldt and Mendocino Counties (Table 1). Based on estimated numbers of marijuana plants and assumed water usage of 6 gallons per day per plant, they calculated that marijuana cultivation uses approximately 29% and 21% of the water that flows in the Redwood Creek and Salmon Creek watersheds per day during periods of minimum streamflow (Table 2). Although based on several assumptions (marijuana cultivation water sources and usage, complete visibility of cultivation sites in aerial imagery, complete usage of greenhouses), these estimates raised considerable concern about potential negative impacts of marijuana cultivation on watershed health and aquatic animals (cite). NSOs often exhibit a preference for nesting, roosting, and foraging in and near riparian areas (e.g., Hamer et al. 2007, Irwin et al. 2007). Thus, it is plausible that ecological changes caused by widespread water diversion for marijuana cultivation have negative indirect effects on NSOs.

Comment [MWG16]: This sentence fits the concern that I had above about water usage. But this should definitely be mentioned above

Figure 2: Outdoor (A) and greenhouse (B) marijuana cultivation sites identified with Google Earth™ (from Bauer cite). *Add Google Earth image(s) of trespass grow site(s).*

Table 1: Estimated numbers of outdoor marijuana cultivation sites, outdoor marijuana plants, marijuana greenhouses, marijuana plants in greenhouses, and total number of marijuana plants in four watersheds in Humboldt and Mendocino Counties (from Bauer cite).

	Redwood Creek (67.3 km²)	Salmon Creek (95.6 km²)	Redwood Creek North (730 km²)	Outlet Creek (419 km²)
Total outdoor cultivation sites	231	306	120	633
Total outdoor plants	10,475	11,697	5,984	16,843
Plant : Land area $\left(\frac{1}{km^2}\right)$	173.7	122.4	8.2	40.2
Total Greenhouses	324	302	273	320
Estimated Total Plants in Greenhouses	8,053	8,851	11,029	9,180
Greenhouse : Land Area $\left(\frac{1}{km^2}\right)$	4.8	3.1	0.4	0.8
Total Plants per Watershed*	**18,528**	**20,548**	**17,013**	**26,023**

**Field data indicate these totals may be underestimates.*

Table 2: Estimated daily water use for marijuana cultivation per day and during an entire growing season compared with minimum streamflow in four watersheds in Humboldt and Mendocino Counties (from Bauer cite).

	Redwood Creek	Salmon Creek	Redwood Creek North	Outlet Creek
Daily Water Use (gpd)	111,167	123,289	102,078	156,138
Minimum Streamflow (gpd)	387,763	581,645	---	---
Percent Use	**28.7%**	**21.2%**	---	---
Water Use per 150 Day Season (gal)	16,675,308	18,493,344	15,311,700	23,420,700

Marijuana growers on both public and private lands often illegally clearcut vegetation in order to create growing space for marijuana plants and room for artificial ponds and other structures (Bauer cite, Gabriel et al. 2013; Figure 3). Illegal cutting, along with creation of roads to access grow sites, can increase sedimentation in streams and creeks and thereby degrade habitat quality for aquatic and amphibious animals (Bauer cite). The effect of illegal vegetation clearing on NSOs is unknown. Given the close association of both marijuana cultivation and NSOs with riparian areas and surrounding uplands (e.g., Hamer et al. 2007, Irwin et al. 2007), it is plausible that widespread marijuana cultivation results in habitat loss or fragmentation for NSOs.

Figure 3: Areas cleared for outdoor marijuana cultivation.

From cite.

Clearing of a riparian area for marijuana cultivation at a trespass grow site.
Courtesy of Craig Thompson.

Widespread outdoor marijuana cultivation can further damage watershed health by polluting water and soils. In addition to pesticides, tremendous quantities of fertilizer are often applied at marijuana grow sites (HSVTC 2012, Thompson et al. 2014). Fertilizers, along with low flows caused by drought conditions and water diversion, may contribute to algae blooms and reduced oxygen levels in creeks and rivers (cite). Other pollution, including human waste, trash, and spilled diesel fuel from generators, is also frequently observed in and around streams at raided

outdoor marijuana grow sites (HSVTC 2012, C. Thompson, pers. comm.). Like water diversion and increased stream sedimentation, pollution from outdoor marijuana cultivation is primarily a source of concern for aquatic and amphibious animals but could have indirect ecological effects on NSOs and other wildlife.

Multiple recent wildfires in California have been attributed to marijuana growers. For example, in 2014, a marijuana grower was indicted on charges of starting the Nicolls Fire that burned nearly 1,700 acres in the Sequoia National Forest (SacBee 2014b). This grower allegedly set multiple fires in an attempt to avoid capture by other growers that he claimed were trying to kill him. Another marijuana grower was recently arrested for igniting the 2014 Bully Fire that burned nearly 13,000 acres in Shasta County (SacBee 2014a). This fire was apparently started when the grower's rental truck ignited dry grass when driven off-road in order to deliver soil amendments to a grow site. In 2009, a marijuana grower's camp stove ignited the 90,000-acre La Brea Fire in the Los Padres National Forest in southern California (inciweb). Large wildfires (e.g., thousands of acres) can burn through multiple NSO territories and can negatively affect NSOs in a variety of ways, particularly when they burn large areas at moderate to high severity (reviewed in *Threats: Wildfires*).

Illegal marijuana growers are often heavily armed in order to protect their crops and for poaching wildlife for food or to prevent wildlife damage to plants, equipment, or food caches (Gabriel et al. 2013, Boehm 2014; Figure 4). Many biologists and other field personnel working in California's forests have been interrogated, pursued, or shot at by marijuana growers (Gabriel et al. 2013, D. Hansen pers. obs.). Safety concerns associated with widespread illegal marijuana

cultivation can substantially curtail the ability of researchers and land managers to effectively locate, study, and manage spotted owls and other wildlife. For example, Six Rivers National Forest biologists were repeatedly excluded from entire pre-project NSO survey units in 2013 due to evidence of trespass outdoor marijuana cultivation (D. Hansen pers. obs.). Similarly, Keane et al. (2011) stated that their California spotted owl (*S. o. occidentalis*) survey crew was excluded from large portions of a study area in the Sierra Nevada in 2010 due to extensive illegal marijuana cultivation operations. Gabriel et al. (2013; Gabriel cite) estimated that safety concerns due to trespass outdoor marijuana cultivation resulted in exclusion of researchers from 15-25% of one fisher study area in California and a projected additional cost of $500,000-750,000 for the life of the combined budgets of two of California's fisher research projects. Wildlife surveyors who were able to work alone in the past must now frequently work in pairs for safety reasons, reducing survey efficiency and increasing project costs (Gabriel et al. 2013, D. Hansen pers. obs.). Exclusion from study areas can also compromise the ability of researchers to properly design and complete research investigating important conservation issues, such as effects of pesticides on fishers (Gabriel et al. 2013) and wildfires on spotted owls (Keane et al. 2011).

Figure 4: Armed marijuana growers posing in front of a poached deer (from Gabriel et al. 2013).

Magnitude and Location of Threat

Estimates of marijuana production and value are generally based on either federal marijuana seizure data (e.g., assuming that seizures represent 10 or 15% of the total amount produced) or marijuana consumption surveys and estimates of plant yields and market value (Gettman 2006) (reviewed in PBS 2014). Estimates from both of these methods indicate that California is, by far, the primary marijuana-producing state in the U.S. and that most of this production is from outdoor cultivation (NDIC 2011, Gettman 2006). Gettman (2006) estimated that, in 2006 alone, California produced an estimated 8.6 million pounds of marijuana with a value of more than 13.8 billion dollars. An estimated 89% of this product and value was from outdoor cultivation. If correct, marijuana is the largest cash crop in California (Gettman 2006), which is remarkable given that California is the most productive agricultural state in the U.S. (USDA 2014).

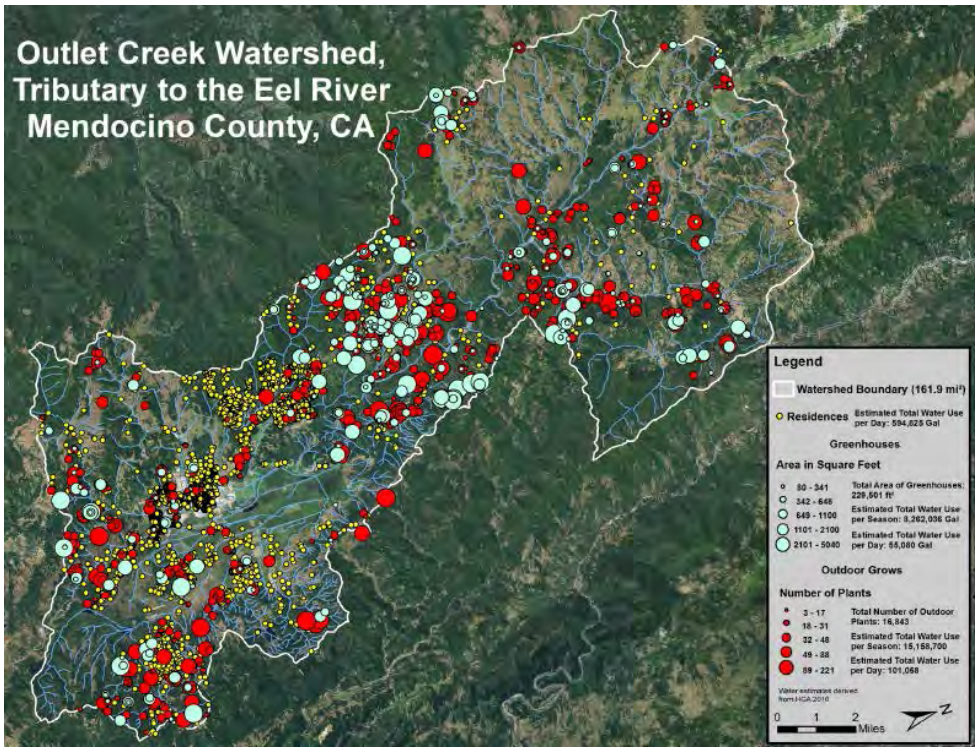
Outdoor marijuana cultivation in California has increased dramatically in recent years, including on both public and private lands (Bauer cite, NDIC 2011). This rapid growth was due to increased demand for domestically grown marijuana; possibly driven by state legalization of marijuana for medical use, changes in public perception of health or legal risk associated with marijuana use, or reduced imports from other countries due to tighter border control measures implemented after 9/11 (NDIC 2007, 2011, SacBee 2012). However, rapid growth of marijuana production in California apparently outstripped consumer demand in the last few years, particularly following federal crackdowns on medical marijuana dispensaries in the state (SacBee 2012). Desire among growers to maintain high profits in the face of increasing supply and decreasing prices could be a factor driving recent increases in the size and intensity (e.g., use of pesticides, fertilizer, and water) of many outdoor marijuana cultivation operations (cite, Bauer cite).

The number of outdoor marijuana plants eradicated in the U.S. increased by 250% between 2005 and 2010 (NDIC 2011). Federal eradication data suggest that trespass outdoor marijuana cultivation is increasing particularly rapidly on National Forests in California (NDIC 2011). Between 2005 and 2013, over 16 million marijuana plants were eradicated at approximately 3,356 sites on National Forests in California (Boehm 2014). Federal agencies have largely attributed increased numbers of trespass outdoor marijuana cultivation sites to expansion of operations by international drug trafficking organizations (e.g., Mexican drug cartels) into remote mountainous areas (particularly in northern California) in order to avoid detection by law enforcement personnel (NDIC 2007, Boehm 2014). However, the degree to which increases in amounts of eradicated or seized marijuana reflect increased production versus increased drug

enforcement effort is unclear, as is the scale of international drug trafficking organizations' role in outdoor marijuana cultivation in California (cite, NDIC 2010).

Outdoor marijuana production in California is also growing rapidly on private lands (NDIC 2007, Bauer cite). Personnel with the California Department of Fish and Wildlife (Bauer cite) used aerial imagery in Google Earth™ to estimate changes in the number and sizes of marijuana cultivation operations in four watersheds in Humboldt and Mendocino Counties during 2009-2012. In 2012 they identified nearly 1,300 outdoor grow sites and more than 1,200 greenhouses likely used for marijuana cultivation in these watersheds (Table 1; e.g., Figure 5). The number and size of marijuana cultivation operations identified increased in all four watersheds by 68-104% between 2009 and 2012. The total number of greenhouses and the number of greenhouses greater than 1,000 ft^2 increased by 69% and 87%, respectively. Continued use of aerial imagery and flyovers will shed greater light on the number, size, and location of outdoor marijuana operations on both public and private lands. For example, the California Department of Fish and Wildlife (2012) noted that law enforcement officers spotted more than 200 new marijuana grow operations in the Mattole Watershed in Humboldt County during a single flyover. *Describe proportion of marijuana cultivation sites identified by Bauer which were located on properties owned by private citizens vs. trespass grows on federal and/or timber co. lands. Incorporate other law enforcement information (e.g., any additional FOIA information from USFS law enforcement).*

Figure 5: Locations and sizes of marijuana cultivation operations identified in the Outlet Creek Watershed in Mendocino County using aerial imagery in Google Earth™ (from Bauer cite).



Summary and Management Implications

There is currently little direct information regarding potential impacts of illegal outdoor marijuana cultivation on NSOs. However, widespread application of ARs and other toxicants at outdoor grow sites are negatively impacting fishers, which have overlapping home ranges and diets with NSOs in northwestern California (Gabriel et al. 2012, 2013, Thompson et al. 2014). There is also evidence of widespread exposure to toxicants among barred owls in Humboldt County, and an NSO from Mendocino County recently tested positive for ARs (Gabriel cite, Calforests 2014). Thus, it is likely that NSOs in California are widely exposed to toxicants

applied at illegal outdoor marijuana grow sites. ARs and other pesticides can directly kill owls and other raptors or increase their vulnerability to other sources of mortality such as predation, disease, parasites, hypothermia, or injury (reviewed above). Furthermore, illegal outdoor marijuana cultivation is apparently causing widespread environmental degradation through toxicant exposure in other animals, reduced streamflows, pollution, poorly planned logging and road construction, and wildlife poaching (Bauer cite, Gabriel et al. 2013). Safety concerns associated with the widespread presence of heavily armed marijuana growers may also be impacting conservation of spotted owls and other wildlife by reducing the efficiency and effectiveness of research and survey efforts (Keane et al. 2011, Gabriel et al. 2013, D. Hansen pers. obs.).

Increased funding and effort are needed for evaluation of effects of outdoor marijuana cultivation on NSOs, other wildlife, and ecosystems (cite). Greater funding and coordination are also needed for interdiction, clean-up, and restoration at illegal outdoor grow sites (cite). These efforts require a substantial, multi-agency law enforcement presence, experts capable of identifying and properly disposing of toxicants, personnel and equipment for removing large amounts of trash and other material, and natural resource specialists for rehabilitating or restoring sites (Gabriel et al. 2013, Boehm 2014). Even if marijuana is legalized in California, tremendous resources, effort, and coordination may still be needed to regulate the industry and to continue to locate, clean up, and restore abandoned or interdicted illegal grow sites. Only a small portion of interdicted outdoor grow sites in California have been cleaned up thus far and even less have been restored (cite). Many of these sites may continue to pose an environmental threat long after they are abandoned by growers (Gabriel et al. 2013). For example, trespass

outdoor growers often cache ARs and other toxicants in water-proof containers, which bears can eventually find and open, allowing further poisoning and exposure of wildlife even after growing operations have ceased at the site (cite, HSVTC 2012).

Comment [MWG17]: They don't really cache these toxicants, the toxicants are manufactured in child proof or waterproof/resistance containers that leave the material still viable for years. This is citable by percom from many folks, including myself and craig.

The Environmental Protection Agency (EPA) and California Department of Pesticide Regulation (CDPR) have recently taken steps to reduce threats from SGARs to wildlife, children, and pets. Since 2011, EPA regulations have prohibited the sale of SGARs to the general consumer. Under EPA regulations, SGARs may only be purchased at agricultural stores, in bait station form rather than as loose pellets, and in relatively small quantities (Bradbury 2008). Most AR manufacturers quickly complied with these regulations and brought replacement products to market containing FGARs or neurotoxins, rather than SGARs (CDPR 2013, Murray 2013). However, the EPA only recently reached an agreement with Reckitt Benckiser to end distribution of their popular d-Con® products containing SGARs and sold without a protective bait station by March 31, 2015 (EPA 2014). On July 1, 2014, the CDPR further limited access to SGAR products in California by classifying them as restricted materials (California Department of Consumer Affairs 2014). In California, products containing SGARs can only be purchased from CDPR-licensed pest control dealers by certified applicators (California Department of Consumer Affairs 2014). Increased restrictions on public access to products containing SGARs should help to reduce exposure of wildlife to these compounds. However, considering that banned pesticides are commonly found at trespass outdoor marijuana cultivation sites (HSVTC 2012, Thompson et al. 2014) growers will likely continue to widely apply SGARs in forests occupied by NSOs, fishers, and other sensitive wildlife.

Comment [MWG18]: Cite Gabriel 2013 for banned pesiticides too. Showing a 3 years of publications documenting these toxicants.

Comment [MWG19]: Or other new emerging toxicants, or massive amounts of legal , high poundage FGARs.

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Outdoor Marijuana Cultivation

Introduction

Although marijuana is perhaps the largest cash crop in California (Gettman 2006), its cultivation is largely unregulated and little is known about its environmental effects. Recent research has indicated that outdoor marijuana cultivation is currently having widespread and profound environmental impacts in California (Bauer cite, Gabriel et al. 2012, 2013, Thompson et al. 2014). Negative impacts of outdoor marijuana cultivation include wildlife deaths caused by pesticide exposure and poaching; habitat degradation caused by logging, road construction, pollution, and water diversion; and heightened safety concerns for research and resource personnel (Bauer cite, Gabriel et al. 2012, 2013, Thompson et al. 2014). The specific effects of outdoor marijuana cultivation on northern spotted owls (*Strix occidentalis caurina*; NSOs) are unknown. Recent findings of widespread pesticide exposure among fishers (*Martes pennanti*) and barred owls (*Strix varia*) in northwestern California suggest that NSOs in the state are likewise exposed and could be negatively affected at both territory and population levels (Gabriel cite, Gabriel et al. 2012; reviewed below). NSOs could also be directly affected by environmental degradation from outdoor marijuana cultivation, such as through habitat modification or suppression of rodent prey populations, or indirectly affected through ecological changes caused by reduced streamflows or pollution. Safety concerns associated with illegal marijuana cultivation may also be impacting NSOs and other wildlife through reduced research and survey efficiency and effort (Gabriel et al. 2013).

Pesticides

Pesticide application is usually intended to suppress populations of rodents, insects, mollusks, and other agricultural and urban pests, but can have inadvertent negative impacts on humans, pets, and other non-target animals (Erickson and Urban 2004, Albert et al. 2010, Mnif et al. 2011, Gabriel et al. 2012). Widespread secondary exposure to pesticides has been reported for raptors, carnivores, and other wildlife that consume poisoned rodents around farms and human dwellings (Albert et al. 2010, Murray 2013, Thompson et al. 2014). Researchers have generally assumed that pesticides pose little threat to wildlife outside of agricultural and urban areas (Gabriel et al. 2013). However, a recent publication reported that 79% of fishers tested in two study areas on federal and tribal forest lands in California had been exposed to anticoagulant rodenticides (ARs), including four that apparently died from lethal toxicosis (Gabriel et al. 2012; note: at least two more fishers in California died from AR poisoning following publication of this study: Gabriel et al. 2013). Most fishers in the study had been exposed to multiple AR compounds (range = 1-4, mean = 1.6). These findings not only raised concern for the West Coast fisher population, which the U.S. Fish and Wildlife Service recently proposed to list as threatened under the federal Endangered Species Act, but for the NSO, which has an overlapping distribution and diet with the fisher (Gabriel et al. 2013, Calforests 2014, USFWS 2014). Subsequently, ARs have been detected in a dead NSO recovered in Mendocino County (Calforests 2014) and xx of xx (xx%) barred owls tested for exposure in Humboldt County (Gabriel cite). Although barred owls are being tested as a proxy for NSOs (Gabriel cite), NSOs may be more widely exposed to ARs given their greater dietary specialization on rodents (see USFWS 2013). Strong circumstantial evidence implicates pervasive illegal outdoor marijuana

cultivation as the primary source of pesticide exposure for forest predators in California (Gabriel et al. 2012, 2013, Thompson et al. 2014).

ARs detected in forest predators in northern California include brodifacoum, bromadiolone, difethialone, chlorophacinone, diphacinone, warfarin, and coumachlor (Gabriel cite, Gabriel et al. 2012). Brodifacoum, bromadiolone, difethialone are classified as second-generation anticoagulant rodenticides (SGARs). SGARs were introduced in the 1970s due to widespread development of resistance among rodents to first-generation anticoagulant rodenticides (FGARs), such as warfarin, chlorophacinone, and diphacinone (Buckle et al. 1994). SGARs are more acutely toxic than FGARs and generally require only a single dose to kill rodents (Erickson and Urban 2004). However, rodents usually survive 5-10 days after consuming a lethal dose, during which time they may continue to consume additional rodenticide and remain available to predators (Cox and Smith 1992, Erickson and Urban 2004). SGARs are more persistent in animal tissues than FGARs and insecticides, which are more rapidly metabolized and excreted (Erickson and Urban 2004). Thus, exposure to FGARs and other non-SGAR pesticides is more difficult to detect than for SGARs and exposure to them could be underestimated (Albert et al. 2010, Thompson et al. 2014). Pesticides are often applied along with large quantities of fertilizer at the base of marijuana plants grown outdoors, suggesting that marijuana plants may be taking up pesticidal compounds from the soil (Thompson et al. 2014; Figure 1). ~~If this occurs, NSOs and other wildlife could be exposed to pesticides through consumption of insects and rodents that eat marijuana plants, as well as by eating rodents that ingest AR bait (cite).~~

Comment [UFS1]: Can't cite me here, I did not talk about uptake in the paper. As far as I know, this is strongly suspected but hasn't been proven.

Large quantities of ARs, particularly SGARs, are often spread across large areas in and around illegal outdoor marijuana grow sites (Gabriel et al. 2012, Thompson et al. 2014; Figure 1). Gabriel et al. (2012) noted that thousands of pounds of pesticides were found at illegal outdoor marijuana grow sites in California in 2008 and that 150 pounds of pesticide were found during a single three-week eradication operation on the Mendocino National Forest in 2011. Three sites raided in Humboldt County in 2013 contained a total of at least 17 pounds of SGAR bait, which researchers estimated was sufficient to kill 2,753 woodrats, 14 fishers, or five spotted owls (Humboldt Sentinel August 2, 2013). Other pesticides, such as organochlorine, organophosphate, and carbamate insecticides, some of which are banned in the U.S., are also frequently found at illegal outdoor marijuana grow sites (~~cite~~HSVTC 1012, Thompson et al. 2014).

Figure 1: (A) Rodenticide and other pesticides found at a trespass outdoor marijuana grow site in Humboldt County (photo: Humboldt County Sheriff's Office) and (B) rodenticide bait and dry fertilizer strewn together below approximately 2,000 marijuana plants at a trespass outdoor grow site in Humboldt County (from Gabriel et al. 2012).

ARs are vitamin K antagonists, which cause impairment of the blood's ability to clot (Murray 2013). A lethal dose of AR causes animals to die from hemorrhage (Erickson and Urban 2004). Animals may also exhibit weakness prior to death or with a sublethal dose (Erickson and Urban 2004). Rodents exposed to ARs show altered behavior, such as spending more time in the open, freezing rather than bolting when threatened, and staggering (Cox and Smith 1992). These behaviors may increase predation risk for affected rodents and the opportunity for secondary exposure of predators to ARs (Cox and Smith 1992). Owls and other raptors with sublethal secondary exposure to ARs may often have reduced blood-clotting activity and can die from

minor wounds such as those commonly inflicted by prey (Erickson and Urban 2004, Murray 2013, Thompson et al. 2014). It is also worth noting that invertebrates respond differently and are not negatively impacted by the uptake of vitamin K antagonists. They are therefore capable of accumulating both FGAR and SGAR compounds either through direct consumption or potentially or the consumption of vegetation where uptake of pesticidal compounds has occurred. NSOs and other wildlife may therefore be exposed to pesticides through consumption of live or dead insects in the vicinity of grow sites.

Non-AR pesticides have a variety of physiological effects, such as disrupting endocrine function or damaging the central nervous system (Grue et al. 1997, Mnif et al. 2011). Chronic or sublethal exposure to carbamate or organophosphate pesticides has been shown to reduce immune response, cause neurological disorders, reduce thermoregulatory control, and impair anti-predator behavior in wildlife (Grue et al. 1997; reviewed in Thompson et al. 2014). Pesticides can also have additive or synergistic effects on animals (Larsen et al. 2003 cited in Mnif et al. 2011). This is a source of additional concern for NSOs and other forest predators active near outdoor marijuana cultivation sites, where multiple types of pesticide are often present (HSVTC 2012, Thompson et al. 2014). Mortalities associated with exposure to pesticides are likely underestimated because carcasses are often predated or scavenged before biological samples can be obtained and because sublethal exposure can predispose wildlife to death from other causes (cite, Albert et al. 2010).

There is no information available concerning population-level impacts of secondary pesticide exposure for NSOs in California. As reviewed above, secondary exposure to pesticides can kill

raptors and other wildlife both through lethal toxicosis and by increasing the risk of mortality due to other factors such as predation, hypothermia, disease, parasites, or injury. NSO population rates are particularly sensitive to changes in adult survival (Noon and Biles 1990) so it is possible that direct and indirect mortalities associated with pesticide exposure could contribute to population declines (Sibley et al. 2000~~cite~~, Thompson et al. 2014). Pesticide exposure could also negatively impact NSO reproduction. Gabriel et al. (2012) noted that fisher mortalities caused by AR poisoning occurred between mid-April and mid-May. The timing of these deaths coincided with the planting phase of outdoor marijuana cultivation, when seedlings are most vulnerable to rodent pests and AR use is likely highest (Gabriel et al. 2012). This time of year is also when NSOs incubate and brood young (cite). Reduced parental care during this phase, for example due to compromised behavior or death of one or both parents, could result in death of offspring due to chilling, undernourishment, or predation (Grue et al. 1997~~cite~~). NSO populations could also be negatively impacted by pesticide suppression of prey populations or changes in community ecology caused by reductions of insects, small mammals, carnivores, raptors, amphibians, and aquatic animals (Relyea and Diecks 2008~~cite~~).

Other Environmental Effects

Activities related to outdoor marijuana cultivation can have a variety of environmental impacts beyond exposure of wildlife to pesticides, including negative effects of illegal and poorly planned water diversion, logging, and road construction; pollution; poaching; and ignition of wildfires (reviewed below). Negative impacts occur on both public and private lands (cite, Bauer cite, Gabriel et al. 2013). The potential environmental impacts of marijuana cultivation

could vary considerably, depending on the operation's location, scale, and practices. We are unaware of any information regarding effects of ecological degradation from marijuana cultivation on NSOs. Negative effects on NSOs are possible given the subspecies' sensitivity to habitat modification (cite) and close association with riparian areas (cite), where the impacts of marijuana cultivation are often concentrated. Furthermore, safety concerns associated with marijuana cultivation can substantially impact the ability of land managers to effectively survey and manage spotted owls and other sensitive wildlife (Keane et al. 2011, Gabriel et al. 2013, D. Hansen pers. obs.).

Personnel with the California Department of Fish and Wildlife (Bauer cite) recently estimated hydrologic impacts of marijuana cultivation in northwestern California using high-resolution aerial imagery in Google Earth™ (e.g., Figure 2) and marijuana industry estimates of marijuana plant water requirements. Using these methods, they estimated that more than 82,000 marijuana plants were cultivated in 2012 in just four watersheds in Humboldt and Mendocino Counties (Table 1). Based on estimated numbers of marijuana plants and assumed water usage of 6 gallons per day per plant, they calculated that marijuana cultivation uses approximately 29% and 21% of the water that flows in the Redwood Creek and Salmon Creek watersheds per day during periods of minimum streamflow (Table 2). Although based on several assumptions (marijuana cultivation water sources and usage, complete visibility of cultivation sites in aerial imagery, complete usage of greenhouses), these estimates raised considerable concern about potential negative impacts of marijuana cultivation on watershed health and aquatic animals (cite). This concern is currently heightened given California's ongoing severe drought (cite). NSOs often exhibit a preference for nesting, roosting, and foraging in and near riparian areas (cite). Thus, it

is plausible that ecological changes caused by widespread water diversion for marijuana cultivation have negative indirect effects on NSOs.

Figure 2: Outdoor (A) and greenhouse (B) marijuana cultivation sites identified with Google Earth™ (from Bauer cite). *Add Google Earth image(s) of trespass grow site(s).*

Table 1: Estimated numbers of outdoor marijuana cultivation sites, outdoor marijuana plants, marijuana greenhouses, marijuana plants in greenhouses, and total number of marijuana plants in four watersheds in Humboldt and Mendocino Counties (from Bauer cite).

	Redwood Creek (67.3 km²)	Salmon Creek (95.6 km²)	Redwood Creek North (730 km²)	Outlet Creek (419 km²)
Total outdoor cultivation sites	231	306	120	633
Total outdoor plants	10,475	11,697	5,984	16,843
Plant : Land area $\left(\frac{1}{km^2}\right)$	173.7	122.4	8.2	40.2
Total Greenhouses	324	302	273	320
Estimated Total Plants in Greenhouses	8,053	8,851	11,029	9,180
Greenhouse : Land Area $\left(\frac{1}{km^2}\right)$	4.8	3.1	0.4	0.8
Total Plants per Watershed*	**18,528**	**20,548**	**17,013**	**26,023**

**Field data indicate these totals may be underestimates.*

Table 2: Estimated daily water use for marijuana cultivation per day and during an entire growing season compared with minimum streamflow in four watersheds in Humboldt and Mendocino Counties (from Bauer cite).

	Redwood Creek	Salmon Creek	Redwood Creek North	Outlet Creek
Daily Water Use (gpd)	111,167	123,289	102,078	156,138
Minimum Streamflow (gpd)	387,763	581,645	---	---
Percent Use	**28.7%**	**21.2%**	---	---
Water Use per 150 Day Season (gal)	16,675,308	18,493,344	15,311,700	23,420,700

Marijuana growers on both public and private lands often illegally clearcut vegetation in order to create growing space for marijuana plants and room for artificial ponds and other structures (cite, Gabriel et al. 2013; Figure 3). Illegal cutting, along with creation of roads to access grow sites, can increase sedimentation in streams and creeks and thereby degrade habitat quality for aquatic and amphibious animals (cite). The effect of illegal vegetation clearing on NSOs is unknown. Given the close association of both marijuana cultivation and NSOs with riparian areas and surrounding uplands, it is plausible that widespread marijuana cultivation results in habitat loss or fragmentation for NSOs.

Figure 3: Area cleared for outdoor marijuana cultivation (from cite). *Find and add photo from trespass grow site adjacent to creek.*

Widespread outdoor marijuana cultivation can further damage watershed health by polluting water and soils. In addition to pesticides, tremendous quantities of fertilizer are often applied at marijuana grow sites (~~cite~~HSVTC 2012, Thompson et al. 2014). Fertilizers, along with low flows caused by drought conditions and water diversion, can contribute to algae blooms and reduced oxygen levels in creeks and rivers (cite). Other pollution, including human waste, trash, and spilled diesel fuel from generators, is also frequently observed in and around streams at raided outdoor marijuana grow sites (~~cite~~HSVTC 2012, C. Thompson pers com). Like water diversion and increased stream sedimentation, pollution from outdoor marijuana cultivation is primarily a source of concern for aquatic and amphibious animals but could have indirect ecological effects on NSOs and other wildlife.

Multiple recent wildfires in California have been attributed to marijuana growers. For example, in 2014, a marijuana grower was indicted on charges of starting the Nicolls Fire that burned nearly 1,700 acres in the Sequoia National Forest (SacBee 2014b). This grower allegedly set

multiple fires in an attempt to avoid capture by other growers that he claimed were trying to kill him. Another marijuana grower was recently arrested for igniting the 2014 Bully Fire that burned nearly 13,000 acres in Shasta County (SacBee 2014a). This fire was apparently started when the grower's rental truck ignited dry grass when driven off-road in order to deliver soil amendments to a grow site. In 2009, a marijuana grower's camp stove ignited the 90,000-acre La Brea Fire in the Los Padres National Forest in southern California (inciweb). Large wildfires (e.g., thousands of acres) can burn through multiple NSO territories and can negatively affect NSOs in a variety of ways, particularly when they burn large areas at moderate to high severity (reviewed in *Threats: Wildfires*).

Illegal marijuana growers are often heavily armed in order to protect their crops and for poaching wildlife for food or to prevent damage to plants, equipment, or food caches (Boehm cite, Gabriel et al. 2013; Figure 4). Many biologists and other field personnel working in California's forests have been interrogated, pursued, or shot at by marijuana growers (cite, Gabriel et al. 2013, D. Hansen pers. obs.). Safety concerns associated with widespread illegal marijuana cultivation can substantially curtail the ability of researchers and land managers to effectively locate, study, and manage spotted owls and other wildlife. For example, Six Rivers National Forest biologists were repeatedly excluded from entire pre-project NSO survey units in 2013 due to evidence of trespass outdoor marijuana cultivation (D. Hansen pers. obs.). Similarly, Keane et al. (2011) stated that their California spotted owl (*S. o. occidentalis*) survey crew was excluded from large portions of a study area in the Sierra Nevada in 2010 due to extensive illegal marijuana cultivation operations. Gabriel et al. (2013; Gabriel cite) estimated that safety concerns due to trespass outdoor marijuana cultivation resulted in exclusion of researchers from 15-25% of one

fisher study area in California and a projected additional cost of $500,000-750,000 for the life of the combined budgets of two of California's fisher research projects. Wildlife surveyors who were able to work alone in the past must now frequently work in pairs for safety reasons, reducing survey efficiency and increasing project costs (Gabriel et al. 2013, D. Hansen pers. obs.). Exclusion from study areas can also compromise the ability of researchers to properly design and complete research investigating important conservation issues, such as effects of pesticides on fishers (Gabriel et al. 2013) and wildfires on spotted owls (Keane et al. 2011).

Figure 4: Armed marijuana growers posing in front of a poached deer (from Gabriel et al. 2013).

Magnitude and Location of Threat

Estimates of marijuana production and value are generally based on either federal marijuana seizure data (e.g., assuming that seizures represent 10% of the total amount produced) or marijuana consumption surveys and estimates of plant yields and market value (Gettman 2006) (reviewed in PBS 2014). Estimates from both of these methods indicate that California is, by

far, the primary marijuana-producing state in the U.S. and that most of this production is from outdoor cultivation (cite, NDIC 2011, Gettman 2006). Gettman (2006) estimated that, in 2006 alone, California produced an estimated 8.6 million pounds of marijuana with a value of more than 13.8 billion dollars. An estimated 89% of this product and value was from outdoor cultivation. If correct, marijuana is the largest cash crop in California (Gettman 2006), which is remarkable given that California is the most productive agricultural state in the U.S. (USDA 2014).

Outdoor marijuana cultivation in California has increased dramatically in recent years, including on both public and private lands (cite, Bauer cite, NDIC 2011). This rapid growth was due to increased demand for domestically grown marijuana; possibly driven by state legalization of marijuana for medical use, changes in public perception of health or legal risk associated marijuana use, or reduced imports from other countries due to tighter border control measures implemented after 9/11 (cite, NDIC 2007, 2011, SacBee 2012). However, rapid growth of marijuana production in California apparently outstripped consumer demand in the last few years, particularly following federal crackdowns on medical marijuana dispensaries in the state (SacBee 2012). Desire among growers to maintain high profits in the face of increasing supply and decreasing prices could be a factor driving recent increases in the size and intensity (e.g., use of pesticides, fertilizer, and water) of many outdoor marijuana cultivation operations (cite, Bauer cite).

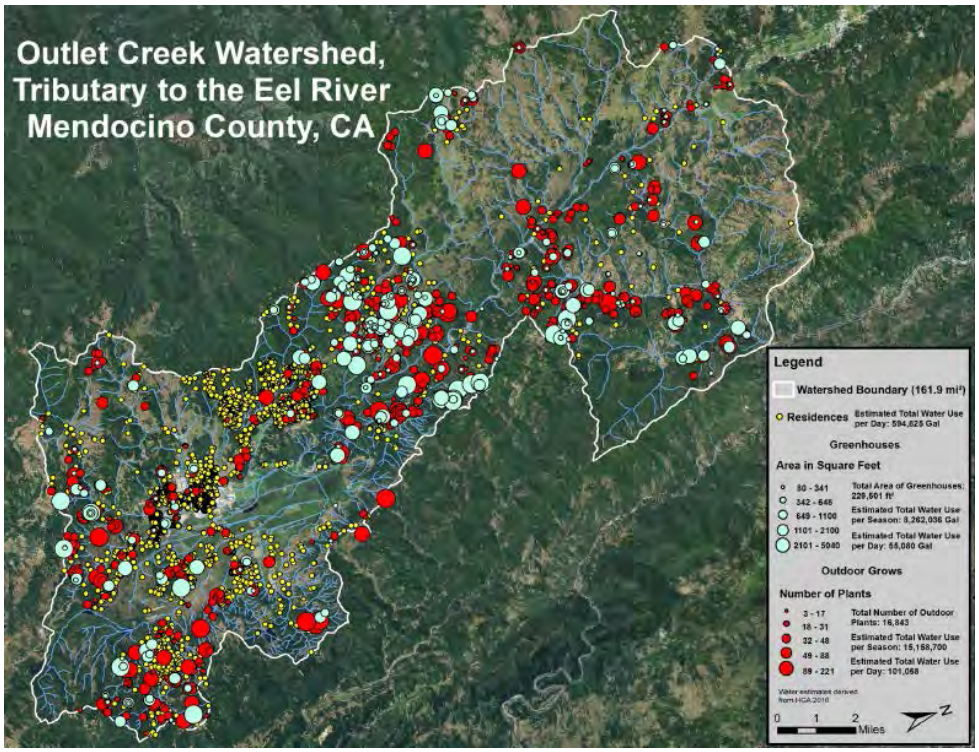
The number of outdoor marijuana plants eradicated in the U.S. increased by 250% between 2005 and 2010 (NDIC 2011). Federal eradication data suggest that trespass outdoor marijuana

cultivation is increasing particularly rapidly on National Forests in California (NDIC 2011). Between 2005 and 2013, over 16 million marijuana plants were eradicated at approximately 3,356 sites on National Forests in California (Boehm 2014). Federal agencies have largely attributed increased numbers of trespass outdoor marijuana cultivation sites to expansion of operations by international drug trafficking organizations (e.g., Mexican drug cartels) into remote mountainous areas (particularly in northern California) in order to avoid detection by law enforcement (NDIC 2007, Boehm cite). However, the degree to which increases in amounts of eradicated or seized marijuana reflect increased production versus increased drug enforcement effort is unclear, as is the scale of international drug trafficking organizations' role in outdoor marijuana cultivation in California (cite, NDIC 2010).

Outdoor marijuana production in California is also growing rapidly on private lands (NDIC 2007, Bauer cite). Personnel with the California Department of Fish and Wildlife (Bauer cite) used aerial imagery in Google Earth™ to estimate changes in the number and sizes of marijuana cultivation operations in four watersheds in Humboldt and Mendocino Counties during 2009-2012. In 2012 they identified nearly 1,300 outdoor grow sites and more than 1,200 greenhouses likely used for marijuana cultivation in these watersheds (Table 1; e.g., Figure 5). The number and size of marijuana cultivation operations identified increased in all four watersheds by 68-104% between 2009 and 2012. The total number of greenhouses and the number of greenhouses greater than 1,000 ft^2 increased by 69% and 87%, respectively. Continued use of aerial imagery and flyovers will shed greater light on the number, size, and location of outdoor marijuana operations on both public and private lands. For example, the California Department of Fish and Wildlife (2012) noted that law enforcement officers spotted more than 200 new marijuana grow

operations in the Mattole Watershed in Humboldt County during a single flyover. *Describe proportion of marijuana cultivation sites identified by Bauer which were located on properties owned by private citizens vs. trespass grows on federal and/or timber co. lands. Incorporate other law enforcement information (e.g., FOIA information from USFS law enforcement).*

Figure 5: Locations and sizes of marijuana cultivation operations identified in the Outlet Creek Watershed in Mendocino County using aerial imagery in Google Earth™ (from Bauer cite).



Summary and Management Implications

There is currently little direct information regarding potential impacts of illegal outdoor marijuana cultivation on NSOs. However, widespread application of ARs and other toxicants at

outdoor grow sites are negatively impacting fishers, which have overlapping home ranges and diets with NSOs in northwestern California (Gabriel et al. 2012, 2013, Thompson et al. 2014). There is also evidence of widespread exposure to toxicants among barred owls in Humboldt County, and an NSO from Mendocino County recently tested positive for ARs (Gabriel cite, Calforests 2014). Thus, it is likely that NSOs in California are widely exposed to toxicants applied at illegal outdoor marijuana grow sites. ARs and other pesticides can directly kill owls and other raptors or increase their vulnerability to other sources of mortality such as predation, disease, parasites, hypothermia, or injury (reviewed above). Furthermore, illegal outdoor marijuana cultivation is apparently causing widespread environmental degradation through toxicant exposure in other animals, reduced streamflows, pollution, poorly planned logging and road construction, and wildlife poaching (cite, Bauer cite, Gabriel et al. 2013). Safety concerns associated with the widespread presence of heavily armed marijuana growers may also be impacting conservation of spotted owls and other wildlife by reducing the efficiency and effectiveness of research and survey efforts (Keane et al. 2011, Gabriel et al. 2013, D. Hansen pers. obs.).

Increased funding and effort are needed for evaluation of effects of outdoor marijuana cultivation on NSOs, other wildlife, and ecosystems (cite). Greater funding and coordination are also needed for interdiction, clean-up, and restoration at illegal outdoor grow sites (cite). These efforts require a substantial, multi-agency law enforcement presence, experts capable of identifying and properly disposing of toxicants, personnel and equipment for removing large amounts of trash and other material, and natural resource specialists for rehabilitating or restoring sites (Gabriel et al. 2013, Boehm 2014). Even if marijuana is legalized in California,

tremendous resources, effort, and coordination may still be needed to regulate the industry and to continue to locate, clean up, and restore abandoned or interdicted illegal grow sites. Only a small portion of interdicted outdoor grow sites in California have been cleaned up thus far and even less have been restored (cite). Many of these sites may continue to pose an environmental threat long after they are abandoned by growers (Gabriel et al. 2013). For example, trespass outdoor growers often cache ARs and other toxicants in water-proof containers, which bears can eventually find and open, allowing further poisoning and exposure of wildlife even after growing operations have ceased at the site (cite).

The Environmental Protection Agency (EPA) and California Department of Pesticide Regulation (CDPR) have recently taken important steps to reduce threats from SGARs to wildlife, children, and pets. Since 2011, EPA regulations have prohibited the sale of SGARs to the general consumer. Under EPA regulations, SGARs may only be purchased at agricultural stores, in bait station form rather than as loose pellets, and in relatively small quantities (Bradbury 2008). Most AR manufacturers quickly complied with these regulations and brought replacement products to market containing FGARs or neurotoxins, rather than SGARs (CDPR 2013, Murray 2013). However, the EPA only recently reached an agreement with Reckitt Benckiser to end distribution of their popular d-Con® products containing SGARs and sold without a protective bait station by March 31, 2015 (EPA 2014). On July 1, 2014, the CDPR further limited access to SGAR products in California by classifying them as restricted materials (California Department of Consumer Affairs 2014). In California, products containing SGARs can only be purchased from CDPR-licensed pest control dealers by certified applicators (California Department of Consumer Affairs 2014). Increased restrictions on public access to products containing SGARs

should help to reduce exposure of wildlife to these compounds. However, considering that banned pesticides are commonly found at trespass outdoor marijuana cultivation sites (HSVTC 2012~~cite~~, Thompson et al. 2014), growers will likely continue to apply SGARs in forests occupied by NSOs, fishers, and other sensitive wildlife.

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Ch. 1: Status and Trends in California

Introduction

Several lines of evidence are available for evaluating the northern spotted owl's (*Strix occidentalis caurina*; NSO) status and trends in California. These include changes in the subspecies' geographic range and distribution, density and abundance, occupancy and demographic rates, meta-population dynamics, and genetics. The most reliable information available for examining the NSO's status and trends is provided by long-term demographic studies. Data from these studies are periodically analyzed together in meta-analyses for describing larger demographic patterns within ecoregions and states. A new demographic meta-analysis is expected to be released in mid-2015. This document will provide the best available information for determining the NSO's current status and trends. However, only a small portion of the NSO's range in California occurs within demographic study areas and those study areas all occur in relatively productive forests in the northwestern part of the state. It is therefore important to consider other sources of information, such as data collected for monitoring NSOs in National Parks and on industrial timber company lands located in different regions of northern California. The NSO's status and trends likely vary among regions, forest types, and ownerships and could be influenced by a host of factors, such as differences in forest ecology, management history, and stressors such as competition with invasive barred owls (*Strix varia*). It is also important to remember that available sources of information for evaluating the NSO's status and trends in California vary substantially in terms of their purpose and scientific rigor.

Range

The current range of the NSO includes southwestern British Columbia and the Cascade Mountains, coastal ranges, and intervening forests of Washington, Oregon, and California (USFWS 2011a). In California, the NSO's range extends from the Oregon border through the Northern Coast Ranges to Marin County, across the Klamath Mountains, and down the southern Cascades to the vicinity of the Pit River, where it contacts the range of the California spotted owl (*S. o. occidentalis*) (Figure 1.1).

The precise historical range of the NSO is unknown. Thus, despite substantial loss, degradation, and fragmentation of NSO habitat (see Chapters 2 and 3 of this volume), there is no evidence that the subspecies' range has contracted since Euro-American settlement (Thomas et al. 1990). However, British Columbia's NSO population has declined to very low numbers and is highly vulnerable to extirpation (Chutter et al. 2004). NSO populations in the Cascades and Olympic Peninsula of Washington and the Northern Coast Range of Oregon are also rapidly declining and may become vulnerable to extirpation (Forsman et al. 2011; see *Demography*, below). Loss of NSO populations could cause substantial contraction of the subspecies' range. For example, extirpation of NSOs from British Columbia alone would reduce the subspecies' range by approximately 8% (Cooper 2006).

Comment [LVD1]: Yes, and we also can't rule out that there may have been some localized expansions of the species range. Historically, prairies were much more extensive in coastal CA (see Redwood National Parks prairie management plan). In fact, the coastal prairies that occur primarily on the ridges and south-facing slopes in the redwood region are part of the California coast grassland that was ranked as one of the most endangered ecosystems in America (Noss and Peters 1995 report on endangered ecosystems). Currently, there are NSO living in prairie intrusion forests throughout coastal CA that would not have been forest lands at all 100+ years ago.

Distribution

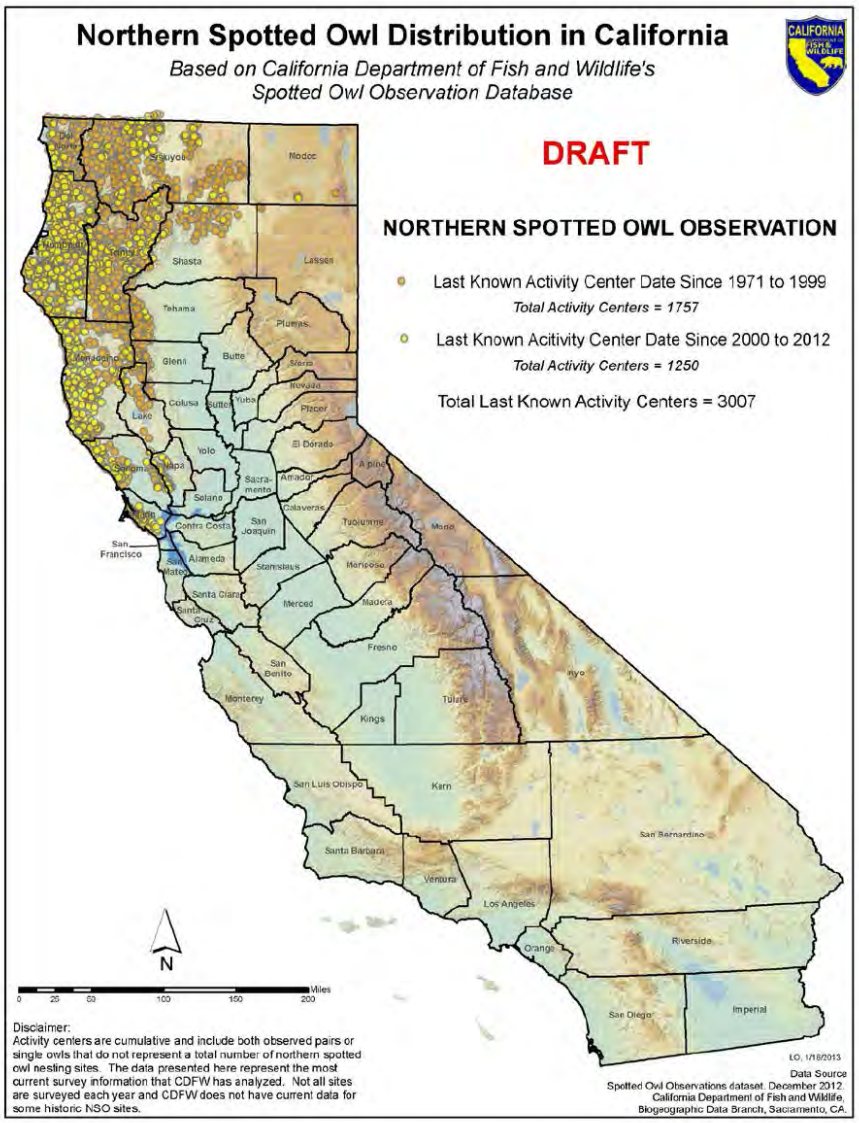
NSOs are thought to have been well distributed throughout most coniferous forests in the Pacific Northwest and northwestern California prior to Euro-American settlement (USFWS 2011a). The abundance and distribution of NSOs have likely declined due to removal of most (ca. 60-88%) old forest within its range (USFWS 1990; see Chapter 2 of this volume). For example, the Puget Trough in Washington and the Willamette Valley in Oregon no longer support NSOs due to land conversion and timber harvesting and very few NSOs remain in British Columbia (Thomas et al. 1990). The NSO's distribution has decreased in other areas of Washington and Oregon as well, due primarily to negative effects of timber harvesting, wildfires, and competition with barred owls (*Strix varia*) (Thomas et al. 1990).

Comment [LVD2]: I think the statement is accurate, but it doesn't seem like a 1990 publication would be the best source to support the conclusion. I would recommend using several publications including the status review (Courtney et al. 2004), Revised NSO recovery plan and possibly Forsman et al. 2011.

It is unknown if the NSO's distribution has changed in California. A difference is evident in the distribution of known historically (1971-1999) and recently (2000-2012) occupied activity centers (ACs) in the Eastern Klamath, Interior Northern Coast Ranges, and Southern Cascades regions of the state (Figure 1.1; see USFWS 2011a Appendix C for ecoregional boundaries generally followed in this synthesis). It is unclear from these data, however, whether the distribution of NSOs has in fact decreased in these areas or if the apparent decline in distribution is due to some other factor such as decreased survey effort or reporting of detections. It is also possible that this difference is due to the greater number of years included in the historical period than in the recent period (29 vs. 13 yrs). However, the two periods are similar in length relative to federal listing of the NSO (10 vs. 13 yrs) when survey effort presumably became more intensive and widespread. Some portions of the Klamath, Interior Northern Coast Ranges, and Southern Cascades have experienced widespread intensive timber harvesting or large wildfires, which could have reduced the NSO's distribution (see Chapters 2 and 3 of this volume). These forms of disturbance, along with competition with invasive barred owls, have likely contributed to declining occupancy by NSOs in some areas of California (see *Occupancy*, below). Nonetheless, the Klamath and Interior Northern Coast Ranges (but not the Southern Cascades) still appear to contain relatively large amounts of well connected suitable habitat and likely function as crucial population sources for NSOs (Schumaker et al. 2014; see *Source-Sink Dynamics*, below).

Comment [LVD3]: In balance, I think it should be mentioned that some level of disturbance in portion of the NSO range in CA contributes to increased habitat heterogeneity that actually improves habitat fitness for NSO (Franklin et al. 2000). This same phenomenon has been demonstrated by Olson et al. 2004, Hoopa and Green Diamond (10-year status review).

Figure 1.1: Distribution of northern spotted owl activity centers in the California Department of Fish and Wildlife's Spotted Owl Observation Database (from California Department of Fish and Wildlife 2013).



Density and Abundance

Species are rarely uniformly distributed across their range. Knowledge of variation in the density and abundance of NSOs is of potential conservation value because it can help identify areas where limited conservation resources should be focused. For example, while declines in low-abundance areas may be more likely to cause contraction of a species' range or distribution (see *Range* and *Distribution*, above), declines in high-abundance areas may disproportionately impact the species' probability of long-term persistence; particularly when high-abundance areas function as population sources (Pulliam 1988, Rodríguez 2002, Schumaker et al. 2014; see *Source-Sink Dynamics*, below).

Several studies have estimated either crude densities (owls or occupied territories per unit area) or ecological densities (owls per unit area of specified habitat class[es]) of NSOs in California (Blakesley et al. 2004; Table 1.1). These estimates are interesting in that they appear to reflect geographic variation in the ecology of NSOs (see below). However, they have limited utility for evaluating the NSO's status or trends in California. Available density estimates for the state are largely restricted to relatively mesic areas of northwestern California, which differ ecologically from drier interior forests (e.g., in terms of climate, forest productivity, and prey communities). Inferences from most density estimates are also limited because they are based on empirical counts of unmarked NSOs, which can bias estimates (Franklin et al. 1990, Diller and Thome 1999). Many of the currently available density and occupancy estimates for NSOs in California were provided by timber companies (Tables 1.1 and 1.2). While potentially useful for evaluating effects of management activities on timber company lands, these estimates do not describe population trends. Rigorous evaluation of NSO population trends require~~s~~ ~~adequate~~ long term statistically valid sampling designs ~~effort~~ from which with estimates of abundance or population lambda with confidence intervals can be repeatedly obtained within the same study area ~~year after year~~. In contrast, timber companies generally shift their NSO survey areas over time as timber harvest projects are completed in some areas and begun in others.

Based on limited information, both crude and ecological densities of NSOs appear to be substantially higher in northwestern California than in the Oregon Coast Ranges (Blakesley et al. 2004; Table 1.1). Lower densities in the Oregon Coast Ranges could be partially related to widespread intensive timber harvesting, which apparently contributed to a major decline in densities during the early 1990s (Thrailkill et al. 1998). Some areas of northwestern California have also experienced widespread intensive timber harvesting (see Chapter 2 of this volume) but its effect on NSOs might have differed from that in the Oregon Coast Ranges. In general, NSOs in California primarily subsist on dusky-footed woodrats (*Neotoma fuscipes*) (in terms of biomass contribution to diets). NSOs that primarily subsist on dusky-footed woodrat often have smaller home ranges, and apparently occur at higher densities, than those that primarily rely on smaller-bodied prey (Carey et al. 1992, Zabel et al. 1995). Furthermore, in contrast with other primary prey species, such as northern flying squirrels (*Glaucomys sabrinus*) and tree voles (*Arborimus* spp.), dusky-footed woodrats seem to respond positively, albeit temporarily, to some forms of intensive timber harvesting (see Chapter 2 of this volume).

Comment [LVD4]: Again this is where the issue of habitat heterogeneity (Franklin et al. 2000) should be mentioned in terms of the differential NSO response in NW CA versus areas where NSO feed primarily on flying squirrels. The mixture of older stands for roosting and nesting and young stands for woodrats provides the best habitat. As you noted, this woodrat response is only temporary, which makes the best NSO habitat highly dynamic in this region.

Densities of NSOs are also thought to be higher in northwestern California than in the state's interior (Calforests 2014). However, there are apparently only two density estimates currently

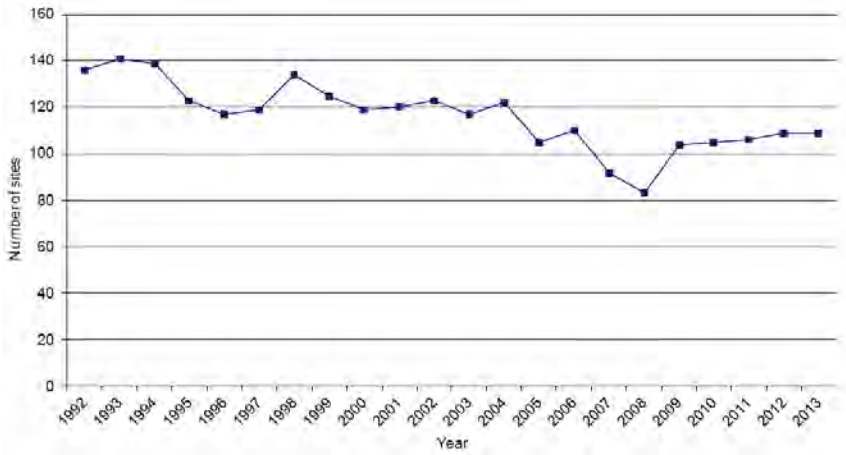
available for interior northern California and both of these were for crude densities of occupied territories, rather than for individual owls as estimated by most studies in northwestern California (Table 1.1). These crude territory densities are substantially lower than those found on two timber companies' lands in the Redwood Region (Table 1.1). NSO densities may be relatively low in the Southern Cascades of California due to the prevalence of drier, less productive forests, a history of widespread intensive harvesting, and effects of recent large wildfires (see Chapters 2 and 3 of this volume). Additional density estimates are needed for the Eastern Klamath of California. It is uncertain whether Sierra Pacific Industries' (2013) estimates are representative of densities across the region as a whole. Most NSO activity centers (ACs) included in Sierra Pacific's density estimates were located near the margins of the company's lands or on adjacent ownerships, rather than within the interiors of the company's holdings (see Maps 2-5 in Sierra Pacific Industries 2013, which are copyrighted and cannot be reproduced without permission). This pattern suggests that densities could be higher on neighboring lands such as the Shasta-Trinity National Forest.

Comment [LVD5]: This may also be a case where the adjacent FS lands provide the roosting and nesting habitat while SPI is producing the woodrats.

The California Forestry Association cited annual density estimates in timber company monitoring reports as evidence of stable or increasing NSO populations on private timberlands in the state (Calforests 2014). Reported crude densities on Humboldt Redwood Company, Mendocino Redwood Company, and The Conservation Fund lands in the Redwood Region were indeed relatively similar among years (Calforests 2014). However, it is unclear how changing survey methods and survey areas, as well as changing detectability of NSOs, influenced these companies' estimates over time (see Franklin et al. 1990). For example, recent adoption of survey protocols requiring more survey passes and use of electronic callers likely increased detection rates, and thus density estimates, on some of these lands. Estimates of crude densities of NSOs and numbers of ACs on Green Diamond Resource Company lands in the Redwood Region suggest that NSO densities have declined on that ownership (Figure 1.2; Table 1.1). The number of NSO ACs on Green Diamond lands briefly increased in 1998, apparently due to the company's acquisition of 70,000 acres of timberland that year (Green Diamond Resource Company 2014). Following a substantial decline during 2004-2008, the number of ACs began to gradually increase in 2009 (Figure 1.2). This increase appears to have been due to the company's adoption of a more rigorous survey protocol and implementation of a barred owl removal experiment during that same year (Green Diamond Resource Company 2014; see Chapter 4 of this volume). Sierra Pacific Industries' (2013) density trends for its ownerships in the Eastern Klamath are difficult to evaluate and are therefore not included here. Sierra Pacific Industries' (2013) estimates are empirical, potentially influenced by changing survey effort and areas, mostly descriptive of ACs at the margin of or outside the company's ownership, and were compared among blocks of years, rather than annually.

Comment [LVD6]: It would be useful to know which estimates are empirical counts with no statistical estimates of variance (i.e., no confidence intervals and therefore no way to assess the probability that the estimate represents the true value of the parameter).

Figure 1.2: Number of NSO activity centers ("sites") on Green Diamond Resource Co. lands during 1992-2013 (from Green Diamond Resource Co. 2014).



Rigorous ecological density estimates can be used to estimate population sizes for ecologically similar areas (Franklin et al. 1990). However, there are currently insufficient data for producing such an estimate for California or any of its regions. The California Forestry Association estimated that as many as 6,000 NSO territories currently exist in the state (Calforests 2014). This figure was based on an estimated statewide crude density of 0.28 territories per mile². This density estimate was, in turn, based on the cumulative number of known NSO ACs in California (see *Distribution*, above) and the proportion of "potential" habitat in the state that has been surveyed. The number of ACs known to have been recently occupied is substantially lower than the cumulative number that have been identified since the early 1970s (USFWS 2011a; see *Distribution*, above). This could be due to multiple factors, including declining occupancy rates (see *Occupancy*, below) and NSOs' use of different ACs over time. Thus, the timber industry's estimate provides little or no insight into the current number of NSOs or occupied ACs in the state. Furthermore, while reasonable projections of suitable habitat exist for NSOs in California (Davis and Dugger 2011, USFWS 2011a, Schumaker et al. 2014), the California Forestry Association did not cite these data and it is unclear how it estimated the total and surveyed areas of suitable habitat in the state.

Table 1.1: Density estimates for NSOs in California and Oregon.

Study	Region	Owner	Method	Crude Density (owls/ mi²)*	Crude Density (occupied territories/ mi²)*	Ecological Density (owls/ mi²)**†
Diller and Thome 1999	N Redwood	Green Diamond	Mark-Recapture	0.54 (0.24-0.91)		0.97-2.72
Green Diamond Resource Co. 2014	N Redwood	Green Diamond	Empirical (marked)	0.34 (0.12-0.53)		
Tanner and Gutierrez 1995 cited in Diller and Thome 1999	N Redwood	Redwood National Park	Empirical	0.57		
Humboldt Redwood Co. 2013	N Redwood	Humboldt Redwood	Empirical	0.53-1.01	0.36-0.50	
Mendocino Redwood Co. 2014	N Redwood	Mendocino Redwood	Empirical	0.47-.077		
The Conservation Fund unpubl. data in Calforests 2014	N Redwood	The Conservation Fund	Empirical		0.29-.036	
Chow 2001	S Redwood	Public (Various)	Empirical	0.97		2.09
Franklin et al. 1990	W Klamath	Six Rivers National Forest, Other	Mark-Recapture	0.61		1.41-1.71
Sierra Pacific Industries 2013	E Klamath	Sierra Pacific Industries	Empirical		0.17-0.18	
Woodbridge and Cheyne 1995	So Cascades	Klamath National Forest	Empirical		0.05-0.20	
Thrailkill et al. 1998	OR Coast Ranges	Bureau of Land Management	Empirical	0.07-0.25		0.57-0.90
Anthony et al. 2000 cited in Blakesley et al. 2004	OR Coast Ranges	Oregon Dept. of Forestry	Empirical	0.13-0.27		

*Ranges = low-high survey areas (Woodbridge and Cheyn 1995, Thraillkill et al. 1998, Diller and Thome 1999, Anthony et al. 2000, Green Diamond Resource Co. 2014), low-high survey years (Humboldt Redwood Co. 2013, Mendocino Redwood Co. 2014). **Habitat definitions used to calculate ecological densities: Franklin et al. 1990: all conifer cover classes weighted by NSO use (based on telemetry), but mostly ≥20.6 in DBH; Diller and Thome 1999: all forest classes weighted by NSO use (based on nest locations) but mostly >40 yrs; Chow 2001: all forested area; Thrailkill et al. 1998: old, mature, old over young, mature over young. †Ranges of ecological densities: Franklin et al. 1990: with two different habitat definitions; Diller and Thome 1999: low-high survey areas.

Occupancy

NSO population trends are most directly evaluated with demographic data (see *Demography*, below). However, occupancy data are often more logistically and economically feasible to collect than demographic data and, with proper accounting of detection probability, can provide a useful index of spotted owl population rates (MacKenzie 2005, Olson et al. 2005, Mackenzie et al. 2012, Tempel 2014). Occupancy data that inadequately incorporate detection probabilities for spotted owls must be interpreted carefully since they can be strongly influenced by survey effort, habitat attributes, social and reproductive status of NSOs, presence of barred owls, and other factors (Mackenzie 2005, Olson et al. 2005). Recent research in NSO demographic study

areas suggests that competition with barred owls is driving NSOs to move large distances (several miles) between different territories within the same season (Davis et al. 2013, Higley and Mendia 2013). Higley and Mendia (2013) warned that occupancy estimates for unmarked populations may therefore be inflated (i.e., the same individual could appear to occupy multiple territories within the same season) and suggested using the presence of pairs, rather than individuals, to determine occupancy.

There is limited information available for describing occupancy trends for NSOs in California. Much of the available information is from annual monitoring reports provided by industrial timber companies (Table 1.2). These data show trends in annual proportions of known, surveyed, or previous year's ACs found to be occupied (see Table 1.2 footnote). It is important to acknowledge that much of the data presented in Table 1.2 provide only crude indices of occupancy in California and that most of them cannot be compared among ownerships due to differences in monitoring and analytical methods. Future efforts to evaluate the status of NSOs in California would benefit from greater consistency in occupancy monitoring and from reporting of modeled occupancy rates, which account for detectability of NSOs and other factors that can obscure occupancy trends (e.g., Figure 1.5).

Recent occupancy estimates are unavailable for the Redwood National and State Parks in the northern portion of the Redwood Region. The National Park Service has discontinued surveying most historical territories in these parks due to apparent widespread displacement of NSOs by barred owls (Schmidt 2013; see Chapter 4 of this volume). In contrast with an apparently strong decline in occupancy in the Redwood National and State Parks, NSO occupancy rates on National Park Service lands in the southern portion of the Redwood Region have fluctuated annually but suggest a stable trend over time (Ellis et al. 2013; Table 1.2; Figure 1.3). Perhaps due to the area's geographic isolation, barred owls are still relatively uncommon the southern Redwood Region (Ellis et al. 2013; see Chapter 4 of this volume). Occupancy by NSOs appears to be gradually declining on industrial timberlands in the northern Redwood Region (Table 1.2; Figures 1.2, 1.4, 1.5, and 1.7). Given the substantial and increasing presence of barred owls in NSO territories on these lands (see Chapter 4 of this volume), it is surprising that more dramatic declines in NSO occupancy are not evident (e.g., see Table 1.2 for occupancy rates in Washington and Oregon). It is possible that NSOs respond differently to barred owls on these lands than elsewhere within their range. It is also possible that a more rapid decline is currently occurring than is indicated by the crude data presented in these companies' reports. Yet another possibility is that a more rapid decline will occur on these lands after a post-colonization lag period has elapsed or a critical threshold level of barred owl presence is reached (USFWS 2013).

NSO occupancy in the Northwestern California demographic study in the Western Klamath Region has declined dramatically in recent years (Franklin et al. 2013, 2014; Table 1.2). This decline has coincided with increasing barred owl presence in the study area, suggesting that NSOs are being displaced by barred owls (see Chapter 4 of this volume). The recently increased rate of declining occupancy by NSOs in this study area appears to support the hypothesis that barred owls can have lag or threshold effects on NSO populations. Recent declines in occupancy in the Northwestern California study area may also be related to effects of multiple consecutive years of poor weather conditions on demographic rates (see *Demography*, below). Recent annual reports from the Hoopa demographic study did not include analyses of occupancy data for

NSOs (Higley and Mendia 2012, 2013). However, unmodeled occupancy rates in 2012 and 2013 were low (0.40 and 0.35, respectively). Low occupancy rates on the Hoopa Reservation may be related to substantial declines in numbers of NSOs, likely due to decreasing demographic rates (see *Demography*, below) and increasing numbers of NSO territories with barred owl detections (see Chapter 4 of this volume). Greater declines in numbers of NSOs and increases NSO territories with barred owl detections beginning in 2005 provide additional support for the hypothesis that barred owls have lag or threshold effects on NSOs.

There is currently no clear pattern in occupancy data available for the Eastern Klamath and Southern Cascades of California. Timber companies in those regions have reported evidence of stable occupancy rates (Sierra Pacific Industries 2013, Michigan-California Timber Company 2014; Figure 1.6; note: Sierra Pacific's estimates are not provided in Table 1.2 for reasons discussed in *Density and Abundance*, above). However, more rigorous, published research conducted primarily on industrial timberlands in the Eastern Klamath and Southern Cascades found substantial declines in both simple (total) and pair occupancy (Farber and Kroll 2012; Figure 1.7). The barred owl invasion appears to still be in the early colonization phase in the Eastern Klamath, where this study was primarily conducted (Farber and Kroll 2012; see Chapter 4 of this volume). Thus, declining occupancy during the study was likely caused by some other factor, such as timber harvesting on the industrial timberlands that comprised much of the study area or wildfires on neighboring public lands (see Chapters 2 and 3 of this volume). Research in other areas of the NSO's range indicates that occupancy is negatively affected by habitat loss and fragmentation (Dugger et al. 2011, Sovern et al. 2014).

Table 1.2: Estimates and indices of occupancy by northern spotted owls in California, Oregon, and Washington.

Study	Region	Owner	Years	Number of Sites	Proportion Occupied (Total)	Proportion Occupied (Pairs)	Modeled Occupancy (Total)	Modeled Occupancy (Pairs)	Apparent Trend
Mendocino Redwood Company 2013	N Redwood	Private	2001-2013 (proportion); 2001-2008 (modeled)		0.75 - 0.69*		0.88 - 0.78*†		Declining (weak)
Humboldt Redwood Company 2014	N Redwood	Private	2003-2013		0.81 - 0.63*†				Declining (weak)
Green Diamond Resource Company 2014	N Redwood	Private	1999-2013 (no. sites); 2009-2013 (occupancy)	135 - 108*†	0.88 - 0.83*‡				Declining (weak)
Ellis et al. 2013	S Redwood	NPS	1999-2012		0.86 - 0.94*	0.72 - 0.87*			Stable
Franklin et al. 2002, 2003, 2010-2014	W Klamath	USFS, BLM, Private	2001-2013		0.67 - 0.37*	0.59 - 0.28*			Declining (strong)
Farber and Kroll 2012	E Klamath, S Cascades	Private, USFS	1995-2009				0.81 - 0.50*	0.75 - 0.46*	Declining (strong)
Michigan-California Timber Company 2014	E Klamath, S Cascades	Private	2000-2013		0.35 - 0.52 (2001-2013: 0.66 - 0.52)*†				Stable
Davis et al. 2013a	OR Klamath	BLM, State, Private	2001-2013		0.86 - 0.49*	0.62 - 0.30*			Declining (strong)
Dugger et al. 2011	OR S Cascades	USFS	1991/1992-2006				w/o barred owls: 0.86 - 0.71*†; w/ barred owls: 0.87 - 0.11*†		Declining (strong)
Kroll et al. 2010	WA E Cascades	NPS, USFS, Private	1990/1-2003				w/o barred owls: 0.83 - 0.64*†; w/ barred owls: 0.73 - 0.30*†	w/o barred owls: 074 - 0.36*†	Declining (strong)

*Start and end values. †Estimated from graph. ‡Occupancy of previous year's sites.

Figure 1.3: Occupancy status at monitored northern spotted activity centers on National Park Service lands in Marin County, California during 1999-2012 (from Ellis et al. 2013).

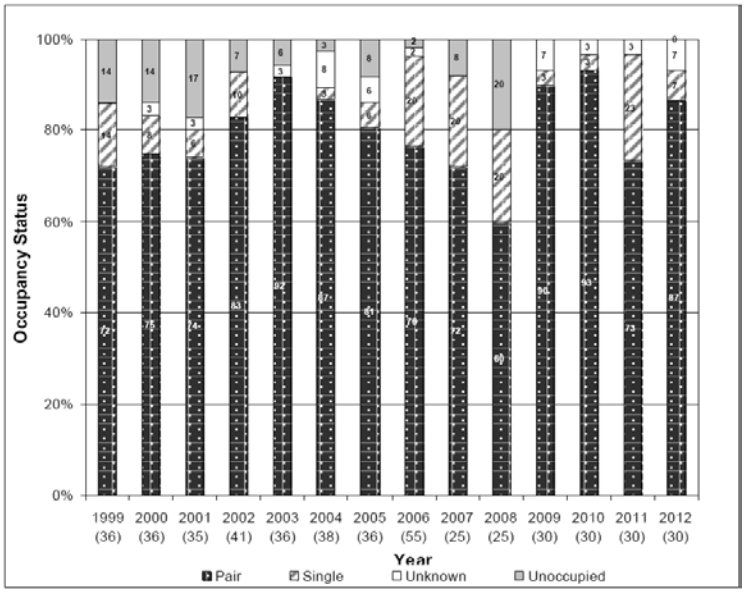


Figure 1.4: Annual numbers of known and occupied northern spotted owl activity sites (activity centers) on Humboldt Redwood Company lands during 2003-2013 (from Humboldt Redwood Company 2014).

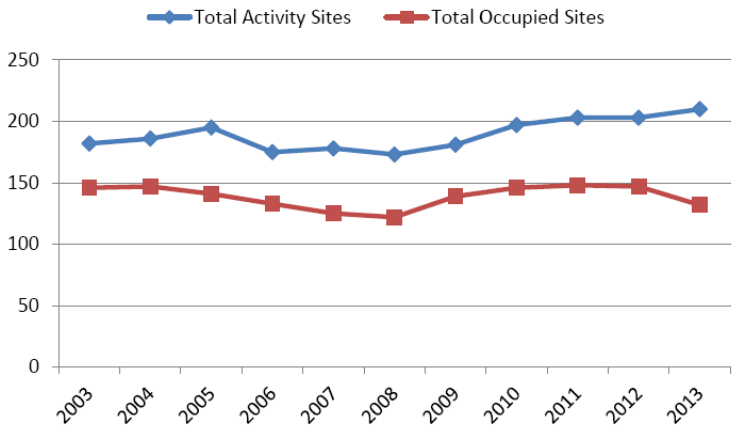


Figure 1.5: Annual proportion of northern spotted owl activity centers occupied (blue line) and modeled occupancy probability (red line) on Mendocino Redwood Company lands (from Mendocino Redwood Company 2013).

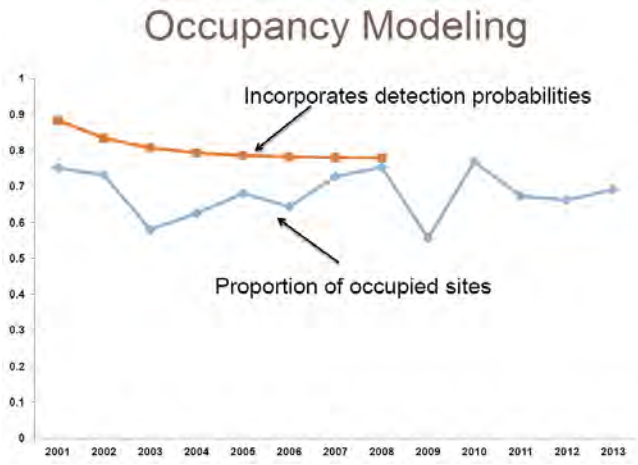


Figure 1.6: Percent of surveyed northern spotted owl sites occupied on Michigan-California Timber Company lands during 2000-2013 (from Michigan-California Timber Company 2014).

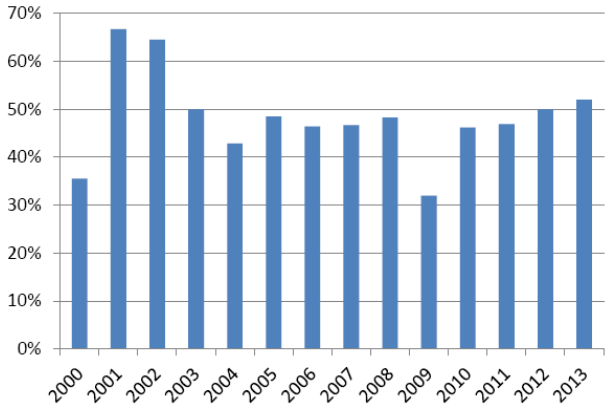
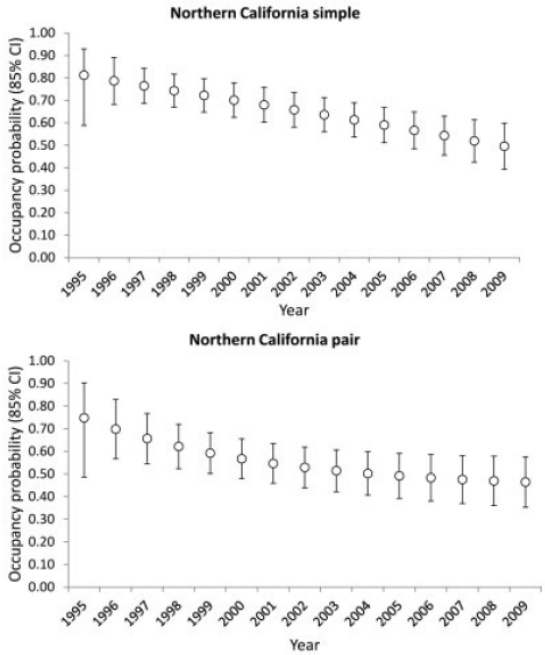


Figure 1.7: Estimated annual simple (total) and pair occupancy probabilities (with 85% confidence intervals) for northern spotted owls in the Eastern Klamath Region of California during 1995-2009 (from Farber and Kroll 2012).



Demography

Reproduction

Reproductive data are commonly collected as part of monitoring efforts for NSOs (e.g., Calforests 2014). They are easier and more cost-effective to obtain than those required for estimating survival or population trends. NSOs exhibit considerable annual fluctuations in reproduction (Forsman et al. 2011, Calforests 2014). Given often large annual fluctuations in reproduction, evaluation of trends in reproduction could require longer-term datasets than are available for many monitoring areas.

The 2011 demographic meta-analysis reported that fecundity of NSOs (number of female fledglings per female) significantly declined during 1985-2008 in four of 11 density study areas, may have declined in three other areas, and was stable in four areas (Forsman et al. 2011). Two of the four study areas with significant declines in fecundity were located in California (Northwestern California in the Western Klamath Region and Green Diamond in the Redwood Region). Two others were located in portions of southwestern Oregon (Klamath and South Cascades) that are nearby and ecologically similar to the Eastern Klamath and Southern Cascades of California (see USFWS 2011a and 2012a for regions). Also, the one area in

California with stable fecundity (Hoopa) had low fecundity estimates compared to other areas. Together these data, which represent the most reliable evidence currently available, indicate that NSO reproduction could be declining across much of California and southwestern Oregon.

Annual fluctuations in fecundity were evident in all three demographic studies in California and were remarkably synchronous (Forsman et al. 2011; Figure 1.8). Forsman et al. (2011) found that variation in fecundity was associated with a variety of variables, including the age of breeding females, whether the year was even or odd, weather or climate (e.g., early nesting season temperature or precipitation), percent cover of suitable habitat, and the presence of barred owls. Franklin et al. (2013) noted a pattern of "good" and "bad" reproductive years in the Northwestern California demographic study area, which is likely associated with annual variation in weather during the early nesting season (also see Franklin et al. 2000). Franklin et al. (2013) also observed that particularly poor reproductive years have occurred in their study area at four-year intervals, suggesting that "some other extrinsic factor may be operating, such as seed production governing small mammal populations." Forsman et al. (2011) reported that barred owl presence was in the top models explaining fecundity in the Green Diamond study area, suggesting that competition with barred owls contributed to declining reproduction on that ownership. Reports from the Klamath and South Cascades demographic studies in southern Oregon noted negative associations between reproduction and rainfall during the early nesting season (Davis et al. 2013b, Dugger et al. 2014). Declining reproduction in these study areas also appears to be related to increasing presence of barred owls.

Following publication of the 2011 meta-analysis, California's demographic studies reported three consecutive years (2011-2013) of very low reproduction (Franklin et al. 2013, Higley and Mendia 2013, Green Diamond Resource Company 2014). This dip in reproduction might have been partially driven by high rainfall during the early nesting season during 2010-2012 (see below). Those three consecutive years of low reproduction exacerbated the negative long-term trend that was already occurring on Green Diamond lands (Green Diamond Resource Company 2014; Figure 1.9). Negative trends in reproduction also occurred in the Klamath and South Cascades demographic study areas subsequent to the end of the 2011 meta-analysis study period (Davis et al. 2013b, Dugger et al. 2014; Figures 1.10 and 1.11). Davis et al. (2013b) concluded that particularly poor reproduction during recent years "…may indicate potentially serious problems with maintaining a stable population. This is even more alarming since these results are following a long term downward trend."

Figure 1.8: Mean annual fecundity in California's three northern spotted owl demographic studies during 1985-2008 (from Forsman et al. 2011).

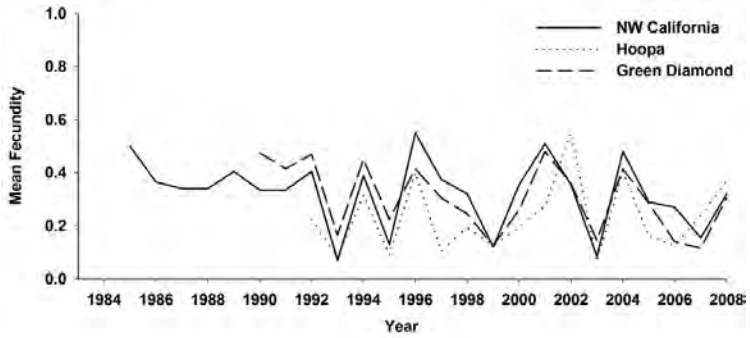


Figure 1.9: Number of fledglings produced per monitored pair of northern spotted owls on Green Diamond Resource Company lands during 1992-2013 (from Green Diamond Resource Company 2014).

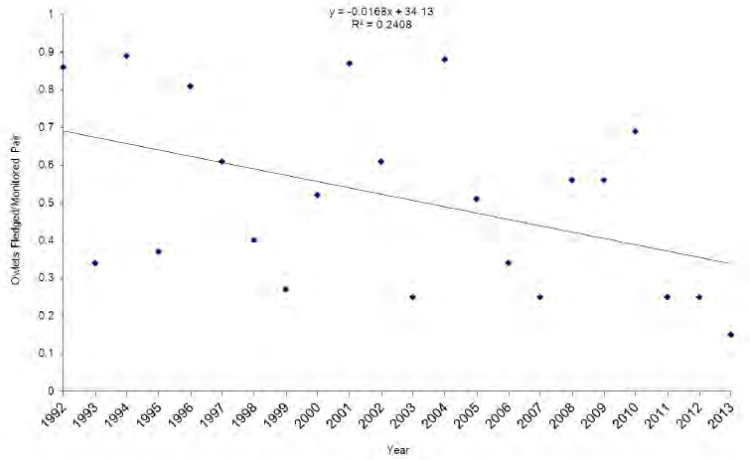


Figure 1.10: Fecundity of northern spotted owls ("STOC") in the Klamath demographic study area during 1990-2013 (from Davis et al. 2013a). Dashed line is a polynomial trend line (r^2 = 0.419). Vertical line represents the first year in which barred owls ("STVA") were detected in more than 10% of spotted owl territories.

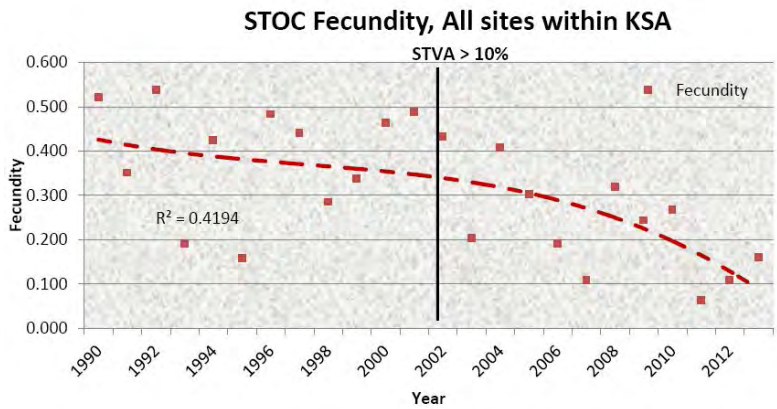
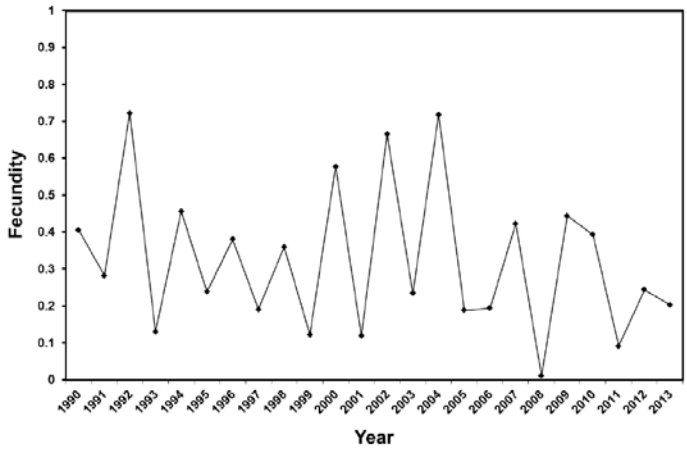


Figure 1.11: Fecundity of northern spotted owls in the South Cascades demographic study area during 1990-2013 (from Dugger et al. 2014).



Information is also available for describing recent trends in NSO reproduction in portions of California outside of demographic study areas. Ellis et al. (2013) found below average fecundity during 2007 and 2010-2012 on National Park Service lands in the southern Redwood Region (Figure 1.12). Humboldt Redwood Company (2013) and Mendocino Redwood Company (2014) likewise reported low reproduction during those years (Figures 1.13 and 1.14). These observations, along with those from demographic studies in California and southern Oregon described above, suggest that low reproduction during recent years was primarily driven by a

factor that acted at a very large spatial scale, rather than at the scale of individual ownerships or ecological regions. As noted above, high rainfall during the early nesting season was likely a primary cause of low reproduction during recent years. This apparent relationship is illustrated by the negative association between NSO reproductive success and early season rainfall observed on Mendocino Redwood Company lands (Figure 1.13).

Monitoring results suggest a stable long-term trend in reproduction on National Park Service lands in the southern Redwood Region (Figure 1.12). In the northern Redwood Region, Humboldt Redwood Company (2013) data likewise suggest little or no trend, although the period covered could be too short to capture long-term trends in reproduction (Figure 1.14). Mendocino Redwood Company (2014) provided a longer-term data set that suggests that a shallow decline in reproduction has occurred on their lands, primarily due to below average reproduction during seven of eight years during 2006-2013 (Figure 1.13). Data provided by the Fruit Grower's Supply Company (2014) suggests that a decline in reproduction occurred on their lands in the Eastern Klamath and Southern Cascades regions of California during 1990-2005 (Figure 1.15). It is important to note, however, that these are only descriptions of apparent trends based on patterns in relatively crude data. A more rigorous analysis of the data is needed to support strong conclusions about reproductive trends on industrial timberlands in the Redwood Region.

Figure 1.12: Fecundity of northern spotted owls on National Park Service lands in Marin County during 1999-2005 and 2007-2012 (from Ellis et al. 2013). The solid line indicates mean fecundity during these periods combined, the dashed lines are one standard deviation from the mean, error bars indicate ±1 standard error, and n is the total number of spotted owl territories.

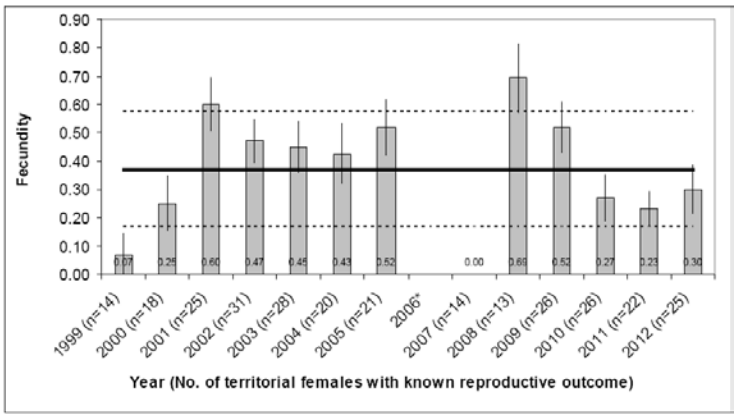


Figure 1.13: Reproductive success (average number of fledglings/pair) of northern spotted owls and amounts of rainfall during the early nesting season on Mendocino Redwood Company lands during 1989-2013 (from Mendocino Redwood Company 2014).

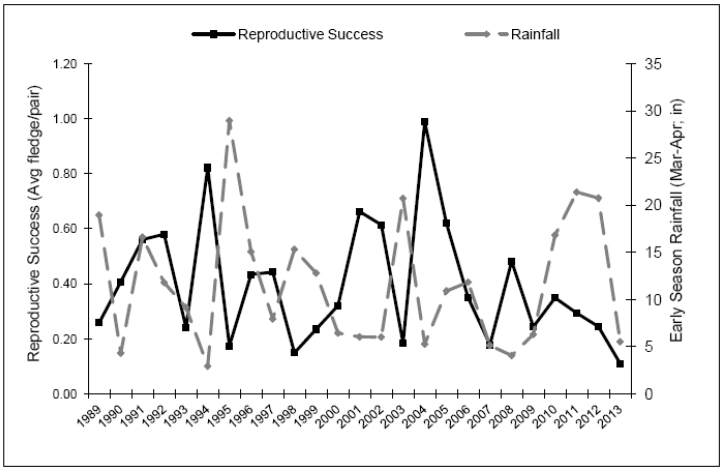


Figure 1.14: Reproductive rate and numbers of nesting pairs and juveniles on Humboldt Redwood Company lands during 2003-2012 (from Humboldt Redwood Company 2013).

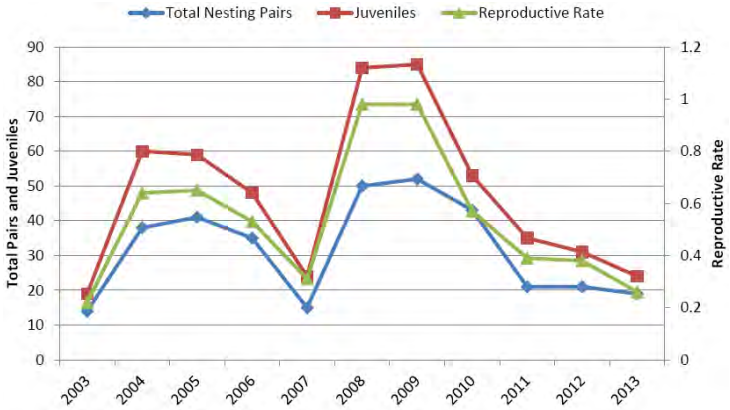
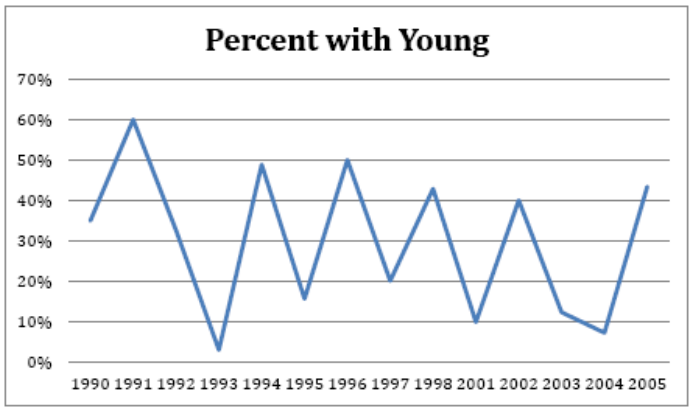


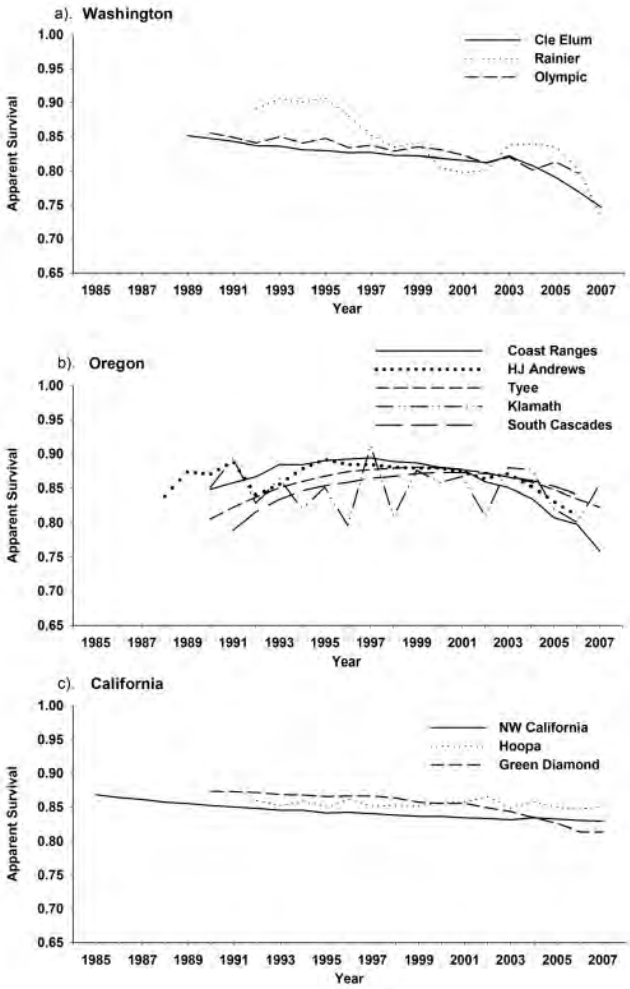
Figure 1.15: Fecundity of northern spotted owls on Fruit Growers Supply Company land during 1990-2005 (from Fruit Growers Supply Company 2014).



Survival

Available information concerning recent survival rates of NSOs is mostly limited to that provided in the 2011 demographic meta-analysis (Forsman et al. 2011). Survival data are not collected by timber companies other than Green Diamond Resource Company, which submits its data for analysis and reporting in the demographic meta-analyses. Forsman et al. (2011) reported statistically significant declines in apparent survival for 10 of 11 NSO demographic study areas, including all three study areas in California (Figure 1.16). Declines in many study areas were most precipitous during the last five years of the study period (i.e., 2003-2007 for survival; Figure 1.16). The Klamath in southern Oregon was the only study area that did not have a significantly declining survival rate through 2007. Forsman et al. (2011) stated that "collectively, the declines in apparent survival of Northern Spotted Owls across much of the subspecies' range are cause for concern because Spotted Owl populations are most sensitive to changes in adult survival rates (Noon and Biles 1990, Lande 1991)."

Figure 1.16: Model averaged estimates of apparent survival of adult female northern spotted owls three study areas in Washington (a), five study areas in Oregon (b), and three study areas in California (c) during 1985-2007 (from Forsman et al. 2011).



NSO demographic studies have largely deferred reporting of more recent survival data to the forthcoming meta-analysis, which is expected to be released in 2015. The limited information available prior to release of that meta-analysis suggests that survival has continued to decline since the 2011 meta-analysis study period. Davis et al. (2013b) reported that subsequent "…data regarding occupancy (in the Klamath study area) has shown a rapid decline, which suggests the stability of the survival rate may no longer be valid." Franklin et al. (2013) reported an alarming drop in apparent survival in 2011 on the Northwestern California demographic study area (Figure 1.17). Their subsequent annual report deferred reporting of 2012-2013 survival data to the forthcoming meta-analysis (Franklin et al. 2014). Higley and Mendia (2013) reported a statistically non-significant decline in survival of NSOs on the Hoopa Valley Indian Reservation in the Western Klamath (Figure 1.18). Their best model explaining survival of NSOs suggested that the decline was at least partially related to increasing numbers of barred owls in the study area.

Figure 1.17: Annual estimates (solid dots with 95% confidence intervals) of, and trend in (solid line), apparent survival for subadult and adult northern spotted owls in northwestern California during 1985-2012 (from Franklin et al. 2013).

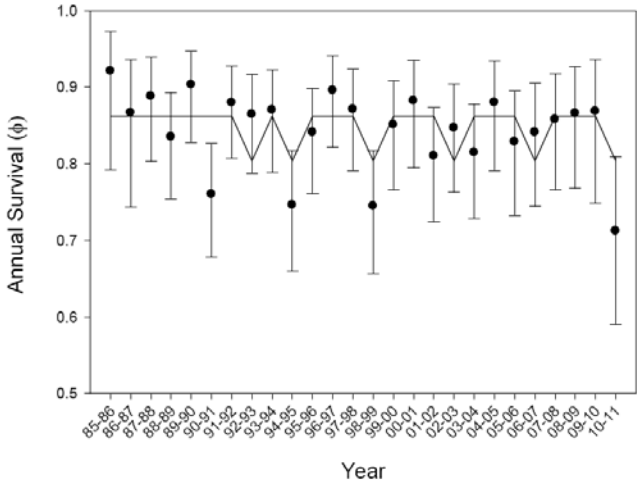
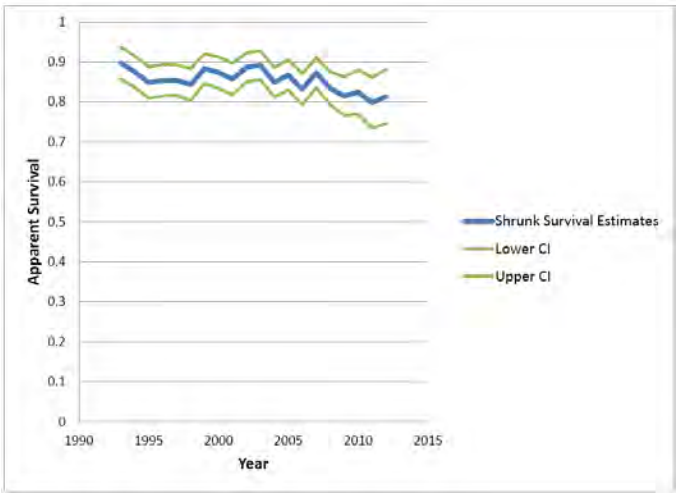


Figure 1.18: Estimates and 95% confidence intervals for NSO apparent survival on the Hoopa Valley Indian Reservation, Humboldt County, California during 1994-2012 (from Higley and Mendia 2013).



Forsman et al. (2011) reported that the presence of barred owls was included in the best model structures for several study areas, including the Green Diamond and Klamath, and was in a competitive model for Northwestern California (Forsman et al. 2011). Given evidence that barred owl presence continued to increase after the study period covered by Forsman et al. (2011) (see Chapter 4 of this volume), it is likely that the forthcoming meta-analysis will report continued declines in apparent survival for many, if not all, demographic study areas. Franklin et al. (2013) noted that apparent survival in the Northwestern California study area, like reproduction, is influenced by annual variation in weather during the early spring. Thus, recent consecutive years with poor weather during the early spring further suggest that survival has likely continued to decline since the period analyzed by Forsman et al. (2011).

Population Change

A new demographic meta-analysis is expected to be released in 2015. Until then, the 2011 meta-analysis (Forsman et al. 2011) provides the most current available estimates of population change for NSOs across their range. Except for the Green Diamond Resource Company, which submits its data for analysis and reporting in periodic meta-analyses, timber companies do not estimate population change for NSOs. Forsman et al. (2011) stated that their results likely "…reflected conditions on federal lands and areas of mixed federal and private lands within the range of the Northern Spotted Owl because the study areas were (1) large, covering ≈ 9% of the range of the subspecies, (2) distributed across a broad geographic region and within most of the geographic provinces occupied by the owl, and (3) the percent cover of owl habitat was similar between our study areas and the surrounding landscapes." Only one of the study areas included in the meta-analysis was entirely located on private lands (Green Diamond). Thus, it is unclear whether results from the 2011 meta-analysis reflect demographic trends on private lands across

the range of the NSO. Given weaker habitat conservation measures for NSOs on many private ownerships compared with federal lands, Forsman et al. (2011) stated that, "if anything, our results depict an optimistic view of the overall population status of the Northern Spotted Owl."

Forsman et al. (2011) reported estimates of the annual finite rate of population change (λ) for 11 study areas located across the NSO's range. Estimates of λ ranged from 0.929 to 0.996 (i.e., declines of 0.4 to 7.1% per year) for these study areas during the period of 1990-2006. There was strong evidence of population declines on seven of the study areas, including the Northwestern California (-1.7% per year) and Green Diamond (-2.8% per year) study areas in California. Negative population trends were also found on the Hoopa study area in California (-1.1% per year) and on the Klamath and South Cascades in southern Oregon (-1.0% and -1.8% per year, respectively) but they were not statistically significant. The weighted mean estimate of λ for all study areas combined was 0.971, indicating an average population decline of 2.9% per year during the study. Variables included in the best model in the meta-analysis of λ indicated effects of ecoregion (geographic location and major forest type) and the proportion of NSO territories with barred owl detections.

In addition to estimates of annual rate of population change, Forsman et al. (2011) provided estimates of realized population change, which describes population change over the study period (Figure 1.19). NSO populations in Washington and northern Oregon declined by approximately 40-60% during 1990-2006. Populations on the Northwestern California and Green Diamond study areas declined by 20-30% during the study period, although the 95% confidence intervals for these estimates slightly overlapped zero (Figure 1.19). Declines of 5-15% were evident on the Hoopa, Klamath and South Cascades study areas but these trends were not statistically significant (Figure 1.19).

Figure 1.19: Estimates of realized population change with 95% confidence intervals for northern spotted owls in California and southern Oregon (from Forsman et al. 2011).

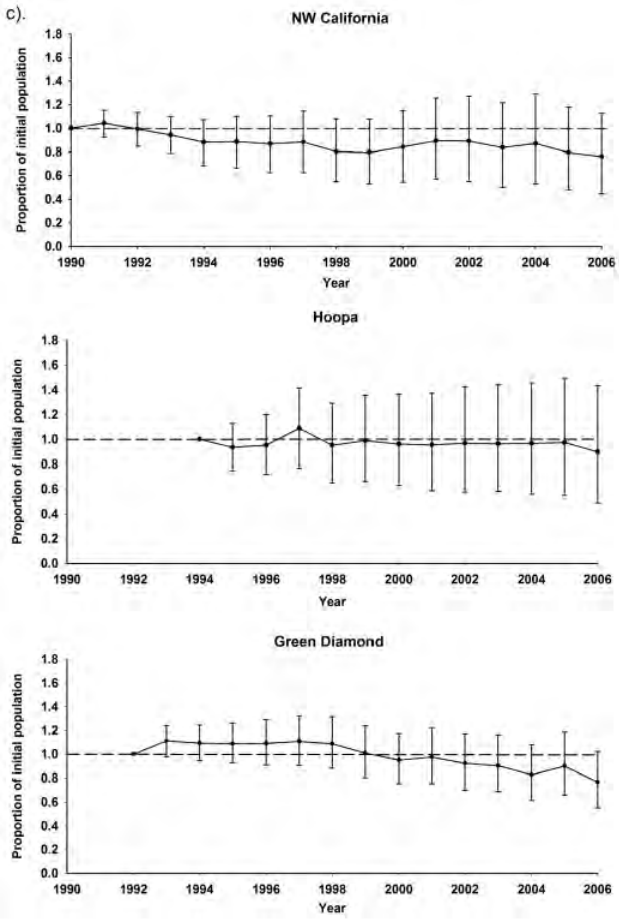
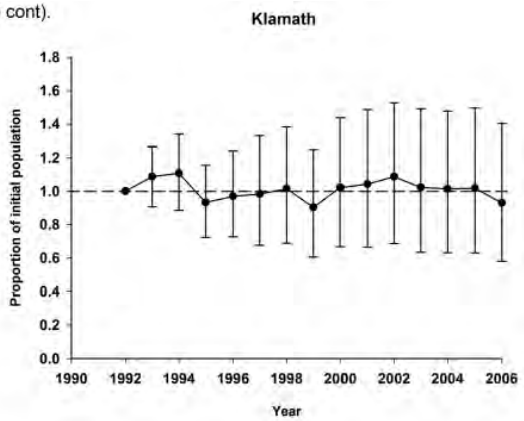
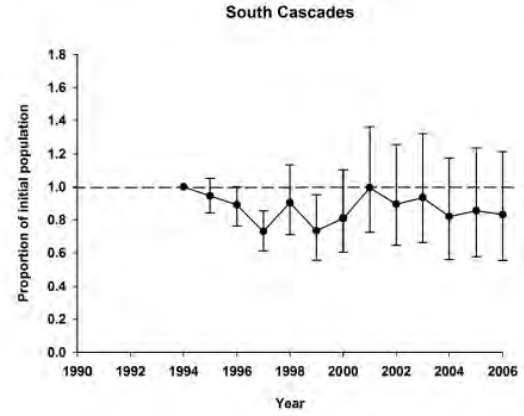


Figure 1.19 (cont.).

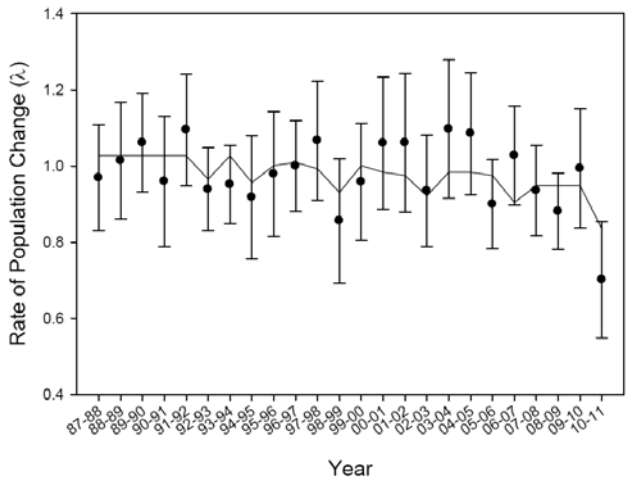
b cont).





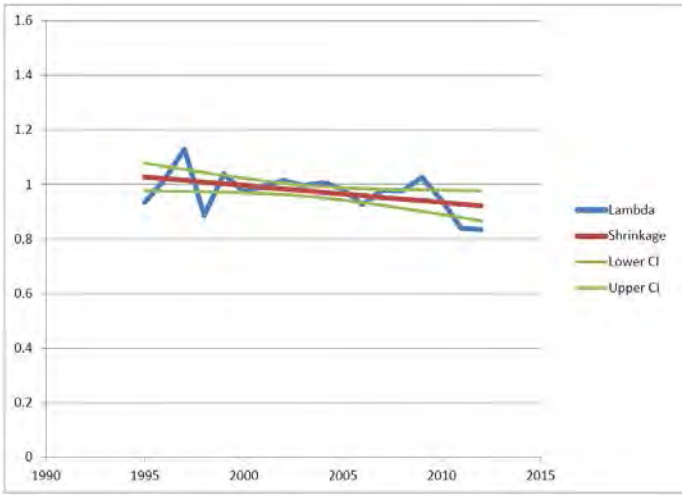
Following the 2011 meta-analysis study period (i.e., >2007), NSOs in the Northwestern California study area experienced a further decline in λ (mean = 0.978 or -2.2% per year) (Figure 1.20). The last year included in this analysis (2011) had the lowest annual estimate of λ found during the 24-year analysis period (Figure 1.20). The forthcoming meta-analysis should reveal whether the substantial drops in apparent survival and λ in the Northwestern California study area in 2011 were anomalous or indicative of an increased rate of population decline in the study area. Franklin et al. (2013) found that fecundity, apparent survival, and λ in the study area fluctuated during "good" and "bad" years, which was likely at least partially related to weather (see above). Annual rate of population change was also apparently negatively affected by increasing presence of barred owls. Given continued increases in barred owls (see Chapter 4 of this volume), poor weather during the early spring during 2010-2012, and poor reproduction by NSOs during 2011-2013 (see above), it is likely that λ continued to decline on this study area and probably others in California and southern Oregon.

Figure 1.20: Annual estimates of (dots with 95% confidence intervals) and trend in (solid line) rate of population change in the Northwestern California study area (from Franklin et al. 2013).



Higley and Mendia (2013) reported that the estimate of λRJS (Jolly-Seber Capture-Recapture model) for the Hoopa demographic study during 1995-2012 was 0.977, indicating a mean annual population decline of 2.3%. The decline was statistically significant in 2011 and 2012 (point estimates of λRJS not included in the 95% CI; Figure 1.20). Higley and Mendia (2013) noted that "the recent decline in survival, the point estimate of λRJS and the actual number of birds detected this past season all point to a population that is in fact, declining. This apparent decline in spotted owls corresponds with an increase in total annual barred owl detections and proportion of spotted owl territories with barred owl detections." They further noted that the forthcoming meta-analysis will show that it is "...very clear that northern spotted owls are in decline across all 11 study areas and that in many cases the decline is accelerating."

Figure 1.21: Trend in rate of population change on the Hoopa Valley Indian Reservation, Humboldt County, California during 1994-2012 (from Higley and Mendia 2013).



Source-Sink Dynamics

As described by Gutiérrez and Harrison (1996), source-sink dynamics exist for species "…that occupy both high-quality habitats (sources) where populations grow and produce emigrants, and low-quality habitats (sinks) where populations cannot sustain themselves in the absence of immigration." Population sinks potentially function as reservoirs for repopulation of sources that go extinct but may also reduce population growth rates (Pulliam 1988, Gutiérrez and Harrison 1996). Identifying source and sink areas is therefore, an important component of conservation research and planning.

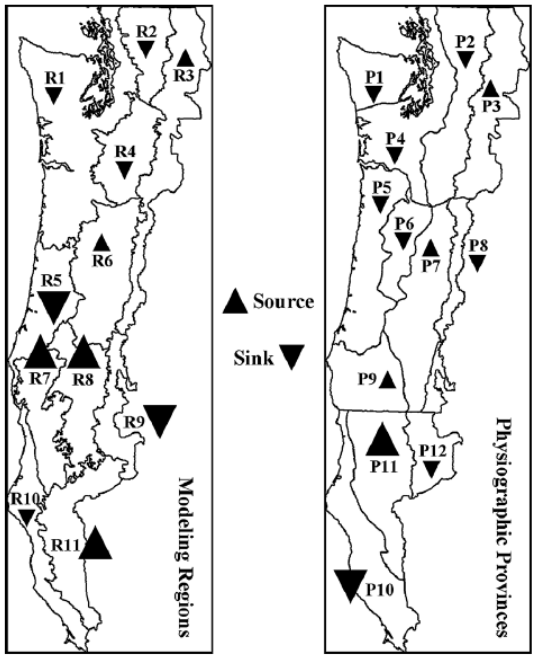
Schumaker et al. (2014) recently published a rangewide study of source-sink dynamics for NSOs. Their source-sink simulation modeling incorporated an array of regional data for NSO occupancy rates, movement distances and rates, life history attributes, habitat suitability and connectivity, encounter rates with barred owls, and environmental stochasticity. Source-sink dynamics in this study emerged from simulated interactions between individual NSOs and landscapes, rather than being predefined based on habitat suitability as was done in previous studies. The simulation models by Schumaker et al. (2014) ~~found~~ predicted that most ecological regions and physiographic provinces currently function as population sinks for NSOs (Figures 1.22 and 1.23). The study's results ~~indicated~~ projected that the Klamath Provinces of California and Oregon and the Interior Northern Coast Ranges of California are the subspecies' strongest population sources (Figure 1.23). The Klamath Provinces appear to be particularly important for maintaining NSO population stability due not only to being net population sources but to their high levels of population connectivity with multiple surrounding regions (Schumaker et al. 2014; Figure 1.23). The Redwood and Southern Cascades regions in California were both classified as moderate population sinks. Schumaker et al. (2014) identified the Klamath Provinces and

Comment [LVD7]: I think this section should also include a discussion of habitat fitness (Franklin et al. 2000), which is another method to quantify source versus sink habitats.

Comment [LVD8]: I personally don't think a simulation model should be used to draw management conclusions. In my opinion, they require so many assumptions to generate the necessary model parameters that they should only be used to develop testable hypotheses. The data we have accumulated over the years on population recruitment through immigration of subadults indicates that most of the birds are coming from within the redwood region. We don't have the data, but my guess is that the redwood region has contributed more recruits to the Klamath region than the reverse.

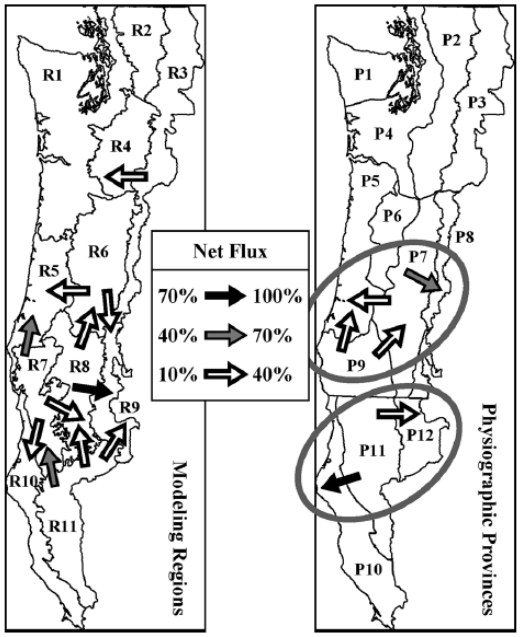
California Cascades as areas in which it could be particularly important to focus habitat protection and restoration efforts, respectively.

Figure 1.22: Relative source and sink values in northern spotted owl modeling regions and physiographic provinces (from Schumaker et al. 2014). The sizes of symbols denote major versus minor or moderate sources and sinks.



R7: Klamath West, R8: Klamath East, R9: Eastern Cascades South, R10: Redwood Coast, R11: Inner California Coast Ranges, P10: California Coast Range, P11: California Klamath, P12: California Cascades. See Schumaker et al. (2014) for other modeling regions and physiographic provinces.

Figure 1.23: Graphical representation of net movement ("Net Flux") of individual (simulated) northern spotted owls from one modeling region or physiographic province to another (from Schumaker et al. 2014). The largest Net Flux values are shown in black, intermediate values in gray, and smallest values in white. Gray ovals highlight two areas with strong patterns of Net Flux.

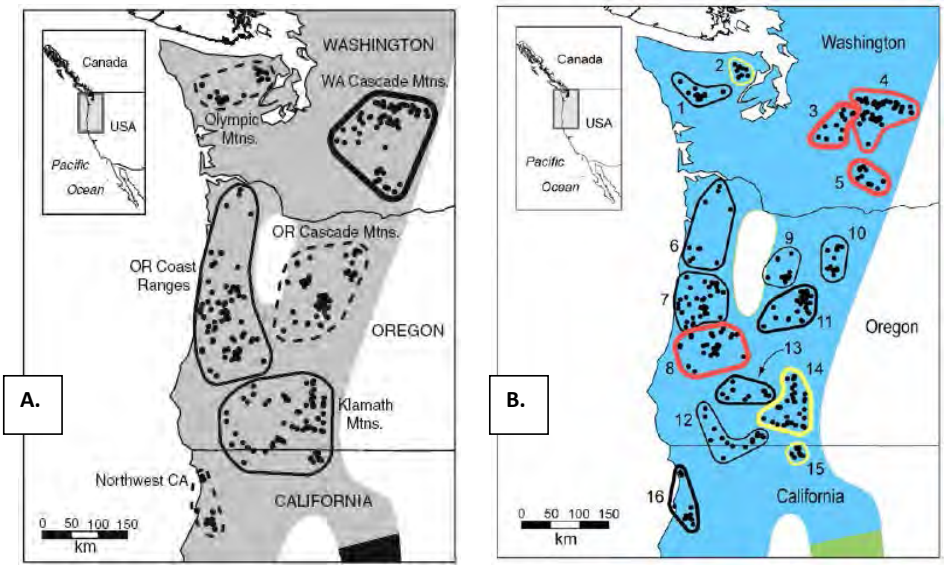


Genetics

Funk et al. (2010) found statistically significant evidence that NSOs have experienced genetic bottlenecks during recent decades in the Washington Cascades, Oregon Coast Ranges, and "Klamath Mountains" of Oregon and California (Figure 1.24). An earlier report on this study indicates that evidence of a bottleneck in the Klamath Mountains analysis area was primarily driven by data from the southern Cascades of Oregon and California, rather than from the Klamath Provinces (Funk et al. 2008; Figure 1.24). Evidence of recent genetic bottlenecks in the Washington Cascades, Oregon Coast Ranges, and southern Cascades are concordant with recent demographic declines in these regions (Forsman et al. 2011; see *Demography*, above). Surprisingly, Funk et al. (2010) did not find evidence of a genetic bottleneck in the Olympic Mountains of Washington, where NSOs have recently experienced dramatic population declines (Forsman et al. 2011). However, they noted that their small sample size for this region limited their power to detect a genetic bottleneck if one occurred. Funk et al. (2010) did not find statistically significant evidence of a recent genetic bottleneck in northwestern California (Western Klamath and Redwood regions). They suggested that this could likewise have been due to low statistical power or to the relatively gradual population declines reported for that area at the time (see *Demography*, above). The analyses of Funk et al. (2010) did not address whether

genetic bottlenecks were solely a result of population declines or were also contributing to them. Genetic declines can contribute to reduced demographic rates through effects of inbreeding depression and loss of adaptive genetic variation (reviewed in Funk et al. 2010).

Figure 1.24: Recent population bottlenecks in NSOs. Points represent 352 individual owls included in the analysis which are grouped into six (A) and 16 (B) regions. Statistically significant bottlenecks are represented by solid lines (A) or yellow ($p = 0.05$) and red ($p = 0.01$) lines (B). (A) represents significant bottlenecks under 5, 10, and 15% multi-step mutation models as solid bold lines and under 10 and 15% multi-step mutation models as finer solid lines (see Funk et al. 2010). (B) indicates greater magnitude bottlenecks with bolder lines. From Funk et al. 2010 (A) and 2008 (B).



Summary of Current Status and Trends

Rigorous long-term research has indicated that NSO populations are dramatically declining in Washington and northern Oregon and more gradually declining in southern Oregon and California (Forsman et al. 2011). Yet, while less precipitous than those in the northern portion of the NSO's range, the rapidity of population declines in southern Oregon and California are cause for grave concern regarding the subspecies' status and trends. A new demographic meta-analysis, which is due for public release during 2015, will replace the 2011 meta-analysis and provide the most reliable information for evaluating the NSO's current status and trends. Based on information available in annual research reports, it is clear that the forthcoming meta-analysis will show that populations in southern Oregon and California are declining more rapidly than was evident in the 2011 meta-analysis (Davis et al. 2013a, Franklin et al. 2013, Higley and Mendia 2013, Dugger et al. 2014, Green Diamond Resource Company 2014).

The NSO's status and trends are less clear in portions of California outside the state's three demographic study areas. Much of the information for these areas is provided by industrial timber companies, which have uniformly concluded that NSO populations on their lands are stable (Calforests 2014). However, the data provided by these companies are insufficient for drawing strong conclusions about the NSO's status and trends, and may in fact indicate gradual declines in occupancy and reproduction on some ownerships (see *Occupancy* and *Demography*, above). Forsman et al. (2011) suggested that, due to weaker habitat protection, NSO demographic trends could generally be worse on non-federal lands than on the federal and mixed federal/non-federal lands on which most demographic studies are conducted. This appears to be true in California, where NSOs experienced greater declines on Green Diamond Resource Company lands than on nearby tribal and Forest Service lands (Forsman et al. 2011; see *Occupancy* and *Demography*, above). However, the degree to which these differences were due to variation in land management, effects of competition with barred owls, or other factors is unclear.

It is likewise unclear if demographic trends in California's three demographic study areas accurately represent those in drier, less productive forests in the state's interior. An occupancy study in California's Eastern Klamath and Southern Cascades (Farber and Kroll 2012) and demographic studies in ecologically similar areas of southern Oregon (Davis et al. 2013a, Dugger et al. 2014) could provide the most reliable information currently available for evaluating NSO's status and trends in interior California (see *Occupancy* and *Demography*, above). These studies indicate that NSOs are currently declining in at least some portions of the Eastern Klamath and Southern Cascades regions (note: these regions cover portions of both California and southern Oregon as they are ecologically rather than politically defined; see USFWS 2011a Appendix C). Evidence of population declines in the Klamath regions (Forsman et al. 2011, Farber and Kroll 2012, Davis et al. 2013a, and Franklin et al. 2013) are particularly concerning in light of the critical contributions these areas likely provide to the NSO's long-term persistence (Schumaker et al. 2014; see *Source-Sink Dynamics*, above).

Although the Redwood Region ~~appears to currently~~is projected to function as a population sink, it still retains high densities and abundances of NSOs and is therefore important to the subspecies' conservation (Schumaker et al. 2014; see *Density and Abundance* and *Source-Sink Dynamics*, above). There is limited information available for evaluating the NSO's status and trends in portions of the Redwood Region outside of Green Diamond's lands. Monitoring on National Park Service lands and adjacent ownerships suggest that the population in Marin County is stable while NSOs in the Redwood National and State Parks have substantially declined. These differences appear to be largely due to negative effects of high barred owl densities in the Redwood National and State Parks and the relatively slow rate of the barred owl invasion in Marin County (see *Occupancy*, above). In contrast with the Green Diamond Resource Company, other timber companies in the northern portion of the Redwood Region have concluded that their NSO populations are stable (Calforests 2014). It is possible that NSOs have indeed fared better on these ownerships than on Green Diamond lands; for example, due to less intensive timber harvesting or more recent colonization by barred owls. However, the data provided by these companies are insufficient for drawing firm conclusions about the NSO's status and trends on these lands, and actually appear to indicate gradual declines in some areas. More consistent and rigorous monitoring (e.g., consistent survey areas and protocols; reporting

Comment [LVD9]: There are no data to support this assertion so I think simulation model projections need to be reported with the uncertainty they deserve. As the great statistician George E. P. Box stated: "All models are wrong, but some are useful."

of modeled occupancy rates) would assist future evaluations of the NSO's status and trends on industrial timberlands in California.

Acknowledgements

Source-Sink Dynamics

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Schumaker et al. (2014) recently published a rangewide study of source-sink dynamics for NSO. Their source-sink simulation modeling incorporated an array of regional data for NSO occupancy rates, movement distances and rates, life history attributes, habitat suitability and connectivity, encounter rates with barred owls, and environmental stochasticity. Source-sink dynamics in this study emerged from simulated interactions between individual NSOs and landscapes, rather than being predefined based on habitat suitability as was done in previous studies. The simulation models by Schumaker et al. (2014) predicted that most ecological regions and physiographic provinces currently function as population sinks for NSOs (Figures 1.22 and 1.23). The study's results projected that the Klamath Provinces of California and Oregon and the Interior Northern Coast Ranges of California are the subspecies' strongest population sources (Figure 1.23). The Klamath Provinces appear to be particularly important for maintaining NSO population stability due not only to being net population sources but to their high levels of population connectivity with multiple surrounding regions (Schumaker et al. 2014; Figure 1.23). The Redwood and Southern Cascades regions in California were both classified as moderate population sinks. Schumaker et al. (2014) identified the Klamath Provinces and California Cascades as areas in which it could be particularly important to focus habitat protection and restoration efforts, respectively.

Comment [JRD1]: They also may help identify areas where restoration of habitat, or management of barred owls, could be warranted.

Comment [JRD2]: I think Lowell's comment is reasonable here – maybe the point is that source-sink evaluations, and subsequently identifying sources and sinks is absolutely scale dependent. Thus, the sources and sinks we found in the Schumaker et al. paper, because the scale was so big (regions/provinces were millions of acres each) means that they were comprised of both sources and sinks. If we were to have looked at a smaller scale we would have more nuanced descriptions of sources/sinks – it is an important point.

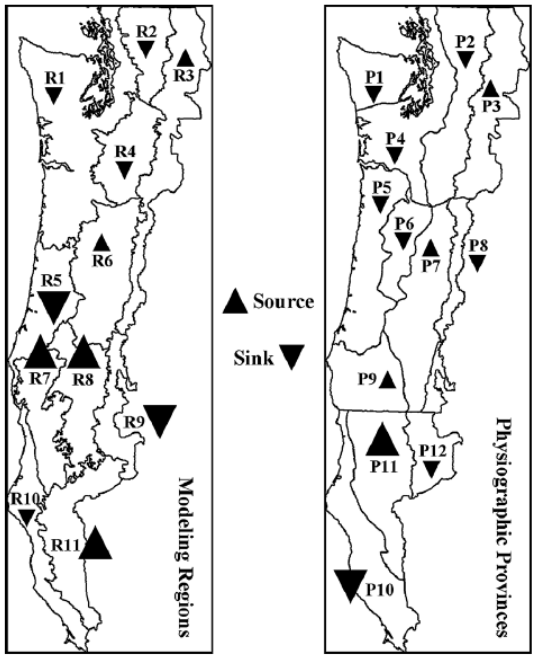
Comment [JRD3]: I might add to that sentence "…for NSO at the (large) spatial scale of modeling regions and ecogeographic provinces.

Comment [JRD4]: We didn't really use "occupancy rates" but we did include habitat suitability.

Comment [JRD5]: See previous comment on spatial scale.

Comment [JRD6]: Lowell's comment on not drawing management conclusions from simulations/models. I see his point, but none of the demographic studies is near big enough to do what he's saying – we did a range-wide analyses (not a tiny portion of the range, like individual DSAs are…and even cumulatively they're <12% of the range). Thus, I kind of think that saying the source/sink stuff should "only be used to develop testable hypotheses" – really means that it will never happen at the range-wide scale. We either go with the higher uncertainty simulation data, or simply leave it a "blank spot on the map."

Figure 1.22: Relative source and sink values in northern spotted owl modeling regions and physiographic provinces (from Schumaker et al. 2014). The sizes of symbols denote major versus minor or moderate sources and sinks.



R7: Klamath West, R8: Klamath East, R9: Eastern Cascades South, R10: Redwood Coast, R11: Inner California Coast Ranges, P10: California Coast Range, P11: California Klamath, P12: California Cascades. See Schumaker et al. (2014) for other modeling regions and physiographic provinces.

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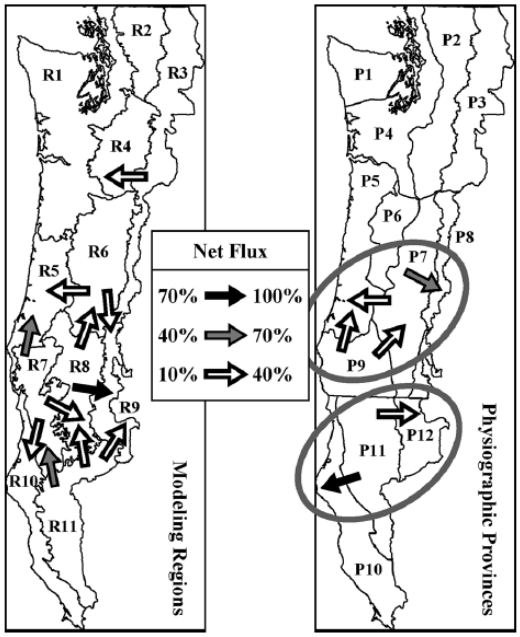


Timber Harvesting

Timber harvesting was a primary impetus for federal listing of the NSO and is still regarded as one of the major threats to the subspecies (Thomas et al. 1990, USFWS 1990, Courtney et al. 2004, USFWS 2011a). Timber harvesting can directly impact NSO populations by removing, degrading, or fragmenting habitat for them or their prey (reviewed below). Harvesting might also indirectly affect NSOs by increasing effects of other stressors, such as competitive pressure from barred owls (*Strix varia*) (Dugger et al. 2011, Forsman et al. 2011; see *Threats: Cumulative and Interactive Effects*). However, timber harvesting likely has complex effects on NSOs in the southern part of their range due to divergent effects of habitat conditions on survival versus reproduction (Franklin et al. 2000, Olson et al. 2004, Diller et al. 2010). The information reviewed herein suggests that some forms and amounts of harvesting are sustainable in northern California but that large-scale removal or fragmentation of habitat around activity centers can strongly impact NSOs (reviewed below and in USFWS 2009).

Comment [UFS1]: As in fire review… should define habitat in more specific terms when warranted.

The kinds of habitat concentrations associated with high survival and fitness of NSOs may be limited in some parts of the subspecies' range due to removal of the majority of old forest during the 19th and 20th centuries (USFWS 1990, Strittholt et al. 2006). Harvesting has been substantially reduced on federal lands since implementation of the Northwest Forest Plan (Healey et al. 2008, Davis and Dugger 2011, Moeur et al. 2011, Kennedy et al. 2012). However, removal of suitable NSO habitat continues on federal lands and is occurring at higher rates on non-federal lands (Davis and Dugger 2011). Habitat loss to logging is only partially offset by recruitment of new habitat ~~on non-federal lands~~ (Davis and Dugger 2011, Moeur et al. 2011;

Comment [UFS2]: Not just federal

reviewed below). This is cause for concern since non-federal lands contain a considerable portion of remaining suitable breeding habitat for the subspecies and because recovery of the NSO partially depends on voluntary conservation efforts on these lands (USFWS 2011a; see *Legal and Regulatory Framework*). The timber industry has cited relatively strict harvest regulations in California as evidence that listing of the NSO under the California Endangered Species Act is unnecessary (California Forestry Association 2014). Yet, contemporary harvesting has still resulted in a net loss of suitable breeding habitat for NSOs on non-federal lands in California (Davis and Dugger 2011, Moeur et al. 2011; reviewed below). Furthermore, the U.S. Fish and Wildlife Service (2009) recently concluded that California's regulations for avoiding take inadequately protect the subspecies and do not reflect the best available science (reviewed below; also see *Threats: Inadequacy of Regulatory Mechanisms*).

Comment [UFS3]: How much is "considerable"? Perhaps state as a percentage of total.

Responses of NSOs to Timber Harvesting

Interior Northern California

NSOs in interior northern California show a strong general preference for relatively old, structurally complex forest. This is illustrated by studies describing both plots around NSO locations (Solis and Gutierrez 1990, Rissler 1995, White 1996, Hershey et al. 1998; but see Irwin et al. 2013) and landscape-scale analysis areas around activity centers (Chávez-León 1989, Solis and Gutierrez 1990, Hunter et al. 1995, Gutierrez et al. 1998). This body of research can be used to inform conservation measures for NSOs in interior northern California (e.g., for evaluating appropriate habitat definitions in take-avoidance guidelines: USFWS 2009). However, the

following review is focused on studies of associations between landscape-scale habitat attributes and NSO demography in interior forests (Franklin et al. 2000, Olson et al. 2004, Dugger et al. 2005, Schilling et al. 2013). These studies are based on rigorous demographic data and provide the best available insight into potential effects of timber harvesting on NSO populations (USFWS 2009). We supplement this review with information from studies of associations between landscape-level habitat characteristics in southern interior forests and the NSO's home range sizes (Carey et al. 1992, Carey and Peeler 1995, Schilling et al. 2013) and probability of occurrence (Zabel et al. 2003, Carroll and Johnson 2008).

Comment [UFS4]: Tempel et al in press might also be good here.

In the California Klamath, Franklin et al. (2000) found that NSO survival was highest when estimated breeding core areas (390 ac) contained large amounts of both "core" (>326 ft from edge) older forest (conifer or mixed forest with conifer QMD ≥21 in and canopy cover ≥70%) and edge with other vegetation classes. In contrast, reproduction was typically highest with lower amounts of core older forest and greater amounts of edge. Estimated core areas supporting high fitness for NSOs (a function of both survival and reproduction) contained both a large concentration of core older forest and considerable habitat edge provided by a mosaic of other vegetation patches with convoluted shapes. Franklin et al. (2000) emphasized the difference between total area of older forest versus area of core older forest. For example, they noted that large amounts of older forest edge cannot occur with low total amounts of older forest. This study did not directly address effects of timber harvesting on NSOs. Vegetation other than older forest was combined into a single class and edges occurred wherever that class and older forest met. Franklin et al. (2000) noted, however, that the dominant silvicultural system in their study

area at that time was large-scale clearcutting, which they concluded was unlikely to contribute to the kinds of habitat mosaics found in territories supporting high fitness.

In the interior of the Oregon Coast Range, Olson et al. (2004) found that NSO survival was positively associated with greater amounts of both "mid-seral" (9.5-31.5 in DBH) and "late-seral" (>31.5 in DBH) forest in landscapes around activity centers (≤4,921 ft) and lower amounts of early-seral forest and non-forest (<9.5 in DBH). Reproduction, in contrast, was negatively associated with area of mid- and late-seral forest and positively associated with edge between early-seral and non-forest and other vegetation classes. Olson et al. (2004) encountered technical difficulties with the habitat fitness potential portion of their modeling but noted that territories supporting high fitness must contain attributes associated with both high survival and high reproduction. This was supported by diagrams made from aerial photos of landscapes around activity centers, which showed remarkably similar habitat mosaics to those presented by Franklin et al. (2000).

Dugger et al. (2005) found a positive association between NSO survival in the Oregon Klamath Province and greater amounts of mature and old forest (≥100 yrs) within estimated core areas (413 ac) and a moderate amount of non-habitat (non-forest, early-seral vegetation, and older forest with harvest entries ≥40% basal area) in the landscape beyond the core area (3,430-ac ring). The specific contribution of timber harvesting (and of different harvest types and intensities) to the non-habitat class and thus, its effects on NSO fitness, were not reported. This study's findings differed from others in that reproduction was positively, rather than negatively, associated with greater amounts of older forest within estimated core areas. These findings

Comment [UFS5]: Differentiate between "core area" and "core habitat".

suggest that widespread harvesting of older forest within NSO core areas would negatively effect both survival and reproduction in this area but that some level of harvesting might be sustainable in the broader landscape (to the degree that it contributes to "optimal" amounts of non-habitat in the 3,430-ac ring surrounding estimated core areas).

Schilling et al. (2013) found additional evidence of a positive influence of both older forest and habitat heterogeneity on NSO survival in the Oregon Klamath. Their best performing model indicated that monthly survival probabilities for NSOs were highest when home ranges (based on radio-telemetry) contained more patches of mature and old forest (≥20 in DBH and ≥40% canopy cover). The second best performing model indicated a positive association between survival and clustering of (i.e., close distances between) older forest patches. Unlike other studies, they did not find an association between survival and total amount of older forest. They noted that this could have occurred due to their small sample size or because most NSO home ranges in their study had amounts of mature and old forest (mean = 72%) that likely exceeded threshold amounts required for survival. A third competitive model suggested that survival was also positively associated with a moderate amount of edge between forest (mean DBH ≥5 in) and other cover classes; thus providing additional support for the value of habitat heterogeneity for NSOs in southern interior forests.

Zabel et al. (2003) modeled probability of NSO occurrence (i.e., habitat suitability) across interior northern California based on habitat conditions at an estimated core area scale (500 ac). The best performing model in their study indicated that the probability of NSOs occurring in a given location was highest with large amounts of suitable nesting-roosting habitat (generally ≥17

in DBH and canopy cover ≥60%) and intermediate amounts of foraging habitat (≥10 in DBH and canopy cover ≥40%) at the core area scale. The second and third best performing models at the core area scale included habitat edge. The results of this modeling study provide further support for conclusions that a combination of both a large concentration of suitable habitat and some form of habitat heterogeneity is important to NSOs in interior northern California.

Carroll and Johnson (2008) also modeled probability of NSO occurrence in interior northern California. Based on their best model, predicted abundance of NSOs in the area was highest when most of the landscape (5,930-ac areas) consisted of mature and old forest (>50 yrs). However, predicted abundance slightly declined when area of mature and old forest increased beyond about 80% of the landscape. This study therefore, provides evidence of at least a slight positive effect of other vegetation classes on probability of NSOs occurring in a given area. These results contrasted with the study's findings for more northern parts of the NSO's range, where the probability of occurrence continued to increase (albeit diminishingly) with greater amounts of older forest.

Studies of home range sizes provide another line of evidence concerning habitat and harvesting influences on NSOs in interior southern forests. Home range studies in the Oregon Klamath found that home range size increased with habitat fragmentation (Carey et al. 1992, Schilling et al. 2013). NSOs in the area are known to use regenerating harvest units for foraging, particularly when closer to the activity center or outside the breeding season (Carey and Peeler 1995, Irwin et al. 2013). However, Carey and Peeler (1995) concluded that the energetic benefit of increased

access to dusky-footed woodrats (*Neotoma fuscipes*) in heavily fragmented forest is often outweighed by the energetic cost of increased travel.

In summary, studies in interior northern California have found that NSOs in the region benefit from both large amounts of older forest concentrated around activity centers and some form of habitat heterogeneity (Franklin et al. 2000, Zabel et al. 2003, Carroll and Johnson 2008). Similar results have been found in the Klamath (Dugger et al. 2005, Schilling et al. 2013) and interior Coast Range of Oregon (Olson et al. 2004). These findings suggest that timber harvesting is sustainable in southern interior forests, provided that suitable breeding habitat is retained in sufficiently large concentrations around NSO activity centers (USFWS 2009). However, whether and how timber harvesting contributes to beneficial habitat heterogeneity in interior southern forests is unclear. Available studies differed in their findings of types, amounts, and locations of beneficial heterogeneity and did not directly evaluate whether timber harvesting contributed to it. In contrast, it is clear from research of associations between landscape-level habitat attributes and NSO demography, presence, and home range size that harvesting within core concentrations of suitable habitat has the potential to strongly impact populations in southern interior forests (USFWS 2009). Despite the volume, rigor, and applicability of research showing associations between landscape-level habitat attributes and NSO fitness, California has yet to integrate it into take-avoidance regulations for interior timberlands (see *Threats: Inadequacy of Regulatory Mechanisms*).

Comment [UFS6]: Is this the proper word? It implies even flow through time. I think you mean compatible or something along those lines.

Comment [UFS7]: Positively or negatively? Be clear

Redwood Province

Most of what is known about NSOs in the Redwood Province is based on research on intensively harvested lands owned by the Green Diamond Resource Co. Studies on these lands found a preference among NSOs for landscapes with greater amounts of intermediate-age or older forest than expected based on general availability of those forest classes (Thome et al. 1999, Folliard et al. 2000, Keithley and Motroni 2000, Gonzales 2005, Diller et al. 2010). However, site fidelity and reproduction on these lands were positively associated with presence of younger forest classes and measures of habitat heterogeneity (e.g., edge) (Thome et al. 1999, 2000, Diller et al. 2010). Studies of the habitat associations of dusky-footed woodrats on these lands appear to provide additional support for the value of younger forest and habitat heterogeneity to NSOs in the area (Hamm et al. 2007, Hamm and Diller 2009). Unpublished but relatively rigorous modeling of associations between landscape-level habitat attributes and NSO fitness and population growth rate has confirmed that NSOs on Green Diamond lands have complex relationships with timber harvesting (Diller et al. 2010). NSOs in this area indeed appear to benefit from some level of habitat heterogeneity, which is currently maintained on Green Diamond lands through small-patch clearcutting (Diller et al. 2010). Yet, habitat quality on these lands (measured as habitat fitness potential *sensu* Franklin et al. 2000) is positively associated with protection of suitable breeding habitat and both habitat quality and population growth rate are negatively associated with harvesting of suitable habitat (i.e., take) (Diller et al. 2010). Thus, appropriate management of NSOs on Green Diamond lands appears to include avoiding take, setting aside suitable habitat from harvesting, and focusing economically-driven harvest requirements in relatively homogeneous blocks of unsuitable forest. Diller et al. (2010)

did not describe habitat conditions associated with habitat fitness potential ≥1 (i.e., conditions associated with NSOs replacing themselves or contributing to a population surplus). Peer reviewed reporting of these conditions is needed in order to identify appropriate take-avoidance guidelines for the northern part of the Redwood Province (see *Threats: Inadequacy of Regulatory Mechanisms*).

Less is known about the ecology and appropriate management of NSOs on other ownerships within the Redwood Province. Habitat selection by NSOs appears to vary among ownerships in the region (Keithley and Motroni 2000, see Appendix 1). The USFWS (2011a, 2012a) recently conducted habitat suitability modeling based on attributes of landscapes (494 ac) surrounding 392 activity centers distributed across much of the province. The model selected for the region included a suite of habitat variables and performed well in terms of its ability to discriminate between areas around NSO activity centers and random sites. The resulting map of relative habitat suitability was incorporated into the USFWS (2012a) process for designating critical habitat for NSOs but has limited utility for characterizing habitat selection by the subspecies. However, "deconstruction" of the habitat suitability modeling outputs (cf. Dunk and Hawley 2009, Woodbridge et al. 2012, Zielinski et al. 2012) allows evaluation of associations between habitat suitability and the full range of candidate variables, including ones not included in the best performing model. Deconstruction of the habitat modeling output for the Redwood Province shows that the probability of NSOs occurring in a given area in the region increases with larger amounts of forest with relatively dense canopy cover and large diameter trees (Appendix 2). Compared with those in the lowest suitability class, landscapes in the highest suitability class contained an average of 1.8 times more nesting-roosting habitat; 2.4 times higher

basal area of conifers ≥20 inches DBH; 2.3 times higher basal area of live trees ≥30 inches DBH; and 2.0, 1.8 and 1.9 times higher densities of conifers ≥20, 30, and 39 inches DBH, respectively. There was a high degree of variability (standard deviation) in terms of structural attributes within habitat suitability classes, particularly for rare habitat elements such as very large diameter trees. This variability likely reflects the high diversity of forest types, management histories, and natural disturbance regimes in the region (see Sawyer 2006, 2007, Stuart and Stephens 2006). Nonetheless, consistent patterns of association between habitat suitability and mean amounts of these variables are evident. In addition, variability in amounts of many of these habitat attributes (coefficient of variation) declined with increasing habitat suitability, further indicating that they are often important to NSOs in the province. These results suggest that timber harvesting that reduces availability of these structural attributes would generally reduce the probability of NSOs occurring in a given area within the Redwood Province. Changes in availability of these structural attributes can occur with a variety of silvicultural approaches and are not solely caused by even-age harvesting.

Effects of Uneven-Age Harvesting and Thinning

Comment [UFS8]: There is a recent pub (GTR) that has a section on this. See Wilson and Forsman. 2013. Thinning Effects on Spotted Owl Prey and Other Forest-Dwelling Small Mammals, in:

Anderson, Paul D.; Ronnenberg, Kathryn L., eds. 2013. Density Management in the 21st Century: West Side Story. Gen. Tech. Rep. PNW-GTR-880. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 249 p.

Some private timberlands in northern California currently emphasize uneven-age regeneration, which typically causes less visually dramatic changes to forests than does even-age harvesting. This form of harvesting nonetheless has the potential to cause substantial changes to forest structure or composition. For example, intensive selective logging of Douglas-fir (*Pseudotsuga mensiesii*) has resulted in extensive conversion of mixed-evergreen forest to hardwood-dominated forest in parts of the Redwood Province (Sawyer 2006). Relatively little harvesting

has occurred on federal lands within the NSO's range since adoption of the Northwest Forest Plan (Davis and Dugger 2011, Moeur et al. 2011, Kennedy et al. 2012; see below). However, federal agencies have recently expressed support for widespread thinning to reduce wildfire risk in interior forests in the Plan area (USFWS 2011a, 2012a).

Effects of contemporary uneven-age harvesting and thinning on NSOs are difficult to evaluate due to the paucity of rigorous research on the topic. Most of the available information about NSO responses to these silvicultural systems is based on the behavior of very small numbers of telemetered owls and was gathered in an opportunistic fashion during studies of other topics (reviewed in Hansen and Mazurek 2010, USFWS 2011a; see below). Evaluation of this topic is further complicated by poor descriptions of harvest methods, locations and intensities and, perhaps more importantly, post-harvest habitat conditions. The terms uneven-age harvesting and thinning encompass a tremendous variety of harvest types, objectives, and effects (Smith 1986). Harvesting described in relation to NSO telemetry consisted of a variety of commercial thinning or partial harvesting (leaving residual trees) prescriptions, including understory thinning of various intensities, removal of most trees up to a relatively large diameter class, and shelterwood harvests prior to or without removal of residual trees (see Hansen and Mazurek 2010).

In a synthesis prepared for the 2011 revised recovery plan for the NSO (USFWS 2011a), Hansen and Mazurek (2010) provided detailed summaries of data concerning responses of both NSOs and California spotted owls (CSOs) to uneven-age harvesting, partial harvesting, and thinning. This information was gleaned from both peer-reviewed and gray literature and was based on small sample sizes. The authors therefore, opted to review each data source as a "case study" so

that relatively detailed descriptions of harvesting and post-harvest conditions could be provided and so that the methodological strengths and weaknesses of studies could be evaluated. We summarize their review below, with the addition of one subsequent citation (Gallagher 2010).

Each of the 12 studies that we reviewed documented at least some use by NSOs or CSOs of areas harvested with uneven-age harvesting, partial harvesting, or thinning. At least four of the studies found owls nesting in harvest areas (Forsman et al. 1984, Zabel et al. 1992, King 1993, and Buchanan et al. 1995) and at least five recorded roosting in them (Solis 1983, Sisco 1990, King 1993, Hicks et al. 1999, and Meiman et al. 2003). It is important to note, however, that older forest structural attributes had been retained or regenerated in most of the harvest areas used for nesting or roosting. Three of the four studies that documented nesting in harvest areas described the nest stands as mature or old forest or an equivalent classification (USFS Region 5 "suitable habitat"; "understory reinitiation phase…of stand development"). The other study did not describe the harvest area used for nesting (King 1993). Harvest areas used for roosting in three studies likewise were either classified as mature or old forest (Solis 1983) or contained some older-forest structural characteristics, such as relatively high basal area or dense canopy cover (King 1993, Meiman et al. 2003). Two studies observed roosting in harvested stands that appeared to differ from this pattern; but one of the authors thought that the deaths of three birds that roosted in them were due to higher predation risk in the more open stands (Sisco 1990, Hicks et al. 1999).

Most of the reviewed studies found that spotted owls foraged to some degree in uneven-age harvested, partially harvested, or thinned areas. Irwin et al. (2005, 2008) stated that some NSOs

in their study areas selectively used certain harvest units but not others. However, they did not provide quantitative comparisons of prescriptions, post-harvest conditions, or proximities of harvest units to activity centers. Two other studies found that spotted owls generally avoided foraging in areas that recently experienced moderate to intensive partial harvesting or thinning, whereas use of lightly harvested areas varied among individuals (Anthony and Wagner 1999, Gallagher 2010). Anthony and Wagner (1999) found that NSOs (n = 15) in southern Oregon foraged in heavy and moderate partial-cuts less than expected (old stands with ≥30-40% of the original basal area removed and ≥"moderate" canopy cover reduction). Light partial-cuts (old forest with ≤20% of the original basal area removed and "small" reductions of "crown cover" [not described]) were used more than expected by two owls, as often as expected by five, and less than expected by eight. In the northern Sierra Nevada, Gallagher (2010) found that CSOs (n = 9) used heavily thinned "defensible fuel profile zones" (canopy cover reduced to 40%, removal of trees <30 in DBH, reduction of tree density and ladder and surface fuels) less than expected based on availability. She also reported a near-significant tendency ($p = 0.08$, n = 5) for avoidance of areas recently treated with understory thinning. Use and availability of harvest areas varied among individuals. Most individuals exhibited avoidance of defensible fuel profile zones and understory thins but one male showed strong selection for thinned areas (primarily understory thins). It is possible that thinning improved prey availability or otherwise benefited this male. However, Gallagher (2010) noted that thinning treatments were located unusually close to this male's activity center, which potentially increased his likelihood of using them due to central place foraging. She also noted that an unusually large proportion of understory thin units in the male's home range were also treated with prescribed fire, which could have temporarily increased abundances of deer mice (*Peromyscus* spp.) or other prey.

The limited available information suggests that thinning and uneven-age harvesting causes some spotted owls to increase their home range sizes, which could impose energetic costs on individuals (Meiman et al. 2003, Gallagher 2010). Meiman et al. (2003) reported that a male NSO's breeding season home range in the Oregon Coast Range was slightly larger before commercial thinning than afterward but that its nonbreeding season home range was 2.3 times larger. The individual appeared to shift its breeding season core area to include less of the thinned area and its nonbreeding season core area was more than twice as large following thinning as it was prior to thinning. In the northern Sierra Nevada, Gallagher (2010) found that the home range sizes of CSOs (n = 9) significantly increased with greater total area of fuels treatments (defensible fuel profile zones and understory thinning). She also reported near-significant trends of increasing home range size with greater area of defensible fuel profile zone ($p = 0.08$) and group selection harvesting ($p = 0.06$).

Four studies reported that thinning or partial harvesting near nests or roosts displaced spotted owls from those areas (Forsman et al. 1984, King 1993, Hicks et al. 1999, Meiman et al. 2003; also J. Reid, pers. comm.). The only study to describe this effect for more than two NSOs suggested that pairs' responses to harvesting near their nests depended on the intensity of the harvest, whether or not habitat in the nest area was excluded from harvesting, and whether or not suitable alternative habitat was available within the home range (Forsman et al. 1984).

The US Fish and Wildlife Service has expressed support for widespread thinning to reduce the risk of severe wildfire in dry forests within the NSO's range (USFWS 2011a, 2012a). Our

review suggests that spotted owls are often resilient to wildfire (and may benefit from low severity or patchy fire in southern forests) but that extensive severe fire can negatively affect the species by reducing amounts and contiguity of nesting and roosting habitat (see *Threats: Wildfire*). This conclusion might appear to support widespread thinning to reduce the risk of large severe fires. However, preliminary findings of negative effects of thinning on the species and the overall lack of reliable information on the topic suggest that more research is needed before thinning is employed at broad scales within the NSO's range. If widespread thinning is applied prior to rigorous study of its effects, our review suggests that it should be conducted well away from NSO activity centers and focused in young, homogeneous stands that are less suitable for NSOs and where thinning might increase habitat heterogeneity or accelerate development of complex, older-forest structure for prey (Carey 2006; but see below regarding effects of thinning on primary prey species). Planning of treatments should also integrate regional or local information about relationships between wildfires and topography (see *Threats: Wildfire*), the composition of NSO diets or prey communities, and other ecological factors that could influence how thinning affects wildfires and NSOs.

Timber Harvest Effects on Prey

The primary prey for NSOs in California are dusky-footed woodrats (*Neotoma fuscipes*), northern flying squirrels (*Glaucomys sabrinus*), and tree voles (*Arborimus* spp.) (Zabel et al. 1995, White 1996, Ward et al. 1998, Farber and Whitaker 2005, Diller et al. 2010, Klamath National Forest, unpubl. data). Other important prey in the state (either in terms of frequency or biomass contributions to diets) include other voles (*Myodes californicus*, *Phenacomys* spp., and

Microtus spp.), deer mice (*Peromyscus* spp.), pocket gophers (*Thomomys* spp.), broad-footed moles (*Scapanus latimanus*), and juvenile brush rabbits (*Sylvilagus bachmani*) and snowshoe hares (*Lepus americanus*). These species have a broad array of habitat associations and thus, respond quite differently to timber harvesting and other forest disturbances (Zeiner et al. 1990). Below we focus solely on timber harvest effects on the three primary prey species for NSOs in California. It is important to acknowledge, however, that NSOs typically have broad diets (see diet studies cited above) and that other prey species may also influence spotted owl demographic rates (Ward and Block 1995, Rosenberg et al. 2003).

Dusky-footed woodrats can occur in relatively high abundances in old forest, particularly in riparian areas and other locations with a well developed understory or brush layer (Carey et al. 1992, 1999). However, they generally reach their highest abundances in stands of brushy pole-timber that develop following severe disturbances (Carey et al. 1992, 1999, Sakai and Noon 1993, Anthony et al. 2003, Hamm et al. 2007). Thus, intensive harvesting of intermediate-age stands can result in temporary increases in abundance of dusky-footed woodrats. There is little information regarding effects of less intensive harvesting on dusky-footed woodrats. Hamm and Diller (2009) rarely found dusky-footed woodrats in thinned stands on private timberlands in the Redwood Region. They suggested that thinning without prescribed burning was insufficient for promoting growth of the disturbance-adapted shrubs locally favored by the species (see *Threats: Wildfire* regarding short-term effects of fire on prey).

Densities and demographic rates of northern flying squirrels are positively associated with habitat elements found in forests (e.g., arboreal lichens, truffles, and snags: Rosenberg and

Anthony 1992, Carey 1995, Waters and Zabel 1995, Gomez et al. 2005, Meyer et al. 2005, Lehmkuhl et al. 2006). Thus, they are likely to respond negatively to intensive forms of timber harvesting (e.g., Waters and Zabel 1995). Northern flying squirrels are also generally sensitive to habitat fragmentation caused by intensive harvesting (Smith 2007). For example, Rosenberg and Raphael (1986) found that densities of northern flying squirrels in the California Klamath Province were substantially lower in the smallest and most insular habitat patches (due to surrounding clearcut harvesting) than in the largest and best connected patches.

Research concerning the effects of thinning and other lower-intensity forms of harvesting on northern flying squirrels has generated inconsistent results (e.g., Carey 2000, Ransome and Sullivan 2002, Ransome et al. 2004, Gomez et al. 2005, Manning et al. 2012). Some of the inconsistency appears to be due to whether treated young stands are compared with structurally simple young stands (e.g., Gomez et al. 2005), structurally complex young stands (e.g., Carey 2000), or stands that have not recently experienced harvesting (Holloway and Smith 2011). The available research suggests that treated stands are more likely to contain relatively low abundances of northern flying squirrels when compared with structurally complex or mature and old stands, whereas they may exhibit similar or even higher abundances when compared with structurally simple young stands. Harvest intensity and levels of retention appear to be another major determinant of thinning effects on northern flying squirrels, with higher intensity thinning (lower retention levels) having stronger negative effects (Meyer et al. 2007, Holloway and Smith 2011, Manning et al. 2012; but see Ransome et al. 2004). Whether thinning is patchy or uniform (in terms of location and intensity) might also be important. For example, thinning can reduce the availability of truffles, the northern flying squirrel's primary food, for more than 10-20 years;

but variable-density thinning appears to be less harmful than commercial thinning (Waters et al. 1994, Colgan et al. 1999, Luoma et al. 2003, Meyer et al. 2005).

Tree voles generally occur at higher densities in old forests than in young forests (reviewed in Sztukowski and Courtney 2004, USFWS 2011b) and selectively use forests containing higher concentrations of habitat elements typically found in older stands (e.g., older stand age, larger diameter downed wood, greater basal area: Dunk and Hawley 2009). Tree voles are thought to be highly vulnerable to logging and other disturbances that reduce the extent and contiguity of old forests (Carey 1991, Huff et al. 1992, Hayes 1996, Adam and Hayes 1998, USFWS 2011b). Some tree vole populations occur in intensively managed landscapes with little or no old forest (e.g., Thompson and Diller 2002). However, the US Fish and Wildlife Service (2011b) noted that "the limited evidence available suggests that tree vole occupation of younger forest stands may be relatively short-lived (Diller 2010, pers. comm.) or intermittent (Hopkins 2010, pers. comm.)." Based on the natural histories of these species, reducing or fragmenting older forest could negatively affect them; but retention of older Douglas-fir (*Pseudotsuga menziesii*) trees and patches of well-connected canopy might ameliorate those impacts (Hayes 1996, Adam and Hayes 1998, USFWS 20011b). Clear-cutting and other severe disturbances should have the strongest effects on tree voles, due to the species' diet, nesting habitat associations, arboreal mode of travel, and apparently poor mobility (USFWS 2011b).

Habitat Lost to Past Timber Harvesting (1800s to 1994)

Rigorous research has shown that the fitness of NSOs in the southern part of their range is highest in landscapes with large concentrations of suitable breeding habitat (reviewed above). Herein we review information showing that the current availability of suitable breeding habitat was strongly affected by past timber harvesting, which removed or modified the majority of old forest that existed historically.

We are unaware of any estimates of the amount of suitable NSO habitat that existed at the time of Euro-American settlement (early to mid-1800s). Nesting-roosting habitat for NSOs generally occurs in relatively old, structurally complex conifer forest (Blakesley 2004). It is therefore, reasonable to evaluate historical trends in old conifer forest as a rough proxy for changes in amounts of suitable NSO habitat (USFWS 1990). Estimates reviewed for the NSO's federal listing determination indicated that approximately 18-24 million acres of old forest existed in western Oregon and Washington and northwestern California during the early to mid-1800s (USFWS 1990). These estimates did not include all regions or potentially suitable forest types within the subspecies' range. After including all regions and conifer forests, Strittholt et al. (2006) estimated that about 40 million acres of old conifer forest (>150 yrs) existed at the time of Euro-American settlement (Table 2). This is a crude approximation, as it is based on incomplete historical information and an assumption that nearly all pre-settlement conifer forest was old (i.e., had not experienced severe disturbance within the previous 150 years). However, Strittholt et al. (2006) noted that their regional estimates closely matched previous estimates for similar

regions and forest types, suggesting that they provide a reasonable baseline for comparison with contemporary forest conditions.

Using satellite imagery, Strittholt et al. (2006) estimated that 11.5 million acres of old conifer forest existed in 2000 (Table 2). Thus, approximately 72% of old conifer forest was lost in the Pacific Northwest during the 19th and 20th centuries (Table 2). This estimated post-settlement loss of old conifer forest is similar to earlier estimates of 60-88% reviewed in the NSO's federal listing determination (USFWS 1990). Strittholt et al. (2006) did not provide estimates of old forest declines by political boundaries so we cannot report their estimates for California alone. Old conifer forests declined by 62% in the Klamath provinces ("Klamath-Siskiyou Forests") and 79% in the eastern Cascades provinces ("Eastern Cascades Forests"), both of which substantially overlap with the NSO's range in northern California. Other than in two small regions surrounding major population centers in Washington and Oregon, declines in old conifer forest were primarily caused by widespread intensive logging (Strittholt et al. 2006). Mountainous terrain in the Klamath and eastern Cascades limited timber harvesting compared with more accessible areas but major losses of old conifer forest nonetheless occurred in those areas (Strittholt et al. 2006). Strittholt et al. (2006) did not evaluate trends in amounts of old forest for the Redwood Province but other sources estimated that 85-96% of old redwood forest was lost to intensive timber harvesting during the post-settlement period (USFWS 1992).

Table 2: Area (ha) of Pacific Northwest ecoregions and estimated historical (early to mid-1800s) and contemporary (2000) extents of old (>150 yrs) and mature (50-150 yrs) conifer forest within them (from Strittholt et al. 2006).

	Cascade Mountain Leeward Forests	*North Cascades Forests*	*Puget Lowland Forests*	*Central Pacific Coastal Forests*	*Central & Southern Cascades Forests*	*Eastern Cascades Forests*	*Klamath-Siskiyou Forests*	*Willamette Valley Forests*
Ecoregion area	1,600,444	1,278,056	1,719,726	4,267,988	4,481,279	5,398,139	5,033,181	1,487,769
Historical old conifer area	960,279	766,844	1,289,794	3,627,790	3,361,005	3,238,883	2,516,625	371,942
Percentage of ecoregion	60	60	75	85	75	60	50	25
Current old conifer area	420,394	511,396	67,353	668,281	1,328,796	687,836	946,394	34,993
Percentage of historical old conifer	44	67	5	18	39	18	38	9
Percent change	−56	−33	−95	−82	−61	−79	−62	−91
Mature conifer area	285,441	203,994	229,634	683,098	899,266	947,215	1,239,586	270,362
Percentage of historical old conifer	30	27	18	19	27	25	49	73
Combined area	705,835	715,391	296,987	1,351,379	2,228,063	1,635,051	2,185,980	305,355
Percentage of historical old conifer	74	93	23	37	66	43	87	82

Strittholt et al. (2006) reported that the majority of old (78%) and mature (50%) conifer forest in 2000 existed on public lands. Nearly all of the remaining old redwood forest likewise occurs on public lands (cite *[http://www.nps.gov/redw/faqs.htm]*). Much of the current difference among ownerships in amounts of older forest and suitable breeding habitat is due to past timber harvest rates. For example, loss of forest to harvesting during the 1970s through early 1990s occurred at substantially higher rates on private timberlands than on federal lands (e.g., >2 times faster in western Oregon) (Cohen et al. 2002, Staus et al. 2002, Healey et al. 2008). Nonetheless, an estimated 32% of suitable breeding habitat for NSOs occurred on non-federal lands at the time of the Northwest Forest Plan's implementation (1994), so conservation efforts for NSOs on non-federal lands remain important.

Although timber harvesting was substantially curtailed on federal lands following implementation of the Northwest Forest Plan (Healey et al. 2008, Kennedy et al. 2012; reviewed below), biologists noted the possibility that NSOs would continue to decline for many years due to lag effects of past harvesting (Courtney et al. 2004). The NSO has a relatively low

reproductive rate and might therefore be unable to immediately recover following removal or reduction of threats (Noon and Biles 1990). Furthermore, substantial recruitment of old forest and suitable nesting-roosting habitat could take multiple decades in areas that formerly experienced widespread intensive harvesting (Moeur et al. 2011; see below). Past harvesting could therefore be among the causes of continuing poor demographic performance of some NSO populations (Courtney et al. 2004). Forsman et al. (2011) noted, however, that some populations are declining on lands not previously subjected to widespread intensive timber harvesting (e.g., some National Parks). Based on this observation, they concluded that lag effects of past timber harvesting poorly explain continuing population declines. Yet, it is possible that lag effects of past timber harvesting do contribute to some population declines but that these effects are obscured by those of other stressors, such as competition with barred owls or large severe wildfires. Lag effects from past harvesting might be similarly obscured on private timberlands by impacts from barred owls and continuing timber harvesting. Timber harvesting continues to occur at high rates on private lands and is still the primary source of habitat loss for NSOs in those areas (Davis and Dugger 2011, Moeur et al. 2011, Kennedy et al. 2012).

Comment [UFS9]: Define "high" rate

Habitat Lost to Contemporary Timber Harvesting (1994-2007)

Davis and Dugger (2011) estimated NSO habitat trends following implementation of the Northwest Forest Plan. Their analyses were mostly limited to federal lands within the Plan area but they also estimated habitat trends on non-federal lands, as reported in the current NSO recovery plan (USFWS 2011a). In addition to these analyses, we review results presented by Moeur et al. (2011) because they provide some additional insight into recent habitat trends for

NSOs on non-federal lands. We do not review habitat trend estimates based on federal ESA Section 7 consultation records (Bigley and Franklin 2004, USFWS 2012b). These records provide a less consistent and complete data source than those used by Davis and Dugger (2011) (see Bigley and Franklin 2004). They may also overestimate habitat changes since they evaluate effects of planned projects, which may be greater than what is actually implemented (Bigley and Franklin 2004).

Davis and Dugger (2011) used remotely sensed (satellite imagery) vegetation data to model changes in habitat suitability for NSOs during the first 15 years of the Northwest Forest Plan (1994-2007 in California and 1996-2006 in Oregon and Washington). They modeled habitat suitability based on habitat attributes surrounding thousands of NSO pair locations. Suitable breeding habitat was defined as having both a probability of owl presence greater than expected based on random chance and environmental conditions typical of those found around nesting and roosting pairs. Habitat loss was defined as a change in suitability rank from suitable or highly suitable to marginal or unsuitable due to vegetation changes caused by forest disturbances. Davis and Dugger (2011) did not estimate recruitment of, or net changes, in breeding habitat. They felt that their remotely sensed data poorly captured the kinds of slow and subtle habitat changes that occur during development of intermediate-aged and older stands. However, Moeur et al. (2011) estimated trends in mature and old forests during the same time period, which could provide insight into net changes in breeding habitat for NSOs.

Comment [UFS10]: And forest inventory plot data

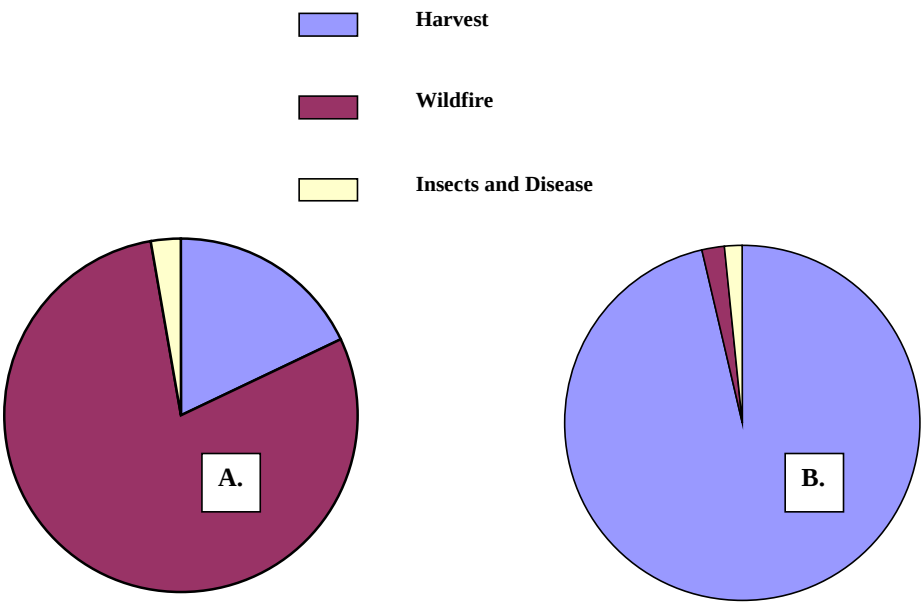
Table 3 shows estimated gross losses of suitable NSO breeding habitat to timber harvesting on federal and non-federal lands during the first 15 years of the Northwest Forest Plan (Davis and

Dugger 2011, USFW 2011a). Timber harvesting was responsible for a gross loss of about 54,000 acres (0.6%) of suitable breeding habitat on federal lands. This loss likely had little rangewide effect on NSOs but could have impacted the subspecies at local or regional scales. For example, harvesting resulted in a 3% gross loss of suitable breeding habitat on federal lands in the California Cascades, where habitat was already relatively limited. Approximately 92% of total suitable breeding habitat lost to timber harvesting occurred on non-federal lands. In contrast with federal lands, nearly all estimated gross habitat loss on non-federal lands was due to timber harvesting rather than natural disturbances (Figure 1; see *Threats: Wildfires*). In just 11-13 years, timber harvesting caused an estimated rangewide gross loss of 625,600 acres (15%) of suitable breeding habitat on non-federal lands. The largest losses on non-federal lands occurred in Oregon (301,200 ac, 22%) and Washington (234,200 ac, 19%). Non-federal lands in California experienced lower gross losses of suitable breeding habitat to harvesting (90,200 acres, 6%). Nonetheless, losses in all three states were substantial given the short time frame during which they occurred and the likelihood that little of the loss was offset by recruitment of suitable breeding habitat during that period (see below).

Table 3: Estimated gross losses of suitable NSO breeding habitat on federal and non-federal lands due to timber harvesting during 1994-2007 in California and 1996-2006 in Oregon and Washington (adapted from Davis and Dugger 2011, USFWS 2011a).

State	Ownership	Province	1994/1996 Ac	Harvest Ac	Harvest %
California	**Federal**	CA Cascades	213,200	6,500	3.0%
		CA Klamath	1,489,800	4,400	0.3%
		CA Coast	145,400	300	0.2%
		CA Federal Total	**1,848,400**	**11,200**	**0.6%**
	Non-Federal		**1,556,700**	**90,200**	**5.8%**
	Combined		**3,405,100**	**101,400**	**3.0%**
Oregon	**Federal**	OR Coast Range	611,200	3,300	0.5%
		Western OR Cascades	2,258,700	13,900	0.6%
		Eastern OR Cascades	402,900	5,800	1.4%
		Willamette Valley	3,400	100	2.9%
		OR Klamath	985,000	6,800	0.7%
		OR Federal Total	**4,261,200**	**29,900**	**0.7%**
	Non-Federal		**1,382,400**	**301,200**	**21.8%**
	Combined		**5,643,600**	**331,100**	**5.9%**
Washington	**Federal**	Olympic Peninsula	763,100	500	0.1%
		Eastern WA Cascades	673,600	8,100	1.2%
		Western WA Cascades	1,283,000	3,700	0.3%
		Western WA Lowlands	24,700	400	1.6%
		WA Federal Total	**2,744,400**	**12,700**	**0.5%**
	Non-Federal		**1,258,900**	**234,200**	**18.6%**
	Combined		**4,003,300**	**246,900**	**6.2%**
Rangewide	**Federal**		**8,853,800**	**53,800**	**0.6%**
	Non-Federal		**4,198,000**	**625,600**	**14.9%**
	Combined		**13,051,800**	**679,400**	**5.2%**

Figure 1: Proportions of suitable breeding habitat loss attributed to harvesting, wildfire, and insects and diseases on (A) federal lands and (B) non-federal lands during 1994-2007 (adapted from Davis and Dugger 2011 and USFWS 2011a).



The USFWS (2011a) and Davis and Dugger (2011) did not describe regional habitat trends for non-federal lands. However, insight into regional habitat trends on non-federal lands can be obtained from trends in mature and old forest during the same time period. Moeur et al. (2011) reported substantial gross losses of mature and old forest (mean DBH ≥20 in) on non-federal lands during the first 15 years of the Northwest Forest Plan. The largest gross losses, in terms of acreage, occurred in the Western Washington Lowlands (387,200 ac, 49%), Oregon Coast Range (362,500 ac, 50%), and California Coast Range (259,000 ac, 35%). All provinces and states within the NSO's range experienced large proportional losses, ranging from 31% in the Eastern Washington Cascades to 48% and 52% in the Klamath and Eastern Cascades of Oregon. Confirming the results of Davis and Dugger (2011; Figure 1), Moeur et al. (2011) found that gross losses of mature and old forest on non-federal lands were almost entirely due to timber harvesting (also see Kennedy et al. 2012).

Moeur et al. (2011) reported that gross loss of mature and old forest was substantially offset by recruitment into that habitat class. They noted, however, that given the short length of the monitoring period (10-14 yrs), recruitment was "likely due to incremental stand growth over the 20-in diameter threshold, or from understory disturbances that removed smaller diameter trees and raised the average stand diameter above the threshold, rather than from an increase in forests of much larger and older trees." Thus, it is unlikely that there was substantial recruitment of suitable and highly suitable breeding habitat for NSOs during this time period. This conclusion is supported by Davis and Dugger (2011), who found that most of the detectable habitat recruitment during their monitoring period occurred in the marginal suitability class, which more closely resembled their definition for dispersal habitat than for breeding habitat. Even if all

mature and old forest recruited during the first 15 years of the Plan provided suitable breeding habitat for NSOs, non-federal lands in California still experienced a net decline in area of mature and old forest during that period, and those in Washington and Oregon fared substantially worse (Moeur et al. 2011).

Future Harvesting in California

It is impossible to provide reliable projections of future timber harvesting or its effects on NSOs in California. Federal agencies have expressed support for widespread thinning to address wildfire risk on public lands in the state but we are unaware of any projections for harvest volume or effects on NSOs from these activities (USFWS 2011a, 2012a). Documents associated with Habitat Conservation Plans for private timberlands in California project substantial impacts of harvesting on some ownerships and relatively low impacts on others (see *Legal and Regulatory Framework* and *Threats: Inadequacy of Regulatory Mechanisms*). However, many landowners, in the state, including some large industrial timber companies, conduct timber harvesting outside of Habitat Conservation Plans. The state requires evaluation of potential environmental impacts of all Timber Harvest Plans but both landowners and responsible agencies have used inconsistent methods for conducting these evaluations. For example, some entities have strictly adhered to the state's Forest Practice Rules (CAL FIRE 2013), others have relied on poorly described and vetted variants of those rules (e.g., option "g+"), and still others have opted to follow US Fish and Wildlife Service (2009) recommendations. Based on an in-depth review of research concerning the NSO's habitat and spatial relationships, the US Fish and Wildlife Service (2009) recommended sweeping changes to NSO habitat retention guidelines in

the Forest Practice Rules for California's northern interior (CAL FIRE 2013). These recommendations are more scientifically supportable than are habitat retention guidelines in the Forest Practice Rules (CAL FIRE 2013), as they incorporate the large body of research of NSO-habitat relationships conducted since 1992 when guidelines in the Forest Practice Rules were created. In addition they were designed to enable CAL FIRE personnel lacking expertise with NSO-habitat relationships to properly determine if take would occur. However, the state has not officially adopted these recommendations or any other changes that incorporate the tremendous body of information about NSO-habitat relationships produced since 1992 (USFW 2009; see *Threats: Inadequacy of Regulatory Mechanisms*). Furthermore, since 2008, when the US Fish and Wildlife Service largely ceased providing technical assistance with timber harvest reviews in northern California, relatively few Timber Harvest Plans have been reviewed by personnel with sufficient biological expertise to evaluate whether or not take will occur (see *Threats: Inadequacy of Regulatory Mechanisms*). Lacking reliable harvest and take projections, and barring a major change in the legal or regulatory framework protecting NSOs, there is currently no reason to conclude that timber harvest effects on NSOs in California will substantially decline in the near future.

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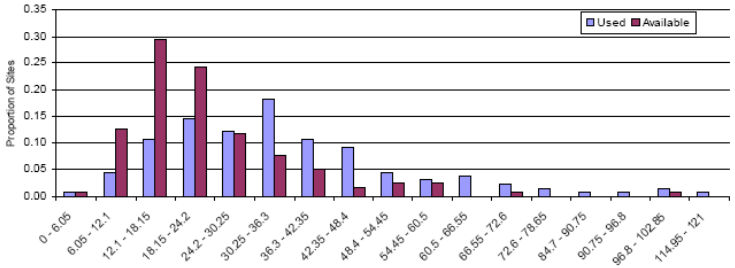
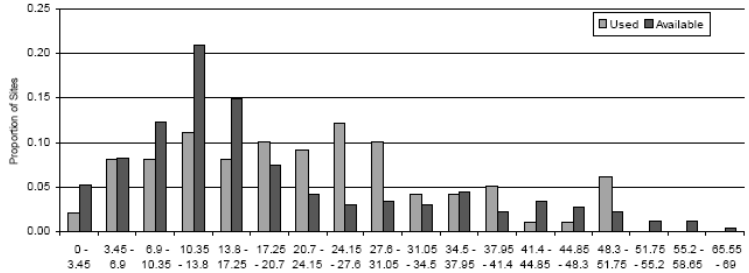
Appendix 1

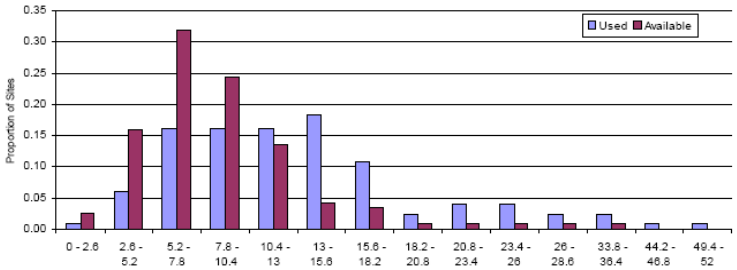
USFWS GNN (see USFWS 2011) histograms showing use by NSOs versus availability of select habitat attributes at a landscape-scale (200 ha, 494 ac) on Mendocino Redwood Co. (left column) and Green Diamond Resource Co. lands (right column).

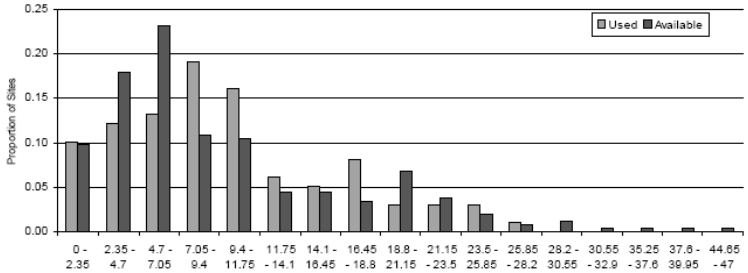
Live conifer trees per hectare ≥20 inches DBH:





Basal area of live conifers ≥20 inches DBH:

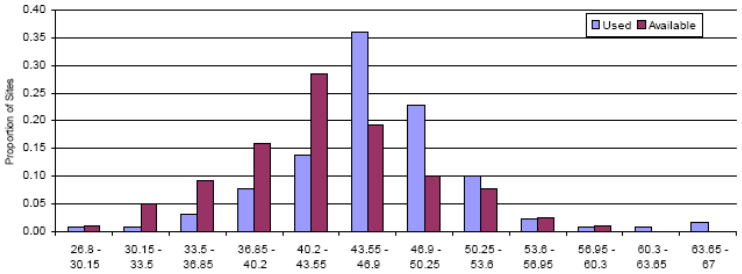


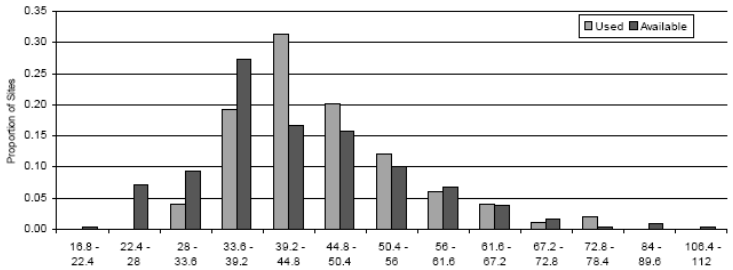


Appendix 1 (continued)

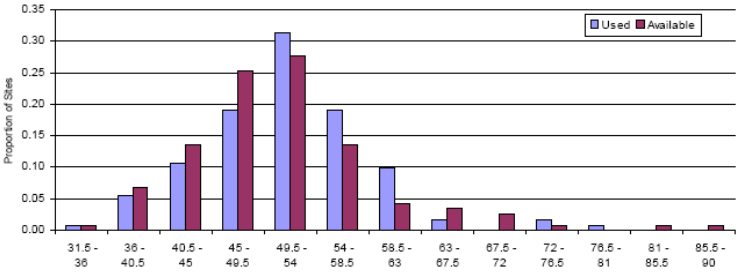
USFWS GNN (see USFWS 2011) histograms showing use by NSOs versus availability of select habitat attributes at a landscape-scale (200 ha, 494 ac) on Mendocino Redwood Co. (left column) and Green Diamond Resource Co. lands (right column).

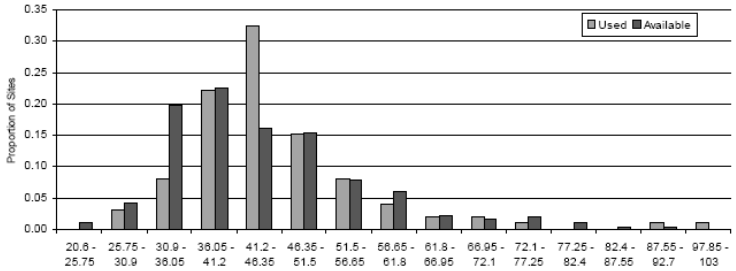
Basal area weighted mean diameter of all live conifers:





Basal area weighted stand age:

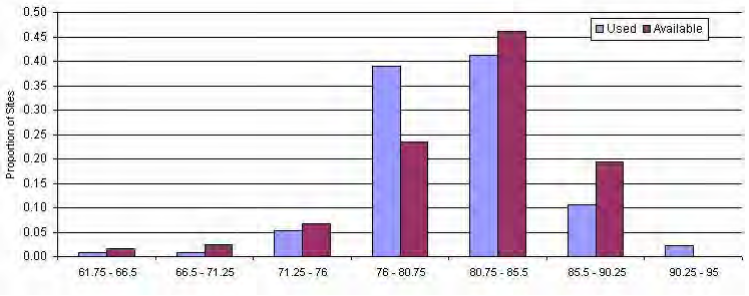


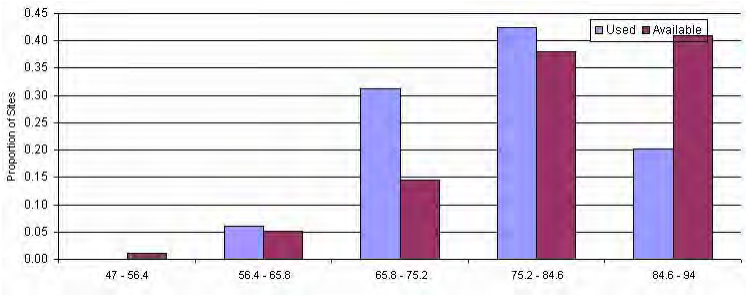


Appendix 1 (continued)

USFWS GNN (see USFWS 2011) histograms showing use by NSOs versus availability of select habitat attributes at a landscape-scale (200 ha, 494 ac) on Mendocino Redwood Co. (left column) and Green Diamond Resource Co. lands (right column).

Canopy cover:





Appendix 2

"Deconstructed" habitat suitability modeling (see text) for NSOs in the Redwood Province showing mean (SD, CV) values of select habitat structural attributes at the 200 ha (494 ac) scale by relative habitat suitability rank (USFWS 2011, unpubl. data).

Variable	Relative Habitat Suitability					
	Very Low	**Low**	**Med. Low**	**Med.**	**Med. High**	**High**
Strength of Selection*	-9.2	-2.9	-1.3	1.6	3.2	8.6
Percent of Region	16.3	24.5	26.2	22.4	9.7	0.9
Nesting-Roosting (ha)	57.9 (43.2, 75)	69.4 (40.8, 59)	79.9 (37.3, 47)	87.6 (33.6, 38)	94.3 (31.1, 33)	105.5 (30.8, 29)
Canopy Cover All Trees (%)	71.2 (23.2, 33)	75.2 (20.7, 28)	78.9 (18.1, 23)	81.0 (16.2, 20)	82.1 (15.5, 19)	82.9 (15.7, 19)
Canopy Cover Conifer (%)	43.9 (31.8, 72)	48.8 (30.0, 61)	53.4 (28.3, 53)	57.4 (27.2, 47)	61.4 (26.5, 43)	64.6 (26.4, 41)
BA Conifers ≥50 cm (m^2/ha)	10.6 (20.7, 195)	12.5 (23.0, 184)	14.1 (24.8, 176)	15.2 (25.6, 168)	17.6 (30.1, 171)	25.2 (45.9, 182)
BA Live Trees ≥75cm (m^2/ha)	7.3 (17.6, 241)	8.5 (20.1, 236)	9.3 (21.8, 234)	9.3 (22.4, 241)	10.4 (27.1, 261)	17.0 (44.0, 259)
Density Trees ≥50 cm (no./ha)	32.3 (37.3, 115)	36.1 (38.4, 106)	39.8 (40.0, 101)	42.5 (42.1, 99)	45.4 (44.5, 98)	50.0 (46.1, 92)
Density Trees ≥75 cm (no./ha)	8.2 (14.8, 180)	9.2 (15.6, 170)	9.9 (16.0, 162)	10.0 (15.5, 155)	10.4 (15.3, 147)	12.8 (16.8, 131)
Density Conifers ≥50 cm (no./ha)	22.1 (34.7, 157)	25.5 (36.4, 143)	28.9 (38.3, 133)	32.6 (40.7, 125)	37.3 (43.6, 117)	43.1 (45.6, 106)
Density Conifers ≥ 75 cm (no./ha)	6.6 (14.5, 220)	7.6 (15.4, 203)	8.4 (15.7, 187)	8.7 (15.2, 175)	9.4 (15.1, 161)	12.0 (16.7, 139)
Density Conifers ≥100 cm (no./ha)	2.5 (7.7, 308)	2.9 (8.4, 290)	3.2 (8.8, 275)	3.1 (8.3, 268)	3.2 (8.5, 266)	4.7 (10.4, 221)
Mean DBH Conifers by BA (cm)	42.8 (34.5, 81)	48.5 (35.5, 73)	51.7 (35.4, 68)	52.1 (34.0, 65)	52.9 (36.1, 68)	60.8 (51.1, 84)
QMD Dominant/Codominant Conifers (cm)	35.7 (29.1, 82)	40.2 (29.9, 74)	42.7 (29.7, 70)	42.6 (28.3, 66)	42.7 (29.7, 70)	48.1 (41.5, 86)

*Strength of selection calculated as the proportion of activity centers in a habitat suitability class divided by the proportion of the modeling region in that class.

September 5, 2014

Ken Hoffman's Peer Review of Timber Harvesting threat section:

Pg. 2

Non-federal lands contain the majority of the remaining breeding pairs of NSO. Not just the breeding habitat. There are more NSO in the Redwood zone on private land in Cali9fornia than the rest of the species range combined. Redwood NSOs are the last source population.

Pg. 7

"Most of the published research" or "a large amount of research" should replace "most of what is known"

'Diller et, al. 2010' is an unpublished document. Non-peer reviewed annual report.

Pg. 8

"Small patch clear-cutting"? WTF?

"Harvesting of suitable habitat (i.e. take)" should say "occupied" habitat.

Pg. 9

"Less is known"? A great deal is known. Less is published.

Pg. 10

Private timberland is divided almost equally between industrial and non-industrial. Most non-industrial timberland is uneven-aged managed – not uneven-aged regenerated.

Pg. 10-14

Thinning on National Forests occurs in even-aged stands surrounded by a sea of suitable habitat. Thinning on private land occurs either in long-term NTMPs or on industrial timberland which is a sea of unsuitable habitat.

Pg. 27

Market conditions drive harvest on non-industrial timberland. Industrial timberland is harvested on a schedule to keep mills in material.

-Thinning on Public land is insignificant for two reasons:

#1 Most NSO are on private land is in the Redwood zone

#2 Most Forest Service thinning occurs in a sea of suitable habitat.

HCPs all result in substantial impacts to NSO habitat and individuals through permitted take.

No mention of the USFWS guidance for the coast?

USFWS Technical Assistance almost immediately increased NSO habitat protections starting in 1999. Coastal guidance also far exceeds FPRs.

-Technical Assistance continued through 2008.

-Paper fails to recognize difference between industrial and non-industrial timber management.

Three Major Points

1. Redwood zone NSO is the last source population.
2. Redwood zone timberland is almost 50/50 industrial/non-industrial.
3. Inadequate regulatory mechanism and process for private land has been obvious since at least 1999.

Wildfire and Salvage Logging

Introduction

Recent status reviews have identified wildfire as a primary threat to the recovery of the northern spotted owl (NSO) (Courtney et al. 2004, USFWS 2011). Much of this concern was based on recent loss of suitable breeding habitat to wildfires and to the risk of extensive severe fires occurring in the future (Davis and Dugger 2011, USFWS 2011). Other researchers and stakeholders have questioned the scientific basis of claims that wildfires pose a threat to NSOs and have expressed distrust of agency recommendations for widespread use of forest thinning to reduce fire risk (e.g., Hanson et al. 2009, Heiken 2010, DellaSala et al. 2013).

There is currently limited information with which to evaluate responses of spotted owls to wildfires and post-fire salvage logging. This research suggests that wildfires have variable and complex effects on the species (Table 1). This is unsurprising given differences in wildfires, research methods, study areas, and spotted owl subspecies and populations. Nonetheless, patterns are evident in the literature concerning spotted owl responses to wildfires and salvage logging and these can be evaluated in light of the species' habitat and prey relationships. Currently available research suggests that low-to-moderate or mixed-severity wildfires have limited effects on spotted owls (Table 1). In fact, such fires could benefit NSOs in southern forests by contributing to landscape-level habitat heterogeneity associated with high fitness (Franklin et al. 2000). In contrast, large-scale severe (stand-replacing) fire can have strong negative effects on spotted owls (Table 1). This likely occurs when fires excessively modify,

reduce, or fragment concentrations of suitable nesting and roosting habitat needed for reproduction and survival (Franklin et al. 2000, Dugger et al. 2005, Schilling et al. 2013). Negative effects of extensive severe wildfires appear to be exacerbated by post-fire salvage logging, which structurally simplifies burned areas, removes important habitat legacies for prey, and creates high contrast habitat edges that educe spotted owls' use of burned areas (Clark 2007, Lee et al. 2012, 2013, Clark et al. 2013, Comfort 2013).

Regardless of scientific uncertainty regarding spotted owl responses to wildfire, it is clear that recent large wildfires have caused tremendous loss, degradation, and fragmentation of suitable habitat for NSOs on federal lands (Davis and Dugger 2011, USFWS 2011; also see Healey et al. 2008, Moeur et al. 2011). This is cause for concern since recovery of the subspecies largely relies on habitat protection on federal lands (USFWS 2011). Furthermore, much of the climate change research indicates that wildfires will continue to be a source of large-scale habitat change during coming decades (Westerling et al. 2006, Lenihan et al. 2008, Westerling and Bryant 2008, Littell et al. 2009). These concerns have prompted ecologists and federal agencies to advocate widespread forest thinning to reduce wildfire risk within the range of the NSO (USFWS 2008, 2011, 2012a, Franklin and Johnson 2012). However, the limited information currently available suggests that spotted owls often respond negatively to forest thinning (reviewed in Hansen and Mazurek 2010, USFWS 2011; see *Threats: Timber Harvesting*). Further research is needed to determine whether and how widespread thinning should be used in forests occupied by NSOs. Currently available information suggests that spotted owls tolerate, and possibly benefit from, low severity or patchy fire (Bond et al. 2002, 2009, Roberts 2008, Roberts et al. 2011, Keane et al. 2011, 2012, Lee et al. 2012, 2013, Comfort 2013). Thus, the current body of research

Comment [UFS1]: Not just continue, but become an increasing source…See Moritz et al. 2012, Dennison et al. 2014, Stavros et al. 2014 as additional references.

Comment [UFS2]: Perhaps couch NSO effects in terms of duration/time (e.g., short-term vs long-term). Much of the problem you write about here will be on how to balance the two.

Comment [UFS3]: Timber harvesting, which has mostly shifted from regeneration to thinning, was and is planned to occur under the NWFP (owl's range). Thinning is not always proposed by the land management agencies to reduce risks of large wildfires and future fire loss of habitat. It is also designed to accelerate development of old forest structure and species composition. Also, it is important to remember that it is also proposed to provide economic inputs to the local economies, another NWFP objective.

So, this statement should read that **research is needed to help land managers understand the effects of thinning on NSO**. Not to determine whether the agencies should thin. The NWFP calls for it.

supports use of prescribed fire and allowing wildfires to burn under prescribed conditions in dry forests within the NSO's range, provided sufficient concentrations of suitable habitat are retained.

Comment [UFS4]: This conclusion seems out of place. You have not made the argument yet.

Wildfire Effects on Spotted Owls

Indirect Evidence

Research of associations between landscape-scale habitat attributes and the demography and presence of NSOs has consistently found that the subspecies benefits from some form of habitat heterogeneity in the southern portion of its range (e.g., ecotones or edges between different vegetation classes) (Franklin et al. 2000, Zabel et al. 2003, Olson et al. 2004, Dugger et al. 2005, Carroll and Johnson 2008, Diller et al. 2010, Schilling et al. 2013; reviewed in *Threats: Timber Harvesting*). Yet, these same studies have also strongly demonstrated the importance of large concentrations of suitable breeding habitat around activity centers (reviewed in *Threats: Timber Harvesting*). Based on this research, wildfires likely have positive effects on NSOs in California when they contribute to beneficial forms of habitat heterogeneity and negative effects when they substantially reduce or degrade suitable habitat around activity centers. Extensive severe wildfires have the potential to remove or fragment core concentrations of suitable breeding habitat across multiple NSO territories. These fires, therefore, have the greatest likelihood of substantially impacting NSO populations. ~~Other~~ Smaller, less severe wildfires may impact fewer territories and have weaker negative effects on populations, burn in a manner that contributes to

Comment [UFS5]: I think it is more "fire-prone" portions rather than southern. The east side of the Cascades in Washington as example.

Comment [UFS6]: Delete?

Comment [UFS7]: Might want to define what you mean by "severe". Studies have used different definitions, which sometimes causes confusion.

Comment [UFS8]: Be careful on use of the term "habitat", should also define this too… nesting/roosting?

beneficial forms of habitat heterogeneity in some territories, or have a combination of these effects.

Direct Evidence

Several studies have investigated responses of NSOs to wildfires (Table 1). These studies provide crucial information for evaluating ~~fire~~ wildfire as a potential threat to the subspecies. However, their inferences are limited due to small sample sizes in all cases, the confounding effects of post-fire salvage logging in one case, and pooling of data from all three spotted owl subspecies in another case (Table 1; see below). In order to supplement these studies, we also reviewed research of fire effects on California spotted owls (*S. o. occidentalis*; CSOs) and Mexican spotted owls (*S. o. lucida*; MSOs) (Table 1). Because inferences from these studies are also limited, and given differences among fires, spotted owl populations, and research methods, we reviewed each project as a "case study". Relatively thorough descriptions of these studies allow identification of patterns in the literature, which could provide insights into general effects of wildfires on the species.

Table 1: Apparent effects of wildfires on spotted owls. See text for additional descriptions of study methods and findings.

Response Metric	Study†	Subspecies	Location*	Apparent Effect**	Notes
Survival	*Bond et al. 2002*	NSO, CSO, MSO	CA, AZ, NM	0	Only one post-fire survey season
	Clark et al. 2011	NSO	OR KLA	-	Likely cumulative effect of timber harvesting, severe fire, and salvage logging
Productivity	Gaines et al. 1997	NSO	E WA CAS	0 (-?)	Apparently no decline but possibly obscured by low reproduction year across population; Possibly lower total reproduction in burned landscapes due to lower pair occupancy; Only one post-fire season
	Bond et al. 2002	NSO, CSO, MSO	CA, AZ, NM	0 (+?)	Slightly higher than in other studies; Only one post-fire season
	Clark 2007	NSO	OR KLA	0 (-?)	Apparently no decline but low statistical power; Possibly lower total reproduction in burned landscapes due to lower pair occupancy
	Roberts 2008	CSO	CA SIERRA		
Site Fidelity	*Bond et al. 2002*	NSO, CSO, MSO	CA, AZ, NM	0	Site fidelity similar to other studies
Occupancy	Elliot 1985	CSO	CA COAST	-	Apparent abandonment by two pairs
	Gaines et al. 1997	NSO	E WA CAS	-	Post-fire occupancy was lowest found during five-year study; Only one post-fire season
	Jenness et al. 2004	MSO	AZ, NM	-	Statistically insignificant effect; Pooled all fire types and severities
	Keane et al. 2011, 2012	CSO	CA SIERRA/CAS	-/0	Extensive high severity fire apparently had a strong negative effect; Extensive low severity fire apparently had a neutral or weak negative effect; Possibly influenced by salvage logging
	Roberts et al. 2011	CSO	CA SIERRA	-	Authors concluded weak effect but pooled all fire types and severities
	Lee et al. 2012	CSO	CA SIERRA	0 (-?)	Similar occupancy at burned vs. unburned; Possibly lower occupancy at severely burned vs. other burned
	Lee et al. 2013	CSO	SO CA	-/0	Similar occupancy at burned vs. unburned; Significant reduction with extensive high severity fire in core area
	Clark et al. 2013	NSO	OR KLA	-	Cumulative effect of timber harvesting, severe fire, and salvage logging
Home Range	Clark 2007	NSO	OR KLA	-	Larger home ranges post-fire
	Bond et al. 2013	CSO	CA SIERRA	0(?)	Similar home range sizes to unburned areas
Roosting	King et al. 1997	NSO	E WA CAS	-	Apparent avoidance of moderate and severe burns
	Bond et al. 2009	NSO	CA SIERRA	-	Significant avoidance of moderate and severe burns during breeding season
Foraging	Clark 2007	NSO	OR KLA	+(?)	Apparent weak selection of moderately burned suitable habitat; Possible weak selection for severely burned suitable habitat; Very low use and availability of both moderately and severely burned suitable habitat
	Bond et al. 2009	NSO	CA SIERRA	+	Significant selection of severe burns
	Eyes 2014	CSO	CA SIERRA		
Roosting and Foraging	Comfort 2013	NSO	OR KLA	-/+ (?)	Preference for small patches of severely burned/salvage logged and avoidance of larger patches; Weak preference for low contrast edges (ecotones) created by fire

†Peer-reviewed publications shown in italics. * Locations: California Klamath (CA KLA); Eastern Washington Cascades (E WA CAS); Oregon Klamath (OR KLA); California, Arizona and New Mexico (CA, AZ, NM); California Central Coast Range (CA COAST); California at margin of northern Sierra Nevada and southern Cascades (CA SIERRA/CAS); California Sierra Nevada (CA SIERRA); southern California San Bernardino and San Jacinto Mountains (SO CA). **Apparent Effect: negative (-), positive (+), neutral (0), varied with fire severity and/or scale (/)—see Notes column and text for further explanations.

Comment [UFS9]: Not statistically, I'd keep the "0" here and delete the "+"

Survival

Wildfires may influence spotted owl survival in both the short- and long-term. For example, spotted owls, like other wildlife, could be injured or killed by smoke during fires (Singer and Schullery 1989, Smith 2000). Due to their poor mobility, young spotted owls with undeveloped flight feathers may be at particular risk of mortality during wildfires (Smith 2000). In addition to potential immediate effects, extensive moderate or severe wildfire might influence spotted owl survival over the longer-term by modifying habitat for roosting, foraging, or prey (see below).

Only two studies are currently available for evaluating effects of wildfires on spotted owl survival rates (Bond et al. 2002, Clark et al. 2011; Table 1). Bond et al. (2002) reported that 18 of 21 (86%) marked spotted owls were resighted one year after wildfires occurred in California, Arizona, and New Mexico. This minimum survival rate was similar to survival estimates found by long-term studies of the three spotted owl subspecies in unburned landscapes (Seamans et al. 1999, Franklin et al. 2000, W.S. LaHaye unpubl. data). Extensive severe fire (36-88%) occurred in four of the eight territories for which fire severity was mapped and the other half primarily burned at low to moderate severity. Thus, even extensive severe fire did not appear to have a large effect on spotted owl survival one year post-fire.

Clark et al. (2011) found evidence of a negative effect of wildfires and/or salvage logging on survival of 23 NSOs in the Oregon Klamath Province. Severe fire and/or post-fire salvage logging occurred in 30% and 41% of suitable NSO habitat in the two study areas. Estimated mean annual survival rates for NSOs located inside fire perimeters (0.69) and apparently

Comment [UFS10]: You should include "in press" results from Tempel et al.

High severity fire had negative effect on survival.

Their results suggest that reductions in the area of high-canopy forest (>70%) resulting from either logging or high-severity wildfire could reduce the viability of California spotted owl populations and may be contributing to ongoing declines in abundance and territory occupancy.

They recommended fuels Rx in dense stands while trying to avoid decreasing canopy too much.

This is good one for short vs long term effects.

Comment [UFS11]: Page 1026 of the paper states this, "Most (6 of 8) territories burned >50% at low to moderate severity."

So, two of the four that had 36-80% were <50%.

Comment [UFS12]: I disagree with this conclusion. Extensive, yes… severe, no.

They concluded that "spotted owls may have the ability to withstand the immediate, short-term (1-year) effects of fire **occurring at primarily low to moderate severities** within their territory.

displaced by fires and post-fire salvage logging (0.66) were lower than in areas just outside the fire perimeters (0.85) and in an unburned reference study area in the neighboring southern Cascades (0.85: Anthony et al. 2006). The degree to which post-fire salvage logging in the study areas influenced NSO survival rates is unknown. The study's occupancy analyses indicated that pre-fire timber harvesting, high severity wildfire~~s~~, and post-fire salvage logging cumulatively impacted NSOs through reductions of suitable nesting/roosting habitat (Clark et al. 2013; see below).

Apparently contradictory findings by Bond et al. (2002) and Clark et al. (2011) may be due to several factors. The most obvious difference between the studies is that the areas studied by Clark et al. (2011) experienced post-fire salvage logging while those studied by Bond et al. (2002) did not. The limited information currently available indicates that salvage logging negatively affects spotted owls (reviewed below). Additionally, the populations studied by Clark et al. (2011) may have been particularly sensitive to habitat loss to wildfires due to intensive pre-fire timber harvesting across a checkerboard ownership. It should also be noted that Bond et al. (2002) only examined wildfire effects one year post-fire. Fire injuries and post-fire outbreaks of insects and pathogens can continue to result in tree mortality for up to several years after a wildfire (Ryan and Amman 1996, Gaines et al. 1997, Hood et al. 2007).

Reproduction

The spotted owl is a relatively long-lived species that exhibits a bet-hedging life history strategy (Noon and Biles 1990, Franklin et al. 2000). This means that individuals often forego breeding

Comment [UFS13]: Based on this, their recommendation was to:
1) Increase protection of older forest in dry forest ecosystems to prevent future habitat loss to timber harvest and
2) Mitigate potential losses of older forest to stand-replacing fire and subsequent salvage logging

I assume that recommendation #1 refers to "nesting/roosting" habitat (a.k.a. older forest)

Comment [UFS14]: I hear and read this a lot. Upon careful reading of Bond et al. (2002), these two papers actually don't contradict each other. Bond et al. (2002) make no conclusion on high-severity wildfire. They only summarized effect (or lack thereof) on low-moderate severity wildfire.

In fact, Clark and Bond actually corroborate on low-moderate wildfire.

Please end this misconception here!

Comment [UFS15]: This is very misleading. I suggest deleting this sentence.

Clark et al. clearly present that high severity wildfire is 1 of 3 causes of loss of NSO N/R habitat.

Bond et al. show no effect from low-mod severity fire.

Comment [UFS16]: One reason why mitigation to reduce future wildfire losses is more important now.

If we had landscapes similar to what they were historically, prior to extensive harvesting, then large wildfires would not be so worrisome.

Comment [UFS17]: Good point. Another potential effect (from anecdotal observations in some of the demographic study areas) could be that sometimes a pair will stick around for a year or two after a wildfire removes extensive amounts of nesting/roosting habitat in their territory. Then eventually, the move on or disappear. We have observed this in a few cases. But again, that was due to high severity, not low-moderate.

Comment [UFS18]: Maybe put years here? It might give some needed context to "short-term" vs "long-term" effects.

during poor environmental conditions in order to maximize their chance of surviving and reproducing in the future. Given the species' life history strategy, spotted owl reproductive rates are likely sensitive to environmental changes, including those brought about by wildfires. However, annual fluctuations in spotted owl reproduction caused by variation in weather, prey populations, or breeding condition could obscure effects of wildfires or other factors on reproduction (e.g., Franklin et al. 2000).

We are aware of four studies that examined potential effects of wildfires on spotted owl reproduction (Gaines et al. 1997, Clark 2007, Bond et al. 2002, Roberts 2008; Table 1). None of these studies found substantive evidence of a wildfire-induced decline in reproduction by the species and one indicated a potentially positive effect. In the eastern Washington Cascades, Gaines et al. (1997) found little difference in productivity (number of young per pair) between burned (0.2; n = 5 or 6/ yr) and unburned sites (0.3; n = 13-17/yr) one year after a predominantly moderate to severe wildfire. However, the post-fire survey season clearly occurred during a poor reproduction year, potentially making it difficult to detect a difference between burned and unburned sites. Clark (2007) found no significant differences in productivity in burned areas in the Oregon Klamath Province (n = 31 territories) and an unburned study area in the neighboring southern Cascades (Anthony et al. 2006). He noted, however, that his study likely lacked the statistical power to detect a difference if one occurred. Bond et al. (2002) found that seven pairs of spotted owls produced an average of 1.0 offspring during a single breeding season following wildfires in California, Arizona, and New Mexico. This was higher than productivity rates found in unburned areas during long-term studies of the three spotted owl subspecies (Seamans et al. 1999, Franklin et al. 2000, W.S. LaHaye unpubl. data). *Add discussion of Roberts (2008)…*

Comment [UFS19]: Not significantly higher, and they cautioned against drawing conclusions from this given high annual variation in reproduction as you state above.

You need to clarify this as it implies that burned areas resulted in higher reproduction. Or delete it and stick to findings that have some statistical backing, otherwise you chance confusing the readers.

Currently available studies suggest that wildfires generally have minimal short-term effects on spotted owl reproduction (Gaines et al. 1997, Clark 2007, Bond et al. 2002) and that primarily low-to-moderate severity fire could positively affect reproduction (Roberts 2008). However, it might be difficult to capture fire effects on spotted owl reproduction (whether positive or negative) during short-term studies, particularly with only a single year of post-fire data (Franklin et al. 2000). In addition, it is possible that solely comparing productivity (e.g., offspring per pair) in burned and unburned areas could obscure a change in total reproduction in burned areas. Studies in Washington and Oregon reported post-fire declines in occupancy by pairs, suggesting that extensive severe fire can reduce reproductive opportunities for spotted owls (Gaines et al. 1997, Clark 2007; see below).

Comment [UFS20]: Apparently no effect.

Comment [UFS21]: Repetitious, already stated

The limited research investigating spotted owl-prey relationships has found positive associations between spotted owl reproduction and abundances or consumption of dusky-footed woodrats (*Neotoma fuscipes*) (White 1996), deer mice (*Peromyscus* spp.) (Ward 2001 cited in Ward and Block 1995, Rosenberg et al. 2003), or a suite of prey with diverse habitat associations (Ward and Block 1995). Abundances of deer mice, pocket gophers (*Thomomys* spp.), and other "pioneer" or "early-successional" prey often increase following fires (Ream 1981, Zwolak and Foresman 2007, Zwolak 2009, Bond et al. 2013). Dusky-footed woodrats appear to initially respond negatively to severe fires (Schwilk and Keeley 1998, Smith 2000) but not to patchy low severity fire, although loss of nest houses might have a brief negative effect on reproduction (Lee and Tietje 2005). However, it is possible that severe fire benefits dusky-footed woodrats over longer time periods (e.g., ≥5-20 yrs) through creation of brushy habitat. Crown fires should

Comment [UFS22]: There's a new paper by Ganey et al. 2014. Relative abundance of small mammals in nest core Areas and burned wintering areas of Mexican spotted Owls in the Sacramento Mountains New Mexico

Species richness and relative abundance of small mammals were greater in the burned wintering areas than in the associated unburned nest core areas

Comment [UFS23]: You jump straight from reproduction to prey… might want to add new section or make connection to reproduction as it also affects other demographic parameters.

negatively affect abundances of prey associated with well-canopied forest, such as northern flying squirrels (*Glaucomys sabrinus*) and tree voles (*Arborimus* spp.). These, along with dusky-footed woodrats, are the primary prey for NSOs in California (reviewed in *Threats: Timber Harvesting*). Low severity fires could also negatively affect northern flying squirrels and other prey associated with closed canopy forests by reducing dead woody materials, fire-intolerant understory plants, and truffles (Lehmkuhl et al. 2006, Meyer et al. 2007). Thus, wildfires likely have complex effects on NSO prey communities, depending on local or regional differences in prey community composition; wildfire size, severity, and configuration; and the length of time vegetation has had to regenerate following fire.

Occupancy

Potential wildfire effects on NSO population rates are most directly evaluated with measures of survival and reproduction. However, occupancy data are often more logistically and economically feasible to collect than are demographic data and could provide an early indication of population trends (MacKenzie 2005, Olson et al. 2005). Spotted owl occupancy is sensitive to environmental factors (Blakesley et al. 2005, Olson et al. 2005) so it is a potentially valuable measure of wildfire effects on the species. Nonetheless, occupancy data must be interpreted carefully since they can be strongly influenced by survey effort, analytical methods, and the presence of barred owls (Olson et al. 2005).

We evaluated nine studies of wildfire effects on spotted owl occupancy (Table 1). As described below and in Table 1, seven of these provided evidence of a negative effect of either severe fire or fire in general.

Two studies indicated potentially negative effects of wildfires on spotted owl occupancy but included few territories (Elliot 1985, Gaines et al. 1997). In Monterey County, California, informal yearly surveys suggested that two pairs of CSOs abandoned their territories for at least four years following a wildfire (Elliot 1985). The author did not describe the fire other than noting that it was extensive and caused substantial damage to understories and oaks in the previously occupied areas. In the eastern Washington Cascades, Gaines et al. (1997) found that two of six NSO sites were occupied one year after a predominantly moderate to severe wildfire. This was the lowest occupancy rate found during the five-year study period.

Two studies found statistically weak evidence of a negative effect of fire on spotted owl occupancy, but their methods may have precluded detection of stronger effects (Jenness et al. 2004, Roberts et al. 2011). Jenness et al. (2004) found a statistically insignificant tendency (p = 0.11) for higher occupancy rank (in ascending order: no owls, singles, pairs, reproductive pairs) in unburned sites than in paired burned sites in Arizona and New Mexico (paired sites were close to each other and had similar habitat and topography). Of the 29 paired-site comparisons, 14 (48%) had a higher occupancy rank in unburned sites, 6 (21%) had a higher rank in burned sites, and 9 (31%) were tied. In the Sierra Nevada of California, Roberts et al. (2011) found lower occupancy rates for CSOs in burned areas than in unburned areas, but the difference was not statistically analyzed (unmodeled occupancy = 0.50 in burned and 0.69 in unburned; modeled

occupancy = 0.46 in burned and 0.72 in unburned). Modeling by both studies indicated that spotted owl occupancy was more strongly influenced by habitat composition or structure than by whether or not fire had recently occurred in territories. However, both studies may have underestimated the impacts of severe fire due to pooling of diverse fire types and severities for analysis (including prescribed fires, wildfires, and wildfires allowed to burn under prescribed conditions).

Two studies found evidence of strong declines in occupancy in areas recently burned by extensive severe wildfire but both may have been confounded by post-fire salvage logging (Keane et al. 2011, 2012, Clark et al. 2013). In southwestern Oregon, Clark et al. (2013) examined how extensive wildfires and subsequent salvage logging affected occupancy dynamics of NSO pairs. In their first analysis, the authors compared pre- and post-fire occupancy dynamics in a burned study area in the Oregon Klamath Province (n = 22) to those in an unburned area in the nearby southern Cascades (Anthony et al. 2006). Combined, high severity fire and salvage logging removed or modified 26% of suitable nesting/roosting habitat in landscapes surrounding NSO activity centers in this area. The burned and salvage-logged study area experienced a 64% reduction in site occupancy during the post-fire period, compared with a 25% reduction in the unburned study area (difference not statistically analyzed). In the second analysis, the authors examined possible effects of severe fire and salvage logging on occupancy dynamics in 40 territories located in three burned study areas in the Oregon Klamath Province. In these areas, 19-26% of suitable habitat was burned at high severity and/or salvage logged. During the study's three-year post-fire period, site extinction probabilities were as high as 72% in two combined study areas and 92% in the third area. Site extinction probabilities in the

Comment [UFS24]: Always state what kind of habitat. Nesting/roosting, foraging, or dispersal?

burned study areas were best explained by a model that included extents of high severity fire, salvage logging, and early seral forest. Models that included these variables separately were not competitive with the model containing all three variables, suggesting that NSO occupancy declined due to cumulative habitat loss from severe fire and pre- and post-fire timber harvesting (see Clark et al. 2013: Table 6). The relative influence of these factors on occupancy is unknown, but the role of severe fire cannot be dismissed. For example, the highest extinction probability (92%) occurred in a study area with little salvage logging (<2%) of previously suitable habitat.

Keane et al. (2011, 2012) estimated occupancy of CSOs in two recently burned study areas near the margin of the Sierra Nevada and southern Cascades of California. One wildfire complex, and an unreported amount of post-fire salvage logging, resulted in an almost complete loss of potentially suitable CSO habitat in the area (70% of the area pre-fire vs. 6% post-fire consisted of mean canopy cover ≥40% and mean DBH ≥11 in). Pre-fire occupancy in this study area was unknown but the Forest Service identified 23 CSO activity centers in the area prior to the fires. Rigorous landscape survey coverage by Keane et al. (2011, 2012) confirmed occupancy in only one territory within the fire perimeter during each of two post-fire years, whereas approximately seven to nine territories were found post-fire in a surrounding one-mile survey buffer. The other area studied by Keane et al. (2011, 2012) primarily burned at low severity (ca. 60% of the area). Pre-fire occupancy was likewise unknown in this area but Forest Service pre-project surveys indicated the presence of about 10 territories. Surveyors confirmed occupancy of six territories in this area during the first and second years post-fire. While the study's findings are

preliminary and may have been influenced by post-fire salvage logging, they suggest that effects of large wildfires on CSOs are dependent on the extent of high severity fire.

Another study provided further evidence that effects of wildfires on spotted owl occupancy depend on the extent and location of high severity fire. Lee et al. (2013) compared occupancy dynamics of CSOs in 71 recently burned sites and 97 unburned sites in the San Bernardino Mountains and San Jacinto Mountains of southern California. An average of 23% of forest within burned "core areas" (500 ac around activity centers) experienced high severity fire (this percent is based on an assumption that the amount of pre-fire forest in burned core areas was the same as that reported for burned and unburned core areas combined). Mean annual probability of occupancy was 0.48 in unburned sites and 0.31 in burned sites. This difference was not statistically significant. However, Lee et al. (2013) did detect a statistically significant negative effect on occupancy when high severity fire burned more than 125 acres of forest within estimated core areas.

Two studies found that wildfires had neutral or positive effects on spotted owl occupancy (Bond et al. 2002, Lee et al. 2012). Bond et al. (2002) calculated site fidelity for spotted owls in 11 territories burned by wildfires in California, Arizona, and New Mexico. The fires burned most of the area within each estimated territory (territory size = ½ the nearest neighbor distance in each study area, based on previous studies). Half of the eight territories for which fire severity was mapped primarily burned at low to moderate severity and the other half experienced extensive severe fire (36-88%). Of 21 color-banded owls in the study, 18 (86%) were resighted the year after the fires and 16 (89%) of these were located in their pre-fire territory. Site fidelity

in this study was comparable to that in long-term studies of the three subspecies in unburned areas (Seamans et al. 1999, Franklin et al. 2000, W.S. LaHaye unpubl. data). In the Sierra Nevada, Lee et al. (2012) compared post-fire occupancy in 41 recently burned and 145 unburned historical CSO territories. An average of 32% of forest in burned territories experienced high severity fire. The authors found no significant association between CSO occupancy and whether or not territories had recently experienced wildfire within a 494-acre circle around activity centers (mean occupancy was 0.76 at unburned sites and 0.80 at burned sites).

The studies reviewed above are not directly comparable due to differences in methods, spotted owl subspecies and populations, fire extents and severities, and the presence or absence of post-fire salvage logging. The preponderance of evidence suggests that spotted owls in fire-prone forests are generally resilient to wildfires (Bond et al. 2002, Jenness et al. 2004, Keane et al. 2011, 2012, Roberts et al. 2011, Lee et al. 2012, 2013). However, wildfires that severely burn large areas of suitable habitat can substantially impact spotted owl occupancy, particularly when it occurs in breeding-season core areas (Elliot 1985, Gaines et al. 1997, Clark et al. 2013, Keane et al. 2011, 2012, Lee et al. 2013). Post-fire salvage logging appears to increase the negative effects of extensive severe fire on spotted owl occupancy; most likely by reducing suitability of burned areas for prey and foraging (Lee et al. 2012, 2013, Clark et al. 2013; reviewed below).

Home Range Size and Habitat Use

Changes in the behavior of individual spotted owls may provide insight into the mechanisms by which wildfires affect populations. For example, post-fire changes in home range size may

reflect fire effects on spotted owl energy budgets through changes in travel distances and prey availability. Changes in energy intake and output could, in turn, influence survival, reproduction, and occupancy of spotted owls. Patterns of habitat use may also be informative. For example, selection or avoidance of burned areas may reflect changes in availability of prey or roosting habitat, which could, in turn, influence occupancy, reproduction, or survival of spotted owls.

To our knowledge, only two studies have evaluated spotted owl home range sizes in relation to wildfires (Clark 2007, Bond et al. 2013; Table 1). Clark (2007) found that annual home range sizes of NSOs inside two fire perimeters in the Oregon Klamath Province were larger after wildfires than before them (n = 14 owls pre-fire and 20 post-fire). He attributed this difference to owls expanding their home ranges in response to habitat fragmentation caused by severe fire and post-fire salvage logging. This hypothesis was supported by other research in the region, which found that NSOs had larger home ranges in fragmented forests than in areas with larger, more intact patches of habitat (Carey et al. 1992, Schilling et al. 2013). Another study in the region suggested that the energetic cost of increased travel in fragmented forest was greater than the energetic benefit of increased access to prey associated with early-successional habitats (Carey and Peeler 1995).

Bond et al. (2013) compared the breeding season home ranges of seven CSOs (from four territories) during a single post-fire year in the Sierra Nevada of California with those in other studies during the same year in other parts of the subspecies range (D. Call, T. Munton, and G. Zimmerman unpubl. data). An average of 23% of forest burned at moderate severity and 9% at

high severity within a 1.2 mile radius of the four nests. Pre-fire home range sizes were unknown but CSOs in the four territories did not appear to have unusually large home ranges following predominantly low to moderate severity wildfire.

Five studies have described patterns of habitat use by spotted owls in burned areas (King et al. 1997, Clark 2007, Bond et al. 2009, Comfort 2013, Eyes 2014; Table 1). King et al. (1997; also Bevis et al. 1997) described initial effects of wildfires on NSOs in two territories in the eastern Washington Cascades. One territory primarily experienced low to moderate severity fire and the other mostly burned at high severity. Both territories experienced an unreported amount of salvage logging in unsuitable or severely burned habitat. Most NSO locations (84% and 89%) in the two territories were daytime roosts. In the territory primarily burned at low to moderate severity, 80% of the pair's post-fire locations were in unburned habitat, 16% were in low severity burns, and 4% were in moderate severity burns. The pair did not appear to roost in severely burned areas. The second territory studied by King et al. (1997) was occupied by a single male. After the fire, the male shifted his activity to an unburned area two to three miles away but continued to occasionally use areas near his former activity center. Of those locations, 74% were in unburned habitat, 17% were in low severity burns, 5% were in moderate severity burns, and 4% were in high severity burns. Maps of burn severity classes and NSO locations indicate that owls in these two territories strongly selected unburned areas for roosting.

Clark (2007) evaluated habitat selection by 12 NSOs (7 territories) inside a wildfire perimeter in the Oregon Klamath Province. NSO locations were primarily nocturnal and may therefore, have largely represented foraging activity. Individuals in this area used all habitat classes, including

moderate and severe burns and areas that had been salvage logged. However, when the data from individuals were pooled for analysis, the owls exhibited a strong preference for nesting-roosting habitat that was unburned or burned at low severity (unburned and low severity were combined into a single class). NSOs in the study also selectively used moderately burned, previously-suitable habitat; although both use and availability of this habitat class were low compared with unburned or lightly burned habitat. Owls' use of burned areas was concentrated closer to activity centers, which was expected, given that spotted owls are central place foragers during the breeding season (Rosenberg and McKelvey 1999).

In the Sierra Nevada, California, Bond et al. (2009) described the habitat associations of seven CSOs from four territories during a single post-fire season. Of the four nests found during the study, one was approximately 0.3 mile outside the fire perimeter, one was in forest burned at low severity, and two were in forest burned at moderate severity. One of the two nest trees found in a moderate severity burn was apparently killed by the fire and one produced the only fledgling detected during the study. It is unclear from the paper whether these events occurred at the same nest or different nests. The four pairs roosted in all burn severity classes but exhibited statistically significant selection of low severity burns and avoidance of moderate and high severity burns. Only one of 60 roost sites was located in a high severity burn. Burned roost sites generally resembled unburned roost sites (>60% canopy cover and large-diameter trees). Bond et al. (2009) also evaluated CSO selection of foraging habitat in the area. Probability of use for foraging was highest when sites were burned and within 0.6 mile of nests or roosts. Probability of use was also positively associated with presence of edge between burn severity classes. Five of the owls foraged in high severity burns within 0.9 mile of nests or roosts more often than in

other burn severity classes. Bond et al. (2009) suggested that CSOs in these four territories selectively foraged in high severity burns in order to access abundant prey in those areas. This hypothesis was supported by their finding that high severity burns had the highest herb and shrub cover and highest basal area of snags of any burn severity class, including unburned. These features are key resources for spotted owl prey communities (Carraway and Verts 1991, Carey et al. 1999, Holloway and Smith 2011).

Comfort (2013) evaluated habitat selection (roost and foraging locations combined) by 23 NSOs in a burned area in the Oregon Klamath Province. Her best performing model for explaining habitat selection included habitat suitability, disturbance severity, high contrast edge, and low contrast edge. Habitat selection varied with spatial scale but NSOs exhibited a strong preference for higher habitat suitability and avoidance of higher severity disturbance (high severity fire and/or salvage logging). NSOs showed a preference for high contrast edge at small spatial scales (2-8 ac) and avoidance at medium and large scales (32-2,049 ac). NSOs also exhibited a weak preference for low contrast edge. Comfort (2013) concluded that patchy, mixed severity fire (small patches of high severity fire within a matrix of unburned and low-to-moderate severity fire) created conditions favored by NSOs in her study, whereas large patches created by high severity fire and salvage logging were strongly avoided. Salvage logging apparently contributed to conditions avoided by NSOs by structurally homogenizing burned areas, which increased the sizes of high severity patches and amounts of high contrast edge. However, the relative influence of high severity fire and salvage logging on habitat selection by NSOs in this study is unknown.

Add discussion of Eyes (2014) (selection of low severity burned edges and proportional use of high severity burned edges)…

The limited available information concerning spotted owl habitat use following wildfires indicates that the species avoids roosting in moderate and high severity burns (King et al. 1997, Clark 2007, Bond et al. 2009). This finding is concordant with the spotted owl's close association with densely-canopied older forest for roosting (Blakesley 2004). Little is known about the effects of wildfire on selection of nest sites. Bond et al. (2009) found three CSO nests in forest recently burned at low and moderate severity, and young fledged from one nest in a moderate severity burn. Moderate severity fire killed one of the four CSO nest trees in their study. We are unaware of any reports of spotted owls nesting in severely burned areas. Based on the species' nesting habitat requirements (Blakesley 2004), long-term use of severely burned areas for nesting is likely uncommon. Two studies specifically examined selection of foraging habitat by spotted owls *(adding Eyes 2014 will make three studies)*. Both found use of all burn severity classes, but Clark (2007) found a preference for foraging in unburned to moderately burned older forest while Bond et al. (2009) found a preference for severe burns. It is unclear if this difference was due to differences in the studies' methods, spotted owl diets, or effects of fire and timber harvesting (including post-fire salvage logging) on vegetation. Comfort's (2013) research suggested that NSOs respond positively to the presence of severe burns when they occur in small patches within a matrix of unburned or low-to-moderate severity burns. However, she combined roost and foraging locations in her analysis, which might have obscured differences in NSO use of burn severity classes for different functions. Furthermore, hers and Clark's (2007) studies were confounded by post-fire salvage logging, which appears to negatively affect spotted

owls (reviewed below). *Discussion of use of fire-created edges in Comfort 2013 and Eyes 2014…*

Salvage Logging

While salvage logging might be judiciously used to meet certain conservation objectives (e.g., generating downed wood to minimize erosion or create wildlife habitat), it is generally conducted to meet financial goals or remove hazard trees (Peterson et al. 2009). Intensive or poorly planned salvage logging can have a variety of negative effects on ecosystems, such as soil compaction, increased erosion, and impacts on insectivorous and cavity-nesting and -denning animals (reviewed in McIver and Starr 2000, Noss et al. 2006, Peterson et al. 2009).

Comment [UFS25]: Economic?

We know of three studies that have directly evaluated effects of post-fire salvage logging on spotted owls (Clark 2007 and Clark et al. 2013, Lee et al. 2012, 2013). Clark (2007) conducted a radio-telemetry study in areas recently burned by wildfires in the Oregon Klamath Province. He recorded limited use of salvage logged areas; presumably for foraging since locations were primarily nocturnal. Use of salvage logged areas was slightly lower than expected based on its abundance in territories (not statistically analyzed), indicating weak avoidance of salvage logged areas by NSOs. However, avoidance might have been stronger since some of the study's telemetry locations were potentially recorded prior to the occurrence of salvage logging. Most (60%) NSO locations in salvage logged areas occurred in riparian buffers, thinned areas, and patches of wildlife leave trees, rather than intensively salvaged areas. During the same study, Clark et al. (2013) found that post-wildfire declines in NSO occupancy were best explained by a

model that included extents of pre-fire timber harvesting, severe fire, and post-fire salvage logging. Models that included these factors separately were not competitive with this model, indicating that severe fire and pre- and post-fire harvesting collectively contributed to declines in NSO occupancy; most likely through cumulative habitat loss or degradation.

In the Sierra Nevada, Lee et al. (2012) recorded occupancy for eight CSO territories that experienced wildfire and post-fire salvage logging. Seven of the territories were occupied during the two-year period between the occurrence of wildfire and salvage logging, whereas none of the territories were occupied following salvage logging.

Lee et al. (2013) evaluated effects of salvage logging on CSOs in the San Bernardino and San Jacinto Mountains of Southern California. They noted that salvage logging in their study area was modest compared with commercial salvage logging typically employed in the Pacific Northwest and Sierra Nevada (salvage logging in their study area mostly consisted of firewood cutting on private in-holdings and hazard tree removal along Forest Service roads). Lee et al. (2013) did not find a statistically significant effect of post-fire salvage logging on CSO occupancy dynamics. However, site extinction probability was slightly higher, and mean annual probability of occupancy was slightly lower, in salvage logged areas than in other burned areas. Weak negative effects of light salvage logging were evident during all eight post-fire study years.

The limited available evidence suggests that salvage logging decreases the probability that spotted owls will use burned areas (Comfort 2013) and increases the probability that they will

abandon their territories following wildfires (Clark 2007, Lee et al. 2012, 2013, Clark et al. 2013). This likely occurs because salvage logging reduces suitability of burned areas for foraging spotted owls and their prey. Stands recently burned by moderate or severe fire often contain high biodiversity due to the presence of both early-successional conditions and key biological legacies in the form of snags, logs, and live trees (Noss et al. 2006). Due to fire suppression and salvage logging, stands with these conditions are currently rare in many fire-prone forests within the spotted owl's range (Noss et al. 2006). Selective use of moderate or high severity burns for foraging is likely due to spotted owls exploiting short-term increases in prey associated with both early-successional vegetation (e.g., shrubs) and legacy habitat elements (e.g., large diameter snags, logs, and live trees) (Ream 1981, Zwolak 2009, Bond et al. 2013). Salvage logging removes legacy elements, while associated use of herbicides reduces shrubs and grasses important to many prey species (Bond et al. 2013, Comfort 2013). In the longer-term, spotted owls can continue to benefit from the contributions of legacy habitat elements to regenerating stands. For example, large legacy snags, trees, and logs can provide valuable habitat elements for northern flying squirrels and other prey (Holloway and Smith 2011). Removal of these elements through salvage logging could therefore reduce the value of subsequent regenerating stands as prey habitat. Harvesting of legacy snags and live trees could also directly affect spotted owls by reducing availability of foraging perches in the short-term and suitable nest trees during later successional stages. Large-scale salvage logging could also reduce NSOs' use of burned areas by extensively replacing low contrast (diffuse) edges with less favorable high contrast (hard) edges (Comfort 2013).

Summary

Inferences from studies of direct effects of wildfires and salvage logging on spotted owls are limited due to inclusion of only a small number of spotted owls or territories. Nonetheless, more information is available concerning this topic than is generally acknowledged. The preponderance of currently available evidence indicates that spotted owls are often resilient to wildfires but can be strongly impacted by extensive severe fire. Following wildfire, many spotted owls may remain in their territories, exploit short-term increases in prey in burned areas, and continue to reproduce at reasonably high rates. However, wildfires that result in substantial loss or fragmentation of suitable habitat, particularly within breeding core areas, can cause spotted owls to increase their home range sizes, abandon their territories, and possibly, emigrate from burned landscapes or die of starvation or disease. Negative effects of severe fire appear to be greatest when suitable habitat is already limited (e.g., due to widespread intensive timber harvesting) and when post-fire salvage logging reduces suitability of burned areas for foraging and prey.

Comment [UFS26]: Seems to contradict previous sentence. Is the unacknowledged info in this paper? Suggest deleting this sentence.

Wildfire Effects on Recent Habitat Trends

Past and continuing habitat loss was a primary reason for listing the NSO under the federal Endangered Species Act (USFWS 1990). At the time of listing, the Fish and Wildlife Service estimated that 60-88% of the subspecies' habitat had already been lost (USFWS 1990; also see *Threats: Timber Harvesting*). They attributed most of this loss to widespread intensive timber harvesting. Since listing of the NSO and subsequent adoption of the Northwest Forest Plan,

timber harvesting has declined and wildfire has been identified as the primary source of forest disturbance and habitat loss on federal lands (Courtney et al. 2004, Healey et al. 2008, USFWS 2011, Kennedy et al. 2012). Nonetheless, timber harvesting continues to be the primary source of habitat loss on non-federal lands (Healey et al. 2008, Davis and Dugger 2011, Moeur et al. 2011, Kennedy et al. 2012).

Comment [UFS27]: This and Kennedy focused on LSOG. Not all late-successional/old-growth forest is NSO habitat (e.g., ponderosa pine, subalpine forests, etc.)

You should put in Lint 2005 and Davis et al. 2011 as they focused on NSO habitat status and trends.

Comment [UFS28]: Or include "older forests and" before "habitat loss".

Estimates of recent trends in amounts of NSO habitat, and of older forest in general, have been produced as part of monitoring efforts for the Northwest Forest Plan; and are therefore, largely restricted to the Plan's area and time span (Davis and Lint 2005, Moeur et al. 2005, 2011, Healey et al. 2008, Davis and Dugger 2011). We focus on estimates by Davis and Dugger (2011) because they replaced those of Davis and Lint (2005) and are more specific to NSO habitat than those of Moeur et al. (2005, 2011) and Healey et al. (2008). We do not review habitat trend estimates based on federal ESA Section 7 consultation records (Bigley and Franklin 2004, USFWS 2012) due to greater scientific uncertainty and methodological bias associated with those data (see Bigley and Franklin 2004). Trends described by Bigley and Franklin (2004), Moeur et al. (2005, 2011), Healey et al. (2008), and the US Fish and Wildlife Service (2012) quantitatively differ from those of Davis and Dugger (2011) but similarly indicate that wildfires have been the primary source of recent habitat loss on federal lands.

Comment [UFS29]: Like this is stated

Comment [UFS30]: Good! Finally, this is clarified. Thank you.

Davis and Dugger (2011) used remotely sensed (satellite imagery) vegetation data to model changes in habitat suitability across the NSO's range during the first 15 years of the Northwest Forest Plan (1994-2007 in California and 1996-2006 in Oregon and Washington). Habitat suitability was based on characteristics surrounding thousands of NSO pair locations across the

Plan area. Suitable breeding habitat was defined as having both a probability of owl presence greater than expected based on random chance and environmental conditions typical of those found around nesting and roosting pairs. Estimated habitat trends included gross loss of both suitable breeding habitat and "core" suitable breeding habitat (>330 ft from edge). Davis and Dugger (2011) considered habitat loss to have occurred when an area classified as suitable at the beginning of Northwest Forest Plan was later downgraded to a lower suitability rank (unsuitable or marginal) due to vegetation changes caused by forest disturbances. Davis and Dugger (2011) did not estimate recruitment of, or net changes in, breeding habitat because their remotely sensed data was incapable of accurately capturing relatively slow and subtle habitat changes during development of intermediate-aged and older stands. They did, however, estimate net trends in NSO dispersal habitat, which they defined as forest with a mean ~~canopy~~conifer cover of at least 40% and a mean conifer DBH of at least 11 inches. Recruitment of dispersal habitat was more detectable than that of breeding habitat due to more rapid and measurable growth in younger forest (some recruitment also occurred due to degradation of suitable breeding habitat by forest disturbances).

Comment [UFS31]: Nesting/roosting

Estimated gross losses of suitable breeding habitat on federal and non-federal lands are presented in Tables 2 and 3, respectively. During the first 15 years of the Northwest Forest Plan, wildfires were responsible for an estimated gross loss of 236,700 acres (2.7%) of suitable breeding habitat on federal lands rangewide and 13,100 acres (0.3%) on non-federal lands (1.9% combined). In California, wildfires removed an estimated 75,500 acres (4.1%) of suitable breeding habitat on federal lands and 5,600 acres (0.4%) on non-federal lands (2.4% combined). Approximately 70% of habitat loss to wildfire on federal lands occurred within the Oregon and California

Klamath Provinces (Table 2). Most of this habitat loss was caused by the 1999 Megram Fire and 2002 Biscuit Fire (Table 4). Fires in the Eastern Cascades Provinces of Washington, Oregon, and California contributed less to total habitat loss than did fires in the Klamath, but were often more destructive in terms of proportion of suitable habitat lost within individual fire perimeters. In contrast with federal lands, wildfires were responsible for very little habitat loss on non-federal lands; rather, timber harvesting accounted for most losses in these areas (Figure 1).

Table 2: Estimated gross losses of suitable NSO breeding habitat on federal lands due to wildfires during 1994-2007 in California and 1996-2006 in Oregon and Washington (adapted from Davis and Dugger 2011, USFWS 2011).

State	Province	Initial Acres	Acres Lost	Percent Lost
California	CA Cascades	213,200	1,800	0.8%
	CA Klamath	1,489,800	71,600	4.8%
	CA Coast	145,400	2,100	1.4%
Oregon	OR Coast Range	611,200	0	0.0%
	Western OR Cascades	2,258,700	28,900	1.3%
	Eastern OR Cascades	402,900	17,800	4.4%
	Willamette Valley	3,400	0	0.0%
	OR Klamath	985,000	93,600	9.5%
Washington	Olympic Peninsula	763,100	200	0.0%
	Eastern WA Cascades	673,600	20,000	3.0%
	Western WA Cascades	1,283,000	700	0.1%
	Western WA Lowlands	24,700	0	0.0%
Rangewide Total		8,854,000	236,700	2.7%

Comment [UFS32]: Initial assumption at implementation of the NWFP was that about 2.5% per decade would be lost to wildfire. We are seeing this exceeded in some provinces, but the reserve network was designed to be large enough to function with losses from large wildfires.

There was not "trigger" to review this in the NWFP but the large amounts lost in some areas is concerning. Most if this loss is also occurring in the reserved land use allocations. This may be a focus of future review after the 20yr monitoring reports are finished (2015).

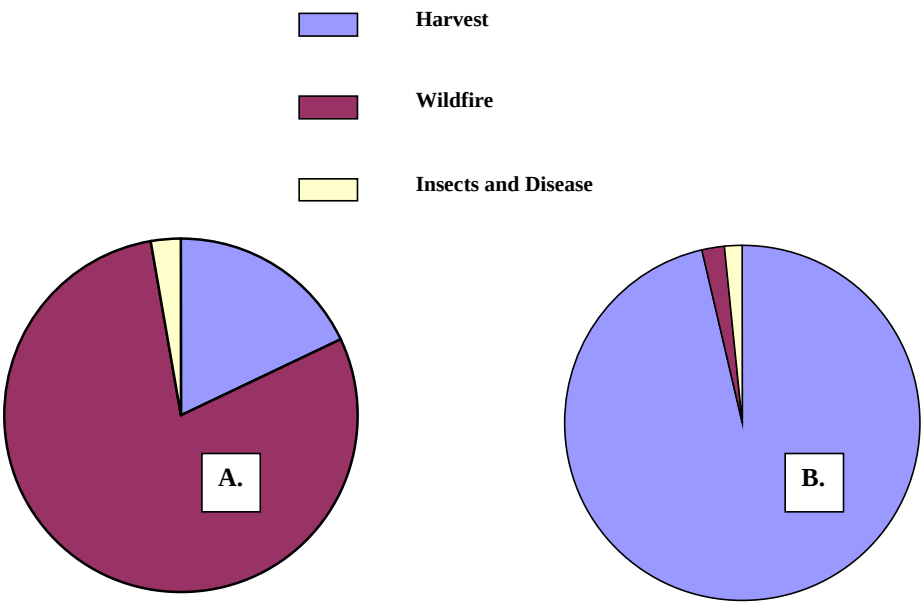
Table 3: Estimated gross losses of suitable NSO breeding habitat on non-federal lands due to wildfires during 1994-2007 in California and 1996-2006 in Oregon and Washington (adapted from Davis and Dugger 2011, USFWS 2011).

State	Initial Acres	Acres Lost	Percent Lost
California	1,556,700	5,600	0.4%
Oregon	1,382,400	5,100	0.4%
Washington	1,258,900	2,400	0.2%
Total	4,198,000	13,100	0.3%

Table 4: Estimated gross losses of suitable NSO breeding habitat to individual wildfires during 1994-2007 (note: "habitat degraded" describes areas downgraded from highly suitable to suitable; from Davis and Dugger 2011).

Fire name	Year	Broad physiographic province	Habitat in wildfire perimeter	Habitat lost		Habitat degraded	
			Acres	*Acres*	*%*	*Acres*	*%*
Biscuit Fire	2002	Klamath Mountains	226,230	93,730	41	12,019	5
Megram Fire	1999	Klamath Mountains	76,337	27,520	36	4,589	6
B&B Complex	2003	East Cascades	26,269	16,403	62	907	3
Bake-oven Fire	2006	Klamath Mountains	23,946	8,873	37	581	2
Boulder Fire	2002	West Cascades	34,059	8,460	25	2,074	6
Davis Fire	2003	East Cascades	8,050	6,943	86	5	0
Pigeon Fire	2006	Klamath Mountains	13,896	5,634	41	327	2
Rex Complex	2001	East Cascades	8,548	4,750	56	278	3
Timbered Rock	2002	West Cascades	10,216	4,539	44	569	6
Spring Fire	1996	West Cascades	13,504	3,931	29	858	6
Deep Harbor Fire	2004	East Cascades	5,761	3,930	68	64	1
Hancock Fire	2006	Klamath Mountains	12,712	3,132	25	336	3
Apple Fire 2	2002	West Cascades	12,227	2,810	23	928	8
Fischer Fire	2004	East Cascades	4,479	2,340	52	34	1
Fork Fire	1996	Klamath Mountains	2,962	2,113	71	14	0
Needles Fire	2003	East Cascades	1,946	874	45	1	0
Trough Fire	2001	Klamath Mountains	1,851	798	43	4	0
Hunter Fire	2006	Klamath Mountains	2,236	789	35	40	2
Deer Point Fire	2002	East Cascades	505	380	75	0	0
Tatoosh Complex	2006	East Cascades	666	378	57	0	0

Figure 1: Proportions of suitable breeding habitat loss attributed to harvesting, wildfire, and insects and diseases on (A) federal lands and (B) non-federal lands during 1994-2007 (adapted from Davis and Dugger 2011 and USFWS 2011).

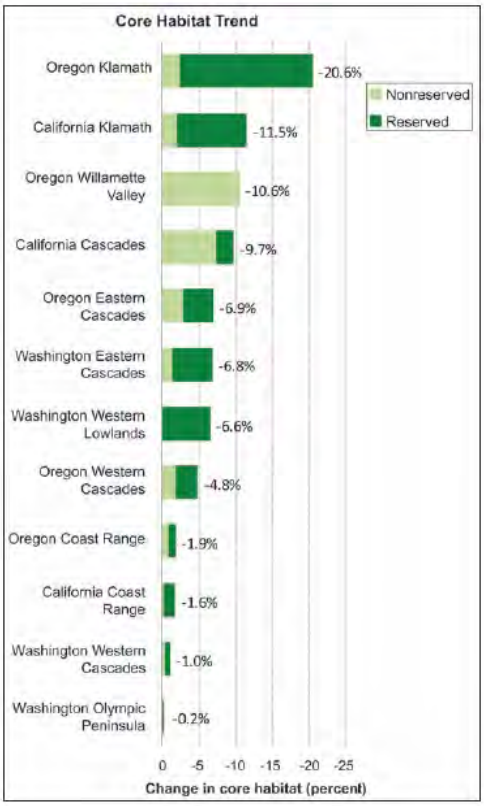


Davis and Dugger (2011) reported substantial losses of core breeding habitat on federal lands during the first 15 years of the Northwest Forest Plan (Figure 2). These losses primarily occurred in reserved areas. Changes in ratios of core and edge habitat classes indicated that increased fragmentation of suitable breeding habitat on federal lands was greatest in the Oregon and California Klamath Provinces and California Cascades Province (see Table 3-3 in Davis and Dugger 2011). Increased fragmentation in these regions was primarily due to wildfires.

Comment [UFS33]: Should define this as there are numerous uses of the term "core" in the literature.

Describe how it differs from the other habitat (e.g., nesting./roosting). Make it clear that the previous numbers above relate to N/R and not "core".

Figure 2: Gross losses of "core" suitable breeding habitat on reserved and non-reserved federal lands during 1994-2007 in California and 1996-2006 in Oregon and Washington (from Davis and Dugger 2011).



Davis and Dugger (2011) estimated a 5.2% net gain in NSO dispersal habitat. Much of this gain was due to succession in young forests in non-reserved lands at the margins of federal forests. However, accounting for forest connectivity and NSO dispersal distances, Davis and Dugger (2011) reported a 1% net loss of "dispersal-capable landscape". Much of the loss of dispersal-capable landscape in the Klamath and Eastern Cascades Provinces was due to large wildfires, whereas timber harvesting on non-federal lands was responsible for much of the loss in other regions.

Loss and fragmentation of breeding habitat to wildfires was likely at least partially offset by recruitment of new habitat through succession of mature and old forest. However, Davis and Dugger (2011) found that detectable recruitment of breeding habitat primarily occurred in the marginal suitability class. This finding was supported by Moeur et al. (2005), who found that about 90% of recruitment of older forest (mature and old-growth combined) during the first 10 years of the Northwest Forest Plan was at the lower end of the class' diameter range (i.e., mean DBH 20-30 in). In fact, Moeur et al. (2011) noted that given the short length of the monitoring period (10-14 yrs), recruitment was "likely due to incremental stand growth over the 20-in diameter threshold, or from understory disturbances that removed smaller diameter trees and raised the average stand diameter above the threshold, rather than from an increase in forests of much larger and older trees." It is likely that some newly recruited mature forest provides suitable habitat for NSOs but much if it could lack the canopy layering, large diameter snags and logs, and other structural attributes typical of nesting and roosting habitat (Blakesley et al. 2004).

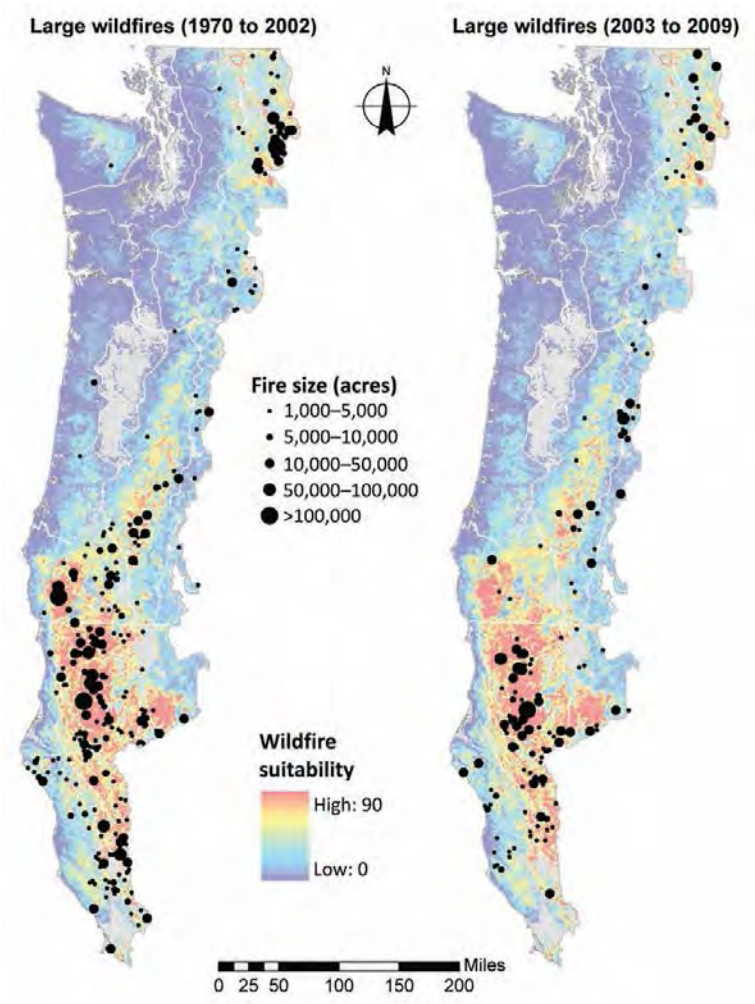
Loss and fragmentation of suitable breeding habitat does not necessarily equate to negative impacts on NSOs (Franklin and Gutiérrez 2002; e.g., Bond et al. 2002, 2009, Lee et al. 2012). Studies in southern Oregon and northern California found that the presence and fitness of NSOs are generally highest in landscapes with a mix of both large amounts of suitable breeding habitat and other habitat classes, such as foraging habitat or "non-habitat" (Franklin et al. 2000, Zabel et al. 2003, Olson et al. 2004, Dugger et al. 2005; reviewed above and in *Threats: Timber Harvesting*). Fitness is also generally highest when suitable breeding habitat occurs in large or clustered patches with large amounts of ecotone or edge between vegetation classes (Franklin et al. 2000, Dugger et al. 2005). This combination of conditions is important because it provides NSOs with a balance of resources needed for both survival and reproduction (Franklin et al. 2000). Active fire regimes in dry forests within the NSO's range in California (e.g., mixed-conifer and interior mixed-evergreen) historically contributed to these conditions by generally sparing older forest and maintaining some form of habitat heterogeneity at both stand and landscape scales (Sugihara et al. 2006). Some contemporary wildfires may still burn in this manner and thereby continue to perform an important ecosystem function in these forests. However, large severe wildfires have contributed, along with fire suppression and timber harvesting, to homogenization of some forests in interior northern California (Skinner et al. 2006). Thus, large severe fires may impact NSOs in California through loss of habitat heterogeneity, as well as reduced amounts and connectivity of suitable breeding habitat.

Fire Risk in California

Prior to Euro-American settlement, dry forests in the western U.S. generally experienced relatively frequent, low-to-moderate or mixed severity fire regimes (Agee 1993, Sugihara et al. 2006, Van de Water and Safford 2011). Mean pre-settlement fire return intervals in California were 11 years in yellow pine forests (e.g., *Pinus ponderosa*, *P. jeffreyi*), 11-16 years in mixed-conifer forests, and 29 years in mixed-evergreen forests (Van de Water and Safford 2011). Mean fire return intervals in redwood forests south of Del Norte County were also relatively frequent (6-44 yrs: Stuart and Stephens 2006). Frequent fire during the pre-settlement period generally maintained forests with less dense and more clumped tree distributions, higher proportions of fire-resistant trees (i.e., larger size classes and more fire-tolerant species), and lighter and less continuous fuel beds than occur today (Sugihara et al. 2006). In northern California, this characteristic fine-scale structural heterogeneity was often overlaid with coarser variability created by effects of elevation, terrain, soils, and other physiographic factors on fire and vegetation patterns (Skinner and Taylor 2006, Skinner et al. 2006, Sawyer 2007). For example, in areas of deeply incised terrain in the Klamath Mountains and southern Cascades of California, upper slopes and south and west facing aspects typically experienced more frequent and severe fire than did other areas (Skinner and Taylor 2006, Skinner et al. 2006). Due to fire suppression, early-successional vegetation communities formerly maintained by frequent, small-scale severe fire have greatly declined in some areas of California (Skinner 1995, Nagel and Taylor 2005). Overall, research indicates that fire suppression and other human activities have led to decreased forest heterogeneity at both stand and landscape scales and have contributed to substantial changes in fire regimes in California's dry forests (Sugihara et al. 2006).

Due to fire suppression, fire-free periods have dramatically increased in California's interior forests (Sugihara et al. 2006). For example, fire rotation near Hayfork in the Klamath Mountains increased more than 10-fold (from 19 to 238 yrs) during the post-settlement period (Taylor and Skinner 2003). Abnormally long fire-free periods have facilitated increased accumulation and continuity of fuels in dry, fire-prone forests (Sugihara et al. 2006). When wildfires do occur there is often an increased risk of them becoming very large and for suppression forces to be overwhelmed by their size and number (e.g., CAL FIRE 2008). As in other dry forests across the western U.S., the mean and maximum sizes of wildfires, and the total annual area burned, significantly increased in California's dry montane forests during the 20th and early 21st Centuries (Miller et al. 2009, 2012). CAL FIRE (2008) noted that more than half of the 26 largest fires recorded in California during 1932-2008 occurred during the last eight years of that period. Based on recent (1970-2002) fire behavior, most of northern California's interior can be classified as highly prone to large (>1,000 ac) wildfires (Davis et al. 2011; Figure 3).

Figure 3: Relative probability of large (>1,000 ac) wildfires ("wildfire suitability") across the NSO's range (from Davis et al. 2011). Modeling was based on landscape and climatic characteristics of locations at which large wildfires occurred during 1970-2002 (left) and was compared with subsequent (2003-2009) locations (right).



Studies of recent trends in extents of high severity fire in California have found conflicting results. For example, Miller et al. (2009) and Miller and Safford (2012) reported a substantial increase in the extent of high severity fire in the Sierra Nevada and southern Cascades of California during 1984-2010; while Hanson and Odion (2014) did not find an increase in the Sierra Nevada during the same period. Similarly conflicting results have been found for the California Klamath Province. Hanson et al. (2009) found a significant increase in high severity fire in the California and Oregon Klamath Provinces during 1984-2005; whereas Miller et al. (2012) did not find an increase in the California Klamath Province during a similar period (1987-2008). Scientific debate ensued regarding the appropriateness of methods used in various studies to determine trends in high severity fire (e.g., Hanson et al. 2009, 2010 vs. Spies et al. 2010).

Differences in findings regarding trends in high severity fire are related to variation in studies' temporal and spatial scales of analysis, as well as in methods for determining fire severity (Courtney et al. 2008, Miller et al. 2012, Hanson and Odion 2014). For example, Miller et al. (2012) noted that both their own study and those of Odion et al. (2004, 2010) may have underestimated trends in high severity fire in the California Klamath Province due to inclusion of unusual fire years. Studies by Odion et al. (2004, 2010) were based on fire effects during a single year (1987), which Miller et al. (2012) described as unusual. Large areas burned at below-average severity during 1987 due to abnormally strong inversions, and the fact that some of the fires burned well into fall (when conditions often favor lower severity fire). Miller et al. (2012) also noted that their own ability to detect a trend in fire severity could have been compromised by inclusion of both this year and 2008, which likewise experienced unusually large, low severity fires. Differences in the area analyzed could also affect evaluations of trends

in high severity fire. For example, the Biscuit Fire, which was predominantly located in Oregon, included extensive areas of high severity fire and therefore could have influenced results of trends analyses for the Oregon and California Klamath Provinces combined versus the California Klamath alone (Miller et al. 2012).

Regardless of whether or not the extent of high severity fire increased in California during the last two decades, large severe fires have recently occurred in these areas, and they were responsible for most loss, degradation, and fragmentation of suitable breeding habitat for NSOs on federal lands (Davis and Dugger 2011, Davis et al. 2011; see above). These data cannot be used to project how fires in the future will affect NSOs since they do not necessarily represent past or future fire conditions or effects. However, it is highly unlikely that wildfires will cease to be a major source of habitat loss for NSOs in the future. Rather, climate change research has generally projected a continued increase in the number and sizes of wildfires and the annual area burned during coming decades (Westerling et al. 2006, Lenihan et al. 2008, Westerling and Bryant 2008, Littell et al. 2009). There is scientific uncertainty regarding recent and future trends in the extent of high severity fire in California. Nonetheless, large severe fires will at least occasionally occur in the future and will continue to be a source of habitat loss and modification for NSOs in the state.

Increases in the number and sizes of wildfires, and effects of fires on NSO habitat, have led to calls for widespread use of thinning and other forms of active management in dry, fire-prone forests (USFWS 2008, 2011, 2012a, Franklin and Johnson 2012). Some researchers and stakeholders, however, have expressed doubts regarding estimates of fire risk and effects on

Comment [UFS34]: The trend in large wildfires has increased, and seems to be continuing (Happy Camp, July Complex…etc). With increased area burned, you get increased area burned in high severity.

Comment [UFS35]: Moritz et al. 2012, Stavros et al. 2014, Dennison et al. 2013

Comment [UFS36]: Perhaps it would be informative to include what was originally planned in the NWFP? The way this reads, and in general, the perception is that this is something newly proposed in response to recent large wildfires.

The NWFP (1994) actually called for widespread thinning in the fire prone portions of the owl's range to reduce risks of stand-replacing wildfires. And this was not just for NSO, it also focused on other late-successional species.

In fact, the agencies developed a specific Land Use Allocation called the "Managed Late Successional Area". Managed Late-Successional Areas are similar to Late- Successional Reserves (LSR) but were identified for certain owl locations in the drier provinces where regular and frequent fire is a natural part of the ecosystem. Certain silvicultural treatments and fire hazard reduction treatments are allowed to help prevent complete stand destruction from large catastrophic events such as high intensity, high severity fires; or disease or insect epidemics.

Even in regular LSRs in the Eastern Cascades or Klamath Provinces, silviculture aimed at reducing the risk of stand-replacing fires may be appropriate. Treatments may include thinning and underburning. Such activities in older stands in westside provinces may be warranted when levels of fire risk are high. (Record of Decision, B-7 to B-8).

Many of these treatments may reduce the quality of habitat for late-successional organisms. Thus, managers need to seek a balanced approach that reduces risk of fire while protecting large areas of fire-prone late-successional forest (B-8).

NSOs, concerns about potential effects of thinning on NSOs, and distrust of federal agency intentions (Hanson et al. 2009, Heiken 2010, DellaSala et al. 2013). As discussed in *Threats: Timber Harvesting* (also Hansen and Mazurek 2010, USFWS 2011), there is currently little known about the effects of forest thinning on spotted owls but the preponderance of evidence indicates that commercial thinning can have negative short-term effects on the species. Federal agencies should carefully consider this information when formulating land management policies and prescriptions aimed at reducing wildfire risk. Land managers should also consider greater use of prescribed fire and allowing wildfires to burn under favorable conditions; particularly at lower elevations in the California Klamath Province, where summertime inversions often minimize fire severity (Miller et al. 2012).

Comment [UFS37]: But how is this balanced with potential long-term beneficial effects? This is what needs to be determined in my opinion.

Again, from NWFP ROD - Many of these treatments may reduce the quality of habitat for late-successional organisms. Thus, managers need to seek a balanced approach that reduces risk of fire while protecting large areas of fire-prone late-successional forest (B-8).

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Wildfire and Salvage Logging

Comment [M1]: The entire document is written within a framework that assumes fire is bad. This biased treatment is unfortunate. I assume you've made fire a threat to the species as reason to list, but this synthesis of fire and owls is biased and poorly done. I stopped reading closely on page 15 because I was tired of correcting the errors and biased statements.

Recent status reviews have identified wildfire as a primary threat to the recovery of the northern spotted owl (NSO) (Courtney et al. 2004, USFWS 2011). Much of this concern is based on recent loss of suitable breeding habitat to wildfires and to the risk of extensive severe fires occurring in the future. Other researchers and stakeholders have questioned the scientific basis of claims that wildfires pose a threat to NSOs and have expressed distrust of agency recommendations for widespread use of forest thinning to reduce fire risk (Hanson et al. 2009, Heiken 2010, DellaSala et al. 2013). Surprisingly, existing reviews supporting both sides of this debate have only considered a portion of the available information concerning spotted owl responses to wildfires, and mostly in regard to their limitations and inconsistent findings. Our review confirms these limitations and suggests that wildfires have variable and complex effects on spotted owls. Fire is a crucial ecosystem process in dry forests within the species' range, and some spotted owl populations are known to benefit from a mix of habitat conditions resembling those historically maintained by active fire regimes (e.g., Franklin et al. 2000). However, the preponderance of currently available evidence indicates that large severe wildfires can have strong negative effects on spotted owls. Wildfires may also negatively affect spotted owls through cumulative or interactive effects with other environmental stressors, such as timber harvesting, salvage logging, and competition with barred owls (see *Potential Threats: Cumulative and Interactive Effects*).

Comment [M2]: unclear

Comment [M3]: wording ?

Comment [M4]: hmmmm.

Wildfire Effects on Spotted Owls

Several studies have investigated responses of NSOs to wildfires (Table A). These studies provide crucial information for evaluating fire as a potential threat to the subspecies. However, their inferences are limited due to small sample sizes in all cases, the potentially confounding effects of post-fire salvage logging in one case, and pooling of data from all three spotted owl subspecies in another case (Table A; see below). In order to supplement these studies, we also reviewed research of fire effects on California spotted owls (CSOs) and Mexican spotted owls (MSOs) (Table A). Because inferences from these studies are also limited, and given differences among fires, spotted owl populations, and research methods, we review each project as a "case study". Relatively thorough descriptions of these studies allow identification of patterns in the literature, which could provide insights into general effects of wildfires on the species.

Comment [M5]: ??

Table A: Apparent effects of wildfires on spotted owls. See text for additional descriptions of study methods and findings.

Response Metric	Study	Subspecies	Location*	Apparent Effect**	Notes
Mortalities	~~Paton et al. 1991~~	~~NSO~~	~~CA KLA~~	~~(?)~~	~~Likely due to heavy radio tags~~
	King et al. 1997	NSO	E WA CAS	-(?)	Only one individual; Possibly due to wildfire also logging
	Clark 2007	NSO	OR KLA	-(?)	Possibly due to wildfire and logging (unpublished grey lit.; analysis has problems)
Survival	Bond et al. 2002	NSO, CSO, MSO	CA, AZ, NM	0	Only one post-fire survey season
	Clark et al. 2011	NSO	OR KLA	-	~~Possible cumulative~~ Cumulative effect of timber harvesting, severe fire, and salvage logging
Productivity	~~Paton et al. 1991~~	~~NSO~~	~~CA KLA~~	~~(?)~~	~~Possible decline; Likely due to heavy radio tags~~
	Gaines et al. 1997	NSO	E WA CAS	0	Apparently no decline but possibly obscured by low reproduction year across population; Possibly lower total reproduction in burned landscapes due to lower pair occupancy; Only one post-fire season Anecdotal, no statistical power!
	Bond et al. 2002	NSO, CSO, MSO	CA, AZ, NM	0 (+?)	Slightly higher than in other studies; Only one post-fire season
	Clark 2007	NSO	OR KLA	0 ?	Apparently no decline but low statistical power; Possibly lower total reproduction in burned and logged landscapes due to lower pair occupancy
	Roberts 2008	CSO	CA SIERRA	+	Repro higher in burned.
Site Fidelity	Bond et al. 2002	NSO, CSO, MSO	CA, AZ, NM	0	Site fidelity similar to other studies
Occupancy	Elliot 1985	CSO	CA COAST	-?	Apparent abandonment by two pairs (this is anecdotal)
	Gaines et al. 1997	NSO	E WA CAS	-?	Post-fire occupancy was lowest found during five-year study; Only one post-fire season (anecdotal, no stats)
	Jenness et al. 2004	MSO	AZ, NM	0	Statistically ~~weak but pooled all fire types and severities~~no difference
	Keane et al. 2011, 2012	CSO	CA SIERRA/CAS	-?	Extensive high severity fire apparently had a strong negative effect; Extensive low severity fire apparently had a neutral or weak negative effect; Result influenced by extensive salvage logging
	Roberts et al. 2011	CSO	CA SIERRA	0	~~Authors concluded weak effect but pooled all fire types and severities~~No difference between burned and unburned
	Lee et al. 2012	CSO	CA SIERRA	0 (+?)	Similar occupancy at burned vs. unburned; Possibly ~~lower~~ higher occupancy at ~~severely~~ burned vs. ~~other~~ unburned
	Lee et al. 2013	CSO	SO CA	0/-	Similar occupancy at burned vs. unburned; Significant reduction with extensive high severity fire in core area
	Clark et al. 2013	NSO	OR KLA	-?	Cumulative effects of timber harvesting, severe fire, and salvage logging
Home Range	Clark 2007	NSO	OR KLA	-?	Larger home ranges post-fire and salvage logging
	Bond et al. 2013	CSO	CA SIERRA	0	Similar home range sizes to unburned areas
Roosting	King et al. 1997	NSO	E WA CAS	-	Apparent avoidance of moderate and severe burns
	Bond et al. 2009	NSO	CA SIERRA	-	Significant avoidance of moderate and severe burns
Foraging	Clark 2007	NSO	OR KLA	+(?)	Apparent weak selection of moderately burned suitable habitat; Possible weak selection for severely burned suitable habitat; Very low use and availability of both moderately and severely burned suitable habitat

Comment [M6]: This study says nothing about fire effects, should be omitted.

Comment [M7]: Always confounded fire and salvage logging. Don't assume or report that the effects were from fire!

Comment [M8]: This study says nothing about fire effects, should be omitted.

Comment [M9]: Always confounded fire and salvage logging. Don't assume or report that the effects were from fire!

Comment [M10]: Leave this to occupancy

Comment [M11]: Always confounded fire and salvage logging. Don't assume or report that the effects were from fire!

Comment [M12]: Always confounded fire and salvage logging. Don't assume or report that the effects were from fire!

	Bond et al. 2009	NSO	CA SIERRA	+	Significant selection of severe burns

* Locations: California Klamath (CA KLA); Eastern Washington Cascades (E WA CAS); Oregon Klamath (OR KLA); California, Arizona and New Mexico (CA, AZ, NM); California Central Coast Range (CA COAST); California at margin of northern Sierra Nevada and southern Cascades (CA SIERRA/CAS); California Sierra Nevada (CA SIERRA); southern California San Bernardino and San Jacinto Mountains (SO CA). **Apparent Effect: negative (-), positive (+), neutral (0), varied with fire severity (/)—see Notes column and text for further explanations.

Survival

Although adult spotted owls are capable of rapid and sustained flight, it is possible that they are occasionally killed by large or fast moving fires. Young owls with undeveloped flight feathers may be at particular risk of mortality during wildfires due to poor mobility (Smith 2000). Even in unburned areas, spotted owls could be injured or killed by smoke (Singer and Schullery 1989, Smith 2000). In addition to these potential immediate effects, extensive moderate or severe wildfire could influence spotted owl survival over the longer-term by ~~removing or~~ modifying habitat for roosting, foraging, or prey (see below).

Comment [M13]: Data-free statement, recommend deletion

Comment [M14]: Could be positive or negative modification, author should avoid judgmental language when speculating.

Only two studies are currently available for evaluating effects of wildfires on spotted owl survival rates (Table A). Bond et al. (2002) reported that 18 of 21 (86%) marked spotted owls were resighted one year after wildfires occurred in California, Arizona, and New Mexico. This minimum survival rate was similar to survival estimates in unburned areas found by other, longer-term studies of the three spotted owl subspecies (Seamans et al. 1999, Franklin et al. 2000, W.S. LaHaye unpubl. data). Extensive severe fire (36-88%) occurred in four of the eight territories for which fire severity was mapped and the other half primarily burned at low to moderate severity. Thus, even extensive severe fire did not appear to have a large effect on spotted owl survival one year post-fire. ~~In contrast,~~ Clark et al. (2011) found evidence of a negative effect of combined wildfires and salvage logging on survival of 23 NSOs in the Oregon Klamath Province. Severe fire and salvage logging occurred in 30% and 41% of suitable NSO habitat in the two study areas. Estimated mean annual survival rates for NSOs located inside fire perimeters (0.69) and apparently displaced by fires and post-fire salvage logging (0.66) were

lower than in areas just outside the fire perimeters (0.85) and in an unburned reference study area in the neighboring southern Cascades (0.85: Anthony et al. 2006). The degree to which post-fire salvage logging in the study areas influenced NSO survival rates is unknown, but we know salvage logging has a documented negative effect on occupancy (Lee et al. 2013).~~.~~ The study's occupancy analyses indicated that pre-fire timber harvesting, wildfires, and post-fire salvage logging cumulatively impacted NSOs through reductions of suitable habitat (Clark et al. 2013; see below).

Apparently contradictory findings by Bond et al. (2002) and Clark et al. (2011) may be due to several factors. The most obvious difference between the studies is that the areas studied by Clark et al. (2011) experienced post-fire salvage logging while those studied by Bond et al. (2002) did not. Additionally, the populations studied by Clark et al. (2011) may have been particularly sensitive to habitat loss to wildfires due to intensive pre-fire timber harvesting across a checkerboard ownership. ~~It is also possible that Bond et al. (2002) failed to detect a negative effect of wildfires on spotted owls due to their reliance on data collected one year after fires occurred.~~It should be noted that Bond et al (2002) only examined effects 1 year post fire. Fire injuries and post-fire outbreaks of insects and pathogens can continue to result in tree mortality for up to several years after a wildfire (Ryan and Amman 1996, Gaines et al. 1997, Hood et al. 2007).

Comment [M15]: Bad language

Comment [M16]: Why assume tree death can only negatively affect SPOW? What about small mammal prey increases post fire?

There is relatively little information about the causes of spotted owl mortalities in recently burned areas. Not all spotted owl projects include radio-telemetry, which enables researchers to

recover dead birds. Even with radio-telemetry, only a portion of owl carcasses are recovered before they are too scavenged or decomposed to conduct a necropsy.

We reviewed three studies that described the condition of dead spotted owls found in areas recently burned by wildfire (Table A). In the Western Klamath Region of California, Paton et al. (1991) reported that one telemetered NSO died during a wildfire and that four more died within seven weeks. There was no evidence that any of the birds died from smoke inhalation or burns; rather, survival in the study area appeared to have declined due to the energetic costs of radio packs that were quite heavy by current standards. However, the authors noted that the telemetered owls in their study were exposed to high levels of carbon monoxide and total suspended particulates when an inversion trapped a dense layer of smoke near the ground for more than three weeks. In the eastern Washington Cascades, King et al. (1997; also Bevis et al. 1997) described a female NSO's behavior and death following a wildfire. The female and her fledgling survived when a low to moderate severity fire burned through the nest grove and produced thick smoke. Shortly after her offspring dispersed, the female moved to a new location outside the burned area and then died less than a month later. Her carcass was emaciated, indicating that she died from starvation or illness. King et al. (1997) speculated that this spotted owl died due to a post-fire decline in prey availability, but no prey data were presented. Clark (2007) reported that a total of eight NSOs died during his telemetry study in the Oregon Klamath Province. Six of the owls were recovered, all of which were emaciated. He likewise suggested that the deaths were related to a ~~post-fire~~ decline in prey availability due to combined effects of fire and salvage logging, but no prey data were presented. ~~This hypothesis was indirectly supported by the study's finding that NSOs' annual home ranges increased after wildfires~~

Comment [M17]: Without presenting examples direct mortality detected in telemetry studies of unburned areas, these anecdotes are biased and misleading.

Comment [M18]: Delete, this paper does not provide any data to judge fire effects on SPOW

Comment [M19]: Data-free anecdotes are dangerous.

Comment [M20]: But like King he had no data to support this speculation.

~~occurred (see below).~~ It is also possible that a factor other than fire caused a decline in prey availability or that the wildfires affected NSO survival in other ways. For example, loss or degradation of suitable roosting habitat could stress NSOs by limiting their ability to thermoregulate (Barrows 1981, Ganey et al. 1993, Ting 1998, Weathers et al. 2001).

Reproduction

The spotted owl is a relatively long-lived species that exhibits a bet-hedging life history strategy (Noon and Biles 1990, Franklin et al. 2000). This means that individuals often forego breeding during poor environmental conditions in order to maximize their chance of surviving and reproducing in the future. Given the species' life history strategy, spotted owl reproductive rates are likely sensitive to environmental changes, including those brought about by wildfires. However, annual fluctuations in spotted owl reproduction caused by variation in weather, prey populations, or breeding condition could obscure effects of wildfires on reproduction (e.g., Franklin et al. 2000).

We are aware of four studies that examined potential effects of wildfires on spotted owl reproduction (Table A). None of these studies found substantive evidence of a wildfire-induced decline in reproduction by the species. In the Western Klamath Region of California, ~~Paton et al. (1991) noted a possible difference in reproduction by NSOs in two areas burned by the same wildfire. Reproduction and fire effects were poorly described for burned versus unburned areas (e.g., number of eggs vs. number of fledglings; inversion-trapped smoke vs. understory burning in different areas of the fire), but demographic rates in the study appeared to be influenced by whether or not owls were fitted with heavy radio tags, rather than by variation in fire effects~~. In

the eastern Washington Cascades, Gaines et al. (1997) found little difference in productivity (number of young per pair) between burned (0.2; n = 5 or 6/ yr) and unburned sites (0.3; n = 13-17/yr) one year after a predominantly moderate to severe wildfire. However, it is possible that coincidentally low reproduction across the population during the post-fire year made it difficult to detect a difference between burned and unburned sites; particularly with such a small sample size. Clark (2007) found no significant differences in productivity in burned areas in the Oregon Klamath Province (n = 31 territories) and an unburned study area in the neighboring southern Cascades (Anthony et al. 2006). He noted, however, that his study likely lacked the statistical power to detect a difference if one occurred. Bond et al. (2002) found that seven pairs of spotted owls produced an average of 1.0 offspring during a single breeding season following wildfires in California, Arizona, and New Mexico. This was higher than productivity rates ~~found~~ found in unburned areas during long~~er~~-term studies of the three spotted owl subspecies (Seamans et al. 1999, Franklin et al. 2000, W.S. LaHaye unpubl. data).

Comment [M21]: No statistics were presented.

Comment [M22]: Why speculate that a difference ought to be there?

Currently available studies suggest that wildfires generally have little or no short-term effects on spotted owl reproduction. However, it might be difficult to capture fire effects on spotted owl reproduction during short-term studies, particularly those with only a single year of post-fire data. In addition, it is possible that solely comparing productivity (e.g., offspring per pair) in burned and unburned areas could obscure a decline in total reproduction in burned areas. Studies in Washington and Oregon reported post-fire declines in occupancy by pairs, suggesting that wildfires may reduce reproductive opportunities for spotted owls (Gaines et al. 1997, ~~Clark 2007;~~ see below). Alternatively, it is possible that wildfires sometimes contribute to higher reproduction by spotted owls. For example some pairs or populations may experience higher

reproduction following wildfires due to short-term increases in availability of deer mice (*Peromyscus* spp.), pocket gophers (*Thomomys* spp.), and other prey (Ream 1981, Zwolak 2009, Bond et al. 2013).

Comment [M23]: Finally, the potential positive effects are mentioned.

Occupancy

Potential wildfire effects on NSO population rates are most directly evaluated with measures of survival and reproduction. However, occupancy data are often more logistically and economically feasible to collect than are demographic data and could provide an early indication of population trends (MacKenzie 2005, Olson et al. 2005). Spotted owl occupancy is sensitive to environmental factors (Blakesley et al. 2005, Olson et al. 2005) so it is a potentially valuable measure of wildfire effects on the species. Nonetheless, occupancy data must be interpreted carefully since they can be strongly influenced by survey effort, analytical methods, and the presence of barred owls (Olson et al. 2005).

We evaluated nine studies of wildfire effects on spotted owl occupancy (Table A). As described below and in Table A, all but one of these provided at least weak evidence of a negative effect of either severe fire or fire in general.

Two studies indicated potentially ~~strong declines~~ negative effects in spotted owl occupancy but included very few territories (Elliot 1985, Gaines et al. 1997). In Monterey County, California, informal yearly surveys suggested that two pairs of CSOs abandoned their territories for at least four years following a wildfire (Elliot 1985). The author did not describe the fire other than

noting substantial damage to understories and oaks in the previously occupied areas. In the eastern Washington Cascades, Gaines et al. (1997) found that ~~only~~ two of six NSO sites were occupied one year after a predominantly moderate to severe wildfire. This was the lowest occupancy rate found during the five-year study period.

Two studies found ~~only weak~~no evidence of ~~a negative~~any effect of fire on spotted owl occupancy, but their methods may have precluded detection of stronger effects (Jenness et al. 2004, Roberts et al. 2011). Jenness et al. (2004) found a statistically insignificant tendency for higher occupancy rank (no owls, singles, pairs, reproductive pairs) in unburned sites than in paired burned sites in Arizona and New Mexico (paired sites were close to each other and had similar habitat and topography). Of the 29 paired-site comparisons, 14 (48%) had a higher rank in unburned sites, 6 (21%) had a higher occupancy rank in burned sites, and 9 (31%) were tied. In the Sierra Nevada of California, Roberts et al. (2011) found ~~lower occupancy estimates for CSOs in burned areas (0.46) than in unburned areas (0.72); but the difference was not statistically analyzed~~no difference in occupancy between burned and unburned sites. Modeling by both studies indicated that spotted owl occupancy was more strongly influenced by habitat composition or structure than by whether or not fire had recently occurred in territories. However, both studies may have underestimated the impacts of severe fire due to pooling of diverse fire types and severities for analysis (including prescribed fires, wildfires, and wildfires allowed to burn under prescribed conditions). Roberts et al. (2011) may also have underestimated shorter-term effects of wildfires due to inclusion of data collected up to 15 years post-fire.

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Comment [M24]: Exactly corrrect

Comment [M25]: Why are you reaching for reasons that bad fire effects were absent rather than presenting the data in an unbiased voice?

Two studies found evidence of strong declines in occupancy in areas recently burned by extensive severe wildfire but both ~~may have been~~were seriously confounded by post-fire salvage logging (Keane et al. 2011, 2012, Clark et al. 2013). In southwestern Oregon, Clark et al. (2013) examined how extensive wildfires and subsequent salvage logging affected occupancy dynamics of NSO pairs. In their first analysis, the authors compared pre- and post-fire occupancy dynamics in a burned study area in the Oregon Klamath Province (n = 22) to those in an unburned area in the nearby southern Cascades (Anthony et al. 2006). High severity fire and salvage logging removed or modified 26% of suitable habitat in landscapes surrounding NSO sites in this area. The burned and salvage logged study area experienced a 64% reduction in site occupancy during the post-fire period, compared with a 25% reduction in the unburned study area (difference not statistically analyzed). In the second analysis, the authors examined possible effects of severe fire and salvage logging on occupancy dynamics in 40 territories located in three burned study areas in the Oregon Klamath Province. In these areas, 19-26% of suitable habitat was burned at high severity and~~/or~~ salvage logged. During the study's three-year post-fire period, site extinction probabilities were as high as 72% in two combined study areas and 92% in the third area. Site extinction probabilities in the burned and logged study areas were best explained by a model that included extents of high severity fire, salvage logging, and early seral forest. Models that included these variables separately were not competitive with the model containing all three variables, suggesting that NSO occupancy declined due to cumulative habitat loss from severe fire and pre- and post-fire timber harvesting. ~~The relative influence of these factors on occupancy is unknown, but the role of severe fire cannot be dismissed. For example, the highest extinction probability (92%) occurred in a study area with little salvage logging (<2%) of previously suitable habitat.~~

Comment [M26]: Incorrect. Their model structures were not organized to differentiate among these effects.

Comment [M27]: Using anecdotal examples as refutation of statistics is wrong and should be avoided.

Keane et al. (2011, 2012) estimated occupancy of CSOs in two recently burned study areas near the margin of the Sierra Nevada and southern Cascades of California. One wildfire complex, and an unreported amount of post-fire salvage logging, resulted in an almost complete loss of potentially suitable CSO habitat in the area (70% of the area pre-fire vs. 6% post-fire consisted of mean canopy cover ≥40% and mean DBH ≥11 in). Pre-fire occupancy in this study area was unknown but the Forest Service identified 23 CSO activity centers in the area prior to the fires. Rigorous landscape survey coverage by Keane et al. (2011, 2012) confirmed occupancy in only one territory within the fire perimeter during each of two post-fire years, whereas approximately seven to nine territories were found post-fire in a surrounding one-mile survey buffer. The other area studied by Keane et al. (2011, 2012) primarily burned at low severity (ca. 60% of the area). Pre-fire occupancy was likewise unknown in this area but Forest Service pre-project surveys indicated the presence of about 10 territories. Surveyors confirmed occupancy of six territories in this area during the first and second years post-fire. While the study's findings are preliminary and may have been influenced by post-fire salvage logging, they suggest that effects of large wildfires on CSOs are strongly dependent on the extent of high severity fire.

Comment [M28]: This study is weak, unpublished, and uninterpretable due to the unquantified salvage logging. Use with care, or not at all.

~~Another study provided further~~ The only published study that accounted for effects of logging and fire separately documented evidence that effects of wildfires on spotted owl occupancy depend on the extent of high severity fire. Lee et al. (2013) compared occupancy dynamics of CSOs in 71 recently burned sites and 97 unburned sites in the San Bernardino Mountains and San Jacinto Mountains of southern California. An average of 23% of forest within burned "core areas" (500 ac around activity centers) experienced high severity fire (this percent is based on an

assumption that the amount of pre-fire forest in burned core areas was the same as that reported for burned and unburned core areas combined). Mean annual probability of occupancy was 0.48 in unburned sites and 0.31 in burned sites. This difference was not statistically significant. ~~However, probability of occupancy was consistently lower in burned sites during all eight post-fire years, suggesting that wildfire had a biologically meaningful effect on CSO occupancy. Furthermore, a~~A statistically significant negative effect on occupancy was detected~~, particularly for pairs,~~ when more than 125 acres of forest within core areas burned at high severity.

~~Finally, t~~Two studies found that wildfires had ~~little~~ positive or no effect on spotted owl occupancy (Bond et al. 2002, Lee et al. 2012). Bond et al. (2002) calculated site fidelity for spotted owls in 11 territories burned by wildfires in California, Arizona, and New Mexico. The fires burned most of the area within each estimated territory (territory size = ½ the nearest neighbor distance in each study area, based on previous studies). Half of the eight territories for which fire severity was mapped primarily burned at low to moderate severity and the other half experienced extensive severe fire (36-88%). Of 21 color-banded owls in the study, 18 (86%) were resighted the year after the fires and 16 (89%) of these were located in their pre-fire territory. Site fidelity in this study was comparable to that in other, longer-term studies of the three subspecies (Seamans et al. 1999, Franklin et al. 2000, W.S. LaHaye unpubl. data).

In the Sierra Nevada, Lee et al. (2012) compared post-fire occupancy in 41 recently burned and 145 unburned historical CSO territories. An average of 32% of forest in burned territories experienced high severity fire. The authors found no significant association between CSO occupancy and whether or not territories had recently experienced wildfire within a 494-acre

circle around activity centers (but mean occupancy was higher in burned sites: 0.76 at unburned sites and 0.80 at burned sites). ~~Of the nine sites in which at least 50% of forest was severely burned within larger 988-acre areas around activity centers, eight were surveyed post-fire and CSOs were detected in five of those (63%). This level of occupancy appears to have been lower than that of burned sites as a whole (not statistically analyzed), but it also indicates that CSOs can persist in areas with extensive severe fire.~~

The studies reviewed above are not directly comparable due to differences in methods, spotted owl subspecies and populations, fire extents and severities, and the presence or absence of post-fire salvage logging. ~~Nonetheless, the weight of currently available evidence indicates that, while spotted owls can persist in burned landscapes, wildfires may often reduce occupancy.~~Current data (weighted by sample sizes, statistical power, and confounding effects of salvage logging) indicate that wildfire does not significantly affect occupancy except rarely, in the most extreme situations, when most suitable habitat in the nest core area is severely burned. ~~The studies further suggest that the magnitude of wildfire effects on occupancy depends on the extent of severe fire. However, even mixed severity wildfires may substantially reduce occupancy when suitable habitat is already limited (e.g., due to intensive timber harvesting: Clark et al. 2013)~~. Post-fire salvage logging can increase the negative effects of extensive severe fire on spotted owl occupancy; most likely by reducing suitability of burned areas for prey and foraging (see below).

Home Range Size and Habitat Use

Changes in the behavior of individual spotted owls may provide insight into the mechanisms by which wildfires affect populations. For example, post-fire changes in home range size may reflect fire effects on spotted owl energy budgets through changes in travel distances and prey availability. Changes in energy intake and output could, in turn, influence survival, reproduction, and occupancy of spotted owls. Patterns of habitat use may also be informative. For example, selection or avoidance of burned areas may reflect changes to availabilities of prey or roosting habitat, which could, in turn, influence occupancy, reproduction, or survival of spotted owls.

To our knowledge, only two studies have evaluated spotted owl home range sizes in relation to wildfires (Clark 2007, Bond et al. 2013). Clark (2007) found that annual home range sizes of NSOs inside two fire perimeters in the Oregon Klamath Province were larger after the fires than before them (n = 14 owls pre-fire and 20 post-fire). He attributed this difference to owls expanding their home ranges in response to habitat fragmentation caused by severe fire and salvage logging. This hypothesis was supported by other research in the region, which found that NSOs had larger home ranges in fragmented forests than in areas with larger, more intact patches of habitat (Carey et al. 1992, Schilling et al. 2013). Another study in the region suggested that the energetic cost of increased travel in fragmented forest was greater than the energetic benefit of increased access to prey associated with early-successional habitats (Carey and Peeler 1995).

Comment [M29]: Whenever you mention this Clark 2007study you must call any affects due to"fire and salvage logging" because they did not discriminate between these thing, but lumped all together.

Bond et al. (2013) compared the breeding season home ranges of seven CSOs (from four territories) during a single post-fire year in the Sierra Nevada of California with those in other studies during the same year in other parts of the subspecies range (D. Call, T. Munton, and G. Zimmerman unpubl. data). An average of 23% of forest burned at moderate severity and 9% at high severity within a 1.2 mile radius of the four nests. Pre-fire home range sizes were unknown but CSOs in the four territories did not appear to have unusually large home ranges following predominantly low to moderate severity wildfire.

Three studies have described patterns of habitat use by spotted owls in burned areas (Table A). King et al. (1997; also Bevis et al. 1997) described initial effects of wildfires on NSOs in two territories in the eastern Washington Cascades. One territory primarily experienced low to moderate severity fire and the other mostly burned at high severity. Both territories experienced an unreported amount of salvage logging in unsuitable or severely burned habitat. Most NSO locations (84% and 89%) in the two territories were daytime roosts. In the territory primarily burned at low to moderate severity, 80% of the pair's post-fire locations were in unburned habitat, 16% were in low severity burns, and 4% were in moderate severity burns. The pair did not appear to use severely burned areas. The second territory studied by King et al. (1997) was occupied by a single male. After the fire, the male shifted his activity to an unburned area two to three miles away but continued to occasionally use areas near his former activity center. Of those locations, 74% were in unburned habitat, 17% were in low severity burns, 5% were in moderate severity burns, and 4% were in high severity burns. Maps of burn severity classes and NSO locations indicate that owls in these two territories strongly selected unburned areas for roosting.

Clark (2007) evaluated habitat selection by 12 NSOs (7 territories) inside a wildfire perimeter in the Oregon Klamath Province. NSO locations were primarily nocturnal and may therefore, have largely represented foraging activity. Individuals in this area used all habitat classes, including moderate and severe burns and areas that had been salvage logged. However, when the data from individuals were pooled for analysis, the owls exhibited a strong preference for nesting-roosting habitat that was unburned or burned at low severity (unburned and low severity were combined into a single class). NSOs in the study also selectively used moderately burned, previously-suitable habitat; although both use and availability of this habitat class were low compared with unburned or lightly burned habitat. Clark (2007) speculated that selection of moderately burned habitat was related to increased prey availability following fire in those areas. Owls' use of burned areas was concentrated closer to activity centers, which was expected, given that spotted owls are central place foragers during the breeding season (Rosenberg and McKelvey 1999).

In the Sierra Nevada, California, Bond et al. (2009) described the habitat associations of seven CSOs from four territories during a single post-fire season. Of the four nests found during the study, one was approximately 0.3 mile outside the fire perimeter, one was in forest burned at low severity, and two were in forest burned at moderate severity. One of the two nest trees found in a moderate severity burn was apparently killed by the fire and one produced the only fledgling detected during the study. It is unclear from the paper whether these events occurred at the same nest or different nests. The four pairs roosted in all burn severity classes but exhibited statistically significant selection of low severity burns and avoidance of moderate and high

severity burns. Only one of 60 roost sites was located in a high severity burn. Burned roost sites generally resembled unburned roost sites (>60% canopy cover and large-diameter trees). Bond et al. (2009) also evaluated CSO selection of foraging habitat in the area. Probability of use for foraging was highest when sites were burned and within 0.6 mile of nests or roosts. Probability of use was also positively associated with presence of edge between burn severity classes. Five of the owls foraged in high severity burns within 0.9 mile of nests or roosts more often than in other burn severity classes. Bond et al. (2009) suggested that CSOs in these four territories selectively foraged in high severity burns in order to access abundant prey in those areas. This hypothesis was supported by their finding that high severity burns had the highest herb and shrub cover and highest basal area of snags of any burn severity class, including unburned. These features are key resources for spotted owl prey communities (Carraway and Verts 1991, Carey et al. 1999, Holloway and Smith 2011).

The limited available information concerning spotted owl habitat use following wildfires indicates that the species ~~strongly~~ avoids roosting in moderate and high severity burns. This is unsurprising, given the spotted owl's close association with densely-canopied older forest for roosting (*section_xxx*). Little is known about the effects of wildfire on selection of nest sites. Bond et al. (2009) found three CSO nests in forest recently burned at low and moderate severity, and young fledged from one nest in a moderate severity burn. Moderate severity fire killed one of the four CSO nest trees in their study. We are unaware of any reports of spotted owls nesting in severely burned areas. Because of the species' nesting habitat requirements (*section_xxx*), it is likely uncommon. Two studies examined selection of foraging habitat by spotted owls. Both found use of all burn severity classes, but Clark (2007) found a preference for foraging in

Comment [M30]: Always confounded fire and salvage logging. Don't assume or report that the effects were from fire! Maybe move all mention of Clark 2007 to salvage logging section.

unburned to moderately burned older forest while Bond et al. (2009) found a preference for severe burns. It is unclear if this difference was due to differences in the studies' methods, spotted owl diets, or effects of fire and timber harvesting on vegetation.

Salvage Logging

Salvage logging further modifies recently burned forests and could exacerbate negative effects of severe fire on spotted owls. While salvage logging might be judiciously used to meet certain conservation objectives (e.g., generating downed wood to minimize erosion or create wildlife habitat), it is generally conducted to meet financial goals or remove hazard trees (Peterson et al. 2009). Intensive or poorly planned salvage logging can have a variety of negative effects on ecosystems, such as soil compaction, increased erosion, and impacts on insectivorous and cavity-nesting and -denning animals (reviewed in McIver and Starr 2000, Noss et al. 2006, Peterson et al. 2009).

We know of three studies that have directly evaluated effects of post-fire salvage logging on spotted owls (Clark 2007 and Clark et al. 2013, Lee et al. 2012, 2013). Clark (2007) conducted a radio-telemetry study in areas recently burned by wildfires in the Oregon Klamath Province. He recorded limited use of salvage logged areas; presumably for foraging since locations were primarily nocturnal. Use of salvage logged areas was slightly lower than expected based on its abundance in territories (not statistically analyzed), indicating weak avoidance of salvage logged areas by NSOs. However, avoidance might have been stronger since some of the study's telemetry locations were potentially recorded prior to the occurrence of salvage logging. Most

Comment [M31]: These papers confound fire and salvage.

(60%) NSO locations in salvage logged areas occurred in riparian buffers, thinned areas, and patches of wildlife leave trees, rather than intensively salvaged areas. During the same study, Clark et al. (2013) found that post-wildfire declines in NSO occupancy were best explained by a model that included extents of pre-fire timber harvesting, severe fire, and post-fire salvage logging. Models that included these factors separately were not competitive with this model, indicating that severe fire and pre- and post-fire harvesting collectively contributed to declines in NSO occupancy; most likely through cumulative habitat loss or degradation.

In the Sierra Nevada, Lee et al. (2012) recorded occupancy for eight CSO territories that experienced wildfire and post-fire salvage logging. Seven of the territories were occupied during the two-year period between the occurrence of wildfire and salvage logging, whereas none of the territories were occupied following salvage logging.

Lee et al. (2013) evaluated effects of salvage logging on CSOs in the San Bernardino and San Jacinto Mountains of Southern California. They noted that salvage logging in their study area was modest compared with commercial salvage logging typically employed in the Pacific Northwest and Sierra Nevada (salvage logging in their study area mostly consisted of firewood cutting on private in-holdings and hazard tree removal along Forest Service roads). Lee et al. (2013) did not find a statistically significant effect of post-fire salvage logging on CSO occupancy dynamics. However, site extinction probability was slightly higher, and mean annual probability of occupancy was slightly lower, in salvage logged areas than in other burned areas. Weak negative effects of light salvage logging were evident during all eight post-fire study years, suggesting that they were biologically, if not statistically, significant.

The limited available evidence suggests that salvage logging increases the probability that spotted owls will abandon their territories following wildfires. This likely occurs because salvage logging reduces suitability of burned areas for foraging spotted owls and their prey. Stands recently burned by moderate or severe fire often contain high biodiversity due to the presence of both early-successional conditions and key biological legacies in the form of snags, logs, and live trees (Noss et al. 2006). Due to fire suppression and salvage logging, stands with these conditions are currently rare in many fire-prone forests within the spotted owl's range (Noss et al. 2006). Selective use of moderate or high severity burns for foraging is likely due to spotted owls exploiting short-term increases in prey associated with both early-successional vegetation (e.g., shrubs) and legacy habitat elements (e.g., large diameter snags, logs, and live trees) (Ream 1981, Zwolak 2009, Bond et al. 2013). Salvage logging removes legacy elements, while associated use of herbicides reduces shrubs and grasses important to many prey species (Bond et al. 2013). In the longer-term, spotted owls can continue to benefit from the contributions of legacy habitat elements to regenerating stands. For example, large legacy snags, trees, and logs can provide valuable habitat elements for northern flying squirrels and other prey (Holloway and Smith 2011). Removal of these elements through salvage logging could therefore reduce the value of subsequent regenerating stands as prey habitat. Harvesting of legacy snags and live trees could also directly affect spotted owls by reducing availability of foraging perches in the short-term and suitable nest trees during later successional stages.

<u>Summary</u>

Research of direct effects of wildfires and salvage logging on spotted owls have been opportunistic and have therefore, lacked the ability to compare pre- and post-fire data. Most studies' inferences are also limited due to inclusion of only a small number of spotted owls or territories. Nonetheless, more information is available concerning this topic than is generally acknowledged. The preponderance of currently available evidence indicates that spotted owls are often resilient to wildfires but can be strongly impacted by extensive severe fire. Following wildfire, many spotted owls may remain in their territories, exploit short-term increases in prey in burned areas, and continue to reproduce at reasonably high rates. However, wildfires that result in substantial loss or fragmentation of habitat can cause spotted owls to increase their home range sizes, abandon their territories, and possibly, die of starvation or disease. Negative effects of severe fire appear to be greatest when suitable habitat is already limited (e.g., due to widespread intensive timber harvesting) and when post-fire salvage logging reduces suitability of burned areas for foraging and prey.

Comment [M32]: Lee et al 2012 and 2013 do look pre- and post-fire!

Wildfire Effects on Recent Habitat Trends

Past and continuing habitat loss was a primary reason for listing the NSO under the federal Endangered Species Act (USFWS 1990). At the time of listing, the Fish and Wildlife Service estimated that 60-88% of the subspecies' habitat had already been lost (USFWS 1990; also see *Potential Threats: Timber Harvesting*). They attributed most of this loss to timber harvesting and land conversion but also acknowledged the roles of wildfire and other natural disturbances. Since listing of the NSO and subsequent adoption of the Northwest Forest Plan, timber harvesting has declined and wildfire has been identified as the primary source of forest

Comment [M33]: How is habitat lost? Define how suitable habitat is defined, and how it is lost.

disturbance and habitat loss on federal lands (Courtney et al. 2004, USFWS 2011, Kennedy et al. 2012).

Estimates of recent trends in amounts of NSO habitat, and of older forest in general, have been produced as part of monitoring efforts for the Northwest Forest Plan; and are therefore, largely restricted to the Plan's area and time span (Davis and Lint 2005, Davis and Dugger 2011, Moeur et al. 2005, 2011). We focus on estimates by Davis and Dugger (2011) because they replaced those of Davis and Lint (2005) and are more specific to NSO habitat than those of Moeur et al. (2005, 2011). We do not review habitat trend estimates based on federal ESA Section 7 consultation records (Bigley and Franklin 2004, USFWS 2012) due to greater scientific uncertainty and methodological bias associated with those data (see Bigley and Franklin 2004). Trends described by Bigley and Franklin (2004), Moeur et al. (2005, 2011), and USFWS (2012) quantitatively differ from those of Davis and Dugger (2011) but similarly indicate that wildfires have been the primary source of recent habitat loss on federal lands (see below).

Comment [M34]: There is a problem of bias in how suitable habitat is defined, and the criteria for 'loss' or 'degraded'.

Davis and Dugger (2011) used remotely sensed (satellite imagery) vegetation data to model changes in habitat suitability across the NSO's range during the first 15 years of the Northwest Forest Plan (1994-2007 in California and 1996-2006 in Oregon and Washington). Habitat suitability was based on characteristics surrounding thousands of NSO pair locations across the Plan area. Suitable breeding habitat was defined as having both a probability of owl presence greater than expected based on random chance and environmental conditions typical of those found around nesting and roosting pairs. Estimated habitat trends included gross loss of both suitable breeding habitat and "core" suitable breeding habitat (>330 ft from edge). Davis and

Comment [M35]: But rarely include burned sites, so definition of 'suitable habitat' is biased against burned forest.

Dugger (2011) considered habitat loss to have occurred when an area classified as suitable at the beginning of Northwest Forest Plan was later downgraded to a lower suitability rank (unsuitable or marginal) due to vegetation changes caused by forest disturbances. Davis and Dugger (2011) did not estimate recruitment of, or net changes in, breeding habitat because their remotely sensed data was incapable of accurately capturing relatively slow and subtle habitat changes during development of intermediate-aged and older stands. They did, however, estimate net trends in NSO dispersal habitat, which they defined as forest with a mean canopy cover of at least 40% and a mean DBH of at least 11 inches. Recruitment of dispersal habitat was more detectable than that of breeding habitat due to more rapid and measurable growth in younger forest (some recruitment also occurred due to degradation of suitable breeding habitat brought about by forest disturbances).

Estimated gross losses of suitable breeding habitat on federal and non-federal lands are presented in Tables B and C, respectively. During the first 15 years of the Northwest Forest Plan, wildfires were responsible for an estimated gross loss of 236,700 acres (2.7%) of suitable breeding habitat on federal lands rangewide and 13,100 acres (0.3%) on non-federal lands (1.9% combined). In California, wildfires removed an estimated 75,500 acres (4.1%) of suitable breeding habitat on federal lands and 5,600 acres (0.4%) on non-federal lands (2.4% combined). Approximately 70% of habitat loss to wildfire on federal lands occurred within the Oregon and California Klamath Provinces (Table B). Most of this habitat loss was caused by the1999 Megram Fire and 2002 Biscuit Fire (Table D). Fires in the Eastern Cascades Provinces of Washington, Oregon, and California contributed less to total habitat loss than did fires in the Klamath, but were often more destructive in terms of proportion of suitable habitat lost within individual fire perimeters.

In contrast with federal lands, wildfires were responsible for very little habitat loss on non-federal lands; rather, timber harvesting accounted for most losses in these areas (Figure A).

Table B: Estimated gross losses of suitable NSO breeding habitat on federal lands due to wildfires during 1994-2007 in California and 1996-2006 in Oregon and Washington (adapted from Davis and Dugger 2011, USFWS 2011).

State	Province	Initial Acres	Acres Lost	Percent Lost
California	CA Cascades	213,200	1,800	0.8%
	CA Klamath	1,489,800	71,600	4.8%
	CA Coast	145,400	2,100	1.4%
Oregon	OR Coast Range	611,200	0	0.0%
	Western OR Cascades	2,258,700	28,900	1.3%
	Eastern OR Cascades	402,900	17,800	4.4%
	Willamette Valley	3,400	0	0.0%
	OR Klamath	985,000	93,600	9.5%
Washington	Olympic Peninsula	763,100	200	0.0%
	Eastern WA Cascades	673,600	20,000	3.0%
	Western WA Cascades	1,283,000	700	0.1%
	Western WA Lowlands	24,700	0	0.0%
Rangewide Total		8,854,000	236,700	2.7%

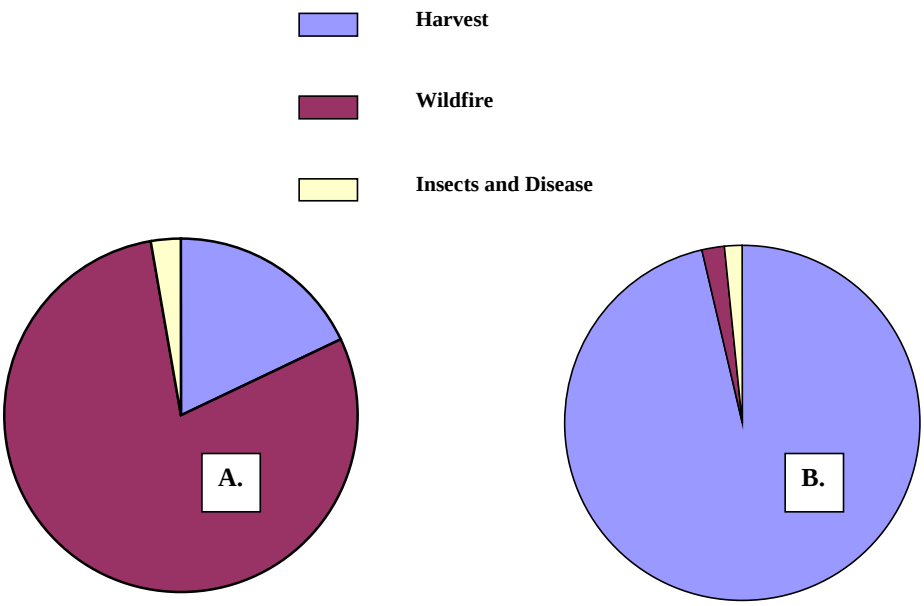
Table C: Estimated gross losses of suitable NSO breeding habitat on non-federal lands due to wildfires during 1994-2007 in California and 1996-2006 in Oregon and Washington (adapted from Davis and Dugger 2011, USFWS 2011).

State	Initial Acres	Acres Lost	Percent Lost
California	1,556,700	5,600	0.4%
Oregon	1,382,400	5,100	0.4%
Washington	1,258,900	2,400	0.2%
Total	4,198,000	13,100	0.3%

Table D: Estimated gross losses of suitable NSO breeding habitat to individual wildfires during 1994-2007 (note: "habitat degraded" describes areas downgraded from highly suitable to suitable; from Davis and Dugger 2011).

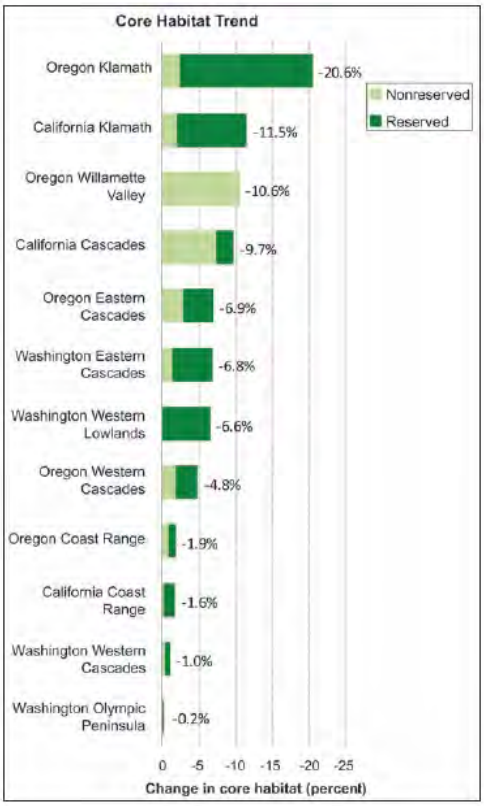
Fire name	Year	Broad physiographic province	Habitat in wildfire perimeter	Habitat lost		Habitat degraded	
			Acres	*Acres*	*%*	*Acres*	*%*
Biscuit Fire	2002	Klamath Mountains	226,230	93,730	41	12,019	5
Megram Fire	1999	Klamath Mountains	76,337	27,520	36	4,589	6
B&B Complex	2003	East Cascades	26,269	16,403	62	907	3
Bake-oven Fire	2006	Klamath Mountains	23,946	8,873	37	581	2
Boulder Fire	2002	West Cascades	34,059	8,460	25	2,074	6
Davis Fire	2003	East Cascades	8,050	6,943	86	5	0
Pigeon Fire	2006	Klamath Mountains	13,896	5,634	41	327	2
Rex Complex	2001	East Cascades	8,548	4,750	56	278	3
Timbered Rock	2002	West Cascades	10,216	4,539	44	569	6
Spring Fire	1996	West Cascades	13,504	3,931	29	858	6
Deep Harbor Fire	2004	East Cascades	5,761	3,930	68	64	1
Hancock Fire	2006	Klamath Mountains	12,712	3,132	25	336	3
Apple Fire 2	2002	West Cascades	12,227	2,810	23	928	8
Fischer Fire	2004	East Cascades	4,479	2,340	52	34	1
Fork Fire	1996	Klamath Mountains	2,962	2,113	71	14	0
Needles Fire	2003	East Cascades	1,946	874	45	1	0
Trough Fire	2001	Klamath Mountains	1,851	798	43	4	0
Hunter Fire	2006	Klamath Mountains	2,236	789	35	40	2
Deer Point Fire	2002	East Cascades	505	380	75	0	0
Tatoosh Complex	2006	East Cascades	666	378	57	0	0

Figure A: Proportions of suitable breeding habitat loss attributed to harvesting, wildfire, and insects and diseases on (A) federal lands and (B) non-federal lands during 1994-2007 (adapted from Davis and Dugger 2011, USFWS 2011).



Davis and Dugger (2011) reported substantial losses of core breeding habitat on federal lands during the first 15 years of the Northwest Forest Plan (Figure B). These losses primarily occurred in reserved areas. Changes in ratios of core and edge habitat classes indicated that increased fragmentation of suitable breeding habitat on federal lands was greatest in the Oregon and California Klamath Provinces and California Cascades Province (see Table 3-3 in Davis and Dugger 2011). Increased fragmentation in these regions was primarily due to wildfires.

Figure B: Gross losses of "core" suitable breeding habitat on reserved and non-reserved federal lands during 1994-2007 in California and 1996-2006 in Oregon and Washington (from Davis and Dugger 2011).



Davis and Dugger (2011) estimated a 5.2% net gain in NSO dispersal habitat. Much of this gain was due to succession in young forests in non-reserved lands at the margins of federal forests. However, accounting for forest connectivity and NSO dispersal distances, Davis and Dugger (2011) reported a 1% net loss of "dispersal-capable landscape". Much of the loss of dispersal-capable landscape in the Klamath and Eastern Cascades Provinces was due to wildfires, whereas timber harvesting on non-federal lands was responsible for much of the loss in other regions.

Loss and fragmentation of breeding habitat to wildfires was likely at least partially offset by recruitment of new habitat through succession of mature and old forest. However, Davis and Dugger (2011) found that detectable recruitment of breeding habitat primarily occurred in the marginal suitability class. This finding was supported by Moeur et al. (2005), who found that about 90% of recruitment of older forest (mature and old-growth combined) during the first 10 years of the Northwest Forest Plan was at the lower end of the class' diameter range (i.e., mean DBH 20-30 in). It is likely that some newly recruited mature forest provides suitable habitat for NSOs but much if it could lack the canopy layering, large diameter snags and logs, and other structural attributes typical of nesting and roosting habitat (*section_xxx*).

Loss and fragmentation of suitable breeding habitat does not necessarily equate to negative impacts on NSOs (Franklin and Gutiérrez 2002; e.g., Bond et al. 2002, 2009, Lee et al. 2012). Studies in southern Oregon and northern California found that the presence and fitness of NSOs are generally highest in landscapes with a mix of both large amounts of suitable breeding habitat and other habitat classes, such as foraging habitat or "non-habitat" (Franklin et al. 2000, Zabel et al. 2003, Olson et al. 2004, Dugger et al. 2005; reviewed in *section_xxx*). Fitness is also

generally highest when suitable breeding habitat occurs in large or clustered patches with large amounts of ecotone or edge (Franklin et al. 2000, Dugger et al. 2005). This combination of conditions is likely important because it provides NSOs with a balance of resources needed for survival and reproduction (Franklin et al. 2000). Active fire regimes in dry forests within the NSO's range in California historically contributed to these conditions by generally sparing older forest and maintaining some form of habitat heterogeneity at both stand and landscape scales (Sugihara et al. 2006). Some contemporary wildfires may still burn in this manner and thereby continue to perform an important ecosystem function in these forests. However, large severe wildfires have contributed, along with fire suppression and timber harvesting, to homogenization of some dry forests within the NSO's range (Skinner et al. 2006). Thus, large severe fires may impact NSOs through loss of habitat heterogeneity, as well as reduced amounts and connectivity of suitable breeding habitat.

Fire Risk in California

Prior to Euro-American settlement, dry forests in the western U.S. generally experienced relatively frequent, low-to-moderate or mixed severity fire regimes (Agee 1993, Sugihara et al. 2006, Van de Water and Safford 2011). Mean pre-settlement fire return intervals in California were 11 years in yellow pine forests (e.g., *Pinus ponderosa*, *P. jeffreyi*), 11-16 years in mixed-conifer forests, and 29 years in mixed-evergreen forests (Van de Water and Safford 2011). Mean fire return intervals in redwood forests south of Del Norte County were also relatively frequent (6-44 yrs: Stuart and Stephens 2006). Frequent fire during the pre-settlement period generally maintained forests with less dense and more clumped tree distributions, higher proportions of

fire-resistant trees (i.e., larger size classes and more fire-tolerant species), and lighter and less continuous fuel beds than occur today (Sugihara et al. 2006). This characteristic fine-scale structural heterogeneity was often overlaid with coarser variability created by effects of elevation, terrain, soils, and other physiographic factors on fire and vegetation patterns (Sawyer 2007). For example, in areas of deeply incised terrain in the Klamath Mountains and southern Cascades of California, upper slopes and south and west facing aspects typically experienced more frequent and severe fire than did other areas (reviewed in Skinner and Taylor 2006, Skinner et al. 2006). Due to fire suppression, early-successional vegetation communities formerly maintained by frequent, small-scale severe fire have greatly declined in some areas of California (Skinner 1995, Nagel and Taylor 2005). Overall, research indicates that fire suppression and other human activities have led to decreased forest heterogeneity at both stand and landscape scales and have contributed to substantial changes in fire regimes in California's dry forests (Sugihara et al. 2006).

Due to fire suppression, fire-free periods have dramatically increased in California's dry forests (Sugihara et al. 2006). For example, fire rotation near Hayfork in the Klamath Mountains increased more than 10-fold (from 19 to 238 yrs) during the post-settlement period (Taylor and Skinner 2003). Abnormally long fire-free periods have facilitated increased accumulation and continuity of fuels in dry forests (Sugihara et al. 2006). When wildfires do occur there is often an increased risk of them becoming very large and for suppression forces to be overwhelmed by their size and number (e.g., CAL FIRE 2008). As in other dry forests across the western U.S., the mean and maximum sizes of wildfires, and the total annual area burned, significantly increased in California's dry montane forests during the 20th and early 21st Centuries (Miller et

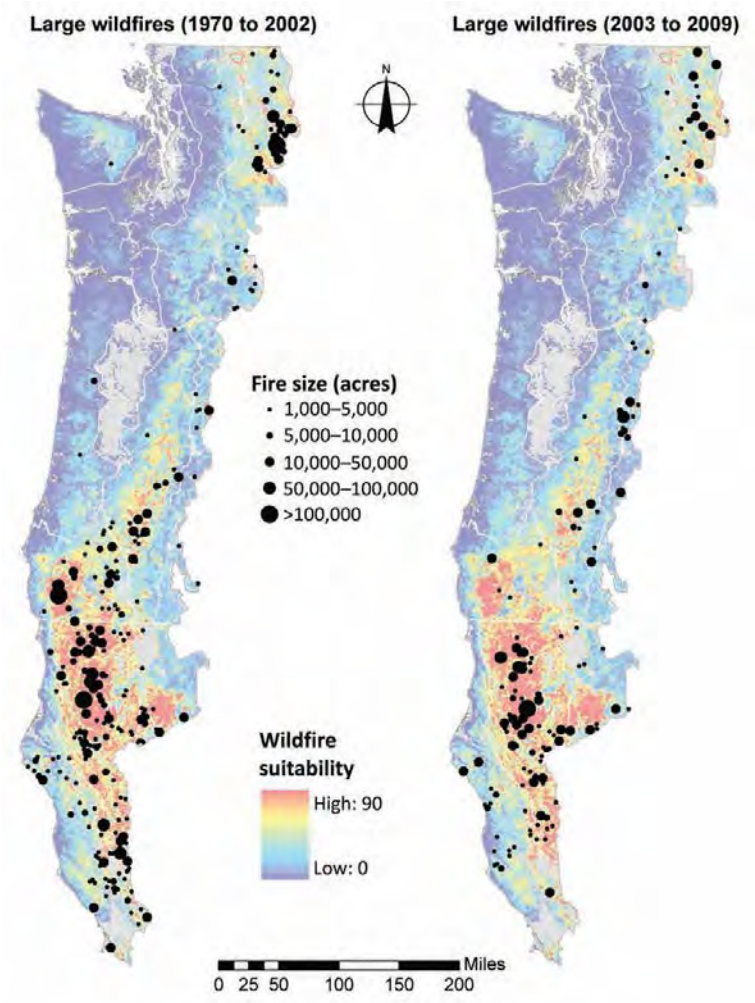
al. 2009, 2012). CAL FIRE (2008) noted that more than half of the 26 largest fires recorded in California during 1932-2008 occurred during the last eight years of that period. Based on recent (1970-2002) fire behavior, the majority of northern California's interior can be classified as highly prone to large (>1,000 ac) wildfires (Davis et al. 2011; Figure C).

Studies of recent trends in extents of high severity fire in California have found conflicting results. For example, Miller et al. (2009) reported a substantial increase in the extent of high severity fire in the Sierra Nevada and southern Cascades of California during 1984-2006; while Hanson and Odion (2014) did not find an increase in the Sierra Nevada during nearly the same period (1984-2010). Similarly conflicting results have been found for the California Klamath Province. Hanson et al. (2009) found a significant increase in high severity fire in the California and Oregon Klamath Provinces during 1984-2005; whereas Miller et al. (2012) did not find an increase in the California Klamath Province during a similar period (1987-2008). Scientific debate ensued regarding the appropriateness of methods used to determine fire severity (e.g., Hanson et al. 2009, 2010 vs. Spies et al. 2010).

Differences in findings regarding trends in high severity fire are related to variation in studies' temporal and spatial scales of analysis, as well as in methods for determining fire severity (Courtney et al. 2008, Miller et al. 2012, Hanson and Odion 2014). For example, Miller et al. (2012) noted that both their own study and those of Odion et al. (2004, 2010) may have underestimated trends in high severity fire in the California Klamath Province due to inclusion of unusual fire years. Studies by Odion et al. (2004, 2010) were based on fire effects during a single year (1987), which Miller et al. (2012) described as unusual. Large areas burned at

below-average severity during 1987 due to abnormally strong inversions, and the fact that some of the fires burned well into fall (when conditions often favor lower severity fire). Miller et al. (2012) also noted that their own ability to detect a trend in fire severity could have been compromised by inclusion of both this year and 2008, which likewise experienced unusually large, low severity fires. Differences in the area analyzed could also affect evaluations of trends in high severity fire. For example, the Biscuit Fire, which was predominantly located in Oregon, included extensive areas of high severity fire and therefore could have influenced results of trends analyses for the Oregon and California Klamath Provinces combined versus the California Klamath alone (Miller et al. 2012).

Figure C: Relative probability of large (>1,000 ac) wildfires ("wildfire suitability") across the NSO's range (from Davis et al. 2011). Modeling was based on landscape and climatic characteristics of locations at which large wildfires occurred during 1970-2002 (left) and was compared with subsequent (2003-2009) locations (right).



Regardless of whether or not the extent of high severity fire increased in California during the last two decades, large severe fires have recently occurred in these areas, and they were responsible for most loss, degradation, and fragmentation of suitable breeding habitat for NSOs on federal lands (Davis and Dugger 2011, Davis et al. 2011; see above). These data cannot be used to project how fires in the future will affect NSOs since they do not necessarily represent past or future fire conditions or effects. However, it is highly unlikely that wildfires will cease to be a major source of habitat loss for NSOs in the future. Rather, climate change research has generally projected a continued increase in the number and sizes of wildfires and the annual area burned during coming decades (see *Potential Threats: Climate Change*). There is scientific uncertainty regarding recent and future trends in the extent of high severity fire in California. Nonetheless, large severe fires will at least occasionally occur in the future and will therefore continue to be a source of habitat loss and modification for NSOs in the state.

Comment [M36]: These aren't peer reviewed. More accurately USFS biologists are responsible for loss and degradation when they redraw PACS and re-designate habitat post fire.

Increases in the number and sizes of wildfires, and effects of fires on NSO habitat, have led to calls for widespread use of thinning and other forms of active management in dry forests (USFWS 2008, 2011, 2012a, Franklin and Johnson 2012). Some researchers and stakeholders, however, have expressed doubts regarding estimates of fire risk and effects on NSOs; concerns about potential effects of thinning on NSOs; and distrust of federal agency intentions (Hanson et al. 2009, Heiken 2010, DellaSala et al. 2013). As discussed in *Potential Threats: Timber Harvesting* (also Hansen and Mazurek 2010, USFWS 2011), there is currently little known about the effects of forest thinning on spotted owls. The available information suggests that low intensity thinning and prescribed fire could be judiciously used to reduce fire risk or restore habitat for NSOs. In contrast, poorly planned thinning could have unintended consequences for

Comment [M37]: This is wrong and biased. Where's Seamans and Gutierrez 2007, Williams et al. 2011. Whre is your citation for how thinning reduced fire risk and 'restores' habitat?

the subspecies. If thinning is used in landscaped occupied by NSOs, it should generally be limited to strategic locations outside of owl core areas and its effects should be monitored within an adaptive management framework. Land managers should also consider allowing more wildfires to burn under prescribed conditions; particularly at lower elevations in the California Klamath Province, where summertime inversions often minimize fire severity (Miller et al. 2012).

Comment [M38]: Where is your evidence that thinning affects fire behavior? This is an enormous leap in logic

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CALIFORNIA FARM BUREAU FEDERATION
GOVERNMENTAL AFFAIRS DIVISION
1127-11TH STREET, SUITE 626, SACRAMENTO, CA 95814 · PHONE (916) 446-4647

August 11, 2016

Mr. Eric Sklar, President
California Fish and Game Commission
1416 9th Street, Room 1320
Sacramento, CA 95814

RE: Determination of whether listing of the Northern Spotted Owl is warranted under the California Endangered Species Act

Dear Mr. Sklar:

The California Farm Bureau Federation (Farm Bureau) is writing to urge the Fish and Game Commission (Commission) not to list the Northern Spotted Owl (NSO) as threatened or endangered pursuant to the California Endangered Species Act (CESA). Farm Bureau represents more than 53,000 members as it strives to protect and improve the ability of farmers and ranchers engaged in production agriculture to provide a reliable supply of food and fiber through responsible stewardship of California's resources. Farm Bureau has many members who own and manage timberland within the range of the NSO and would be impacted by a listing of the NSO under CESA. Farm Bureau urges you to recognize the current protections provided to the NSO by its listing under the federal Endangered Species Act (ESA) and reject the listing petition under CESA.

California has 197,000 nonindustrial family forest landowners who own approximately 7.9 million acres of forestland. Just over 50 percent of these landowners own less than 10 acres of forestland. Of these family forest landowners, over 700 of them manage their lands using a Nonindustrial Timber Management Plan (NTMP). NTMPs cover 315,000 acres of private forestland in California. The NTMP simplifies the permitting process for timber harvest in return for landowners with less than 2,500 acres agreeing to manage their forests using uneven-aged silviculture. California's managed forests provide significant wildlife habitat and are the watersheds where much of our state's surface water originates. Forests that are unable to remain economically viable are at continued risk for conversion to other uses. Maintaining the economic viability of California's family owned forests is essential to maintaining the environmental services our forests provide.

Forest landowners in Northern California have been harvesting timber and managing their lands following the current federal standards protecting NSO since the early 1990's, when it was listed under the federal ESA. California's existing forest practice rules recognize the federal listing of NSO and prohibit its take. CalFire will not issue a THP if the harvest would take an NSO. It is important to recognize that the federal definition of take is much broader than CESA's definition of take, as the federal definition includes habitat modification that leads to a significant impairment of essential behavioral patterns[1]. While listing the NSO under CESA is unlikely to provide any additional

[1] Definition of Harm, 50 CFR §17.3, *Harm* in the definition of "take" in the Act means an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering.

protections to the species, it will add significant uncertainty to the timber operations of forest landowners.

Extensive data has been gathered on private timberlands regarding the status of the NSO since it was listed federally. These data show a species that within its range on California's private timberlands is dynamic yet stable. Documentation to support these findings was provided to the Commission by the California Forestry Association and Farm Bureau requests to be aligned with both the comments and scientific compendium submitted to the Commission by the California Forestry Association.

The petitioners assert that logging is contributing to declines in NSO populations and listing under CESA is necessary to protect the species. The data mentioned previously do not support this assertion. It is also important to recognize that since the federal listing, nearly 26 years ago, timber operations have never had an unauthorized take of an NSO. Listing under CESA does not appear to provide additional protections to the species, however it is likely to add complexity to the timber harvest process by adding additional regulatory approvals necessary for authorization of the Timber Harvest Permit.

California's forest landowners provide significant habitat for NSO. There are approximately 7.8 million acres of privately owned forestland within the NSO range; of that amount approximately 5.3 million acres are nonindustrial forests. These small landowners would be economically harmed by additional restrictions, reviews and paperwork requirements created by a CESA listing of NSO. Often these landowners are managing their lands using selective harvesting methods and creating the very habitat necessary for NSO. Many of these landowners manage their forest under a NTMP. Forests managed under an NTMP are providing long term benefits to myriad wildlife species including NSO. These small landowners operate on very thin margins and any increased costs can make harvesting timber uneconomical. Further because their lands are small in acreage, any restrictions could cause them to lose access to a significant portion of their timber. For example, when buffers are created around activity centers they extend 72 acres around the site. Meaning landowners with acreages less than the size of the buffer lose all ability to harvest timber and even if landowners can still harvest their timber, other restrictions make that harvest more difficult. Some small forest landowners have already lost access to roads due to NSO protection measures making timber harvest more costly.

The significant monitoring and enhancement efforts undertaken by private landowners in California have provided greater understanding of the species and how to manage forests for its benefit. Within California, the NSO population is well-protected and well distributed and listing under CESA is not necessary. Farm Bureau respectfully requests you reject the listing petition and allow the NSO's candidacy designation to expire.

Sincerely,

Noelle G. Cremers
Director, Natural Resources and Commodities

CC: Members, Fish and Game Commission
Ms. Valerie Termini, Executive Director, Fish and Game Commission

INSTRUCTIONS TO

PETITIONERS

The Fish and Game Commission (FGC) requires that petitions to list, change the status of, or delist a species of plant or animal must use the official petition form. This form is provided to assist you in preparing a petition that includes specific kinds of information used by the Department of Fish and Game (DFG) and by the FGC in evaluating the proposed action. We understand that all of the questions on this form may not be addressed, and that different issues are important for different species, but we believe that using the form will ensure that you include the basic information necessary to this process. We encourage you to include suggestions for management and recovery activities that would improve the status of the species involved. We have revised the petition form in order to expedite the listing/delisting process.

Certain sections of the California Fish and Game Code pertain to the petition and listing process. The most pertinent information can be found in Sections 2062, 2067, 2072.3, 2074.6, and 2074.8 of the Code, and Section 670.1, Title 14, California Code of Regulations.

We hope that this information, along with the revised petition form, will facilitate the petition writing process and result in a complete document. Additional information on rare, threatened, and endangered species is available from the DFG. For further information, please contact Ms. Helen Biriss, Chief, Habitat Conservation Planning Branch, Department of Fish and Game, 1416 Ninth Street, Sacramento, California 95814, or telephone (916) 653-4875.

Please mail the petition to:

Sonke Mastrup, Executive Director
Fish and Game Commission
1416 Ninth Street, Room 1320
Sacramento, CA 95814

FGC - 670.1 (3/94)

A PETITION TO THE STATE OF CALIFORNIA FISH AND GAME COMMISSION

For action pursuant to Section 670.1, Title 14, California Code of Regulations (CCR) and Sections 2072 and 2073 of the Fish and Game Code relating to listing and delisting endangered and threatened species of plants and animals.

I. SPECIES BEING PETITIONED:

Common Name: Townsend's Big-eared Bat

Scientific Name: (*Corynorhinus townsendii*)

II. RECOMMENDED ACTION:

(Check appropriate categories)

a. List X b. Change Status ☐

As Endangered X from _____

As Threatened to _____

Or Delist ☐

III. AUTHOR OF PETITION:

Name: Noah Greenwald, Mollie Matteson, Zoë Sheldon, Allison Trowbridge

Address: PO Box 11374, Portland, OR 97211

Phone Number: 503-484-7495

I hereby certify that, to the best of my knowledge, all statements made in this petition are true and complete.

Signature: _____

Date: October 18, 2012

PETITION TO THE STATE OF CALIFORNIA FISH AND GAME COMMISSION
SUPPORTING INFORMATION FOR

Townsend's Big-eared Bat	**(*Corynorhinus townsendii*)**
Common Name	**Scientific Name**

EXECUTIVE SUMMARY

Provide a brief statement explaining why the petitioned action is being recommended. Include a brief summary of each section of the petition. If a species is being petitioned for listing, state why its survival is threatened by any one or a combination of the following factors (listed in Section 670.1, Title 14, CCR):

(1) present or threatened modification or destruction of its habitat;

(2) overexploitation;

(3) predation;

(4) competition;

(5) disease; or

(6) other natural occurrences or human-related activities.

If a species is being recommended for delisting, indicate why State-listing is no longer warranted, and state why any one or a combination of the aforementioned factors no longer threatens its existence.

1. POPULATION TRENDS

Describe current population trends (with numbers and rate) and relate these to viable population numbers. Explain survey methodology used to arrive at numbers or estimates and what assumptions, if any, were involved.

2. RANGE AND DISTRIBUTION

In the text, indicate the percentage of historic distribution that is in existence and the rate of loss. If appropriate, indicate the number of extant occurrences, populations or portions of populations in California. Indicate whether the rate of loss is accelerating, and estimate when extinction would occur if current trends continue. Discuss the relationship between historic and current acreage and degree of habitat fragmentation. Describe the quality of the existing habitats in terms of ability to maintain viable populations with or without enhancement. For delisting, indicate how current distribution reflects the recovery of the species since its listing.

3. **ABUNDANCE**

Provide available historic and current population estimates/trends, densities, vigor, sex and age structures, and explain population changes relative to human-caused impacts or natural events. Compare current and historic abundance in terms of overall population size or size of occurrences, populations or portions of populations, as appropriate. Describe current population trends (with numbers and rate) and relate these to viable population numbers. Explain survey methodology used to arrive at numbers or estimates and what assumptions, if any, were involved.

4. **LIFE HISTORY (SPECIES DESCRIPTION, BIOLOGY, AND ECOLOGY)**

Include pertinent information that is available on species identification, taxonomy and systematics, seasonal activity or phenology, reproductive biology, mortality/natality, longevity, growth rate, growth form, food habits, habitat relationships and ecological niche or ecological attributes, interactions with other species or special habitat requirements that may increase vulnerability of the species to certain natural or human-caused adverse impacts (e.g., obligate wetland or riparian habitat species, low birthrate, colonial species).

5. **KIND OF HABITAT NECESSARY FOR SURVIVAL**

Describe habitat features that are thought to be important to the species' ability to maintain viable population levels. Any or all of the following features may be included, as appropriate:

> *Plant community; edaphic conditions; climate; light; topography/microtopography; natural disturbance; interactions with other plants or animals; associated species; elevation; migration or movement corridors; wintering habitat; breeding habitat; foraging habitat; other habitat features.*

For aquatic organisms, the following features may be included in addition to the above:

> *Water temperature; water flow patterns; stream gradient; water chemistry (dissolved oxygen, salinity, etc.); water depth; bottom type; cover type and availability; fish assemblage/community; aquatic plant abundance; other habitat features.*

6. **FACTORS AFFECTING ABILITY TO SURVIVE AND REPRODUCE**

Discuss the basis for the threats to the species or subspecies, or to each population, occurrence or portion of range (as appropriate) due to one or more of the following factors:

(1) present or threatened modification or destruction of its habitat;

(2) overexploitation;

(3) predation;

(4) competition;

(5) disease; or

(6) other natural events or human-related activities.

Identify the direct, indirect, and cumulative adverse impacts and discuss how these are contributing to the decline of the species. Indicate whether the species is vulnerable to random catastrophic events.

For delisting, state why any one or a combination of the aforementioned factors no longer threatens the existence of the species.

7. DEGREE AND IMMEDIACY OF THREAT

Indicate the immediacy of the threat and the magnitude of loss or rate of decline that has occurred to the present or is expected to occur without protective measures.

8. IMPACT OF EXISTING MANAGEMENT EFFORTS

Describe any ongoing protective measures or existing management plans for the species or its habitat. Information on species or land management activities that are impacting populations or portions of the range and information on proposed land-use changes should be included. This may be best accomplished by discussing populations or portions of the range. A chart may be useful.

Include available information on any or all of the following:

(1) property ownership/jurisdiction for known populations or portions of the range;

(2) current land use;

(3) protective measures being taken, if any, and effectiveness of current management activities;

(4) current research on the species;

(5) existing management/recovery plans and the extent of their implementation;

(6) proposed land-use changes (include knowledge of forthcoming California Environmental Quality Act documents that may or should address impacts, and lead agencies involved); or

(7) county general plans, federal and State agency plans/actions or other plans/actions that address or should address the species.

9. SUGGESTIONS FOR FUTURE MANAGEMENT

Describe activities that may be necessary to ensure future survival of the species after listing or delisting. Include recommendations for any or all of the following:

(1) activities that would protect existing populations (site maintenance, preserve design establishment, etc.);

(2) monitoring programs and studies;

(3) needed amendments to existing management and land-use plans, including county general plans;

(4) agencies/organizations that should be involved in planning and implementing management and recovery actions;

(5) other activities that would help protect existing habitat or ensure survival of the species;

(6) how other sensitive species (listed and unlisted) may benefit from protection of this species;

(7) how other species/habitats may be impacted by management and recovery activities for this species; or

(8) at what point this species would be considered stable and sustainable.

10. AVAILABILITY AND SOURCES OF INFORMATION

Cite literature, available specimen collection records, and other pertinent reference materials. Attach documents critical to the recommended action. Be sure to include recent status surveys. List names, addresses, and telephone numbers of persons providing unpublished information and list those supporting the recommended action.

11. **DETAILED DISTRIBUTION MAP**

Delineate on appropriate maps the historic and present distribution (estimated if not known). Include one map of California showing general distribution, and U.S. Geological Survey topographical maps (or equivalent) of appropriate scale, for more detailed distribution information, including locations of occurrences, populations or portions of populations, as appropriate. Include historic and current distribution as documented by literature, museum records, Natural Diversity Data Base and other Department of Fish and Game records, and testimony of knowledgeable individuals. All maps must be suitable for black and white reproduction and fully labeled, including borders, base map name, map scale and species name, and should not exceed 11" x 14" in size.

BEFORE THE CALIFORNIA FISH AND GAME COMMISSION

A PETITION TO LIST THE TOWNSEND'S BIG-EARED BAT, *CORYNORHINUS TOWNSENDII* AS THREATENED OR ENDANGERED UNDER THE CALIFORNIA ENDANGERED SPECIES ACT

Photo by J. Scott Altenbach (used with permission)

October 18, 2012

CENTER FOR BIOLOGICAL DIVERSITY

PETITIONER

NOTICE OF PETITION

For action pursuant to Section 670.1, Title 14, California Code of Regulations (CCR) and Sections 2072 and 2073 of the Fish and Game Code relating to listing and delisting endangered and threatened species of plants and animals.

I. SPECIES BEING PETITIONED:

Common name: Townsend's big-eared bat
Scientific name: *Corynorhinus townsendii*

II. RECOMMENDED ACTION: List as threatened or endangered

The Center for Biological Diversity submits this petition to list the Townsend's big-eared bat as endangered throughout its range in California pursuant to the California Endangered Species Act (California Fish and Game Code §§ 2050 et seq., "CESA"). This petition demonstrates that the Townsend's big-eared bat clearly warrants listing under CESA based on the factors specified in the statute.

III. PETITIONERS

Primary author: Noah Greenwald, Endangered Species Program Director, Center for Biological Diversity; Mollie Matteson, Bat Advocate, Center for Biological Diversity; Zoë Sheldon, B.A. Conservation Biology, Middlebury College; and Allison Trowbridge.
Address: P.O. Box 11374, Portland, OR 97211
Phone: (503) 484-7495
Email: ngreenwald@biologicaldiversity.org

The Center for Biological Diversity is a nonprofit conservation organization with more than 300,000 members and online activists dedicated to the protection of endangered species and wild places. http://www.biologicaldiversity.org

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BEFORE THE CALIFORNIA FISH AND GAME COMMISSION

IV. EXECUTIVE SUMMARY

Townsend's big-eared bat (*Corynorhinus townsendii* ssp.) is in widespread decline throughout the western United States. In California, populations are widespread but sparsely distributed and surveys show serious declines in the number of colonies, colony size, and availability of suitable roosting habitat primarily related to habitat destruction and disturbance.

In 2011, the California Department of Fish and Game conducted a status review of the Townsend's big-eared bat and found that of the 25 bat species in California, the Townsend's big-eared bat was of greatest conservation concern based on several ranking methods and was at highest risk in every province in the state that it is found in any numbers (Pierson et al. 2011). According to the status review, the bat is severely threatened by a combination of disturbance of cave and mine sites, loss of mine and cave habitat to mining, logging and urban development, white-nose syndrome and other factors (Pierson et al. 2011).

The most recent rangewide survey of Townsend's big-eared bats was conducted by Pierson and Rainey (1998), who conducted a four-year comprehensive survey of all historically reported maternity colonies comprised of >30 bats and several hibernacula in California and reported substantial declines in all metrics utilized. They documented a 52% decline in the number of maternity colonies statewide, a 32% decline in the average size of maternity colonies, a 55% decline in the total population size, and a 44% decline in the number of available roosts, all within the past 40 years. The female population showed a decline from 3,004 to 1,365 individuals. The greatest declines have been in coastal, central Sierra, and Colorado River populations. Pierson and Rainey (1998) concluded that many roosts have a history of disturbance, and none are likely to survive long-term without active maintenance and/or protection.

The Townsend's big-eared bat has disappeared from a significant proportion of historical roost sites and hibernacula (Pierson & Rainey 1998). It is highly sensitive to human disturbance. Humans simply entering a maternity roost can cause a colony to abandon the young or move to another roost. Disturbance at maternity roosts and hibernacula and the loss of these unique habitats to mine closures, renewed mining, timber harvest, or cave commercialization are the principle threats to the Townsend's big-eared bat in California, though other natural and anthropogenic factors clearly play a role in the species' widespread and ongoing decline.
The perilous conservation status of the Townsend's big-eared bat has been recognized by several state and federal agencies, most notably California Department of Fish and Game itself, but it has not yet been afforded any formal status that mandates the protection of habitat or individuals. Listing under the California Endangered Species Act will provide protections essential to the long-term persistence of this species in the state of California.

V. PROCEDURAL HISTORY and CESA LISTING PROCESS

Recognizing that certain species of plants and animals have become extinct "as a consequence of man's activities, untempered by adequate concern for conservation," (Fish and G. Code § 2051 (a)) that other species are in danger of extinction, and that "[t]hese species of fish, wildlife, and plants are of ecological, educational, historical, recreational, esthetic, economic, and scientific value to the people of this state, and the conservation, protection, and enhancement of these species and their habitat is of statewide concern," (Fish and G. Code § 2051 (c)) the California Legislature enacted the California Endangered Species Act ("CESA").

The purpose of CESA is to "conserve, protect, restore, and enhance any endangered species or any threatened species and its habitat...." Fish and G. Code § 2052. To this end, CESA provides for the listing of species as "threatened" and "endangered." "Threatened species" refers to a native species or subspecies of a bird, mammal, fish, amphibian, reptile, or plant that, although not presently threatened with extinction, is likely to become an endangered species in the foreseeable future in the absence of special protection and management efforts. Fish and G. Code § 2067. "Endangered species" refers to a "native species or subspecies of a bird, mammal, fish, amphibian, reptile, or plant which is in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes, including loss of habitat, change in habitat, overexploitation, predation, competition, or disease." Fish and G. Code § 2062.

The Fish and Game Commission ("Commission") is the administrative body that makes all final decisions as to which species shall be listed under CESA, while the Department of Fish and Game ("Department") is the expert agency that makes recommendations as to which species warrant listing. The listing process may be set in motion in two ways: "any person" may petition the Commission to list a species, or the Department may on its own initiative put forward a species for consideration. "Petitions shall include information regarding the population trend, range, distribution, abundance, and life history of a species, the factors affecting the ability of the population to survive and reproduce, the degree and immediacy of the threat, the impact of existing management efforts, suggestions for future management, and the availability and sources of information. The petition shall also include information regarding the kind of habitat necessary for species survival, a detailed distribution map, and any other factors that the petitioner deems relevant." Fish and G. Code § 2072.3. In the case of a citizen proposal, CESA sets forth a process for listing that contains several discrete steps.

Upon receipt of a petition to list a species, a 90-day review period ensues during which the Commission refers the petition to the Department, as the relevant expert agency, to prepare a detailed report. The Department's report must determine whether the petition, along with other relevant information possessed or received by the Department, contains sufficient information indicating that listing may be warranted. Fish and G. Code § 2073.5.

During this period interested persons are notified of the petition and public comments are accepted by the Commission. Fish and G. Code § 2073.3. After receipt of the Department's report, the Commission considers the petition at a public hearing. Fish and G. Code § 2074. At

this time the Commission is charged with its first substantive decision: determining whether the Petition, together with the Department's written report, and comments and testimony received, present sufficient information to indicate that listing of the species "may be warranted." Fish and G. Code § 2074.2. This standard has been interpreted as the amount of information sufficient to "lead a reasonable person to conclude there is a substantial possibility the requested listing could occur." Natural Resources Defense Council v. California Fish and Game Comm. 28 Cal.App.4th at 1125, 1129.

If the petition, together with the Department's report and comments received, indicates that listing "may be warranted," then the Commission must accept the petition and designate the species as a "candidate species." Fish and G. Code § 2074.2. "Candidate species" means a "native species or subspecies of a bird, mammal, fish, amphibian, reptile, or plant that the commission has formally noticed as being under review by the department for addition to either the list of endangered species or the list of threatened species, or a species for which the commission has published a notice of proposed regulation to add the species to either list." Fish and G. Code § 2068.

Once the petition is accepted by the Commission, then a more exacting level of review commences. The Department has twelve months from the date of the petition's acceptance to complete a full status review of the species and recommend whether such listing "is warranted." Following receipt of the Department's status review, the Commission holds an additional public hearing and determines whether listing of the species "is warranted." If the Commission finds that the species is faced with extinction throughout all or a significant portion of its range, it must list the species as endangered. Fish and G. Code § 2062. If the Commission finds that the species is likely to become an endangered species in the foreseeable future, it must list the species as threatened. Fish and G. Code § 2067.

Notwithstanding these listing procedures, the Commission may adopt a regulation that adds a species to the list of threatened or endangered species at any time if the Commission finds that there is any emergency posing a significant threat to the continued existence of the species. Fish and G. Code § 2076.5.

The California Fish and Game Commission ("Commission") has not yet protected Townsend's big-eared bat populations in California under the California Endangered Species Act. It is recognized as a Mammal Species of Special Concern by the California Department of Fish and Game (CDFG), based on its sparse distribution and ongoing decline. It was given this status in 1986 (Pierson & Rainey 1998, Williams 1986). In a 2011 draft California Bat Conservation Plan, the Townsend's big-eared bat was again listed as a Mammal Species of Special Concern by the state of California (Pierson et al. 2011). *C. t. townsendii* is a Regional Forester's Sensitive Species throughout Region 5, a Bureau of Land Management (BLM) Special Status Species, a Western Bat Working Group High Priority species, and a U.S. Fish and Wildlife Service (USFWS) former Category 2 candidate species (Pierson et al. 2011, Pierson & Rainey 1998).

VI. NATURAL HISTORY

A. Description

Townsend's big-eared bat (*Corynorhinus townsendii*) is a medium-sized bat, weighing between nine and 14 grams, and measuring approximately 10 cm total length. Fur is brown, buff, or grayish in color with lighter underparts. Its eponymous ears measure roughly a third of its total body length. Townsend's big-eared bat can be distinguished from other big-eared bat species by the two-pronged lump on its snout (the origin of its other common name, "lump-nosed" bat). Townsend's big-eared bat curls its ears tightly against its head when resting or hibernating. At these times the large tragus remains erect and can be mistaken for an ear, so the lumps on its snout are an important identifying feature (Pierson et al. 1999; Armstrong et al. 1995). The wings of *Corynorhinus* in general, including *C. townsendii*, have a low aspect ratio, a morphology that enhances maneuverability but discourages long-distance flight (Piaggio & Perkins 2005).

B. Taxonomy

Townsend's big-eared bat was originally placed in the genus *Corynorhinus* until that genus was subsumed by the Eurasian genus *Plecotus* (Handley 1959). The species was then known as *Plecotus townsendii* (and may still be referred to as such by some sources) until recent studies confirmed *Corynorhinus* as distinct from *Plecotus* (summarized by Pierson et al. 1999, p. 1; Pierson & Fellers 1998, and supported by genetic studies, e.g. Piaggio & Perkins 2005 and references therein). There are only three named *Corynorhinus* species: *C. townsendii*, *C. rafinesquii* in the southeastern USA, and *C. mexicanus* in Mexico.

Five subspecies of *Corynorhinus townsendii* have been recognized within the US: *virginianus*, *ingens*, *australis*, *pallescens*, and *townsendii* (the nominate subspecies). The *virginianus* and *ingens* subspecies (Virginia big-eared bat and Ozark big-eared bat) are isolated from other *Corynorhinus* populations and both are federally listed as endangered species. They occur in parts of Virginia, West Virginia and Kentucky; and Oklahoma, Arkansas and Kansas, respectively. Subspecies *australis* occurs primarily in Mexico, western Texas and Oklahoma.

Recent genetic studies by Piaggio and Perkins (2005) clarified the phylogenetic relationships of the Townsend's big-eared bat subspecies. They found five well-supported phylogenetic groupings within *C. townsendii*, broadly corresponding to Handley's subspecies; however, the ranges of the subspecies do not always match those outlined by Handley (1959). In particular, the phylogenetic grouping most closely corresponding to *C. t. townsendii* – formerly thought of as a Pacific coastal subspecies – ranges from the Pacific eastward to parts of South Dakota, Colorado, Arizona, and Sonora, Mexico. The phylogroup most closely corresponding to *C. t. pallescens*, formerly thought to occupy much of the arid American West, appears confined primarily to New Mexico and central and southern Colorado. It seems that morphological characteristics are not reliable diagnostics for distinguishing among subspecies.

In this petition, we address Townsend's big-eared bat at the full species level and describe its

status throughout California, following the approach used by Pierson and Rainey (1998) and by the California Department of Fish and Game (CDFG).

C. Reproduction and Growth

Mating occurs primarily in hibernacula, where bats congregate between October and February. Female Townsend's big-eared bats exhibit delayed implantation, wherein sperm are stored until spring emergence; ovulation and fertilization occur subsequently. The gestation period varies somewhat with variance in climate, but typically lasts between 56 and 100 days (Pearson et al. 1952, Pierson & Fellers 1998).

Following spring emergence, females establish maternity colonies, which vary in size; recorded colonies have been comprised of between 30 and 400 females (Pierson et al. 1999). Date of establishment for maternity colonies is variable throughout the state, based on regional climate. Desert and central coast populations may form maternity colonies as early as March, while colonies in the interior portion of northern California may not be established until June (Pierson & Fellers 1998). Males and non-reproductive females roost singly during this period (Pierson & Rainey 1998).

Early in the gestation period, females typically roost in cooler, darker locations, but will often move to warmer places after parturition so as to facilitate thermoregulation and reduce energetic costs associated with lactation, foraging, and other maternal care (Pierson & Rainey 1998). Females exhibit high site fidelity to maternity roosts, returning to the same colony year after year; return rates are reported at 73-77% (Pearson et al. 1952, Pierson et al. 1999). However, reproductive females may switch sites if disturbed by climatic, anthropogenic, or other factors (Pierson & Rainey 1998). The availability of abundant and diverse potential roosting sites for maternity colonies is necessary to accommodate changes in habitat preference throughout the reproductive period.

Females bear a single offspring annually, which at birth weighs roughly ¼ of the mother's weight. Parturition occurs between May and July (Easterla 1973, Pearson et al. 1952, Pierson & Fellers 1998). Juveniles may become volant between 2.5 and 3 weeks of age, and are fully weaned at 6 weeks (Pearson et al. 1952, Pierson & Fellers 1998). Maternity colonies begin to disperse in August after the young are weaned, and have generally fully dissipated by September or October (Pearson et al. 1952, Tipton 1983, Pierson & Fellers 1998, Pierson et al. 1999).

D. Demography

Annual survivorship is estimated to be approximately 50% for young and 80% for adults, in the absence of disturbance (Pierson & Fellers 1998, Pearson et al. 1952). Observed average age is five years, but banding-recapture studies have recorded individual Townsend's big-eared bats that lived up to 24 years, though this may be unusual (Perkins 1994).

Because this species has low fecundity (one offspring per year per reproductively active female)

and fairly low juvenile survivorship, populations are slow to recover from decline or loss. Maintenance of high adult survivorship is crucial to long-term population viability (Crooks et al. 1998, Simons 1983).

Young males disperse after their first summer. However, many, perhaps all, surviving females return to their natal group, so that maternity colonies appear to be multi-generation, matrilineal groups (Pierson & Rainey 1998).

E. Hibernation

Townsend's big-eared bat,, like many other bat species, spends the coldest months of the year in hibernation. Temperature, humidity, and airflow contribute to the maintenance of suitable hibernating conditions, and Townsend's big-eared bats exhibit fairly strict requirements in their selection of hibernacula, preferring stable cold temperatures (below 10ºC) and moderate airflow (Humphrey & Kunz 1976, Perkins et al. 1994, Pierson et al. 1991). The vast majority of hibernacula known to be used by Townsend's big-eared bats are caves, but a few hibernating populations have also been located in buildings (Barbour & Davis 1969, Pearson et al. 1952). In the state of California, Townsend's big-eared bats generally form small hibernating aggregations (<50 animals), though in areas that experience longer periods of sub-freezing temperatures, larger hibernating colonies (>100 animals) may form (Pierson &Fellers 1998). In California, these larger aggregations are typically found at higher elevations (above 2,000 meters) in the White and Inyo Mountains, and in some lower-lying areas north of Lake County (Szewczak et al. 1998, Pierson & Fellers 1998). In regions with more moderate winter conditions, Townsend's big-eared bats may hibernate solitarily or in small groups.

As individuals enter a state of torpor, body temperature falls to within 1-2°C of the ambient temperature in the hibernaculum (Geiser et al. 2004). The decrease in body temperature and metabolic rate reduce energy expenditures by approximately 95% (as compared to remaining normally active) (Geiser et al. 2004, Dunbar & Tomasi 2006). Bats periodically break torpor during hibernation and may become active within or outside of the hibernaculum. The reason for these arousals is not fully known. Arousals may be necessary to enhance immune function, allow bats to consume water or forage, or move among hibernacula (Luis & Hudson 2006, Speakman & Racey 1989, Thomas & Geiser 1997). Townsend's big-eared bats may move between hibernacula even in regions with prolonged or more severe winters in California (Clark & Clark 1997). In areas with moderate winter conditions, hibernating Townsend's big-eared bats arouse more frequently and may forage on warm nights (Pierson et al. 1991). Individual Townsend's big-eared bats have been documented to fly from hibernacula in temperatures below freezing (Humphrey & Kunz 1976). Arousals represent as much as 75% of an individual bat's winter energy expenditures (Boyles et al. 2006).

Duration of hibernation varies with climatic variation across this species' considerable range in the state of California, but bats generally begin to arrive at hibernacula in October, and reach maximum numbers in January. Few active hibernacula are known in California, though some formerly occupied sites have been abandoned by Townsend's big-eared bats as a result of regular anthropogenic disturbance (Pierson & Rainey 1998).

F. Movement

Townsend's big-eared bat seems to be a relatively sedentary species—banded individuals are rarely observed to disperse more than a few kilometers from natal sites, and radio-tracking studies indicate that breeding females generally restrict movements to a range within 15 km of the primary maternity roost (Pierson & Rainey 1998, Brown et al. 1994). Females also exhibit high fidelity to their natal roost sites, returning annually to the same site. Less is known about the movements of male Townsend's big-eared bats, who disperse away from natal sites and do not form colonies in the summer months; males are typically found roosting alone when not hibernating (Pierson & Rainey 1998).

Migration between summer roosting habitat and hibernacula is typically fairly short though bats may move to higher elevations to find suitable hibernating sites (Sherwin et al. 2000b, Szewczak et al. 1998). The longest documented movement between summer roosting habitat and hibernacula in California is 43 km (Pierson & Rainey 1998). Substantial aggregations of adult Townsend's big-eared bats may form in spring and fall at sites near to maternity roosts or hibernacula. The purpose of these gatherings is not entirely clear but it is thought that such behavior may be some form of swarming, a phenomenon wherein some bat species congregate in large numbers prior to hibernation for breeding; they may also serve as staging grounds for the subsequent establishment of maternity colonies (Pierson & Fellers 1998).

Given their capacity for accurate echolocation, Townsend's big-eared bats are probably capable of avoiding most anthropogenic obstacles (they are capable of avoiding mist nets unless taken unawares). However, whether various anthropogenic habitat modifications (roads, habitat fragmentation, lights, renewable energy technologies) may represent barriers to dispersal or other threats to this species bears further investigation.

G. Foraging and Diet

Townsend's big-eared bats are nocturnal insectivores. The western subspecies reportedly forages in a variety of habitats. Foraging individuals have been observed in native oak and ironwood forest on Santa Cruz Island (Brown et al. 1994), in Mojave mixed desert scrub, Great Basin desert scrub and pinyon-juniper forest in the White and Inyo Mountains of the California-Nevada border region (Szewczak et al. 1998), and in riparian woodland in coastal California. Also, foraging bats have been located in sagebrush steppe and open ponderosa pine habitat in central Oregon (Dobkin et al. 1995), and in pinyon pine and juniper woodlands in Nevada and Utah (Kuenzi et al. 1999; Ports & Bradley 1996; Sherwin et al. 2000a).

Townsend's big-eared bats in coastal California are consistently observed to forage primarily in riparian corridors, closely following stream corridors within or along the edge of forested habitat at mid- or canopy level. Radio-tracking data shows that Townsend's big-eared bats avoid open grassland or meadow habitat, though they may occasionally venture to forested patches within a more open matrix (Fellers & Pierson 2002). When flying across open habitat to reach these foraging patches, individuals fly only 1 meter or so above the ground, as if to minimize exposure to potential predators. Townsend's big-eared bats may travel between 1 and 10 kilometers from a

day roost in search of prey, though females typically travel farther than males when foraging. The majority of individuals tracked or observed returned to the same roost each night, though in places where alternate roosts are available, some may switch on a regular basis (Fellers & Pierson 2002).

At Point Reyes National Seashore, Marin County, Fellers and Pierson (2002) observed light-tagged Townsend's big-eared bats foraging around the outer contours of trees and shrubs. Foraging flight is slow, and generally occurs as a methodical series of rising horizontal sweeps, each 3 to 10 meters long, along vegetation's edge. Foraging Townsend's big-eared bats do not pause or hover in a manner that would indicate gleaning, and have been observed feeding on moths in flight (Fellers & Pierson 2002). However, this species' morphology (low wing loading, low aspect ratio) makes it maneuverable in cluttered habitat suitable for gleaning, and it is possible that the limited observations of foraging Townsend's big-eared bats have not noted all foraging behavior.

Townsend's big-eared bats may drink from ponds, lakes, streams, and other sources of open water. Drinking may be the first thing a bat does after leaving the day roost. On the other hand, Townsend's big-eared bat roosts, including maternity colonies, may occur miles from any water source (e.g., over 40 kilometers away in desert areas: P. Brown, pers. comm. 2003), so drinking appears not to be obligatory.

Townsend's big-eared bats feed primarily on moths (greater than 90% of the diet; studies cited in Pierson & Fellers 1998; Pierson et al. 1999). Studies done in Kentucky (subspecies *virginianus*) found that noctuid and sphingid moths dominated the diet, and geometrid and notodontid moths also were consumed (Burford & Lacki 1998; Sample & Whitmore 1993; Shoemaker & Lacki 1993; these moth families include many agricultural pests). Small quantities of other insects are also consumed, particularly beetles and dipterans (flies, mosquitoes, and their relatives) (Dalton et al. 1986; Ross 1967; Sample & Whitmore 1993; Pierson & Fellers 1998).

VII. HABITAT REQUIREMENTS

Townsend's big-eared bats require a range of habitats for various parts of their life history, including summer roosts (maternity roosts), hibernacula, and foraging habitat.

Summer roosting habitat

Preferences for summer roosts are better known than those for any other Townsend's big-eared bat site type (e.g., hibernacula). Reproductively active females form maternity colonies in the summer months, while adult males and non-reproductive females typically roost singly. Reproducing female Townsend's big-eared bats seek out warm, undisturbed roosts in caves, abandoned mines, hollow trees, and human-made structures in California. Pierson & Rainey (1998) describe all maternity roosts identified by their surveys as cave analogues. Documented maternity roosts used by Townsend's big-eared bats are relatively large (of a size sufficient to allow flight but still enclosed)—many are at least 25 m deep, with the primary roosting area located between 1 and 2.5 m above the floor. The size of roost entrances is variable; most are at least 15 cm high and 30 cm wide, though smaller openings seem to be tolerated under some conditions (Pierson & Rainey 1998). Ambient temperature in known maternity roosts range from 18°C in cooler northern regions to 30°C in warmer southern regions; occupied roosts are consistently warmer than unoccupied roosts, suggesting that temperature plays a significant role in roost site selection by Townsend's big-eared bats. Relative humidity in occupied roosts is highly variable, ranging from 19-93%, an indication that humidity is not likely to be a major factor in roost site selection (Pierson & Fellers 1998). All known roosts are consistently semi-dark or dark. Pierson and Rainey (1998) report that in their four-year survey of maternity roosts throughout the state, 43% of those documented were located in caves, 39% in abandoned mines, and 15% in buildings; the remainder were found in other anthropogenic structures that provided cave-like conditions such as bridges and culverts.

Townsend's big-eared bat maternity roosts have been recently documented in the basal hollows of coastal redwoods (*Sequoia sempervirens*). A colony consisting of approximately 40 bats was reported to use at least 2 and as many as 13 of these hollows within Grizzly Creek State Park (Humboldt County) in the summer of 2000 (Mazurek 2004). Previous studies hinted at this use (e.g., Gellman and Zielinski 1996) but none had so thoroughly documented it. Individual Townsend's big-eared bats have also been observed to use redwood hollows as summer roosts (Fellers & Pierson 2002). The formation of these basal hollows is facilitated by fire and aging; older *S. sempervirens* may develop hollows more than 10 meters tall and several meters in diameter (M.J. Mazurek, pers. comm., 2003). Especially in areas with limited suitable cave or mine roosts, these tree hollows represent a significant habitat resource for Townsend's big-eared bat, and Mazurek (2004) suggests that such habitat may have historically constituted the majority of roosting habitat for this species in northwestern California (a region where caves and mines are limited). The documentation of a single maternity colony using as many as 13 roosts in one season suggests that the frequency of roost-switching is higher that previously known; preservation of adequate alternate roosts within the range of maternity colonies is desirable.

Though most records are from lower elevations, maternity colonies have been documented as high as 1,600 meters in the Sierra Nevada and 1,700 meters in the White and Inyo Mountains (Pierson & Fellers 1998).

Early in the gestation period, females typically roost in cooler, darker locations, but will often move to warmer places after parturition so as to facilitate thermoregulation and reduce energetic costs associated with lactation, foraging, and other maternal care (Pierson & Rainey 1998). Females exhibit high site fidelity to maternity roosts, returning to the same colony year after year; return rates are reported at 73-77% (Pearson et al. 1952, Pierson et al. 1999). However, colonies may switch sites if disturbed by climatic, anthropogenic, or other factors (Pierson & Rainey 1998, Sherwin and Gannon 2001). The availability of an abundance and diversity of potential roosting sites for maternity colonies is also necessary to accommodate the aforementioned changes in habitat preference throughout the reproductive period.

Hibernacula

The vast majority of hibernacula known to be used by Townsend's big-eared bats are caves, but a few hibernating populations have also been located in buildings (Barbour and Davis 1969, Pearson et al. 1952). Unlike many other bat species, they rarely hibernate in cracks or crevices, instead hanging singly or in highly visible clusters from open surfaces. Being so exposed, hibernating Townsend's big-eared bats are highly vulnerable to detection and disturbance; they therefore seek and require hibernacula that are secure from disturbance and predation and typically avoid or abandon sites that are disturbed (Pierson & Fellers 1998; Pierson et al. 1999). Few active hibernacula are known in California. Some of those that are known have been abandoned by Townsend's big-eared bats as a result of regular anthropogenic disturbance. The largest hibernating aggregations (200-600 animals) occur in the northern portion of the state, many in Siskiyou County, while hibernacula in southern California tend to host smaller groups (fewer than 20 animals; Pierson & Rainey 1998).

Hibernacula, like maternity roosts, tend to be large, with ceilings high enough to offer a degree of security to hibernating bats. They are often L-shaped, with both horizontal and vertical entrances, a shape that generates an interior cold sink and substantial airflow within the hibernacula (Pierson & Rainey 1998). Townsend's big-eared bats appear to seek the coldest non-freezing temperatures available when selecting hibernacula; in northern California, mean hibernacula temperature is 4.3ºC, while in southern and coastal areas it may be warmer, though preferred temperatures are consistently below 10ºC (Pierson & Rainey 1998). Though the majority of records are from lower elevations, hibernacula have been found as high as 3,188 meters elevation in the White Mountains (Szewczak et al. 1998).

It is possible that Townsend's big-eared bats hibernate in hollow trees in the more climatically mild parts of their California range, but this has yet to be confirmed and bears further investigation. D. Pierson and co-workers are documenting thermal stability and use by other hibernating bat species in basal hollows of giant sequoia in the southern Sierra (Pierson et al. 2006). At this writing Townsend's big-eared bat has not been found in Yosemite giant sequoia hollows.

Connectivity between summer roosting habitat and hibernacula is essential, particularly because Townsend's big-eared bats seem to restrict travel to protected habitat corridors (e.g., riparian areas, forest), avoiding prolonged periods of exposure in more open habitat.

High sensitivity to anthropogenic disturbance (Pierson & Rainey 1998) suggests that freedom from these disturbances is one of the most imperative criteria in hibernacula selection by Townsend's big-eared bats.

Foraging Habitat

The western subspecies of Townsend's big-eared bat reportedly forage in a variety of habitats. Foraging individuals have been observed in native oak and ironwood forest on Santa Cruz Island (Brown et al. 1994), in Mojave mixed desert scrub, Great Basin desert scrub and pinyon-juniper forest in the White and Inyo Mountains of the California-Nevada border area (Szewczak et al. 1998), and in riparian woodland in coastal California. Also, foraging bats have been located in sagebrush steppe and open ponderosa pine habitat in central Oregon (Dobkin et al. 1995), and in pinyon pine and juniper woodlands in Nevada and Utah (Kuenzi et al. 1999; Ports & Bradley 1996; Sherwin et al. 2000a).

Within these various ecosystems, Townsend's big-eared bats forage primarily in riparian corridors, closely following creeks or streams through forest or shrub habitat in search of insect prey (Pierson & Fellers 1998, Fellers & Pierson 2002). Because this species occurs in a wide variety of habitats in California, it is likely to be somewhat adaptable in its foraging requirements, though foraging individuals consistently avoid open grassland or pasture habitat where they may be exposed to predation (Fellers & Pierson 2002, Pierson & Fellers 1998). The degree to which cleared habitat (natural or anthropogenic) represents a barrier to dispersal for this species is not known and bears further investigation, particularly in light of the rapid urbanization occurring in much of the state.

In addition to protecting the habitat where Townsend's big-eared bats forage, it is necessary to conserve the areas where the insects that this species consumes breed and mature. It is thought that moths (Dioptidae, Notodontidae, Doptinae, and others) comprise the primary food source for this bat species.

Townsend's big-eared bats may drink from numerous available water sources near to roosting or foraging habitats. As they are highly agile in flight, individuals are capable of drinking from open water on the wing. Pierson and Fellers (1998) report that Townsend's big-eared bats travel 4 km or farther to drink at ice caves in the Lava Beds National Monument. However, maternity colonies are known more than 40 km from water in arid areas, and it is possible that some populations of Townsend's big-eared bat obtain all necessary water from their insect prey (P. Brown, pers. comm. 2003, S. Osborn, pers. comm. 2010).

VIII. RANGE AND DISTRIBUTION

Townsend's big-eared bat conforms to a type of rare species, as classified by Rabinowitz et al. (1986), that has a wide geographic distribution but is everywhere uncommon and has restrictive habitat needs. Such species are particularly vulnerable to habitat fragmentation and loss of their naturally rare habitat. The range of the Townsend's big-eared bat extends from southern British Columbia in the north to Mexico in the south, and from the west coast, including California, approximately to the western edge of the Great Plains (Pierson et al. 1999). The species is not common in any part of this wide range.

Townsend's big-eared bat is found throughout California in all but subalpine and alpine habitats, and may be found at any season throughout its range (CDFG 2000 and 2008, Figure 1, 2 and 3).

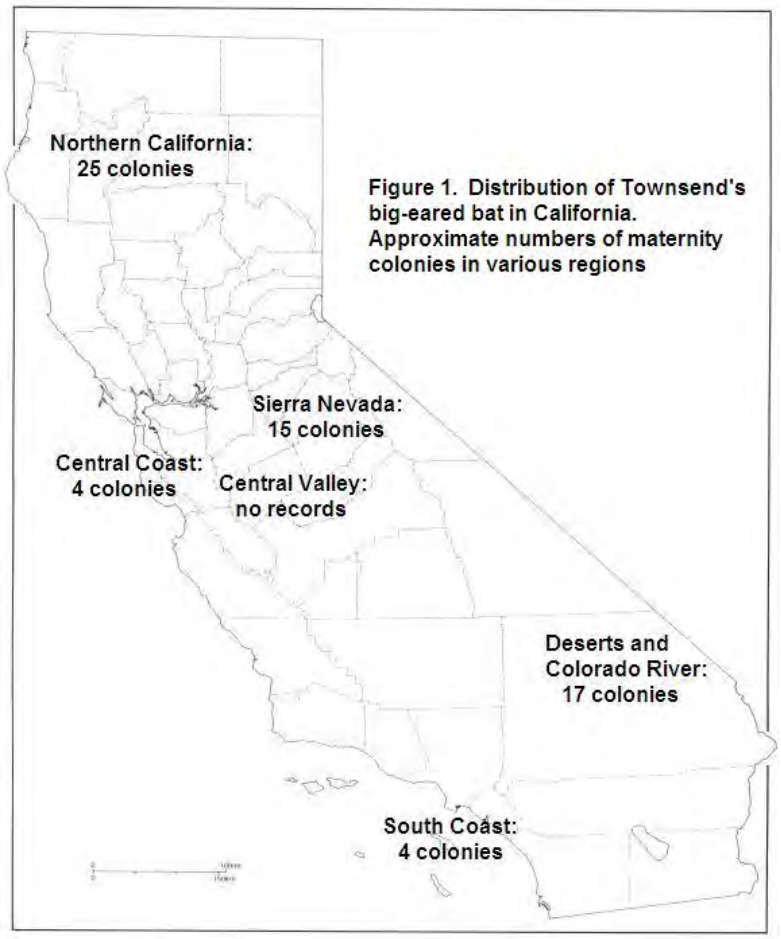

Figure 1. Approximate number and distribution of significant Townsend's big-eared bat maternity colonies in California. (After Pierson & Fellers 1998, Figure 2; plus San Benito County).

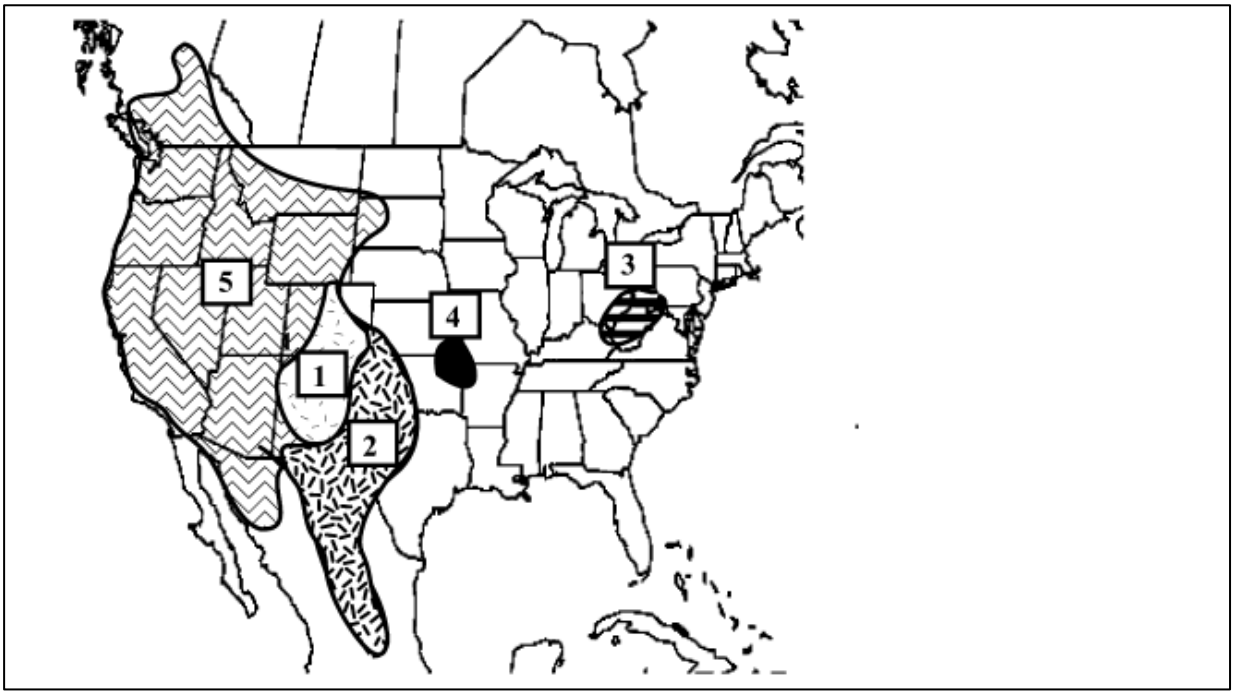

Figure 2. From Piaggio and Perkins (2005) showing the five recognized subspecies of Townsends big-eared bat.

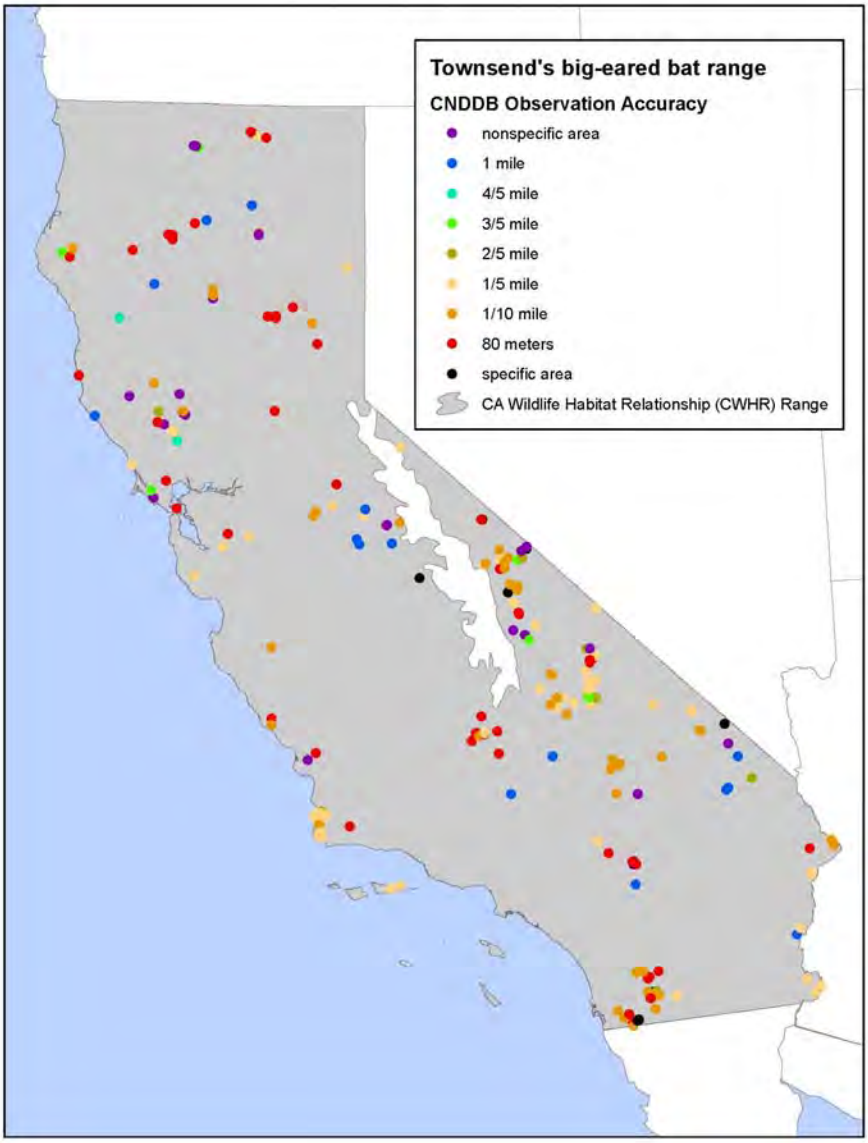

Figure 3. Roughed occurrence locations from the California Natural Diversity Database Biogeographic Data Branch and California range from CDFG 2008.

IX. HISTORIC AND CURRENT DISTRIBUTION AND ABUNDANCE

In California, several areas host substantial populations of the Townsend's big-eared bat, including the northeastern corner of the state, the northern coast and northern coast ranges, and mining regions in the Sierra Nevada and desert zones (Pierson & Rainey 1998). Townsend's big-eared bat is found in a variety of habitat types, including coastal redwood forests, oak savannahs, mixed conifer forests, pinyon-juniper forest, and desert habitats (Pierson and Fellers 1998).

The most recent rangewide survey of Townsend's big-eared bat was conducted by Pierson and Rainey (1998) in which all known significant maternity colonies (>30 animals) for Townsend's

big-eared bat within the state were included. The draft California Bat Conservation Plan (Pierson et al. 2011) provides additional, updated information on the species. This petition relies primarily on the 2011 draft conservation plan (CBCP) as well as the Pierson and Rainey survey in addressing the distribution and abundance of Townsend's big-eared bat in California. Because the CBCP organizes its regional descriptions by U.S. Forest Service "ecoregions," we adopt the same format. We also summarize distribution and abundance from the CBCP in Table 1.

The primary centers of distribution for Townsend's big-eared bat in California in the past 30-70 years are found in areas that offer caves or cave analogues (such as old mine workings) with populations concentrated in the limestone formations of the Sierra Nevada and Trinity mountain ranges, the volcanic formations in the northern part of the state, and a number of mining districts, most significantly those in the desert regions east and southeast of the Sierra Nevada, the Mother Lode country, and the inner coast range north of San Francisco (Pierson & Rainey 1998). Both historically and currently, there have also been significant coastal populations located in buildings or other human-made structures (e.g., bridges or water tunnels).

There have been notable declines in either number of colonies or population levels in many areas where Townsend's big-eared bats occur, such as in the Mother Lode country of the Western Sierra foothills and in the mining district along the Colorado River, likely because of heavy recreational use in both areas, as well as in San Francisco Bay area counties, where native habitat and rural land have undergone conversion for agriculture (i.e., wine production) or suburban/urban development (Pierson & Rainey 1998).

Below are descriptions of Townsend's big-eared bat by ecoregion in California. The U.S. Forest Service defines 19 ecoregions in the state; the CBCP combines four ecoregions into two (the Southern California Coast with the Southern California Mountains and Valleys, and the Mono ecoregion with the Southeastern Great Basin). This petition follows the format of the draft CBCP. However, one additional entry is made for the Channel Islands, and the draft CBCP does not yet include an entry for the Northern California Coast Ranges, so information pertaining to the Northern Coast Ranges is included in this document's description of Townsend's big-eared bat in the Northern Coast ecoregion.

A. Northern California Coast

This ecoregion is a narrow band running north along the coast from the San Francisco Bay to the Oregon border. It includes the western third of Del Norte County, the western halves of Humboldt and Mendocino counties, most of Sonoma County, the western half of Napa County and all of Marin County. The ecoregion ranges in elevation from sea level to 3,000 feet.

There are a number of important early records of Townsend's big-eared bat from the Northern California Coast ecoregion, but biologists consider the species rare there now (Pierson et al. 2011). Into the mid-twentieth century, investigators documented significant populations in the redwood belt (Pearson et al. 1952; Pierson & Fellers 1998), and found the species roosting in the basal hollows of old-growth redwood trees—a feature that has become rarer as commercial

logging has eliminated stands of primary redwood forest. Some scientists believe that before the advent of widespread logging, large, old redwoods were the primary roost sites for Townsend's big-eared bat in this part of the state (Pierson & Fellers 1998). Caves are naturally rare along the coast.

Older buildings have served an important role as roost sites. But building deterioration, as well as renovation, has been responsible for the loss of historic colonies (Pierson & Fellers 1998). The loss of these anthropogenic roosting sites is a leading threat to Townsend's big-eared bat in the region. Disturbance at unprotected sites is another leading cause of colony decline and disappearance.

At this time, only three maternity colonies are known in the ecoregion, and two are in buildings (Pierson et al. 2011). The only adequately protected colonies are on National Park Service land at Point Reyes National Seashore and Golden Gate National Recreation Area.

The CBCP considers Townsend's big-eared bat to be a "highest risk" species in the region (Pierson et al. 2011).

The CBCP draft omits an entry on the Northern Coast Ranges ecoregion, which lies between the Northern California Coast to the west, and the Northern California Interior Coast Ranges, to the east. Two colonies on the Shasta-Trinity National Forest exist at Butter Creek and Cecilville Caves. However, these are not protected, nor is a colony at Calistoga. The greatest threat to Townsend's big-eared bat in the Northern Coast Range is human disturbance at roost sites and deterioration of buildings that host maternity colonies.

B. Klamath Mountains

This ecoregion encompasses much of northwestern California. It includes the western half of Siskiyou County, the eastern two-thirds of Del Norte County, the northeastern portion of Humboldt County, the northern three-quarters of Trinity County, and much of the western half of Shasta County. The Marble Mountains and the Trinity Range are part of this ecoregion. Significant limestone formations occur in the Marble and Trinity mountains. Elevations range from 200 feet to 9,000 feet.

The distribution of Townsend's big-eared bat is patchy in the Klamath Mountains; biologists consider the species rare. However, bat experts also agree that the ecoregion is a very important one for Townsend's big-eared bat in California (Pierson et al. 2011). Historically, a number of limestone caves in the Klamath Mountains have been significant sites for Townsend's big-eared bat (Graham 1966); biologists have also made more recent observations of the species hibernating and roosting in the ecoregion (Marcot 1984; Pierson & Fellers 1998). The abundance of both limestone caves and abandoned mines contributes to the habitat significance of the ecoregion for Townsend's big-eared bats. Important historic roosts occur in the Lake Shasta area and near Cecilville, Hyampom and Hayfork. A large, important roost occurs in a mine on BLM land in Siskiyou County. Caves and mines are used for both nursery roosts and hibernation sites

at this latitude (Pierson et al. 2011).

Disturbance at or loss of roosting and hibernation sites is the leading threat to Townsend's big-eared bat in the region. Biologists consider the risk of white-nose syndrome, the invasive fungal disease now spreading westward from the eastern United States, to be high in this ecoregion (Pierson et al. 2011).

Townsend's big-eared bat is ranked "highest risk" among bat species in the ecoregion (Pierson et al. 2011).

C. Southern Cascades

The Southern Cascades ecoregion is sandwiched between the Klamath Mountains to the west and the Modoc Plateau, to the east. It reaches from the Oregon border to the northern end of the Sierra Nevada range. It encompasses most of eastern Siskiyou County, a small slice of western Modoc County, the eastern half of Shasta County, portions of Lassen County, a piece of northern Plumas County, the northeast corner of Butte County, and eastern Tehama County. Volcanic geology characterizes the region, and lava flows, including lava tube caves, are common throughout the region. The elevational reach of the ecoregion is 2,000 feet to 14,000 feet.

This ecoregion, with its abundance of lava caves, is the most important in California for Townend's big-eared bat. The greatest density of caves in the state, and one of the most important cave regions in North America, is found here. Concomitantly the largest colonies of Townsend's big-eared bat in California are in the Southern Cascades (Pierson et al. 2011). Lava caves provide habitat suitable for both maternity roosts and hibernation, often in close proximity to each other. Ambient air in summer warms more shallow caves, making them suitable for maternity roosts. Deeper, colder caves are suitable for hibernation (Pierson et al. 2011).

The density of caves in the Southern Cascades, and the temperate climate in the region, puts bat populations in this ecoregion at particularly high risk for white-nose syndrome (Pierson et al. 2011). The large colonies of Towsend's big-eared bat found here are especially vulnerable to this fast-spreading infectious disease.

The largest known population, within Lava Beds National Monument, had 134 animals when first discovered in November 1988, and over 600 in early March 1994 (Pierson & Fellers 1998). This site is being monitored and protected by the Monument. Other populations are less secure. The population identified in Pluto's Lava Flow #l in January 1988 was significantly reduced when the site was vandalized a few years later by young people who removed a number of bats and released them in a local store. A nearby site, Pluto's Lava Flow #4, confirmed as a significant hibernating site in February 1994 (with about 250 animals) (Pierson & Fellers 1998), receives heavy recreational traffic. Preliminary survey results indicate that population numbers within this cave are unpredictable, and may fluctuate in response to human disturbance.

The greatest threat to populations in this region is disturbance caused by recreational caving

(Pierson & Rainey 1998) and active vandalism. The CBCP ranks Townsend's big-eared bat as "highest risk" in the Southern Cascades ecoregion (Pierson et al. 2011).

D. Modoc Plateau

Unlike the Southern Cascades ecoregion, the Modoc Plateau includes not only volcanic geology, but also fault-block mountains and intervening valleys. The ecoregion takes in most of Modoc County, extends into the northeastern and southeastern corners of Siskiyou County, south to the center of Lassen County, and a small piece of eastern Shasta County
Elevations range from 3,000 to 9,900 feet (Pierson et al. 2011).

Townsend's big-eared bat is considered extremely rare in the region, but lava flow formations are extensive, and important mining districts occur in the Warner Mountains and in the Hayden Hill area (Pierson et al. 2011), so habitat appears to be available. Surveys have been limited in the ecoregion, but bat experts believe new surveys might turn up more records of the species (Pierson et al. 2011). The only record of Townsend's big-eared bat in the Modoc Plateau is a 1991 study that reported the species in an historic mining district (Pierson & Brown 1992).

As elsewhere, on the Modoc Plateau, the strong association between Townsend's big-eared bats and caves and mines, along with its profound sensitivity to disturbance, makes the species highly vulnerable to disruptive activities such as recreational caving, vandalism, and renewed mining activity. The CBCP ranks Townsend's big-eared bat as "highest risk" in the Modoc ecoregion (Pierson et al. 2011).

E. Northwestern Basin and Range

This ecoregion lies in the easternmost portion of northern California, taking in the eastern parts of Modoc and Lassen counties. Arid valleys occupied by alkali lake beds characterize the area. Elevations range from 4,000 feet to 8,000 feet (Pierson et al. 2011).

Very little bat inventory work has been done in this part of California. Only 12 museum records exist, and all were collected between 1923 and 1941. Of the nine localities in these records, two were for buildings, one of which serves as the only record for Townsend's big-eared bat in the ecoregion. Historic mining areas likely provide suitable habitat for bats, but scientists know very little about bat use of these sites. Biologists consider the area high risk for infection by white-nose syndrome. The CBCP designates Townsend's big-eared bat as "highest risk" among bat species in the Northwestern Basin and Range (Pierson et al. 2011). Vandalism and disturbance from recreational caving likely pose the greatest risks to the species in this ecoregion.

F. Northern California Interior Coast Ranges

This ecoregion is a narrow strip running north-south along the interior, eastern side of the Coast Ranges, north of San Francisco. The elevational gradient goes from 300 to 3,100 feet.

Two Townsend's big-eared bat colonies are protected on land owned by the Homestake Mine Company (Knoxville and Sulphur Creeks), at the south end of the ecoregion. However, most of the caves and mines in the ecoregion are at the northern end. Where caves and mines are more limited, as at the southern end of the ecoregion, buildings become more important for roosting for Townsend's big-eared bats. Disturbance at or loss of cave and mine habitat threatens the species, as does loss of artificial structures (i.e., houses, abandoned buildings). A large and active recreational caving community in northern California, along with tourism at commercial caves, could harm Townsend's big-eared bats due to the species' sensitivity to disturbance (Pierson et al. 2011).

Townsend's big-eared bat has a limited distribution in the Northern Interior Coast Ranges, and the CBCP considers the species "highest risk" in the ecoregion.

G. Great Valley

The Great Valley ecoregion runs the length of the Sacramento and San Joaquin valleys and includes the delta of the Sacramento and San Joaquin rivers. Overall, the ecoregion lies at low elevation, from sea level to 2,000 feet. At the southern end of the ecoregion, however, some highlands reach up to 4,000 feet. Little natural roosting and hibernating habitat exists for Townsend's big-eared bat outside of the Sutter Buttes area and a few other large rock outcrops. The species is sparsely distributed in the Great Valley and the CBCP considers it "lowest risk" in the ecoregion.

H. Sierra Nevada Foothills

The Sierra Nevada Foothills ecoregion is long and narrow, stretching along the west side of the Sierra Nevada Range for over 400 miles, from just east of Redding to the Tehachapi Mountains south of Bakersfield. Elevations range from 200 feet to 5,000 feet. Rivers flowing out of the Sierra Nevada into the Great Valley cut deep canyons in a number of places; most rivers have been dammed at one or more places along their length, creating reservoirs in the foothill zone (Pierson et al. 2011).

The foothills region hosts most of the important cave and mine habitat in the Sierra Nevada. Limestone caves are especially prevalent in the "Mother Lode" country, as are mines. Recreational caving, tourism at caves, rock climbing, and quarrying all threaten caves that serve as bat habitat. Townsend's big-eared bat uses bridges as roosting habitat in the Sierra Nevada foothills, as well. Older buildings can be important habitat in the ecoregion (Pierson et al. 2011).

Townsend's big-eared bat has a limited foothills distribution. Many important roosts have been destroyed or are at risk in the region (Pierson et al. 2011). Pierson & Rainey (1998) found that Townsend's big-eared bat is no longer in many of its traditional maternity sites in this region and populations appear to be seriously reduced. The six currently used roosts that could be monitored have a total population of only 125 animals. In the 1990s, the mean size of maternity colonies in this region was 46.6 with a total of 326 adult females (Pierson & Rainey 1998).

A number of historical roosts are no longer occupied. Several caves have become tourist destinations. One of these, privately owned Moss Cave, once contained the largest known colony in the Mother Lode area. Although cavers report occasional sightings of a colony in the area, several attempts to locate this colony have been unsuccessful.

Those roosts that are still occupied have small, highly disturbed populations. For example, the Murphys population appears to move with disturbance among three known caves, and another locality, yet to be identified. An attempt by a landowner and one group of recreational cavers to gate one of these caves at first met with intense resistance from other recreational cavers, and the gate was breached a number of times.

The Bodfish Cave population, the only one known in the Lake Isabella area, had been vandalized (i.e., 10 dead, smashed animals were found) when visited in August 1988, and was threatened again in the spring of 1992 by the proposed closure of numerous mine workings in the area by Sequoia National Forest (Pierson & Brown 1992). Semi-fossilized guano formations within this cave suggested a very large colony had existed here at one time, although the colony is now relatively small (about 33 adults; Pierson & Rainey 1998).

A reactivation of mining in the Mother Lode country also poses a potential threat to Townsend's big-eared bat. One small colony is located in an old mine near Jamestown, which, until recent suspension of mining activities, was scheduled for demolition as part of a current mining operation. The extent to which Townsend's big-eared bat is using old mines in the Mother Lode area has not been fully explored (Pierson & Rainey 1998).

The CBCP considers Townsend's big-eared bat at "highest risk" in the Sierra Nevada foothills.

I. Sierra Nevada

This ecoregion stretches north-south along the Sierra Nevada Mountains from Susanville to Tehachapi Pass. Bordering the foothills region on the west, and the desert regions of the Northwestern Basin and Range, and the Mohave Desert on the east, the Sierra Nevada ecoregion ranges in elevation from about 1,000 feet to the highest summit of the range, at 14,495 feet (Pierson et al. 2011).

Early, pre-1900 records exist for Townsend's big-eared bat in the Sierra Nevada, but most studies of bat distribution did not occur until the 1990s. The majority of summer cave and mine habitat for Townsend's big-eared bat occur at lower elevations, in the foothills of the Sierra Nevada, rather than higher in the mountains. However, some of the most important roosts for the species occur in this ecoregion, including Boyden Cave, Clough Cave, and Bower Cave. Biologists also believe it likely that hibernacula occur in the higher elevations of the Sierra Nevada, based on survey work done in the nearby Inyo and White Mountains.

Characteristic ceiling stains at old roosting locations in Bower Cave indicate that this site once contained a very significant (many hundreds) Townsend's big-eared bat population. Although

recently acquired by the Stanislaus National Forest, which is developing a management plan, the cave is currently being heavily used for recreation by local residents. Attempts to date by the Forest Service to control access appear to have been unsuccessful. Occasional accumulations of Townsend's big-eared bat guano indicate a population is still trying to use this cave (Pierson & Rainey 1998).

The Boyden Cave population roosts near the gated entrance of a tourist cave. Although the guides are sensitive to the bats, groups pass below the cluster a number of times each day, and colony size is much smaller than it once was (S. Fairchild, pers. comm.). Boyden Cave is within the Giant Sequoia National Monument, administered by the Forest Service.

In April 1991, staff at Sequoia National Park located a well-protected cave within park boundaries that had a large (0.3 x 0.6 m) cluster of Townsend's big-eared bats suggesting a colony size >200. Although the colony was not occupying the cave in July 1991, a large Townsend's big-eared bat guano deposit confirmed the presence of a colony in the area. The Park has expressed a commitment to protecting this colony (Pierson & Rainey 1998).

Old buildings suitable for Townsend's big-eared bat to roost in are less numerous in the Sierra Nevada than other ecoregions; nonetheless, some important roosts for the species have been found in old mine buildings (Pierson et al. 2011). Below about 7,000 feet, bridges are also important roost sites for the species (Pierson et al. 2011).

Threats to Townsend's big-eared bat in the Sierra Nevada ecoregion include recreational caving, tourist activity at commercial caves, and recreational climbing (Pierson et al. 2011). Renewed mining activity and other disturbance at roosting sites in mines likely also poses a threat to the species. Where hibernacula occur at higher, colder elevations, white-nose syndrome could become a major threat (Pierson et al. 2011).

The CBCP considers Townsend's big-eared bat a "highest risk" species in the Sierra Nevada, due to its limited distribution and rarity, and sensitivity to disturbance (Pierson et al. 2011).

J. Central California Coast

The Central Coast ecoregion picks up south of the Northern California Coast ecoregion, and includes the San Francisco Bay area. It hugs the coastline south from San Francisco to the east-west mountains north of Los Angeles. Elevations range from sea level to close to 6,000 feet.

Out of eight Townsend's big-eared bat colonies that were known in the past along the coast from San Francisco Bay area to Santa Barbara, only one remains, and only one new roost was found. One extant colony is near Pescadero (San Mateo County) and another is near Santa Inez (Santa Barbara County), both fairly large (>150 animals); these colonies are located on private lands, making their future very uncertain. Individual animals have been located near Livermore and Calaveras Reservoir, but populations there are not known. The species has been extirpated from the East Bay and Peninsula regions, areas that have been heavily suburbanized (Pierson &

Rainey 1998). Mean maternity colony size in this region is 162.5 with a total of 325 adult females (Pierson & Rainey 1998).

Townsend's big-eared bat roosts in coastal redwoods in this ecoregion. Caves and mines are patchily distributed and many are unprotected as bat habitat. Anthropogenic roosts probably provide the greatest amount of roosting habitat. Because of the rarity of natural roosts, the species was likely always rare along the Central Coast. Townsend's big-eared bats have been extirpated from more urbanized areas. Loss of roost sites, whether caves, mines, or buildings, and urbanization and development of foraging habitat, are likely the greatest threat to the species. The CBCP considers the species "highest risk" in the Central Coast (Pierson et al. 2011).

K. Central California Coast Ranges

This ecoregion encompasses inland coastal ranges from the Sacramento-San Joaquin delta reaching south to the Transverse Ranges. Elevations span 100 feet above sea level to just above 5,000 feet (Pierson et al. 2011).

As in the Central Coast ecoregion, cave and mine habitat is rare in the Central Coast mountain ranges. Mines that do exist are inadequately protected for bats. A magnesite mine in the Mount Hamilton Range used to provide habitat for a small population of Townsend's big-eared bat, but the species has not been observed there in recent surveys. Bear's Gulch Caves at Pinnacles National Monument host over 300 female Townsend's big-eared bats and their young. The site seems to be adequately protected from disturbance (Pierson et al. 2011).

Among the threats to Townsend's big-eared bat in the Central Coast ranges is inundation of important habitat by the proposed Los Banos Grandes Dam. Water would flood the largest remaining stand of old growth sycamore in the region. Townsend's big-eared bat is among the bat species that utilize these large, old trees to roost. Another threat is a planned solar energy plant in the Panoche Valley which will demand large amounts of water and likely draw down sources important to Townsend's big-eared bats that roost in nearby mines (Pierson et al. 2011).

The CBCP considers Townsend's big-eared bat "highest risk" among bat species in the Central Coast Range ecoregion.

L. Mono and Southeastern Great Basin

The CBCP combines the Mono and Southeastern Great Basin ecoregions into one, for the purposes of discussing the status of bats in California (Pierson et al. 2011). The Southeastern Great Basin ecoregion, it should be noted, is in the southeastern area of California, but is actually the southwestern corner of the Great Basin desert in the interior West. In California, these ecoregions stretch from just south of Lake Tahoe to the southern ends of the Panamint Range, the Coso Range, and other desert ranges east of the Sierra Nevada. Elevations range from 1,000 feet to over 14,000 feet in the White Mountains.

This part of the state supports some of the largest populations of Townsend's big-eared bat. Extensive historic mining activity provides abundant bat habitat today. Approximately one-third of the total known population within state resides here. Mean maternity colony size in this region is 118.7 with a total of 1,306 adult females (Pierson & Rainey 1998). There are 12 known roosting colonies. Of these, 11 occur in mines, and most are on public lands (Pierson & Rainey 1998). P. Brown and R. Berry (pers. comm. cited in Pierson & Rainey 1998) report finding at least 20 hibernating Townsend's big-eared bats in a shaft in January 1994 on the China Lake Naval Weapons Center. A significant hibernating population has been found in a mine adit in Death Valley National Monument. At this site, the population increased, once a protective gate was installed, from 17 on March 5, 1992 to 54 on March 5, 1993.

Mine closure poses a significant threat to Townsend's big-eared bat populations in these two desert ecoregions (Pierson et al. 2011). The Bureau of Land Management and Forest Service both have Abandoned Mine Lands (AML) programs to close off dangerous mine openings to human access. However, because these sites function as vital bat habitat in some cases, the appropriate process is for bat surveys to precede closure, and if bats are found, land managers should install bat-friendly gates that keep people out, but allow bats free travel in and out of subterranean habitat. Often, these protocol are not followed and bat colonies may be either excluded from important habitat when mines are sealed off, or they may be entombed underground.

Renewed mining activity also threatens Townsend's big-eared bat roosts in these ecoregions. Mining companies may commence activity in abandoned sites, or may initiate new diggings but backfill old ones in the same vicinity, to relieve themselves of liability issues (Pierson et al. 2011).

Recreational caving and vandalism are other threats to the Townsend's big-eared bat in the Mono and Southeastern Great Basin ecoregions. The roost at Wilson Canyon on the Naval Weapons Center was vandalized in 1988 and has not been reoccupied since then. Since numbers increased at the nearby Mountain Springs Mine, some animals from Wilson Canyon may have moved there. Other mines such as Poleta, Snowflake, and Yaney all had evidence of extensive recreational use in the Pierson and Rainey (1998) survey. The only colony in the area with assurance of future protection is located in Death Valley National Monument. Yet, despite efforts by the Park to protect this site through gating, it was vandalized in 1993, and the number of animals occupying the site in the summer of 1993 was greatly reduced (Pierson & Rainey 1998).

The CBCP considers Townsend's big-eared bat a "highest risk" species in these two desert ecoregions.

M. Southern California Coast and Southern California Mountains and Valleys

Authors of the CBCP combine two ecoregions, the Southern Coast and the Southern Mountains and Valleys, to address the status of bats in the southern coastal zone. These ecoregions lie west

of the southern desert regions of California, stretching from the Sonoran and Mojave deserts to the Pacific Ocean. The Transverse Ranges form the northern boundary and the U.S./Mexico border is the boundary on the south. Elevations range from sea level to over 10,000 feet (Pierson et al. 2011).

Cave and mine habitat exists in the ecoregions at middle and higher elevations. Mining dates back to approximately 150 years ago and abandoned mines are numerous, but few surveys for bats have occurred in them. Biologists believe these AMLs serve as maternity roosts and hibernacula for small groups of bats. Caves are rare (Pierson et al. 2011). Trees and snags may also serve as roost habitat for Townsend's big-eared bat.

The Townsend's big-eared bat has a limited and patchy distribution in the South Coast and South Mountains and Valleys ecoregions. Threats to the species include disturbance at mine and cave sites, and loss of foraging habitat to grazing, fires, and development. Timber cutting may result in the loss of roost trees for the species. Townsend's big-eared bat has largely disappeared from urbanized areas. The species once was found near the coast. In the 1930s it was not common in San Diego county, but was widely distributed and frequently encountered there (Krutzsch 1948). None of the colonies in San Diego county exist any longer (Pierson & Rainey 1998). The likely cause of the species' disappearance in the lower elevation and more western parts of the southern coastal area is likely widespread urbanization and suburbanization (Pierson & Rainey 1998). The authors of the CBCP believe the species has been to exist with habitat fragmentation and conversion of natural habitat to more urban settings (Pierson et al. 2011).

The CBCP considers the Townsend's big-eared bat "highest risk" among bat species in the South Coast and South Mountains and Valleys ecoregions.

N. Mojave Desert

The Mojave Desert ecoregion occupies a large portion of southeast California, extending from the southern terminus of the Sierra Nevada to the northern and northeast ends of the Transverse Ranges, and reaching east to the Nevada and Arizona borders. Most of the ecoregion is within San Bernadino County. There are many physical and biological characteristics of the Mojave Desert ecoregion that are shared with the Colorado and Sonoran deserts to the south. Low elevations begin at 280 feet below sea level (in Death Valley) and reach up to over 7,900 feet.

Abandoned mine lands are abundant in the Mojave Desert, and provide plentiful bat roosting habitat. Natural caves are rare, but some exist at higher elevations, such as limestone caves in the Providence Mountains and Mescal Range. Townsend's big-eared bats have been reported in lava tubes at Pisgah Crater (Brown pers. obs.; BLM 2012). A maternity colony of Townsend's big-eared bats roosts in a pumice cave near Haiwee Reservoir, south of Owens Lake (Brown, pers. obs.; Pierson & Rainey 1996).

Unfortunately, a number of important roosts for Townsend's big-eared bat are not protected and colonies have disappeared or shrunk. One well-known roost for the species was in Mitchell

Caverns in the Providence Mountains, now a state park. Another was in mine workings in Macedonia Canyon. Unfortunately, a number of these sites are not protected. The Mitchell Caverns colony was excluded in about 1970, when the cave entrance was redesigned and a bat-proof gate installed. The occasional occurrence of individual Townsend's big-eared bats in the caverns or nearby mine workings indicates a population still exists in the area. Within days of replacing the gate in the summer of 1993, Townsend's big-eared bats began to reoccupy the cave (pers. comm. cited in Pierson & Rainey 1998). Reactivation of a private mining claim in Macedonia Canyon has excluded the Townsend's big-eared bat colony from its historical roost, but the colony has relocated to another mine in the area. In the Mescal Range, modern day "miners" visit Kokoweef Caverns in search of a "lost river of gold" (Pierson et al. 2011). The lava tube caves near Twentynine Palms and near Owens lake are not protected either, and as a result, receive considerable visitation from recreational cavers, especially in the winter hibernation months when Townsend's big-eared bat is especially vulnerable to disturbance (Pierson et al. 2011).

Another population of Townsend's big-eared bat was identified to the east of the Providence Mountains, in the Castle Mountain range, by the capture of a lactating female (Pierson & Rainey 1998). A total of 75 adult females were estimated in the maternity colony observed by Pierson and Rainey (1998).

Prime habitat in the Mojave Desert for the species seems to combine roosts in canyons with permanent water and riparian vegetation. The largest maternity colonies in the Panamint Mountains possess all these features (Pierson et al. 2011). Biologists believe the higher elevations of ranges such as the Clark, Old Woman, Providence, New York, Granite, Panamint and Kingston ranges provide foraging habitat for Townsend's big-eared bat (Pierson et al. 2011).
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The CBCP rates Townsend's big-eared bat as "highest risk" in the Mojave ecoregion. The species is especially dependent on abandoned mines for roosting and hibernating habitat, due to the scarcity of natural caves. Mine closures and reactivation of abandoned mines jeopardize the species in the ecoregion.

O. Sonoran Desert and Colorado Desert

The CBCP combines two ecoregions, the Sonoran Desert and the Colorado Desert, in its discussion of bats in the extreme southeast corner of California. The ecoregions encompass southern and eastern Riverside County, eastern San Diego County, southeast San Bernardino County, and all of Imperial County. Arizona lies on the eastern border, across the Colorado River, and Mexico is the southern border. Elevations range from below 230 feet below sea level at the Salton Sea, to 4,400 feet.

With mining dating back 150 years, plentiful abandoned mine areas provide roosting sites for bats. Townsend's big-eared bat depends on this abundant mine habitat for roosting, as natural caves are extremely rare in these ecoregions. The few that do exist and were historically used by bats have been largely abandoned, likely due to human disturbance (Pierson et al. 2011).

The Colorado River Basin once supported large bat populations. The Pierson and Rainey (1998) survey and work conducted by P. Brown and P. Leitner since the 1960s have documented alarming declines for most species. Townsend's big-eared bats were once found in many mines along the Colorado River (Pierson & Rainey 1998); three maternity sites were known; and the Alice Mine housed the largest colony (>l000 adults) known in California. Extensive surveys by P. Brown and E. Pierson in 1990, and further surveys by P. Brown in 1991 and 1992 have revealed only one relatively small maternity roost in the Mountaineer Mine with an estimated 50 adult females (present in 1991, but not in 1992), and one isolated individual. Recreational use of abandoned mines is high along the Colorado, and may account for much of the observed decline. A number of surveyed mines, however, which had no evidence of disturbance and offered suitable roosting conditions, also had no bats. Historically, Townsend's big-eared bat was found in large colonies in mines in the Riverside Mountains; the bats foraged along the floodplain of the Lower Colorado River (Stager 1939). The lush and diverse habitat that existed in the floodplain has been converted over the last sixty years to agricultural fields, or is dominated by exotic tamarisk. This conversion has likely reduced available foraging habitat, and contributed to the observed declines (although this species is known to feed over alfalfa and corn fields in the eastern U.S. (Pierson & Rainey 1998). Pesticides, which are heavily used in this area, also may have had a negative effect.

In the Sonoran and Colorado deserts, mine closures, conducted for hazard abatement, threaten Townsend's big-eared bat habitat. Renewed mining activity on old abandoned mine lands also threatens current the species' roosting sites (Pierson et al. 2011). Together with human disturbance and the loss of foraging habitat, Townsend's big-eared bat is today more rare in these two desert ecoregions. The CBCP ranks the species as "highest risk" in this part of California.

P. Santa Cruz Island (Channel Islands)

The CBCP does not include discussion of bats on offshore islands of California. However, there are isolated records for Townsend's big-eared bat on four of the Channel Islands (Brown 1980). The only maternity colony that has been identified occurs on Santa Cruz Island. It has been disturbed a number of times over the years both by displacement from roosts and collection for scientific purposes. A colony, relocated in 1991, in a building at the east end of the island (Brown et al. 1994), is less than half its former size. It is currently roosting in an area under negotiation for purchase by the National Park Service (Pierson & Rainey 1998).

X. POPULATION STATUS AND TRENDS

Townsend's big-eared bat is in widespread decline throughout the western United States, particularly in California. Disappearance from a significant proportion of historical roost sites and hibernacula in California indicate that populations are either being extirpated or forced into sub-optimal habitat (Pierson & Rainey 1998).

The tenuous conservation status of the Townsend's big-eared bat in California or elsewhere in

the West has been recognized by state and federal agencies, but it has not yet been afforded any formal status that mandates the protection of habitat or individuals (WBWG 2005). At the federal level, the western subspecies, *C. t. townsendii* and *C. t. pallescens* were listed as former USFWS category 2 candidates for listing under the Endangered Species Act (ESA) until this category was eliminated (USFWS 1985; USFWS 1994). The U.S. Forest Service (USFS) lists this bat as a sensitive species in region 5, which encompasses all of California, as well as regions 2, 3 and 4 (USFS 2012a). Townsend's big-eared bat is a BLM sensitive species in California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, and Wyoming. Townsend's big-eared bat is listed as a state Species of Special Concern by the following states: Arizona, California, Idaho, Montana, Oregon, Texas, and Utah (WBWG 2005).

The Western Bat Working Group lists Townsend's big-eared bat as the highest priority for conservation action in all eight regions of the West that the group evaluated. No other bat species ranked highest priority in every region (WBWG 2007).

Bat biologists have consistently recognized the precarious status of Townsend's big-eared bat in California. The California Bat Conservation Plan (CBCP), which currently exists only in draft form and is the most recent overall assessment of bat species in the state, lists Townsend's big-eared bat as "highest risk" for California. Biologists evaluated bat species in the state by two different methods, as described in the CBCP, and the species was ranked at the top of the risk list by both approaches (Pierson et al. 2011). In fact, the species is listed as "highest risk" in every ecoregion in the state except the Great Valley, where very little natural or artificial roosting habitat exists, and where the species was likely always very rare.

Graham (1966) first expressed concern for Townsend's big-eared bat in California in the 1960s. In the years since, concern has only grown. Williams (1986) commented that Townsend's big-eared bat was common in central California in the 1960s, but has rarely been seen since the early 1970s. In the 1930s, large colonies of Townsend's big-eared bat were common in the Lower Colorado River area (Stager 1939) but many of these colonies have been reduced or disappeared. A similar story is repeated in other parts of the state, such as the Sierra Nevada foothills and Mojave Desert regions.

Pierson and Rainey (1998) conducted a four-year comprehensive survey of all historically reported maternity colonies in California comprised of >30 bats and several hibernacula and report substantial declines in all metrics utilized, including a 52% decline in the number of maternity colonies statewide, a 32% decline in the average size of maternity colonies, a 55% decline in the total population size, and a 44% decline in the number of available roosts, all within the past 40 years from the survey date. The female population showed decline from 3,004 to 1,365 individuals. The status of all 54 currently known maternity roost sites was evaluated using four criteria: the structural integrity of the roost, the risk of human disturbance, the prospects for future protection, and the availability of alternate roosts. Only four roosts (7.4%) were deemed to be secure. For three roosts (5.6%) the risk was assessed to be very high, for 23 (42.6%) moderately high, and for 24 others (44.4%) moderate (Pierson & Rainey 1998). Pierson and Rainey (1998) identified limited roost availability and roost disturbance by humans as the

primary reasons for the decline. The greatest declines have been in coastal, central Sierra, and Colorado River populations.

Pierson and Rainey (1998) noted that since Townsend's big-eared bats are long-lived animals with a low reproductive rate and high fidelity to their roosts, the consistent pattern of colony loss and declines over a broad geographic area is evidence for a general decline in the species that is a matter of concern.

Pierson and Rainey's survey included searches for additional or alternate roosts within 15 km of historic colony sites, finding about 20 new colonies. In subsequent further intensive surveys, 3 additional maternity colonies were found (Pierson et al. 1999). Since these reports, a significant Townsend's big-eared bat colony has been found in San Benito County (E. Pierson, pers. comm. 2003). There is evidence that additional undiscovered colonies still remain to be found (e.g., several nettings of lactating females far from known maternity colonies), which is unsurprising given the cryptic nature of Townsend's big-eared bat roosts. Such discoveries do not alter the observed trend of extirpations and population decline at historically documented, highly valuable roost sites. It is reasonable to expect that previously undiscovered roosts have been experiencing the same decline. Given human interest in caves, it seems likely that most of the best underground colony sites are already known, and newly found colonies may be occupying suboptimal habitat, perhaps relegated there by disturbance at preferred sites.

Pierson and Rainey (1998) found that of the 18 historic colonies, 33% (6) were apparently extirpated, 33% (6) decreased in size, 6% (1) remained stable, and 28% (5) increased. The average interval between past and recent surveys was 35 years. Of the five colonies that increased in size, four have special protections within Lava Beds National Monument and Point Reyes National Seashore (Pierson et al. 1999). They also documented that only 4 of 54 maternity colonies were secure and that present day maternity colonies averaged 32 percent smaller than historic colonies (112 vs. 164 adult females; Pierson & Rainey 1998). If the 4 protected colonies on National Park Service (NPS) lands discussed above are excluded, the difference is even greater: less-protected present day colonies average 38 percent smaller than in early surveys (n = 34).

Pierson and Rainey (1998) concluded that although some of the known roosts are more secure than others, many have a history of disturbance, and none are likely to survive long-term without active maintenance and/or protection. Building roosts, because they are often abandoned structures in poor repair, are frequently at high risk to destruction by vandalism, fire and/or disintegration. Cave roosts, while generally secure structurally, are often at high risk of disturbance from recreational activities. Old mines vary in their structural integrity, and often experience high recreational use. Mine entrances have a tendency to slump closed over time, and are particularly vulnerable to collapse during winter rains. Renewed mining operations are often located in old mining districts, and many old mine workings have been destroyed by current, open pit mining practices. Additionally, old mines are frequently perceived as a safety hazard, and mine closure programs, particularly on public lands, are common (Pierson & Rainey 1998).

Pierson and Rainey (1998) also surveyed some historic hibernation sites. It is more difficult to assess hibernating than maternity populations because animals appear to move among sites during a hibernating season (Pearson et al., 1952; Humphrey & Kunz, 1976). Nevertheless, four formerly substantial hibernacula (>50 bats) in Napa, Lake, and Shasta counties were observed to have experienced declines from 69 to 94 percent in the past 40 years. A cave on National Forest land in Mariposa County that was a significant Townsend's big-eared bat hibernaculum in the 1960s is now unoccupied due to high recreational use. Two hibernacula within Lava Beds National Monument, one small and one very large (>600 bats) have remained consistent or increased in response to protection from disturbance. A hibernating population in a mine in Death Valley National Park also increased after protective measures (gating) (Pierson & Rainey 1998). Other than a few large hibernacula, hibernacula in California generally have fewer animals, are deeper underground, and are more difficult to find than maternity roosts.

Pierson and Rainey (1998) also review other information regarding Townsend's big-eared bat population decline in California. Perhaps the most unique is their citation of a public health authority that the number of Townsend's big-eared bats submitted for rabies testing has declined in recent years. Since this statistic is collected by completely different means than bat biologists' surveys, it may provide an independent index of the population trend. Since California's human population has been increasing, if there were no change in the Townsend's population we would have expected the number of human-Townsend's big-eared bat encounters to increase.

Pierson and Rainey (1998) explored whether observed discrepancies between current and historic records are indicative of a long-term trend, or fall within the expected variation for populations sampled at two points in time. This survey plus available information on the population biology of Townsend's big-eared bat point to a long-term declining trend. Because bats are long-lived animals with a low reproductive rate (for Townsend's big-eared bat, one young per year), and tend to show great loyalty to chosen roosts, their populations do not show the interannual fluctuations in numbers and distribution characteristic of some mammalian taxa. Pearson et al. (1952) predicted that, with a 38-46% survival rate in the first year, and 75% chance of survival thereafter, population size at maternity sites should remain relatively stable year to year. Studies on two species of Plecotus in Britain (Stebbings 1966), and populations of Townsend's big-eared bat in Virginia revealed that undisturbed populations maintained constant numbers over time (Pierson & Rainey 1998). Although a precipitous decline due to a catastrophic event would not be surprising for any one colony, the pattern, observed in this survey, of a number of colonies, sampled over a broad geographic area, showing serious declines is alarming, and argues for a general decline in California Townsend's big-eared bat populations. Available evidence suggests that human activity has been the primary cause (Pierson & Rainey 1998, Pierson et al. 2011).

XI. FACTORS AFFECTING ABILITY TO SURVIVE AND REPRODUCE

A. Present and Threatened Destruction, Modification, or Curtailment of Habitat or Range

The disturbance and destruction of roosts is a major threat to Townsend's big-eared bat. Of the

58 roost sites known to be used by Townsend's big-eared bat prior to 1980, Pierson and Rainey (1998) documented that 23 (39.6%) have been destroyed or made unavailable to bats, 15 others (25.9%) appear suitable, but are unoccupied, and only 20 (34.5%) are still being used. In many of these, disturbance levels are sufficiently high that occupation is not predictable. Attrition has been highest for building roosts, with 88.2% destroyed or unavailable to bats. Fifty percent of the original cave roosts, and 57.1% of the mine roosts, are no longer being used. Even though caves are inherently the most stable structurally, and thus might be expected to provide the most consistently available habitat, four have become unavailable to bats through human intervention: two by inappropriate gating, one by flooding for a reservoir, and another by quarrying for highway rip-rap. The fifteen roosts that are structurally suitable but unoccupied (1 building, 7 caves, 6 mines, and one flume), all are subject to moderate to high levels of human disturbance. Of the 23 roosts that are no longer available to bats, 9 (mostly buildings) have been demolished, 4 (all buildings) have burned, 4 (all buildings) have been renovated in such a way that bats were excluded, and 6 (including buildings, caves, mines, and a water diversion tunnel) have had the entrance closed. Additionally, three roosts discovered since 1980 have been lost—two have been demolished, and another abandoned following a vandalism incident in 1988, in which a number of juvenile bats died.

Threats to the availability or suitability of important roosts such as disturbance, vandalism, and mine impacts, are widely reported to be the primary factors in the species' decline in California (Pierson & Rainey 1998). Mine closures and mine reactivation, and other impacts to Townsend's big-eared bat habitat are discussed in this section. Forestry practices and transportation issues are also listed as having severe effects on Townsend's big-eared bats. In certain parts of its range in California, the species depends on large, old trees, particularly redwoods for roosting. Bridges are also important roost sites in some parts of the state. Thus, forestry and transportation issues also relate to the need of this species for suitable, undisturbed roost sites. Direct disturbance and vandalism are addressed in section E, under "Other Natural or Anthropogenic Factors."

Timber harvest

Research conducted at Point Reyes National Seashore in Marin County and at Grizzly Creek Redwoods State Park in Humboldt County has demonstrated that large hollow trees, particularly fire-scarred redwoods and large California bay trees with basal hollows, are used by Townsend's big-eared bats (Pierson & Fellers 1998; Fellers & Pierson 2002; Mazurek, 2004). The bats have been found in these trees both summer and winter (Pierson and Fellers 1998), including use of large hollows for maternity roosts (Mazurek 2004). In fact, known colonies of Townsend's big-eared bat along the north and central coast are all in close proximity to residual patches of redwood forest, and the species appears extirpated from areas of former distribution that no longer have redwood forests. According to Pierson and Fellers (1998), "it seems possible that redwood forests are critical to the survival of coastal populations, and that historically, along the coast where caves are few, this species roosted predominantly in very large hollow redwoods." Because second-growth redwoods mostly have not experienced the scarring fire regime that creates large basal hollows, such hollows are found mostly in old-growth redwoods, including old trees left behind in previously cut areas (L. Diller, pers. comm. 2003). From a study of fecal

pellets deposited in basal hollows, it has been shown that, in smaller patches of old growth, bat use of individual hollow redwoods is denser–i.e., bats are more concentrated into large hollow trees where these trees are a more limited resource (Rainey et al. 1992; Zielinski & Gellman 1999).

Based on these findings, timber harvesting in areas with trees with hollows suitable for bats is a threat to the Townsend's big-eared bat. Effects of timber harvest may range from actually cutting or knocking down trees with basal hollows to adversely altering the surrounding habitat. In redwoods, adequate or even sizeable basal hollows suitable for bat use can occur in trees that are otherwise sound and valuable and sought after for harvest and sale. If trees with hollows are left standing, they may be blown down due to removal of surrounding trees that formerly moderated strong winds or to destabilization of soils from damage to or death of surrounding root systems and removal of cover. Finally, trees with hollows that remain standing in harvested areas may be reduced in quality as roosts, by being made more apparent to predators and concentrating predator activity due to removal of surrounding trees; by having their internal environment altered by greater exposure to sun, wind, and lower humidity; and by removal of foraging habitat and cover immediately around the roost.

Because Townsend's big-eared bat is so roost-limited, destruction or degradation of roosts by timber harvest is a significant negative impact to the species. Timber harvest also reduces foraging habitat by removing trees; Townsend's big-eared bats feed extensively around trees (Pierson & Fellers 1998).

Road construction is often associated with timber harvest. Roads for logging may disrupt bats if a road is located too close to a cave or mine entrance or passes over subterranean bat habitat. Roads also have the indirect effect of facilitating greater human visitation and activity in an area. This can lead to more disturbance and possibly vandalism at roosting or hibernation sites (Pierson et al. 2011).

Impacts of forestry practices on Townsend's big-eared bat vary widely in California. In forested environments, biologists have frequently radiotracked the species foraging around oaks, and Townsend's big-eared bats may use large, old oaks for roosting, as other bat species do. Bat experts consider the loss of oak woodlands, due to logging as well as suburbanization and conversion to agriculture (especially vineyards), a potentially severe threat to the species. Together, forest management and oak woodland issues rank high as threats to Townsend's big-eared bat, along with issues associated with caves, mines, and anthropogenic roosts, and urbanization (Pierson et al. 2011).

Timber operations also may affect Townsend's big-eared bats through their applications of chemicals for forest management–herbicides, pesticides, and perhaps fungicides and fertilizers. This subject is further discussed below.

This threat is ongoing and continuing into the foreseeable future. Because populations appear limited by available maternity roosts, caves and mines are lacking in coastal areas, and the species is very limited in number of maternity roosts, this is a severe threat in forested areas.

New or Renewed Mining

Active mining, either at new locations or renewed working of older sites can, and has, destroyed roost sites. In particular, the resurgence of gold mining in the West threatens mine- and cave-dwelling bat species, including Townsend's big-eared bats (Brown & Berry 1991; Brown et al. 1993; Brown 1995; Pierson & Rainey 1991). Since open pits created by current mining practices often are located in historic mining districts, old mine workings are frequently destroyed as part of renewed operations. Several instances of such destruction are confirmed from California; for example, circa 1997, pit mining at the Briggs mine of Briggs Corporation/Canyon Resources, near Manly Fall, Inyo County, destroyed a colony of approximately 250 Townsend's big-eared bats (P. Brown, pers. comm. 2004). The renewal of Radcliff/World Beater gold mine also has affected this area. Renewed mining at the Knoxville Site in Napa County demolished the Townsend's big-eared bat population there (Pierson & Rainey 1998). Quarrying for a California Department of Transportation project caused the extirpation of a Townsend's big-eared bat cave roost (Pierson & Rainey 1998).

Mining can harm bats in a variety of other ways, beyond simple destruction of roosting and/or hibernation sites. New, expanded, or renewed mining operations can degrade or destroy foraging habitat for Townsend's big-eared bat. Chemical contamination of water, including acid drainage and heavy metal leaching, may harm bats and their insect prey. Mining may draw down the water table or otherwise alter hydrological systems, which can affect availability of water for bats and their prey (Pierson et al. 2011).

Quarries are another form of mining that can harm Townsend's big-eared bats. Three roosts in limestone caves occupied by Townsend's big-eared bat in the Mother Lode country are currently owned by quarry companies. One of these roosts is one of the most significant in the state (Pierson et al. 2011).

While mitigation of mining's impacts may be possible in some scenarios, there is currently no legal mandate for any such action to protect resident bat populations or their roosts (Brown et al. 1995, Pierson et al. 1991, Pierson & Fellers 1998).

Mine closures

Abandoned underground mines provide important roosting habitat for the Townsend's big-eared bat, but in recent years, concern for human safety has prompted the closure of inactive mines across many western states at the expense of bats that rely on these sites (Altenbach & Pierson 1995, Belwood & Waugh 1991, Brown et al. 1993, Pierson et al. 1991). Mines are typically closed without consideration for the biological value of abandoned mines as habitat, by collapsing or filling all entrances, which either excludes or entraps resident bat populations, effectively extirpating them from the site (Pierson & Fellers 1998). Pierson & Rainey (1998)

documented the loss of two historic maternity roosts of Townsend's big-eared bats in California due to closure of a mine and an associated tunnel and closure of an old railroad tunnel near Dunsmuir, Siskiyou County in 1991 by Southern Pacific Railroad (Pierson & Rainey 1998). Several sites identified in Pierson and Rainey (1998) were threatened by mine closures. Given the high roost fidelity exhibited by the Townsend's big-eared bat and the shortage of suitable maternity roosts and hibernacula, mine closures represent a significant source of habitat loss to this species.

According to the Office of Surface Mining (OSM, Department of the Interior), state and federal agencies estimate there are over 300,000 open underground mines across the United States. Agencies have closed approximately 33,000 mine openings considered to be dangerous since passage of the Surface Mining Control and Reclamation Act of 1977 (SMCRA; Henry 2001). Most of these closings were funded by the Abandoned Mine Land (AML) Reclamation Fund, administered by OSM. A survey conducted by OSM in 2000 indicated approximately 1,234 of the mine closures (3.7%) have involved some form of bat-compatible closure method such as bat gates or bat pipes. No consistent or comprehensive reporting or monitoring is available for mine closures on private lands.

Based on a review of topographically mapped mining symbols, the California Department of Conservation's Office of Mine Reclamation estimates that there are more than 47,000 abandoned mining sites in California, some with multiple openings or points of access. Approximately 62,000 hazardous abandoned mine openings are estimated to exist in the state, about 31% of which are located on private lands, 67% percent on federal lands, and about 2% on state lands (see also California Department of Conservation 2000). An unknown but probably small fraction of mine openings are likely to be suitable for Townsend's big-eared bats. All are potentially subject to closure by federal, state, private, or local action. Mine closures in California in response to perceived safety hazards, particularly on public lands, are common.

No comprehensive report of mine closures in California has been compiled. An inventory of National Park Service lands in California (14 units) reported 7,337 hazardous openings and 402 closures (National Park Service 2001). Over 12,000 mine properties in California and northwest Nevada are believed to be on BLM land, and about another 5,000 yet unrecorded are likely on BLM land, but no comprehensive inventory has been conducted (BLM 2003). The number of potentially unsafe mine openings at these approximately 17,000 BLM sites is unknown. The Forest Service estimates that at least 154 closures for physical hazards were done in California national forests from 1996 to 2002 (J. Clayton, pers. comm. 2003). By some estimates, as many as 200 or more bat-compatible mine closures have occurred in California, though consistent standards for the Townsend's big-eared bat have not been applied (Milford 2000). While some bat-compatible closures have resulted in significant increases in colony size, (as reported in Pierson and Rainey (1998), the Death Valley population of bats found in a mine adit increased once a protective gate was installed), the contribution of such actions to statewide recovery efforts is not yet known. Bat-compatible gating may be the best alternative in some situations, though Burghardt (2001) reports that gates intended to be bat-compatible apparently caused a Townsend's big-eared bat colony to abandon its Arizona roost for reasons not yet understood.

Some of the available but unoccupied roosts discussed in Pierson and Rainey (1998) were abandoned mines that were gated improperly so as not to accommodate bats.

The California Office of Mine Reclamation recently began a program of abandoned mine remediation. As of 2003, of 56 mining "features" addressed at 23 sites, roughly half were fenced, and 7 (6 sites) were gated in a bat-compatible fashion (D. Craig, pers. comm. 2003). Depending on configuration, fencing may or may not leave mine entrances accessible to Townsend's big-eared bat. Some of the remaining features (those not fenced or gated) were filled with soil or foam or collapsed to achieve closure, rendering them unusable by bats.

Recently, the American Reinvestment and Recovery Act (ARRA) has accelerated the number of mine closures on public lands, due to greater availability of funds for such work. It remains to be seen whether these closures will be made compatible with bat use (Pierson et al. 2011). If they are done without regard for bat-compatibility, additional mine habitat for Townsend's big-eared bat will be lost.

Abandoned mines are particularly important habitat for Townsend's big-eared bat in California's desert regions, where natural caves tend to be rare. The western Sierra Nevada foothills are another region where mines play an especially significant role in supporting populations of Townsend's big-eared bat (Pierson et al. 2011). Widespread mine closures in these regions, in the absence of protective measures, could seriously diminish regional populations of the species.

As mine closures and renewed mining are ongoing, these threats are immediate and continuing for the foreseeable future. The degree of threat is severe because the activities are widespread and renewed gold mining is on the rise. Although there is increasing awareness of the need for consideration of bats and installation of bat gates, strict habitat protections for Townsend's big-eared bats are lacking and safety considerations often drive closures of old mines. Many mines are on private lands and may be subject to impacts without detailed environmental consideration.

Roost inundation by construction of dams

Most reservoirs in California have been placed on rivers draining the Sierra Nevada, Klamath and Trinity Mountains, at the same elevations favored by Townsend's big-eared bats for maternity roost sites. Many of the known caves used by the species are in river drainages or near the shores of current reservoirs. Townsend's big-eared bat roosts have been impacted by past dams. For example, at least one former significant cave roost, along the Stanislaus River, is known to have been inundated by the damming of the river, forming New Melones Reservoir (Pierson & Fellers 1998).

Proposals to build or raise dams in the state currently threaten known populations of Townsend's big-eared bat. For example, proposals to raise the level of Lake Success, a reservoir on the Tule River, would impact Townsend's big-eared bat roost sites. In addition, proposals to raise Shasta dam and the water level of Lake Shasta would impact two important Townsend's big-eared bat maternity colonies known to occur on National Forest lands near Lake Shasta (Pierson & Fellers 1998). Other dam sites or raises are proposed and the affected lands may not have been fully

surveyed for Townsend's big-eared bat roosts.

Inundation by dams also kills riparian vegetation that provides suitable foraging habitat and movement corridors for Townsend's big-eared bats.

A great number of the hydroelectric dams in the state are coming due for their fifty-year permit review and renewal by the Federal Energy Regulatory Commission. It is not clear whether the environmental review process will include any issue pertaining to bats, other than bat use of hydro-electric facilities for roosting, and the need for safe bat exclusion, if necessary. However, the review process should include indirect impacts to bat habitat, as well. For example, fluctuating water levels in reservoirs and alteration of downstream flows affect riparian areas important to bats for foraging. The clearing of forests for installation of power lines or water diversion corridors can also harm bat habitat and bat populations (Pierson et al. 2011).

As evidenced by active proposals for dam siting or raising that would impact Townsend's big-eared bat, this threat is immediate. Significant roosts would be threatened, therefore this is a severe threat.

Deterioration or destruction of building roosts

Most known Townsend's big-eared bat building roosts are in abandoned structures that are generally in a poor state of repair. Even if maintained, such structures have a limited life expectancy relative to cave roosts. With increasing suburbanization, many historically known building roosts have been demolished or renovated to the exclusion of resident bat colonies. Of 17 buildings known to have supported Townsend's big-eared bat maternity colonies prior to 1980, 11 (65%) had been demolished, renovated, or otherwise altered in such a way as to exclude the colony by 1990 (Pierson & Rainey 1998). For example, an abandoned ranch house used by a coastal northern California colony was scheduled for demolition when a Townsend's big-eared bat colony was first discovered. The previous roost for this colony was likely a privately owned deteriorating building in a town nearby, from which a Townsend's big-eared bat colony was excluded in the 1970's when renovations converted it to an upscale bed-and-breakfast. To protect this colony, the park canceled plans for demolition and has conducted repairs to insure the persistence of the structure.

The Santa Cruz Island colony of Townsend's big-eared bats uses an abandoned human-built structure and potential construction on or demolition of this property threaten the bat population there. The landowner, the National Park Service, has considered excluding the bats. The building's roof was recently torn off and replaced, which temporarily adversely affected the bats. Off national park lands, it is unlikely that maternity colonies would receive any consideration.

Both larger maternity colonies, as well as bachelor groups and mixed groups of non-reproductive bats, may occupy buildings and other structures. Smaller groups are more likely to escape notice, and as a consequence, may be unintentionally destroyed in the course of renovation or other changes to structures (Pierson et al. 2011).

Disturbance at buildings, just as with disturbance at caves and mines, is also an issue for this sensitive species (see Disturbance, below). Illegal or incompetent exclusion, or outright killing of bats by pest control operators, is discussed under Pest Control Operations, below. The burning of abandoned buildings also causes loss of building roost habitat, and is discussed under Vandalism, below.

Aging, demolition, fire and other threats to buildings used as roosts by Townsend's big-eared bats are ongoing and immediate. The degree of risk is high because although buildings are not the most common roosts, the species cannot afford to lose even a few maternity roosts. The risk to coastal populations is severe, since buildings account for nearly all of the known roosts in these areas.

Repair and renovation of bridge roosts and other anthropogenic roosts

Bridges are a special category of anthropogenic structure that may be used for roosting by Townsend's big-eared bats. The species uses bridges and other transportation structures (such as culverts) infrequently, but in certain areas, such as the Sierra Nevada foothills, bridges appear to provide an important alternative to natural caves or mine habitat. Generally, older bridges are more conducive to use by Townsend's big-eared bats. Retrofitting and renovation of such structures can result in the loss of a roost site (Pierson et al. 2011).

Townsend's big-eared bats may roost in other structures, as well, such as hydroelectric dams or abandoned railroad tunnels. Renovations, repairs, or earthquake retrofitting may harm, exclude, or disturb bats to the point of causing them to abandon these types of roost sites.

Threats to bridges, dams and other anthropogenic structures used by Townsend's big-eared bats are ongoing and immediate, as such structures are renovated, retrofitted or replaced. The importance of human-made structures as roosts varies regionally. The degree of threat overall is moderate because although these types of structures are not commonly used by Townsend's big-eared bats, the species cannot afford to lose even a few roost sites.

Loss of riparian habitat

Radio tracking and light-tagging studies conducted at Pt. Reyes National Seashore demonstrated that riparian vegetation is important foraging and movement habitat for Townsend's big-eared bat (Pierson & Fellers 1998). According to Pierson, conversion of cottonwood riparian habitat to agriculture along the lower Colorado River provides the most likely explanation for observed declines in Townsend's big-eared bat and other bat species in this area. Foraging areas adjacent to water sources may be essential for desert populations (Pierson & Fellers 1998). The widespread invasion of tamarisk (*Tamarix* spp.) in desert areas also has contributed to loss of native riparian vegetation.

Throughout California, there have been dramatic losses of riparian habitat, mainly due to agriculture, including livestock grazing as well as crop production, and urban development. Dams for flood control and water withdrawal inundate riparian habitat. They also alter natural flood regimes downstream of dams, which can lead to the eventual loss of cottonwood and sycamore stands that depend on periodic flooding. Water drawdown and diversion also alters and degrades riparian habitat. Mining activities can be water-intensive, and particularly in arid regions, water drawdown for mining can have a significant impact on riparian habitat (Pierson et al. 2011). Mining itself can directly destroy riparian habitat; e.g., dredging, bulldozing, construction of mining access roads along streams, etc. Similarly, logging and road construction associated with timber harvest has had a significant effect on riparian areas in certain parts of California. Channeling and riprapping of rivers for flood control is yet another way that riparian areas important to bats may be damaged or lost (Pierson et al. 2011).

While a variety of restoration efforts are underway, California is far from regaining its former extent of riparian habitat; therefore this threat is ongoing.

Urban and Suburban Development

Urban and suburban expansion affects Townsend's big-eared bats in a variety of ways. The effects of urban and suburban development include destruction or modern "upgrading" of old buildings that have historically served as bat roosts; clearing of forests that may be used for foraging, or large old trees used for roosting, for development; increases in human disturbance, including cave recreation, mine exploration and hobby prospecting, and vandalism, associated with increased urban and suburban populations near Townsend's big-eared bat hibernacula and roosts; loss of riparian habitat due to urbanization and increased water withdrawal; inundation of roosts by reservoirs, also associated with increased human populations requiring more water, flood control, and hydropower (Pierson et al. 2011). Urban and suburban development may have other effects on Townsend's big-eared bat, including release of pollutants into the environment, loss of habitat that supports prey species, and even issues that for the most part can only be speculated upon, such as increased automobile/bat collisions, and more frequent contact between humans and bats in built environments, leading possibly to increased "bat hysteria" and persecution of remnant bat populations.

The particular ways in which urbanization leads to the loss of Townsend's big-eared bats are likely complex and interrelated and difficult to tease apart. There is a dearth of detailed information regarding the impacts of urban/suburban development on Townsend's big-eared bat in California. Nonetheless, biologists considering the status of bats in California overwhelmingly concluded that urban development was a leading issue for bat conservation, and that Townsend's big-eared bat was one of the "highest risk" bat species on this issue.

B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Collection for scientific purposes

Though the harvesting of individual Townsend's big-eared bats for museum or academic specimen collections is no longer a common practice, it may have contributed to historical declines. Pierson and Rainey (1998) report several incidences wherein entire colonies may have been destroyed by collection for scientific purposes; the Olema Inn colony (Marin County) was almost entirely extirpated in the 1970s, and a series of collections from the isolated Santa Cruz Island population were likely responsible for its decline there. Several institutions have single-site collections of more than 75 Townsend's big-eared bats. This approaches the size of the majority of documented populations of this species.

Activities related to research and monitoring have also been documented to harm populations of this highly sensitive species: Twente (1955) reported that many individuals abandoned a hibernaculum after being banded, and most were never recaptured. Monitoring activities have been shown to instigate movement to alternate hibernacula; such disturbance may have detrimental effects on bats' already-marginal winter energy budgets (Humphrey & Kunz 1976).

Recently, the appearance of white-nose syndrome in the eastern U.S. has generated new interest in cataloging and studying hibernating bats in the West. Biologists have a concern and a desire to better understand where bats occur and how many there are, before the invasive fungal disease spreads to the western part of the country. Public land managers need to know more about where bats occur and which sites are important hibernacula, in order to make better management decisions about where to focus protective actions. Greater scientific information is desirable, but increased research and monitoring activity at Townsend's big-eared bat roosts and hibernacula may lead to increased disturbance, depletion of energy reserves during hibernation, and diminished reproductive success. Biologists will need to carefully consider whether and how to survey Townsend's big-eared bat sites, in order to obtain valuable information in advance of white-nose syndrome, but without causing harmful increases in stress and disruption to the bats.

All of the above said, public agencies and universities already exercise a degree of oversight, so we estimate the degree of this threat is small.

C. Disease or Predation

Disease

The most significant disease threat to Townsend's big-eared bat is the westward spread of white-nosed syndrome (WNS). Since discovered in 2006, white-nose syndrome has been rapidly spreading throughout the eastern United States, killing up to 6.7 million hibernating bats (USFWS 2012a). As with other infectious diseases, WNS appears to have multiple routes of transmission. Bats spread the deadly fungus to each other, and likely to new cave or mine environments as well. There is strong evidence that people have also spread the fungus into new areas, beginning with the appearance of the fungus at the disease epicenter, a heavily visited commercial cave in upstate New York. Biologists now believe the fungus came to North America from Europe. The fungus is found on bats in many European caves, but does not cause

mortality or even many ill effects.

In order to slow the potential spread of WNS by people, some land owners and public land managers have closed caves, either in targeted fashion or on a broad basis. Winter season closures had been a management strategy at both private and public caves for some time, pre-WNS, when the goal was simply to limit human disturbance to hibernating bats. For Townsend's big-eared bats, which roost in caves and mines in summer and hibernate in them in winter, winter-only closures do not eliminate human disturbance (although the particular sites used by Townsend's big-eared bats for summer versus winter may very well be different). An additional consideration for land managers and private owners of caves will now be that the WNS fungus can likely be spread in summer as well as winter. Spores deposited in a cave or mine on the boots, clothing or gear of a person, may remain viable for months or longer. So, winter-only closures are unlikely to be a sufficient management approach for Townsend's big-eared bat conservation, either from the perspective of minimizing human disturbance in summer, or lowering the risk of WNS fungal transmission by people.

To date, the threat of WNS spreading to the West has resulted in very little change with regard to cave management on either public or private lands in California. Lava Beds National Monument is one of the most important areas in California for the Townsend's big-eared bat (see Southern Cascades ecoregion). It also attracts cave recreationists from around the world (Pierson et al. 2011). The Monument has instituted screening procedures and requires that no gear from WNS-affected states be brought for use in the Monument. Similar policies have been instituted by the National Park Service at Pinnacles National Monument and Sequoia-Kings Canyon National Parks, the other main "cave" parks in California. Several important hibernating and roosting sites for Townsend's big-eared bat occur on national forest land, including the Stanislaus, Sequoia, Lassen, and Shasta-Trinity National Forests, and Bureau of Land Management lands (Pierson et al. 2011). Although the USFS has declared emergency cave closures in its Eastern, Southern, and Rocky Mountain regions, beginning in 2009, no national forest caves in California have been closed as a precautionary measure against the potential human spread of WNS. The BLM has essentially taken no action on any of its lands to close caves, except in New Mexico, where the BLM cooperated in an interagency WNS response plan; a total of approximately 30 caves, on various public land ownerships, are now administratively closed to human access as a result. Decontamination protocols for WNS and gear restrictions are also not yet required for cave visitors on California federal lands.

Environmental conditions conducive to WNS fungal growth appear to exist in caves and mines throughout much of California, from the northern regions to the southern Sierra Nevada foothills. The temperature range for growth of the fungus is 5-15° C. It does not grow above 20°C. Most hibernating bats seek sites that maintain temperatures at 5-10° C. The optimal temperature range for fungal growth is 10-15° C. Caves as low in elevation and as far south as the southern Sierra Nevada foothills maintain year-round temperatures at 12-18° C (Pierson et al. 2011). Thus, it is possible that fungal growth could occur in cave and mine sites dispersed through much of the state.

One cause for hope for Townsend's big-eared bats is that WNS has not infected other subspecies of the big-eared bat found in the eastern U.S., including the Virginia big-eared bat (*C. t. virginianus*) or the Ozark big-eared bat (*C. t. ingens*). It is unclear why these subspecies have

thus far avoided the emergent fungal disease, which has affected seven other bat species. Biologists do not yet know how WNS will affect western bats should it continue to spread, and in which western species it is likely to cause mortality.

Predation

Predation on Townsend's big-eared bats is common, given the vulnerability of roosting individuals, particularly juveniles. Owls, snakes, hawks, and carnivorous mammals have all been reported to prey on bats of one species or another (e.g., Tuttle 1994; Pierson et al. 1999). Natural levels of predation are not thought to influence population dynamics in Townsend's big-eared bat. However, human presence can artificially increase the abundance of some native predators (e.g., raccoons), and humans also introduce and provide support for non-native predators such as rats, cats, and dogs. Pearson et al. (1952) observed domestic cats carrying dead Townsend's big-eared bats in California. Fellers (2000) documented severe effects of predation by introduced black rats (*Rattus rattus*) on a maternity colony of Townsend's big-eared bats roosting in an attic; rats apparently killed all young produced by the colony of 215 female bats before the young became volant. These studies suggest monitoring of predators should be considered and control instituted where necessary and appropriate.

The threat of disease is possible, with WNS likely to spread into California in the foreseeable future. The degree of threat to Townsend's big-eared bat is unknown, but potentially severe if the subspecies proves susceptible to the fungal disease**.**

Predation is ongoing and presents a moderate threat. Juveniles may be completely wiped out in some situations (Fellers 2000).

D. Inadequacy of Existing Regulatory Mechanisms

To date, existing regulatory mechanisms have been inadequate to halt or reverse the statewide decline in the populations and habitats of the Townsend's big-eared bat. The inadequacy of existing mechanisms is ongoing and therefore an immediate threat. This petition seeks to redress this threat by bringing Townsend's big-eared bat under the protection of CESA. In the absence of such protection, Townsend's big-eared bat is under severe threat and likely to go extinct.

1. Federal Regulatory Mechanisms

Federal Species Status

The Townsend's big-eared bat is currently afforded no protection under the Federal Endangered Species Act. The Townsend's big-eared bat was formerly recognized as a C2, species of concern until USFWS abandoned this category in 1996. Although this category did not provide any regulatory protection, USFWS did in some cases encourage federal agencies to consider "species of concern" and to adopt conservation recommendations during ESA Section 7 consultation (e.g., informal consultation with East Bay Regional Parks regarding a mine closure in Black Diamond Mines Regional Park, USFWS reference number 1-1-95-I-952, July 5, 1995). However, these informal measures were implemented only at the discretion of the landowner,

have not provided sufficient protection for Townsend's big-eared bat, and have largely ceased since the species of concern category was eliminated.

National Environmental Policy Act

For federal actions, because the BLM and Forest Service consider the Townsend's big-eared bat a special status species in the state, it may receive some National Environmental Policy Act (NEPA) review. NEPA is a disclosure law that only requires the agencies to consider the impacts of their actions on the environment, including the Townsend's big-eared bat, but does not require selection of an environmentally benign alternative. NEPA typically only applies to major projects and programs.

Federal Cave Protections

Federal cave protections may be found under regulations for the Departments of Interior and Agriculture (e.g., Code of Federal Regulations, Title 36, Part 2 [36 CFR 2]; 36 CFR 261; 36 CFR 290; 43 CFR 37). Federal regulations protect caves only on federal lands (e.g., national forests, national parks), where prohibited acts include harming wildlife, curtailing free movement of wildlife, discharging firearms, firecrackers or other explosives, throwing rocks or other items, and, in national parks, smoking.

The Federal Cave Resources Protection Act of 1988 (16 U.S.C. 4301-4309) mandated that the Secretaries of the Interior and Agriculture list "significant caves" within 21 months of enactment of the legislation, and that this list be actively maintained and updated. Caves may be designated as significant for their importance to wildlife (36 CFR 290; 43 CFR 37.11(c)(1)). All caves on National Park Service-administered lands have been designated "significant" (43 CFR 37.11d); and the Forest Service has delegated designation of significant caves to employees at the individual forest level. No centralized list of significant caves appears to be available, and some local delegates appear to be far behind in designating significant caves within their jurisdictions. Protections provided by the 1988 act arguably apply only to caves officially listed as significant; but some of the federal regulations cited above regarding caves appear to apply to all caves on certain federal lands, regardless of listing as significant or lack thereof.

The cave protections discussed here are limited in their application in California (to caves on public lands). Enforcement is rarely pursued and penalties are rarely imposed, despite common reports of cave vandalism. Listing of caves as significant under the 1988 federal act does not appear to be a priority. Further, although protection of caves is highly valuable to Townsend's big-eared bats, mines and other roosts constitute more than half of maternity roosts known for the species (Pierson & Fellers 1998), and cave laws do not protect these roosts.

2. State Regulatory Mechanisms

California Fish and Game Code

Bats are non-game mammals under California Fish and Game Code, §4150. As such, bats are protected from being taken or possessed without a permit (Fish and Game Code §4152; take means hunt, pursue, catch, capture, or kill, or attempt any of these; §86). The State may pursue

civil damages for violation of these sections, but enforcement is rare. A major exception in the law is that bats may be taken or harassed for the purpose of preventing damage to property, which allows building owners to exclude bats from human-made structures where they roost. Section 251.1 of the California Code of Regulations, Title 14, otherwise protects bats and other mammals and birds from harassment (intentional disruption of normal behavior, including but not limited to feeding, breeding, or sheltering). These provisions do not provide protection for bat habitat.

California Species Status

Currently, Townsend's big-eared bat has no protection under the California Endangered Species Act. The species is designated a California Special Concern species by CDFG. This category carries no protective weight other than to enhance the likelihood of being considered in NEPA and CEQA analyses (see below). The stated purpose of such designation is "to halt or reverse their decline by calling attention to their plight and addressing the issues of concern early enough to secure their long term viability" (CDFG). However, the factors leading to the decline of Townsend's big-eared bat continue.

California Environmental Quality Act

Under the California Environmental Quality Act (CEQA, §15380), Townsend's big-eared bat receives some consideration because of its status as a state Species of Special Concern. As routinely implemented, however, CEQA is primarily a disclosure law, and avoidance or mitigation of effects is largely at the discretion of the acting agency. Further, only limited categories of actions come under CEQA review. For example, destruction or disturbance of roosts at existing structures typically would not come under CEQA review (B. Bolster, pers. comm. 2003; Pierson & Fellers 1998). The CBCP notes that even when impacts to bats are considered in CEQA analysis, the impacts are addressed through mitigation measures, and take and/or loss of roost habitat may still be the result (Pierson et al. 2011).

It is worth noting that neither CEQA nor NEPA nor other laws mentioned here, other than federal and California ESA, include a recovery component. That is, without being included on the list of endangered and threatened species, no regulatory mechanism is in place that seeks the recovery of the Townsend's big-eared bat from its reduced and vulnerable condition. In the same vein, CEQA and NEPA do not require consideration of unoccupied areas, even if such areas were formerly valuable habitat (e.g., previously occupied by large colonies), and are important for recovery of the species.

California Cave Protection Act

Caves and their physical and biological resources, including bats, have protections under the California Cave Protection Act (California Penal Code §623). Killing or harming cave wildlife by any means is prohibited, as is burning any material that produces any smoke or gas that is harmful to them. Penalties are imprisonment for up to one year or a fine up to $1000 or both. The statute applies to knowing and intentional acts, and may be bypassed with written permission of the cave owner. Presumably cave owners can do anything otherwise legal in or with their own caves–even destroy them if other laws are met.

Unfortunately, the cave statute discussed above is limited in its application in California (to caves on private lands when damage is done without written permission of owner). Enforcement is rarely pursued and penalties are rarely imposed, despite common reports of cave vandalism. Further, although protection of caves is highly valuable to Townsend's big-eared bats, mines and other roosts constitute more than half of maternity roosts known for the species (Pierson & Fellers 1998), and cave laws do not protect these roosts.

Various federal and state agencies, often in cooperation with other agencies or organizations, have policies and programs intended to benefit bats, including Townsend's big-eared bat. Nonetheless, the CBCP cites the lack of any interagency effort to date to identify the most important bat caves in the state and to take coordinated, appropriate management action to protect them—a key need. This issue is especially pressing for hibernation sites in caves in the northern lava bed country (Pierson et al. 2011). Altogether, although these efforts have created some localized successes, they are non-regulatory in nature, and, have not been able to stop or reverse the statewide decline of the species.

California Bat Conservation Plan

The California Bat Conservation Plan (CBCP) is currently in draft form (Pierson et al. 2011) and has not been released for public review. The team developing the plan is reviewing conservation issues, ecoregions and species accounts to produce a comprehensive conservation plan for California bat species. Since this plan is not complete, has not been accepted by regulatory agencies and is not yet funded, potential protections for Townsend's big-eared bat resulting from the plan cannot be considered in the ESA listing process. Listing under California's Endangered Species Act is required to ensure long-term survival of this species.

E. Other Natural or Anthropogenic Factors

The roosting biology of Townsend's big-eared bat, leads them to roost in highly visible clusters on open surfaces, near roost entrances, making them highly vulnerable to disturbance. Low reproductive rate and high roost fidelity increase the risks for the species (Pierson & Fellers 1998; Pierson et al. 1999). Additional natural and anthropogenic threats are discussed below.

Recreation and other Disturbance

Human disturbance of caves and mines in California is the most widely cited reason for the abandonment of historic Townsend's big-eared bat roost sites (Pierson & Rainey 1998; Pierson & Fellers 1998). According to Pierson et al. (2011), the primary threats to bats from recreational caving are:

1. Disturbance of roosting bats that may result in displacement, compromised reproductive success, or death;
2. Deliberate vandalism that may result in death of bats; and/or
3. Introduction of pathogens, particularly *G. destructans*.

Townsend's big-eared bats typically respond strongly to disturbance of maternity colonies, so much so that simply entering a maternity roost can cause a colony to abandon the young or move to another roost (Pearson et al. 1952; Graham 1966; Stebbings 1966; Mohr 1972; Humphrey & Kunz 1976). Alternate roosts are likely to be of sub-optimal quality in terms of temperature, proximity to foraging areas, or other factors that may expose bats to greater risk of predation, substantially increase energy expenditures, or otherwise compromise their reproductive success and survival. The threat of energy imbalance is especially significant during pregnancy and lactation, which are metabolically very demanding of adult females.

The species is also highly vulnerable in its hibernacula. Townsend's big-eared bats often roost well within human reach and are defenseless in their hibernating state (Pierson & Rainey 1998). Disturbance during hibernation may cause bats to awaken prematurely, expending energy reserves that often cannot be spared. Each arousal can consume the equivalent of between 10 and 30 days of fat reserves (Thomas et al. 1990; Tuttle 1991). Though bats may return to torpor after disturbance, the remaining energy reserves may not be adequate to last the winter (Amer. Soc. Mammal. 1992).

The sensitivity of Townsend's big-eared bat to disturbance is reflected in the extraordinary measures recommended to reduce disturbance when conducting roost surveys. These measures include limiting group size; minimizing use of lights and using only red lights or night-vision equipment; maintaining complete silence, placing tape over zipper pulls and not carrying equipment that might clank or jingle, not wearing fabrics that make rustling or scuffing noises (e.g., nylon); and minimizing time spent near the bats (e.g., Roswell RA, undated, Jagnow 1998). These measures are not widely known outside the research and specialized caving communities, and probably would be incompatible with most cave or mine recreation.

Most of the cave sites presently or historically known to be Townsend's big-eared bat roosts are now subject to considerable human disturbance and heavily used for recreational purposes. Recreational activity at mines including artifact collection and searching for mineral specimens is also a problem (Pierson et al. 2011).

In California, a study of 58 formerly occupied (pre-1980) maternity roosts found that only 20 (34%) were still occupied, and that 15 (26%) remained apparently suitable physically but were unoccupied. All 15 available but unoccupied sites were subject to between moderate and high levels of human disturbance (Pierson & Rainey 1998), and included caves (7), mines (6), and structures (2). Pierson and Rainey (1998) also found that at many of the sites still occupied, disturbance levels were sufficiently high that the sites were not reliably occupied during periods when they should be, and/or population numbers were lower. Pierson and Fellers (1998) reported signs of human intrusion at 5 of 11 caves they surveyed for hibernacula: footprints in several, evidence of a fire and of a climbing route, and they encountered parties of people in one cave during their survey.

A few specific examples are given below: In May 1998, an occupied roost, possibly a maternity roost, was discovered at a mine on BLM land in Siskiyou County. In a repeat survey in June

1998, an active campsite was found outside the mine and only two bats were present within (Pierson & Fellers 1998). Samwell Cave in the Shasta-Trinity National Forest was once an important roost but now receives too much recreational visitation (Pierson & Rainey 1998). A cave within Stanislaus National Forest in Siskiyou County was formerly an important Townsend's big-eared bat hibernaculum, but currently has no hibernating population due to high recreational use. Although recommendations for the protection of the cave were submitted to the Forest Service in October 1991, no effective protection measures have been implemented (Pierson and Fellers 1998). Disturbance may cause bats to be driven from preferred roosts to lower quality sites: for example, a colony in San Bernardino County that had been disturbed in its preferred roost was found at a roost with standing water, an atypical setting for a Townsend's big-eared bat roost (Pierson & Rainey 1998). Lower quality roosts are likely to lower reproductive success and survival of Townsend's big-eared bats, as has been shown for the big brown bat, *Eptesicus fuscus* (Brigham & Fenton 1986).

Another example of the effects of disturbance and failure to control disturbance comes from a pair of caves with a Townsend's big-eared bat colony on U.S. Forest Service land in Shasta County. The colony is monitored irregularly on a volunteer basis by the Shasta Area Grotto (a chapter of the National Speleological Society), in cooperation with the Klamath and Shasta-Trinity National Forests (Pierson & Fellers 1998). The site was identified in 1966 as a significant Townsend's big-eared bat maternity colony. Due to heavy recreational use, and the installation of an inappropriate gate, this cave was abandoned by the species many years ago. Despite recent replacement of the gate, the colony has not returned to the cave, since the gate does not protect the chamber where visitors congregate and the bats prefer to roost. Also, the Forest Service continues to issue keys on request to recreational users. A substantial colony of Townsend's big-eared bats was located in 1996 at a cave nearby and is likely to have been the same population that abandoned the previously occupied, disturbed site. This new cave, also under the jurisdiction of the Forest Service, has been subjected to frequent visitation disturbance for mapping and cave inventory (Pierson & Fellers 1998).

This degree of habitat loss and degradation through disturbance is a severe threat to the species. Further evidence that disturbance is a major factor in the decline of Townsend's big-eared bat is provided by the accumulating evidence that colonies respond positively, and numbers of animals often increase dramatically, when people are prevented from entering roost sites –e.g., through monitoring and enforcement or installation of "bat friendly" gates (Pierson et al. 1991; Riddle 1995; Stihler & Hall 1993; Pierson & Fellers 1998, Pierson & Rainey 1998, Pierson et al. 1999). For example, a hibernaculum in Lava Beds National Monument has increased from 134 to over 600 bats from 1988 to 1994 after being protected. A hibernaculum in Death Valley increased from 17 to 54 bats within one year of being gated. Such population increases in response to reductions in disturbance (e.g., via appropriate gating) have also been documented for the Ozark big-eared bat (USFWS 1995).

California's human population has grown from 5.7 million in 1930 (US Census Bureau 2000) to 38 million in the year 2011 (US Census Bureau 2012), and is expected to be close to 43 million

by 2025 (California Dept. of Finance 2012). As a first approximation, we may expect human visitation of caves and mines–and consequent disturbance and degradation of vital Townsend's big-eared bat roosting habitat–to grow along with the state's population.

Regionally, issues associated with disturbance of bats at caves and mines are of particularly serious concern to biologists in the northern California lava country, in the Klamath Mountains, Southern Cascades, Modoc, Northwest Basin and Range, and in the Sierra Nevada foothills (Pierson et al. 2011).

Disturbance and vandalism of caves and other roosts are ongoing, widespread, and affect critical roosting habitat. This threat is severe, jeopardizing the continued existence of the species, and is immediate and continuing.

Vandalism

Evidence of vandalism, sometimes clearly directed at the bats, has been observed at several Townsend's big-eared bat roosts (Pierson & Rainey 1998; Pierson & Fellers 1998), and is a well-documented phenomenon in caves and mines and toward bats (Tuttle 1979).

Fire can be a highly damaging form of vandalism. In October 1992, a hibernating population of over 10,000 Townsend's big-eared bats was discovered in New Mexico, 100 meters deep in a timber-lined mineshaft. When the site was revisited in February 1993, the shaft had been burned. Several hundred dead animals could still be seen hanging from the walls, and thousands more were presumed dead (Pierson & Rainey 1998). Burghardt (2001) reported an incident after gating of a mine used by bats (species not specified): "Individuals annoyed by being excluded from the mine and aware of the bat colony threw burning sticks through the gate directly under the roost." Numbers at the roost went from 200 to 20, perhaps due to effects of the smoke (Burghardt 2001). Smoke, toxic chemicals released by burning materials, depletion of oxygen, and the disturbance of fire all threaten bats. Empty buildings that shelter bats are also targets of vandals, and 4 of 17 buildings (24%) in California known to house Townsend's big-eared bat maternity colonies prior to 1980 had been burned as of Pierson and Rainey's (1998) subsequent survey.

Some people have irrational feelings about bats, and researchers report frequent vandalism and destruction, citing findings of bat colonies being burned, crushed, or otherwise destroyed, dead baby bats in an arranged pile, or individuals removing bats from roosts for use in pranks (Pierson & Rainey 1998). An account on the California Dept. of Fish and Game website described: "Caves and mines [used for 'parties'], frequently strewn with beer cans, shotgun shell casings, fireworks, or other litter [and] evidence of cruel vandalism in the form of hair spray cans, matches, and incinerated bats [being] not uncommon in easily accessible caves and mines" (Gruver and Keinath 2006).

Sometimes vandalism may have a more purposeful motivation--one Townsend's big-eared bat colony in an area of a proposed project was disturbed after a student located the colony and sought independent confirmation. When another researcher arrived to examine the roost, the bats

were gone and the site showed evidence of disturbance. (The project went forward: personal communication, 2003, name withheld by request.)

Land managers consistently report that strong measures are needed to keep trespassers out of underground openings in accessible, high-traffic areas, and even in remote areas where openings are known. Determined vandals can breach almost any barrier. Gates or fences at cave or mine openings require constant monitoring and repair due to vandalism (Burghardt 2001, Stabler & Herder 2001). The National Park Service has made repeated efforts over a number of years to protect a cave used by Townsend's big-eared bat in Sequoia-Kings Canyon National Park, but every gate installation has been breached and the cave repeatedly vandalized (Pierson & Fellers 1998).

Vandalism is ongoing and therefore immediate, and severe in the degree of threat it poses, jeopardizing the future of the species. Maternity roosts and hibernacula are the most critical and vulnerable sites.

Changes in the distribution and abundance of prey

Humans have caused many alterations of insect habitat that may affect Townsend's big-eared bats indirectly through reduction of prey species. Moths are the primary prey of Townsend's big-eared bats, and agriculture and urbanization have greatly altered or eliminated large areas of moth habitat. The great majority of moths preyed upon by the bats are herbivorous and may be more or less selective of native plant species as food (e.g., oak moths). By eliminating large areas of native vegetation or largely replacing it with introduced species or with monocultures, the moths fed upon by Townsend's big-eared bat may be reduced in diversity and abundance. Unfortunately, little data is currently available to assess the extent of any such effect. Dr. Patricia E. Brown (pers. comm., 2004) attributes a general decline of Townsend's big-eared bat along the lower Colorado River to loss of native habitat that once supported foraging by the species (see also Pierson & Rainey 1998, p. 24).

Perkins and Schommer (1991) assert that spraying Bt (*Bacillus thuringiensis*) may suppress reproduction of Tussock moths and spruce budworms to the extent that reproduction in Townsend's big-eared bat is also suppressed.

More information also is needed about the impact of artificial lighting on moth diversity and abundance. Outdoor lights attract many moths; less obvious is that these lights disturb their behavior and may inhibit reproduction and survival of many moth species (Frank 1988; Eisenbeis 2002). Frank (1996) quotes an entomological work from 1900–relatively early in the history of outdoor electric lighting–as saying,

> "While employed in Washington, D.C., I made a splendid collection of the moths of that region simply by going the rounds of a number of electric lights every evening. The lamps of the Treasury Building were sometimes very productive of fine specimens and the broad stone steps and pillars were frequently littered with moths. . . Besides making the acquaintance of a number of insects new to me, I met several entomologists who, like myself, had been attracted to the lights by the abundance of specimens."

Frank goes on to note, "Today lamps in big cities such as Washington, D.C., Philadelphia, and Boston rank among the worst places to collect moths or meet entomologists." Although effects of lights on insects at the individual level are well recognized, population effects have been little investigated. We are not aware of data that find Townsend's big-eared bats foraging around outdoor lights, nor of quantification of lighting effects on moth species abundance in California.

Forest management activities—particularly timber harvest and spraying—kill moths and other prey insects and may reduce the prey base for Townsend's big-eared bats (Sample et al. 1993, Sample & Whitmore 1993). Perkins and Schommer (1991) suggest that Bt sprays may suppress tussock moth and spruce budworm moth reproduction enough to suppress reproduction in Townsend's big-eared bats for one or two years (Pierson & Fellers 1998).

Changes in prey abundance are an ongoing threat. Surveys along the lower Colorado River, where there appear to be available, undisturbed roost sites that are unoccupied, suggest reduction of prey species through habitat alteration (for agriculture) may be responsible for a significant portion of regional Townsend's big-eared bat decline.

Wind energy

Wind energy development is a growing issue in California. State law mandates that by 2020, 25% of the state's energy come from renewable sources. The majority of bats killed at turbines are migratory species, rather than hibernating species (such as Townsend's big-eared bat). However, based on currently available information, the CBCP considers the Townsend's big-eared bat at "medium risk" from wind energy. The species is "known to fly high when in open or returning to roost." Research elsewhere has shown that where there is "high local bat activity by species that fly at turbine height, there is mortality of those species" (Pierson et al. 2011).

More information is needed to determine how wind energy may specifically affect Townsend's big-eared bat. Meanwhile, wind energy development is proceeding rapidly, and because no bat species in the state have any regulatory status, there are no requirements that impacts to bat be analyzed when officials review wind projects (Pierson et al. 2011).

Environmental contaminants

Townsend's big-eared bats are at risk from anthropogenic toxins in the environment because they are long-lived, mobile and active, consume between 40 and 100 percent of their body mass in prey each night, have high specific metabolic rates, live amidst potential toxic exposures, and rely heavily on fat storage and use for survival (Hickey et al. 2001; McCracken 1986; Clark 1981). There are three primary pathways for exposure to environmental contaminants: ingestion (water or insect prey), inhalation, and dermal/cutaneous. Townsend's big-eared bats may also be impacted by reduced prey availability due to pesticide spraying.

1. Ingestion

Townsend's big-eared bats in California are at risk from drinking contaminated water. For example, mining and drilling operations often produce contaminated ponds, including temporary pools on the surface of the ground or on tailings. Since bats can and do drink from very small

water bodies, even depressions not intended as ponds can expose bats to contaminants. Cyanide contamination from gold mining operations is thought to have decimated a population of Townsend's big-eared bat in east-central California (Clark 1991). Bat deaths at cyanide concentrations less than 20 parts per million have been reported (Clark 1991). In Nevada, fifteen mines reported killing at least 158 bats of undetermined species between 1986 and 1989 in cyanide solution ponds (Pierson et al. 1999). This probably represents the tip of the iceberg, since dead animals are notoriously hard to detect, especially those as small as a bat. Although bats comprised about 34 percent of the detected wildlife fatalities (Clark & Hothem 1991), they may be neglected in assessment of cyanide risks (Nevada Mining Assoc. et al. 1990; Pierson & Fellers 1998). Oil extraction waste pits or reserve pits are also known to cause bat mortality (Esmoil & Anderson 1995; Flickinger & Bunck 1987).

The risk posed by contaminated waters may be exacerbated in arid areas and dry seasons where water associated with mining or drilling may be the only nearby water (Pierson et al. 1999). Netting to exclude bats and provision of clean water sources can be effective in reducing impacts, but sometimes the contaminated features are so large that complete netting is extremely problematic (Clark 1991). Grading to reduce surface ponding and to direct runoff to netted and/or treated ponds may also be useful.

Water sources may also be contaminated by pesticides, which may drift, run off, seep, or be sprayed into the water. Standard application practices avoid spraying directly into water, but water sources used by bats can be so small that spraying operations overlook them. Effects of pesticide ingestion by Townsend's big-eared bat are discussed further below under dietary exposure.

Dietary exposure to pesticides and contaminants has been documented for other species of bats. Organochlorine compounds (e.g., DDT), mercury, and cholinesterase inhibitors (e.g., organophosphorus [OP] and carbamate pesticides) are some of the toxins that have been found in bats (Clark et al. 1996; Hickey et al. 2001; McCracken 1986). Over 150 million pounds of active ingredient of pesticides were applied in California in 2001, and 188 million pounds were applied in 2000 (CDPR 2002). For Townsend's big-eared bats, the most likely path of exposure to these compounds is through diet, which consists predominantly of moths (terrestrial herbivores), but also includes aquatic insects (some of which are predators, adding a potential aquatic exposure pathway; Dalton et al. 1986; Whitaker et al. 1977; Pierson et al. 1999). Mercury, for example, would be most likely to reach Townsend's big-eared bats in toxic concentrations after being magnified through aquatic food chains, although in a few areas, dissolved mercury may be of concern. Research may be needed on mercury in Townsend's big-eared bats near former placer mining districts of California, which could be accomplished through analyses on carcasses or fur.

Chemicals of greatest concern in the Townsend's big-eared bat diet are those that are somewhat persistent, tend to accumulate up food chains, and are stored in fat reserves in the body. DDT fits this description and for a time was registered by the EPA for use on bats, which it kills and harms quite dramatically (USGS 1998). Other chemicals that also fit these characteristics, such as PCBs, dioxin and furans, need to be investigated for accumulation in, effects on, and degree of

threat to the Townsend's big-eared bat in California.

Some OP and carbamate pesticides are persistent or even bioaccumulative in food chains, such as diazinon and carbofuran. OP pesticides have been implicated as immune suppressors and endocrine disruptors in amphibians (Kiesecker 2002). OP pesticides are heavily used in California on tree crops to control moth and other pests. For example, more than 1.6 million pounds of chlorpyrifos were applied to more than 1.3 million acres in California in 2001 (6th in acreage of application among all pesticides), and approximately 1 million pounds of diazinon were applied to nearly half a million acres (30th in acreage; CDPR 2002). Orchards may be suitable foraging habitat for Townsend's big-eared bats, although sampling in these areas has been minimal, and contaminated moths could be consumed by the bats in orchards or nearby habitats. Diazinon also is used extensively for structural pest control, where bats could be exposed to contaminated insects or surfaces. Chlorpyrifos, diazinon, and other pesticides drift from the agricultural Central Valley into the Sierra Nevada, where their residues have been detected in frogs in areas inhabited by Townsend's big-eared bats (Sparling et al. 2001). Frog tadpoles inside national parks in the Sierra Nevadas, far from the sites of application of these pesticides, have reduced cholinesterase activity (OP and carbamate pesticides function as cholinesterase inhibitors; cholinesterase is an enzyme essential to normal neural function in vertebrates, including bats).

Atrazine, a triazine herbicide heavily used in California, is an immune suppressor and a developmental disruptor in amphibians at concentrations commonly found in the environment (Hayes et al. 2002, 2003; Kiesecker 2002). The developmental processes disrupted in amphibians are similar in mammals (Hayes et al. 2002). Nearly 30,000 pounds of atrazine (active ingredient) was used on more than 7,700 acres of forest land in California in 2001 (CDPR 2002). Other triazine herbicides include hexazinone, which is commonly used on forest land in California: 45,000 pounds on 18,000 acres in 2001 (CDPR 2002). Hexazinone has not been subjected to the same scrutiny for sublethal biological effects (e.g., immune suppression, gonadal deformities) as atrazine. Townsend's big-eared bats are likely to be exposed to these herbicides, as well as even more widely used chemicals including 2-4 D, glyphosate, imazapyr, and triclopyr), by ingesting contaminated prey, by being sprayed directly (see Dermal, below), and by drinking contaminated water. Both atrazine and hexazinone are soluble and mobile and tend to contaminate water sources (CDPR 2002; Extoxnet 1996-1998).

Contaminants typically have sublethal effects at lower concentrations. Pesticide testing traditionally has focused on mortality, and the study of sublethal effects is infrequent. Some sublethal effects nonetheless can have significant population level results.

2. Inhalation

Air quality in parts of California is poor due to human activities, with elevated levels of ozone, oxides of nitrogen, sulfur compounds, particulates, and other contaminants. Townsend's big-eared bats feed on the wing and require high respiration rates to fuel their activity. Poor air quality in California is demonstrated to adversely affect trees and mammals (causing increased

asthma and aggravating other respiratory illnesses in humans). It is reasonable to expect that areas of low air quality impair bats including Townsend's big-eared bats, but we are not aware of studies of this topic.

3. Dermal/cutaneous

Finally, pesticides may be absorbed through the skin. The main chance of this would be if bats were directly sprayed (to avoid wind, spray applications often begin at first light, a time when bats may still be flying), or through contact with sprayed surfaces. If Townsend's big-eared bats in California prove to forage by gleaning, this would produce contact with sprayed plant surfaces. Dermal exposure can be difficult to separate in the field from ingestion by licking pesticide residues off the fur and skin. Ingestion appears likely to be the more significant exposure route.

The CBCP cites pesticides associated with agriculture as a medium to high risk for bats in a number of ecoregions throughout the state. These include the Central Coast and Central Coast Range, Mono and Southeastern Great Basin, Mojave, and Sonoran and Colorado Deserts (Pierson et al. 2011). Agricultural pesticide and herbicide use is especially frequent in the Great Valley; however, Townsend's big-eared bat is extremely rare there, probably due to the dearth of suitable roosting sites. Pesticides and other contaminants in urban and suburban settings can also threaten bat. This is especially a concern in the South Coast region (Pierson et al. 2011).

Toxins pose a present and continuing threat to the Townsend's big-eared bat. The degree of the threat is most certain for drinking water contamination, which is well-documented and best known from mining and drilling districts. This threat is moderate to high. The degree of threat from pesticides, air pollution, and other sources of toxicity is uncertain and needs to be investigated.

Pest control operations

Private pest control operators may remove, kill, or exclude Townsend's big-eared bats at buildings and other anthropogenic roost sites where property owners wish to be rid of roosting colonies. There are no licensing or education requirements regarding bat exclusion for pest control operators. Such operators, or even private landowners, may inadvertently or purposefully seal in bats, including non-volant young in nursery groups, in attics or other structures, when they cover or calk bats' entry and exit points. Other methods of bat control include illegal application of poisonous chemicals, and capture and killing of bats. Take of bats is allowed under California state law where the "pest animal" is deemed to be harming crops or other property, including structures. Under this law, entire colonies may be destroyed (Pierson et al. 2011).

The threat of pest control operations to Townsend's big-eared bat is ongoing and immediate. It is unclear how many colonies are being harmed or destroyed, and in certain regions where Townsend's big-eared bat is especially dependent on anthropogenic roosts, the impact may be substantial.

Exotic invasives

Invasion and domination of riparian ecosystems in some drier portions of California by the non-native invasive plant, tamarisk or saltcedar (*Tamarix* spp.), has severely altered riparian ecosystems. Foraging areas of riparian vegetation adjacent to water sources may be essential for desert populations of Townsend's big-eared bat (Pierson & Fellers 1998), but tamarisk invasion reduces or nearly eliminates the native riparian vegetation, with corresponding impacts on the native insect (prey) community. The widespread invasion of tamarisk in desert areas also has contributed to the drying of water sources and salinization of soils (Larmer 1998). The Colorado River corridor in California is an area that is heavily invaded by tamarisk and has seen a decline in Townsend's big-eared bat population (Pierson & Fellers 1998).

Although ongoing, the degree of threat from exotic invasive species is unknown.

Small population size

Small population size can be a threat to a widespread and declining species like the Townsend's big-eared bat when the bats persist only in small, fragmented and remnant colonies through much of their range in California. Although the bats are relatively mobile, colonies are now few enough and widely enough dispersed that many may act as isolated small populations.

Small populations are more vulnerable to extinction than large ones (Pimm 1991; Noss & Cooperrider 1994). Noss and Cooperrider (1994) identified four major factors that predispose small populations to extinction: (1) greater risk of being wiped out by environmental variation or natural catastrophes like unusually harsh weather, fires, or other unpredictable phenomena; (2) chance variation in sex ratios or other population parameters (demographic stochasticity); (3) genetic deterioration resulting from inbreeding and genetic drift (random changes in gene frequencies); and (4) disruption of metapopulation dynamics (i.e., some species are distributed as systems of local populations linked by occasional dispersal, which offsets demographic or genetic deterioration). As a colonial species, Townsend's big-eared bats also may be subject to a fifth factor, a tendency for the growth rate of a local population to be impaired when its size falls below a critical level. In other words, the species experiences advantages of colonial behavior (perhaps warmth, reduced predation risk), and as colonies decline in size they tend to lose these benefits. This is referred to as an Allee effect (Stephens et al. 1999), and it can lead to populations of colonial species crashing more rapidly than anticipated. It has been suggested that the passenger pigeon, a colonial breeder, was in part a victim of an Allee effect.

Climate change

Biologists assessing the array of threats to bats have only recently considered what harms climate change may pose. The draft revised CBCP acknowledges climate change as an issue with "potentially important consequences for bats" (Pierson et al. 2011). Pierson et al. (2011) express the greatest concern for species that hibernate like Townsend's big-eared bat and determined that effects from climate change may be "severe" to the species.

Early research on bats and climate change in the West suggests that at least one way in which bats will be affected is through increased drought and diminishment of water sources. Reduced

availability of drinking water in close proximity to maternity roosts appears to lower reproductive success in bats studied in Colorado (Adams 2010).

Other scientific research suggests that hibernacula conditions may shift with climate change, resulting in less favorable conditions at hibernacula in warmer climes. In the eastern U.S. for example, before the advent of white-nose syndrome, population trends for the Indiana bat (*Myotis sodalis*) appeared to be downward at more southerly hibernacula, whereas populations were creeping upward at more northern locations (USFWS 2009b). Scientists theorize that climate change is playing at least a partial role in this transition (USFWS 2007, Clawson 2002). Similarly, a pre-white-nose-syndrome model of the range of the little brown bat (*Myotis lucifugus)* predicted northward expansion with climate change (Humphries et al. 2002). However, adaptation to climate change for bats may not be so simple as northward or upslope shifts. Suitable hibernation sites must also be available in potential range expansion areas. Because areas of abundant caves and/or mines are not evenly distributed across the landscape, this could be a significant challenge for Townsend's big-eared bat.

Climate change may also cause phenological mismatches between bats' life cycle stages and that of their insect prey (USFWS 2009b). For example, the peak of female bats' energetic demand is during pregnancy and lactation. However, if the peak of insect prey abundance shifts due to climate change, this may diminish reproductive success.

XII. IMPACT OF EXISTING MANAGEMENT EFFORTS

The main existing management efforts related to Townsend's big-eared bat are to evaluate potential impacts on mine and cave habitat, and to install bat-friendly gates or fencing where appropriate and to the extent that funds are available. Evaluation of impacts may take place during CEQA or NEPA reviews. Gating for bats, to reduce roost disturbance, is typically done under discretionary or grant programs, and funding is often limiting (E. Lorentzen, pers. comm. 2003).

While the USDA Forest Service manages the largest area of public lands within California (about 20% of California's total land area), the BLM (about 15%) and the National Park Service (4%) also manage sizeable areas. National Park Service units in California contain thousands of abandoned mines, notably in Death Valley National Park, Mojave National Park, and Joshua Tree National Park (Houghton & Kerbo 1995; National Park Service 2001). Townsend's big-eared bat roosts discussed by Pierson and Fellers (1998) fell primarily on public lands (18 on federal, none on state, and 5 on private lands, of 23 roosts with ownership data provided), though this is probably strongly influenced by the greater accessibility and availability of information on public lands, and also by the extirpations and population decline of the species on less-protected lands (Pierson & Rainey 1998). Pierson and Rainey (1998) state that 13 of the 20 largest colonies currently known are on public lands. At least one site, though not currently among the largest, is in a State park (Mitchell Caverns).

As of about 2000, the National Park Service had placed about 28 bat-friendly closures in National Park units in California, including Death Valley. Of these, up to about 20 were placed or modified to address Townsend's big-eared bat concerns. Approximately 15 to 20 more bat

gates were in development on national park lands in California as of 2000, some of which should benefit Townsend's big-eared bats (Burghardt 2000). Pierson and Rainey (1998) and Pierson and Fellers (1998) also reported that NPS protective management at Lava Beds National Monument and Point Reyes National Seashore appeared to have stabilized or increased Townsend's big-eared bat populations at a handful of roosts.

There appear to be no centralized data on how many mines or caves exist in California, or how many bat gates have been installed. Numbers of mine openings are certainly in the tens of thousands, while caves appropriate to Townsend's big-eared bats may be fewer by orders of magnitude. By some estimates, as many as 200 or more "bat-friendly" mine closures have occurred in California (Milford 2000); however, consistent standards of what constitute mine closures friendly to Townsend's big-eared bats are needed to accurately interpret such numbers. While bat-friendly closures have yielded significant local protection and some colony population increases, to date, bat-friendly closures are not leading to a statewide recovery of the species (Pierson & Rainey 1998; Pierson & Fellers 1998).

Management by USFS, BLM, and in some cases the California Department of Parks and Recreation has in the past often weighed recreational interests as more important than bats. Forest Service management has been reluctant to act on the biological significance of caves and mines. The decision makers of this agency, often against the advice of their own biologists, give recreation first priority despite documented incompatibility between casual recreation and viable cave and mine bat populations. The Forest Service has allowed continued tourist disturbance at the historically important Samwel Cave and Subway Cave sites. BLM biologists report they are unable to obtain support from superiors for site protection (Pierson & Rainey 1998). While funding may sometimes be an issue, in the absence of a listing of the species, many public land managers will consider it their duty merely to balance recreational and competing interests. Unfortunately, the Townsend's big-eared bat does not respond well to multiple uses of its roosts, and there is presently little weight on its side for restricting or closing popular caves and mines to recreationists.

Even the recent advent of white-nose syndrome, the emerging bat disease that has killed nearly 7 million bats in the eastern, midwestern, and southern U.S. since 2006, has done essentially nothing to change cave management and recreational caving policy on California public lands. The disease is caused by a fungal pathogen that can be transmitted bat-to-bat, from bats to caves, and by people to caves, on their gear and clothing (USGS 2011). In the eastern states, caves on federal lands (primarily USFS and National Park Service) are either off-limits to non-essential entry, or visitation is controlled via permitting, screening, and decontamination procedures. Biologists are deeply concerned that this disease will spread to the western states, as it has to 19 states and four Canadian provinces in the eastern half of North America. The U.S. Fish and Wildlife Service and the USGS/National Wildlife Health Service have issued official policy recommendations to limit non-necessary human access into caves and other bat-inhabited sites (i.e., mines) in order to prevent the anthropogenic spread of the disease (USFWS 2009a, Sleeman 2011). Of particular concern is a leap-frogging of the disease into an entirely new part of the country, such as California, that could occur as the result of human transmission.

However, most caves on public lands in California remain open to the public, and there are no regulations that mandate use of decontaminated gear and clothing to enter caves on national

forest or BLM caves. To our knowledge, only the National Park Service has instituted management changes for cave visitation in California (e.g., Lava Beds National Monument, Sequoia-Kings Canyon National Park). The USFS web pages for Samwel Cave (on the Shasta-Trinity NF) and Subway Cave (on the Lassen NF) both indicate the historic Townsend's big-eared bat sites are open for visitation, and make no mention of the risk of white-nose syndrome, nor the need to follow established WNS decontamination procedures (USFS 2012 b and c; USFWS 2012b).

Existing management efforts to prevent the spread of white-nose syndrome on California public lands are far from adequate; essentially, they are non-existent. The degree to which the disease poses a threat to Townsend's big-eared bat is unknown, but the failure of public lands managers in California to safeguard the species from possible exposure to this devastating, fast-spreading malady is indicative of the shortcomings of bat protection efforts on the state's public lands.

Mitigations for new or renewed mining activities in California have been pursued, ranging from gating other roosts to constructing artificial mine- or cave-like structures (Brown & Berry 1991, Pierson et al. 1991, Brown 1995, Brown et al. 1993, Tuttle & Taylor 1998). The success of these mitigations relative to leaving roosts undamaged has not been comprehensively weighed.

XIII. RECOMMENDED MANAGEMENT AND RECOVERY ACTIONS

Based on the severe threats and clearly imperiled status of the Townsend's big-eared bat we hereby request the species be listed as endangered under the California Endangered Species Act. As part of this protection, the following actions are needed to secure the future of Townsend's big-eared bat:

1. Immediately prohibit unnecessary human access to known and historic Townsend's big-eared bat roosting sites during the period when bats use or may use these sites.

2. Promptly and systematically survey all caves, mines, and structures for Townsend's big-eared bat populations, and for potential habitat for the species.

3. Install bat-accessible gates for all caves and mines with potential habitat that are subject to human disturbance (do not close mines that are currently unoccupied if they provide potential habitat and can be gated). Bat-appropriate gating has proven to be a viable management option for the protection of roosting Townsend's big-eared bat colonies: protective gates have been installed at Knoxville, Sulfur Creek, Death Valley National Monument, and Mitchell Caverns, and populations (still below historical levels) have subsequently increased at all locations (Pierson & Rainey 1998). Monitor gate effectiveness and make changes as necessary. Gates should not alter net airflow and should minimize the bottleneck posed by the gate to exit or entry of large numbers of bats. Culvert closures with gates may be acceptable if they are large enough (Altenbach 2003).

4. Amend or prepare land management plans to include appropriate measures for Townsend's big-eared bat.

5. Monitor cave and mine roosts regularly and enforce regulations regarding public access, maintaining gates as needed.

6. Survey and evaluate the status of known populations regularly.

7. Monitor (e.g., with track plates or hair traps) predator activity at roosts, and institute measures for control where necessary.

8. Avoid broadcast of pesticides (insecticides, herbicides, fungicides) in forests, including spraying of *Bacillus thuringiensis* (Bt). Permitting for pesticide application should be evaluated for effects on Townsend's big-eared bat and effects mitigated by the establishment of buffer zones, use of least harmful chemical agents, and by contributions to roost protection efforts.

9. The California Department of Pesticide Regulation should develop information regarding pesticide effects on Townsend's big-eared bats, recommendations for minimization of effects, and conduct or fund research on effects of pesticides on the survival and reproduction of Townsend's big-eared bats or related species, including sublethal behavioral, developmental, and endocrine effects. Based on the results of such research, Department of Pesticide Regulation should develop regulations to ensure that pesticide effects on Townsend's big-eared bats are insignificant.

10. The California Department of Forestry (CDF) and CDFG should develop protocols for evaluating forest areas for Townsend's big-eared bat use and regulating timber harvest in such areas. Particular attention should be given to caves, mines, structures, and trees with hollows that potentially serve as roosts. Consider input from bat experts and the public on the draft protocols.

11. CDF and the California Department of Parks and Recreation, in coordination with CDFG, bat experts and the public, should develop a larger system of old-growth redwood reserves and a long-term strategy for encouraging development of basal hollows in large redwoods on State lands, to provide increased roosting habitat–including maternity roosts–for Townsend's big-eared bat.

12. Surveys for Townsend's big-eared bat should consider external exit surveys as a first option, rather than entering a mine, cave, building, or tree hollow and potentially disturbing a colony. Recent techniques such as motion detectors and infrared video with infrared floodlights can increase the accuracy and reduce the labor associated with exit surveys. Internal surveys are still appropriate in many cases but should be evaluated carefully and must be conducted by experienced, trained personnel for an absolute minimum of bat disturbance.

XIV. INFORMATION SOURCES

All sources used in the development of this petition are listed in the Literature Cited. We also attach, as Appendix 1 to this document (with some sources in compact-disc electronic format), copies of literature and documents pertinent to the status of Townsend's big-eared bat in

California and its context in the larger range, including copies of useful summary reports. If the Commission or the Department has any difficulty locating any necessary references, please contact petitioners.

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August 11, 2016

Mr. Eric Sklar, President
California Fish and Game Commission
P.O. Box 944209
Sacramento, CA 94244-2090

Re: Proposed listing of the Townsend's Big-eared bat – Comment on "Report to the Fish & Game Commission – A Status Review of the Townsend's Big-eared bat (*Corynorhinus townsendii*) in California"

Dear President Sklar and Members of the Commission:

Thank you for the opportunity to comment on the Department's status review and recommendation to not list the Townsend's Big-eared bat as endangered under the California Endangered Species Act.

Green Diamond Resource Company (Green Diamond) is a family-owned company that was established in Washington State in 1890. Consistent with its long-term commitment to responsible forestry, Green Diamond owns and sustainably manages over 370,000 acres of timberland in California. Green Diamond's long-term perspective supports significant commitments to research and conservation for wildlife, water quality and aquatic resources on its forested lands through two federally approved habitat conservation plans and related consistency determinations from the CA Department of Fish and Wildlife.

In the Status Review Report, the Department describes the Townsend's bat as generally a cave and mine roosting bat, but it also roosts in large open spaces in buildings and in cavernous spaces in bridges and dams. There are a few occurrences of documented roosts in large old trees where repeated scarring from fires and other damage resulted in creation of large basal hollows. As a result of these habits, disturbance, degradation of and loss of suitable roost sites were recognized as threats to Townsend's bats. The petition relied on data trends from non-tree roost sites as an argument for the petitioned listing of Townsend's bats.

Green Diamond's timberlands do not provide the common roosting habitat (caves, mines, abandoned buildings, bridges or dams) for Townsend's bats. However, Green Diamond's lands do provide potential roosting habitat for Townsend's bats in the form of large trees with basal hollows. Green Diamond's lands contain stands of old-growth conifer habitat that range from 5 to 100 acres in sized that are currently withheld from harvest on due to protection for the state and federally listed marbled murrelet and our commitments under our Forest Stewardship Council certification. Some of these areas are also held in reserve through conservation easements. Other potentially suitable large diameter roost trees exist in a scattered distribution across the remainder of Green Diamond's ownership.

Since initiation of wildlife studies on its lands in 1990, Green Diamond has actively identified and retained trees with existing structure as important components of the forest that provide nesting, denning and roosting habitat for sensitive wildlife species (e.g., spotted owls, fishers). These tree retention commitments became an enforceable component of timber harvesting plans in 1992 upon approval and implementation of the Northern Spotted Owl Habitat Conservation Plan and continue to be implemented to this day. The tree retention commitments continued to evolve over time, and Green Diamond voluntarily adopted a Terrestrial Dead Wood Management Plan as a part of its timber harvest operations in 1999. That effort was jointly developed with the California Department of Fish and Game. The current version of our tree retention is being formally adopted as the TREE (Terrestrial Retention of Ecosystem Elements) guidelines in a proposed federal Forest Habitat Conservation Plan that will replace the 1992 plan for northern spotted owls. Green Diamond started implementing the TREE program in 2013 in timber harvest plans as part of our Forest Stewardship Council certification. When approved, the 50 year commitment of the federal Forest Habitat Conservation Plan will continue to protect potential roost sites for Townsend's bats by incorporating these measures in state timber harvesting plans.

Green Diamond believes that its current practices implemented through state timber harvesting plans protect potential roosting habitat, reduce risk of take and prevent significant adverse impacts to the Townsend's bat. Green Diamond supports the Department's recommendation that the petitioned action for listing the Townsend's bat is not warranted.

Sincerely,

Keith A. Hamm

Keith A. Hamm, Certified Wildlife Biologist®
Manager, Conservation Planning
Green Diamond Resource Company

Cc: Mr. Charlton H. Bonham
Director, California Department of Fish and Wildlife
1416 9th Street
Sacramento, CA 95814

FGC - 670.1 (3/94)

A PETITION TO THE STATE OF CALIFORNIA
FISH AND GAME COMMISSION

For action pursuant to Section 670.1, Title 14, California Code of Regulations (CCR) and Sections 2072 and 2073 of the Fish and Game Code relating to listing and delisting endangered and threatened species of plants and animals.

I. SPECIES BEING PETITIONED:

Common Name: Livermore tarplant

Scientific Name: *Deinandra bacigalupii*

II. RECOMMENDED ACTION:

(Check appropriate categories)

a. List X

As Endangered X

As Threatened ___

b. Change Status

from _____

to _____

Or Delist ___

III. AUTHOR OF PETITION:

Name: Heath Bartosh

Address: 832 Escobar Street

Martinez, CA 94553

Phone Number: 925-228-2017

I hereby certify that, to the best of my knowledge, all statements made in this petition are true and complete.

Signature: _____

Date: August 29, 2014

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Executive Summary

Livermore tarplant (*Deinandra bacigalupii*) is an erect, aromatic, taprooted annual in the sunflower family (Asteraceae), which was described as new to science in 1999 (Baldwin 1999). *Deinandra bacigalupii* (DEBA) is currently known from only three occurrences limited to just 90 acres in the Livermore Valley, Alameda County, California. One occurrence is located on public and private lands, and the remaining two are on privately owned parcels. A total of 303,720 individuals have been estimated in a single year (2009) (Bartosh 2009).

One of the three occurrences has been steadily encroached upon since 2002 from soil deposition activity, excavation of the western portion of the property, and the construction of a roadway. All of these activities have, and continue to directly impact DEBA occupied habitat Potential indirect impacts to DEBA from its proximity to these activities include establishment and expansion of non-native plants, changes in hydrologic conditions, soil compaction and disturbance, inadvertent or intentional application of herbicides, fertilizers, and pesticides near to colonies. Zoning within all or portions of the remaining occurrences is such that the parcels can be plowed for crops or developed into a horse boarding facility without CEQA review. Heavy, illegal off-road vehicle use is also affecting one of the occurrences.

Overall, the species is threatened by alteration of habitat due to industrial and agricultural uses and associated disturbances, displacement by non-native grasses and forbs that tolerate alkaline habitat, off-road vehicle use, and development potential based on zoning designations.

DEBA is not currently proposed for listing under the Federal Endangered Species Act as all occurrences are located on private land, which alone does not trigger a Federal nexus. Listing of Livermore tarplant under the California Endangered Species Act is necessary to provide critical legal protections and habitat designations to ensure survival of this highly endangered plant species.

TAXONOMY AND DESCRIPTION

TAXONOMIC HISTORY

Livermore tarplant (*Deinandra bacigalupii* B.G. Baldwin) is an endemic species from the Livermore Valley, Alameda County, California. Robert F. Hoover made the type collection (*R.F. Hoover 9954*, UC) on August 31, 1966 from the "junction of Ames St. and Raymond Road, north of Livermore, in "sandy alkaline soil." Hoover only labeled his collection as *Hemizonia*, without identification to species. Less than a year later, on April 26, 1967 Rimo Bacigalupi annotated Hoover's collection stating "Does not seem to match any thus far published species of *Hemizonia.*" Dale E. Johnson identified the collection to be *Hemizonia paniculata* [= *Deinandra paniculata*] in 1978. Barry Tanowitz (1983) included these plants within his circumscription of *Hemizonia increscens* subsp. *increscens* [= *Deinandra increscens* subsp. *increscens*], as reflected in David J. Keil's (1993) treatment of *Hemizonia* in *The Jepson Manual*. Hoover's specimen went unrecognized as a new species until freshly collected plants from the same population were brought to the Curator of the Jepson Herbarium, Bruce Baldwin, for identification by Dean K. Kelch and Rob Preston (Baldwin 1999). The original description was published by Bruce Baldwin in 1999 (Baldwin 1999). *Dienandra bacigalupii* was named in honor of Rimo Bacigalupi, first Curator of the Jepson Herbarium (Baldwin 1999).

Figure 1. Livermore tarplant (*Deinandra bacigalupii*). Photograph by Heath Bartosh

DESCRIPTION

Livermore tarplant (*Deinandra bacigalupii*, hereafter abbreviated DEBA) is an erect, aromatic, taprooted annual in the sunflower family (Asteraceae). It grows to a height of 10 to 40 cm, branched in the distal half or to near the base. When mature it produces flat-topped or panicle-like clusters of inflorescences (heads). The leaves are sessile, mostly cauline, entire or irregularly lobed, and are coarse-hairy and stalked-glandular. The radiate flowering heads consist of 8 (sometimes 6 or 9) deep yellow ray flowers and 15 to 18 (sometimes 10 or 21) disk flowers that are mostly staminate and have yellow to brown anthers. The disk pappus generally comprises 8 to 13 awl-shaped to square, fringed to deeply cut scales 0.1 to 0.8 mm.

PHENOLOGY

DEBA flowers from June to October (Baldwin in Baldwin et al. 2012; CNPS 2014). Seed production closely follows flowering during summer and fall months.

SIMILAR TAXA

DEBA is sympatric with Lobb's tarplant (*Deinandra lobbii*) and occurs in the same geographic region as Kellogg's tarplant (*Deinandra kelloggii*) but is not known to co-occur with *D. kelloggii*. Lobb's tarplant differs from DEBA primarily by having only 3 (sometimes 4) ray and disc flowers each (Baldwin in Baldwin et al. 2012). Kellogg's tarplant differs from DEBA mainly by having 5 ray flowers and six disk flowers (ibid.). *Deinandra lobbii* occurs at the type locality of DEBA.

Although, DEBA is morphologically similar to *D. increscens* and *D. paniculata*, which are not known to occur in the San Francisco Bay Area, it can be readily distinguished from those two species by its much shorter pappus and its yellow or brownish, as opposed to dark purple, anthers. In the East Bay, there are no other *Deinandra* species that can be easily mistaken for DEBA (Baldwin 1999).

ECOLOGY

HABITAT

DEBA is supported by poorly drained, seasonally dry, highly alkaline Pescadero and Solano series soils (Baldwin 1999) of sedimentary parent material. It occurs in alkaline meadows and grasslands in the vicinity of barren alkali scalds, alkali vernal pools, and playa-like pools.

The primary (largest) population of DEBA co-occurs with several California Rare Plant Rank (CRPR) and state and federally-listed species, including brittle scale (*Atriplex depressa* [CRPR 1B.2]), hispid bird's-beak (*Chloropyron molle* subsp. *hispidum* [CRPR 1B.1]), and palmate bracted bird's-beak (*Chloropyron palmatum* [state and federally endangered]). DEBA is supported by alkali meadow/grassland near the margins of alkali sink habitat, both considered sensitive natural communities by the California Department of Fish and Wildlife

In the Livermore Valley region, alkali grassland generally occurs on alkaline soils of the Clear Lake, Pescadero, San Ysidro, and Solano series. In some areas, these grasslands are dominated by saltgrass (*Distichlis spicata*), while other areas of alkali grassland resemble valley non-native grassland, though cover of non-native annual grasses and forbs supported by these soil types is low while native grass and forb cover is high. Of the vegetation communities described by Holland (1986), the most similar is alkali meadow. Alkali meadow is characterized by a sparse to densely vegetated plant community consisting of relatively few low growing plant species with a strong component of perennial species (Holland 1986). It is usually supported by fine-textured, seasonally or perennially moist alkaline soils. Features referred to as alkali scalds are frequently associated with alkali grassland. Alkali scalds exhibit saline or alkaline crusts on the soil surface, supporting little or no vegetation, due to elevated soil pH, which can be toxic to most plant species (Nomad 2009).

Alkali sink vegetation occurs on poor soils with high alkalinity due to evaporation of water that accumulates in closed drainages. Of the vegetation communities described by Holland (1986), the most similar are valley sink scrub and alkali playa. Valley sink scrub is characterized by low, open to dense, succulent shrublands, dominated by alkali-tolerant Chenopodiaceae species, especially iodine bush (*Allenrolfea occidentalis*). A layer of understory plant species is usually lacking but in some areas may support perennial and annual vegetation. Similarly, alkali playa is characterized by low, grayish, microphyllous and succulent shrubs to about one meter tall. Total cover is usually low, due to wide spacing between shrubs and minimally developed understory. However, in some years, with adequate rainfall, there are spectacular wildflower displays between the shrubs (Coats et al. 1988). Valley sink scrub occurs on heavy, saline, or alkaline clays of lakebeds, basin rims or playas. High groundwater supplies provide capillary water for the perennial plant species. Soil surface is often bright white, salty crust over dark sticky clay. Similarly, alkali playa occurs on poor soils with high salinity and/or alkalinity due to evaporation of water that accumulates in closed drainages. These areas often have a high water table and with salt crust on the surface.

Elevation of DEBA occurrences ranges from 152 to 183 meters. Average mean temperature of Livermore Valley is 14 degrees Celsius, and the average annual rainfall is between 33 to 46 centimeters (USDA 1966).

POLLINATION

No pollination studies have been performed on DEBA to date and no anecdotal observation data on pollinators is available. In general, members of the Asteraceae are considered to be pollinated by wide diversity of insects, or more rarely birds or wind. Pollinators of this taxon likely include members of

Diptera, Hymenoptera, Lepidoptera, Hemiptera and Coleoptera, based on observations on other *Deinandra* and related taxa.

ASSOCIATED SPECIES

DEBA is often associated with a number of native and non-native species including iodine bush (*Allenrolfea occidentalis*), brittlescale (*Atriplex depressa*), soft chess (*Bromus hordeaceus*[*]), pungent tarplant (*Centromadia pungens* subsp. *pungens*), salt dodder (*Cuscuta salina*), saltgrass (*Distichlis spicata*), annual hairgrass (*Deschampsia danthonioides*), alkali heath (*Frankenia salina*), narrow tarplant (*Holocarpha virgata* subsp. *virgata*), alkali barley (*Hordeum depressum*), Mediterranean barley (*Hordeum marinum* subsp. *gussoneanum**), toad rush (*Juncus bufonius* var. *bufonius*), California goldfields (*Lasthenia californica*), sickle grass (*Parapholis incurva**), narrowleaf flax flower (*Leptosiphon liniflorus*), long styled sand spurrey (*Spergularia macrotheca* var. *longistyla*), hairy clover (*Trifolium microcephalum*), brome fescue (*Festuca bromoides**), small six-weeks grass (*Festuca microstachys*), and rattail six weeks grass (*Festuca myuros**) (Baldwin 1999).

DISTRIBUTION

All known populations of DEBA are in the eastern portion of the Livermore Valley on both public and private land within the City of Livermore and unincorporated Alameda County, California. Populations are clustered in three occurrences, located within a three mile radius of each other in the Altamont Creek watershed that feeds Las Positas Creek (see Figure 2 and 3). These occurrences[1] are hereafter referred to as EO 1 (EO = Element Occurrence) Greenville Road, EO 2 Springtown[2], and EO 4 East Valley. The total areal extent of occupied habitat is approximately 90 acres. See *Known Occurrences* section below for additional details on occurrences.

[*] Denotes a species with an origin other than California (non-native).

[1] An occurrence (or element occurrence, "EO") is defined by the DFG California Natural Diversity Database (CNDDDB) as a discrete plant population separated from other populations by at least ¼ mile.

[2] Includes the former EO #3

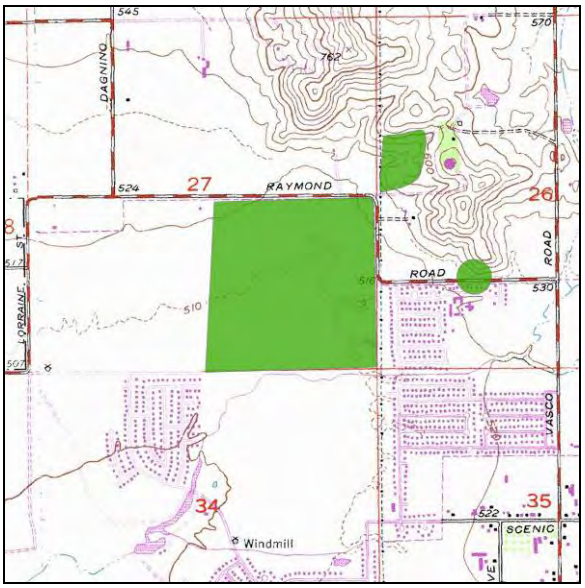

Figure 2. DEBA occurrence EO 2 Springtown (3 shaded polygons) as mapped by CNDDB.

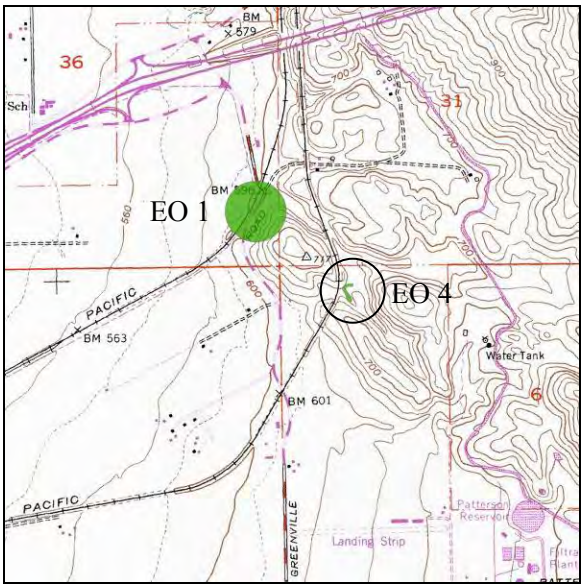

Figure 3. DEBA occurrence EO 1 Greenville Road, is the circle on the left and EO 4 East Valley is the small polygon east of the railroad tracks.

ABUNDANCE

As an annual plant, DEBA's population numbers can be expected to fluctuate dramatically from year to year depending on climatic conditions and other factors (see *Trends* section below). Very little population data has been collected on DEBA over the years based on CNDDB occurrence data. Of the three occurrences only EO 2 at Springtown has census information associated with it. The highest number of individuals observed there, according to the CNDDB, is 100 individuals at one of the colonies at this location. In August 2009, a census conducted of EO 1 (Bartosh 2009) estimated a total of 301,620 individuals.

Table 1. DEBA Census Totals

ELEMENT OCCURRENCE	2000	2004	2009
EO 1 – Greenville Road	n/a	n/a	1,600
EO 2 - Springtown	100 (est. from one colony[3])	unknown	302,120
EO 4 – East Valley	n/a	n/a	n/a

Source: CNDDB December 2013; Bartosh 2009.

Historically, DEBA may have been more abundant when the Springtown Alkali Sink and adjacent alkali habitats were still intact prior to the development of a residential subdivision, golf course, and former dump site north of Interstate 580 and east of North Livermore Avenue. Based on an evaluation of U.S. Department of Agriculture soils and California's Farmland Mapping and Monitoring datasets (Cal. Dept. of Conservation FMMP 2009) it is estimated that 28 percent (648 acres) of the same soil series known to support DEBA have been lost in the Springtown area (Bartosh et al. 2010). Commercial and industrial development along the Greenville Road corridor may have also replaced DEBA occupied habitat.

[3] A colony is defined as a discontinuous cluster of plants within a "population" defined in the above footnote.

TRENDS

Little is known about the long-term population trends of DEBA. Over the few years that observations have been made on DEBA, the largest number of individuals that have been counted in one year (2009) was 303,720. However, as discussed above, this species is an annual, and thus population numbers can fluctuate dramatically from year to year. For such annual species, habitat quantity and quality, and the degree and nature of the direct and indirect threats, are also critical and accurate indicators of the status of the species. These factors are discussed under *Known Occurrences and Threats* sections below.

KNOWN OCCURRENCES

As outlined above, DEBA is known from only three occurrences in and near the city of Livermore, Alameda County, California. It occupies approximately 90 of the 2,313 acres of potentially suitable alkaline habitat in the Springtown watershed based on Bartosh et al. 2010. Although this acreage of potentially suitable habitat is identified, it is possible that this entire habitat (identified by soil series) is not necessarily suitable and habitat requirements may be more specialized than currently understood as there is no current evidence it can survive outside its current distribution. One of these occurrences is on land owned by the City of Livermore, however a small discontinuous colony of this population lies on a private parcel. The other two occurrences are located on private land.

EO 1. GREENVILLE ROAD

This occurrence is located within unincorporated Alameda County, south of Interstate 580 and immediately east of Greenville Road south its intersection with Las Positas Road. This small occurrence is approximately 0.5 acres located on private land (APN 99B-5700-2-9) and currently operated as a soils disposal site. Soil disposal activities are encroaching on DEBA occupied habitat (see *Threats* section for additional detail). This 0.5-acre site is triangular in shape and DEBA occupies an alkaline swale/scald and the uplands surrounding it, including the Greenville Road shoulder. No population information has been systematically collected at this site, however approximately 1,600 individuals were estimated at this location in 2009.

EO 2. SPRINGTOWN

This occurrence is the type locality (first collected in 1966) and is located north of Interstate 580 between North Livermore Avenue and Vasco Road (Figure 2). Based on the most recent surveys there are two colonies, although CNDDB shows three. One colony, north and east of Raymond Road is not considered extant, therefore only two colonies are discussed. Based on CNDDB methodology these colonies are treated as one occurrence.

The largest colony is located on land owned by the City of Livermore that is currently zoned as open space designated for the Springtown Wetlands Preserve. It is also partially grazed by cattle. This colony, comprising approximately 75 acres, is located south of Raymond Road and west of Ames Street. In 2009 population sampling was conducted on the City of Livermore's Springtown Wetlands Preserve Property. The goal of the sampling was to estimate the number of Livermore tarplant individuals present in the Springtown Wetlands Preserve owned by the City of Livermore. Because counting each individual plant within this population was infeasible due to high overall abundance, the total number of individuals was estimated by extrapolation from a sampled portion of the population. Sampling methodology followed a two-stage sampling design with ten 60 meter x 60 meter macroplots randomly placed throughout the sampling area. Twenty 1 meter x 2 meter rectangular quadrats were placed randomly within each macroplot. All Livermore tarplant individuals were counted within each quadrat and recorded on data

sheets. Based on statistical analysis, the population size of Livermore tarplant individuals in the Springtown Wetlands Preserve was estimated to be approximately 301,620 ± 63,931 individuals, with a 95% confidence interval. This results in an estimate of a population ranging from 237,690 to 365,552 and is likely around 300,000 (Bartosh 2009). A majority of these individuals were characterized as small plants less than ten centimeters tall. The generally small plant size was likely due to unseasonably high temperatures in the Livermore Valley that stressed young plants before they reached maturity. Many of these diminutive individuals were observed in flower or to have developed fruit.

The other colony, which comprises approximately 0.5-acre, is separated by city streets and a residential subdivision and occupies privately owned land (APN 99B-5300-5-5). This parcel is located immediately west of Vasco Road and north of Dalton Avenue (opposite Pasatiempo Street). A visual estimate of this population was made in 2009 at roughly 500 individuals. These two colonies may have been essentially continuous and part of a much larger colony prior to residential development on the west side of Vasco Road.

EO 4. East Valley

This occurrence is approximately 0.35-mile southeast, on the other side of a low prominence (717 feet in elevation) from EO 1. It is also located in a drainage swale that ultimately drains into EO 1. This occurrence is also 0.5-acre in size and is privately owned (APN 99B-5600-4-24) as of 2011. The habitat that supports this occurrence is mostly intact except for the western edge, which has been historically impacted by a Western Pacific Rail line. No population information is available for this occurrence.

ATTEMPTS TO LOCATE ADDITIONAL POPULATIONS

The available data indicate that DEBA has likely always been limited in distribution. As early as the 1860s, when William Brewer came through the Livermore Valley during the original California Geological Survey, botanists have spent time collecting specimens in alkaline areas of east Alameda and Contra Costa counties. Since then, many of California's most renowned botanists have spent time documenting the plants of this area, such as:

- Edward Lee Greene in the 1880s and 1890s
- Willis Linn Jepson in the 1890s
- Alice Eastwood in the 1920s
- John Thomas Howell in the 1930s
- Robert F. Hoover in the 1930s and 1960s
- Peter Raven in the 1950s
- Helen Sharsmith in the 1960s
- Larry Heckard in the 1970s
- Roger Raiche in the 1980s
- James Jokerst in the 1980s
- Dean Wm. Taylor in the 1990s
- Barbara Ertter in the 1990s

- Sue Bainbridge in the 1990s and 2000s

In all of these years no other populations within Livermore Valley have been found. Although approximately 2,313 acres of potentially suitable habitat (Bartosh et al. 2010) are present within nearby Contra Costa County, DEBA does not occur there. Heath Bartosh[4] has spent over 300 hours throughout 2007, 2011, and 2012 conducting predictive field searches for DEBA in Contra Costa County with a particular focus on the high quality alkaline habitat in the Vasco and Byron areas. During these searches DEBA was not observed.

THREATS

DEGREE AND IMMEDIACY

The threats to all three occurrences of DEBA are potentially significant and immediate. The primary risk factors are habitat destruction through development (potential and on-going) and other human-related activities, and competition from non-native plants.

1. Habitat Modification or Destruction

DEBA is threatened both directly and indirectly by development at all three sites. Direct threats include development activities that may destroy both plants and occupied and unoccupied habitat. Indirect threats include changes in hydrologic regime and water quality, invasion and habitat alteration by non-native plants, and soil disturbance and compaction.

The Greenville Road occurrence (EO 1) is zoned as rural property used for agriculture. This occurrence has been steadily encroached upon since 2002 based on aerial photo evaluation (Figures 4, 5, and 6). Habitat loss and degradation has resulted from soil deposition activity, excavation of the western portion of the property, and the construction of a roadway. The new roadway was accompanied by grading and gravelling of natural habitat. All of these activities have directly impacted DEBA occupied habitat. Potential and likely indirect impacts to DEBA from its proximity to this use include establishment and expansion of non-native plants, changes in hydrologic conditions, soil compaction and disturbance, inadvertent or intentional application or runoff of herbicides, fertilizers, and pesticides near to colonies, and continued soils deposition. The runoff from deposited soils adjacent to occupied habitat has altered site hydrology and has the potential to change soil chemistry of alkaline habitat.

[4] Senior Botanist at Nomad Ecology and Research Associate at the University and Jepson Herbaria at the University of California Berkeley

Figure 4. Soil deposition to the left and constructed road in the background at EO 1.

Figure 5. 2002 aerial photo of EO 1 without disturbance.

Figure 6. 2012 aerial photo of EO 1 showing soils deposition and road.

The Springtown occurrence (EO 2), existing as two colonies, has two different zoning designations. The colony within the Springtown Wetlands Preserve (despite the "Preserve" moniker) has no permanent protection. However, it is currently zoned as open space and the City of Livermore General Plan's Open Space and Conservation Element has objectives related to DEBA protection. The City of Livermore is currently in the process of developing a conservation/mitigation bank that may include wetland construction within the Springtown Wetlands Preserve (S. Stewart pers. comm. 2014). If approved wetland creation has the potential to directly impact DEBA and its habitat through construction and indirectly through alteration in surface hydrology and additional introductions of noxious weeds.

Setting land use objectives is important as this location represents the largest population of DEBA but it is without permanent protection, such as a conservation easement, and a management plan. This area is also currently subject to heavy, illegal off-road vehicle use that is concentrated in the southern portion of the population (Figure 4). The main portion of this colony is directly threatened by expansion of an existing stand of perennial pepperweed (*Lepidium latifolium*) from the east side of Ames Street into the preserve. Perennial pepperweed[5] typically forms monocultures and has the potential to displace all native vegetation including DEBA. Perennial pepperweed is highly competitive and forms dense colonies that displace native vegetation and wildlife and dense populations are difficult to control (DiTomaso and Healy 2007).

[5] Perennial pepperweed is currently on the Caliofrnia Department of Food and Agriculture's B List of Noxious weeds (CDFA 2013) and has a California Invasive Plant Council rating of High (Cal-IPC 2013).

Figure 7. Off-road vehicle track at southern part of population (EO 2).

The second colony of EO 2, near the intersection of Vasco Road and Dalton Avenue, is significantly threatened due to its location within unincorporated Alameda County where it is zoned as a rural property used for agriculture, 10+ acres. With this zoning designation, this land could be plowed for crops or developed into a horse boarding facility without CEQA review.

The East Valley occurrence (EO 4) has a similar threat level as the second colony of EO 2, but this zoning designation also allows for higher use. The zoning is “rural property in transition to a higher use” City of Livermore Development Code (2010). With this zoning designation not only is agriculture a threat but there is potential for actual development into industrial, commercial, or residential property. Any habitat alteration at this occurrence has the potential to directly impact DEBA or indirectly impact it through changes in surface hydrology; changes in water quality and/or chemistry due to the application of herbicides or pesticides; increase in soil siltation or compaction from agricultural uses; and increase in non-native plants, which may invade from disturbed areas.

2. Overexploitation

Overexploitation is not known to be a significant threat.

3. Predation

Predation is not known to be a significant threat at this time.

4. Competition

All habitat for DEBA is threatened by invasion of non-native grasses and forbs from surrounding areas, and can be exacerbated by disturbance in these areas. A lack or absence of appropriate disturbance such as some changes in hydrology or appropriate grazing may also be a catalyst for detrimental competition of DEBA. Non-native grasses such as ripgut brome (*Bromus diandrus**) and Italian ryegrass (*Festuca perennis**) pose a threat through thatch accumulation in ungrazed areas of occupied DEBA habitat.

However, the most significant immediate threat to all DEBA occurrences is the non-native invasive broadleaf pepperweed (*Lepidium latifolium**)[6] and stinkwort (*Dittrichia graveolens**)[7]. These species are aggressive invaders and are well adapted to alkaline habitat. Broadleaf pepperweed is a perennial that spreads by rhizomes, which makes removal difficult. Stinkwort is a prolific seeder. Its seeds are wind dispersed, which allows isolated populations to spread easily. Based on their life histories these species have the potential to aggressively outcompete DEBA in its natural habitat, particularly broadleaf pepperweed, which can form a monoculture if left unabated (DiTomaso and Healy 2007)..

5. Disease

Disease is not known to be a significant threat at this time.

6. Other Natural Events or Human-related Activities

Since ca. 2002 the Greenville Road occurrence (EO 1) has been impacted by road building and soils deposition activities, as described above.

Habitat destruction and off-road vehicle use threaten the continued existence of DEBA. The Springtown occurrence (EO 2) is routinely used, illegally, by off-road vehicle enthusiasts and bmx bicycle riders. As shown in Figure 7 above, a "figure 8" shaped off-road vehicle track has been created by local residents. This track is within the southern portion of the population and, through its creation and use, has directly impacted DEBA individuals and serves as a vector for non-native plant invasions.

CURRENT MANAGEMENT ACTIVITIES

The only DEBA occurrence that has associated conservation management activities is the Springtown Wetlands Preserve colony of EO 2. It is currently zoned as open space and the City of Livermore General Plan's Open Space and Conservation Element has objectives related to DEBA protection including:

- Objective OSC-1.1 (Policy 6): The City shall preserve and maintain Frick Lake and the Springtown Alkali Sink area as important wildlife and plant habitats through preservation of open space in and around these areas.
- Objective OSC-1.4 (Policy 3): The City shall encourage and cooperate with the County, EBRPD, LARPD, and other agencies and organizations to establish a program to preserve representative examples of natural and near-natural landscape communities, such as the Springtown Alkali Sink, Brushy Peak, Corral Hollow, Cedar Mountain and Sycamore Grove.

Though these objectives have resulted in some baseline studies conducted by Susan Bainbridge[8], such as vegetation classification, mapping, and change detection for vegetation and palmate-bracted bird's beak, floristic inventory, and rare plant and weed mapping, these studies have not yet resulted in any active, on-the-ground, management activities. However, a Springtown Alkali Sink Working group has been convened by the City of Livermore Planning Department. This working group includes representatives from the Friends of Springtown, the University and Jepson Herbaria, Alameda County Resource Conservation District, East Bay Chapter of the California Native Plant Society, and Tri-Valley Conservancy. While not working directly on DEBA protection, their objectives related to protection of the alkali sink include signage, fundraising, outreach, weed control, and additional fencing, as well as

[6] Cal-IPC Rating of High
[7] Cal-IPC Rating of Moderate
[8] Research Associate at the University and Jepson Herbaria at the University of California Berkeley

enhancing long-term protection and management. As mentioned above, the Springtown Wetlands Preserve is subject to heavy off-road vehicle impacts due to a lack of sufficient fencing, although there is posting of "no trespassing" signs. Law enforcement patrols appear to be too infrequent to minimize or prevent these impacts.

The other two occurrences, EO 1 and EO 4, have no existing management.

POTENTIAL MANAGEMENT ACTIVITIES

To assure adequate management and recovery of DEBA, the species must be listed pursuant to the California Endangered Species Act (CESA) by the State of California and the remaining colonies must be set aside in preserve areas that provide sufficient ecosystem function, adequate buffering from disturbance, appropriate ecological management, and inclusion of areas of potential, unoccupied habitat.

1. Listing the Species Under CESA

Given the extreme rarity of the species and its current threats, listing under the CESA is an appropriate action to be undertaken by the State of California. This plant is not currently proposed for listing under the Federal Endangered Species Act as all occurrences are located on private and other non-federal lands, where DEBA solely occurs, which does not trigger a Federal nexus and therefore provides little or no protection. Thus, DEBA requires the take prohibitions of CESA to assist in its protection. State listing will also make it possible to procure private and public funding to initiate some of the protective and research needs of the species.

2. Adequate Buffering

For development projects that have the potential to occur at any of the occurrences, buffering for sensitive species is typically set at a minimum buffer of 100 feet. Buffering of sensitive species is theorized to provide protection from edge effects, which include invasion of non-native species, microclimate changes, and changes in hydrology.

The Greenville Road occurrence (EO 1) is insufficiently buffered from impacts related to the soils deposition and road construction. Close monitoring of this site could yield information about the changes in hydrology and other environmental factors. There should also be monitoring of the impacts from non-native plant introductions from deposition of these soils. Similar concerns may require the establishment of a buffer at the colony of EO 2, west of Vasco Road, and EO 4 should developments be approved on these parcels to protect DEBA from direct and indirect impacts.

A long term monitoring program to inform an adaptive management program requires adequate buffering of the colonies/occurrences. Currently, little information exists regarding an accurate minimum buffering requirement of DEBA. With little known about reproductive biology of species, buffers need to be set at conservative distances until we understand what is allowable minimum. Vegetation monitoring transects set to specifically analyze the changes from the edge of adjacent roads or developments to the center of existing populations would help inform managers and agency personnel about the needs of the present and potential DEBA preserves and help to further designs for future reserves for other alkaline grassland species.

3. Preservation of Potential Habitat.

Principles of conservation biology include an emphasis on the need for the preservation of both occupied and unoccupied, potential habitat of a given species. The matrix of contiguous occupied and potential habitat allows species to expand and migrate through time and space in response to varying changes in climate and disturbance regimes. This matrix also allows species to survive stochastic events that may destroy individual populations. Currently very little alkali habitat is preserved in the Livermore Valley and lands further east in Alameda County. The following recommendations could be implemented to the long-term benefit of DEBA. It should be noted that although protecting adjacent similar habitat for long-term viability is a viable concept, however all areas mapped as the same soil series may not be suitable in the near term as there is no current evidence it can survive outside its current distribution. Therefore population expansion or translocation for preservation or mitigation purposes may not be viable.

Within northern Livermore Valley hundreds of acres of potentially suitable alkaline habitat exist in the vicinity of the Springtown occurrence (EO 2), particularly between Frick Lake and Vasco Road and south of Hartford Avenue east of North Livermore Avenue. Alkali habitat found in Doolan Canyon to the east may also be suitable for DEBA (Nomad 2009). East of the Greenville (EO 1) and East Valley (EO 4) occurrences there are small amounts of habitat that is potentially suitable, specifically in alkali areas north of Patterson Pass Road. However, the long term viability of this smaller amount of potential habitat surrounding fragmented occupied habitat of EO 1 and EO 4 has less probability of long term survival in this part of the Livermore Valley even if preserves are established there. If research through experimental reintroduction of DEBA into these areas is successful, the prospects of long term survival of the species could plausibly be improved, especially within the northern Livermore Valley, north of Interstate 580. The large and near pristine alkali habitat here would, if preserved, create large areas of core habitat although some is surrounded by roads and subdivisions.

4. Ecological Management

A program of ecological management, including the principles of adaptive management, is required to ensure the long term viability of DEBA. Given the fact that the desired preserves, yet to be protected, are fragmented by roads and subdivisions, management is expected to be more costly and intensive than for larger preserves.

As stated above there is currently no management plan for any of the occurrences nor is there adequate funding for management of DEBA occurrences. Without the establishment of conservation easements the private ownership of the land could also impede independent monitoring and management measures for the species. Any ecological management should be conducted in a manner consistent with research needs and goals listed below.

5. Research Needs

Priorities for ecological research include pollination biology, seed dispersal, seed herbivory, plant demographics, breeding system, germination studies, distribution of genetic diversity within and between occurrences and soil and other habitat requirements. This information could be used to build population models that could assist with the design of reserves.

Priorities for management research include ways to reduce the spread of broadleafed pepperweed, and stinkwort, particularly in alkali habitat. Burning, mowing, grazing, and appropriate herbicide use should be explored as well as the timing, frequency, and intensity of these disturbances. Researching the disturbance regimes and hydrology of alkali habitat is also needed to assist recovery of other rare alkali species such as the Federally and State Endangered palmate-bracted bird's-beak (*Chloropyron palmatum*).

6. Monitoring

Monitoring of extant populations of DEBA should be undertaken yearly using standardized protocols, especially in the smaller populations, which are at greater risk. Data obtained should be submitted to the California Department of Fish and Wildlife Natural Diversity Database. Surveys of any additional suitable habitat should also be regularly performed.

7. Agencies and Organizations to be Involved

City of Livermore
City of Livermore Community Development
Alameda County Board of Supervisors
Alameda County Planning Department
Zone 7 Water Agency

California Department of Fish and Wildlife
Department of Interior – U.S. Fish and Wildlife Service

California Native Plant Society – East Bay Chapter
Tri-Valley Conservancy
Friends of Springtown Preserve
University and Jepson Herbaria at the University of California, Berkeley
Alameda County Resource Conservation District

Availability of Sources of Information

- "north of Livermore, junction of Ames Street and Raymond Road, in sandy alkaline soil, Alameda County, California." August 31, 1966. R. F. Hoover 9954 (holotype, UC; isotypes, CAD OBI, UC)

CAS	California Academy of Sciences
OBI	Robert F. Hoover Herbarium at Cal Poly San Luis Obispo
UC	University Herbarium, University of California, Berkeley

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Livermore Tarplant

(*Deinandra bacigalupii*)

Presentation to the California Fish and Game Commission

August 25, 2016

Jeb Bjerke - Native Plant Program

Purpose of Presentation

Summarize the Livermore Tarplant Status Review Document*

*Document was accepted at June 2016 Fish and Game Commission meeting

Presentation Overview

1. Species Information
2. Threats
3. Department Recommendation

Species Info

- Sunflower family (Asteraceae)
- Described as a new species in 1999

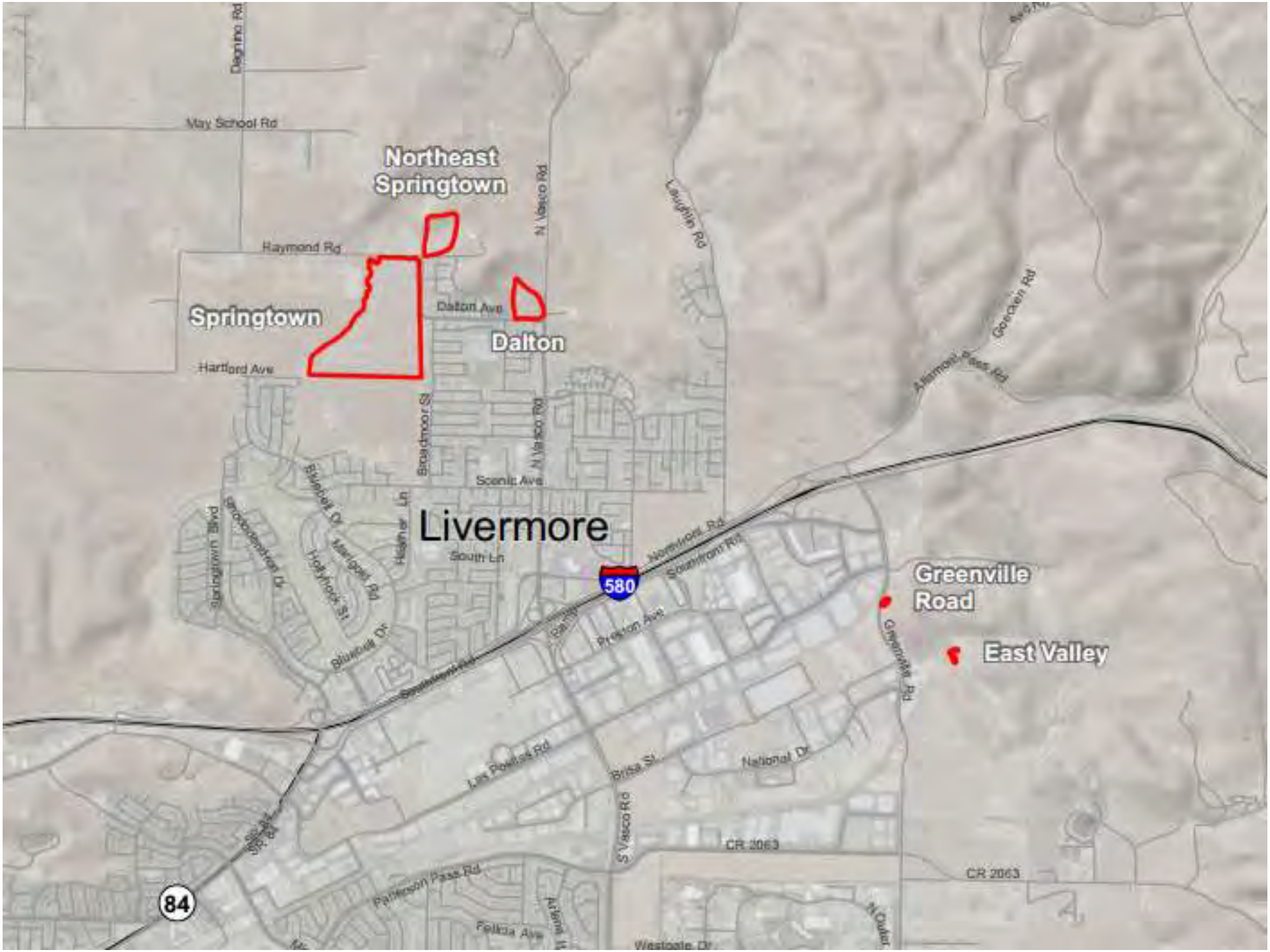
Livermore Tarplant
(*Deinandra bacigalupii*)

Species Info

- Tarplants/tarweeds group
- Sticky glands and strong odor
- Summer-flowering annual

June → October

SOLANO
116
121
Fairfield
37
29
Vallejo
780
80
Richmond
Concord
580
CONTRA
COSTA
Walnut
Creek
123
24
13
Upper Arroyo
Las Positas
HUC-12 Watershed
SAN
FRANCISCO
Oakland
680
61
San
Francisco
185
Livermore
205
Pleasanton
580
Livermore Valley
San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Parkinson Pass Rd
Felicia Ave
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Altamont Pass Rd
Goodsell Rd
Bluebell Dr
Marigold Rd
Hollyhock St
Springtown Blvd
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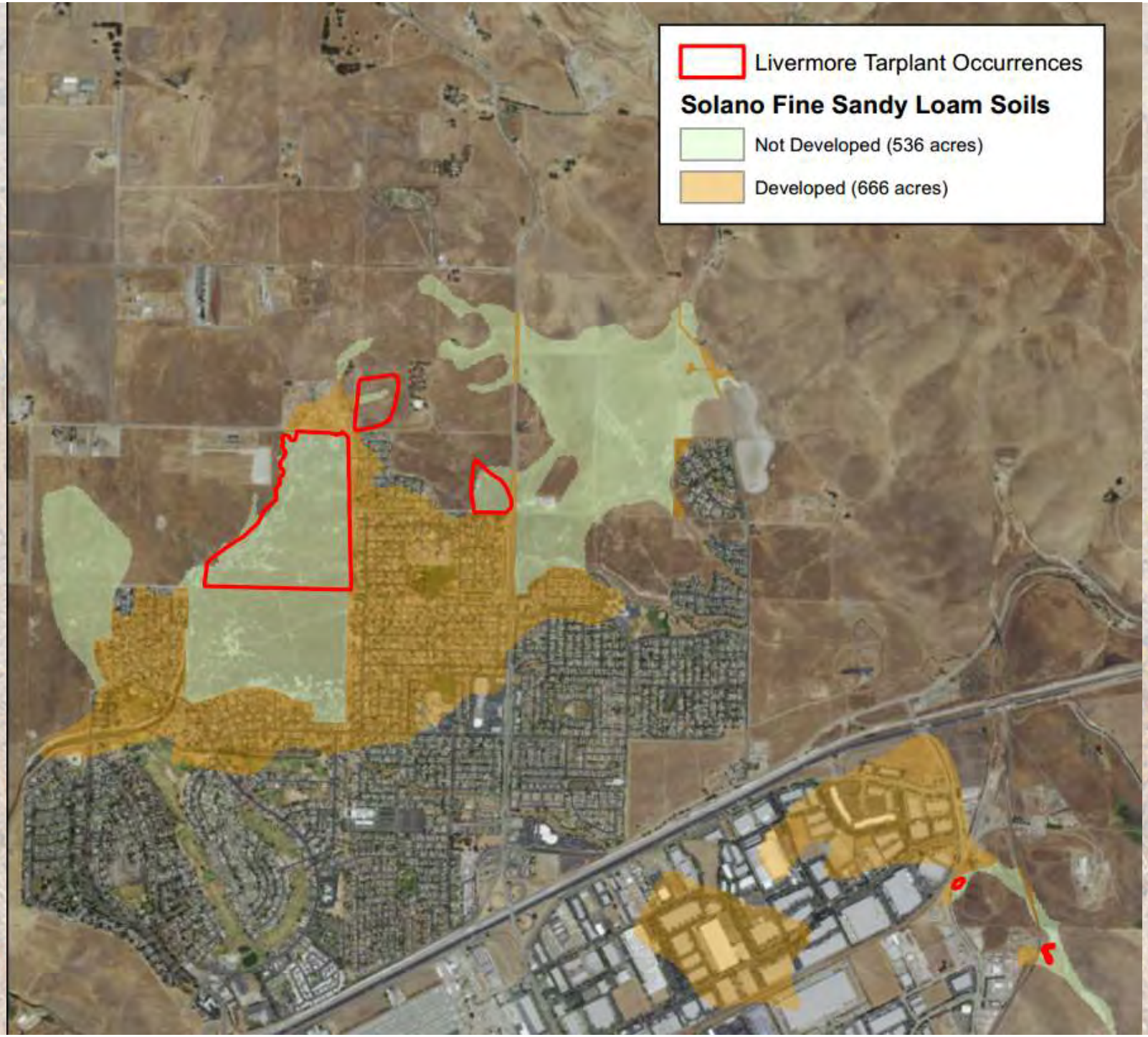
84

Habitat

- Alkaline meadows and edges of alkaline barrens or sinks
- Poorly drained
- Seasonally dry
- Near “scalds”

Habitat

- Alkaline meadows and edges of alkaline barrens or sinks
- Poorly drained
- Seasonally dry
- Near “scalds”
- Solano fine sandy loam soil

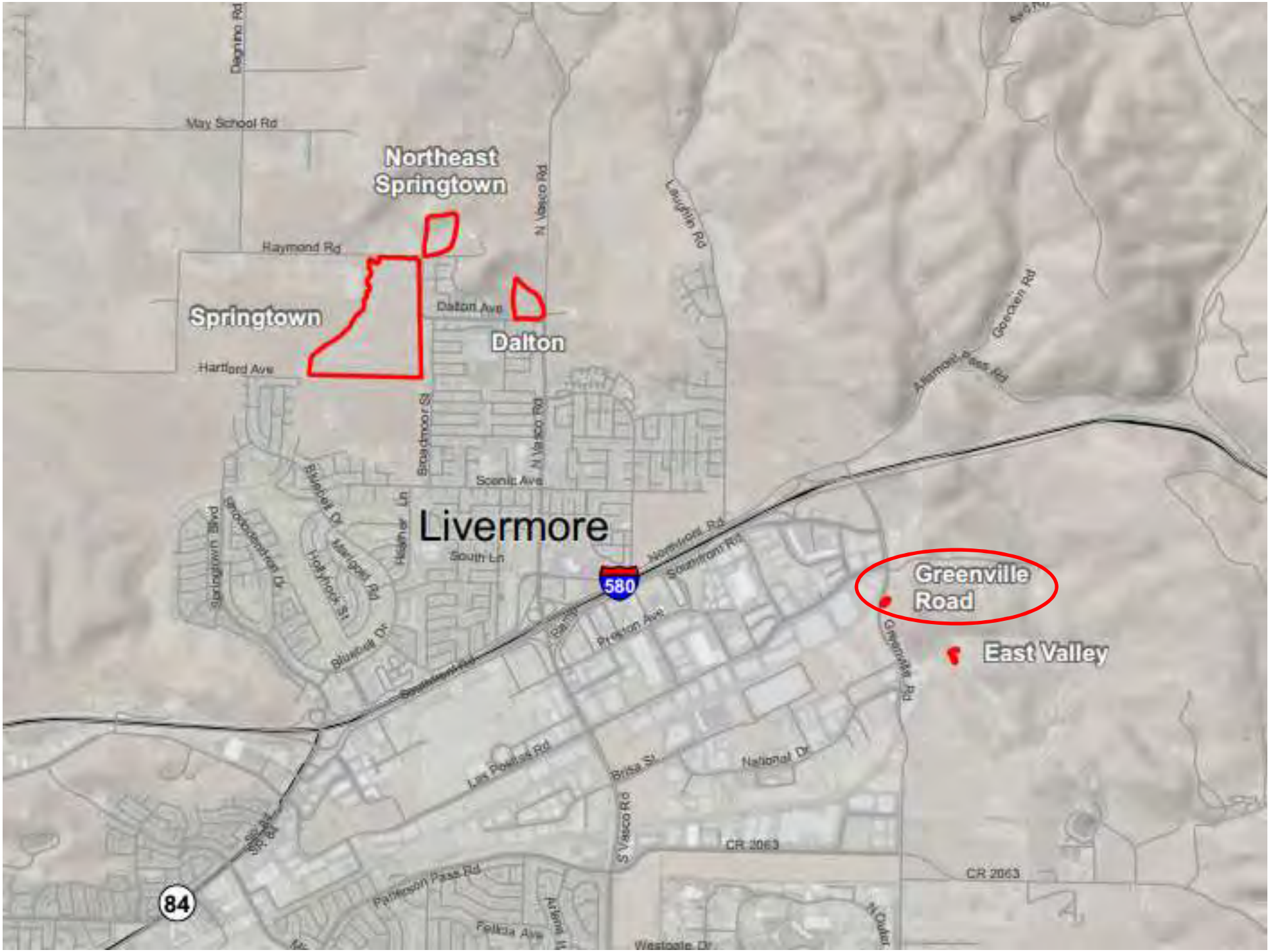

Livermore Tarplant Occurrences
Solano Fine Sandy Loam Soils
Not Developed (536 acres)
Developed (666 acres)

Threats Overview

- Habitat Modification and Destruction
- Non-native Species
- Recreation Activities
- Vulnerability of Small Populations
- Herbicide Use and Right-of-way Maintenance
- Potential Threats:
  - Grazing
  - Climate Change

Threats

- Habitat Modification and Destruction
  - No permanent habitat protection
  - Private property and agricultural zoning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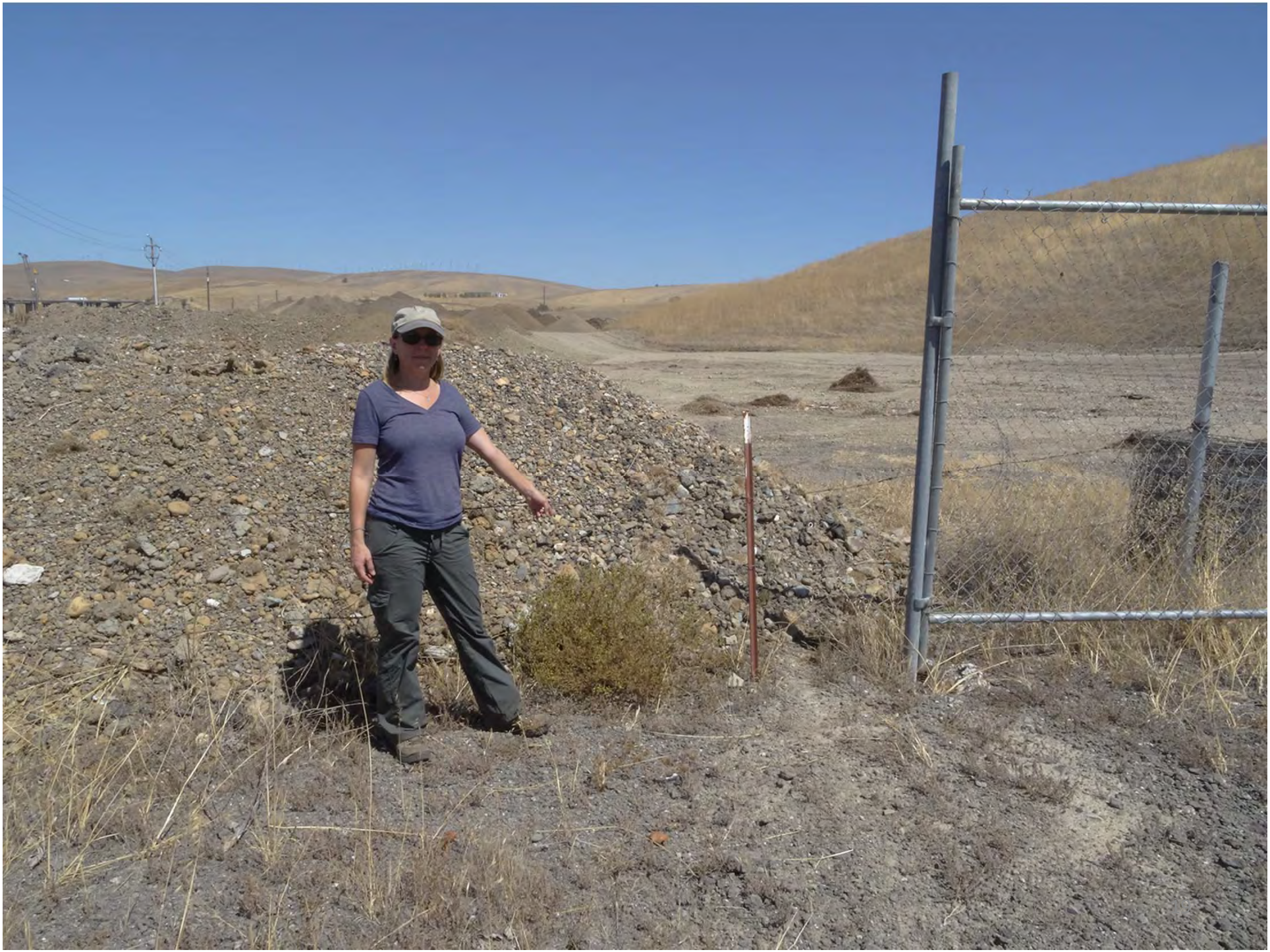


Threats

Non-native species

- Competition
- Thatch accumulation from invasive grasses

Threats

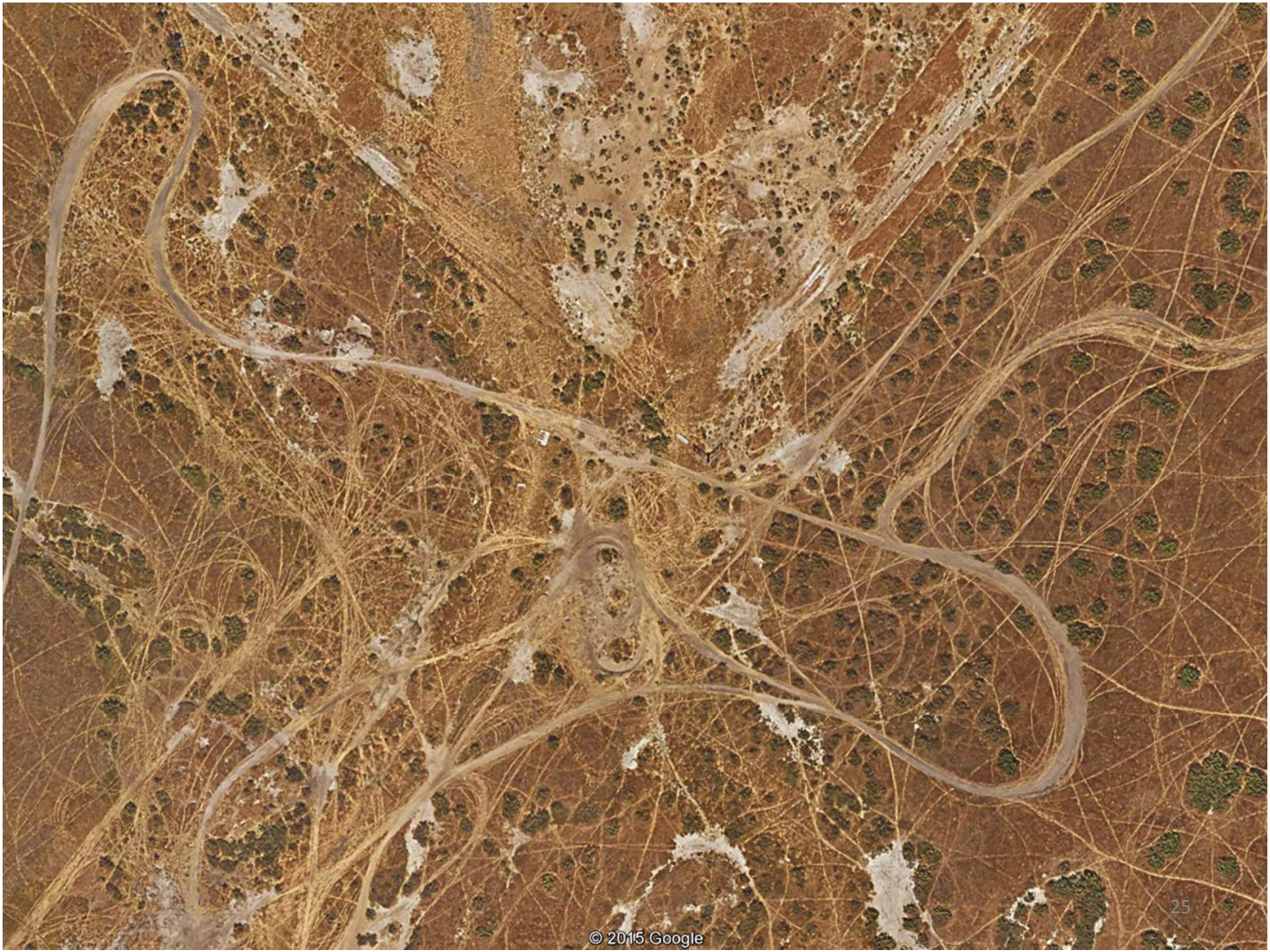
Non-native species

- Competition
- Thatch accumulation from invasive grasses
- Perennial pepperweed, stinkwort adapted to alkaline conditions

Perennial pepperweed

Other Threats

- Recreation Activities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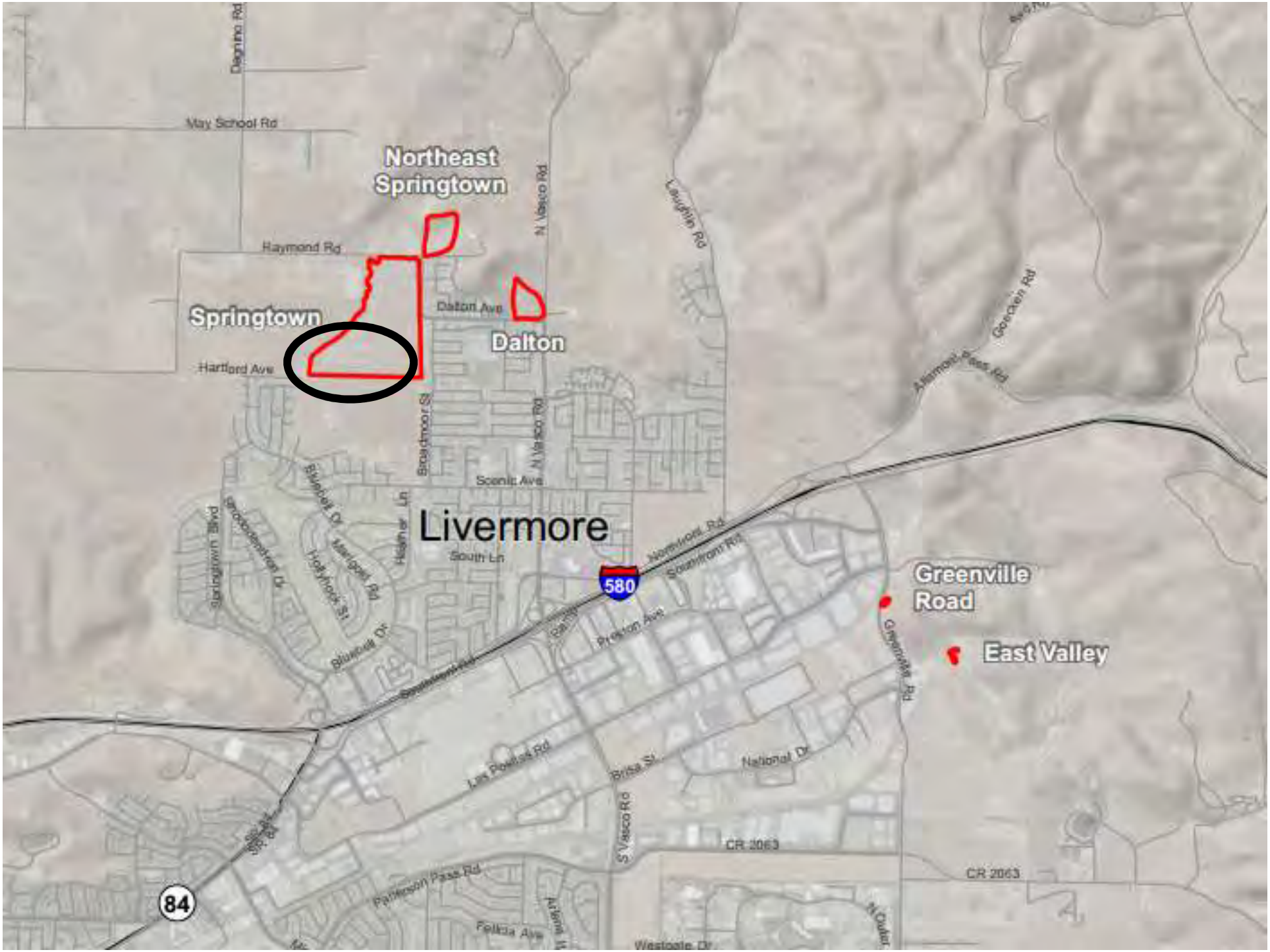
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Other Threats

- Recreation Activities
- Vulnerability of Small Populations
- Herbicide Use and Right-of-way Maintenance
- Potential Threats:
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  - Climate Change

Recommendation to Commission

Factors for Commission Determination

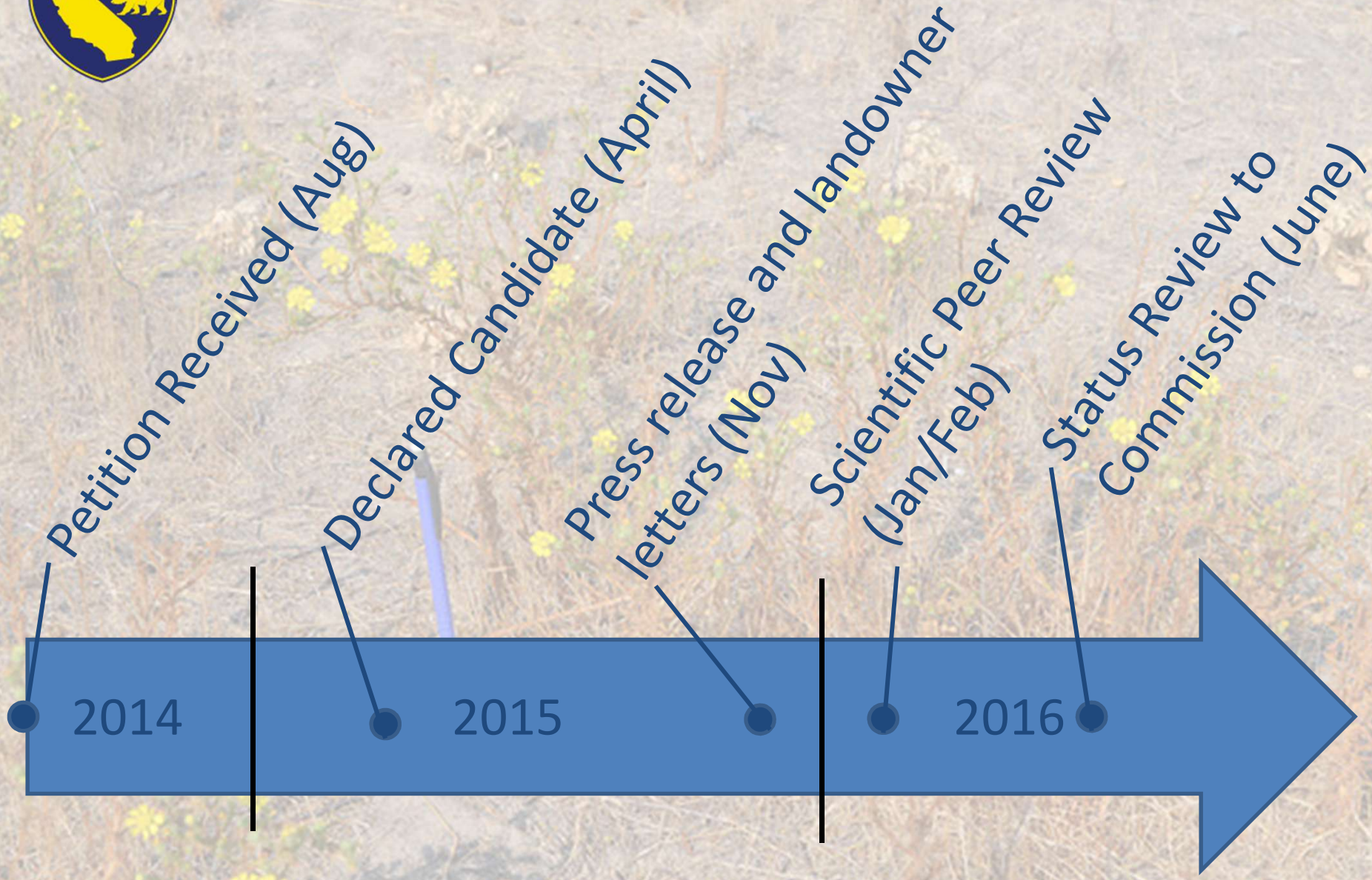
1) present or threatened modification or destruction of habitat;
2) overexploitation;
3) predation;
4) competition;
5) disease; or
6) other natural occurrences or human-related activities.

(Cal. Code Regs., tit. 14, § 670.1, subd. (i)(1)(A))

The Department recommends that the Commission find the petitioned action to list Livermore tarplant as an endangered species to be warranted.

Questions?

Timeline


Petition Received (Aug)
Declared Candidate (April)
Press release and landowner letters (Nov)
Scientific Peer Review (Jan/Feb)
Status Review to Commission (June)
2014
2015
2016

STATE OF CALIFORNIA
FISH AND GAME COMMISSION
INITIAL STATEMENT OF REASONS FOR REGULATORY ACTION
(Pre-publication of Notice Statement)

Amend Sections 1.74, 5.05, 5.40, 5.60, 7.00, 7.50,
Subsection (c) of Section 43, and subsections (c)(3) and (c)(7) of Section 671,
Title 14, California Code of Regulations
Re: Freshwater Sport Fishing Regulations

I. Date of Initial Statement of Reasons: June 23, 2016

II. Dates and Locations of Scheduled Hearings:

(a)	Notice Hearing:	Date:	August 25, 2016
		Location:	Folsom
(b)	Discussion Hearing:	Date:	October 20, 2016
		Location:	Eureka
(c)	Adoption Hearing:	Date:	December 8, 2016
		Location:	San Diego

III. Description of Regulatory Action:

(a) Statement of Specific Purpose of Regulation Change and Factual Basis for Determining that Regulation Change is Reasonably Necessary:

This Department proposal combines Department and public requests for changes to Title 14, California Code of Regulations (CCR), for the 2016 Sport Fishing Regulations Review Cycle. This proposal will increase fishing opportunities for landlocked salmon, increase protection for listed steelhead, remove regulations that are no longer relevant, update nomenclature for amphibians and reptiles, correct regulations pertaining to combined bag and possession limits for trout and landlocked salmon, clarify the bag and possession limits for trout, and update the sport fishing report card requirements. The proposed regulatory changes are needed to reduce public confusion and improve regulatory enforcement.

The Department is proposing the following changes to current regulations:

Sport Fishing Report Card Requirements
To eliminate public confusion, the Department is proposing to remove outdated requirements for lobster report card when the reporting period was changed in 2013 from annual to a season basis, and update the general sport fishing report

card requirements.

Proposal: Amend Section 1.74, Sport Fishing Report Card Requirements
Repeal outdated requirements to lobster report cards that are no longer applicable and propose minor changes for clarity.

Eastman Lake
The US Army Corps of Engineers is requesting the Department to remove the closure at Eastman Lake because bald eagles are no longer nesting in the closure area. The conditions at the reservoir have changed and the closure is no longer effective or relevant. Water levels have changed so drastically that the location of the buoy line is not consistent with the regulations.

Proposal: Remove Special Fishing Regulations Subsections 7.50(b)(62A) and (62B), Eastman Lake
Removal of the existing closure area will open the lake to fishing year-round.

Reptile and Amphibian Nomenclature Updates
The scientific understanding of the relationships of amphibians and reptiles has changed since the regulations were adopted. The current lists in California Code of Regulations, Title 14, Section 5.05, 5.60, 43(c)(1), 671(c)(3), and 671(c)(7) include some names that are no longer considered valid by the scientific community. In addition, some species that were thought to be only one have been split into two or more species. This can lead to confusion by Law Enforcement and permittees/licensees regarding whether a species is allowed to be possessed or not. An updated list of common and scientific names of amphibians and reptiles was developed to clarify which currently recognized species are represented by the existing names in the sport fishing, native and reptile captive propagation, and restricted species regulations. The proposed changes to 5.05, 5.60, and 43(c)(1) are consistent with the May 2016 version of the Department's "Complete List of Amphibian, Reptile, Bird and Mammal Species in California," available at : http://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=87155. Nomenclature changes to restricted species in 671 were obtained from the International Union for Conservation of Nature (IUCN, http://www.iucnredlist.org/) and in consultation with herpetological experts.

The proposed changes are solely taxonomic and will not result in a change of sport take or restricted status, with the exception of *Batrachoseps pacificus* and *Thamnophis sirtalis* in 5.05 and 5.60, respectively. The latter corrects the accidental omission of San Mateo County from the special closure area, making the closure consistent with the take language, which specifies no *T. s. tetrataenia*, a fully protected species listed as endangered under both the federal and California Endangered Species Acts (ESA and CESA, respectively) may be taken with a sport fishing license. The former interprets the intent of allowing *B.*

pacificus to be taken with sport fishing license. Prior to 2002, *B. pacificus* was considered a very widespread species, ranging from the Central Coast and Channel Islands, Baja California, and the central and southern Sierra Nevada. It was subsequently split into several species, many of which have very small ranges and some of which are species of special concern. Additionally, some of the common species' ranges overlap with those of protected species and are difficult to identify morphologically. *Batrachoseps pacificus*, as it is currently recognized, only occurs on the Channel Islands. The only currently recognized species that is relatively widespread and occurs in an area that does not overlap any currently recognized sensitive *Batrachoseps* spp. and used to be part of the *B. pacificus* complex is *B. major*. Therefore, we propose to replace *B. pacificus* with *B. major*. This change requires inclusion of a special closure to protect *B. major aridus*, which is listed as endangered under ESA and CESA, but it occurs in an area far separated from the rest of the species and any other *Batrchoseps* spp.

Proposal: Update Sections 5.05, 5.60, 43(c)(1), 671(c)(3) and (c)(7), Amphibians, Reptiles, and Restricted Species, respectively
The proposed changes will replace outdated names with valid, currently recognized names and will include the new names of the species that were split, where appropriate.

District General Regulations and Special Fishing Regulations Update for Clarity
To eliminate public confusion and potential enforcement issues, the Department is proposing to further define the bag and possession limits for trout in the District General and Special Fishing regulations sections by adding the word "trout" in the bag and possession limit column in subsections 7.00(a) through (g) and 7.50(b). Updating the tables will provide consistency with the proposed updated text in sections 7.00 and 7.50(a).

Proposal: Amend Subsections (a) through (g) of Section 7.00, District General Regulations, and Subsection (b) of 7.50, Special Fishing Regulations,
Add the word "trout" throughout Section 7.00, subsections (a) through (g), and Section 7.50, subsection (b), to clarify that bag and possession limits are specific to trout, unless stated otherwise.

San Clemente Lake
San Clemente Dam was removed recently (Summer 2015) to provide steelhead unimpeded access upstream. With the removal of the dam no reservoir remains, therefore there is no body of water to list.

Proposal: Amend Special Fishing Regulations subsection (b)(165) of Section 7.50, San Clemente Lake
Remove special regulation for San Clemente Lake.

Los Padres Reservoir
Los Padres Dam has had a fish trap located downstream where adult steelhead are captured and trucked upstream of the dam. A floating fish collector is being constructed in Los Padres Reservoir and was completed in Fall 2015. The fish collector is designed to allow passage downstream of steelhead trout, from kelts to juveniles. Since Los Padres is accessible to steelhead, there should be no take of rainbow trout which, with access to the ocean, can become anadromous. Therefore, given the ability to assume an anadromous form, rainbow trout should not be allowed to be taken. All fish taken should be limited to brown trout.

Proposal: Amend Special Fishing Regulations subsection (b)(105) of Section 7.50, Los Padres Reservoir
Prohibit take of rainbow trout in Los Padres Reservoir to reduce take of listed steelhead.

Las Garzas Creek Tributaries
Allowing a partial fishing season on this Carmel River tributary is inconsistent with other regulations for the Carmel River watershed. Removing this creek would result in consistent regulations in the Carmel River watershed.

Proposal: Amend Special Fishing Regulations subsection (b)(97) of Section 7.50, Las Garzas Creek and tributaries
Remove Las Garzas Creek and its tributaries from the Special Fishing Regulations.

Increase Fishing Opportunity for Landlocked Salmon
Landlocked salmon are stocked into select lakes and reservoirs and are a highly sought after game fish. In the Freshwater Sport Fishing Regulations the statewide daily bag and possession limit is five landlocked salmon in combination. In some reservoirs the landlocked salmon (Kokanee) are abundant, but only obtain a small overall length (<12” TL). Anglers are unsatisfied with only being allowed to take five landlocked salmon per day of this small size. Anglers would like to take and possess more of these small fish each angling day.

To increase angler satisfaction with the landlocked salmon fishery at select waters, the Department proposes an increase to the daily bag and possession limit on select waters. This proposal recommends a daily bag limit increase from five to ten fish per day and possession limit increase from ten to twenty fish, but no more than five can be Chinook salmon. Waters for which the bag and possession limits are recommended for change include: Trinity Lake (Trinity Co.), Lake Pardee (Amador Co.), New Bullards Bar Reservoir (Yuba Co.), Bucks Lake (Plumas Co.), and Scotts Flat Reservoir, Upper (Nevada Co.).

Proposal: Add Subsections (b)(27.5), (b)(130.6), (b)(135.4), (b) 174.1), and (b)(194.6) to Section 7.50, the Special Fishing Regulations
Add Trinity Lake, Lake Pardee, New Bullards Bar Reservoir, Bucks Lake, and Upper Scotts Flat Reservoir to the Special Fishing Regulations with a 10 landlocked salmon daily bag limit and 20 landlocked salmon possession limit.

Clarify New Regulation for Landlocked Salmon
In 2015, the Department created a new definition for landlocked salmon and established a daily bag limit of 5 fish and a possession limit of 10 fish as defined in sections 1.57 and 5.41, respectively. The words "or landlocked" were mistakably added to Section 7.00 and, as a result, the adopted language does not significantly change the original regulation for bag and possession limits. The bag and possession limit for trout and salmon (i.e., now landlocked salmon), is still in combination as opposed to a separate limit for trout and another for landlocked salmon. Also, language in 7.50(a) states "trout and salmon in combination." This section also needs to be revised as landlocked salmon and Chinook salmon have their own bag and possession limits and are not meant to be combined with trout bag and possession limits. Therefore, the Department is proposing to revise language in sections 7.00 and 7.50 that is incorrect or no longer relevant to the existing sport fishery.

Proposal: Amend Section 7.00, District General Regulations, and subsection (a) of 7.50, Special Fishing Regulations.
Revise the language in both sections to read "daily bag and possession limits, unless otherwise noted, mean the total number of trout."

Minor Editorial Corrections for Clarity
In addition to the above proposals, minor editorial corrections are proposed to correct typographical errors and to improve regulation clarity.

Benefits of the Proposed Regulations
It is the policy of this state to encourage the conservation, maintenance, and utilization of the living resources of the ocean and inland waters under the jurisdiction and influence of the state for the benefit of all the citizens of the State. In addition, it is the policy of this state to promote the development of local California fisheries in harmony with federal law respecting fishing and the conservation of the living resources of the ocean and inland waters under the jurisdiction and influence of the State. The objectives of this policy include, but are not limited to, the maintenance of sufficient populations of all species of aquatic organisms to ensure their continued existence and the maintenance of a sufficient resource to support a reasonable sport use. Adoption of scientifically-based trout and salmon seasons, size limits, and bag and possession limits provides for the maintenance of sufficient populations of trout and salmon to ensure their continued existence.

The benefits of the proposed regulations are concurrence with Federal law, sustainable management of California's trout and salmon resources, and promotion of businesses that rely on recreational sport fishing in California.

(b) Authority and Reference Sections from Fish and Game Code for Regulation:

Authority: Sections 200, 202, 205, 215, 220, 240, 315, 316.5, and 2003, Fish and Game Code.

Reference: Sections 200, 205, 206, 215, 220 and 316.5, Fish and Game Code.

(c) Specific Technology or Equipment Required by Regulatory Change:

None.

(d) Identification of Reports or Documents Supporting Regulation Change:

May 2016 version of the Department's "Complete List of Amphibian, Reptile, Bird and Mammal Species in California," available at : http://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=87155.

(e) Public Discussions of Proposed Regulations Prior to Notice Publication:

No public meetings are scheduled prior to the notice publication. The 45-day public notice comment period provides adequate time for review of the proposed changes.

IV. Description of Reasonable Alternatives to Regulatory Action:

(a) Alternatives to Regulation Change:

No alternatives were identified.

(b) No Change Alternative:

The no change alternative would leave existing regulations in place.

(c) Consideration of Alternatives:

In view of information currently possessed, no reasonable alternative considered would be more effective in carrying out the purpose for which the regulation is proposed, would be as effective and less burdensome to affected private persons than the proposed regulation, or would be more cost effective to affected private persons and equally effective in

implementing the statutory policy or other provision of law.

V. Mitigation Measures Required by Regulatory Action:

The proposed regulatory action will have no negative impact on the environment; therefore, no mitigation measures are needed.

VI. Impact of Regulatory Action:

The potential for significant statewide adverse economic impacts that might result from the proposed regulatory action has been assessed, and the following initial determinations relative to the required statutory categories have been made:

(a) Significant Statewide Adverse Economic Impact Directly Affecting Businesses, Including the Ability of California Businesses to Compete with Businesses in Other States:

The proposed action is not anticipated to have a significant statewide adverse economic impact directly affecting business, including the ability of California businesses to compete with businesses in other states because the expected impact of the proposed regulations on the amount of fishing activity is anticipated to be minimal relative to recreational angling effort statewide.

(b) Impact on the Creation or Elimination of Jobs Within the State, the Creation of New Businesses or the Elimination of Existing Businesses, or the Expansion of Businesses in California; Benefits of the Regulation to the Health and Welfare of California Residents, Worker Safety, and the State's Environment:

The expected impact of the proposed regulations on the amount of fishing activity is anticipated to be minimal relative to recreational angling effort statewide. Therefore the Commission does not anticipate any impacts on the creation or elimination of jobs, the creation of new business, the elimination of existing business or the expansion of businesses in California.

The Commission anticipates benefits to the health and welfare of California residents. Providing opportunities for a salmon and trout sport fishery encourages consumption of a nutritious food.

The Commission does not anticipate any non-monetary benefits to worker safety.

The Commission anticipates benefits to the environment by the

sustainable management of California's sport fishing resources.

(c) Cost Impacts on a Representative Private Person or Business:

The agency is not aware of any cost impacts that a representative private person or business would necessarily incur in reasonable compliance with the proposed action.

(d) Costs or Savings to State Agencies or Costs/Savings in Federal Funding to the State:

None.

(e) Nondiscretionary Costs/Savings to Local Agencies:

None.

(f) Programs Mandated on Local Agencies or School Districts:

None.

(g) Costs Imposed on Any Local Agency or School District that is Required to be Reimbursed Under Part 7 (commencing with Section 17500) of Division 4, Government Code:

None.

(h) Effect on Housing Costs:

None.

VII. Economic Impact Assessment:

The proposed regulations will revise and update inland sport fishing regulations starting in 2017. Currently, the seasons, size limits, and bag and possession limits for sport fishing are periodically reviewed by the Department of Fish and Wildlife and the Commission. This set of amendments will increase fishing opportunities for landlocked salmon, remove regulations which are no longer applicable, update nomenclature for amphibians and reptiles, increase protection for listed steelhead, and update the Steelhead Report Card and the Sport Fishing Report Card requirements.

Inland sport fishing regulation's affected parties include recreational anglers, commercial passenger fishing vessels and a variety of businesses that support anglers. The economic impact of regulatory changes for sport fisheries are

estimated by tracking resulting changes in fishing effort, angler trips and length of stay in the fishery areas. Distance traveled affects gas and other travel expenditures. Day trips and overnight trips involve different levels of spending for gas, food and accommodations at area businesses as well as different levels of sales tax impacts. Direct expenditures ripple through the economy, as receiving businesses buy intermediate goods from suppliers that then spend that revenue again. Business spending on wages is received by workers who then spend that income, some of which goes to local businesses. Recreational fisheries spending, thus multiplies throughout the economy with the indirect and induced effects of the initial direct expenditure.

The adoption of scientifically-based regulations provides for the maintenance of sufficient populations of inland sport fish to ensure their continued existence and future sport fishing opportunities that in turn support businesses related to the fishery economy.

The most recent 2011 U.S. Fish and Wildlife national survey of fishing, hunting, and wildlife associated recreation for California reports about 1.35 million resident and nonresident inland sport fish anglers contributed about $1.2 billion in trip and equipment expenditures to the State's economy. Adding the indirect and induced effects of this $1.2 billion direct revenue contribution the total economic benefit to California's economy is estimated to be about $2.03 billion. This corresponds with about $960 million in total wages to Californians and about 16,000 jobs in the State annually.

This regulatory action may impact businesses that provide services to sport fishermen but these effects are anticipated to range from none to small positive impacts, depending on the regulations ultimately adopted by the Commission. Sport fishing business owners, boat owners, tackle store owners, boat manufacturers, vendors of food, bait, fuel and lodging, and others that provide goods or services to those that sport fish in California may be positively affected to some degree from increases to business that may result under the range of proposed regulations. These anticipated impacts may vary by geographic location. Additionally, economic impacts to these same businesses may result from a number of factors unrelated to the proposed changes to inland sport fishing regulations, including weather, fuel prices, and success rates in other recreational fisheries that compete for angler trips.

(a) Effects of the Regulation on the Creation or Elimination of Jobs Within the State:

The cumulative effects of the changes statewide are estimated to be neutral to job elimination and potentially positive to job creation in California. No significant changes in fishing effort and sport fishing expenditures to businesses are expected as a direct result of the

proposed regulation changes.

(b) Effects of the Regulation on the Creation of New Businesses or the Elimination of Existing Businesses Within the State:

The cumulative effects of the changes statewide are expected to be neutral to business elimination and have potentially positive impacts to the creation of businesses in California. No significant changes in fishing effort and sport fishing expenditures to businesses are expected as a direct result of the proposed regulation changes.

(c) Effects of the Regulation on the Expansion of Businesses Currently Doing Business Within the State:

The cumulative effects of the changes statewide are expected to be neutral to positive to the expansion of businesses currently doing business in California. No significant changes in fishing effort and inland sport fishing expenditures to businesses are expected as a direct result of the proposed regulation changes.

(d) Benefits of the Regulation to the Health and Welfare of California Residents:

The Commission anticipates benefits to the health and welfare of California residents. Trout and salmon are a nutritious food source and increasing inland sport fishery opportunities encourages consumption of this nutritious food. Sport fishing also contributes to increased mental health of its practitioners as fishing is a hobby and form of relaxation for many. Sport fishing also provides opportunities for multi-generational family activities and promotes respect for California's environment by younger generations, the future stewards of California's natural resources.

(e) Benefits of the Regulation to Worker Safety:

The proposed regulations are not anticipated to impact worker safety conditions.

(f) Benefits of the Regulation to the State's Environment:

It is the policy of the state to encourage the conservation, maintenance, and utilization of the living resources of the inland waters under the jurisdiction and influence of the state for the benefit of all its citizens and to promote the development of local California fisheries. The objectives of this policy include, but are not limited to, the maintenance of sufficient populations of all species of aquatic organisms to ensure their continued

existence and the maintenance of a sufficient resource to support a reasonable sport use, taking into consideration the necessity of regulating individual sport fishery bag limits in the quantity that is sufficient to provide a satisfying sport. Adoption of scientifically-based inland trout and salmon seasons, size limits, and bag and possession limits provides for the maintenance of sufficient populations of trout and salmon to ensure their continued existence.

Informative Digest/Policy Statement Overview

This Department proposal combines Department and public requests for changes to Title 14, California Code of Regulations (CCR), for the 2016 Sport Fishing Regulations Review Cycle. This proposal will increase fishing opportunities for landlocked salmon, increase protection for listed steelhead, remove regulations that are no longer relevant, update nomenclature for amphibians and reptiles, correct regulations pertaining to combined bag and possession limits for trout and landlocked salmon, clarify the bag and possession limits for trout, and update the sport fishing report card requirements. The proposed regulatory changes are needed to reduce public confusion and improve regulatory enforcement.

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The scientific understanding of the relationships of amphibians and reptiles has changed since the regulations were adopted. The current lists in California Code of Regulations, Title 14, Section 5.05, 5.60, 43(c)(1), 671(c)(3), and 671(c)(7) include some names that are no longer considered valid by the scientific community. In addition, some species that were thought to be only one have been split into two or more species. This can lead to confusion by Law Enforcement and permittees/licensees regarding whether a species is allowed to be possessed or not. An updated list of common and scientific names of amphibians and reptiles was developed to clarify which currently recognized species are represented by the existing names in the sport fishing, native reptile captive propagation, and restricted species regulations. The proposed

changes to 5.05, 5.60, and 43(c)(1) are consistent with the May 2016 version of the Department's "Complete List of Amphibian, Reptile, Bird and Mammal Species in California," available at : http://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=87155. Nomenclature changes to restricted species in 671 were obtained from the International Union for Conservation of Nature (IUCN, http://www.iucnredlist.org/) and in consultation with herpetological experts.

The proposed changes are solely taxonomic and will not result in a change of sport take or restricted status, with the exception of *Batrachoseps pacificus* and *Thamnophis sirtalis* in 5.05 and 5.60, respectively. The latter corrects the accidental omission of San Mateo County from the special closure area, making the closure consistent with the take language, which specifies no *T. s. tetrataenia*, a fully protected species listed as endangered under both the federal and California Endangered Species Acts (ESA and CESA, respectively) may be taken with a sport fishing license. The former interprets the intent of allowing *B. pacificus* to be taken with sport fishing license. Prior to 2002, *B. pacificus* was considered a very widespread species, ranging from the Central Coast and Channel Islands, Baja California, and the central and southern Sierra Nevada. It was subsequently split into several species, many of which have very small ranges and some of which are species of special concern. Additionally, some of the common species' ranges overlap with those of protected species and are difficult to identify morphologically. *Batrachoseps pacificus*, as it is currently recognized, only occurs on the Channel Islands. The only currently recognized species that is relatively widespread and occurs in an area that does not overlap any currently recognized sensitive *Batrachoseps* spp. and used to be part of the *B. pacificus* complex is *B. major*. Therefore, we propose to replace *B. pacificus* with *B. major*. This change requires inclusion of a special closure to protect *B. major aridus*, which is listed as endangered under ESA and CESA, but it occurs in an area far separated from the rest of the species and any other *Batrchoseps* spp.

<u>Proposal: Update Sections 5.05, 5.60, 43(c)(1), 671(c)(3) and (c)(7), Amphibians, Reptiles, and Restricted Species, respectively</u>
The proposed changes will replace outdated names with valid, currently recognized names and will include the new names of the species that were split, where appropriate.

District General Regulations and Special Fishing Regulations Update for Clarity
To eliminate public confusion and potential enforcement issues, the Department is proposing to further define the bag and possession limits for trout in the District General and Special Fishing regulations sections by adding the word "trout" in the bag and possession limit column in subsections 7.00(a) through (g) and 7.50(b). Updating the tables will provide consistency with the proposed updated text in sections 7.00 and 7.50(a).

<u>Proposal: Amend Subsections (a) through (g) of Section 7.00, District General Regulations, and Subsection (b) of 7.50, Special Fishing Regulations,</u>
Add the word "trout" throughout Section 7.00, subsections (a) through (g), and Section

7.50, subsection (b), to clarify that bag and possession limits are specific to trout, unless stated otherwise.

San Clemente Lake
San Clemente Dam was removed recently (Summer 2015) to provide unimpeded steelhead access upstream. With the removal of the dam no reservoir remains, therefore there is no body of water to list.

Proposal: Amend Special Fishing Regulations subsection (b)(165) of Section 7.50, San Clemente Lake
Remove special regulation for San Clemente Lake.

Los Padres Reservoir
Los Padres Dam has had a fish trap located downstream where adult steelhead are captured and trucked upstream of the dam. A floating fish collector is being constructed in Los Padres Reservoir and will be completed in Fall 2015. The fish collector is designed to allow passage downstream of steelhead trout, from kelts to juveniles. Since Los Padres is accessible to steelhead, there should be no take of rainbow trout which, with access to the ocean, can become anadromous. Therefore, given the ability to assume an anadromous form, rainbow trout should not be allowed to be taken. All fish taken should be limited to brown trout.

Proposal: Amend Special Fishing Regulations subsection (b)(105) of Section 7.50, Los Padres Reservoir
Prohibit take of rainbow trout in Los Padres Reservoir to reduce take of listed steelhead.

Las Garzas Creek Tributaries
Allowing a partial fishing season on this Carmel River tributary is inconsistent with other regulations for the Carmel River watershed. Removing this creek would result in consistent regulations in the Carmel River watershed.

Proposal: Amend Special Fishing Regulations subsection (b)(97) of Section 7.50, Las Garzas Creek and Tributaries
Remove Las Garzas Creek and its tributaries from the Special Fishing Regulations.

Increase Fishing Opportunity for Landlocked Salmon
Landlocked salmon are stocked into select lakes and reservoirs and are a highly sought after game fish. In the Freshwater Sport Fishing Regulations the statewide daily bag and possession limit is five landlocked salmon in combination. In some reservoirs the landlocked salmon (Kokanee) are abundant, but only obtain a small overall length (<12" TL). Anglers are unsatisfied with only being allowed to take five landlocked salmon per day of this small size. Anglers would like to take and possess more of these small fish each angling day.

To increase angler satisfaction with the landlocked salmon fishery at select waters, the

Department proposes an increase to the daily bag and possession limit on select waters. This proposal recommends a daily bag limit increase from five to ten fish per day and possession limit increase from ten to twenty fish, but no more than five can be Chinook salmon. Waters for which the bag and possession limits are recommended for change include: Trinity Lake (Trinity Co.), Lake Pardee (Amador Co.), New Bullards Bar Reservoir (Yuba Co.), Bucks Lake (Plumas Co.), and Scotts Flat Reservoir, Upper (Nevada Co.).

Proposal: Add Subsections (b)(27.5), (b)(130.6), (b)(135.4), (b) 174.1), and (b)(194.6) to Section 7.50, Special Fishing Regulations
Add Trinity Lake, Lake Pardee, New Bullards Bar Reservoir, Bucks Lake, and Upper Scotts Flat Reservoir to the Special Fishing Regulations with a 10 landlocked salmon daily bag limit and 20 landlocked salmon possession limit.

Clarify New Regulation for Landlocked Salmon
In 2015, the Department created a new definition for landlocked salmon and established a daily bag limit of 5 fish and a possession limit of 10 fish as defined in sections 1.57 and 5.41, respectively. The words "or landlocked" were mistakably added to Section 7.00 and, as a result, the adopted language does not significantly change the original regulation for bag and possession limits. The bag and possession limit for trout and salmon (i.e., now landlocked salmon), is still in combination as opposed to a separate limit for trout and another for landlocked salmon. Also, language in 7.50(a) states "trout and salmon in combination." This section also needs to be revised as landlocked salmon and Chinook salmon have their own bag and possession limits and are not meant to be combined with trout bag and possession limits. Therefore, the Department is proposing to revise language in 7.00 and 7.50 that is incorrect or no longer relevant to the existing sport fishery.

Proposal: Amend Section 7.00, District General Regulations, and subsection (a) of 7.50, Special Fishing Regulations.
Revise the language in both sections to read "daily bag and possession limits, unless otherwise noted, mean the total number of trout."

Minor Editorial Corrections for Clarity
In addition to the above proposals, minor editorial corrections are proposed to correct typographical errors and to improve regulation clarity.

Benefits of the Proposed Regulations
It is the policy of this state to encourage the conservation, maintenance, and utilization of the living resources of the ocean and inland waters under the jurisdiction and influence of the state for the benefit of all the citizens of the State. In addition, it is the policy of this state to promote the development of local California fisheries in harmony with federal law respecting fishing and the conservation of the living resources of the ocean and inland waters under the jurisdiction and influence of the State. The objectives of this policy include, but are not limited to, the maintenance of sufficient

populations of all species of aquatic organisms to ensure their continued existence and the maintenance of a sufficient resource to support a reasonable sport use. Adoption of scientifically-based trout and salmon seasons, size limits, and bag and possession limits provides for the maintenance of sufficient populations of trout and salmon to ensure their continued existence.

The benefits of the proposed regulations are concurrence with Federal law, sustainable management of California's trout and salmon resources, and promotion of businesses that rely on recreational sport fishing in California.

Regulatory Language

Section 1.74, Title 14, CCR, is amended as follows:

§1.74. Sport Fishing Report Card Requirements.
(a) Purpose. These regulations are designed to improve recreational fishing effort and catch information in some or all areas where the fisheries operate. Many of these species are of high commercial value, and therefore, additional enforcement mechanisms are needed to improve compliance with existing bag limits and other regulations, and to reduce the potential for poaching.
(b) Report card requirements apply to any person fishing for or taking the following species regardless of whether a sport fishing license is required:
(1) Salmon, in the anadromous waters of the Klamath, Trinity, and Smith river basins. Anadromous waters are defined in Section 1.04 of these regulations.
(2) Steelhead trout.
(3) White sturgeon.
(4) Red abalone.
(5) California spiny lobster.
(c) General Report Card Requirements.
(1) Any person fishing for or taking any of the species identified in this Section shall have in his immediate possession a valid non-transferable report card issued by the department for the particular species. See special exemption regarding possession of report cards for lobster divers in Section 29.91 of these regulations.
(2) All entries made on any report card or tag shall be legible and in indelible ink.
(3) A report card holder fishing with a one, two, or ten-day sport fishing license, may replace the expired fishing license without purchasing a new report card so long as the report card is still valid.
(4) Report cards are not transferable and shall not be transferred to another person. No person shall possess any report card other than his own.
(5) ~~Only~~A person may only obtain one abalone report card and one sturgeon report card ~~may be issued per person~~ per report card period.
(6) Any report card holder who fills in all available lines on his steelhead, salmon or lobster report card shall return or report the card to the department pursuant to subsection 1.74(e) prior to purchasing a second card.
(7) Data recording and tagging procedures vary between report cards and species. See specific regulations in sections 5.79, 5.87, 5.88, 27.92, 29.16, and 29.91 that apply in addition to the regulations of this Section.
(d) Report Card Return and Reporting Requirements
(1) Report card holders shall return or report their salmon, steelhead, sturgeon, or abalone report cards to the department pursuant to subsection 1.74(e) by January 31 of the following year.
(A) Any ~~person~~ report card holder who fails to return or report his salmon, steelhead, sturgeon, or abalone report card to the department by the deadline may be restricted from obtaining the same card in a subsequent license year or may be subject to an

additional fee for the issuance of the same card in a subsequent license year.
~~(2) Report card holders shall return or report their lobster report cards purchased on or before July 31, 2013 pursuant to subsection 1.74(e) by January 31 of the following year.~~
(~~3~~2) Report card holders shall return or report their lobster report cards ~~purchased after July 31, 2013~~ pursuant to subsection 1.74(e) by April 30 following the close of the lobster season ~~specified on the card~~for which the card was issued.
(A) Any report card holder who fails to return or report his or her lobster report card ~~purchased after July 31, 2013~~ by April 30 following the close of the lobster season specified on the card shall be subject to a nonrefundable non-return fee specified in Section 701, in addition to the annual report card fee, for the issuance of a lobster report card in the subsequent fishing season.
(e) Report Card Return and Reporting Mechanisms:
(1) By mail or in person at the address specified on the card. A report card returned by mail shall be postmarked by the date applicable to that card as specified in subsection ~~1.74(d)(1), 1.74(d)(2), or 1.74(d)(3)~~1.74(d)(1) or 1.74(d)(2).
(2) Online through the department's ~~internet~~ license sales service website by the date applicable to that card as specified in subsection ~~1.74(d)(1), 1.74(d)(2), or 1.74(d)(3)~~ 1.74(d)(1) or 1.74(d)(2).
(3) If a report card is submitted by mail and not received by the department, it is considered not returned unless the ~~individual~~report card holder reports his or her report card as lost pursuant to subsection 1.74(f).
(f) Lost report cards.
(1) Any report card holder who loses his report card shall submit an affidavit, signed under penalty of perjury, in person to a department license sales office containing all of the following information:
(A) A statement containing the report card holder's full name confirming that the originally issued report card cannot be recovered.
(B) A statement containing the report card holder's best recollection of the prior catch records that were entered on the report card that was lost.
(C) A statement describing the factual circumstances surrounding the loss of the card.
(2) An ~~Affidavit~~affidavit for a lost report card shall be presented at a department license sales office, by the date applicable to that card specified in subsection ~~1.74(d)(1), 1.74(d)(2), or 1.74(d)(3)~~1.74(d)(1) or 1.74(d)(2) to be considered returned.
(3) Notwithstanding subsection 1.74(c)(5), any report card holder who loses his report card during the period for which it is valid may replace the lost report card by submitting an affidavit as described in subsection 1.74(f)(1) and payment of the report card fee and replacement processing fee specified in Section 701.
(A) Based on the information provided in the written affidavit for abalone and sturgeon report cards, the department shall issue only the number of tags that were reported unused on the previously issued report card.
Note: Authority cited: Sections 200, 202, 205, 220, 1050, 1053.1, 1055.1 and 7380, Fish and Game Code. Reference: Sections 200, 202, 205, 206, 220, 713, 1050, 1053.1, 1055.1, 7149.8, 7380, 7381 and 7382, Fish and Game Code.

Section 5.05, Title 14, CCR, is amended as follows:

§5.05. Amphibians.
(a) Only the following amphibians may be taken under the authority of a sportfishing license, subject to the restrictions in this section. No amphibians may be taken from ecological reserves designated by the commission in Section 630 or from state parks, or national parks or monuments.
(b) Limit: The limit for each of the species listed below is four, unless otherwise provided. Limit, as used in this section, means daily bag and possession limit.
(1) ~~Pacific~~Coastal giant salamander (*Dicamptodon tenebrosus*)
(2) Rough-skinned newt (*Taricha granulosa*)
(3) Northwestern salamander (*Ambystoma gracile*)
(4) Black salamander (*Aneides flavipunctatus*), except Santa Cruz black salamander (*Aneides flavipunctatus niger*): See Special Closure (f)(1)
(5) Clouded salamander (*Aneides ferreus*)
(6) Wandering salamander (*Aneides vagrans*)
(~~6~~7) Arboreal salamander (*Aneides lugubris*)
(~~7~~8) California slender salamander (*Batrachoseps attenuatus*)
(~~8~~9) ~~Pacific~~Southern California slender salamander (*Batrachoseps ~~pacificus)~~major*), except desert slender salamander (*Batrachoseps major aridus*): See Special Closure (f)(2)
(~~9~~10) Dunn's salamander (*Plethodon dunni*)
(~~10~~11) Ensatina ~~salamander~~ (*Ensatina eschscholtzii*)
(~~11~~12) Western toad (~~*Bufo*~~*Anaxyrus* boreas)
(~~12~~13) Woodhouse's toad (~~*Bufo*~~*Anaxyrus woodhouseii*)
(~~13~~14) Red-spotted toad (~~*Bufo*~~*Anaxyrus punctatus*)
(~~14~~15) Great Plains toad (~~*Bufo*~~*Anaxyrus cognatus*)
(~~15~~16) Great Basin spadefoot ~~toad~~ (*Spea ~~(Scaphiopus)~~ intermontana*)
(~~16~~17) California ~~chorus~~ treefrog (*Pseudacris ~~(Hyla)~~ cadaverina*)
(~~17~~18) Pacific ~~chorus~~ treefrog (*Pseudacris ~~(Hyla)~~ regilla*)
(19) Baja California treefrog (*Pseudacris hypochondriaca)*
(20) Sierran treefrog (*Pseudacris sierra*)
(~~18~~21) Southern leopard frog (~~*Rana (Lithobates)*~~ *sphenocephalus*): Limit: No limit.
(~~19~~22) Rio Grande leopard frog (~~*Rana (Lithobates)*~~ *berlandieri*): Limit: No limit.
(~~20~~23) American ~~Bullfrog~~bullfrog (~~*Rana (Lithobates)*~~ *catesbeiana~~us~~us*): Limit: No limit
(c) Open season: All year. The season closures in Chapter 3 (District Trout and Salmon District General Regulations and Special Regulations) do not apply to fishing for amphibians with methods other than hook and line (see sections 7.00 and 7.50(a)(~~2~~3)).
(d) Hours: Amphibians may be taken at any time of day or night.
(e) Methods of take:
(1) Amphibians may be taken only by hand, hand-held dip net, or hook and line, except bullfrogs may also be taken by lights, spears, gigs, grabs, paddles, bow and arrow, or fishing tackle.
(2) It is unlawful to use any method or means of collecting that involves breaking apart

of rocks, granite flakes, logs, or other shelters in or under which amphibians may be found.
(f) Special closures:
(1) No black salamanders (*Aneides flavipunctatus*) may be taken in San Mateo, Santa Clara, and Santa Cruz counties.
(2) No Southern California slender salamanders (*Batrachoseps major*) may be taken from the Santa Rosa Mountains in Riverside County.
Note: Authority cited: Sections 200, 202, 205, 210, 219 and 220, Fish and Game Code. Reference: Sections 200, 201, 202, 203.1, 205 and 220, Fish and Game Code.

Section 5.20, Title 14, CCR, is amended as follows:

§5.20. Clams, Freshwater.
(a) Open season: All year, except for closures listed under special regulations.
(b) Limit: Fifty pounds (in the shell).
(c) Methods of take: Freshwater clams may be taken only by hand, or by spade, shovel, hoe, rake or other appliance operated by hand.
(d) The season closures in Chapter 3 (District Trout and Salmon Special Regulations) do not apply to freshwater Clam fishing (see sections 7.00 and 7.50(a)(~~2~~3)).
Note: Authority cited: Sections 200, 202, 205, 210, 219 and 220, Fish and Game Code. Reference: Sections 200-202, 203.1, 205-210 and 215-222, Fish and Game Code.

Section 5.35, Title 14, CCR, is amended as follows:

§5.35. Crayfish.
(a) Open season: All year, except for closures listed in subsection (d) of this Section.
(b) Limit: No limit.
(c) Methods of take: Crayfish may be taken only by hand, hook and line, dip net or with traps not over three feet in greatest dimension. Any other species taken shall be returned to the water immediately. Traps need not be closely attended.
(d) Closures for Protection of Shasta Crayfish: Fall River upstream of Spring Creek Bridge, Lava Creek, Tule River and all connected waters upstream of Little Tule River, Sucker Springs Creek, Crystal Lake, Rising River and Rising River Lake are closed to take and possession of crayfish. (See Section 4.30 for prohibition against crayfish use for bait in sections of the Pit River).
(e) The season closures in Chapter 3 (District Trout and Salmon Special Regulations) do not apply to crayfish fishing with methods other than hook and line (see sections 7.00 and 7.50(a)(~~2~~3)).
Note: Authority cited: Sections 200, 202, 205, 215 and 8491, Fish and Game Code. Reference: Sections 200, 202, 205, 206, 8490 and 8491, Fish and Game Code.

Section 5.40, Title 14, CCR, is amended as follows:

§5.40. Lamprey.
(a) Open season: All year, except for closures listed under district or special regulations.
(b) Limit: 5.
(c) Methods of take: Lamprey may be taken only by hand, hook and line, spear, bow and arrow fishing tackle, or dip net.
(d) The season closures in Chapter 3 (District Trout and Salmon Special Regulations) do not apply to lamprey fishing with methods other than hook and line (see sections 7.00 and 7.50(a)(~~2~~3)).
Note: Authority cited: Sections 200, 202 and 205, Fish and Game Code. Reference: Sections 200, 202 and 205, Fish and Game Code.

Section 5.60, Title 14, CCR, is amended as follows:

§5.60. Reptiles.
(a) Only the following reptiles may be taken under the authority of a sportfishing license, subject to the restrictions in this section. No sportfishing license is required for the sport take of any rattlesnake, but bag and possession limits do apply. No reptiles shall be taken from ecological reserves designated by the commission in Section 630 or from state parks, or national parks or monuments.
(b) Limit: The limit for each of the species listed below is two, unless otherwise provided. Limit, as used in this section, means daily bag and possession limit.
(1) Painted turtle (*Chrysemys picta*): Limit: No limit.
(2) Pond ~~Slider Turtle~~slider (~~*Pseudemys (*~~*Trachemys*~~*)*~~ *scripta*): Limit: No limit.
(3) Spiny softshell ~~turtle (*Trionyx (Apalone) spiniferus (spinifera)*~~(*Apalone spinifera*): Limit: No limit.
(4) Western banded gecko (*Coleonyx variegatus*), except San Diego banded gecko (*Coleonyx variegatus abbotti*): See Special Closure (f)(1)
(5) Desert iguana (*Dipsosaurus dorsalis*)
(6) Common chuckwalla (*Sauromalus* ~~*obesus (ater)*~~*ater*)
(7) Zebra-tailed lizard (*Callisaurus draconoides*)
(8) Desert spiny lizard (*Sceloporus magister*)
(9) Granite spiny lizard (*Sceloporus orcutti*)
(10) Western fence lizard (*Sceloporus occidentalis*): Limit: Species No. 10-14 have a limit of twenty-five (25) in the aggregate
(11) ~~Sagebrush~~Common sagebrush lizard (*Sceloporus graciosus*): Limit: Species No. 10-14 have a limit of twenty-five (25) in the aggregate
(12) ~~Side~~Common side-blotched lizard (*Uta stansburiana*): Limit: Species No. 10-14 have a limit of twenty-five (25) in the aggregate
(13) Western skink (~~*Eumeces*~~ *Plestiodon skiltonianus*): Limit: Species No. 10-14 have a limit of twenty-five (25) in the aggregate
(14) Desert night lizard (*Xantusia vigilis*), except Sierra night lizard (*Xantusia* (*vigilis*) *sierrae*): See Special Closure (f)(2): Limit: Species No. 10-14 have a limit of twenty-five (25) in the aggregate
(15) Long-tailed brush lizard (*Urosaurus graciosus*)

(16) ~~Tree~~Ornate tree lizard (*Urosaurus ornatus*)
(17) ~~Small-scaled~~Baja California brush lizard (*Urosaurus ~~microscutatus~~nigricaudus*)
(18) Desert horned lizard (*Phrynosoma platyrhinos*)
(19) ~~Short~~ Pygmy short-horned lizard (*Phrynosoma douglas~~s~~ii*)
(20) Great ~~basin~~Basin collared lizard (*Crotaphytus bicinctores*)
(21) ~~Banded~~Mearns' rock lizard (*Petrosaurus mearnsi*)
(22) Baja California collared lizard (*Crotaphytus vestigium*)
(23) Long-nosed leopard lizard (*Gambelia wislizenii*)
(24) Gilbert's skink (~~Eumeces (*Plestion*)~~ *Plestiodon gilberti*)
(25) ~~Western~~Tiger whiptail (~~*Cnemidophorus (Aspidoscelis)*~~ *Aspidoscelis tigris*)
(26) Southern alligator lizard (*Elgaria multicarinata*)
(27) Northern alligator lizard (*Elgaria coerulea*)
(28) ~~Rubber~~Northern rubber boa (*Charina bottae*)~~, except southern rubber boa (*Charina bottae umbratica*)~~: See Special Closure (f)(3)
(29) ~~Rosy~~Northern three-lined boa (*Lichanura ~~trivirgata~~orcutti*)
(30) ~~Ringneck~~Ring-necked snake (*Diadophis punctatus*), except Regal ring-necked snake (*Diadophis punctatus regalis*): See Special Closure (f)(4)
(31) ~~Sharp~~Common sharp-tailed snake~~s~~ (*Contia ~~spp.~~tenuis*)
(32) Forest sharp-tailed snake (*Contia longicauda*)
(~~32~~33) Spotted leaf-nosed snake (*Phyllorhynchus decurtatus*)
(~~33~~34) North American ~~Racer~~racer (*Coluber constrictor*)
(~~34~~35) Coachwhip (~~*Masticophis (Coluber)*~~ *Coluber flagellum*), except San Joaquin Coachwhip (*Coluber* (*Masticophis*) *flagellum ruddocki*): See Special Closure (f)(5)
(~~35~~36) Striped whipsnake (~~*Masticophis (Coluber)*~~*Coluber taeniatus*)
(~~36~~37) ~~California whipsnake (striped racer) (*Masticophis (Coluber)*~~Striped racer (*Coluber lateralis*), except Alameda striped racer (whipsnake) (*Coluber* (*Masticophis*) *lateralis euryxanthus*): See Special Closure (f)(6)
(~~37~~38) Western ~~(Desert)~~ patch-nosed snake (*Salvadora hexalepis*), except coast patch-nosed snake (*Salvadora hexalepis virgultea*): See Special Closure (f)(7)
(~~38~~39) Glossy snake (*Arizona elegans*), except California glossy snake (*Arizona elegans occidentalis*): See Special Closure (f)(8)
(~~39~~40) ~~Gopher snake~~Gophersnake (*Pituophis ~~melanoleucus~~catenifer*): Limit: Four (4)
(~~40~~41) ~~Common~~ California kingsnake (*Lampropeltis ~~getula~~californiae*): Limit: Four (4)
(~~41~~42) California mountain kingsnake (*Lampropeltis zonata*), except San Diego mountain kingsnake (*Lampropeltis zonata pulchra*) and San Bernardino mountain kingsnake (*Lampropeltis zonata parvirubra*): Limit: One (1). See Special Closure: (f)(9)
(~~42~~43) Long-nosed snake (*Rhinocheilus lecontei*)
(~~43~~44) Common ~~garter snake~~gartersnake (*Thamnophis sirtalis*), except San Francisco ~~garter snake~~gartersnake (*Thamnophis sirtalis tetrataenia*) and South Coast ~~garter snake~~gartersnake (*Thamnophis sirtalis* spp.): See Special Closure (f)(10)
(~~44~~45) Terrestrial ~~garter snake~~gartersnake (*Thamnophis elegans*)
(~~45~~46) ~~Western aquatic (~~Sierra~~)~~ ~~garter snake~~gartersnake (*Thamnophis couchii*)
(~~46~~47) ~~Pacific coast aquatic~~Aquatic ~~garter snake~~gartersnake (*Thamnophis atratus*)
(~~47~~48) Northwestern ~~garter snake~~gartersnake (*Thamnophis ordinoides*)
(~~48~~49) Checkered ~~garter snake~~gartersnake (*Thamnophis marcianus*)

(~~49~~50) ~~Variable~~ Western ~~ground snake~~groundsnake (*Sonora semiannulata*)
(~~50~~51) Western shovel-nosed snake (*Chionactis occipitalis*)
(~~51~~52) ~~California (~~Western~~)~~ black-headed snake (*Tantilla planiceps*)
(~~52~~53) ~~Southwestern (~~Smith's~~)~~ black-headed snake (*Tantilla hobartsmithi*)
(~~53~~54) Sonoran lyresnake~~Lyre snakes~~ (*Trimorphodon ~~biscutatus~~lambda*)
(55) California lyresnake (*Trimorphodon lyrophanes*)
(~~54~~56) Desert nightsnake ~~Night snakes~~ (*Hypsiglena ~~spp.~~chlorophaea*)
(57) Coast nightsnake (*Hypsiglena ochrorhyncha*)
(~~55~~58) Western ~~blind snake (Southwestern~~ threadsnake~~)~~ (~~*Leptotyphlops (*~~*Rena~~*)*~~ *humilis*)
(~~56~~59) Western ~~diamondback~~diamond-backed rattlesnake (*Crotalus atrox*)
(~~57~~60) ~~Mojave~~Mohave rattlesnake (*Crotalus scutulatus*)
(~~58~~61) Western rattlesnake~~s~~ (*Crotalus ~~viridus (~~oreganus~~)~~ ~~spp.~~*)
(~~59~~62) Speckled rattlesnake (*Crotalus mitchellii*)
(~~60~~63) Sidewinder~~s~~ (*Crotalus cerastes~~ spp.~~*)
(~~61~~64) Panamint rattlesnake (*Crotalus stephensi*)
(~~62~~65) Red diamond rattlesnake (*Crotalus ruber*): Limit: Zero (0)
(c) Open season: All year.
(d) Hours: Reptiles may be taken at any time of day or night.
(e) Methods of take:
(1) Reptiles may be taken only by hand, except as provided in subsections (e)(2) and (3) below, or by the following hand-operated devices:
(A) Lizard nooses.
(B) Snake tongs.
(C) Snake hooks.
(2) Rattlesnakes may be taken by any method.
(3) Turtles may be taken by hook and line. Fishing methods described in Section 2.00 apply to the take of spiny softshell turtles, slider turtles and painted turtles.
(4) It is unlawful to use any method or means of collecting that involves breaking apart of rocks, granite flakes, logs or other shelters in or under which reptiles may be found.
(f) Special Closures:
(1) No geckos (*Coleonyx variegatus*) may be taken in San Diego County south and west of Highway 79 to its junction with County Road S-2, and south and west of County Road S-2 to the eastern San Diego County border.
(2) No night lizards (*Xantusia vigilis*) may be taken in Kern County.
~~(2)~~(3) No rubber boas (*Charina bottae* or *Charina umbratica*) may be taken in Kern, Los Angeles, Riverside, and San Bernardino counties.
~~(3) No night lizards (*Xantusia vigilis*) may be taken in Kern County.~~
(4) No ~~ringneck~~ring-necked snakes (*Diadophis punctatus*) may be taken in San Bernardino ~~or~~and Inyo counties.
(5) No coachwhips (~~*Masticophis (Coluber)*~~ *flagellum*) may be taken in the following counties: Alameda, Contra Costa, Fresno, Kern, Kings, Merced, Monterey, San Benito, San Joaquin, San Luis Obispo, Santa Barbara, Stanislaus, and Tulare.
(6) No ~~California whipsnakes (~~striped racers~~)~~ (~~*Masticophis (Coluber)*~~ *lateralis*) may be taken in Alameda and Contra Costa counties.
(7) No ~~Western (desert)~~ patch-nosed snakes (*Salvadora hexalepis*) may be taken in the

following counties: Los Angeles, Orange, Riverside, San Bernardino, San Diego, San Luis Obispo, Santa Barbara, and Ventura.
(8) No glossy snakes (*Arizona elegans*) may be taken in the following counties: Alameda, Fresno, Imperial (west of Hwy 111), Kern, Los Angeles, Riverside (southwest of Hwy 111 and I-10), San Benito, San Bernardino (West of I-215 and Hwy 138), San Diego, San Joaquin, San Luis Obispo, Santa Barbara, Santa Clara and Tulare.
(9) No California mountain kingsnakes (*Lampropeltis zonata*) may be taken in Imperial, Los Angeles, Orange, Riverside, San Bernardino, San Diego, and Ventura counties.
(10) No common ~~garter snakes~~gartersnakes (*Thamnophis sirtalis*) may be taken in ~~Los Angeles.~~San Mateo, Los Angeles, Orange, Riverside, San Diego, and Ventura counties.
Note: Authority cited: Sections 200, 202, 205, 210, 219 and 220, Fish and Game Code. Reference: Sections 200, 201, 202, 203.1, 205 and 220, Fish and Game Code.

Section 7.00, Title 14, CCR, is amended as follows:

§7.00. District General Regulations.
Unless otherwise provided, waters shown as open to trout fishing in subsections (a) through (g) below, are open to fishing for other species. Gear restrictions listed in this section apply to the take of all species of fish unless otherwise noted. Every body of water listed in subsections (a) through (g) of Section 7.00 (below) is closed to all fishing, except during the open season as shown. Unless otherwise provided, waters closed to trout fishing are closed to fishing for all other species, except that these closures do not apply to fishing for amphibians (see Section 5.05), freshwater clams (see Section 5.20), crayfish (see Section 5.35), and lamprey (see Section 5.40), using legal fishing methods other than hook-and-line fishing, and saltwater clams, crabs, ghost shrimp, and blue mud shrimp (see Ocean Regulations Booklet Sections 29.20 to 29.87). Crabs may only be taken using hoop nets or by hand, and Dungeness crab may only be taken within the North Coast District and Sonoma and Mendocino counties.
Daily bag and possession limits, unless otherwise provided, mean the total number of trout~~ or landlocked salmon in combination~~. Unless otherwise provided, no more than one daily bag limit may be possessed. Coho (silver) salmon may not be taken in any of the waters of the State, except in Lake Oroville and Oroville-Thermalito Complex (Diversion Pool, Forebay, and Afterbay) and the Feather River from the Diversion Pool Dam to the Fish Barrier Dam. Incidentally hooked Coho (silver) salmon, except those in Lake Oroville and Oroville-Thermalito Complex (Diversion Pool, Forebay, and Afterbay) and the Feather River from the Diversion Pool Dam to the Fish Barrier Dam, must be immediately released unharmed to the waters where they are hooked. In waters where the bag limit for trout is zero, fish for which the bag limit is zero must be released unharmed, and should not be removed from the water.
These waters may also be subject to restrictions on fishing methods and gear (sections 2.00 through 2.45), fishing hours (section 3.00), and the use of bait (sections 4.00 through 4.30).

District/Water	*Open Season*	*Daily Bag and Possession Limit*
(a) North Coast District		
(1) All lakes and reservoirs except those listed by name in the Special Regulations.	All year.	5 trout per day. 10 trout in possession.
(2) Anadromous waters of the Klamath and Trinity River Systems, and those entering the ocean south of Humboldt Bay, which are not listed in the Special Regulations.	Closed to all fishing all year.	
(3) All anadromous waters tributary to Humboldt Bay, and north of Humboldt Bay, except those of the Klamath and Trinity river systems and those listed by name in the Special Regulations.	Fourth Saturday in May through Oct. 31. Only artificial lures with barbless hooks may be used.	2 hatchery trout or hatchery steelhead*. 4 hatchery trout or hatchery steelhead* in possession. Closed to the take of salmon.
(4) All streams except anadromous waters and those listed by name in the Special Regulations.	Last Saturday in Apr. through Nov. 15.	5 trout per day~~,~~. 10 trout in possession.

(NOTE: A list of the non-anadromous waters opened to trout fishing (STREAMS AND PORTIONS OF STREAMS NOT LISTED IN THE SPECIAL REGULATIONS THAT ARE OPEN TO TROUT FISHING FROM THE LAST SATURDAY IN APRIL THROUGH NOVEMBER 15 (New 6-12-98), which is incorporated by reference herein) is available from the Department's Region 1 Office, 601 Locust Street, Redding, CA 96001 (Telephone: (530) 225-2300).
(5) SPECIAL BROOK TROUT BONUS BAG AND POSSESSION LIMIT: UP TO 10 BROOK TROUT PER DAY LESS THAN 8 INCHES TOTAL LENGTH MAY BE TAKEN AND POSSESED IN ADDITION TO THE OTHER DAILY BAG AND POSSESSION LIMITS SPECIFIED FOR THE NORTH COAST DISTRICT

(b) Sierra District

(1) Anadromous waters of Tehama and Shasta counties not listed in the Special Regulations. (Section 7.50). (See subsections (b)(156) and (b)(156.5) of Section 7.50, regarding the Sacramento River.)	Last Saturday in Apr. through Nov. 15. Only artificial lures and barbless hooks may be used.	2 hatchery trout or hatchery steelhead*. 4 hatchery trout or hatchery steelhead* in possession. Closed to the take of salmon.
(2) All lakes and reservoirs except those in the Fall River Valley, those in Inyo and Mono counties and those listed by name in the Special Regulations.	All year.	5 trout per day. 10 trout in possession.
(3) All streams, lakes and reservoirs in Inyo and Mono counties, except those listed by name in the Special Regulations.	Last Saturday in Apr. through Nov. 15.	5 trout per day. 10 trout in possession.
(4) All streams, lakes and reservoirs in the Fall River Valley above the Pit No. 1 PG&E Diversion Dam on Fall Riverin Shasta County, except those listed by name in the Special Regulations.	Last Saturday in Apr. through Nov. 15.	2 trout
(5) All streams in Lassen and Modoc counties east of Highway 395 and north of Clarks Valley Road. Clarks Valley Road is defined as those portions of county routes 510, 512 and 506 running easterly from the town of Madeline to the Nevada border.	Saturday preceding Memorial Day through Nov. 15.	5 trout per day. 10 trout in possession.
(6) All other streams except those listed by name in the Special Regulations.	Last Saturday in Apr. through Nov. 15.	5 trout per day. 10 trout in possession.

(7) Mono County waters, when closed to trout fishing, are closed to all fishing, except for the unrestricted portions of Fish Slough which are open to fishing all year. Also, see Mono County waters listed in sections 5.00 and 7.50.

(8) SPECIAL BROOK TROUT BONUS BAG AND POSSESSION LIMIT:
(A) IN SIERRA DISTRICT WATERS OF SISKIYOU, SHASTA AND TEHAMA COUNTIES, UP TO 10 BROOK TROUT PER DAY LESS THAN 8 INCHES TOTAL LENGTH MAY BE TAKEN AND POSSESSED IN ADDITION TO THE OTHER DAILY BAG AND POSSESSION LIMITS SPECIFIED FOR THE SIERRA DISTRICT.
(B) IN THE SIERRA DISTRICT SOUTH OF INTERSTATE 80, UP TO 10 BROOK TROUT PER DAY LESS THAN 10 INCHES TOTAL LENGTH MAY BE TAKEN AND POSSESSED IN ADDITION TO THE OTHER DAILY BAG AND POSSESSION LIMITS SPECIFIED FOR THE SIERRA DISTRICT. THIS ALLOWANCE DOES NOT INCLUDE RED LAKE IN ALPINE COUNTY OR KIRMAN, LANE OR ROOSEVELT LAKES IN MONO COUNTY.

(c) North Central District		5 trout
(1) All lakes and reservoirs except those listed by name in the Special Regulations.	All year.	
(2) All streams except those listed by name in the Special Regulations.	Closed to all fishing all year.	
(3) The tidewaters of all streams except those listed by name in the Special Regulations. Note: Some waters within this district are tide waters regulated by regulations for the ocean and San Francisco Bay District (see sections 1.53 and 27.00)	All year Closed to all fishing all year.	
(d) Valley District		
(1) All lakes and reservoirs except those listed by name in the Special Regulations.	All year.	5 trout

(2) All anadromous waters except those listed by name in the Special Regulations (See definition of anadromous waters, Section 1.04).	All year.	2 hatchery trout or hatchery steelhead*. 4 hatchery trout or hatchery steelhead* in possession. Closed to the take of salmon.
(3) All streams except anadromous waters and those listed by name in the Special Regulations.	All year	5 trout
(e) South Central District (1) All lakes and reservoirs except those listed by name in the Special Regulations.	All year	5 trout
(2) That portion of any stream west of any Highway 1 bridge except those listed by name in the special regulations.	Dec. 1 through Mar. 7, but only on Sat., Sun., Wed., legal holidays and opening and closing days. Only barbless hooks may be used.	2 hatchery trout or hatchery steelhead*. 4 hatchery trout or hatchery steelhead* in possession. Closed to the take of salmon.
(3) All streams in Alameda, Contra Costa, and Santa Clara Counties except those listed by name in the Special Regulations.	Last Saturday in Apr. through Nov. 15	5 trout Closed to the take of salmon.
(4) All other streams and portions of streams except those listed in subsection (e)(2) above or by name in the Special Regulations.	Closed to all fishing all year	
(f) Southern District		
(1) All lakes and reservoirs except those listed by name in the Special Regulations.	All year.	5 trout

(2) All streams except anadromous waters in San Diego County, and except those listed by name in the Special Regulations.	All year. Only artificial lures with barbless hooks may be used.	2 trout
(3) All streams except anadromous waters in Los Angeles, Ventura, Santa Barbara, Orange, San Bernardino and Riverside Counties, and except those listed by name in the Special Regulations.	All year.	5 trout
(4) All anadromous waters except those listed by name in the Special Regulations (See definition of anadromous waters, Section 1.04)	Closed to all fishing all year.	
(5) All streams and tributaries (except those listed by name in the Special Regulations) above Twitchell Dam on the Cuyama River, above Bradbury Dam and below Gibraltar Dam on the San Ynez River; above Matilja Dam on Matilija Creek and above Wheeler Gorge Campground on NF Matilija Creek; and above Rindge Dam on Malibu Creek.	All year	5 trout
(g) Colorado River District		
(1) The Colorado River and its back waters	All year	10 trout
(2) All other waters	All year	5 trout

*Hatchery trout or steelhead have a healed adipose fin clip (adipose fin is absent). Unless otherwise provided, all other trout and steelhead must be immediately released. Wild trout or steelhead are those not showing a healed adipose fin clip (adipose fin present).
Note: Authority cited: Sections 200, 202, 205, 220 and 240, Fish and Game Code. Reference: Sections 200, 205 and 206, Fish and Game Code.

Section 7.50, Title 14, CCR, is amended as follows:

§7.50. Alphabetical List of Waters with Special Fishing Regulations.

(a) General Provisions:

(1) Every body of water listed below is closed to the take of salmon and salmon fishing, unless otherwise noted.

(2) Unless otherwise provided, waters shown as open to trout ~~and~~or salmon fishing below, are open to fishing for other species. Every body of water listed below is closed to all fishing except during the open season as shown. Gear restrictions listed in this section apply to the take of all species of fish unless otherwise noted.

(3) Unless otherwise provided, waters closed to trout ~~and~~or salmon fishing are closed to fishing for all other species, except that these closures do not apply to fishing for amphibians (see Section 5.05), freshwater clams (see Section 5.20), crayfish (see Section 5.35), and lamprey (see Section 5.40), using legal fishing methods other than hook-and-line fishing, and saltwater clams, crabs, ghost shrimp, and blue mud shrimp (see Ocean Regulations Booklet Sections 29.20 to 29.87). Crabs may only be taken using hoop nets or by hand, and Dungeness crab may only be taken within the North Coast District and Sonoma and Mendocino counties.

(4) Daily bag and possession limits, unless otherwise noted, mean the total number of ~~salmon or trout in combination~~trout.

(5) Unless otherwise provided, it is unlawful to possess more than one daily bag limit.

(6) These waters may also be subject to restrictions on fishing methods and gear (sections 2.00 through 2.40), fishing hours (section 3.00), and the use of bait (sections 4.00 through 4.30).

(b)

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(1) Alambique Creek (San Mateo Co.).	Last Saturday in Apr. through Nov. 15	5 trout
(1.5) Alameda Creek and tributaries (Alameda and Santa Clara cos.).		
(A) Alameda Creek and tributaries downstream of San Antonio, Calaveras, and Del Valle Reservoirs except for Arroyo Del Valle between Bernal Ave. and the Thiessen St. intersection with Vineyard Ave.	Closed to all fishing all year.	

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
1. Arroyo Del Valle between Bernal Ave. and the Thiessen St. intersection with Vineyard Ave.	All year. Only artificial lures with barbless hooks may be used.	0 trout
(B) Alameda Creek tributaries upstream of San Antonio, Calaveras, and Del Valle Reservoirs.	Last Saturday in Apr. through Nov. 15. Only artificial lures with barbless hooks may be used.	0 trout
(2) Albion River (Mendocino Co.). Also see Section 8.00(b).		
Main stem below the confluence of South Fork Albion.	Fourth Saturday in May through Mar. 31. Only artificial lures with barbless hooks may be used from the fourth Saturday in May through Oct 31. Only barbless hooks may be used from Nov. 1 through Mar. 31.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(3) Alder Creek (Mendocino Co.). Also see Section 8.00(b).		
Main stem below Tramway Gulch.	Fourth Saturday in May through Mar. 31. Only artificial lures with barbless hooks may be used from the fourth Saturday in May through Oct 31. Only barbless hooks may be used from Nov. 1 through Mar. 31.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(4) Almanor Lake tributaries (Lassen, Plumas and Shasta Cos.) upstream to the first lake.	Saturday preceding Memorial Day through Nov. 15	5 trout per day.10 trout in possession.

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(4.5) American River, North Fork, Middle Fork, South Fork and their tributaries above Folsom Lake (Placer, Eldorado, Amador, and Alpine cos.)	Last Saturday in Apr. through Nov. 15.	5 trout per day. 10 trout in possession.
	Nov. 16 through the Friday preceding the last Saturday in Apr. Only artificial lures with barbless hooks may be used.	0 trout
(5) American River (Sacramento Co.)		
(A) From Nimbus Dam to the Hazel Avenue bridge piers.	Jan. 1 through July 15.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
	July 16 through Dec. 31.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession. 2 Chinook salmon. 4 Chinook salmon in possession.
(B) From Hazel Avenue bridge piers to the U.S. Geological Survey gauging station cable crossing about 300 yards downstream from the Nimbus	Jan. 1 through July 15. Only barbless hooks may be used-.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
Hatchery fish rack site.	July 16 through Aug. 31. Only barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession. 2 Chinook salmon. 4 Chinook salmon in possession.
(C) From the U.S. Geological Survey gauging station cable crossing about 300 yards down- stream from the Nimbus Hatchery fish rack site to the SMUD power line crossing at the southwest boundary of Ancil Hoffman Park.	Jan. 1 through July 15. Only barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
	July 16 through Oct. 31. Only barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession. 2 Chinook salmon. 4 Chinook salmon in possession.
(D) From the SMUD power line crossing at the southwest boundary of Ancil Hoffman Park down- stream to the Jibboom Street bridge.	Jan. 1 through July 15.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
	July 16 through Dec. 31.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession. 2 Chinook salmon. 4 Chinook salmon in possession.
(E) From the Jibboom Street bridge to the mouth.	Jan. 1 through July 15.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
	July 16 through Dec. 16.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession. 2 Chinook salmon. 4 Chinook salmon in possession.
	Dec. 17 through Dec. 31.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(6) Antelope Creek (Tehama Co.).		

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(A) From confluence with North Fork downstream to U.S. Geological Survey gauging station cable crossing at mouth of Antelope Creek Canyon.	Last Saturday in April through Nov. 15. Only artificial lures with barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(B) From U.S. Geological Survey gauging station cable crossing at mouth of Antelope Creek Canyon downstream to mouth of Antelope Creek.	June 16 through September 30.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(6.5) Antelope Lake tributaries (Plumas Co.).	Saturday preceding Memorial Day through Nov. 15	5 trout per day. 10 trout in possession.
(7) Applegate River and tributaries (Siskiyou Co.).	Last Saturday in Apr. through Nov. 15	5 trout per day. 10 trout in possession.
(8) Aptos Creek (Santa Cruz Co.) from mouth to bridge on Aptos Creek Road. Also see Low-Flow Restrictions, Section 8.00(c)(4).	Dec. 1 through Mar. 7, but only on Sat., Sun., Wed., legal holidays and opening and closing days. Only barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(9) Arroyo de los Frijoles above Lake Lucerne (San Mateo Co.).	Last Saturday in Apr. through Nov. 15.	5 trout
(10) Arroyo Grande Creek (San Luis Obispo Co.).		

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(A) Above Lopez Reservoir.	Last Saturday in Apr. through Nov. 15.	5 trout~~, but only~~. 2 salmon.
(B) From mouth to Lopez Canyon Dam.	Closed to all fishing all year.	
(11) Arroyo Leon (San Mateo Co.).	Closed to all fishing all year.	
(12) Arroyo Seco River (Monterey Co.). Also see Section 8.00(c).		
(A) The main stem Arroyo Seco and tributaries above the waterfall located approximately 3.5 miles upstream from the U.S. Forest Service Ranger Station.	Last Saturday in Apr. through Nov. 15.	5 trout
(B) The main stem Arroyo Seco and tributaries below the waterfall located approximately 3.5 miles upstream from the U.S. Forest Service Ranger Station.	Dec. 1 through Mar. 7, but only on Sat., Sun., Wed., legal holidays and opening and closing days. Only barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(12.5) Auburn Ravine Creek and tributaries (Placer Co.) east of Nelson Lane.	Fourth Saturday in May through Oct. 15.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(13) Balm of Gilead Creek (Trinity Co.).	See Eel River 7.50(b)(63).	

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(13.5) Bass Lake (Siskiyou Co.).	Feb. 1 through Sept. 30.	5 trout
(14) Battle Creek (Shasta and Tehama Cos.).		
(A) From mouth to Coleman Fish Hatchery weir.	Closed to all fishing all year.	
(B) From 250 feet upstream from the Coleman National Fish Hatchery upstream to Angel Falls (near Mineral) on the South Fork and to Ponderosa Way Bridge on the North Fork.	Last Saturday in Apr. through Nov. 15. Only artificial lures with barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(15) Bear Creek and tributaries (Shasta and Siskiyou Cos.) between Pondosa Way bridge and confluence with Fall River.	Saturday preceding Memorial Day through Nov. 15	5 trout per day. 10 trout in possession.
(17) Bear Creek (San Bernardino Co.) from Big Bear Dam to confluence of Santa Ana River.	All year. Only artificial lures with barbless hooks may be used	2 trout
(18) Bear River (Humboldt Co.) downstream from County Road Bridge at Capetown, excluding tributaries.	Fourth Saturday in May through Mar. 31. Only artificial lures with barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(18.5) Bear River and tributaries (Placer Co.)		
(A) From Highway 20 south (downstream) 2.5 miles to the abandoned concrete dam (the Boardman Diversion Dam).	Last Saturday in Apr. through Nov. 15. Maximum size limit: 14 inches total length.	5 trout per day. 10 trout in possession.
(B) From Highway 65 to the South Sutter Irrigation District Diversion Dam.	Fourth Saturday in May through Oct. 15.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(19) Berryessa Lake tributaries (Lake and Napa Cos.).	Last Saturday in Apr. through Nov. 15	5 trout
(19.5) Big Bear Lake tributaries (San Bernardino Co.)	Saturday preceding Memorial Day through last day of Feb.	5 trout per day. 10 trout in possession.
(20) Big Chico Creek (Butte Co.).		
(A) From mouth to Bear Hole, located approximately one mile downstream from the upper end of Bidwell Park	June 16 through Feb. 15. Only artificial lures with barbless hooks may be used from Oct. 16 through Feb. 15.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(B) From Bear Hole to the upper boundary of the Big Chico Creek Ecological Reserve	Nov. 1 through April 30. Only artificial lures with barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(C) From the upper boundary of the Big Chico Creek Ecological Reserve to Higgins Hole Falls, located about one-half mile upstream from Ponderosa Way.	Closed to all fishing all year.	
(21) Big Lagoon (Humboldt Co.). For purposes of this regulation, the boundary between Big Lagoon and Maple Creek is the first private road bridge, located approximately 1/2 mile southeast of the Highway 101 bridge crossing.	All year. Only barbless hooks may be used. Cutthroat trout minimum size limit: 10 inches.	2 cutthroat trout. 2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(22) Big River (Mendocino Co.). Also see Section 8.00(b). Main stem below the confluence of Two Log Creek.	Fourth Saturday in May through Mar. 31. Only artificial lures with barbless hooks may be used from the fourth Saturday in May through Oct. 31. Only barbless hooks may be used from Nov. 1 through Mar. 31.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(23) Big Sur River (Monterey Co.).		
(A) Big Sur river and tributaries above the upstream end of the gorge pool at the boundary of Pfeiffer Big Sur State Park with the Ventana Wilderness Area.	Fourth Saturday in May through Oct. 31. Only artificial lures with barbless hooks may be used.	0 trout

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(B) Big Sur river within Pfeiffer Big Sur State Park, east of the Highway 1 bridge, to its boundary with the Ventana Wilderness Area.	Closed to fishing all year.	
(23.5) Big Tree Creek (Calaveras Co.) Within Calaveras Big Trees State Park (upstream of the Highway 4 culvert crossing).	Closed to all fishing all year.	
(24) Big Trees Creek (Tuolumne Co.) upstream from the confluence of Beaver Creek.	Closed to all fishing all year	
(25) Black Butte River and tributaries (Glenn Co.) except Cold Creek.	Closed to all fishing all year	
(25.3) Bodfish Creek and tributaries (Santa Clara Co.)	Closed to all fishing all year.	
(25.5) Boggy Creek (Fresno Co.) and tributaries (tributary to Thomas Edison Lake).	June 1 through October 15.	5 trout per day. 10 trout in possession.
(26) Bogus Creek (Siskiyou Co.).	See Klamath River 7.50(b)(91.1).	
(26.5) Bridgeport Reservoir Tributaries (Mono Co.).		

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
All Bridgeport Reservoir tributaries except Swauger Creek, from Bridgeport Reservoir upstream to Highway 395, and Swauger Creek, from Bridgeport Reservoir upstream to the private property fence line above the Forest Service campground.	Last Saturday in April through the Friday preceding Memorial Day and Oct. 1 through Nov. 15. Minimum size limit: 18 inches total length. Only artifical lures with barbless hooks may be used.	1 trout
	Saturday preceding Memorial Day through Sep. 30.	5 trout per day. 10 trout in possession.
(27) Brush Creek (Mendocino Co.). Also see Section 8.00(c).		
Main stem below the Lawson bridge.	Fourth Saturday in May through Mar. 31. Only artificial lures with barbless hooks may be used from the fourth Saturday in May through Oct. 31. Only barbless hooks may be used from Nov. 1 through Mar. 31.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(27.5) Bucks Lake	All year.	5 trout per day. 10 trout in possession. 10 landlocked salmon per day. 20 landlocked salmon in possession.
(28) Bucks Lake tributaries (Plumas Co.).	Saturday preceding Memorial Day through Sept. 30.	5 trout per day. 10 trout in possession.
(28.5) Burney Creek (Shasta Co.) from Burney Creek Falls downstream to Lake Britton.	Last Saturday in April through Nov. 15. Only artificial lures with barbless hooks may be used.	2 trout Maximum size limit: 14 inches total length.

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(29) Butano Creek (San Mateo Co.).		
(A) Above Butano Falls.	Last Saturday in Apr. through Nov. 15.	5 trout
(B) From mouth to county bridge on Pescadero-Bean Hollow Road. Also see Low- Flow Restrictions, Section 8.00(c)(2)	Dec. 1 through Mar. 7, but only on Sat., Sun., Wed., legal holidays and opening and closing days. Only barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(30) Butt Creek and Butt Valley Reservoir Powerhouse Outfall (Plumas Co.).		
(A) Butt Creek.	Saturday preceding Memorial Day through Nov. 15.	5 trout per day. 10 trout in possession.
(B) Butt Valley Reservoir powerhouse outfall, from the powerhouse, downstream to a marker adjacent to Ponderosa Flat Campground.	Saturday preceding Memorial Day through Feb. 28.	2 trout
(31) Butt Valley Reservoir (Plumas Co.).	All year	2 trout
(32) Butte Creek (Butte and Sutter Cos.).		

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(A) From the Oro-Chico Road bridge crossing south of Chico to the Centerville Head Dam, located 300 yards downstream from the DeSabla Powerhouse below DeSabla Reservoir.	November 15 through February 15. Only artificial lures with barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(B) From the Oro-Chico Road bridge crossing south of Chico to the point that Butte Creek enters the Sacramento River both via Butte Slough outfall gates at Moon's Bend and through Butte Slough, thence both the East and West Canals of the Sutter Bypass, thence Sacramento Slough.	All year	Open to fishing for non-salmonids only. Closed to the take of trout, and steelhead.
(33) By-Day Creek and tributaries (Mono Co.).	Closed to all fishing all year	
(34) Cache Creek and tributaries (Lake Co.).	Last Saturday in Apr. through Nov. 15	5 trout
(35) Calaveras River downstream from New Hogan Dam and the diverting canal (Mormon Slough) from Bellota Weir downstream to Interstate Highway 5 (Calaveras and San Joaquin cos.).	Fourth Saturday in May through Mar. 31. Only artificial lures with barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(35.5) Calleguas Creek and tributaries (Ventura Co.).	Saturday preceding Memorial Day through November 30. Only artificial lures with barbless hooks may be used.	Open to fishing for non-salmonids only. Closed to the take of trout and steelhead
(35.6) Canyon Creek upstream of the falls located about four miles north of the wilderness area boundary. (Trinity Co.)	Last Saturday in April through November 15.	2 trout
(35.7) Caribou Reservoir (Plumas County)	Last Saturday in Apr. through Nov. 15	2 trout
(36) Carmel River and tributaries above Los Padres Dam (Monterey Co.).	Last Saturday in Apr. through Nov. 15. No rainbow trout less than 10 inches or greater than 16 inches total length may be kept. Only artificial lures with barbless hooks may be used.	5~~,~~ trout, no more than 2 of which may be rainbow trout.
(37) Carmel River below Los Padres Dam. (Monterey Co.)		
(A) Carmel River tributaries below Los Padres Dam and main stem from Los Padres Dam to the bridge at Robles Del Rio/Esquiline roads (Rosie's Bridge).	Closed to all fishing all year.	
(B) Carmel River main stem below the bridge at Robles Del Rio/Esquiline roads (Rosie's Bridge). Also, see Section 8.00(c).	Dec. 1 through Mar. 7, but only on Sat., Sun., Wed., and opening and closing days. Only artificial lures with barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(38) Carson River, East Fork and tributaries (Alpine Co.).		
(A) Carson River, East Fork and tributaries above Carson Falls.	Closed to all fishing all year	
(B) Carson River, East Fork from Hangman's Bridge downstream to Nevada State Line.	All year. Only artificial lures with barbless hooks may be used.	0 trout
(39) Cassel Forebay (Hat Creek) (Shasta Co.)	See Hat Creek #1 7.50(b)(75).	
(39.3) Castle Creek (Shasta Co.)	Last Saturday in Apr. through Nov. 15. Only artificial lures with barbless hooks may be used.	0 trout
(39.5) Ceder Creek and tributaries upstream from Moon Lake access road (Lassen Co.).	Closed to all fishing all year	
(40) Chorro Creek (San Luis Obispo Co.) from the point that Chorro Creek enters Midway Marina in Morro Bay upstream to the twin bridges on South Bay Boulevard.	Dec. 1 through Mar. 7, but only on Sat., Sun., Wed., legal holidays and opening and closing days. Only barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(42) Clear Lake tributaries (Lake Co.).	Last Saturday in Apr. through Nov. 15	5 trout
(42.3) Codornices Creek (Alameda Co.).	Closed to all fishing all year	

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(42.5) Cold Creek (Fresno Co.) and tributaries (tributary to Thomas Edison Lake).	June 1 through October 15.	5 trout per day. 10 trout in possession.
(43) Convict Creek (Mono Co.).		
(A) Convict Creek, including side channels and meanders, in the U.C. study area as posted. This area begins about 1/2 mile above the Highway 395 bridge and extends upstream about 1/2 mile.	Closed to all fishing all year.	
(B) Convict Creek downstream of the U.C. study area.	Last Saturday in April through the Friday preceding Memorial Day and Oct. 1 through Nov. 15. Minimum size limit: 18 inches total length. Only artificial lures with barbless hooks may be used.	2 trout
	Saturday preceding Memorial Day through Sept. 30.	5 trout per day. 10 trout in possession.
(C) Convict Creek upstream of the U.C. study area.	Last Saturday in April through Nov. 15.	5 trout per day. 10 trout in possession.
(43.5) Coon Creek and tributaries (Placer Co.) east of Highway 65.	Fourth Saturday in May through Oct. 15.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(43.6) Coon Creek (San Luis Obispo Co.)	Closed to all fishing all year.	

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(44) Corral Valley Creek and tributaries (Alpine Co.).	Closed to all fishing all year	
(45) Corralitos Creek (Santa Cruz Co.) from mouth to Browns Valley Road. Also see Low-Flow Restrictions, Section 8.00(c)(5).	Dec. 1 through Mar. 7, but only on Sat., Sun., Wed., legal holidays and opening and closing days. Only barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(46) Cosumnes River (Sacramento Co.) from Highway 99 bridge upstream to the Latrobe vehicle bridge.	Jan. 1 through Oct. 15. Only barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(47) Cottoneva Creek (Mendocino Co.). Also see Section 8.00(b). Main stem below the confluence of South Fork Cottoneva Creek.	Fourth Saturday in May through Mar. 31. Only artificial lures with barbless hooks may be used from the fourth Saturday in May through Oct. 31. Only barbless hooks may be used from Nov. 1 through Mar. 31.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(48) Cottonwood Creek (Inyo Co.).		
(A) Cottonwood Creek main stem between mouth of Little Cotton-wood Creek and South Fork of Cottonwood Creek.	July 1 through Nov. 15. Only artificial lures with barbless hooks may be used	0 trout
(B) Cottonwood Creek (1) and tributaries upstream from the confluence of South Fork,	July 1 through Nov. 15. Only artificial lures with barbless hooks may be used	5 trout

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(2) Little Cottonwood Creek and tributaries, (3) the South Fork of Cottonwood Creek and tributaries, and (4) the unnamed tributary flowing through Horseshoe Meadow.		
(49) Cottonwood Creek drainage lakes (Inyo Co.).		
(A) Cottonwood Lakes 1, 2, 3 and 4 and their tributaries (Inyo Co.).	July 1 through Nov. 15. Only artificial lures with barbless hooks may be used.	0 trout
(B) All remaining Cottonwood Creek drainage lakes.	July 1 through Nov. 15. Only artificial lures with barbless hooks may be used	5 trout
(49.5) Cottonwood Creek and tributaries (Modoc Co.).	Saturday preceding Memorial Day through Nov. 15. Only artificial lures with barbless hooks may be used.	0 trout
(50) Cottonwood Creek, North Fork and tributaries (White Mountains, Mono Co.).	Closed to all fishing all year	
(50.5) Cow Creek and tributaries upstream from Forest Service road 9S10 (Fresno Co.).	Closed to all fishing all year	
(50.8) Coyote Creek (Santa Clara Co.) Also see Low-Flow Restrictions, Section 8.00(c)(1).	Last Saturday in April through November 15. Only artificial lures and barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(51) Coyote Valley Creek and tributaries (Alpine Co.).	Closed to all fishing all year	
(52) Crooked Creek (Mono Co.).		
(A) Crooked Creek below the City of Los Angeles gauging station.	Closed to all fishing all year.	
(B) Crooked Creek and tributaries above the Los Angeles gauging station.	Last Saturday in April through Nov. 15. Only artificial lures with barbless hooks may be used.	0 trout
(53) Crowley Lake (Mono Co.). (See individual listings for regulations on tributary waters which include: Convict, Crooked, Hilton, Hot, McGee, and Whiskey creeks and the upper Owens River).		
(A) Crowley Lake within 1,800 feet of the outlet dam (this area is marked with a series of buoys).	Closed to all fishing all year for safety purposes.	
(B) Crowley Lake, except for the closed area near the outlet dam (see above).	Last Saturday in Apr. through July 31.	5 trout per day. 10 trout in possession.
	Aug. 1 through Nov. 15. Minimum size limit:18 inches total length. Only artificial lures with barbless hooks may be used.	2 trout

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(53.5) Davis Creek and tributaries (Modoc Co.).	Saturday preceding Memorial Day through November 15. Only artificial lures with barbless hooks may be used.	0 trout
(54) Davis Lake tributaries (Plumas Co.).	Saturday preceding Memorial Day through Nov. 15.	5 trout per day. 10 trout in possession.
(54.5) Deadman Creek (Mono Co.).		
(A) Deadman Creek downstream from Hwy. 395. See Owens River 7.50(b)(134).	Last Saturday in April through Nov. 15. Maximum size limit: 16 inches total length. Only artificial lures with barbless hooks may be used.	2 trout
	Nov. 16 through the Friday preceding the last Saturday in Apr. Only artificial lures with barbless hooks may be used.	0 trout
(B) Deadman Creek upstream from Hwy. 395.	Last Saturday in April through Nov. 15.	5 trout per day. 10 trout in possession.
(55) Deep Creek (San Bernardino Co.) from headwaters at Little Green Valley to confluence of Willow Creek	All year. Only artificial lures with barbless hooks may be used	2 trout
(56) Deer Creek (Tehama Co.).		

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(A) From 250 feet below Upper Deer Creek Falls and fishway (located 1.5 miles upstream from Potato Patch Campground) downstream 31 miles to U.S. Geological Survey gauging station cable crossing at mouth of Deer Creek Canyon (see Section 2.35 for closure at Upper Deer Creek Falls).	Last Saturday in April through Nov. 15. Only artificial lures with barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(B) From U.S. Geological Survey gauging station cable crossing at mouth of Deer Creek Canyon downstream to mouth of Deer Creek.	June 16 through Sept. 30.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(57) Deer Creek (Yuba and Nevada Cos.) from mouth to Smartville- Englebright Dam road crossing.	Fourth Saturday in May through Oct. 15. Only artificial lures with barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(58) Diaz Lake (Inyo Co.).	First Saturday in Mar. through Nov. 15.	5 trout per day. 10 trout in possession.
	Nov. 16 through the Friday preceding the first Saturday in Mar.	5 trout
(59) [Reserved]		

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(59.5) Dry Creek and tributaries (Placer Co.) east of the Atkinson Street Bridge in Roseville.	Fourth Saturday in May through Oct. 15.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(60) Dry Creek (Yuba and Nevada Co.) from mouth to Sid Smith Dam about one mile above junction of Scott Forbes and Peoria roads.	Fourth Saturday in May through Oct. 15.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(61) Eagle Lake and tributaries (Lassen Co.).		
(A) Eagle Lake.	Saturday preceding Memorial Day through Dec. 31.	2 trout per day. 4 trout in possession.
(B) Eagle Lake inside the break-water at the Gallatin Marina and Pine Creek Slough and Pine Creek below State Highway 44.	Closed to all fishing all year	
(C) Eagle Lake tributaries, including Pine Creek above State Hwy. 44.	Saturday preceding Memorial Day through Nov. 15.	5 trout per day. 10 trout in possession.
(61.5) Earl Lake/Talawa (Del Norte Co.).	All year. Only barbless hooks may be used. Cutthroat trout minimum size limit: 10 inches.	2 cutthroat trout. 2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
~~(62) Eastman Lake (Madera and Mariposa cos.).~~	~~Also see Section 5.00 (Black Bass).~~	
~~(A) From the United States Corps of Engineers' buoy line 1000 feet south of the Raymond Bridge (Ben Hur Road) downstream to the United States Corps of Engineers' buoy line near the Codorniz boat ramp.~~	~~Aug. 1 through Nov. 30.~~	~~5~~
~~(B) From the United States Corps of Engineers' buoy line near the Codorniz boat ramp downstream to the dam.~~	~~All year.~~	~~5~~
(62.5) Edson Creek and all tributaries (Siskiyou Co.).	See McCloud River 7.50(b)(115).	
(63) Eel River (Humboldt, Lake, Mendocino and Trinity cos.).	Low-Flow Restrictions, Section 8.00, also apply, see below for more detail.	

ALL WATERS OF THE EEL RIVER DRAINAGE EXCEPT THOSE LISTED BELOW ARE CLOSED TO ALL FISHING.

(A) Main stem.

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
1. From mouth to Fulmor Road, at its paved junction with the south bank of the Eel River.	All year. Only artificial lures with barbless hooks may be used from April 1 through the Friday preceding the fourth Saturday in May. Only barbless hooks may be used from fourth Saturday in May through Mar. 31.	Catch and Release of Chinook salmon. 2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
2. From Fulmor Road, at its paved junction with the south bank of the Eel River, to South Fork Eel River. Also see Low-Flow Restrictions, Section 8.00(a)(1).	All year. Only artificial lures with barbless hooks may be used from Apr. 1 through Sept. 30. Only barbless hooks may be used from Oct. 1 through Mar. 31.	Catch and Release of Chinook salmon. 2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
3. From South Fork Eel River to Cape Horn Dam. (See also Pillsbury Lake tributaries (7.50(b)(138).	Jan. 1 through Mar. 31 and Fourth Saturday in May through Sept. 30. Only artificial lures with barbless hooks may be used.	Catch and Release of Chinook salmon. 2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
	Apr. 1 through the Fourth Friday in May and Oct. 1 through Dec. 31.	Closed to all fishing.
(B) Van Duzen River.		
1. Main stem and tributaries above Eaton Falls, located about 1/2 mile upstream of the mouth of the South Fork (Little Van Duzen) and 2 1/2 miles west of Dinsmore.	Last Saturday in Apr. through Nov. 15.	5 trout

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
2. Main stem from its junction with the Eel River to the end of Golden Gate Drive near Bridgeville (approximately 4,000 feet upstream from the Little Golden Gate Bridge). Also see Low-Flow Restrictions, Section 8.00(a)(3).	Fourth Saturday in May through Mar. 31. Only artificial lures with barbless hooks may be used from the fourth Saturday in May through Sept. 30. Only barbless hooks may be used from Oct. 1 through Mar. 31.	Catch and Release of Chinook salmon. 2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
	Apr. 1 to Fourth Friday in May.	Closed to all fishing
(C) South Fork Eel River from mouth to Rattlesnake Creek. Also see Low-Flow Restrictions, Section 8.00(a)(2).	Fourth Saturday in May through Mar. 31. Only artificial lures with barbless hooks may be used from the fourth Saturday in May through Sept. 30. Only barbless hooks may be used from Oct. 1 through Mar. 31.	Catch and Release of Chinook salmon. 2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
	Apr. 1 to Fourth Friday in May.	Closed to all fishing
(D) Middle Fork Eel River.		
1. Middle Fork main stem from mouth to Bar Creek. Also see Low-Flow Restrictions, Section 8.00(a)(2).	Jan. 1 through May 31 and July 16 through Sept. 30. At all times, only artificial lures with barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
	Jun. 1 through July 15 and Oct. through Dec. 31.	Closed to all fishing
2. Middle Fork tributaries above Indian Dick/Eel River Ranger Station Road	Last Saturday in Apr. through Nov.15. Maximum size limit:14 inches total length.	5 trout

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
3. Middle Fork and tributaries above mouth of Uhl Creek.	Last Saturday in Apr. through Nov. 15. Maximum size limit:14 inches total length. Only artificial lures with barbless hooks may be used.	2 trout
4. Balm of Gilead Creek and tributaries above falls 1 1/4 miles from mouth.	Last Saturday in Apr. through Nov. 15. Maximum size limit: 14 inches total length. Only artificial lures with barbless hooks may be used.	2 trout
5. North Fork of Middle Fork and tributaries above mouth of Willow Creek.	Last Saturday in Apr. through Nov. 15. Maximum size limit: 14 inches total length. Only artificial lures with barbless hooks may be used.	2 trout
(64) El Estero Lake (Monterey Co.) portions of the lake south of the Pearl Street bridge known as Camino Aquajito Arm and Camino El Estero finger.	Closed to all fishing all year	
(65) Elk Creek (Mendocino Co.). Also see Section 8.00(b). Main stem below the confluence of South Fork Elk Creek.	Fourth Saturday in May through Mar. 31. Only artificial lures with barbless hooks may be used from the fourth Saturday in May through Oct. 31. Only barbless hooks may be used from Nov. 1 through Mar. 31.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(66) Elk River (Humboldt Co.) downstream from Highway 101 bridge, excluding tributaries.	Fourth Saturday in May through Mar. 31. Only artificial lures with barbless hooks may be used from the fourth Saturday in May through Oct. 31. Only barbless hooks may be used from Oct. 1 through Mar. 31.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or 4 hatchery steelhead** in possession.
(67) Fall River (Shasta Co.).		

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(A) Fall River from its origin at Thousand Springs downstream to the mouth of the Tule River and including Spring Creek and excluding all other tributaries.	Last Saturday in Apr. through Nov. 15. Maximum size limit:14 inches total length. Only artificial lures with barbless hooks may be used.	2 trout
(68) Feather River below Fish Barrier Dam (Butte, Sutter and Yuba cos.).		
(A) From Fish Barrier Dam to Table Mountain bicycle bridge in Oroville.	Closed to all fishing all year	
(B) From Table Mountain bicycle bridge to Highway 70 bridge.	Jan. 1 through July 15. Only barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(C) From Highway 70 bridge to the unimproved boat ramp above the Thermalito Afterbay Outfall.	All year.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(D) From the unimproved boat ramp above the Thermalito Afterbay Outfall to 200 yards above the Live Oak boat ramp.	Jan. 1 through July 15	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
	July 16 through Oct. 15.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession. 2 Chinook salmon. 4 Chinook salmon in possession.
	Oct. 16 through Dec. 31.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(E) From 200 yards above Live Oak boat ramp to the mouth. For purposes of this regulation, the lower boundary is defined as a straight line drawn from the peninsula point on the west bank to the Verona Marine boat ramp.	Jan. 1 through July 15.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
	July 16 through Dec. 16.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession. 2 Chinook Salmon. 4 Chinook salmon in possession.

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
	Dec. 17 to Dec. 31.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(68.1) Feather River, Middle Fork (Plumas Co.), from the Union Pacific Railroad Bridge (1/4 mile upstream of County A-23 bridge) to the Mohawk Bridge.	First Saturday in April through Nov. 15.	5 trout per day. 10 trout in possession.
(68.2) Feather River North Fork from Belden Bridge downstream to Cresta Powerhouse (excluding reservoirs) (Butte and Plumas Co.).	Last Saturday in Apr. through Nov. 15. Only artificial lures with barbless hooks may be used.	0 trout
(68.3) Fish Slough (Mono Co.).		
(A) The portions of Fish Slough which lie within the Owens Valley Native Fishes Sanctuary and BLM Spring.	Closed to all fishing all year.	
(B) All other portions of Fish Slough. Also, see Section 5.00(b)(16) for black bass regulations.	Last Saturday in Apr. through Nov. 15.	5 trout
preceding the last Saturday in Apr.	Nov. 16 through the Friday	0 trout

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(69) Freshwater Creek (Humboldt Co.) downstream from bridge at “3 Corners” on the Old Arcata Road, excluding tributaries.	Fourth Saturday in May through Mar. 31. Only artificial lures with barbless hooks may be used from the fourth Saturday in May through Oct. 31. Only barbless hooks may be used from Nov. 1 through Mar. 31.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(69.5) Freshwater Lagoon (Humboldt Co.).	All year.	5 trout per day. 10 trout in possession.
(70) Garcia River (Mendocino Co.). Also see Section 8.00(b). Main stem below the Eureka Hill Road bridge.	Fourth Saturday in May through Mar. 31. Only artificial lures with barbless hooks may be used from the fourth Saturday in May through Oct. 31. Only barbless hooks may be used from Nov. 1 through Mar. 31.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(71) Golden Trout Wilderness Area (Tulare Co.), excluding the main stem Kern River (see subsection 7.50(b)(86), and the Tule River drainage (See subsection 7.50(b)(197)).	Last Saturday in Apr. through Nov. 15. Only artificial lures with barbless hooks may be used.	5 trout
(71.5) Grass Valley Creek Reservoir (Trinity Co.)	All year. Only artificial lures with barbless hooks may be used.	2 trout.
(72) Greenwood Creek (Mendocino Co.). Also see Section 8.00(b).		

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
Main stem below the log bridge about 1 1/2 miles east of Highway 1.	Fourth Saturday in May through Mar. 31. Only artificial lures with barbless hooks may be used from the fourth Saturday in May through Oct. 31. Only barbless hooks may be used from Nov. 1 through Mar. 31.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(72.5) Guadalupe River below Guadalupe Reservoir (Santa Clara Co.) including Los Gatos Ck. Below Vasona Lake, and Alamitos Ck. and Arroyo Calero below Calero Reservoir.	Last Saturday in April through November 15. Only artificial lures and barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(73) Gualala River (Mendocino and Sonoma cos.). Also see Section 8.00(b). Main stem below the confluence of Wheatfield and South Forks.	Fourth Saturday in May through Mar. 31. Only artificial lures with barbless hooks may be used from the fourth Saturday in May through Oct. 31. Only barbless hooks may be used from Nov. 1 through Mar. 31. Fishing from a flotation device is prohibited from Nov. 15 through Feb. 28 from the confluence of the North Fork to the Highway 1 bridge.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(74) Hat Creek (Shasta Co.) from Lake Britton upstream to Baum Lake, exclusive of the concrete Hat No. 2 intake canal between Baum Lake and the Hat No. 2 Powerhouse.	Last Saturday in Apr. through Nov.15. Minimum size limit:18 inches total length. Only artificial lures with barbless hooks may be used. Aquatic invertebrates of the orders Plecoptera (stoneflies), Ephemeroptera (mayflies) and Trichoptera (caddisflies) may not be taken or possessed	2 trout.

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(75) Hat Creek No.1 and Cassel Forebays (Shasta Co.). Those portions of Hat Creek known as No. 1 Forebay and Cassel Forebay.	Last Saturday in Apr. through Nov. 15	5 trout per day. 10 trout in possession.
(76) Heenan Lake and tributaries (Alpine Co.).		
(A) Heenan Lake.	Only on Fridays, Saturdays, and Sundays from the Friday before Labor Day through the last Sunday in October. Fishing hours: Only from sunrise to sunset. Only artificial lures with barbless hooks may be used.	0 trout
(B) Heenan Lake tributaries.	Closed to all fishing all year.	
(77) Hennessey Lake tributaries (Napa Co.).	Last Saturday in Apr. through Nov. 15	5 trout
(77.3) Hilton Creek (Mono Co.).		
(A) Hilton Creek downstream from Crowley Lake Drive.	Last Saturday in April through the Friday preceding Memorial Day and Oct. 1 through Nov. 15. Minimum size limit: 18 inches total length. Only artificial lures with barbless hooks may be used.	2 trout
	Saturday preceding Memorial. Day through Sept. 30.	5 trout per day. 10 trout in possession.
(B) Hilton Creek upstream from Crowley Lake Drive.	Last Saturday in April through Nov. 15.	5 trout per day. 10 trout in possession.

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(77.5) Hobart Creek (Tuolumne Co.), tributary to Spicer Meadows Reservoir.	July 1 through Nov. 15.	5 trout per day~~,~~ . 10 trout in possession.
(78) Hot Creek (Mono Co.). Hot Creek from the State hatchery property line to the confluence with the Owens River.	All year. Only artificial flies with barbless hooks may be used	0 trout
(79) Illinois River and tributaries (Del Norte Co.).	Closed to fishing all year.	
(80) Independence Lake and tributaries (Nevada and Sierra Cos.).	NOTE: ALL LAHONTAN CUTTHROAT TROUT TAKEN SHALL BE IMMEDIATELY RETURNED TO THE WATER	
(A) Independence Lake tributaries and Independence Lake within 300 feet of the mouths of all tributaries.	Closed to all fishing all year	
(B) Independence Lake except Independence Lake within 300 feet of the mouths of all tributaries.	All year Only artificial lures with barbless hooks may be used	5 trout per day. 10 trout in possession.
(81) Indian Tom Lake (Siskiyou Co.).	All year	2 trout

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(82) Inyo County, Southwestern Portion, in all waters bounded by the Inyo County line on the south and west, Independence Creek on the north (open to fishing), and Highway 395 on the east (also see Cottonwood Creek and Diaz Lake Restrictions.)	First Sat. in March through Nov. 15.	5 trout per day. 10 trout in possession.
(83) Islay Creek (San Luis Obispo Co.).	Closed to all fishing all year	
(84) Junction Lake and tributaries (Mono Co.) including the lake's outlet stream to Highway 108.	Closed to all fishing all year	
(84.5) Kaweah River and tributaries (Tulare Co.).	All year.	5 trout per day. 10 trout in possession.
(85) Kent Lake tributaries (Marin Co.).	Last Saturday in Apr. through Nov. 15	5 trout
(86) Kern River (Kern and Tulare Cos.).		
(A) From Lake Isabella to the Johnsondale bridge.	All year.	5 trout per day. 10 trout in possession.
(B) From Johnsondale bridge upstream to the point where U.S. Forest Service Trail 33E30 heads east to joint the Rincon Trail.	Last Saturday in Apr. through Nov. 15. Minimum size limit:14 inches total length. Only artificial lures with barbless hooks may be used.	2 trout
	Nov. 16 through the Friday preceding the last Saturday in Apr. Only artificial lures with barbless hooks may be used.	0 trout

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(C) From the point where U.S. Forest Service Trail 33E30 heads east to join the Rincon Trail upstream to the mouth of Tyndall Creek.	Last Saturday in Apr. through Nov. 15. Maximum size limit: 10 inches total length for rainbow trout only. Only artificial lures with barbless hooks may be used.	2 trout
(87) Kings River (Fresno Co.).		
(A) Kings River, South Fork from its confluence with Copper Creek downstream to the Highway 180 crossing at Boyden Cave.	All year.	
(B) Kings River South Fork, from the Highway 180 crossing at Boyden Cave downstream to the main stem; Middle Fork, from the western boundary of Kings Canyon National Park downstream to the main stem; and main stem, from the confluence of the South and Middle forks downstream to Garnet Dike Campground.	All year. Only artificial lures with barbless hooks may be used.	0 trout
(C) Kings River, from Garnet Dike Campground downstream to Pine Flat Lake.	All year.	2 trout

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(D) Kings River from Pine Flat Dam downstream to U. S. Army Corps of Engineers Bridge on Pine Flat Road.	Last Saturday in Apr. through Nov. 15.	5 trout
(E) Kings River Thorburn Spawning Channel, the 2,200 foot long channel located 5 miles downstream from Pine Flat Dam, and the reach of river within a 200-foot radius of the channel exit.	Closed to all fishing all year.	
(F) Kings River, from Cobbles (Alta) Weir downstream to the Highway 180 crossing.	All year. Only artificial lures with barbless hooks may be used.	0 trout
(88) Reserved.		
(89) Kirman (Carmen) Lake (Mono Co.).	Last Saturday in Apr. through Nov. 15. Minimum size limit: 16 inches total length. Only artificial lures with barbless hooks may be use	2 trout
(90) Kirman (Carmen) Lake tributaries (Mono Co.).	Closed to all fishing all year	
(91) Klamath River Regulations (See Section 1.74 for salmon punch card requirements.		

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(A) Klamath River main stem and all tributaries above Iron Gate Dam, except Shovel Creek and tributaries. The Klamath River main stem within 250 feet of the mouth of Shovel Creek is closed to all fishing November 16 through June 15.	Last Saturday in Apr. through Nov. 15	5 trout per day. 10 trout in possession.
(B) Shovel Creek and tributaries above mouth of Panther Creek.	Last Saturday in Apr. through Nov. 15.	5 trout
(C) Shovel Creek and tributaries up to and including Panther Creek.	Closed to all fishing all year	

. . . [No changes to subsection (b)(91.1)]

(92) Klopp Lake (Humboldt Co.).	All year. Only artificial lures with barbless hooks may be used	2 trout
(93) Laguna de Santa Rosa (Sonoma Co. tributary to Russian River) upstream from Guerneville Road bridge.	Last Saturday in Apr. through Nov. 15.	Open to fishing for non- salmonids only. Closed to the take of trout, and steelhead.
(95) Lagunitas Creek and tributaries (Marin Co).	Closed to all fishing all year	
(96) Lagunitas Lake (Marin Co.).	All year. Maximum size limit: 14 inches total length. Only artificial lures with barbless hooks may be used	2 trout

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(96.5) Lane Lake (Mono Co.).	Last Saturday in Apr. through Nov. 15.	2 trout
~~(97) Las Garzas Creek and tributaries above Robinson Canyon Road (Monterey Co.).~~	~~Fourth Saturday in May through Oct. 31. Only artificial lures with barbless hooks may be used.~~	~~0~~
(98) Lassen Creek and tributaries (Modoc Co.)	Saturday preceding Memorial Day through Nov. 15. Only artificial lures with barbless hooks may be used.	0 trout
(98.5) Laurel Lakes and tributaries (Mono Co.)	Last Saturday in Apr. through Nov. 15. Minimum size limit: 14 inches total length. Only artificial lures with barbless hooks may be used	2 trout
(98.6) Lee Vining Creek from the Lee Vining conduit downstream to Mono Lake (Mono Co.)	Last Saturday in Apr. through Nov. 15.	2 trout
(99) Limekiln Creek and tributaries above Highway 1 (Monterey Co.). Also see Low-Flow Restrictions, Section 8.00(c)(9).	Dec. 1 through Mar. 7, but only on Sat., Sun., Wed., legal holidays and opening and closing days. Only barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(100) Little Butano Creek above the diversion dam at Butano State Park (San Mateo Co.).	Last Saturday in Apr. through Nov. 15	5 trout
(101) Little Cottonwood Creek and tributaries (Inyo Co.).	See Cottonwood Creek 7.50(b)(48).	

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(102) Little River (Humboldt Co.) downstream from the County Road bridge at Crannell, excluding tributaries.	Fourth Saturday in May through Mar. 31. Cutthroat trout minimum size limit: 10 inches total length. Only artificial lures with barbless hooks may be used from the fourth Saturday in May through Oct. 31. Only barbless hooks may be used from Nov. 1 through Mar. 31.	2 cutthroat trout. 2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(103) Little Sur River and tributaries above Coast Road (Monterey Co.).	Fourth Saturday in May through Oct. 31. Only artificial lures with barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(103.5) Little Truckee River (Sierra and Nevada cos.) from Stampede Reservoir Dam Downstream to Boca Reservoir.	Last Saturday in Apr. through Nov. 15. Maximum size limit: 14 inches total length. Only artificial lures with barbless hooks may be used.	2 trout
	Nov. 16 through the Friday preceding the last Saturday in Apr. Only artificial lures with barbless hooks may be used.	0 trout
(104) Llagas Creek (Santa Clara Co.). Also see Low-Flow Restrictions, Section 8.00(c)(5).		
(A) From mouth to Monterey Highway Bridge.	Dec. 1 through Mar. 7, but only on Sat., Sun., Wed., legal holidays and opening and closing days. Only barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(B) From Monterey Highway Bridge to Chesbro Dam.	Closed to all fishing all year	

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(104.3) Los Angeles Aqueduct from Owens River to Alabama Gates (Inyo County).	First Saturday in Mar. through Nov. 15.	5 trout per day. 10 trout in possession.
	Nov. 16 through the Friday preceding the first Saturday in Mar.	5 trout
(104.5) Los Osos Creek (San Luis Obispo Co.).	Closed to all fishing all year.	
(105) Los Padres Reservoir (Monterey Co.).	Last Saturday in Apr. through Nov. 15. ~~No rainbow trout less than 10 inches or greater than 16 inches total length may be kept.~~ Only artificial lures with barbless hooks may be used.	~~5 trout, no more than 2 of which may be rainbow trout.~~ 5 brown trout. 0 rainbow trout.
(106) Macklin Creek (Nevada Co.), arising near Milton-Bowman Tunnel alignment, flowing north- westerly and having its junction with the Middle Fork Yuba River about 2 1/4 miles downstream from Milton Reservoir.	Closed to all fishing all year	
(107) Mad River and tributaries (Humboldt Co.).		
(A) Mad River from the mouth to 200 yards upstream.	Jan. 1 through Mar. 31. Only artificial lures with barbless hooks may be used.	2 hatchery trout or hatchery steelhead.~~**~~ **. 4 hatchery trout or hatchery steelhead** in possession.

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(B) Mad River main stem, from 200 yards above its mouth upstream to the confluence with Cowan Creek, excluding tributaries. Also see Low-Flow Restrictions, Section 8.00(a)(4).	Fourth Saturday in May through Mar. 31. Only artificial lures with barbless hooks may be used from the fourth Saturday in May through Oct. 31. Only barbless hooks may be used from Nov. 1 through Mar. 31.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(C) Mad River main stem, from the confluence with Cowan Creek to the confluence with Deer Creek, excluding tributaries.	Closed to all fishing all year.	
(D) Mad River main stem from the confluence with Deer Creek to Ruth Dam.	Fourth Saturday in May through Oct. 31. Only artificial lures with barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(E) Mad River and tributaries above Ruth Dam.	Last Saturday in May through Nov. 15.	5 trout per day. 10 trout in possession.
(109) Mammoth Pool (Fresno and Madera cos.).	June 16 through Apr. 30.	5 trout per day. 10 trout in possession.
(110) Mammoth Pool tributaries (Fresno and Madera Cos.) from their mouths to a point 300 feet upstream.	June 16 through Nov. 15	5 trout per day. 10 trout in possession.

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(111) Martis Creek from the Martis Lake dam downstream to the confluence with the Truckee River (Nevada Co.)	Last Saturday in Apr. through Nov. 15. Minimum size limit: 14 inches total length. Only artificial lures with barbless hooks may be used.	2 trout
(112) Martis Lake and tributaries (Nevada and Placer Cos.)		
(A) Martis Lake.	Last Saturday in Apr. through Nov. 15. Only artificial lures with barbless hooks may be used	0 trout
(B) Martis Lake tributaries.	Closed to all fishing all year	
(113) Mattole River (Humboldt Co.). Also see Section 8.00(a).		
(A) Mattole River main stem from the mouth to 200 yards upstream.	Closed to all fishing all year.	
(B) Mattole River main stem from 200 yards upstream of mouth to confluence with Stansberry Creek.	Jan. 1 through Mar. 31. Only artificial lures with barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(C) Mattole River main stem from confluence with Stansberry Creek to confluence with Honeydew Creek.	Jan. 1 through Mar. 31 and Fourth Saturday in May through Aug. 31. Only artificial lures with barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(115) McCloud River and tributaries (Shasta and Siskiyou cos.).		

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(A) Moosehead Creek and all tributaries.	Closed to all fishing all year.	
(B) McKay Creek and all tributaries including Sheepheaven Spring.	Closed to all fishing all year.	
(C) Edson Creek and all tributaries, excluding Dry Creek.	Closed to all fishing all year.	
(D) Swamp Creek and all tributaries.	Last Saturday in Apr. through Nov. 15. Only artificial lures with barbless hooks may be used.	0 trout
(E) McCloud River from McCloud Dam downstream to confluence of Ladybug Creek.	Last Saturday in Apr. through Nov. 15. Only artificial lures with barbless hooks may be used.	2 trout
(F) McCloud River from confluence of Ladybug Creek downstream to lower boundary of the U.S. Forest Service loop (southern boundary of section 36, T38N, R3W).	Last Saturday in Apr. through Nov. 15. Only artificial lures with barbless hooks may be used.	0 trout
(G) McCloud River from the lower boundary of the U.S. Forest Service loop (southern boundary of section 36, T38N, R3W) downstream to the upper boundary of the McCloud River Club (southern boundary of section 14, T37N, R3W).	Closed to all fishing all year.	

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(115.2) McDonald Creek (Humboldt Co.). (115.3) McGee Creek (Mono Co.).	Closed to fishing all year.	
(A) McGee Creek downstream from Highway 395.	Last Saturday in April through Friday preceding Memorial Day and Oct. 1 through Nov. 15. Minimum size limit: 18 inches total length. Only artificial lures with barbless hooks may be used.	2 trout
	Saturday preceding Memorial Day through Sept. 30.	5 trout per day. 10 trout in possession.
(B) McGee Creek upstream from Highway 395.	Last Saturday in April through Nov. 15.	5 trout per day. 10 trout in possession.
(115.4) McKay Creek and all tributaries (Siskiyou Co.)	See McCloud River 7.50(b)(115).	
(115.6) McLeod Lake (Mono Co.).	Last Saturday in Apr. through Nov. 15. Only artificial lures with barbless hooks may be used.	0 trout
(115.8) Meiss Lake (Alpine Co.).	Closed to all fishing all year	
(116) Mendocino Lake tributaries (Mendocino Co.).	Last Saturday in Apr. through Nov. 15	5 trout
(117) Merced River (Mariposa Co.).		
(A) From the Happy Isles footbridge downstream to the western boundary of Yosemite National Park at El Portal.	Last Saturday in Apr. through Nov. 15. Only artificial lures with barbless hooks may be used.	0 rainbow trout. 5 brown trout per day. 10 brown trout in possession.

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(B) From the western boundary of Yosemite National Park at El Portal boundary downstream to the Foresta bridge.	All year. Only artificial lures with barbless hooks may be used.	0 rainbow trout. 5 brown trout per day. 10 brown trout in possession.
(C) From Foresta bridge downstream to Lake McClure.	Last Saturday in April through November 15. November 16 through the Friday preceding the last Saturday in April.	5 trout per day. 10 trout in possession.
(118) Merced River (Merced Co.).		
(A) From Crocker-Huffman Dam downstream to the Schaffer bridge on Oakdale Road.	Jan. 1 through Oct. 31. Only artificial lures with barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(B) From the Schaffer bridge on Oakdale Road downstream to the mouth.	Jan. 1 through Oct. 31. Bait may be used from Jan. 1 through Oct. 31. However, from April 1 through the Friday preceding the fourth Saturday in May, bait may be used only with single hooks having a gap between 1/2 and 1 inch, or with multiple hooks having a gap between 1/4 adn 1/2 inch.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(118.2) Milk Ranch Creek and tributaries (Alpine Co.) above the confluence with the North Fork Mokelumne River.	Closed to fishing all year.	

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(118.5) Mill Creek (Mono Co. tributary to West Walker River) and tributaries upstream from confluence with Lost Cannon Creek.	Closed to all fishing all year	
(119) Mill Creek (Tehama Co.).		
(A) From the Lassen National Park boundary downstream to the U.S. Geological Survey gauging station cable crossing at the mouth of Mill Creek Canyon.	Last Saturday in April through Nov. 15. Only artificial lures with barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(B) From U.S. Geological Survey gauging station cable crossing at mouth of Mill Creek Canyon downstream to the mouth of Mill Creek.	June 16 through Sept. 30.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(120) Milton Lake and middle Fork Yuba River between Milton Lake and Jackson Meadows Dam (Nevada and Sierra cos.).	Last Saturday in Apr. through Nov. 15. Maximum size limit: 12 inches total length. Only artificial lures with barbless hooks may be used	2 trout
(122) Mitchell Creek and tributaries (Contra Costa Co.).	Closed to all fishing all year	
(124) Mokelumne River (San Joaquin Co.).		

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(A) From Camanche Dam to Highway 99 bridge.	Jan. 1 through Mar. 31.	1 hatchery trout or 1 hatchery steelhead**
	Fourth Saturday in in May through July 15.	1 hatchery trout or 1 hatchery steelhead**
	July 16 through Oct. 15.	1 hatchery trout or hatchery steelhead**. 2 Chinook salmon.
(B) From Highway 99 bridge to the Woodbridge Irrigation District Dam including Lodi Lake.	Jan. 1 through July 15.	1 hatchery trout or 1 hatchery steelhead**
	July 16 through Dec. 31.	1 hatchery trout or hatchery steelhead**. 2 Chinook salmon.
(C) Between the Woodbridge Irrigation District Dam and the Lower Sacramento Road bridge.	Closed to all fishing all year	
(D) From the Lower Sacramento Road bridge to the mouth. For purposes of this regulation, this river segment is defined as Mokelumne River and its tributary sloughs downstream of the Lower Sacramento Road bridge and east of Highway 160 and north of Highway 12.	Jan. 1 through July 15.	1 hatchery trout or 1 hatchery steelhead**
	July 16 through Dec. 16.	1 hatchery trout or hatchery steelhead**. 2 Chinook salmon.
	Dec. 17 through Dec. 31.	1 hatchery trout or 1 hatchery steelhead**

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(125) Mono Creek (Fresno Co.) and tributaries from Edison Lake upstream to the confluence with the North Fork Mono Creek.	June 1 through October 15.	5 trout per day. 10 trout in possession.
(125.5) Moosehead Creek and tributaries (Shasta and Siskiyou cos.).	See McCloud River 7.50(b)(115).	
(126) Murray Canyon Creek and tributaries (Alpine Co.) upstream from the falls located about 1/4 mile above the confluence with the East Fork Carson River.	Closed to all fishing all year	
(128) Nacimiento River (Monterey and San Luis Obispo cos.) from Nacimiento Reservoir.		
(A) From the headwaters in the Los Padres National Forest, downstream to the southern border of Fort Hunter-Liggett Military Reservation.	Last Saturday in Apr. through Nov. 15.	5 trout
(B) Nacimiento Lake~~,~~ and the main stem Nacimiento River upstream to the southern boundary of Fort Hunter-Liggett.	All year.	5 trout

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(C) Main stem below Nacimiento Dam, downstream to its confluence with the Salinas River.	Saturday preceding Memorial Day through October 31. Only artificial lures with barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(129) Napa River and tributaries (Napa Co.). Also see Section 8.00(b).		
(A) Main stem above the Oakville Cross Road Bridge near Yountville and all Napa River tributaries.	Closed to all fishing all year.	
(B) From the Oakville Cross Road Bridge near Yountville to the Trancas Bridge. Note: The Napa River below the Trancas Bridge is tidewater, and is under the regulations for the Ocean and San Francisco Bay District (see Sections 1.53 and 27.00).	Fourth Saturday in May through Mar. 31. Only artificial lures with barbless hooks may be used from the fourth Saturday in May through Oct. 31. Only barbless hooks may be used from Nov. 1 through Mar. 31.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(130) Navarro River (Mendocino Co.). Also see Low-Flow Restrictions, Section 8.00(b)(1). Main stem below the Greenwood Road bridge.	Fourth Saturday in May through Mar. 31. Only artificial lures with barbless hooks may be used from the fourth Saturday in May through Oct. 31. Only barbless hooks may be used from Nov. 1 through Mar. 31.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(130.5) Nelson Corral Reservoir and tributary (Lassen Co.).		

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(A) Nelson Corral Reservoir.	All year.	2 trout
(B) Nelson Corral Reservoir tributary (the unnamed tributary entering the reservoir at the north end).	Closed to all fishing all year	
(130.6) New Bullards Bar Reservoir	All year.	5 trout. 10 landlocked salmon per day. 20 landlocked salmon in possession.
(131) Newlands Lake tributaries (Lassen Co.).	Closed to all fishing all year	
(132) Nicasio Lake tributaries (Marin Co.).	Last Saturday in Apr. through Nov. 15	5 trout
(133) Noyo River (Mendocino Co.). Also see Low-Flow Restrictions, Section 8.00(b)(1).		
(A) Noyo River main stem from the mouth to the Georgia-Pacific logging road bridge one mile east of Highway 1.	Fourth Saturday in May through Mar. 31. Only artificial lures with barbless hooks may be used from the fourth Saturday in May through Oct. 31. Only barbless hooks may be used from Nov. 1 through Mar. 31.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(B) Noyo River main stem from the Georgia-Pacific logging road bridge one mile east of Highway 1 to the confluence with the South Fork Noyo River.	Fourth Saturday in May through Oct. 1. Only artificial lures with barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(C) Noyo River main stem from the confluence with the South Fork Noyo River to the Sonoma/Mendicino Boy Scout Council Camp.	Fourth Saturday in May through Mar. 31. Only artificial lures with barbless hooks may be used from the fourth Saturday in May through Oct. 31. Only barbless hooks may be used from Nov. 1 through Mar. 31.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(134) Owens River (Inyo and Mono Cos.), including Pleasant Valley and Tinemaha lakes, except (A), (B), (C), (D) and (E) below.	First Saturday in Mar. through Oct. 31.	5 trout per day. 10 trout in possession.
	Nov. 1 through the Friday preceding the first Saturday in Mar.	5 trout
(A) Upper Owens River from Benton Bridge road crossing upstream to Big Springs. Above Big Springs, see Deadman Creek 7.50(b)(54.5).	Last Saturday in April through Nov. 15. Maximum size limit: 16 inches total length. Only artificial lures with barbless hooks may be used.	2 trout
	Nov. 16 through the Friday preceding the last Saturday in Apr. Only artificial lures with barbless hooks may be used.	0 trout
(B) Upper Owens River from Benton Bridge road crossing downstream to upper Owens River fishing monument.	Saturday preceding Memorial Day through Sep. 30.	5 trout per day. 10 trout in possession.
(C) Upper Owens River from fishing monument (located about 1/4 mile upstream from maximum lake level) to Crowley Lake.	Last Saturday in April through July 31.	5 trout per day. 10 trout in possession.
	Aug. 1 through Nov. 15. Minimum size limit: 18 inches total length. Only artificial lures with barbless hooks may be used.	2 trout
(D) From Pleasant Valley	Jan. 1 through Sept. 30.	2 trout

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
Dam downstream to footbridge at lower end of Pleasant Valley Campground.	Oct. 1 through Dec. 31. Only artificial lures with barbless hooks may be used.	0 trout
(E) From footbridge at lower end of Pleasant Valley Campground east (downstream) 3.3 miles along Chalk Bluffs Road to the redwood sport fishing regulations sign.	All year. Only artificial lures with barbless hooks may be used.	0 trout
(135) Pajaro River (Monterey, Santa Clara, Santa Cruz and San Benito Cos.) from mouth to Uvas Creek. Also see Low-Flow Restrictions, Section 8.00(c)(5).	Dec. 1 through Mar. 7, but only on Sat., Sun., Wed., legal holidays and opening and closing days. Only barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(135.4) Lake Pardee	All year.	5 trout. 10 landlocked salmon per day. 20 landlocked salmon in possession.
(135.5) Parker Creek (Mono Co.). from the Lee Vining Conduit to Rush Creek.	Last Saturday in Apr. though Nov. 15. Only artificial lures with barbless hooks may be used	0 trout
(135.8) Upper Penitencia Creek (Santa Clara Co.) a tributary to Coyote Ck. Also see Section 8.00(c).	Closed to all fishing all year	

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(136) Pescadero Creek (San Mateo Co.) from mouth to the Stage Road bridge at Pescadero. Also see Low-Flow Restrictions, Section 8.00(c)(2).	Dec. 1 through Mar. 7, but only on Sat., Sun., Wed., legal holidays and opening and closing days. Only barbless hooks may be used	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(137) Pescadero Creek tributaries and main stem above the Stage Road bridge at Pescadero (Santa Clara and San Mateo Cos.).	Closed to all fishing all year.	
(138) Pillsbury Lake tributaries (Lake Co.).	Last Saturday in Apr. 5 through Nov. 15.	5 trout
(139) Pine Creek and Pine Creek Slough (Lassen Co.) See Eagle Lake 7.50(b)(61).		
(A) Pine Creek Slough and Pine Creek below State Highway 44.	Closed to fishing all year.	
(B) Pine Creek above State Highway 44.	Saturday preceding Memorial Day through Nov. 15.	5 trout per day. 10 trout in possession.
(139.5) Pine Creek (Goose Lake Tributary) and tributaries (Modoc Co.).	Saturday preceding Memorial Day through November 15. Only artificial lures with barbless hooks may be used.	0 trout
(139.7) Pinole Creek (Contra Costa Co.) and tributaries. (140) Piru Creek (Los Angeles and Ventura cos.).	Closed to all fishing all year	

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(A) Piru Creek and tributaries upstream of Pyramid Lake.	All year. Only artificial lures with barbless hooks may be used.	2 trout
(B) From Pyramid Dam downstream to the bridge approximately 300 yards below Pyramid Lake.	Closed to all fishing all year.	
(C) From the bridge approximately 300 yards below Pyramid Lake downstream to the falls about above the old Highway 99 bridge.	All year. Only artificial lures with barbless hooks may be used.	0 trout
(141) Pit River (Shasta and Modoc cos.).		
(A) Pit River (Modoc County) from the Hwy 395 bridge/South Fork Pit River crossing near the town of Likely downstream to the Highway 299 (Canby) bridge/Pit River crossing.	All year.	0 trout
(B) From Pit No. 3 (Britton Dam) downstream to the outlet of the Pit No. 3 Powerhouse.	Last Saturday in Apr. through Nov. 15. Minimum size limit: 18 inches total length. Only artificial lures with barbless hooks may be used.	2 trout
	Nov. 16 through the Friday preceding the last Saturday in Apr. Only artificial lures with barbless hooks may be used.	0 trout
(C) Pit River, from Pit No. 3 Powerhouse	Last Saturday in Apr. through Nov. 15.	5 trout

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
downstream to Pit No. 7 dam.	Nov. 16 through the Friday preceding the last Saturday in Apr. Only artificial lures with barbless hooks may be used.	0 trout
(D) From Pit No. 7 dam downstream to Shasta Lake.	All year	5 trout
(143) Pole Creek and tributaries (Placer Co.)	Closed to all fishing all year	
(144) Portuguese Creek, West Fork (Madera Co.) from headwaters downstream to confluence with the East Fork Portuguese Creek.	Last Saturday in Apr. through Nov. 15. Only artificial lures with barbless hooks may be used	0 trout
(145) Prosser Creek from the Prosser Reservoir dam downstream to the confluence with the Truckee River (Nevada Co.)	Last Saturday in Apr. through Nov. 15. Minimum size limit: 14 inches total length. Only artificial lures with barbless hooks may be used.	2 trout
(146) Purisima Creek (San Mateo Co.).	Last Saturday in Apr. through Nov. 15	5 trout
(147) Putah Creek (Solano and Yolo cos.) from Solano Lake to Monticello Dam.	All year. Only artificial lures and barbless hooks may be used.	0 trout
(148) Redwood Creek and tributaries (Alameda Co.).	Closed to all fishing all year	
(149) Redwood Creek and tidewaters (Marin Co.)	Closed to all fishing all year	

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(150) Redwood Creek (Humboldt Co.). Also see Section 8.00(a).		
(A) Redwood Creek main stem, within a radius of 200 yards of its mouth.	Jan. 1 through Mar. 31. Only artificial lures with barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(B) Redwood Creek main stem, from 200 yards above the mouth to the mouth of Prairie Creek.	Fourth Saturday in May through Mar. 31. Only barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(C) Redwood Creek main stem, from the mouth of Prairie Creek to the mouth of Bond Creek.	Fourth Saturday in May through Mar. 31. Only artificial lures with barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(D) Redwood Creek and tributaries, above the mouth of Bond Creek.	Closed to all fishing all year.	
(150.5) Robinson Creek (Mono Co.).	Last Saturday in	5 trout
(A) From the U.S. Forest Service boundary downstream to Upper Twin Lake.	April through Sept. 14 Sept. 15 through Nov. 15. Only artificial lures with barbless hooks may be used.	0 trout
(B) Between Upper and Lower Twin Lakes.	Last Saturday in April through Sept. 14.	5 trout

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(151) Rock Creek Diversion Channel (Mono Co.). Rock Creek Diversion Channel from its source below Tom's Place to its confluence with Crooked Creek.	Closed to all fishing all year.	
(152) Rock Creek (Shasta Co.) from its confluence with Pit River to Rock Creek Falls (about one mile upstream)	Closed to all fishing all year	
(152.5) Roosevelt Lake (Mono Co.).	Last Saturday in Apr. through Nov. 15.	2 trout
(153) Rush Creek (Mono Co.) only from Grant Lake Dam downstream to Mono Lake.	Last Saturday in Apr. through Nov. 15. Only artificial lures with barbless hooks may be used	0 trout
(154) Russian Gulch and tributaries (Sonoma Co.). Main stem below the confluence of the East Branch. Also see Section 8.00(b).	Fourth Saturday in May through Mar. 31. Only artificial lures with barbless hooks may be used from the fourth Saturday in May through Oct. 31. Only barbless hooks may be used from Nov. 1 through Mar. 31.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(155) Russian River and tributaries (Sonoma and Mendocino Cos.). Also see Section 8.00(b).		

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(A) Russian River main stem below the confluence of the East Branch Russian River. (See also Mendocino Lake tributaries (7.50(b)(116)).	All Year. Only artificial lures with barbless hooks may be used from Apr. 1 through Ocr. 31 Only barbless hooks may be used from Nov. 1 through Mar. 31.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
	Closed to all fishing from Feb. 19 through Apr. 30.	
(B) Russian River main stem above the confluence of the East Branch and all River tributaries. (See Laguna de Santa Rosa 7.50(b)(93) and Santa Rosa Creek 7.50(b)(172) for non-salmonids only.)	Closed to all fishing all year.	
(C) Russian River within 250 feet of the Healdsburg Memorial Dam.	Closed to all fishing all year.	
(156) Sacramento River and tributaries above Keswick Dam (Shasta, and Siskiyou Cos.).	Also see Sierra District General Regulations (See Section 7.00(b)).	
(A) Sacramento River and tributaries from Box Canyon Dam downstream to the Scarlett Way bridge in Dunsmuir.	All Year. Only artificial lures with barbless hooks may be used.	0 trout

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(B) Sacramento River and tributaries excluding Soda Creek from Scarlett Way bridge downstream to the county bridge at Sweetbriar (See Soda Creek 7.50(b)(180.5)).	Last Saturday in Apr. through Nov. 15.	5 trout per day. 10 trout in possession.
(C) Sacramento River mainstem (excluding tributaries) from the Scarlett Way bridge downstream to the county bridge at Sweetbriar.	Nov. 16 through the Friday preceding the last Saturday in Apr. Only artificial lures with barbless hooks may be used.	0 trout
(D) Sacramento River and tributaries excluding Castle Creek from the county bridge at Sweetbriar downstream to Shasta Lake (See Castle Creek 7.50(b)(39.3)).	Last Saturday in Apr. through Nov. 15. Only artificial lures with barbless hooks may be used.	2 trout
(E) Sacramento River mainstem (excluding all tributaries) from the county bridge at Sweetbriar downstream to Shasta Lake.	Nov. 16 through the Friday preceding the last Saturday in Apr. Only artificial lures with barbless hooks may be used.	0 trout
(156.5) Sacramento River and tributaries below Keswick Dam (Butte, Colusa, Contra Costa, Glenn, Sacramento, Solano, Sutter, Tehama and Yolo Cos.).	Also see Sierra District General Regulations (See Section 7.00(b)).	

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(A) Sacramento River from Keswick Dam to 650 feet below Keswick Dam.	Closed to all fishing all year.	
(B) Sacramento River from 650 feet below Keswick Dam to the Deschutes Road bridge.	All year. Only barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(C) Sacramento River from the Deschutes Road bridge to the Red Bluff Diversion Dam.	Jan. 1 through July 31.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
	Aug. 1 through Dec. 16.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession. 2 Chinook salmon. 4 Chinook salmon in possession.
	Dec. 17 through Dec. 31.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(D) Sacramento River from the Red Bluff Diversion Dam to the Hwy 113 bridge near Knights Landing. Note: It is unlawful to take fish 0-250 feet downstream from the overflow side of the Moulton, Colusa and Tisdale Weirs.	Jan. 1 through July 15.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
	July 16 through Dec. 16.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession. 2 Chinook salmon. 4 Chinook salmon in possession.
	Dec. 17 through Dec. 31.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(E) Sacramento River from the Hwy 113 bridge near Knights Landing to the Carquinez Bridge (includes Suisun Bay, Grizzly Bay and all	Jan. 1 through July 15.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
tributary sloughs west of Highway 160). Note: It is unlawful to take fish 0-250 feet downstream from the overflow side of the Fremont and Sacramento Weirs.	July 16 through Dec. 16.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession. 2 Chinook salmon. 4 Chinook salmon in possession.
	Dec. 17 through Dec. 31.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(157) Sagehen Creek (Nevada Co.).		
(A) From the stream gauging station (located about one-eighth mile below Sagehen Creek Station Headquarters) upstream to about one-eighth of a mile above the station headquarters at a point where the stream splits into two sections.	Closed to all fishing all year	
(B) From the Highway 89 bridge upstream to the gauging station at the east boundary of the Sagehen Creek Station.	Last Saturday in Apr. through Nov. 15 Only artificial lures with barbless hooks may be used	0 trout

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(158) Salinas River and tributaries (Monterey and San Luis Obispo Cos.). Also see Section 8.00(c).		
(A) The main stem Salinas River.	Dec. 1 through Mar. 7, but only on Sat., Sun., Wed., legal holidays and opening and closing days. Only barbless hooks may be used. ~~Only barbless~~	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(B) All Salinas River tributaries upstream of Arroyo Seco River confluence (including the San Antonio River below San Antonio Reservoir and Dam, Paso Robles Creek and tributaries, Atascadero Creek, Santa Margarita Creek and tributaries but excluding the Nacimiento River) See 7.50(b)(128). (159) Salmon Creek and tributaries (Sonoma Co.). Also see Section 8.00(b).	Last Saturday in Apr. through Nov. 15. Only barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(A) Salmon Creek main stem below Highway 1.	Fourth Saturday in May through Mar. 31. Only artificial lures with barbless hooks may be used from the fourth Saturday in May through Oct. 31. Only barbless hooks may be used from Nov. 1 through Mar. 31.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(B) Salmon Creek main stem above Highway 1 and all Salmon Creek tributaries.	Closed to all fishing all year	
(160) Salmon Creek and tributaries above Highway 1 (Monterey Co.).	Last Saturday in Apr. through Nov. 15	5 trout
(161) Salmon River (Siskiyou Co.)	See Klamath River 7.50(b)(91.1).	
(163) San Benito River and tributaries (San Benito Co.).	Last Saturday in Apr. through Nov. 15	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(164) San Clemente Creek and tributaries (Monterey Co.) except for Trout Lake.	Last Saturday in Apr. through Nov. 15 Only artificial lures with barbless hooks may be used	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
~~(165) San Clemente Reservoir (Monterey Co.).~~	~~Closed to all fishing all year~~	
(165.2) San Diego Creek (Orange Co.). Downstream of the MacArthur Blvd. bridge only.	Saturday preceding Memorial Day through Nov. 30. Only artificial lures with barbless hooks may be used.	Open to fishing for non- salmonids only. Closed to the take of trout, and steelhead.
(166) San Francisquito Creek and tributaries (Santa Clara and San Mateo Cos.)	Closed to all fishing all year	

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(167) San Gabriel River, West fork and tributaries (Los Angeles Co.).		
(A) Upstream of Cogswell Dam (including Cogswell reservoir and its tributaries).	All year. Only artificial lures with barbless hooks may be used.	2 trout
(B) From Cogswell Dam downstream to the second bridge upstream from the Highway 39 bridge.	All year. Only artificial lures with barbless hooks may be used.	0 trout
(167.2) San Gabriel River (Los Angeles and Orange Cos.) Upstream of the Highway 22 bridge to the start of concrete-lined portion of the river channel.	Saturday preceding Memorial Day through Nov. 30. Only artificial lures with barbless hooks may be used.	Open to fishing for non- salmonids only. Closed to the take of trout, and steelhead.
(168) San Gregorio Creek (San Mateo Co.) from the mouth to the Stage Road bridge at San Gregorio. Also see Low-Flow Restrictions, Section 8.00(c)(2).	Dec. 1 through Mar. 7, but only on Sat., Sun., Wed., legal holidays and opening and closing days. Only barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(168.5) San Joaquin River (Fresno, Madera, Merced, San Joaquin, and Stanislaus Cos.).		

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(A) From Friant Dam downstream to the Highway 140 bridge.	All year.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(B) From the Highway 140 bridge downstream to the Interstate 5 bridge at Mossdale.	All year.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(168.6) San Juan Creek main stem (Orange Co.).	Closed to all fishing all year.	
(169) San Lorenzo River (Santa Cruz Co.) from the mouth to the Lomond Street bridge in the town of Boulder Creek. Also see Section 8.00(c).	Dec. 1 through Mar. 7, but only on Sat., Sun., Wed., legal holidays and opening and closing days. Only barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(170) San Luis Obispo Creek (San Luis Obispo Co.) from mouth to the first and most southwestern highway 1/101 bridge (the first bridge upstream from the lagoon).	Dec. 1 through Mar. 7, but only Sat., Sun., Wed., legal holidays and opening and closing days. Only barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(170.1) San Luis Rey River (San Diego Co.).	Closed to all fishing all year.	
(170.5) San Mateo Creek and tributaries downstream from the falls between the Tenaja Road crossing and Fisherman's Camp (San Diego and Riverside cos.).	Closed to all fishing all year.	
(171) San Simeon Creek (San Luis Obispo Co.) from mouth to the pedestrian bridge in San Simeon Beach State Park.	Dec. 1 through Mar. 7, but only Sat., Sun., Wed., legal holidays and opening and closing days. Only barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(171.6) Santa Margarita River and tributaries downstream from the Interstate 15 bridge (San Diego and Riverside cos.).	Closed to all fishing all year.	
(171.7) Santa Paula Creek and tributaries above the falls located 3 miles upstream from the Highway 150 bridge (Ventura Co.).	All year.	5 trout
(172) Santa Rosa Creek (Sonoma Co. tributary to Russian River) from Laguna de Santa Rosa to Highway 12 bridge.	Last Saturday in Apr. through Nov. 15.	Open to fishing for non- salmonids only. Closed to the take of trout, and steelhead.

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(172.3) Santa Ynez River and tributaries downstream from Bradbury Dam (Santa Barbara Co.).	Closed to all fishing all year.	
(172.5) Santa Ynez River and tributaries upstream of Gibraltar Dam (Santa Barbara County).	All year	2 trout
(172.7) Sausal Creek (Alameda Co.). and tributaries	Closed to all fishing all year.	
(173) Scott Creek (Santa Cruz Co.) from mouth to confluence with Big Creek. Also see Low-Flow Restrictions, Section 8.00(c)(3).	Dec. 1 through Mar. 7, but only Sat., Sun., Wed., legal holidays and opening and closing days. Only barbless hooks may be used	0 trout
(174) Scott River (Siskiyou Co.). 7.50(b)(91.1).	See Klamath River	
(174.1) Scotts Flat Reservoir, upper	All year	5 trout per day. 10 trout in possession. 10 landlocked salmon per day. 20 landlocked salmon in possession.
(174.3) See Canyon Creek (San Luis Obispo Co.).	Closed to all fishing all year.	

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(174.5) Sespe Creek and tributaries above Alder Creek confluence. (Ventura Co.).	All year. Only artificial lures with barbless hooks may be used.	0 trout
(175) Shasta Lake (Shasta Co.).	All year	5 trout
(176) Shasta River (Siskyou Co.). 7.50(b)(91.1).	See Klamath River	
(176.5) Sheepheaven Spring (Siskiyou Co.).	See McCloud River 7.50(b)(115).	
(177) Shovel Creek and tributaries (Siskiyou Co.).	See Klamath River 7.50(b)(91).	
(177.2) Silver Creek (Mono County) tributary to West Walker River and tributaries upstream from Silver Falls.	Closed to all fishing all year.	
(177.5) Silver Creek between Sworinger Lake and Lost Lake and all other tributaries to Sworinger Lake (Modoc and Lassen Cos.).	Closed to all fishing all year	
(178) Silver King Creek and tributaries (Alpine Co.) upstream of the confluence with Snodgrass Creek.	Closed to all fishing all year	
(178.5) Sisquoc River and tributaries (Santa Barbara Co.).	Closed to all fishing all year	

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(179) Slinkard Creek and tributaries (Mono Co.) upstream from a Department of Fish and Game cable crossing located about 2.7 miles south of a point on Highway 89 two miles west of its junction with Highway 395 (the cable is located about 600 feet below a rock dam on Clinkard Creek within the south half of Section 21, T9N, R22E).	Aug. 1 through Nov. 15. Only artificial flies with barbless hooks may be used.	0 trout
(180) Smith River (Del Norte Co.) Yearly limits apply for entire river.	Low-Flow Restrictions, Section 8.00, also apply, see below for more detail.	
(A) Main stem from the mouth to confluence of Middle and South forks. Also see Low-Flow Restrictions, Section 8.00(a)(7).	Fourth Saturday in May through Apr. 30. Only artificial lures with barbless hooks may be used from the fourth Saturday in May through Aug. 31. Only barbless hooks may be used from Sep. 1 through Apr. 30.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession. 2 cutthroat trout minimum size limit: 10 inches total length. 1 Chinook salmon and no more than 5 wild Chinook salmon* over 22 inches per year.
(B) Middle Fork Smith River		

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
1. from mouth to Patrick Creek Also see Low-Flow Restrictions, Section 8.00(a)(7).	Fourth Saturday in May through Apr. 30. Only artificial lures with barbless hooks may be used from the fourth Saturday in May through Aug. 31. Only barbless hooks may be used from Sep. 1 through Apr. 30.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession. 2 cutthroat trout minimum size limit: 10 inches total length. 1 Chinook salmon and no more than 5 wild Chinook salmon* over 22 inches per year.
2. above the mouth of Patrick Creek. Also see Low-Flow Restrictions, Section 8.00(a)(7).	Fourth Saturday in May through Oct. 31. Only artificial lures with barbless hooks may be used.	2 cutthroat trout minimum size limit: 10 inches total length. 2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(C) South Fork Smith River		

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
1. from the mouth upstream approximately 1,000 feet to the County Road (George Tryon) bridge and Craigs Creek to Jones Creek. Also see Low-Flow Restrictions, Section 8.00(a)(7).	Fourth Saturday in May through Apr. 30. Only artificial lures with barbless hooks may be used from the fourth Saturday in May through Aug. 31. Only barbless hooks may be used from Sep. 1 through Apr. 30.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession. 2 cutthroat trout minimum size limit: 10 inches total length. 1 Chinook salmon and no more than 5 wild Chinook salmon* over 22 inches per year.
2. from the George Tryon bridge upstream to the mouth of Craigs Creek. Also see Low-Flow Restrictions, Section 8.00(a)(7).	Closed to fishing all year.	
3. above the mouth of Jones Creek. Also see Low-Flow Restrictions, Section 8.00(a)(7).	Fourth Saturday in May through Oct. 31. Only artificial lures with barbless hooks may be used.	2 cutthroat trout minimum size limit: 10 inches total length. 2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(D) North Fork Smith River.		

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
1. from the mouth to Stony Creek. Also see Low-Flow Restrictions, Section 8.00(a)(7).	Fourth Saturday in May through Mar. 31. Only artificial lures with barbless hooks may be used from the fourth Saturday in May through Aug. 31. Only barbless hooks may be used from Sep. 1 through Mar. 31.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession. 2 cutthroat trout minimum size limit: 10 inches total length. 1 Chinook salmon and no more than 5 wild Chinook salmon* over 22 inches per year.
2. above the mouth of Stony Creek.	Fourth Saturday in May through Oct. 31. Only artificial lures with barbless hooks may be used.	2 cutthroat trout minimum size limit: 10 inches total length. 2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(180.5) Soda Creek (Shasta Co.)	Last Saturday in Apr. through Nov. 15. Only artificial lures with barbless hooks may be used.	0 trout
(180.6) Solano Lake (Solano County)	All year. Only artificial lures and barbless hooks may be used.	0 trout
(181) Sonoma Creek and tributaries (Sonoma Co.).		

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(A) Sonoma Creek and tributaries above the Sonoma Creek seasonal waterfall in Sugarloaf Ridge State Park (located 0.2 miles upstream of the west end of the Canyon Trail).	Last Saturday in Apr. through Nov. 15.	5 trout
(B) Sonoma Creek and tributaries between the Sonoma Creek seasonal waterfall in Sugarloaf Ridge State Park (located 0.2 miles upstream of the west end of the Canyon Trail) and the Highway 121 bridge. Note: Sonoma Creek below the Highway 121 Bridge is tidewater, and is regulated by regulations for the Ocean and San Francisco Bay District (see sections 1.53 and 27.00).	Closed to all fishing year.	
(181.8) Sonoma Lake (Sonoma Co.).	All year	2 trout
(182) Sonoma Lake tributaries (Sonoma Co.).	Last Saturday in April through Apr. 15.	2 trout

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(183) Soquel Creek (Santa Cruz Co.) from mouth to confluence of East and West branch. Also see Low-Flow Restrictions, Section 8.00(c)(4).	Dec. 1 through Mar. 7, but only on Sat., Sun., Wed., legal holidays and opening and closing days. Only barbless hooks maybe used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(184) Soulajoule Lake tributaries (Marin Co.).	Last Saturday in Apr. through Nov. 15	5 trout
(185) Squaw Valley Creek and tributaries (Shasta Co.) only from the bridge crossing on U S Forest Service road (#39N21) located one-eighth mile upstream of the mouth of Cabin Creek (Northwest 1/4 of Section 14, T38N, R3W) downstream to an including Tom Dow Creek.	Last Saturday in Apr. through Nov. 15	2 trout
(186) Stanislaus River (Calaveras, San Joaquin, Stanislaus and Tuolumne Cos.).		
(A) From Goodwin Dam down- stream to the Highway 120 bridge in Oakdale.	Jan. 1 through Oct. 31. Only artificial lures with barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(B) From the Highway 120 bridge in Oakdale to the mouth.	Jan. 1 through Oct. 31. Bait may be used from Jan. 1 through Oct. 31. However, from April 1 through the Friday preceding the fourth Saturday in May, bait may be used only with single hooks having a gap between 1/2 and 1 inch, or with multiple hooks having a gap between 1/4 and 1/2 inch.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(187) Stanislaus River, Middle Fork (Tuolumne Co.).		
(A) From Beardsley Dam downstream to the U. S. Forest Service footbridge at Spring Gap (including the Beardsley Afterbay).	Last Saturday in Apr. through Nov. 15. Only artificial lures with barbless hooks may be used.	2 trout
(B) From the U.S. Forest Service footbridge at Spring Gap to New Melones Reservoir.	Last Saturday in Apr. through Nov. 15	2 trout
(187.5) Stevens Creek (Santa Clara Co.) downstream of Stevens Reservoir.	Last Saturday in April through Nov. 15. Only artificial lures with barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(188) Stone Lagoon (Humboldt Co.).	All year. Only artificial lures with barbless hooks may be used. Cutthroat trout minimum size limit: 14 inches.	2 cutthroat trout. 2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(189) Stony Creek, and tributaries (Colusa, Glenn and Lake Cos.).		
(A) From the headwaters downstream to the diversion dam west of Stonyford in the center of Section 35, T18N, R7W, except the portion of Stony Creek Middle Fork from Red Bridge upstream.	Last Saturday in April through Nov. 15.	5 trout per day. 10 trout in possession.
	Nov. 16 through the Friday preceding the last Saturday in April. Only artificial lures with barbless hooks may be used.	0 trout
(B) Stony Creek Middle Fork from Red Bridge upstream.	Last Saturday in April through Nov. 15. Only artificial lures with barbless hooks may be used.	2 trout
	Nov. 16 through the Friday preceding the last Saturday in April. Only artificial lures with barbless hooks may be used.	0 trout
(189.5) Susan River (Lassen County) from the confluence of Willard Creek and the Susan River, downstream to the Bizz Johnson trail bridge located approx. 1/4 mi. downstream from the 3 mi. marker on the Bizz Johnson trail. Also, see Section 8.10 for special open season for youths participating in Youth Fishing Derby.	Last Saturday in April through November 15. Only artificial lures with barbless hooks may be used.	0 trout
(189.8) Swamp Creek and all tributaries (Siskiyou Co.)	See McCloud River 7.50(b)(115).	

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(190) Sweetwater River and tributaries downstream from the Sweetwater Dam (San Diego Co.).	Closed to all fishing all year.	
(191) Sworinger Lake tributaries (Modoc and Lassen Cos.) upstream to the first lake	Closed to all fishing all year	
(192) Tahoe Lake and tributaries (Placer and El Dorado Cos.).		
(A) Tahoe Lake tributaries upstream to the first lake.	July 1 through Sept. 30	5 trout per day. 10 trout in possession.
(B) Tahoe Lake except (192)(C) below.	All year.	5 trout, but no more than 2 mackinaw trout.
(C) Tahoe Lake within 300 feet of the mouth of its tributaries.	July 1 through Sept. 30.	5 trout, but no more than 2 mackinaw trout.
(193) Ten Mile River Mendocino Co.). Also see Section 8.00(b)(1). Ten Mile River main stem below the confluence with the Ten Mile River North Fork, and the Ten Mile River North Fork below the confluence with Bald Hill Creek.	Fourth Saturday in May through Mar. 31. Only artificial lures with barbless hooks may be used from the fourth Saturday in May through Oct 31. Only barbless hooks may be used from Nov. 1 through May 31.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(193.5) Topanga Canyon Creek and tributaries (Los Angeles Co.).	Closed to all fishing all year.	

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(194) Topaz Lake (Mono Co.).	Jan. 1 through Sept. 30	5 trout
(194.5) Trabuco Creek (a.k.a. Arroyo Trabuco Creek)(Orange Co.). Downstream of the I-5 bridge to the confluence with San Juan Creek	Closed to all fishing all year.	
(194.6) Trinity Reservoir	All year.	5 trout per day. 10 trout in possession. 10 landlocked salmon per day. 20 landlocked salmon in possession.
(195) Trinity River and tributaries downstream of Lewiston Dam.	See Klamath River 7.50(b)(91.1)	
(195.1) Trinity River, above Trinity Dam (Trinity County) from the confluence with Tangle Blue Creek, (Hwy. 3) downstream (south) to the mouth of Trinity Lake, approximately 13.8 miles.	Last Saturday in Apr. through Nov. 15.	5 trout per day. 10 trout in possession
	Nov. 16 through the Friday preceding the last Saturday in April. Only artificial lures with barbless hooks may be used.	0 trout
(195.5) Trout Lake (Siskiyou Co.).	Only Wednesdays and weekends from the last Saturday in April through Sept. 30. Only artificial lures may be used.	2 trout
(196) Truckee River (Nevada, Placer and Sierra Cos.).		

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(A) Truckee River for 1,000 feet below the Lake Tahoe outlet dam.	Closed to all fishing all year.	

NOTE: THE AREA FROM 1,000 FEET BELOW THE LAKE TAHOE OUTLET DAM DOWNSTREAM TO TROUT CREEK IS REGULATED BY THE DISTRICT GENERAL REGULATIONS.

(B) Truckee River from the confluence of Trout Creek downstream to the Glenshire Bridge.	Last Saturday in Apr. through Nov. 15. Minimum size limit: 14 inches total length. Only artificial lures with barbless hooks may be used.	2 trout
	Nov. 16 through the Friday preceding the last Saturday in Apr. Only artificial lures with barbless hooks may be used.	0 trout
(C) Truckee River from the Glenshire Bridge downstream to the mouth of Prosser Creek.	Last Saturday in Apr. through Nov. 15. Minimum size limit: 14 inches total length. Only artificial flies with barbless hooks may be used.	2 trout
	Nov. 16 through the Friday preceding the last Saturday in Apr. Only artificial flies with barbless hooks may be used.	0 trout
(D) Truckee River from the mouth of Prosser Creek downstream to the Nevada State Line.	Last Saturday in Apr. through Nov. 15. Minimum size limit: 14 inches total length. Only artificial lures with barbless hooks may be used.	2 trout
	Nov. 16 through the Friday preceding the last Saturday in Apr. Only artificial lures with barbless hooks may be used.	0 trout
(197) Tule River and tributaries (Tulare Co.).		

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(A) Tule River, North Fork (Tulare Co.), only in the North Fork Tule River and all its forks and tributaries above the confluence with Pine Creek (about 50 yards upstream from the Blue Ridge road bridge, about 12 1/4 miles north of Springville).	All year. Only artificial flies with barbless hooks may be used.	2 trout
(B) All remaining portions of the Tule River and tributaries.	All year.	5 trout per day. 10 trout in possession.
(198) Tuolumne River (Stanislaus and Tuolumne Cos.).		
(A) From O'Shaughnessy Dam (Hetch Hetchy Reservoir) downstream to Early Intake Dam.	Last Saturday in April through Nov. 15. Maximum size limit: 12 inches total length. Only artificial lures with barbless hooks may be used.	2 trout
	Nov. 16 through the Friday preceding the last Saturday in Apr. Only artificial lures with barbless hooks may be used.	0 trout
(B) From Early Intake Dam downstream to Lumsden Bridge.	Last Saturday in April through Nov. 15.	5 trout
	Nov. 16 through the Friday preceding the last Saturday in April. Only artificial lures with barbless hooks may be used.	0 trout

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(C) From Lumsden Bridge downstream to Clavey River Falls.	Last Saturday in Apr. through Nov. 15. Maximum size limit: 12 inches total length Only artificial lures with barbless hooks may be used.	2 trout
	Nov. 16 through the Friday preceding the last Saturday in Apr. Only artificial lures with barbless hooks may be used.	0 trout
(D) From La Grange Dam downstream to Hickman bridge.	Jan. 1 through Oct. 31. Only artificial lures with barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(E) From Hickman bridge to the mouth.	Jan. 1 through Oct. 31. Bait may be used from Jan. 1 through Oct. 31. However, from April 1 through the Friday preceding the fourth Saturday in May, bait may be used only with single hooks having a gap between 1/2 and 1 inch, or with multiple hooks having a gap between 1/4 and 1/2 inch.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(199) Upper Otay Lake (San Diego Co.).	All year. Only artificial lures with barbless hooks may be used.	0 for all species
(199.5) Upper Truckee River and tributaries upstream from confluence with Showers Creek (Alpine and El Dorado Cos.).	July 1 through Sept. 30. Only artificial lures with barbless hooks may be used.	0 trout

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(200) Usal Creek and tributaries (Mendocino Co.). Also see Section 8.00(b). Usal Creek main stem below the Usal-Shelter Cove Road	Fourth Saturday in May through Mar. 31. Only artificial lures with barbless hooks may be used from the fourth Saturday in May through Oct. 31. Only barbless hooks may be used from Nov. 1 through Mar. 31.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(201) Uvas or Carnadero Creek (Santa Clara Co.) Also see Low-Flow Restrictions, Section 8.00(c)(5). (A) From Highway 152 Bridge to Uvas Dam.	Closed to all fishing all year	
(B) From mouth to Highway 152 Bridge.	Dec. 1 through Mar. 7, but only on Sat., Sun., Wed., legal holidays and opening and closing days. Only barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(202) Van Duzen River (Humboldt Co.).	See Eel River 7.50(b)(63) and Section 8.00(a).	
(203.5) Waddell Creek (Santa Cruz Co.) from mouth to Highway 1 bridge. Also see Low-Flow Restrictions, Section 8.00(c)(3).	Dec. 1 through Mar. 7, but only Sat., Sun., Wed., legal holidays and opening and closing days. Only barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(204) Walker Creek and tributaries (Marin Co.) Also see Section 8.00(b).		

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(A) Walker Creek main stem below Highway 1.	Fourth Saturday in May through Mar. 31. Only artificial lures with barbless hooks may be used from the fourth Saturday in May through Oct. 31. Only barbless hooks may be used from Nov. 1 through Mar. 31.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(B) Walker Creek main stem above Highway 1 and all Walker Creek tributaries.	Closed to fishing all year.	
(204.5) Walker Creek (Mono Co.) from the Lee Vining Conduit to Rush Creek.	Last Saturday in April through Nov. 15. Only artificial lures with barbless hooks may be used.	0 trout
(205) Walker River, East Fork (Mono Co.) from Bridgeport Dam to Nevada State Line.	Last Saturday in Apr. through Nov. 15. Minimum size limit: 18 inches total length. Only artificial lures with barbless hooks may be used. NOTE: BOW AND ARROW FISHING FOR CARP ONLY IS PERMITTED.	1 trout
	Nov. 16 through the Friday preceding the last Saturday in Apr. Only artificial lures with barbless hooks may be used. NOTE: BOW AND ARROW FISHING FOR CARP ONLY IS PERMITTED.	0 trout
(205.5) West Walker River (Mono County) from the confluence with the Little Walker River (Hwy. 395 bridge at mile marker 96) downstream (north) to the inlet of Topaz Lake. (206) Walnut Creek (Contra Costa Co.) .	Nov. 16 through the Friday preceding the last Saturday in April. Only artificial lures with barbless hooks may be used.	0 trout

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(A) Upstream of the confluence with Grayson Creek.	Fourth Saturday in May through Mar. 31. Only artificial lure with barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(B) Downstream of the confluence with Grayson Creek.	All year.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(206.5) Whiskey Creek (Mono Co.).		
(A) Whiskey Creek downstream from Crowley Lake Drive (old Highway 395).	Last Saturday in April through the Friday preceding Memorial Day and Oct. 1 through Nov. 15. Minimum size limit: 18 inches total length. Only artificial lures with barbless hooks may be used.	2 trout
	Saturday preceding Memorial Day through Sept. 30.	5 trout per day. 10 trout in possession.
(B) Whiskey Creek upstream from Crowley Lake Drive.	Last Saturday in April through Nov. 15.	5 trout per day. 10 trout in possession.
(207) Wildcat Creek and tributaries (Contra Costa Co.)	Closed all year to fishing	
(208) Willow Creek and tributaries (tributary to Goose Lake, Modoc Co.).	Saturday preceding Memorial Day through Nov. 15. Only artificial lures with barbless hooks may be used.	0 trout

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(208.5) Wolf Creek and tributaries (tributary to West Walker River) (Mono Co.).	August 1 through November 15. Only artificial flies with barbless hooks may be used.	0 trout
(208.6) Wolf Creek Lake (tributary to Wolf Creek) (Mono County)	Closed to all fishing all year	
(209) Yellow Creek (Plumas Co.) from Big Springs downstream to the marker at the lower end of Humbug Meadow.	Last Saturday in Apr. through Nov. 15 Maximum size limit: 10 inches total length. Only artificial lures with barbless hooks may be used.	2 trout
(210) Yuba River, Middle Fork (Nevada and Sierra Cos.) from Jackson Meadows Dam downstream to Milton Lake.	See Milton Lake 7.50(b)(120).	
(211) Yuba River, North Fork (Sierra and Yuba cos.)	~~Last Saturday in Apr.~~	~~2~~
(A) From the western boundary of Sierra City to the confluence with Ladies Canyon Creek.	Last Saturday in Apr. through Nov. 15. Only artificial lures with barbless hooks may be used.	2 trout
	Nov. 16 through the Friday preceding the last Saturday in Apr. Only artificial lures with barbless hooks may be used.	0 trout
(B) From Ladies Canyon Creek downstream to New Bullards Bar Reservoir.	Last Saturday in Apr. through Nov. 15.	5 trout
	Nov. 16 through the Friday preceding the last Saturday in Apr. Only artificial lures with barbless hooks may be used.	0 trout

Body of Water	Open Season and Special Regulations	Daily Bag and Possession Limit
(212) Yuba River (Yuba and Nevada Cos.) from mouth to Englebright Dam.		
(A) From mouth to the Highway 20 bridge.	All year. Only artificial lures with barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.
(B) From Highway 20 bridge to Englebright Dam.	Dec. 1 through Aug. 31. Only artificial lures with barbless hooks may be used.	2 hatchery trout or hatchery steelhead**. 4 hatchery trout or hatchery steelhead** in possession.

* Wild Chinook salmon are those not showing a healed adipose fin clip and not showing a healed left ventral fin clip. **Hatchery trout or steelhead in anadromous waters are those showing a healed adipose fin clip (adipose fin is absent). Unless otherwise provided, all other trout and steelhead must be immediately released. Wild trout or steelhead are those not showing a healed adipose fin clip (adipose fin is present).

Note: Authority cited: Sections 200, 202, 205, 215, 220, 240, 315 and 316.5, Fish and Game Code. Reference: Sections 200, 202, 205, 215 and 316.5, Fish and Game Code.

Section 43, Title 14, CCR, is amended as follows:

§43. Captive Propagation and Commercialization of Native Reptiles.

…[No changes to subsections (a) through (b)]

(c) Propagation and Possession for Commercial Purposes. Native reptiles may not be sold, possessed, transported, imported, exported or propagated for commercial purposes, except as provided in Section 40(f) and except as follows:
(1) S<u>pecies and s</u>ubspecies Authorized. Pursuant to the provisions of this section, only the following <u>species and</u> subspecies may be sold, possessed, transported, imported, exported or propagated for commercial purposes:
(A) California ~~common~~ kingsnake (*Lampropeltis* ~~*getulus*~~ *californiae*);
(B) California subspecies of the ~~gopher snake~~<u>gophersnake</u> (*Pituophis* ~~*melanoleucus*~~<u>*catenifer*</u>): Great Basin ~~gopher snake~~<u>gophersnake</u> (*Pituophis*

~~*melanoleucus*~~*catenifer deserticola*), Pacific ~~gopher snake~~gophersnake (*Pituophis* ~~*melanoleucus*~~*catenifer catenifer*), San Diego ~~gopher snake~~gophersnake (*Pituophis* ~~*melanoleucus*~~*catenifer annectens*), and ~~Sonora gopher snake~~Sonoran gophersnake (*Pituophis* ~~*melanoleucus*~~*catenifer affinis*);
(C) ~~California subspecies of the rosy boa (*Lichanura trivirgata*); Coastal rosy boa (*Lichanura trivirgata roseofusca*) and Desert rosy boa (*Lichanura trivirgata gracia*)~~Northern three-lined boa (*Lichanura orcutii*).
(2) Bill of Sale. All animals sold pursuant to this section must be accompanied by a numbered bill of sale which shall contain the name and permit number of the permittee, the complete scientific name of each native reptile sold and the name and address of the buyer. A copy of the bill of sale shall be retained by the buyer.

…[No changes to subsections (d) through (k)]

Note: Authority cited: Sections 200, 202, 205, 220, 5061 and 6896, Fish and Game Code. Reference: Sections 200, 202, 205, 220, 5061 and 6896, Fish and Game Code.

Section 671, Title 14, CCR, is amended as follows:

§671. Importation, Transportation and Possession of Live Restricted Animals.

. . . [No changes to subsections (a) through (b)]

(c) Restricted species include:

. . . [No changes to subsections (c)(1) through (c)(2)]

(3) Class Amphibia-Frogs, Toads, Salamanders
(A) Family Bufonidae-Toads ~~*Bufo marinus, Bufo paracnemis, Bufo horribilis* (Giant toad or marine toad group) and all other large toads from Mexico and Central and South America-(D).~~
1. Genera *Rhinella* and *Rhaebo* (formerly *Bufo*) (giant/marine toad group and all other large toads from Mexico and Central and South America)-(D).
(B) Family Pipidae-Tongueless Toads
1. Genus *Xenopus* (~~C~~clawed frogs)-(D).
(C) Family Ambystomatidae-Mole Salamanders
1. Genus *Ambystoma* (nonnative tiger ~~salamanders~~salamander group)-(D)
(D) Family ~~Leptodactylidae~~Eleutherodactylidae~~-Neotropical~~Rain Frogs
1. *Eleutherodactylus coqui*~~-Commom Coqui or Coqui frog~~common coquí or coquí -(D).

. . . [No changes to subsections (c)(4) through (c)(6)]

(7) Class Reptilia-Reptiles
(A) Order Crocodilia-Crocodiles, Caimans, Alligators and Gavials

All species (D).
(B) Family Chelyridae-Snapping Turtles
All species (D).
(C) Family Elapidae-Cobras, Coral Snakes, Mambas, Kraits, etc.
All species (D).
(D) Family Viperidae-Adders and Vipers
All species (D).
(E) Family Crotalidae~~-Pit Vipers~~Pitvipers
All nonnative species (D)~~, except *Crotalus viridis* (Western rattlesnake), *Crotalus atrox* (Western diamondback rattlesnake), *Crotalus ruber* (red diamondback rattlesnake), *Crotalus scutulatus* (Mojave rattlesnake), *Crotalus mitchelli* (speckled rattlesnake) and *Crotalus cerastes* (Sidewinder) not restricted~~.
(F) Family Colubridae-Colubrids
1. *Dispholidus typus* (Boomslang) (D).
2. ~~*Theoltornis kitlandii*~~ Genus *Thelotornis* (Bird, twig, or vine snakes) (D).
3. ~~All species of g~~Genus *Nerodia* (watersnakes) (D).
(G) Family Helodermatidae
1. *Heloderma suspectum suspectum* (reticulate Gila monster) (D).

. . . [No changes to subsections (c)(8) through (c)(11)]

Note: Authority cited: Sections 2118 and 2120, Fish and Game Code. Reference: Sections 1002, 2116, 2118, 2118.2, 2118.4, 2119, 2120, 2122, 2123, 2124, 2125, 2126, 2127, 2150, 2190 and 2271, Fish and Game Code.

STATE OF CALIFORNIA
FISH AND GAME COMMISSION
INITIAL STATEMENT OF REASONS FOR REGULATORY ACTION
(Pre-publication of Notice Statement)

Amend Subsection (a)(1) of Section 29.45
Title 14, California Code of Regulations
Re: Recreational Razor Clam Fishery in Humboldt County

I. Date of Initial Statement of Reasons: June 23, 2016

II. Dates and Locations of Scheduled Hearings:

(a) Notice Hearing: Date: August 25, 2016
Location: Folsom, CA

(b) Discussion Hearing: Date: October 20, 2016
Location: Eureka, CA

(c) Adoption Hearing: Date: December 8, 2016
Location: San Diego, CA

III. Description of Regulatory Action:

(a) Statement of Specific Purpose of Regulation Change and Factual Basis for Determining that Regulation Change is Reasonably Necessary:

Under existing law, razor clams may be taken for recreational purposes with a sport fishing license subject to regulations prescribed by the Fish and Game Commission (Commission). Current regulations for clams specify bag and possession limits, open/closed fishing areas by year, fishing hours and gear restrictions. The proposed regulation change is in response to public recommendations including Humboldt Area Saltwater Angers and Humboldt County Board of Supervisors, and would restore the original location of the management boundary at Little River Beach, Humboldt County.

Area Closures by Year:
Under existing law, razor clams can be taken all year in any area of the state, except in Del Norte County they may be taken north of Battery Point only in odd-numbered years and south of Battery Point only in even-numbered years, and at Little River Beach in Humboldt County they may be taken north of Strawberry Creek between Strawberry Creek and Moonstone Beach only in odd-numbered years, and south of Strawberry Creek between Strawberry Creek and Mad River only in even-numbered years.

The first twenty clams dug must be retained as the bag limit regardless of size or broken condition.

The razor clam management boundary line at Little River Beach, commonly referred to as Clam Beach, is a seasonal creek, named Strawberry Creek that was meant to divide the beach into approximate equal segments that could be fished in alternate years. Since the adoption of this regulation in 1953 in response to a decline in larger clams, this natural creek has meandered southward by 0.6 miles from its original location, resulting in a larger area in the northern section open for clamming during odd-numbered years. In even-numbered years, clammers now have to travel quite far south from the beach access point, the south county parking lot, to reach the smaller, southern section of the beach. The original location of the creek crossed the beach near where a county-maintained public parking lot exists today.

Rotating areas for clamming has been shown to encourage the recovery and productivity of clam beds for future seasons while relieving fishing pressure on alternate years so that clams can grow unmolested. As a result of the southward migration of the creek boundary line, the goal of an annual rotation of effort somewhat equally distributed between north and south sections of the beach has been compromised.

Change for clarity

The following regulation change to Subsection (a)(1) of Section 29.45, Title 14, CCR, would restore the original intent of the razor clam regulation pertaining to Little River Beach, Humboldt County by replacing reference to the Strawberry Creek boundary with reference to a boundary marker and accompanying latitude reading due west of the trailhead leading from the county south parking lot. The northern and southern boundaries would remain in regulation as Moonstone Beach and Mad River, respectively.

The regulation references Little River Beach near McKinleyville, Humboldt County, however it is generally referred to by area locals and on maps as Clam Beach so this name would also replace Little River Beach in regulations with the latter remaining in place parenthetically. The amendment would address the following:

1. Replace reference to the Strawberry Creek boundary with the boundary line due west from the county parking lot trailhead located at 40° 59.67' north latitude.
2. Also replace the name Little River Beach with Clam Beach while using the former name parenthetically.

Benefits of the Regulation

The Commission anticipates benefits to the razor clam resource and its

fishery in Humboldt County. The proposed regulation changes are intended to provide increased clam fishing opportunity in even-numbered years by increasing the size of the open southern Clam Beach management zone, thereby restoring the original intent of the regulation. The Commission anticipates benefits to the environment by the sustainable management of California's razor clam resources.

(b) Authority and Reference Sections from Fish and Game Code for Regulation:

Authority: Sections 200, 202, 205, 206, 215, & 220, Fish and Game Code

Reference: Sections 200, 202, 205, 206, 215, & 220, Fish and Game Code

(c) Specific Technology or Equipment Required by Regulatory Change:

None.

(d) Identification of Reports or Documents Supporting Regulation Change:

None.

(e) Public Discussions of Proposed Regulations Prior to Notice publication:

No public meetings are scheduled prior to the notice publication. The 45-day public notice comment period provides adequate time for review of the proposed changes.

IV. Description of Reasonable Alternatives to Regulatory Action:

(a) Alternatives to Regulation Change:

No alternatives were identified.

(b) No Change Alternative:

The no change alternative would leave existing regulations in place without a solution to the following issues raised by the public.

The Strawberry Creek management boundary at Clam Beach has migrated a considerable distance to the south requiring a much longer walk to the southern management zone from the nearest parking lot, which is especially difficult for elderly and infirmed persons. In addition, the original intent of the creek boundary was to more or less evenly divide Clam Beach

into two management zones and the creek migration has contributed to a distinctly uneven zonation of the beach.

(c) Consideration of Alternatives:

In view of information currently possessed, no reasonable alternative considered would be more effective in carrying out the purposes for which the regulation is proposed or would be as effective and less burdensome to the affected public than the proposed regulation.

V. Mitigation Measures Required by Regulatory Action:

The proposed regulatory action is expected to have no negative impact on the environment; therefore, no mitigation measures are needed.

VI. Impact of Regulatory Action:

The potential for significant statewide adverse economic impacts that might result from the proposed regulatory action has been assessed, and the following initial determinations relative to the required statutory categories have been made:

(a) Significant Statewide Adverse Economic Impact Directly Affecting Businesses, including the Ability of California Businesses to Compete with Businesses in Other States:

The proposed action will not have a significant statewide adverse economic impact directly affecting business, including the ability of California businesses to compete with businesses in other states. The proposed changes are necessary for the continued preservation of the resource and fishing opportunity and therefore the prevention of adverse economic impacts.

(b) Impact on the Creation or Elimination of Jobs Within the State, the Creation of New Businesses or the Elimination of Existing Businesses, or the Expansion of Businesses in California; Benefits of the Regulation to the Health and Welfare of California Residents, Worker Safety, and the State's Environment:

The Commission does not anticipate any impacts on the creation or elimination of jobs, the creation of new business, the elimination of existing businesses or the expansion of businesses in California. The proposed regulation changes are intended to provide increased razor clam fishing opportunity in Humboldt County in even numbered years.

The Commission anticipates benefits to the environment by the sustainable management of California's razor clam resource.

The Commission does not anticipate any non-monetary benefits to worker safety.

(c) Cost Impacts on a Representative Private Person or Business:

The agency is not aware of any cost impacts that a representative private person or business would necessarily incur in reasonable compliance with the proposed action.

(d) Costs or Savings to State Agencies or Costs/Savings in Federal Funding to the State:

None.

(e) Nondiscretionary Costs/Savings to Local Agencies:

None.

(f) Programs mandated on Local Agencies or School Districts:

None.

(g) Costs Imposed on Any Local Agency or School District that is Required to be Reimbursed Under Part 7 (commencing with Section 17500) of Division 4, Government Code:

None.

(h) Effect on Housing Costs:

None.

VII. Economic Impact Assessment:

The economic impact of the proposed regulatory changes for the recreational razor clam fishery is expected to be economically neutral since the regulatory change will restore the original location of the management boundary line on Clam Beach (also known as Little River Beach), Humboldt County and increase razor clam fishing opportunity in the southern management section of the beach.

The proposed changes are consistent with existing scientifically-based regulations related to rotating areas to razor clam fishing. Providing for sustainable razor clam fishing in turn supports businesses that contribute to the fishery economy, such as:

sport fishing business owners, tackle store owners, vendors of food, bait, fuel and lodging, and others that provide goods or services to those that recreationally pursue razor clams in Humboldt County, California.

Effects of the regulation on the creation or elimination of jobs within the State

The cumulative effects of the changes statewide are estimated to be neutral to the creation or elimination of jobs in California. No significant changes in fishing effort and recreational fishing expenditures to businesses are expected as a direct result of the proposed regulation changes.

Effects of the regulation on the creation of new businesses or the elimination of existing businesses within the State

The cumulative effects of the changes statewide are expected to be neutral to the creation or elimination of businesses in California. No significant changes in fishing effort and recreational fishing expenditures to businesses are expected as a direct result of the proposed regulation changes.

Effects of the regulation on the expansion of businesses currently doing business within the State

The cumulative effects of the changes statewide are expected to be neutral to the expansion of businesses currently doing business in California. No significant changes in fishing effort and recreational fishing expenditures to businesses are expected as a direct result of the proposed regulation changes.

Benefits of the regulation to the health and welfare of California residents

The proposed regulation change will provide increased opportunity for razor clam fishing in the southern management section at Clam Beach, Humboldt County during even years.

Benefits of the regulation to worker safety

The proposed regulations are not anticipated to impact worker safety conditions.

Benefits of the regulation to the State's environment

It is the policy of this State to encourage the conservation, maintenance, and utilization of living marine resources under the jurisdiction and influence of the

State for the benefit of all citizens (Section 1701, Fish and Game Code). Benefits of the proposed management actions include increased fishing opportunity, along with the continuation of the reasonable and sustainable management of recreational razor clam resources.

Informative Digest/Policy Statement Overview

Under existing law, razor clams may be taken for recreational purposes with a sport fishing license subject to regulations prescribed by the Fish and Game Commission (Commission). Current regulations for clams specify bag and possession limits, open/closed fishing areas by year, fishing hours and gear restrictions. The proposed regulation change is in response to public recommendations including Humboldt Area Saltwater Angers and Humboldt County Board of Supervisors, and would restore the original location of the management boundary at Little River Beach, Humboldt County.

The razor clam management boundary line at Little River Beach, commonly referred to as Clam Beach, is a seasonal creek, named Strawberry Creek, that was meant to divide the beach into approximate equal segments that could be fished in alternate years. Since the adoption of this regulation in 1953 in response to a decline in larger clams, this natural creek has meandered southward by 0.6 miles from its original location, resulting in a larger area in the northern section open for clamming during odd-numbered years. In even-numbered years, clammers now have to travel quite far south from the beach access point, the south county parking lot, to reach the smaller, southern section of the beach. The original location of the creek divided the beach relatively near where a county-maintained public parking lot exists today.

Rotating areas for clamming has been shown to encourage the recovery and productivity of clam beds for future seasons while relieving fishing pressure on alternate years so that clams can grow unmolested. As a result of the southward migration of the creek boundary line, the goal of an annual rotation of effort somewhat equally distributed between north and south sections of the beach has been compromised. The amendment would address the following:

1. Replace reference to the Strawberry Creek boundary with the boundary line due west from the county parking lot trailhead located at 40° 59.67' north latitude.
2. Also replace the name Little River Beach with Clam Beach while using the former name parenthetically.

<u>Benefits of the Regulation</u>
The Commission anticipates benefits to the razor clam resource and its fishery in Humboldt County. The proposed regulation changes are intended to provide increased clam fishing opportunity in even-numbered years by increasing the size of the open southern Clam Beach management zone, thereby restoring the original intent of the regulation. The Commission anticipates benefits to the environment by the sustainable management of California's razor clam resources.

<u>Consistency with State or Federal Regulations</u>
The proposed regulations are neither inconsistent nor incompatible with existing state regulations. Section 20, Article IV, of the State Constitution specifies that the Legislature may delegate to the Fish and Game Commission such powers relating to the protection and propagation of fish and game as the Legislature sees fit. The Legislature has

delegated to the Commission the power to regulate the recreational take of razor clams, specifically the size and bag limits, seasons and means of taking (Fish and Game Code sections 200 and 205). The Commission has reviewed its own regulations and finds that the proposed regulations are neither inconsistent nor incompatible with existing state regulations. The Commission has searched the California Code of Regulations and finds no other state agency regulations pertaining to the recreational take of razor clams.

Regulatory Language

Amend Section 29.45, Title 14, CCR, as follows:

§29.45. RAZOR CLAMS.

... [No changes to subsections (a)(2), (a)(3) and (b)]

(a) Open season:

(1) Clam Beach (also known as Little River Beach) ~~Little River Beach~~ in Humboldt County: Between Mad River and ~~Strawberry Creek~~ south of the boundary line due west from the Clam Beach south parking lot trailhead (40° 59.67' N. lat.) open only during even-numbered years; between ~~Strawberry Creek and~~ Moonstone Beach and north of the boundary line due west from the Clam Beach south parking lot trailhead (40° 59.67' N. lat.) open only during odd-numbered years.

Note: Authority cited: Sections 200, 202, 205 and 220, Fish and Game Code. Reference: Sections 200, 202, 205, 206 and 220, Fish and Game Code.

State of California
Department of Fish and Wildlife

RECEIVED
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COMMISSION

2016 JUL 22 AM 8: 13

Memorandum

Date: July 18, 2016

To: Valerie Termini
Executive Director
Fish and Game Commission

From: Charlton H. Bonham
Director

Subject: **Agenda Item for the August 24-25, 2016 Fish and Game Commission Meeting Regarding Proposed Amendments to Sport Fishing Regulations**

Attached please find two Initial Statement of Reasons to amend Title 14, California Code of Regulations (CCR). This proposal contains inland sportfishing revisions to amend sections 1.74, 5.05, 5.40, 5.60, 7.00, 7.50, subsection (c) of Section 43, and subsections (c)(3) and (c)(7) of Section 671, Title 14, CCR, and razor clam boundary change in Humboldt County to amend subsection (a)(1) of Section 29.45 Title 14, CCR.

This inland sportfishing regulatory proposal will increase fishing opportunities for landlocked salmon, increase protection for listed steelhead, remove regulations that are no longer relevant, update nomenclature for amphibians and reptiles, correct regulations pertaining to combined bag and possession limits trout and landlocked salmon, clarify the bag and possession limits for trout, and update the sport fishing report card requirements. The proposed regulatory changes are needed to reduce public confusion and improve regulatory enforcement.

The razor clam management boundary line at Little River Beach, commonly referred to as Clam Beach, is Strawberry Creek, a seasonal creek that was meant to divide the beach into approximate equal segments that could be fished in alternate years. Since the adoption of this regulation in 1953 in response to a decline in larger clams, this natural creek has meandered southward by 0.6 miles from its original location, resulting in a larger area in the northern section open for clamming during odd-numbered years. In even-numbered years, clammers now have to travel quite far south from the beach access point, the south county parking lot, to reach the smaller, southern section of the beach. The original location of the creek divided the beach relatively near where a county-maintained public parking lot exists today.

The proposed regulation change would restore the original intent of the regulation by replacing reference to the Strawberry Creek boundary with reference to a boundary marker and accompanying latitude reading, due west of the trailhead leading from the Clam Beach south county parking lot. The northern and southern boundaries would remain in regulation as Moonstone Beach and Mad River, respectively.

If you have any questions regarding this item, please contact Kevin Shaffer, Acting Chief, Fisheries Branch, at (916) 327-8841 or at Kevin.Shaffer@wildlife.ca.gov.

The public notice for the razor clam boundary should identify Environmental Scientist Christy Juhasz as the Department's point of contact for this rulemaking. She can be reached at (707) 576-2887 or at Christy.Juhasz@wildlife.ca.gov.

Attachments

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STATE OF CALIFORNIA
FISH AND GAME COMMISSION
INITIAL STATEMENT OF REASONS FOR REGULATORY ACTION
(Pre-publication of Notice Statement)

Amend Section 670
Title 14, California Code of Regulations
Re: Falconry

I. Date of Initial Statement of Reasons: July 26, 2016

II. Dates and Locations of Scheduled Hearings:

(a) Notice Hearing:	Date:	August 25, 2016
	Location:	Folsom, CA
(b) Discussion Hearing:	Date:	October 20, 2016
	Location:	Eureka, CA
(c) Adoption Hearing:	Date:	December 8, 2016
	Location:	San Diego, CA

III. Description of Regulatory Action:

(a) Statement of Specific Purpose of Regulation Change and Factual Basis for Determining that Regulation Change is Reasonably Necessary:

The falconry regulations were last amended in 2013 to conform to federal guidelines which required states to adopt their own rules governing the sport. At that time it was understood by the Fish and Game Commission (Commission), falconers, and the public that the new California regulations would need updating. The proposed amendments include numerous changes to bring the regulations more in line with the current practice of falconry in California and federal guidelines. In addition, editorial changes were needed for clarity and consistency.

PROPOSED REGULATIONS

The changes currently proposed for inclusion are enumerated in the following table. The first column is the current subsection to be amended. The second column indicates the new subsection (renumbered) of the amendment, and the third column contains the general subject to be changed, edited, or made more specific (refer to the regulatory text for proposed language and context).

Current subsection	New subsection	Reason for the Proposed Amendment Revision, Addition, or Deletion
670	670	The following minor editorial changes are proposed for clarity and consistency in Title 14 throughout Section 670 where appropriate: • Change all subsection titles from ALL CAPITALS to Upper/lower case. • Delete internal subsection references found within the same subsection; replace with "as described (or specified) herein where appropriate. • Change all Department website references to the current web address: wildlife.ca.gov. • Number or renumber subsections to separate different provisions for clarity. • Change all references to "regulatory year" to "license year". • Change all references to "lapsed" licenses to "expired". • Change all references to "level" to "class". • Change all references to "consecutive" days to "calendar days" (e.g., 30 calendar days). This change does not conflict with federal falconry regulations, which read "consecutive calendar days". • Replace most references to "he/she" with "licensee", and "his/her" with "the licensee's" (or similar as needed). • Change all references to federal regulations found in Title 50, CFR, Part 21, to "50 CFR 21" for consistency. • The USFWS amended their falconry regulations to allow California falconers to report directly to the Department. Accordingly, remove all references to the federal form 3-186A and electronic reporting, and replace with the Department's reporting system.
	(a)(2)	• Add clause to recognize exceptions required under Fish and Game Code Section 12300, Application of code to California Indians; Limitations and condition. • Add the words "it shall be unlawful" to clarify that possession of a valid license is required while engaged in falconry activities and lack of a license is a citable offense.
	(a)(4)	• At the Commission's request, add language that specifies the types of documentation falconers are required (according to the activity involved) to carry which include, but are not limited to; o an original valid hunting license when hunting with a raptor; o permission to hunt on private property; o permission to fly or hunt with another falconer's bird(s); o permission to fly a raptor for rehabilitation purposes; or o department approved exemption from banding when transporting or flying an un-banded raptor.

Current subsection	New subsection	Reason for the Proposed Amendment Revision, Addition, or Deletion
	(a)(5)	• Change the date of the Code of Federal Regulations to the most recent 07/02/2015. • Delete "The department shall make these and the federal regulations available at www.dfg.ca.gov/licensing/"since the public is directed to the new website in subsection (a)(6).
	(a)(6)	• Add a statement directing the public to obtain and submit forms to the License and Revenue Branch, or to the Department's online reporting system.
(b)	(b)(7)	• Amend the definition of Falconry by deleting the reference to "free flight." The word "training" includes free flight and other activities when not in flight.
	(b)(8)	• Amend the definition of "Hacking" which is a method of having the raptor "gain experience and conditioning"
	(b)(10)	• Amend the definition of "Imp" to "Imping" using "another" feather to repair a damaged feather on a bird.
	(b)(12)	• Add definition of "license year" for consistency with other regulations. This replaces the definition of "Regulatory year" in (b)(15).
(b)(15)		• Delete definition of "Regulatory year" and replace with License year (b)(12).
(c)	(c)	• When referring to California hunting laws and regulations, change "related to" to "authorizing" for clarity.
(c)	(c)(1)	• Add clarity and improve instructions regarding procedures to follow in the event of inadvertent take of species (other than threatened or endangered species); • Add "let it lay" language, meaning that if inadvertent take of species (other than threatened or endangered species) occurs to let the raptor feed on it. • Add language for animals injured as a result of unauthorized take to be taken to rehabilitation facility.
	(c)(2)	• Add the reporting of band or tag numbers (if any) of wildlife taken unintentionally. Important wildlife information is gained through band returns.
(d)	(d)	• Clarify that the unauthorized take of threatened and endangered species, candidate species or fully protected species is not covered by a falconry license. • Add "fully protected" species as listed in California. • Delete provisions requiring licensee to ensure that falconry activities do not result in the take or possession of a threatened or endangered wildlife species taken incidentally by a falconry raptor. Threatened and endangered species may not be taken or possessed at any time.

Current subsection	New subsection	Reason for the Proposed Amendment Revision, Addition, or Deletion
	(d)	• Change reporting the take of listed species to License and Revenue Branch rather than to the Department's regional offices.
(e)	(e)(1)(A)	• Add nonresident, or non-US citizen for clarity.
	(e)(1)(B)	• Delete "resident or nonresident" and replace with "licensee" for clarity. • Add "…that has not been expired for more than 5 years" for clarity
	(e)(1)(C)	• Delete "resident" and replace with "licensee"
	(e)(1)(D)	• Delete "…and intends to establish permanent residency in California prior to becoming a resident," since residency is not a requirement for licensing in California (for example a non-US citizen unlicensed falconer may apply in order to practice falconry); there is no need for this provision.
	(e)(2)(A)	• Delete "lapsed license" since it cannot be renewed and must be a new license. • Add reference to the "nonrefundable fee".
	(e)(2)(B)	• Add language to clarify that an application is renewable when not expired more than 5 years. • Add reference to the "nonrefundable fee."
(e)(2)(A)	(e)(2)(D)	• Clarify that the certification relates to "pending or previous administrative proceedings" that could disqualify the applicant.
(e)(2)(B)	(e)(2)(E)	• Clarify that the Department is "reviewing" the documents submitted by the applicant rather than "evaluating".
(e)(2)(C)		• Move the applicable nonresident provisions to subsection (e)(5) Nonresidents of California and Non-US Citizens, keeping these related regulations together for clarity.
(e)(3)	(e)(3)	• Add, "Any applicant not possessing a valid falconry license, or required to apply for a new…" for clarity on who needs to take the exam. • Clarify that the exam fee is charged for each examination in order to recover the Department's reasonable costs.
	(e)(3)(A) 2. and 3.	• Add language to clarify that nonresident and non-US citizens who have a valid license are exempt from the examination. • Add language for an exception when the applicant is a member of a federally recognized tribe and has a valid falconry license issued from that member's tribe, in accordance with FGC Section 12300.
	(e)(3)(B)	• Add language to clarify the necessity of an inspection of raptor facilities prior to a license being issued to a new falconer applicant.
(e)(4)		• Clarify that a falconry license is not valid unless renewed annually with the required application form and payment of fees.

Current subsection	New subsection	Reason for the Proposed Amendment Revision, Addition, or Deletion
	(e)(4)(A)-(C)	• Clarify that the practice of falconry is not allowed under an expired license, and what steps need to be taken if the licensee wishes to continue to practice falconry. • Clarify that an expired license is not valid unless renewed. • Provide for renewal of licenses not expired more than 5 years. • Clarify that a license expired more than 5 years may not be renewed but that an application for a new license is required.
	(e)(5)(A)	• Add, "The applicant is a member of a federally recognized tribe and has a valid falconry license issued from that member's tribe" in accordance with FGC Section 12300.
(e)(5)(A)	(e)(5)(B) 1.-3.	• Delete "fly raptors" and add "practice falconry" to clarify that practicing falconry covers more than just flying a raptor. • Clarify that the authorization to fly a California licensee's raptor must be signed and dated and in possession. • Clarify that the facilities of nonresident or non-U.S. citizen falconers are temporary but must still meet the housing standards in California regulations, or nonresident or non-U.S. citizen may house raptors held under their license with a California licensee.
	(e)(5)(C)	• Add provisions to clarify that a non-resident, or non-US citizen, or tribally licensed falconer, seeking a California license, must submit proof of valid license and have their raptor facilities inspected to obtain a California license.
	(e)(5)(D)	• Add provisions to clarify that a non-resident or non-US citizen, or tribal member falconer without a valid license must apply as a new applicant, pass the examination, and have their raptor facilities inspected to obtain a California license.
(e)(6)	(e)(6)	• Clarify that the Department has 'sole discretion' to establish the class for a falconer.
	(e)(6)(A)3.	• Clarify the necessity of maintaining a continuous sponsorship of an apprentice, and what period of time will be counted toward a total of 2 years sponsorship.
	(e)(6)(A)4.	• Add, "The Apprentice may take raptors less than 1 year old, except nestlings." This language is the same as provided in 50 CFR 21.29(c)(2)(i)(E) limiting what can be permitted in California. • Add that an apprentice must maintain proof of legal acquisition.
	(e)(6)(A)6.	• Clarify that it is the responsibility of the sponsor to certify that the minimum requirements have been met by the apprentice.

Current subsection	New subsection	Reason for the Proposed Amendment Revision, Addition, or Deletion
	(e)(6)(B)2.	• Specify that the General class falconer must maintain proper documentation of legal acquisition of birds, whether from California or elsewhere. • Delete the portion of the provision regarding "threatened and endangered species, and eagles". This portion is repetitive of the provisions set forth in subsection (d) which clearly provide that take of threatened and endangered species is unlawful, and is repetitive of the provisions set forth in subsection (e)(6)(C)2. which clearly provide that Master Falconers may possess eagles.
	(e)(6)(C)1.	• Specify that the Master class falconer must maintain proper documentation of legal acquisition of birds, whether from California or elsewhere. • Delete the portion of the provision regarding "threatened and endangered species, and eagles". This portion is repetitive of the provisions set forth in subsection (d) which clearly provide that take of threatened and endangered species is unlawful, and is repetitive of the provisions set forth in subsection (e)(6)(C)2. which clearly provide that Master Falconers may possess eagles.
	(e)(6)(C)2.	• Add language specifying that proof of legal acquisition of eagles is required. • Clarify that eagles shall not be taken from the wild and may only be obtained from a permitted source. Eagles in the wild are fully protected in California and therefore can only be obtained from a permitted source. • Add language to allow temporary transfer of eagles from a rehabilitation facility to a licensee to assist in rehabilitation. • Add clarification for documentation of the Master Falconer's prior experience with eagles.
(e)(7)	(e)(7)(B)	• Clarify that the exam fee must be paid each time the applicant takes the examination.
	(e)(7)(C)2.	• Add language to clarify that a new inspection is not required if the facilities shared by multiple falconers have passed a previous inspection.
	(e)(7)(E)	• Clarify that the administrative processing fee is charged only when the falconer requests that the Department enter the Resident Falconer Raptor Capture, Recapture and Release Report form into the online reporting system.
	(e)(7)(F)-(G)	• Delete subsections concerning the Raptor Capture Drawing, and consolidate in a new subsection (g)(8) for clarity.
	(e)(8)(D)	• Clarify that notification to the Department is required to be in writing.

Current subsection	New subsection	Reason for the Proposed Amendment Revision, Addition, or Deletion
	(e)(9)	• Add “the Fish and Game Code” to allow for suspension or revocation based on violations of FGC sections pertaining to raptors. • At the request of the Commission, add examples regarding what types of violations would result in immediate revocation including: o if the violations pertain to conduct that threatens native wildlife, o agricultural interests of this state, o the welfare of the birds, o the safety of the public, and o prior conviction or suspension. • Change “pursuant to” to “as described herein” for consistency.
	(e)(11)	• Add “30 calendar days” to clarify the last day for an appeal.
	(e)(12)	• Delete “after the expiration of the license.” The purpose of record retention was to have a 5-year retention maximum, not until after the license has expired.
	(e)(13)	• Change five “calendar” days to “business” days consistent with state offices being open.
(f)	(f)(1)-(3)	• Change the reference from federal reporting forms to the Department’s online reporting system. The requirements for each submittal are the same and the Administrative Processing Fee will be charged in the same way. • Add language to require that the inadvertent take of non-target wildlife be reported on the Hunting Take Report. • Clarify that the inadvertent take of non-target wildlife is required to be reported as set forth in subsections (c) and (d).
(g)	(g)(1)	• Revise to lower case “resident”.
	(g)(2)	• Revise to lower case “nonresident”. • Delete text related to the requirements for a license since this has already been described.
	(g)(3)	• Add a provision which specifies that non-U.S. citizens are not eligible to capture any California wild raptor.
(g)(7)(A)	(g)(8)(A)	• Clarify that there is no limit on capturing Northern Goshawk outside of the Tahoe Basin.
(g)(7)(K)	(g)(9)	• Renumber subsection (g)(7)(K)1.-10. to (g)(9)(A)-(J) to separate the Special Raptor Capture Random Drawing requirements to its own subsection. • Clarify that the random drawing is to distribute permits for those species with quotas as provided in (g)(8). • Revise to lower case “resident” and “nonresident”.
	(g)(9)(C)	• Clarify where licensee is to apply for drawing, and that a fee is required for each application.

Current subsection	New subsection	Reason for the Proposed Amendment Revision, Addition, or Deletion
	(g)(9)(D)	• Change the “midnight” deadline to “11:59 pm” for clarity • Change the application deadline to May 15, closer to the actual draw date as a convenience to the participants. • Delete “Incomplete, late ... shall not be included in the Drawing,” because the drawing will be held based on the electronic filing of the applicants, which cannot be completed until the information is correctly submitted.
	(g)(9)(E)	• Add a description of the random draw and award method by computer.
	(g)(9)(F)	• Change notification process to exclude mailed notification because both the entry and notice are only available online. • Delete notification to unsuccessful applicants because the entry and notification are only available online. • Change deadline for permit payment to June 30, the last day of the license year. • Delete date associated with permit awards to alternates, if any are available, they will be awarded in the order selected in the random drawing.
	(g)(9)(I)	• Clarify that when the permit holder is unsuccessful, the permit is to be returned to the License and Revenue Branch with 10 days of the expiration of the permit.
(g)(8)	(g)(10)(A)	• Clarify that any owner (not only a researcher) of a transmitter should be contacted.
(g)(11)	(g)(13)	• Clarify that the written permission of the private property owner is to be the original with signature.
(h)(2)(A)	(h)(2)(A)	• Clarify that a licensed falconer may temporarily possess and fly a raptor if they possess the appropriate class to do so.
(h)(3)		• Delete subsection (h)(3). The permanent disposition of wildlife, including birds, from a rehabilitation facility is set forth in Section 679, Possession of Wildlife and Wildlife Rehabilitation.
(h)(4)	(h)(3)	• Clarify that falconers are permitted to have temporary possession, while caring for an injured raptor.
	(h)(3)(A)	• Clarify that the terms of the transfer are at the discretion of the rehabilitator to ensure necessary care of the raptor • Clarify that licensee must have legible documentation of assisting a rehabilitator while flying the raptor.
	(h)(3)(B)	• Delete provision that a rehabilitator can permanently transfer a raptor to licensee. • Add that the Department can make a determination for extended care of the raptor by a licensee.
(h)(5)	(h)(4)	• Clarify that the importation of raptors by nonresidents or non-U.S. citizens may require additional federal permits.

Current subsection	New subsection	Reason for the Proposed Amendment Revision, Addition, or Deletion
(h)(6)	(h)(5)(B)	• Add “metal” to designate band type.
	(h)(5)(C)	• Delete authorization to allow any release of non-native raptors.
	(h)(5)(D)	• Add language prohibiting the release of barred owl in California (reason is due to conflicts with native spotted owls). • Add LRB as point of contact, with Wildlife Branch as responsible for disposition of barred owls.
(h)(7)	(h)(6)	• Add “or fully protected” according to California designation.
(h)(9)	(h)(8)	• Add “of any other raptor species” to clarify that following provisions regarding carcasses are for raptors other than eagles.
	(h)(8)(A)	• Add LRB as point of contact, with Wildlife Branch as responsible for disposition of any bird carcass to be delivered to the Department. • Revise for clarification the delivery of raptor carcasses to the Department.
	(h)(8)(E)	• Delete (D) and re-write as (E). • Revise provisions regarding taxidermy, that only the licensee may possess the mounted bird. • Upon expiration of the license or the death of the licensee, the mounted bird must be returned to the Department. • Add LRB as point of contact, with Wildlife Branch as responsible for disposition of the mount.
(h)(10)(A)2.	(h)(9)(A)2.	• Add LRB as a point of contact, and clarify that the disposition of a recaptured and unwanted bird will be determined by Wildlife Branch.
(h)(12)	(h)(11)	• Clarify the type of band as seamless “metal” bands. • Delete “licensed falconers” and add “persons or entities” to clarify that there are other types of permittees who can legally possess raptors.
(h)(14)	(h)(13)(B)	• Transfer of raptors to a federal Propagation Permit shall be reported on the falconer’s report to the Department.
(i)(1)	(i)(1)	• Clarify that a goshawk captured in the wild in California be banded with a permanent, nonreusable, numbered USFWS leg band. • Add language to clarify that peregrine, gyrfalcon or Harris’s hawk (not allowed for wild capture in California) that are legally acquired and imported into California also get a permanent, nonreusable, numbered USFWS leg band if they do not already have one.
(i)(1)(A)	(i)(1)(A)	• Revise to designate that LRB distribute “new or replacement permanent, nonreusable, numbered USFWS leg” bands which shall report banding data to the USFWS.
(i)(2)		• Delete subsection regarding lost or removed bands here, and incorporate into other subsections.

Current subsection	New subsection	Reason for the Proposed Amendment Revision, Addition, or Deletion
	(i)(2)	• Add provision that captive bred raptors listed under MBTA need a seamless metal band. Added to comply with federal regulations.
(i)(3)		• Delete subsection regarding rebanding here, and incorporate into other subsections.
	(i)(3)-(4)	• Add language to include lost or removed bands and rebanding provisions. Revision was made to mirror the federal regulation that allows the falconer to remove and reband birds under certain circumstances.
(j)(1)(C)	(j)(1)(C)	• Revise to allow supervision of raptors by non-licensed falconers (e.g. spouse, family member, etc.) while the raptor is outside. • Specify a minimum age of 12 which is the same minimum age for an apprentice class.
(j)(1)(E)	(j)(1)(E)	• Clarify the requirement for an inspection of raptor facilities and associated fees for facilities moved to a new location.
(j)(3)	(j)(3)	• Clarify that new applicants and applicants renewing a license that has been expired more than 5 years, are required to have their facilities inspected.
	(j)(3)(A)	• At the Commission's request, delete the word "premises" and add "facilities" clarifying that inspections are applicable to the raptor "facilities" as described in this subsection. • At the Commission's request, add language that the Department will make a reasonable attempt to contact licensee prior to conducting the inspection. (Note: it is the responsibility of the licensee to assure that the department's contact information is current.)
(j)(3)(B)	(j)(3)(B)	• Clarify that an original signature of the property owner on the permission letter is required if the raptor facilities are located on property not owned by the licensee.

(b) Authority and Reference Sections from Fish and Game Code for Regulation:

Authority: Sections: 200, 202, 203, 355, 356, 395, 396, 398, 710.5, 710.7, 713, 1050, 1054, 1530, 1583, 1802, 3007, 3031, 3039, 3503, 3503.5, 3511, 3513, 3800, 3801.6, 3950, 4150, and 10500, Fish and Game Code.

Reference: Sections: 395, 396, 713, 1050, 3007, 3031, 3503, 3503.5, 3511, 3513, and 3801.6 Fish and Game Code. Title 50, Code of Federal Regulations, Parts 21.29 and 21.30, and California Penal Code Section 597.

(c) Specific Technology or Equipment Required by Regulatory Change: None.

(d) Identification of Reports or Documents Supporting Regulation Change: None.

(e) Public Discussions of Proposed Regulations Prior to Notice publication: None.

IV. Description of Reasonable Alternatives to Regulatory Action:

(a) Alternatives to Regulation Change:

During and since the previous update of the falconry regulations in 2013, the public and licensed falconers provided recommendations for amendments to the regulations. Those recommendations that were accepted are enumerated in the ISOR. Some alternatives were rejected for the following reasons (subsection citations are to the revised numbering of the amended text):

- §670(a)(2): A valid original hunting license and falconry license are the only documents required to practice falconry. If other documents are required, they should be specified by the Department.
  Rejected. Other documentation that may be required is noted throughout the regulation, for example, permission to fly on private land, documentation that falconer is assisting in rehabilitation, permission to fly another falconer's bird, etc.
- §670(b)(12) Establish a three year license to replace the current single year license.
  Rejected: Hunting regulations are set by the license year, which is the 12 month period starting July 1 and ending the following June 30, and is the same as the falconry license term, or federal regulatory year. All licenses, tags, reporting requirements, and permits issued by the Department are established for a period of one year.
- §670(b)(13): Definition for "non-native raptor" should include hybrid raptors.
  Rejected: The Department does not consider hybrids as non-native in all cases.
- §670(d): Falconers cannot "ensure" that their raptors will not "take state or federally listed threatened, endangered, or candidate wildlife, or wildlife designated as fully protected within the State of California." The Department should provide some relief from this no-take provision.
  Rejected: The new California falconry regulations closely follow the requirements of the Federal Regulations with respect to the "no-take" rule. The falconer is instructed in the Federal regulations to identify the location of protected species and avoid flying the raptor in that location. In the event that unintended take occurs, both regulations provide that the falconer immediately report the take to appropriate federal and state authorities.
- §670(e)(1)(D): Include ability for a non-US citizen to use "equivalent experience" in place of a current license when seeking a California license.
  Rejected: All that is required to obtain a California falconry license is passing the falconry examination which demonstrates basic knowledge. Other documentation may be used to demonstrate the class level of the licensee with discretionary approval of the Department.
- §670(e)(4): Include some exemption for practicing falconry with an expired license in case the Department is late processing.
  Rejected: The Department has not been tardy issuing licenses since administering the program.

- §670(e)(4): Add provision for Department to collect back fees if the individual continues to practice falconry without a license.
  Rejected: The penalties for illegally practicing falconry without a license (as with hunting, fishing, etc.) are sufficient.
- §670(e)(5): Change to read, "A nonresident licensed falconer or non-U.S. citizen licensed falconer may 'transport their legally held raptors to' temporarily practice falconry in California for up to 120 calendar days without being required to obtain a California falconry license."
  Rejected: The insertion of "transport their legally held raptors to" will not change or clarify the current provision.
- §670(e)(6): Strike "at its sole discretion". If a falconer meets the requirements and qualifications for the class described in these regulations the licensee should be granted a license for that class.
  Rejected: The Department now has oversight of the falconry program in California, and has the sole authority to determine if a falconer meets the specified requirements for any falconry class.
- §670(e)(6)(A)2: Consider additional oversight of apprentice program.
  Rejected: The current oversight of the apprentice program mirrors that of the federal regulations. No evidence that additional oversight is needed.
- §670(e)(6)(A)4: Change to read, "An Apprentice falconer may only capture from the wild or possess a passage red-tailed hawk or an American kestrel of any age."
  Rejected: 50 CFR 21.29(c)(2)(i)(E) states that the apprentice "may take raptors less than 1 year old, except nestlings." This same language is proposed as an addition to this subsection.
- §670(e)(6)(A)(4),(B)(2) and (C)(1): In each subsection for Apprentice, General and Master class, it says, "Apprentice/General/Master falconer must maintain written proof of legal acquisition." This is redundant. It is elsewhere stated that all falconers must report disposition of falconry raptors to the Department in a timely manner.
  Rejected. The Department is requiring written documentation of legal acquisition to be on-hand so the origin of all birds may be determined. When asked by law enforcement they must produce a paper record.
- §670(e)(6)(B): The possession limits of raptors should be reduced, an experienced falconer can handle two birds, three at most.
  Rejected. Language in state regulations is consistent with federal regulations. There is no evidence that more raptors in possession equates to reduced care. The Department will retain existing language.
- §670(e)(6)(C)2.i.: Falconers wanted to add ". . . captured from the wild in California pursuant to Fish and Game Code 3511, but . . ."
  Rejected. Section 3511(a)(1) FGC also states "No provision of this code or any other law shall be construed to authorize the issuance of a permit or license to take a fully protected bird." The insertion of the reference to FGC 3511 in the regulation would be repetitive and is presently cited in Authority and Reference.

- §670(e)(6)(C)2.ii.: Delete the portion of the provision regarding “eagles ... transferred from a rehabilitation facility” thus allowing Master falconer possession of a rehabilitated eagle.
  Rejected: Possession of eagles with specified origins (not caught from the wild in California), from a permitted source, and with proof of legal acquisition, is clearly stated in subsections (e)(6)(C)2. i.-iii. A Master falconer may possess any eagle (except bald eagles) within those qualifications. Section 679 further provides for the permanent disposition from rehabilitation facilities of wildlife including birds.
- §670(e)(8)(B): Delete failure to comply with city and local ordinances as a reason for denial of a new or renewal license.
  Rejected: Allowing denials, revocations or suspensions based on a violation of a city or county ordinance that constitutes a violation of the Fish and Game Code, regulations related to raptors in Title 14, or Penal Code Section 597, protects birds and the public by preventing persons who have not followed such ordinances from holding a Department-issued license.
- §670(e)(9): The falconers disagree with the penalties for violation and propose that they should be more in line with the hunting regulations section that deals with license suspension and revocation.
  Rejected. The Department does not support a change to these provisions, which are uniquely tied to the falconry license and the possession of living raptors.
- §670(g): Proposed that trapping raptors at any time of the year needs to be re-examined; that some species may breed when less than one year old, while still in their juvenile plumage; it is possible that someone might legally trap a juvenile hawk that in fact has a nest with eggs or young, unbeknownst to the trapper. In contrast, another commenter supported year-round take of raptors.
  Rejected. The environmental review did not indicate there was an issue with take of wild raptors for use in falconry. Current regulations restrict age and number of young taken from a nest. Other restrictions are also instituted, such as limitations on the number of goshawks in the Tahoe Basin, limitations on the number of prairie falcons statewide, and seasonal restrictions for merlin. Therefore, the current language will be retained.
- §670(g)(7): Suggested that the Department add ferruginous hawk to the list of allowed species.
  Rejected. Due to species decline as described in the Final Environmental Document (FED) using best available population/trend data, the ferruginous hawk was taken off the list of allowed raptors. There is no new data to indicate a change from the conclusions of the FED.
- §670(g)(7)(A): Suggested removing the limit on Northern Goshawk in the Tahoe Basin.
  Rejected. Analysis in FED was based on best available population/trend data. There is no change in knowledge from when the FED was completed.
- §670(g)(7)(H): Suggested removing statewide limit on prairie falcon.
  Rejected. Analysis in FED was based on best available population/trend data. There is no change in knowledge from when the FED was completed.

- §670(g)(7)(K): Falconers suggested that the dates and terms of the Special Capture Drawing and Permit appear to exclude spring captures and should be changed.
  Rejected. A permit to obtain a raptor with quota is issued in July and will be valid for one year, including the following spring. However, new drawing dates move the drawing closer to the issuance of the special permit in June.
- §670(h)(3): Falconers want to be able to obtain healthy rehabilitated raptors from rehabilitation facilities.
  Rejected. This entire subsection is removed because it is inconsistent with other regulations in Title 14. Subsection 679(f)(4), Title 14, states: " If any *[rehabilitated]* animal cannot be released, it shall be transferred to a zoological garden, museum, college, university, or other education/research institution or wildlife exhibitor." The current provision does not include falconers.
- §670(h)(4): Notification of importation of a raptor into California is excessive.
  Rejected: These California provisions mirror those found in the federal regulations 50 CFR 21.29, 14 (ii)(A) through (E).
- §670(h)(9)(D): Falconers want to modify the limitations on possession of birds to say, "Possession of the mounted raptor will not count against the possession limit of the falconer."
  Rejected. The clarification is unnecessary, the Department has not and will not count dead birds as a part of the possession limit described in regulation "for falconry purposes." The possession of a carcass, parts, or a mounted bird is permitted by a falconer provided that the license is not expired. After expiration, or upon the death of the falconer, the mounted bird must be returned to the Department for disposition. No other person may possess the mount.
- §670(h)(13)(C): Apprentice falconers should be able to work as sub-permittee for abatement activities.
  Rejected: Although a change to federal abatement regulations is proposed with the USFWS, nothing has been approved.
- §670(i): Consider specialized banding of all falconry raptors.
  Rejected: Though the Department considers this a worthy consideration, this is outside of scope of this regulatory rulemaking.
- Address option of requiring a signed-off validation by agency staff (CDFW, U.S. Fish and Wildlife Service) as part of reporting take in the future, similar to the process for completing deer tags.
  Rejected: Outside of scope of this regulatory rulemaking.
- Address the option for allowing depredating raptors (those captured under federal Migratory Bird Treaty Act depredation permits) to be placed with falconers.
- Rejected: Outside of scope of this regulatory rulemaking.

(b) No Change Alternative:

The falconry regulations were last amended in 2013 to conform to federal guidelines which required states to adopt their own rules governing the sport. At

that time it was understood by the Commission, falconers, and the public that the new California regulations would need updating and amending. The "No Change" alternative would not update the regulations and would not meet this expectation.

(c) Consideration of Alternatives:

In view of information currently possessed, no reasonable alternative considered would be more effective in carrying out the purpose for which the regulation is proposed, would be as effective and less burdensome to affected private persons than the proposed regulation, or would be more cost effective to affected private persons and equally effective in implementing the statutory policy or other provision of law.

V. Mitigation Measures Required by Regulatory Action:

The proposed regulatory action will have no negative impact on the environment. Therefore, no mitigation measures are needed.

VI. Impact of Regulatory Action:

The potential for significant statewide adverse economic impacts that might result from the proposed regulatory action have been assessed, and the following initial determinations relative to the required statutory categories have been made:

(a) Significant Statewide Adverse Economic Impact Directly Affecting Businesses, Including the Ability of California Businesses to Compete with Businesses in Other States:

The Commission does not anticipate significant statewide adverse economic impact directly affecting business, including the ability of California businesses to compete with businesses in other states. The proposed regulations amend the existing rules for the sport of falconry, primarily for recreational purposes.

(b) Impact on the Creation or Elimination of Jobs Within the State, the Creation of New Businesses or the Elimination of Existing Businesses, or the Expansion of Businesses in California; Benefits of the Regulation to the Health and Welfare of California Residents, Worker Safety, and the State's Environment:

The Commission does not anticipate any significant impacts on the creation or elimination of jobs, the creation of new businesses or the elimination of existing businesses, or the expansion of businesses; and no benefits to the health and welfare of California residents, or to worker safety or to the state's environment. The proposed regulations affect a limited number of falconers in California and therefore are unlikely to create or eliminate jobs, or result in the expansion or elimination of existing businesses.

(c) Cost Impacts on a Representative Private Person or Business:

The proposed amendments do not impose any additional fees or costs to private persons involved in the sport of falconry.

(d) Costs or Savings to State Agencies or Costs/Savings in Federal Funding to the State: None

(e) Nondiscretionary Costs/Savings to Local Agencies: None

(f) Programs Mandated on Local Agencies or School Districts: None

(g) Costs Imposed on Any Local Agency or School District that is Required to be Reimbursed Under Part 7 (commencing with Section 17500) of Division 4, Government Code: None

(h) Effect on Housing Costs: None

VII. Economic Impact Assessment

(a) Effects of the Regulation on the Creation or Elimination of Jobs Within the State:

The cumulative effects of the changes statewide are expected to be neutral with regard to the creation or elimination of jobs within the State.

(b) Effects of the Regulation on the Creation of New Businesses or the Elimination of Existing Businesses Within the State:

The cumulative effects of the changes statewide are expected to be neutral with regard to the creation of new businesses or the elimination of existing businesses within the State.

(c) Effects of the Regulation on the Expansion of Businesses Currently Doing Business Within the State:

The cumulative effects of the changes statewide are expected to be neutral with regard to expansion of businesses currently doing business within the State.

(d) Benefits of the Regulation to the Health and Welfare of California Residents:

The cumulative effects of the changes statewide are expected to be neutral with regard to the health and welfare of California residents.

(e) Benefits of the Regulation to Worker Safety:

The proposed regulations do not address and will not affect worker safety.

(f) Benefits of the Regulation to the State's Environment:

The cumulative effects of the changes statewide are expected to be neutral with regard to the state’s environment.

(g) Other Benefits of the Regulation:

The Commission anticipates benefits to licensed falconers in the current practice of the sport in California through clarified regulations.

Informative Digest/Policy Statement Overview

Amend Sections 670, Falconry, Title 14, California Code of Regulations (CCR).

The falconry regulations were last amended in 2013 to conform to federal guidelines which required states to adopt their own rules governing the sport. At that time it was understood by the Commission, falconers, and the public that the new California regulations would require updating and amendment to bring the regulations more in line with the current practice of falconry in California.

Numerous minor edits, renumbering, and clarifying changes are proposed; the more substantive changes include:

- Revising language to be more consistent with regulatory language standards (e.g., using lower-case for all headers, renumbering subsections, appropriate references for websites, replacing “regulatory year” with “license year,” reference to expired licenses, references to federal regulations).
- Allowing falconers to complete reports using the Department’s online reporting system found on the Department website at wildlife.ca.gov. Accordingly, no reporting to the USFWS is required and all references to the federal form 3-186A are removed.
- Clarifying what documentation is required to be carried when engaged in falconry activities.
- Amending the definitions (e.g., falconry, hacking, imping) to more accurately represent the activity.
- Improving instructions to falconers for procedures to avoid take of unauthorized wildlife and instructions to follow in the event that inadvertent take does occur, including fully protected species, and adopting “let it lay” language for non-protected species (meaning that if take occurs to let the raptor feed on the prey) and reporting requirements.
- Clarifying that a falconry license does not authorize the take of threatened or endangered species, candidate species or fully protected species.
- Clarifying licensee application procedures for resident, nonresident, tribal, and non-US citizen falconers.
- Adding language specifying that a tribal member with a valid falconry license issued from that member’s tribe will be treated in the same manner as a nonresident licensed falconer.
- Clarifying that a tribal member that does not have a license must apply for a California license to practice falconry outside the jurisdiction of the tribe.
- Clarifying that the exam fee is charged for each multiple examination to recover the Department’s reasonable costs.
- Adding an exam exemption for new resident falconers with a valid out-of-state falconry license.
- Clarifying when inspections are needed.
- Clarifying what is allowed and not allowed under an expired license, and what steps must be taken if a licensee wishes to continue to practice falconry.

- Adding terms for renewal, at the Department's discretion, of a license where the licensee has been unlawfully in active practice without annual renewal and the payment of fees.
- Revising suspension and revocation clause to be more specific to the types of violations that would result in immediate action.
- Regarding written authorization required for certain activities, adding specifications that the authorization must be signed and dated with original signature.
- Identifying License and Revenue Branch as the point of contact for certain determinations, with the actual determination being made by Wildlife Branch in some instances.
- Clarifying the necessity of maintaining a continuous sponsorship of an apprentice; what period of time will be counted toward a total of 2 years sponsorship; and sponsor responsibility to assure that minimum qualifications have been met.
- Clarifying that falconers must maintain proper documentation of legal acquisition of birds and records retention is for 5 years only.
- Clarifying that take of northern goshawk outside of the Tahoe Basin does not have a limit.
- Adding language that identifies no need for a new inspection if the facilities shared by multiple falconers have passed a previous inspection.
- Clarifying when the administrative fee applies.
- Revising specifications for applying for the raptor capture drawing and obtaining a permit, including revision of deadline dates and times.
- Allowing falconers to remove bands or reband raptors under certain circumstances, if needed.
- Adding specific language allowing family members to watch raptors outside, but only if a specific age.
- Deleting the existing provision in 670 that raptors may be permanently transferred to a falconer from rehabilitation facilities. Section 679 provides for the permanent disposition from rehabilitation facilities of wildlife including birds.
- Clarifying that falconers may temporarily possess raptors from rehabilitation facilities for the purpose of conditioning for release back in to the wild.
- Adding text to clarify that non-native raptors or barred owls may not be released into the wild.
- Revising text regarding process and limitations for mounting raptor carcasses.
- Clarifying that unannounced inspections are applicable to falconry facilities.
- Revising language so that the Department will make a reasonable attempt to contact the licensee prior to conducting inspections.

BENEFITS OF THE PROPOSED ACTION:

The Commission anticipates benefits to licensed falconers in the current practice of the sport in California through clarified regulations.

EVALUATION OF INCOMPATIBILITY WITH EXISTING REGULATIONS:

Section 20, Article IV, of the State Constitution specifies that the Legislature may delegate to the Fish and Game Commission such powers relating to the protection and propagation of fish and game as the Legislature sees fit. The Legislature has delegated to the Commission the power to regulate the practice of falconry. No other State agency has the authority to promulgate such regulations. The Commission has searched the CCR for any regulations regarding falconry and has found no such regulation; therefore the Commission has concluded that the proposed regulations are neither inconsistent nor incompatible with existing State regulations.

Regulatory Text

Section 670 is hereby amended to read:

§ 670. Practice of Falconry.

(a) ~~GENERAL PROVISIONS~~ General Provisions.

(1) Any person who wants to engage in falconry activities shall first apply for and be issued an annual falconry license from the department. ~~While engaged in falconry, a resident, nonresident or non-U.S. citizen shall carry an original permit, and all additional documentation or legible copies thereof, that authorize him or her to practice falconry in California.~~

(2) Except as provided in Section 12300, Fish and Game Code, it shall be unlawful for any person to engage in falconry in California unless they have in their possession a valid original falconry license.

(3) Falconry activities shall be as provided by the Fish and Game Code and regulations provided herein.

(4) While engaged in a falconry activity the licensee shall have in his/her possession the document(s) required for that activity as set forth herein: an original valid hunting license and required stamps, such as an upland game or state duck stamp along with a Federal migratory-bird hunting and conservation stamp, when hunting with a raptor; permission to hunt on private property; permission to fly or hunt with another falconer's bird(s); permission to fly a raptor for rehabilitation purposes; a nuisance bird abatement permit; or, department approved exemption from banding when transporting or flying an un-banded raptor.

(5) Applicable regulations adopted by the U.S. Secretary of the Interior pursuant to the Migratory Bird Treaty Act (MBTA) and published in Title 50, Code of Federal Regulations, ~~(CFR),~~ Part 21 ~~(Revised 11/05/2012)~~ (Revised 07/02/2015), hereinafter referred to as 50 CFR 21, are hereby incorporated and made a part of these regulations. ~~The department shall make these and the federal regulations available at www.dfg.ca.gov/licensing/.~~

(6) Falconry applications and records as required by this section shall be kept on forms provided by the department and submitted to the department's License and Revenue Branch,1740 N. Market Blvd., Sacramento, CA 95834; or, submitted to the department's online reporting system website at wildlife.ca.gov.

(b) ~~FALCONRY DEFINITIONS~~ Definitions. For purposes of this section, the following definitions apply:

(1) "Abatement" is the use of trained raptors to reduce human/wildlife conflicts.

(2) "Captive-bred raptor" means the progeny of a mating of raptors in captivity, or progeny produced through artificial insemination.

(3) "Capture" means to trap or capture or attempt to trap or capture a raptor from the wild.

(4) "Eagles" includes golden eagle (*Aquila chrysaetos*), bald eagle (*Haliaeetus leucocephalus*), white-tailed eagle (*Haliaeetus albicilla*), and Steller's sea-eagle (*Haliaeetus pelagicus*).

(5) "Exotic raptor" is a raptor that has no subspecies occurring naturally in the wild in the United States and is not covered under the MBTA.

(6) "Eyas raptor" or "nestling" is a young raptor not yet capable of flight.

(7) "Falconry" means the possession, housing, trapping, transport, and use of raptors for the purpose of hunting or ~~free flight~~ training.
(8) "Hacking" is the temporary or permanent release of a raptor held for falconry to the wild so that it may ~~survive on its own~~ gain experience and conditioning.
(9) "Hybrid raptor" means offspring of raptors of two or more distinct species listed in Title 50, CFR, Section 10.13.
(10) ~~"Imp"~~ "Imping" is to cut a broken or damaged feather and replace or repair it with ~~an undamaged~~ another feather.
(11) "Imprint" means a raptor that is hand-raised in isolation from the sight of other raptors from two weeks of age until it has fledged. An imprinted raptor is considered to be so for its entire lifetime.
(12) "License year" is the 12-month period starting July 1 and ending the following June 30, and is the same as the term "regulatory year" for determining possession and take of raptors for falconry as defined in 50 CFR 21.
~~(12)~~ (13) "Non-native raptor" is any raptor that does not naturally occur in the state of California.
~~(13)~~ (14) "Passage raptor" is a juvenile raptor less than one year old that is capable of flight.
~~(14)~~ (15) "Raptor" means any bird of the Order Falconiformes, Accipitriformes or Strigiformes, or a hybrid thereof.
~~(15) "Regulatory year" is the 12-month period starting July 1 and ending the following June 30, and is the same as the falconry license term.~~
(16) "Wild raptor" means a raptor removed from the wild for falconry. It is considered a wild captured raptor, no matter its time in captivity or whether it is transferred to other licensees or permit types.
(c) ~~TAKE OF GAME SPECIES OR NONGAME BIRDS OR MAMMALS~~ Take of Game Species or Nongame Birds or Mammals. Every person using falconry raptors to hunt or take resident small game including upland game species, migratory game birds, or nongame birds or mammals in California shall abide by the laws and regulations ~~related to~~ authorizing hunting of such species, including but not limited to licenses, seasons, bag limits, and hunting hours.
(1) A licensee shall ensure, to the extent possible, that falconry activities do not result in unauthorized take of wildlife.
(A) If an animal is injured as a result of unauthorized take, the licensee shall remove the animal from the raptor and transport the injured animal to the nearest wildlife rehabilitation center.
(B) If an animal is killed as a result of an unauthorized take, the licensee may allow a falconry bird to feed on the kill but the licensee shall not possess the animal and shall leave the kill at the site where taken.
(2) The take shall be reported to the department, with the band or tag number of the species taken (if any), as set forth in subsection (f).
(d) ~~TAKE OF STATE OR FEDERAL THREATENED OR ENDANGERED SPECIES.~~ Take of State or Federal Threatened or Endangered Species. ~~A licensee shall ensure that falconry activities do not cause the take of state or federally threatened or endangered wildlife, for example, by avoiding flying a raptor in the vicinity of the listed species. Any threatened or endangered bird, mammal, reptile or amphibian taken by a~~

~~raptor without intent shall be removed from the raptor as soon as practical, and left at the site where taken if dead, or taken to the nearest wildlife rehabilitation center if injured. The take~~ This license does not authorize take of state or federally listed threatened, endangered, or candidate wildlife, or wildlife designated as fully protected within the State of California. Any take shall be reported by the licensee to the nearest U.S. Fish and Wildlife Service (USFWS) Ecological Services Field Office and the ~~nearest department regional office (www.dfg.ca.gov/regions/)~~ department's License and Revenue Branch within 10 calendar days of the kill. The licensee shall report his or her name, falconry ~~permit~~ license number, date, species and sex (if known) of the animal taken, and exact location of the kill ~~pursuant to subsections (19), (19)(i) and (19)(ii), Title 50, Section 21.29, subdivision (f), Code of Federal Regulations~~ as provided in 50 CFR 21.

(e) ~~LICENSING~~ Licensing.

(1) ~~FALCONRY LICENSES~~ Falconry Licenses: A falconry license is issued in one of three falconry classes listed in subsection (e)(6) and may be issued to a:

(A) California resident, nonresident, or non-US citizen, who is applying for ~~his/her first~~ a new license;

(B) California ~~resident or nonresident~~ licensee who is applying to renew a ~~lapsed~~ license that has not been expired for more than 5 years;

(C) California ~~resident~~ licensee who is applying to renew a license that has not ~~lapsed~~ expired; and,

(D) Nonresident or non-U.S. citizen falconer who has a valid falconry license issued from another state or country ~~and intends to establish permanent residency in California prior to becoming a resident~~.

(2) ~~APPLICATION FOR LICENSE~~ Application for License.

(A) The applicant for a new license~~, or lapsed license~~ shall submit a completed New Falconry License Application with the nonrefundable fee, as specified in Section 703, to the address listed on the application.

(B) The applicant for ~~a license~~ renewal of a license that has not been expired for more than 5 years, shall submit a completed Falconry License Renewal Application with the nonrefundable fee, as specified in Section 703, to the address listed on the application.

(C) The department may issue new licenses and renew ~~existing or lapsed expired~~ licenses with the conditions it determines are necessary to protect native wildlife, agriculture interests, animal welfare, and/or human health and safety.

~~(A) SIGNED CERTIFICATION~~ (D) Signed Certification. Each application shall contain a certification worded as follows: "I certify that I have read and am familiar with both the California and U.S. Fish and Wildlife Service falconry regulation, CFR 50, Sections 21.29 through 21.30, and that the information I am submitting is complete and accurate to the best of my knowledge and belief. I understand that any false statement herein may subject me to cancellation of the application, suspension or revocation of a license, and/or administrative, civil, or criminal penalties. I understand that my facilities, equipment, or raptors are subject to unannounced inspection pursuant to ~~Section~~ subsection 670(j), Title 14, of the ~~CCR~~ California Code of Regulations. I certify that I have read, understand, and agree to abide by, all conditions of this license, the applicable provisions of ~~FGC~~ the Fish and Game Code, and the regulations promulgated thereto. I certify that ~~I am not currently under any Fish and Wildlife license~~

~~or permit revocation or suspension, and that there are no other legal or administrative proceedings pending that would~~ there are no pending or previous legal or administrative proceedings that could disqualify me from obtaining this license." The application shall be submitted with the applicant's original signature.
~~(B) EXPERIENCE~~ (E) Experience. The department shall consider an applicant's falconry experience acquired in California, as well as another state or country when ~~evaluating~~ reviewing an application for any class of license. The department shall determine which ~~level~~ class of falconry license is appropriate, consistent with the class requirements herein and the documentation submitted with the application demonstrating prior falconry experience.
~~(C) NONRESIDENT FALCONER ESTABLISHING PERMANENT RESIDENCY. A nonresident falconer establishing permanent residency in California shall submit documentation of prior experience and any falconry license held from his/her previous state or country of origin along with the completed application. The department shall continue to recognize a new resident's falconry license issued from another state or country, until the license expires, or the department approves or denies the application, whichever comes first. If a new resident's license expires shortly before or shortly after he/she moves to California, he/she is allowed to practice falconry for up to 120 days without a California license according to (5)(C) below.~~
(3) ~~EXAMINATION REQUIREMENT~~ Examination Requirement. ~~Any person applying for his/her first~~ Any applicant not possessing a valid falconry license, or required to apply for a new falconry license in California shall pass the falconry examination to demonstrate proficiency in falconry and raptor-related subject areas before being issued a license. An applicant shall correctly answer at least 80 percent of the questions to pass the examination. Any applicant who fails to pass the examination may take another examination no earlier than the next business day following the day of the failed examination. The applicant shall submit a nonrefundable Falconry Examination fee each time the applicant takes an examination.
(A) An applicant who meets one of the following criteria shall be exempt from taking the California falconry examination:
1. An applicant who provides documentation of successfully passing a federally approved examination in a state that has had its falconry regulations certified as specified in ~~Title 50, CFR, Section 21.29~~ 50 CFR 21, will not be required to take the examination in California if the applicant took the examination less than five years prior to submitting an application for a California falconry ~~permit~~ license.
2. The applicant is a nonresident or non-U.S. citizen falconer who has a valid falconry license issued from another state or country.
3. The applicant is a member of a federally recognized tribe and has a valid falconry license issued from that member's tribe.
(B) After successfully passing the falconry examination, the raptor housing facility, if any, of a new applicant shall pass an inspection and be certified by the department, pursuant to subsection (j), before a license may be issued.
~~(4) LAPSED LICENSES. If a license has lapsed for fewer than five years, the license may be renewed at the level held previously if the applicant provides proof of licensure at that level. If a license has lapsed for five years or more, the applicant shall successfully complete the California examination. Upon passing the examination, a~~

~~license may be renewed at the level previously held if the applicant provides proof of licensure at that level.~~
(4) Expired License. A license for the practice of falconry expires and is not valid unless renewed annually with the required application form and payment of fees as specified in Section 703.
(A) It shall be unlawful for any person to practice falconry, including possession of falconry raptors, without a valid license in their possession.
(B) If a license has not been renewed for a period less than 5 years from the expiration date on the license, the license may be renewed at the class held previously if the applicant provides proof of licensure at that class.
(C) If a license has not been renewed for a period of more than 5 years from the expiration date on the license, it shall not be renewed. The applicant shall apply for a new falconry license and successfully complete the examination as set forth in subsection (e)(3). Upon passing the examination and the payment of the annual license fee a license may be issued at the class previously held if the applicant provides proof of prior licensure at that class.
(5) ~~NONRESIDENTS OF CALIFORNIA AND NON-US CITIZENS~~ Nonresidents of California and Non-US Citizens.
(A) A person who is a member of a federally recognized tribe and has a valid falconry license from that member's tribe shall be considered a nonresident licensed falconer for purposes of this subsection (e)(5).
~~(A)~~ (B) A nonresident licensed falconer or non-U.S. citizen licensed falconer may temporarily practice falconry in California for up to 120 ~~consecutive~~ calendar days without being required to obtain a California falconry license.
~~(B)~~ 1. A nonresident licensed falconer or non-U.S. citizen licensed falconer may ~~fly raptors held for falconry by~~ practice falconry with raptors from a licensed California falconer, provided that signed and dated written ~~permission~~ authorization is given to the nonresident or non-U.S. citizen by the licensee. ~~This~~ The original written authorization must be carried with ~~him/her while flying or transporting~~ the licensee while in possession of the raptor.
~~(C)~~ 2. A nonresident licensed falconer or non-U.S. citizen ~~currently~~ licensed falconer shall provide and thereafter maintain facilities and equipment for raptors in ~~his/her~~ the licensee's possession while temporarily practicing falconry in California. Temporary facilities shall meet the standards in these regulations, including but not limited to provisions described in subsection (j), and pursuant to ~~Title 50, CFR, Section 21.29~~ 50 CFR 21.
3. A nonresident licensed falconer or non-U.S. citizen licensed falconer may house raptors in ~~his/her~~ the licensee's possession at another licensed falconer's facilities while temporarily practicing falconry in California.
(C) A nonresident licensed falconer or non-U.S. citizen licensed falconer applying for a falconry license in California shall submit proof of a valid falconry license held from the licensee's tribe, state or country along with the completed New Falconry Application and Fee and pass a facility inspection pursuant to subsection (j).
(D) A nonresident or non-US citizen applicant applying for a falconry license in California but not possessing a valid original falconry license from the applicant's tribe, state, or country of origin shall submit the completed New Falconry License Application

and Fee, and pass the examination and pass a facility inspection pursuant to (e)(3) herein.
(6) ~~FALCONRY CLASSES~~ Falconry Classes. There are three classes of licensed falconers in California: Apprentice falconer, General falconer, and Master falconer. The department at its sole discretion may issue a falconry license in one of these classes to an applicant who meets the requirements and qualifications for the class as described in these regulations.
(A) ~~APPRENTICE FALCONER~~ Apprentice Falconer.
1. ~~AGE~~ Age. An applicant for an Apprentice falconer license shall be at least 12 years of age at the date of application. If an applicant is less than 18 years of age, a parent or legal guardian shall co-sign the application and shall be legally responsible for activities of the Apprentice falconer.
2. ~~SPONSORSHIP~~ Sponsorship. A sponsor is required for at least the first two years in which an Apprentice falconry license is held, regardless of the age of the Apprentice falconer. A sponsor shall be a Master falconer or a General falconer who has at least two years of experience at the General Falconer ~~level~~ class. A sponsor shall certify in writing to the department that the sponsor will assist the Apprentice falconer, as necessary, in learning the husbandry and training of raptors held for falconry; learning the relevant wildlife laws and regulations; and determining what species of raptor is appropriate for the Apprentice falconer to possess; and will notify the department's License and Revenue Branch immediately if sponsorship terminates.
3. ~~TERMINATION OF SPONSORSHIP~~ Termination of Sponsorship. If sponsorship is terminated, an Apprentice falconer and ~~his/her~~ the Apprentice's sponsor shall immediately notify the department's License and Revenue Branch in writing. ~~For a license to remain valid,~~ The license shall be valid only if the Apprentice falconer ~~shall acquire~~ acquires a new sponsor within 30 calendar days from the date sponsorship is terminated, and ~~provide~~ provides written notification, along with the new sponsor's certification ~~described in subsection (e)(6)(A)2.~~ to the department once a new sponsor is secured. Failure to comply with sponsorship requirements ~~will~~ shall result in loss of qualifying time from the date sponsorship was terminated to the date of securing a new sponsor, and no subsequent license ~~will~~ shall be issued until the required two years ~~requirements~~ of sponsorship have been fulfilled.
4. ~~POSSESSION OF RAPTORS~~ Possession of Raptors. An Apprentice falconer may possess for falconry purposes no more than one wild or captive-bred red-tailed hawk (*Buteo jamaicensis*) or American kestrel (*Falco sparverius*) at any one time, regardless of the number of state, tribal, or territorial falconry licenses in possession and only as long as the raptor in possession is trained in the pursuit of game and used in hunting. An Apprentice falconer may only capture from the wild or possess a passage red-tailed hawk or an American kestrel. The Apprentice may take raptors less than 1 year old, except nestlings. Apprentice falconers are not required to capture a wild raptor themselves; the raptor can be transferred to ~~him/her~~ the Apprentice by another licensee. An Apprentice falconer may not capture from the wild or possess an eyas raptor or a raptor that is imprinted on humans. An Apprentice falconer must maintain written proof of legal acquisition.
5. ~~INSPECTION OF FACILITIES~~ Inspection of Facilities. After successfully passing the falconry examination, the facility of an Apprentice applicant shall pass an inspection and

be certified by the department, pursuant to subsection (j), before a license may be issued.
6. ~~ADVANCEMENT FROM APPRENTICE CLASS~~ Advancement From Apprentice Class. An Apprentice falconer shall submit a completed Apprentice Falconer's Annual Progress Report, as specified in Section 703, to the address listed on the report. The report shall demonstrate that the Apprentice falconer has practiced falconry with a raptor at the Apprentice ~~level~~ class for at least two years, including maintaining, training, flying, and hunting with the raptor for at least four months in each ~~regulatory~~ license year, and a summary of the species the Apprentice possessed, how long each was possessed, how often each was flown, and methods of capture and release. Within the report, the sponsor shall certify in writing to the department that the Apprentice falconer has met the requirements of these regulations. No falconry school program or education shall be substituted for the minimum period of two years of experience as an Apprentice falconer.
(B) ~~GENERAL FALCONER~~ General Falconer.
1. ~~AGE~~ Age. General falconers shall be at least 16 years of age. If an applicant is less than 18 years of age, a parent or legal guardian shall co-sign the application and shall be legally responsible for activities of the General falconer.
2. ~~POSSESSION OF RAPTORS~~ Possession of Raptors. A General falconer may possess for falconry purposes any wild raptor species listed in subsection ~~(g)(5)~~ (g)(6), ~~and~~ any captive-bred or hybrid of any species of Order Falconiformes, Accipitriformes, or Strigiformes, or any legally acquired raptor from another state or country. ~~federally or state listed threatened or endangered species,and eagles.~~ A General falconer must maintain written proof of legal acquisition. A General falconer shall possess no more than three raptors for use in falconry at any one time, regardless of the number of state, tribal, or territorial falconry licenses in possession; and only two of these raptors may be wild-caught. Only eyas or passage raptors may be wild-caught; except American kestrel (*Falco sparverius*) or great horned owl (*Bubo virginianus*) may be captured at any age.
3. ~~ADVANCEMENT FROM GENERAL CLASS~~ Advancement From General Class. A General falconer shall have practiced falconry with a raptor, including maintaining, training, flying, and hunting with the raptor, at the General ~~level~~ class for at least five years before advancing to Master falconer. No falconry school program or education shall be substituted for the minimum period of five years of experience as a General falconer.
(C) ~~MASTER FALCONER~~ Master Falconer.
1. ~~POSSESSION OF RAPTORS~~ Possession of Raptors. A Master falconer may possess for falconry purposes any wild raptor species listed in subsection ~~(g)(5)~~ (g)(6), ~~and~~ any captive-bred or hybrid of any species of Order Falconiformes, ~~the Order~~ Accipitriformes, or ~~the Order~~ Strigiformes, or any legally acquired raptor from another state or country. ~~federally or state listed threatened or endangered species, and eagles.~~ A Master falconer must maintain written proof of legal acquisition. A Master falconer may possess any number of raptors except ~~he/she~~ the licensee shall possess no more than five wild-caught raptors for use in falconry at any one time, regardless of the number of state, tribal, or territorial falconry licenses in possession. Only eyas or passage raptors may be wild-caught; except American kestrel (*Falco sparverius*) or great horned owl (*Bubo virginianus*) may be captured at any age.

2. ~~POSSESSION OF EAGLES~~ Possession of Eagles. A Master falconer may possess up to three eagles with proof of legal acquisition at any one time, except no bald eagle ~~may~~ shall be possessed.
i. Eagles ~~may~~ shall not be captured from the wild in California, ~~but may~~
ii. Eagles may only be obtained from ~~captive breeders, imported from another state, or transferred from a rehabilitation facility if the eagle is not releasable~~ a permitted source.
iii. Eagles originating in California from a licensed California rehabilitation facility may be temporarily transferred to a Master Falconer for the purpose of rehabilitation in accordance with 50 CFR 21, and with subsection (h)(3) herein.
iv. The department shall authorize in writing which species of eagles a Master falconer may possess pursuant to ~~Title 50 CFR Section 21.29(c)(iv)~~ 50 CFR 21. The Master falconer shall submit a written request for this authorization and include a resume of ~~his/her~~ the licensee's experience in handling large raptors such as eagles, and two letters of recommendation to the department's License and Revenue Branch. The resume documenting experience shall include information about the type of large raptor species handled, such as eagles or large hawks, the type and duration of the activity in which experience was gained, and contact information for references who can verify the experience. The two letters of recommendation shall be from persons with experience handling and/or flying large raptors. Each letter shall be ~~a signed, original that describes~~ dated, signed in ink with an original signature and shall describe the author's experience with large raptors, ~~and may include but is not limited to~~ including but not limited to, handling of raptors held by zoos, rehabilitating large raptors, or scientific studies involving large raptors. Each letter shall also assess the licensee's ability to care for eagles and fly them in falconry. The department may deny a request for a Master falconer to possess an eagle if the applicant has less than the equivalent of two years of experience handling large raptors or, at the department's discretion, the department determines that based on a letter of recommendation the applicant is not capable of caring for the eagle or flying it in falconry.
(7) ~~FEES~~ Fees. The base fee for a falconry license is specified in Fish and Game Code Section 396. Falconry related fees are specified in Section 703 of these regulations for the following:
(A) ~~APPLICATION~~ Application. An applicant shall submit a nonrefundable Falconry Application Fee when applying for a new license or renewing a license.
(B) ~~EXAMINATION~~ Examination. An applicant shall submit a nonrefundable Falconry Examination Fee each time ~~he or she applies to take~~ the applicant takes an examination.
(C) ~~INSPECTION~~ Inspection. An applicant or licensee shall submit a nonrefundable Inspection Fee prior to the department inspecting ~~his/her~~ the licensee's facilities, raptors, if present, and equipment. The Inspection Fee provides for inspections of up to five enclosures.
1. If a facility has more than five enclosures, an additional inspection fee is required for every additional enclosure over five.
2. If the applicant or licensee is sharing an existing raptor facility with another licensed falconer, and possesses proof of a passed inspection, there is no requirement for an additional inspection.

(D) ~~RE-INSPECTION~~ Re-inspection. An applicant shall submit an additional nonrefundable Inspection Fee when his or her facility has failed to pass a previous inspection.
(E) ~~ADMINISTRATIVE PROCESSING~~ Administrative Processing. An applicant shall submit a nonrefundable Administrative Processing Fee for each ~~Federal Form 3-186A~~ Resident Falconer Raptor Capture, Recapture and Release Report ~~form~~ submitted to the department's License and Revenue Branch when not using the ~~USFWS's electronic~~ department's online reporting system ~~on-line at https://migbirdapps.fws.gov/Falconry/srv/index.htm~~.
~~(F) SPECIAL RAPTOR CAPTURE DRAWING APPLICATION. An applicant shall submit a nonrefundable Special Raptor Capture Drawing Application Fee when applying to capture a species with a capture quota~~.
~~(G) SPECIAL RAPTOR CAPTURE PERMIT. A successful applicant shall submit the appropriate nonrefundable Special Raptor Capture Permit fee to receive the permit.~~
(8) ~~DENIAL~~ Denial. The department may deny the issuance of a new license or a renewal of an existing or ~~lapsed~~ expired license if:
(A) The applicant or licensee has failed to comply with regulations adopted pursuant to the Fish and Game Code related to raptors, Fish and Game Code Section 1054, or Penal Code Section 597; or
(B) The applicant or licensee has failed to comply with any provision of any statute, regulation, rule or ordinance existing in any other state or in any city, county, or other local governing entity in any other state, that is related to the care and licensing of raptors, so long as the failure to comply would constitute a violation of the Fish and Game Code, regulations related to raptors in Title 14, or Penal Code Section 597;
(C) The applicant or licensee has failed to comply with any provision of any federal statute, regulation, or rule that is related to the care and licensing of raptors, including but not limited ~~Title 50, CFR Sections 21.29 and 21.30~~ 50 CFR 21.
(D) The department shall deny the issuance of a license or renewal of an existing license if the applicant or licensee fails to submit all required items or perform any task necessary to obtain a license. Before denying an application for this reason, the department shall notify the applicant in writing that the application is deficient. The applicant may supplement an application by providing the missing required information or materials. If sent by U.S. mail or other carrier, these materials shall be postmarked no later than 30 calendar days after the date of the proof of service accompanying the department's notification. If the 30 calendar day deadline falls on a weekend or holiday the submission of additional information or materials will be accepted until the close of business on the first state business day following the deadline to submit additional information or materials. The department may extend this deadline for good cause. If denied, the applicant or licensee may submit a new application at any time.
(9) ~~SUSPENSION AND REVOCATION~~ Suspension and Revocation. Any license issued pursuant to these regulations may be suspended or revoked at any time by the department for failure to comply with the Fish and Game Code or regulations adopted pursuant to the Fish and Game Code related to raptors, Fish and Game Code Section 1054, or Penal Code Section 597. If the licensee has been convicted in a court of competent jurisdiction of violating one of these provisions, the suspension or revocation shall take effect immediately if the violation pertains to conduct that threatens native

wildlife, agricultural interests of this state, the welfare of the birds, or the safety of the public, or if the licensee has been previously convicted of violating the provisions described above or has had his or her license previously suspended or revoked. If the licensee has not been convicted, the suspension or revocation shall take effect when the time to request an appeal ~~pursuant to subsection (e)(11)~~ as described herein has expired. A timely request for an appeal will stay the department's suspension or revocation if the licensee was not convicted as described above.

(10) ~~PROOF OF SERVICE~~ Proof of Service. All notices sent from the department to ~~an~~ a falconry applicant or licensee ~~pursuant to subsections (e)(8) or (e)(9)~~ as described herein shall include a proof of service that consists of a declaration of mailing, under penalty of perjury, indicating the date of mailing the department's notification, denial, or other correspondence.

(11) ~~APPEAL~~ Appeal. Any applicant or licensee who is denied a license, an amendment to an existing license or has a license suspended or revoked by the department pursuant to these regulations may appeal that denial, amendment, suspension, or revocation by filing a written request for an appeal with the commission. If sent by U.S. mail or other carrier, a request for an appeal shall be postmarked no later than 30 calendar days after the date of the proof of service accompanying the department's notice of denial, suspension, or revocation. If submitted electronically or by facsimile, it shall be received no later than 30 calendar days after the date of the proof of service. The commission shall not accept a request for an appeal that is submitted after the 30 calendar day deadline to request an appeal. If the 30 calendar day deadline falls on a weekend or holiday the request for appeal will be accepted until the close of business on the first state business day following the 30 calendar day deadline to submit a request for appeal.

(12) ~~RECORD KEEPING~~ Record Keeping. A licensee shall retain copies of all falconry-related records (hard copy or electronic) including but not limited to the applicant's falconry license, raptor transfer records, capture and release and disposition records, import or export documentation, sponsorship information, annual reports submitted to the department, and all health records of raptors possessed pursuant to the falconry license (Falconry Records) for at least five years ~~after the expiration of the license~~.

(13) ~~NAME OR ADDRESS CHANGE~~ Name or Address Change. The licensee shall notify the department's License and Revenue Branch, in writing, of any change of name or mailing address within 30 calendar days of the change. Facility address changes must be reported within five ~~calendar~~ business days of the change.

(f) ~~REPORTING REQUIREMENTS~~ Reporting Requirements.

~~(1) Licensees shall comply with USFWS's electronic reporting requirements on Federal Form 3-186A for all raptors possessed. Federal Form 3-186A can be accessed at the USFWS's electronic reporting system on-line at https://migbirdapps.fws.gov/Falconry/srv/index.htm. If a licensee is unable to use the Form 3-186A electronic reporting system, he/she may submit a paper Form 3-186A by mail, fax, or email to the department's License and Revenue Branch, or he/she may report over the telephone to the License and Revenue Branch. The information from the paper form or during a call will be entered into the USFWS's electronic reporting system by department staff, and the department shall charge an Administrative Processing Fee, as specified in Section 703, for each form completed.~~

~~(2) A licensee shall submit to the department's License and Revenue Branch a report using the Resident Falconer Raptor Capture, Recapture and Release Report, as specified in Section 703, within 10 calendar days of capture of a raptor from the wild or the release of a raptor back to the wild. The submission shall include information about the county of capture/release, date of capture/release, a description of the capture/release site, a description of the capture method, species information, and Latitude/Longitude coordinates of capture/release site. Capture, recapture and release in California may also be entered and reported electronically if the department offers an electronic reporting system. Licensee shall also report the capture and release by entering the required information on Form 3-186A in the USFWS's electronic reporting system within 10 calendar days of the capture.~~

(1) Licensees are required to report all raptor acquisition and disposition information using the Resident Falconer Raptor Capture, Recapture and Release Report within 10 calendar days to the department's online reporting system.

(A) For raptors acquired from the wild or released back to the wild, submission shall include information about the county of capture/release, date of capture/release, a description of the capture/release site, a description of the capture method, species information, and Latitude/Longitude coordinates of capture/release site.

(B) If a licensee is unable to use the department's online reporting system, the licensee may submit relevant forms by mail, fax, or email to the department's License and Revenue Branch, or the licensee may report over the telephone to the License and Revenue Branch. The information will be entered into the department's online reporting system by department staff, and the department shall charge a nonrefundable Administrative Processing Fee, as specified in Section 703, for each form entered.

~~(3)~~ (2) Upon applying for license renewal or within 10 calendar days after expiration of the license, whichever comes first, a licensee shall submit to the department, an annual report using the Falconry Hunting Take Report, as specified in Section 703, summarizing the number and type of prey species taken while hunting, counties hunted, and birds used in hunting during the most recent license year, as well as any inadvertent take of non-target wildlife.

~~(4)~~ (3) Upon applying for license renewal or within 10 calendar days after expiration of the license, whichever comes first, an Apprentice falconer shall submit to the department's License and Revenue Branch an annual report using the Apprentice Falconer's Annual Progress Report, as specified in Section 703. The report shall be signed and dated by both the Apprentice falconer and sponsor. The report will be used by the department to determine qualifying experience for future licenses.

(g) ~~CAPTURING RAPTORS FROM THE WILD~~ Capturing Raptors From the Wild.

(1) A ~~Resident~~ resident licensed falconer may not capture more than two raptors from the wild during the ~~regulatory~~ license year and only as authorized for each falconry class license.

(2) A ~~Nonresident~~ nonresident licensed falconer ~~with a license to practice falconry in a state certified according to Title 50, CFR, Section 21.29(b)(10)~~ may request to capture within California one wild raptor of the species specified in subsection ~~(g)(7)~~ (g)(8), excluding species with capture quotas, and shall submit to the department's License and Revenue Branch a complete Nonresident Falconer Application for Raptor Capture Permit , as specified in Section 703. The permit issued shall be valid beginning on July

1 and ending on June 30 of the following year, or if issued after the beginning of the permit year, for the remainder of that permit year. Whether successful or unsuccessful in capturing a raptor, the nonresident licensed falconer shall submit a complete Nonresident Falconer Raptor Capture Permit and Report, as specified in Section 703. Nonresidents shall only capture raptors from the wild in accordance with the conditions of the permit. Nonresidents that request to capture species with capture quotas must submit an application for the random drawing, as specified in subsection ~~(g)(7)(K)~~ (g)(9).
(3) Non-U.S. citizens are not eligible to capture any California wild raptor.
~~(3)~~ (4) Raptors may be captured by trap or net methods that do not injure them. The licensee shall identify all set traps with the name and address of the licensee and shall check such traps at least once every 12 hours, except that all snare type traps shall be attended at all times when they are deployed.
~~(4)~~ (5) A licensee shall be present during the capture of a raptor from the wild; however another General or Master licensed falconer may capture the raptor for the licensee. A licensee's presence during capture includes attendance of snare traps, or attendance while checking non-snare traps at least once every 12 hours. If a licensee has a long-term or permanent physical impairment that prevents ~~him/her~~ the licensee from attending the capture of a raptor for use in falconry, then another licensee may capture a bird for the licensee without ~~him/her~~ the licensee being present. The licensee is responsible for reporting the capture. The raptor will count as one of the two raptors the licensee is allowed to capture in that ~~regulatory~~ license year.
~~(5)~~(6) The following raptor species may be captured from the wild in California: Northern goshawk (*Accipiter gentilis*), Cooper's hawk (*Accipiter cooperii*), sharp-shinned hawk (*Accipiter striatus*), red-tailed hawk *(Buteo jamaicensis*), red-shouldered hawk (*Buteo lineatus*), merlin (*Falco columbarius*), American kestrel (*Falco sparverius)*, prairie falcon (*Falco mexicanus*), barred owl (*Strix varia*), and great horned owl (*Bubo virginianus*).
~~(6)~~ (7) No more than two nestlings of the species allowed for capture from the wild may be captured by the same General or Master licensee during the ~~regulatory~~ license year. In no case may all nestlings be captured and removed from any nest. At least one nestling shall be left in a nest at all times.
~~(7)~~ (8) The following restrictions apply to the total, cumulative capture of wild raptors among all licensees. These restrictions are in addition to the limitation of two wild raptors per licensee during the ~~regulatory~~ license year.
(A) ~~NORTHERN GOSHAWK~~ Northern Goshawk.
No more than one northern goshawk may be captured within the Lake Tahoe Basin during the ~~regulatory~~ license year. There are no restrictions on the cumulative number or location of Northern goshawk captured in the balance of the state during the license year.
1. The Lake Tahoe Basin area is defined as those portions of Placer, El Dorado, and Alpine counties within a line: beginning at the north end of Lake Tahoe, at the California-Nevada state line approximately four miles north of Stateline Point in the near vicinity of Mt. Baldy; westerly along the Tahoe Divide between the Lake Tahoe and Truckee River drainages to the intersection of the north line of Section 36, T17N, R17E, MDM; west along said north section line to the section corner common to section 25, 26, 35, and 36, T17N, R17E, MDM; south approximately one mile along the common section line; southwesterly to the intersection of the Tahoe Divide and Highway 267 in

the near vicinity of Brockway Summit; southwesterly in the near vicinity of the Tahoe Divide to Mt. Pluto; south to Mt. Watson; westerly approximately two miles to Painted Rock; southerly approximately two miles along the Tahoe Divide to the intersection of Highway 89; southwesterly along the Tahoe Divide to Ward Peak; southerly approximately 30 miles along the Tahoe Divide to a point on the Echo Lakes Road; southeasterly along said road to Old Highway 50; southeasterly along Old Highway 50 to the intersection of the Echo Summit Tract Road; southerly along said road to Highway 50; easterly along Highway 50 to the intersection of the South Echo Summit Tract Road; southerly along said road to the Tahoe Divide; southerly along the Tahoe Divide past the Alpine county line to Red Lake Peak; northerly along the Tahoe Divide past Monument Peak to the California-Nevada state line; north on the state line to the point of beginning. NOTE: the area described above includes the entire basin of Lake Tahoe within California.

(B) ~~COOPER'S HAWK~~ Cooper's Hawk. No restrictions on cumulative number or location of Cooper's hawks captured statewide during the ~~regulatory~~ license year.

(C) ~~SHARP-SHINNED HAWK~~ Sharp-shinned Hawk. No restrictions on cumulative number or location of sharp-shinned hawks captured statewide during the ~~regulatory~~ license year.

(D) ~~RED-TAILED HAWK~~ Red-tailed Hawk. No restrictions on cumulative number or location of red-tailed hawks captured statewide during the ~~regulatory~~ license year.

(E) ~~RED-SHOULDERED HAWK~~ Red-shouldered Hawk. No restrictions on cumulative number or location of red-shouldered hawks captured statewide during the ~~regulatory~~ license year.

(F) ~~MERLIN~~ Merlin. No restrictions on cumulative number or location of merlins captured statewide during the ~~regulatory~~ license year. Merlins may be captured only from August 15 through February 28 every year.

(G) ~~AMERICAN KESTREL~~ American Kestrel. No restrictions on cumulative number or location of American kestrels captured statewide during the ~~regulatory~~ license year.

(H) ~~PRAIRIE FALCON~~ Prairie Falcon. No more than 14 prairie falcons may be captured per ~~regulatory~~ license year.

(I) ~~BARRED OWL~~ Barred Owl. No restrictions on cumulative number or location of barred owls captured statewide during the ~~regulatory~~ license year.

(J) ~~GREAT HORNED OWL~~ Great Horned Owl. No restrictions on cumulative number or location of great horned owls captured statewide during the ~~regulatory~~ license year.

~~(K) RANDOM DRAWING.~~

(9) Special Raptor Capture Permit Drawing. A random drawing shall be held by the department to ~~determine distribution of~~ distribute Special Raptor Capture Permits to capture species with quotas, which include one Northern goshawk in the Tahoe Basin and prairie falcons from the wild as specified in subsection ~~(g)(7)~~ (g)(8). An applicant may be a resident and/or nonresident and must possess a valid General or Master falconry license at the time of application to enter the drawing. Non-U.S. citizens are not eligible to enter the drawing.

~~1.~~ (A) ~~A Resident~~ A resident applicant shall not submit more than two drawing applications each ~~regulatory~~ license year.

~~2.~~ (B) ~~A Nonresident~~ A nonresident applicant shall not submit more than one drawing application each ~~regulatory~~ license year.

~~3.~~ (C) ~~Applicants shall submit to the department's License and Revenue Branch~~ Licensees may apply through the department's Automated License Data System at license agents, department license sales offices, or on the department's website, using a Special Raptor Capture Drawing Application~~, as specified in Section 703~~. Each application submitted must specify ~~the falconer's name, contact information, GO ID number,~~ the species ~~he/she~~ the applicant is applying for to capture from the wild. ~~, and include the~~The applicant shall submit a nonrefundable Drawing Application Fee, as specified in Section 703 for each drawing application submitted.
~~4.~~ (D) Applications must be received by ~~midnight~~ 11:59pm, Pacific Standard Time, on ~~Jan. 31~~ May 15 each year. ~~through the department's Automated License Data System~~. ~~Incomplete, late and ineligible applications, and applications submitted without the fee, shall not be included in the drawing.~~
~~5.~~ (E) Permits are awarded according to an applicant's choice and computer-generated random number (lowest to highest) drawing. Successful applicants and a list of alternates for each species and/or area shall be determined by random drawing within 10 business days following the application deadline date. If the drawing is delayed due to circumstances beyond the department's control, the department shall conduct the drawing at the earliest date possible.
~~6.~~ (F) Successful and alternate applicants will be ~~mailed notification as soon as practical~~ notified. Unsuccessful applicants shall not be notified ~~by mail~~. ~~Upon receipt of the notification, the~~ The successful applicant shall submit the Raptor Capture Permit Fee, as specified in Section 703, to the department's License and Revenue Branch by 5:00 p.m. on ~~June 1~~ June 30 each year to claim the permit. If the deadline to submit the fee falls on a weekend or holiday, payment will be accepted until 5:00 p.m. on the first state business day following the deadline to submit payment. Unclaimed permits shall be awarded to alternates for that species and/or area ~~after June 1~~on an individual basis, in the order drawn.
~~7.~~ (G) A Special Raptor Capture Permit shall only be issued to a successful applicant who holds a General or Master falconry license that is valid for the same license year that the permit ~~shall be~~ is valid. Only the permit holder is entitled to capture a raptor, and the permit shall be in immediate possession of the permit holder during the capture. Permits are not transferable and are valid only for the species, area and period as specified on the permit.
~~8.~~ (H) A permit holder who successfully captures a Northern goshawk or prairie falcon shall immediately complete the capture portion of the permit and shall return the permit to the department's License and Revenue Branch or enter it on the department's online reporting system within 10 calendar days of the capture. The submission shall include information about the county of capture, date of capture, a description of the capture site, a description of the capture method, species information, and Latitude/Longitude coordinates of capture site. ~~The capture may also be entered and reported electronically if the department offers an electronic reporting system. The permit holder shall also report the capture by entering the required information on Form 3-186A in the USFWS's electronic reporting system within five calendar days of the capture.~~
~~9.~~ (I) A permit holder who is unsuccessful in capturing a Northern goshawk or prairie falcon shall indicate "unsuccessful" on the report card portion of the permit and ~~return it~~

shall return the permit to the department's License and Revenue Branch within 10 calendar days of the close of the season expiration of the permit.
10. (J) The permit holder shall surrender his/her the permit to an employee of the department for any act by the permit holder that violates any raptor related provision of the Fish and Game Code, or any regulation of the commission adopted pursuant thereto, and any act on the part of the permit holder that endangers the person or property of others. The decision of the department shall be final.
(8) BANDED OR MARKED RAPTORS (10) Banded or Marked Raptors. If a licensee captures a raptor that has a band, research marker, or transmitter attached to it, the licensee shall promptly report the band number and all other relevant information to the Federal Bird Banding Laboratory at 1-800-327-2263.
(A) If the raptor has a transmitter attached to it, the licensee may possess the raptor for up to 30 calendar days, during which time the licensee shall make a reasonable attempt to contact the researcher owner of the transmitter. If the researcher owner wants to replace the transmitter or its batteries, or have the transmitter removed and the bird released, the researcher or his or her owner or the owner's designee may make such change or allow the licensee to do so before the raptor is released. Temporary possession of the raptor will not count against the licensee's possession limit for falconry raptors. If the researcher owner cannot be contacted or does not want the transmitter to remain on the raptor, the licensee may keep the raptor if it was lawfully captured.
(B) If the raptor belongs to a falconer, subsection (h)(10) (h)(12) shall apply.
(9) INJURY DUE TO TRAPPING (11) Injury Due to Trapping. If a raptor is injured due to trapping, the raptor may be put on the licensee's falconry license and it will count as part of the possession limit. If the licensee adds the raptor on the falconry license, he/she the licensee shall report the capture to the department's License and Revenue Branch online reporting system within 10 calendar days after capture, and shall have the raptor immediately treated by a veterinarian or a permitted California wildlife rehabilitator. Alternately, the injured raptor may be immediately given directly to a veterinarian or a permitted California wildlife rehabilitator. In either case, the licensee is responsible for the costs of care and rehabilitation of the raptor.
(10) UNINTENTIONAL CAPTURE (12) Unintentional Capture. A licensee shall immediately release any bird unintentionally captured that he/she the licensee is not authorized to possess.
(11)PUBLIC AND PRIVATE LANDS (13) Public and Private Lands. A licensee is not authorized to capture raptors or practice falconry on public lands where it is prohibited, on private property without written permission from the landowner or tenant, or on tribal government lands without written permission. The licensee shall carry the original signed written permission while practicing falconry.
(h) POSSESSION, TRANSFER, AND DISPOSITION OF RAPTORS Possession, Transfer, and Disposition of Raptors.
(1) PERMANENT TRANSFER OF RAPTOR Permanent Transfer of Raptor. A licensee may acquire a raptor through a transfer and shall report the transfer by entering the required information on Form 3-186A in the USFWS's electronic the department's online reporting system within 10 calendar days of the transfer. The number of raptors acquired through a transfer is not restricted, as long as the licensee abides by the

requirements of ~~his/her~~ the licensee's class, and does not exceed ~~his/her~~ the licensee's possession limit.
(A) If a licensee transfers a raptor removed from the wild to another licensee in the same year in which it is captured, the raptor will count as one of the raptors the licensee is allowed to capture from the wild that year. It will not count as a capture by the recipient.
(B) A surviving spouse, executor, administrator, or other legal representative of a deceased licensee may transfer any bird held by the licensee to another authorized licensee within 90 calendar days of the death of the licensee. After 90 calendar days, disposition of a raptor held under the license ~~is~~ shall be at the discretion of the department.
(2) ~~TEMPORARY TRANSFER OR CARE OF RAPTOR~~ Temporary Transfer or Care of Raptor. Any licensee who temporarily transfers possession of ~~his/her~~ the licensee's raptor to another licensee, or allows an unlicensed person to temporarily care for a raptor, shall provide written notification of such transfer to the department's License and Revenue Branch within 10 calendar days after the bird is transferred. The notification shall include contact information including name, address, phone number, and email address of the temporary caregiver.
(A) Temporary possession of a raptor by a licensee shall not exceed 120 ~~consecutive~~ calendar days. Temporary possession may exceed 120 calendar days only if a request is made to the department's License and Revenue Branch and written authorization is given. Temporary care of a raptor by an unlicensed person shall not exceed ~~a 45 consecutive calendar day period~~ 45 calendar days. A raptor cared for by an unlicensed person shall remain housed at the licensee's facility. The unlicensed person is not authorized to fly the raptor. ~~The licensed person~~ A licensed falconer in temporary possession of a raptor may fly the raptor if ~~he /she~~ the falconer possesses the appropriate ~~level~~ class license.
~~(3) POSSESSION OF RAPTORS FROM REHABILITATION FACILITIES. A licensee may possess a raptor of any age that he/she is allowed to possess acquired from a permitted wildlife rehabilitation facility. Transfer of a nonreleasable wild raptor from a permitted California wildlife rehabilitation facility is at the discretion of the rehabilitator and will count as one of the raptors a licensee is allowed to capture from the wild during the regulatory year. A licensee acquiring a raptor from a permitted California wildlife rehabilitation facility shall report the transfer by entering the required information on Form 3-186A in the USFWS's electronic reporting system within 10 calendar days of the transfer.~~
~~(4) ASSISTING IN RAPTOR REHABILITATION~~ (3) Assisting In Raptor Rehabilitation. A General or Master falconer may assist a permitted California wildlife rehabilitator to condition a raptor for its release back into the wild. A rehabilitation raptor ~~possessed~~ in the care of the licensee for this purpose shall not be added to the licensee's falconry license, but shall remain under the permit of the rehabilitator.
(A) The rehabilitator shall provide the licensee with a letter of temporary transfer that identifies the raptor and explains that the falconer is assisting in its rehabilitation. The terms of the temporary transfer are at the discretion of the rehabilitator to assure the necessary care of the raptor. The licensee shall have in possession the letter or legible

copies possession while flying the raptor for rehabilitation. while assisting in the rehabilitation of the raptor.
(B) The licensee shall return any such raptor that cannot be released to the wild to the rehabilitator within 180 calendar days unless the rehabilitator transfers the raptor to the licensee otherwise authorized by the department's License and Revenue Branch. The department's Wildlife Branch will make the possession determination.
(5) IMPORTATION OF RAPTORS BY NONRESIDENTS OR NON-U.S. CITIZEN
(4) Importation of Raptors by Nonresidents or Non-U.S. Citizen. A nonresident or non-U.S. citizen may temporarily import lawfully possessed raptors into California for up to 120 calendar days. The department's License and Revenue Branch shall be notified within 10 calendar days prior to importing the raptor. A nonresident or non-U.S. citizen shall submit to the department's License and Revenue Branch official written authority to export raptors from the originating state or country, along with a health certificate for the raptor, prior to importing a raptor. A non-U.S. citizen may import his/her a falconry raptor that he/she the licensee possesses legally, provided that importation of that species into the United States is not prohibited, and he/she the licensee has met all permitting requirements of his/her the licensee's country of residence. Import of raptors, including exotic raptors, may be subject to other state and federal laws and may require additional federal permits.
(6) RELEASE OF RAPTORS (5) Release of Raptors. A licensee may release a native, wild caught raptor to the wild in California only to a location near the site that raptor was originally captured, and in appropriate habitat for that species of raptor. If the licensee cannot access the site of original capture, then licensee shall release in it in appropriate habitat for that species of raptor.
(A) Prior to release, the licensee shall ensure the immediate area around the release site is free from other raptors.
(B) The licensee shall remove any falconry band on the raptor being released; however seamless metal bands shall remain attached.
(C) A licensee may not intentionally and permanently, release a non-native raptor, hybrid, or native captive-bred raptor to the wild in California, unless authorized by the department.
(D) A licensee shall not release any barred owl to the wild in California. A licensee shall contact the department's License and Revenue Branch to determine disposition of a barred owl in possession. The department's Wildlife Branch will determine disposition.
(7) HACKING (6) Hacking. A wild raptor may be hacked for conditioning or as a method for release back into the wild. Any hybrid, captive-bred, or exotic raptor a licensee has in possession may be hacked for conditioning, and shall have two attached functioning radio transmitters during hacking except native captive bred raptors shall have a minimum of one functioning transmitter. A licensee may not hack any raptor near a known nesting area of a state or federally threatened or endangered, or fully protected animal species or in any other location where a raptor may take or harm a state or federally listed threatened or endangered, or fully protected animal species. Only a General or Master falconer may hack falconry raptors.
(8) DEATH, ESCAPE OR THEFT (7) Death, Escape or Theft. A licensee whose raptor dies, escapes, or is stolen, shall report the loss of the raptor by entering the required information on Form 3-186A in the USFWS's electronic the department's online

reporting system within 10 calendar days of the loss. A licensee may attempt to recover a raptor lost to the wild for up to 30 calendar days before reporting the loss. The licensee shall also report a theft of a raptor to an appropriate local law enforcement agency within 10 calendar days of the loss.

~~(9) DISPOSITION OF RAPTOR CARCASS~~ (8) Disposition of Raptor Carcass. If a raptor dies and was banded or had an implanted microchip, the band or microchip shall be left in place. If a licensee keeps the carcass or parts thereof, ~~he/she~~ the licensee shall retain all records of the raptor. A licensee must send the entire body of a golden eagle carcass held for falconry, including all feathers, talons, and other parts, to the National Eagle Repository. Within 10 calendar days the carcass of any other raptor species shall be either:

(A) Delivered to the department~~. A carcass may only be delivered to the department if the carcass is frozen and if the licensee obtains permission from the department prior to delivery; or~~ if the licensee obtains authorization from the department's License and Revenue Branch prior to delivery. The department's Wildlife Branch will make the determination where the carcass will go. A carcass may only be delivered to the department if the carcass is frozen; or

(B) Donated to any person authorized to possess the raptor or parts thereof; or

(C) Kept by the licensee for use in imping; or

~~(D) Delivered to a taxidermist for mounting and possession by the falconer; or~~

~~(E)~~ (D) Burned, buried, or otherwise destroyed~~.~~; or

(E) Delivered to a taxidermist for mounting and possession by the licensed falconer only.

1. Within 30 days of the expiration of a license, the licensee shall return the mounted raptor to the department.

2. Within 30 days of the death of the licensee, the estate shall return the mounted raptor to the department.

3. In either event, the licensee or the estate shall contact the department's License and Revenue Branch. The department's Wildlife Branch will determine the disposition of the mounted raptor.

~~(10) RECAPTURE~~ (9) Recapture. A licensee may recapture a raptor wearing falconry equipment or a captive-bred or exotic raptor at any time whether or not the licensee is authorized to possess the species. A recaptured raptor will not count against the possession limit of the licensee, nor will its capture from the wild count against the licensee's limit on number of raptors captured from the wild. The licensee shall report recaptured raptors ~~to the department's License and Revenue Branch~~ by submitting a complete Resident Falconer Raptor Capture, Recapture and Release Report ~~and by entering the required information on Form 3-186A in the USFWS's electronic~~ to the department's online reporting system within five calendar days.

(A) A recaptured falconry raptor shall be returned to the person who lawfully possessed it. If that person cannot possess the raptor or does not wish to possess it, the licensee who recaptured the raptor may keep it if that species is allowed under ~~his/her~~ the licensee's existing license. If kept, the raptor will count towards the licensee's possession limit.

1. A licensee who retains a recaptured raptor shall report the acquisition to the department's ~~License and Revenue Branch by submitting a complete Resident Falconer~~

~~Raptor Capture, Recapture and Release Report and by entering the required information on Form 3-186A in the USFWS's electronic~~ online reporting system within five calendar days.
2. If neither party wishes to keep the raptor, disposition of the raptor will be at the discretion of the department. The licensee in possession shall contact the department's License and Revenue Branch. The department's Wildlife Branch will determine the disposition of the recaptured raptor.
~~(11) USE OF FEATHERS~~ (10) Use of Feathers. A licensee may possess feathers of each species of raptor authorized to be possessed for as long as the licensee has a valid falconry license. For eagle feathers, a licensee must follow federal standards as noted in ~~Title 50, CFR, Section 21.29~~ 50 CFR 21. A licensee may receive raptor feathers from another person in the United States as long as that person is authorized to possess the feathers. Feathers from a falconry raptor may be donated to any person with a valid permit to possess them, or to anyone exempt from a permit requirement for feather possession. Any feathers of falconry raptors possessed by a falconer whose license has expired or been suspended or revoked shall be donated to any person exempt from the permit requirement or authorized by permit to acquire and possess the feathers within 30 calendar days of the license expiration, suspension or revocation. If the feathers are not donated, they shall be burned, buried, or otherwise destroyed.
~~(12) PURCHASE, BUY, SELL, TRADE, OR BARTER~~ (11) Purchase, Buy, Sell, Trade, or Barter. No person ~~may~~ shall purchase, buy, sell, trade or barter wild raptors or any parts thereof including but not limited to feathers. A licensee may purchase, buy, sell, trade or barter captive-bred, hybrid or exotic raptors marked with seamless metal bands to other ~~licensed falconers~~ persons or entities who are authorized to possess them.
~~(13) USE OF HYBRID, NON-NATIVE, AND EXOTIC RAPTORS~~ (12) Use of Hybrid, Non-native, and Exotic Raptors. When flown free, hybrid, non-native, or exotic raptors shall have attached at least two functioning radio transmitters to allow the raptor to be located.
~~(14) OTHER USES OF FALCONRY RAPTORS~~ (13) Other Uses of Falconry Raptors. A licensee may use falconry raptors for education, exhibiting, propagation, or abatement. A licensee may transfer a wild-caught raptor to a raptor propagation permit, but the raptor shall have been used in falconry for at least two years, or at least one year for a sharp-shinned hawk, merlin, Cooper's hawk or American kestrel. A wild caught raptor may be transferred to another permit type other than falconry only if it has been injured and can no longer be used in falconry. In this case, the licensee shall provide a copy of a certification from a veterinarian to the department's License and Revenue Branch stating that the raptor is not useable in falconry.
(A) ~~EDUCATION AND EXHIBITING~~ Education and Exhibiting. A licensee may use raptors in his or her possession for training purposes, education, field meets, and media (filming, photography, advertisements, etc.), as noted in ~~Title 50, CFR, Section 21.29~~ 50 CFR 21, if the licensee possesses the appropriate valid federal permits, as long as the raptor is primarily used for falconry and the activity is related to the practice of falconry or biology, ecology or conservation of raptors and other migratory birds. Any fees charged, compensation, or pay received during the use of falconry raptors for these purposes may not exceed the amount required to recover costs. An Apprentice falconer

may use ~~his/her~~ the licensee's falconry raptor for education purposes only under the supervision of a General or Master falconer.
(B) ~~PROPAGATION~~ Propagation. A licensee may conduct propagation activities with raptors possessed under a falconry permit if the licensee possesses a valid federal Raptor Propagation Permit and the person overseeing propagation has any other necessary state and federal authorization or permits. The raptor shall be transferred from a falconry license to a federal Raptor Propagation Permit if it is used in captive propagation for eight months or more in a ~~regulatory~~ license year. The transfer shall be reported by ~~entering the required information on Form 3-186A in the USFWS's and by entering the required information on Form 3-186A in the USFWS's electronic~~ submitting a complete Resident Falconer Raptor Capture, Recapture and Release Report to the department's online the department's online reporting system. Transfer of a raptor from a falconry license to a federal Raptor Propagation Permit is not required if the raptor is used for propagation purposes fewer than eight months in a ~~regulatory~~ license year.
(C) ~~ABATEMENT~~ Abatement. A Master falconer may conduct abatement activities with raptors possessed under a falconry license and receive payment if the licensee possesses a valid federal Special Purpose Abatement Permit. A General falconer may conduct abatement activities only as a sub-permittee of the holder of a valid federal Special Purpose Abatement Permit.
(i) ~~BANDING AND TAGGING~~ Banding and Tagging.
(1) A goshawk~~, peregrine, gyrfalcon or Harris's hawk~~ captured from the wild or acquired from another licensee ~~or a permitted California wildlife rehabilitator~~ shall be banded with a permanent, nonreusable, numbered USFWS leg band if the raptor is not already banded. ~~Captive bred raptors that are listed under the MBTA shall be banded with seamless metal bands.~~ A peregrine, gyrfalcon or Harris's hawk legally acquired from another state, or from another licensee, shall be banded with a permanent, nonreusable, numbered USFWS leg band if the raptor is not already banded.
(A) A licensee shall obtain a permanent, nonreusable, numbered USFWS leg band from the department's License and Revenue Branch ~~or regional office prior to capturing a raptor from the wild~~. The License and Revenue Branch shall report banding data to the USFWS.
(B) A licensee may purchase and implant an ISO (International Organization for Standardization)-compliant (134.2 kHz) microchip in addition to the band. The licensee shall report the band number ~~and~~ or the microchip information ~~on Form 3-186A in the USFWS's electronic reporting system.~~ to the department's online reporting system when reporting acquisition of the bird.
~~(2) Lost or Removed Bands. A band may be intentionally removed from a raptor only by a department employee or a person authorized by the department's License and Revenue Branch or regional office. A licensee shall report the loss or removal of any band to the department's License and Revenue Branch and enter the required information on Form 3-186A in the USFWS's electronic reporting system within five calendar days of the loss or removal.~~
(2) Captive bred raptors that are listed under the MBTA shall be banded with seamless metal bands.

~~(3) Rebanding. A licensee shall reband a raptor if the original band is lost or removed. The licensee shall enter the required information on Form 3-186A in the USFWS's electronic reporting system within 10 calendar days of rebanding.~~
(3) If a band is lost or must be removed from a raptor in a licensee's possession, the licensee shall report the loss of the band to the department's online reporting system within five (5) days, and the licensee shall request a replacement permanent, nonreusable, numbered USFWS leg band from the department's License and Revenue Branch.
(4) After receiving a replacement band from the department's License and Revenue Branch, the licensee shall reband a raptor if the original band is lost or removed. The License and Revenue Branch shall report rebanding data to the USFWS.
~~(4) Prohibition on Defacing Band.~~ (5) The alteration, counterfeiting or defacing of a band is prohibited except that licensees may remove the rear tab or may smooth any imperfect surface provided the integrity of the band and numbering are not affected.
~~(5) Health Considerations.~~ (6) The department may approve an exemption from the banding requirement if a licensee provides documentation that health or injury problems to a raptor are caused by a band. If an exemption is approved, the licensee shall keep the written exemption and shall carry a copy when transporting or flying the raptor. If a wild Northern goshawk is exempted from the banding requirement, an ISO-compliant microchip supplied by the USFWS shall be used instead.
(j) ~~FACILITIES, EQUIPMENT, AND INSPECTIONS~~ Facilities, Equipment, and Inspections.
(1) ~~HOUSING STANDARDS AND SPECIFICATIONS~~ Housing Standards and Specifications. Raptor housing facilities shall meet the standards in ~~Title 50, CFR, Section 21.29(d)~~ 50 CFR 21 at all times. Raptor housing facilities shall be inspected and certified by the department prior to issuance of a falconry license. Thereafter, a licensee shall maintain approved permanent facilities for housing raptors.
(A) Raptor housing facilities shall protect raptors housed in them from predators, the environment, domestic animals, and escape, and shall provide a healthy, clean, and safe environment.
(B) Indoor ("mews") or outdoor ("weathering area") raptor facilities may be used to house raptors.
(C) Falconry raptors may be kept outside in the open at any location~~, only if they are in the immediate~~ when in the presence of a licensed falconer and may be temporarily under watch by a person 12 years or older designated by the licensee.
(D) Permanent falconry facilities may be either on property owned by a licensee, on property owned by another person where a licensee resides, or elsewhere with property owner approval.
(E) A licensee shall report to the department's License and Revenue Branch, in writing within five calendar days if the licensee moves ~~his/her~~ the licensee's permanent falconry facilities to another location ~~by submitting a completed Raptor Facilities and Falconry Equipment Inspection Report, as specified in Section 703, and the inspection fee~~. The department will conduct a facility inspection, as specified in Section 703, and the licensee shall pay the inspection fees.

(2) ~~EQUIPMENT~~ Equipment. A licensee shall have jesses or other materials and equipment to make them, leash, swivel, bath container, and appropriate scales or balances for weighing raptors ~~he/she~~ the licensee possess.
(3) ~~INSPECTIONS~~ Inspections. Inspections of indoor or outdoor facilities, equipment, and raptors shall be conducted by the department. Inspections are required for a new license applicant, applicants renewing a ~~lapsed~~ license which has been expired more than 5 years, and licensees that move facility housing to a new address~~, and these persons~~. Applicants and licensees shall initiate the inspection by submitting a complete Raptor Facilities and Falconry Equipment Inspection Report and fees, as specified in Section 703. Equipment and facilities that meet the federal standards shall be certified by the department using the Raptor Facilities and Falconry Equipment Inspection Report. Equipment and facilities that do not meet the minimum standards and specifications shall not be certified by the department.
(A) The department may conduct unannounced visits to inspect facilities, equipment, or raptors possessed by the licensee, and may enter the ~~premises~~ facilities of any licensed falconer during a reasonable time of the day and on any day of the week. The department will make a reasonable attempt to contact the licensee prior to conducting the inspection. The department may also inspect, audit, or copy any permit, license, book, or record required to be kept by the licensee under these regulations at any time.
(B) If a licensee's facilities are not on property owned by the licensee, ~~he/she~~ the licensee shall submit to the department's License and Revenue Branch a signed and dated statement with original signature from the property owner indicating the property owner agrees that the falconry facilities and raptors may be inspected by the department without advance notice.

Note: Authority: Fish and Game Code Sections: 200, 202, 203, 355, 356, 395, 396, 398, 710.5, 710.7, 713, 1050, 1054, 1530, 1583, 1802, 3007, 3031, 3039, 3503, 3503.5, 3511, 3513, 3800, 3801.6, 3950, 4150, 10500. Reference: Fish and Game Code Sections: 395, 396, 713, 1050, 3007, 3031, 3503, 3503.5, 3511, 3513, 3801.6. Title 50, Code of Federal Regulations, Parts 21.29 and 21.30, and California Penal Code Section 597.

State of California
Department of Fish and Wildlife

Memorandum

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COMMISSION

2016 JUL 29 AM 9:18

AMENDED ISOR
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2016 AUG 10 PM 4:40

Date: July 27, 2016

To: Valerie Termini
Executive Director
Fish and Wildlife Commission

From: Charlton H. Bonham
Director

Subject: **Agenda Item for the August 24-25, 2016 Fish and Game Commission Meeting Requesting Authorization to Publish Notice of Commission Intent to Amend Section 670, Falconry, Title 14, California Code of Regulations (CCR)**

The Department of Fish and Wildlife (Department) requests that the Fish and Game Commission (Commission) authorize publishing notice of its intent to amend Section 670, Title 14, CCR.

The falconry regulations were last amended in 2013 to conform to federal guidelines which required states to adopt their own rules governing the sport. At that time it was understood by the Commission, falconers, and the public that these new California regulations would necessarily need updating. The proposed amendments to the current regulations are largely to conform to federal regulations, provide clean-up of existing regulations, and are not substantive in nature.

The Department is proposing the following amendments to the existing falconry regulations:

- Changes to bring the regulations in line with current federal guidelines
- Changes in reporting requirements to require reporting only to the state, rather than both the state and federal agencies
- Amendments suggested by licensed falconers and the public
- Numerous editorial corrections, renumbering and referencing
- Four edits requested by the Commission at its June 23 meeting.

If you have any questions regarding this item, please contact Karen Miner, Nongame Wildlife Program Manager at (916) 445-3685. The public notice for this rulemaking should identify Senior Environmental Scientist (Specialist), Carie Battistone as the Department's point of contact. Ms. Battistone can be reached at (916) 445-3615 or via email at Carie.Battistone@wildlife.ca.gov.

Attachments

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ec: Stafford Lehr, Deputy Director
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State of California
Department of Fish and Wildlife

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COMMISSION

2016 JUL 19 PM 1:

Memorandum

Date: July 18 ~~July 7,~~ 2016

To: Valerie Termini
Executive Director
Fish and Game Commission

From: Charlton H. Bonham
Director

Subject: **Agenda Item for the August 25-26, 2016 Fish and Game Commission Meeting Re: Request to Publish Notice of the Commission's Intent to Adopt Section 748.6, Title 14, California Code of Regulations, Standards for Imposing Enhanced Penalties for Illegal Take of Game with Defined Characteristics**

Please find attached the Initial Statement of Reasons (ISOR) to permanently add Section 748.6, *Enhanced Penalties for Illegal Take of Game with Defined Characteristics,* to Title 14 of the California Code of Regulations (CCR).

The Fish and Game Commission (Commission) proposes to implement the provisions of Fish and Game Code Section 12013.3 to enact definitions of "trophy" game animals and a game bird for the purpose of enhanced fines and penalties for poaching such an animal as defined.

To ensure that California is taking all available steps to deter illegal poaching activity, the Department of Fish and Wildlife (Department) requests that the Commission authorize publication of notice of its intent to adopt regulations set forth in Section 748.6, Title 14, CCR, as described in the attached ISOR.

If you have any questions regarding this item, please contact David Bess, Chief/Deputy Director, Law Enforcement Division, by telephone at (916) 653-4094 or by e-mail at David.Bess@wildlife.ca.gov. The public notice should identify Captain Patrick Foy of the Law Enforcement Division, as the Department's point of contact for this rulemaking. You can contact Captain Foy at (916) 651-6692 or at Patrick.Foy@wildlife.ca.gov.

Attachments

ec: David Bess, Chief/Deputy Director
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Scott Barrow
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2016 JUL 19 PM 1:1

STATE OF CALIFORNIA
FISH AND GAME COMMISSION
INITIAL STATEMENT OF REASONS FOR REGULATORY ACTION
(Pre-publication of Notice Statement)

Add Section 748.6,
Title 14, California Code of Regulations
Re: Standards for Imposing Penalty Enhancements for
Illegal Take of Game with Defined Characteristics

I. Date of Initial Statement of Reasons: May 26, 2016

II. Dates and Locations of Scheduled Hearings:

(a)	Notice Hearing:	Date:	August 25, 2016
		Location:	Folsom
(b)	Discussion/Adoption:	Date:	December 8, 2016
		Location:	San Diego

III. Description of Regulatory Action:

(a) Statement of Specific Purpose of Regulation Change and Factual Basis for Determining that Regulation Change is Reasonably Necessary:

The Fish and Game Commission (Commission) proposes to implement the provisions of Fish and Game Code Section 12013.3 by adopting definitions of "trophy" deer, elk, antelope, bighorn sheep, and wild turkey for the purpose of enhanced fines and penalties for poaching as required below:

> "(b) The Commission shall adopt regulations to implement this section, including establishing a trophy designation and monetary value based on the size or related characteristics of deer, elk, antelope, bighorn sheep, and wild turkey."

This rulemaking process proposes to add Section 748.6 to Title 14, California Code of Regulations (CCR), to establish standards that can be used by the courts to impose higher criminal penalties in cases where individuals are convicted of the poaching violations set forth in Fish and Game Code Section 12013.3, which include taking specified wildlife out of season, without a license or tag, with the use of lights or bait, and waste of game.

Defining trophy characteristics and allowing for imposition of a range of fines commensurate with the egregious nature of the violation, or violations, will potentially provide a deterrent to would be poachers, when informed of a court's new authority to increase the fines and penalties. Current violations of the Fish and Game Code or Title 14 are predominantly misdemeanors with a penalty of a six month sentence in county jail and up to a $1,000 fine, unless otherwise specified. The courts rarely sentence a convicted poacher to a jail term and are left with no significant authority to assess a greater penalty for many of the most egregious poaching violations. The courts need the authority to assess a penalty for an egregious violation, or multiple violations, compared to other violations that may be spur-of-the-moment bad decisions made by a hunter with no previous poaching convictions.

Present Regulations

There are no current regulations that define enhanced characteristics for game mammals or wild turkeys, and there are no monetary values established if convicted of poaching an animal identified as having "enhanced characteristics", with the exception of Fish and Game Code Section 12008.5 which addresses the unlawful take of any bighorn sheep.

Fish and Game Code Section 12008.5: Notwithstanding Section 12000, the punishment for taking any bighorn sheep in violation of Chapter 11 (commencing with Section 4900) of Part 3 of Division 4, or any regulation adopted pursuant thereto, is a fine of not more than two thousand dollars ($2,000) or imprisonment in the county jail for not more than one year, or both the fine and imprisonment.

Proposed Regulation Changes

The Department of Fish and Wildlife (Department) developed the following designations after researching similar standards of nine western states. The states of Nevada, Arizona, Colorado, Idaho, Oregon, Washington, Utah, Montana and New Mexico all have standards for the purpose of increasing penalties associated with poaching of specified animals. Wyoming has no size designations, but the law does increase the penalties associated with poaching certain game mammals out of season. The Department then reached out to interested user groups and non-governmental organizations associated with hunting and wildlife management to gain input on the proposed standards. No state has a trophy size designation for wild turkey.

The Commission is proposing to add a new Section 748.6 to Title 14, CCR, as follows:

Add Subsection (a) of Section 748.6
For purposes of implementing the penalty enhancements set forth in Fish and Game Code section 12013.3, the following subsections are proposed to be added to Title 14 and animals meeting the criteria specified will be designated as trophies:

Add subsection (1) In deer hunting zones A, all B zones, D10, D11, D13, D15, and D16, any deer with four or more points on either antler (excluding eye guards) or with an outside antler spread of at least sixteen inches. In all other deer hunting zones (all X zones, all C zones, and zones D3, D4, D5, D6, D7, D8, D9, D12, D14, D 17, D19), any deer with four or more points on either antler (excluding eye guards) or with an outside antler spread of at least twenty-two inches.

Justification
Deer are California's most popular big game hunted species. California's deer populations include two primary subspecies: mule deer and blacktail deer. The deer are managed by the Department of Fish and Wildlife by herds, large and small, across the state's bioregions. Mule deer make up the majority of the deer in the eastern half of the state of California all the way to the eastern Sierra and into Nevada and are, on average, larger deer. Blacktail deer make up the majority of the deer in the western half of the state of California and are, on average, smaller deer. Each subspecies of deer has the potential to migrate across boundaries and hybridization is a regular occurrence. For the purposes of these regulations, the Commission proposes to divide the state in two major sections with blacktail deer predominantly to the west and mule deer predominantly to the east.

California's deer hunting zones A, B, and several D zones on the western half of California offer readily available tags in most zones. The deer in these zones are predominantly blacktail. These zones offer opportunity to deer hunters because the tags in many of the zones rarely, if ever, sell out. However, success and trophy quality is generally lower. California's X zones and many of the D deer zones are available to hunt by lottery and are generally harder to draw but offer lower hunting pressure and higher overall success and generally higher trophy opportunity.

For purposes of establishing a trophy standard for deer, California's deer hunting zones are divided into two groups each with a different standard that qualifies as a trophy.

Deer zones A, all B zones, D10, D11, D13, D15, D16: Deer having four or more points on at least one side not including eye guards or an outside spread of 16 inches or greater.

For all X zones and all C zones, and zones D3, D4, D5, D6, D7, D8, D9, D12, D14, D 17, D19 (there is no D18 zone): Deer having four or more points on at least one side not including eye guards or an outside spread of 22 inches or greater.

Add subsection (2) Any elk with five or more points on either antler (including eye guards);

Justification
The standard for seven of the eight western states that have standards for elk was either five or six antler points on at least one side. In California, public outreach to elk hunting and wildlife management groups consistently supported a standard of at least five points on one side. A standard of five points on one side is preferred and widely regarded as a trophy quality elk in California.

Add subsection (3) Any pronghorn antelope with a horn that is at least fourteen inches in length;

Justification
The standard for seven of the eight western states that have standards for antelope was a 14-inch horn on at least one side. In California, public outreach to big game hunting and wildlife management groups consistently supported a standard of at least one horn greater than or equal to 14 inches on one side. A 14-inch standard on at least one side is preferred and widely regarded as a trophy quality antelope.

Add subsection (4) Any bighorn sheep ram as defined as follows: a male bighorn sheep (Ovis canadensis) having at least one horn, the tip of which extends beyond a point in a straight line beginning at the front (anterior) edge of the horn base, and extending downward through the rear (posterior) edge of the visible portion of the eye and continuing downward through the horn. All reference points are based on viewing the ram directly from a 90 degree angle from which the head is facing.

Justification
The standards for bighorn sheep horn size in six of the western states surveyed were between a one-half to three-quarter curl on at least one side. Measurement standards vary with how those curl sizes are

measured, however. California hunters who are drawn via lottery to hunt bighorn sheep have been held to a very high standard since sheep hunting was authorized. The standard for measurement is inflexible, is reliable for hunters on a visual basis, and is within the range of the one-half to three-quarter size curl standard used in several other states.

The Commission proposes to use the standard similar to what is stated in Section 362(c), Title 14, CCR. Relying upon strict language in 362(c), Title 14, CCR, however, would inadvertently omit Sierra Nevada bighorn sheep, a protected endangered species that is not hunted in California, so the language is modified to apply to all bighorn sheep in California.

A mature bighorn sheep ram is defined as follows: a male bighorn sheep (*Ovis canadensis*) having at least one horn, the tip of which extends beyond a point in a straight line beginning at the front (anterior) edge of the horn base, and extending downward through the rear (posterior) edge of the visible portion of the eye and continuing downward through the horn. All reference points are based on viewing the ram directly from a 90 degree angle from which the head is facing.

Add subsection (5) Any wild turkey with either a spur that is at least one inch in length, or a beard (measured by the longest strand of one or more beards) that is eight or more inches.

Justification

No other state uses a measurement standard for wild turkey, so the Department proposed and solicited input from several representatives of various non-governmental hunting and wildlife conservation organizations.

The two most reliable reference points for measuring wild turkey used by hunters and biologists are the beard and spur lengths. The wild turkey beard is most prevalent on the males, is similar in look to a long tuft of hair, hence the term "beard" but in actuality is a group of modified feathers. Between 10 and 20 percent of females also have beards, but they are not usually as long, and an even lower percentage of hens have spurs.

The average lifespan of wild turkey is three years and it takes the average male bird, called a "Tom", this long to develop a beard to reach a length of eight or more inches, and for the spurs to reach a length of at least one inch. Most hunters consider a bird with either of these two physical characteristics of this size a "trophy" sized animal.

Necessity for all of subsection (a)

The proposed regulatory changes are needed to implement subdivision (b) of Fish and Game Code Section 12013.3, which requires the Commission to adopt regulations "establishing a trophy designation...based on the size or related characteristics of deer, elk, antelope, bighorn sheep, and wild turkeys."

Add Subsection (b) of Section 748.6

For purposes of measuring the attributes listed in Subsection (a) of Section 748.6, to designate a game mammal or wild turkey a trophy, the following subsections are proposed for addition to Title 14:

Definitions.
(1) A point is a projection of the antler at least one inch long and longer than the width of its base.
(2) The outside antler spread is measured between perpendiculars at a right angle to the center line of the skull at the widest part, whether across the main beams or points.
(3) An eye guard is a projection on the lower one-third of the antler.
(4) The length of a pronghorn antelope horn is measured with a flexible measuring tape along the center of the outer curve from the tip of the horn to a point in line with the lowest edge base, using a straight edge to establish the line end.
(5) The length of a wild turkey's beard is the distance from the turkey's skin to the tip of the longest strand of one or more beards, and the length of a spur is measured along the outside curve of the spur.

Justification

The definitions section clarifies terminology and describes a standardized process to measure key characteristics of the animals. The definitions and measurements are based upon commonly used standards in the hunting and outdoors industry, and their use will promote clear and consistent enforcement.

Necessity

This subsection defines terms used within Fish and Game Code Section 12013.3 and/or the proposed regulations. These definitions are necessary in that they provide the public, wildlife officers, and the courts with the details necessary to understand and implement Fish and Game Code section 12013.3 and the proposed regulations.

Add Subsection (c) of Section 748.6

For purposes of imposing criminal penalties as set forth in Fish and Game Code section 12013.3(a), the following subsection is proposed to be added to Title 14 to aid the courts in determining the appropriate fine

within the range authorized by the law:

In determining the monetary value of any fine imposed pursuant to Fish and Game Code section 12013.3, courts should consider the totality of the circumstances, including but not limited to, the degree to which the standards set forth in subsection (a) are exceeded, and any prior violations of the defendant.

Justification

This subsection will implement Fish and Game Code Section 12013.3 by encouraging courts to consider the degree by which the trophy standards are exceeded in determining the amount of criminal fines.

Necessity

Fish and Game Code 12013.3 authorizes the Fish and Game Commission to define trophy characteristics but it statutorily mandated a range of fines associated with the violation, or violations. Subsection (c) of Section 748.6 provides the court with guidance on how much to assess a convicted poacher, within the range defined in statute, based on not just the violation itself, but the degree by which the violation, or violations, occurred.

It is possible for a single poaching act to be in violation of all six subsections of 12013.3(a). It is also possible for a poacher to specifically target a certain animal of trophy category and pursue that animal in violation of only one poaching law, bypassing other animals with lesser, or non-defined trophy characteristics, but to such a degree that it still meets the original intent of the legislation. In addition, the courts will also be authorized to take into account the violation history of the defendant.

(b) Authority and Reference Sections from Fish and Game Code for Regulation:

Authority: Section 12013.3, Fish and Game Code.

Reference: Section 12013.3, Fish and Game Code.

(c) Specific Technology or Equipment Required by Regulatory Change:

None.

(d) Identification of Reports or Documents Supporting Regulation Change:

None

(e) Public Discussions of Proposed Regulations Prior to Notice Publication:

On April 28, 2016, representatives from the Department of Fish and Wildlife Law Enforcement Division used a stakeholder group meeting made up of several non-governmental organizations involved in hunting and wildlife management to propose the trophy sized standards. Those elected Board members of the respective organizations represented tens of thousands of hunters in California and throughout the country who contribute time and resources to wildlife management projects, and included representatives of the two organizations that sponsored the legislation in 2012. Feedback from those representatives was factored into the proposed trophy standards for each species.

On May 18, 2016, a representative from the Department of Fish and Wildlife Law Enforcement Division presented the regulation change proposal to the Wildlife Resources Committee and took public questions from the audience and many of the same persons who offered comments at the earlier stakeholder group meeting.

IV. Description of Reasonable Alternatives to Regulatory Action:

(a) Alternatives to Regulation Change:

Only one alternative was considered in relation to bighorn sheep. Two states in the western states surveyed used "any sheep" as a standard. Since Fish and Game Code Section 12008.5 already increases the penalty for poaching any bighorn sheep and Fish and Game Code Section 12013.3 specifically mandates the sheep be characterized by "establishing a trophy designation and monetary value based on the size or related characteristics of deer, elk, antelope, bighorn sheep, and wild turkeys or parts thereof," this alternative was considered but rejected.

No other alternatives were identified by or brought to the attention of Commission staff that would have the same desired regulatory effect.

(b) No Change Alternative:

The No Change Alternative is not a reasonable alternative due to the legislative mandate.

(c) Consideration of Alternatives:

In view of information currently possessed, no reasonable alternative considered would be more effective in carrying out the purpose for which

the regulation is proposed, would be as effective and less burdensome to affected private persons than the proposed regulation, or would be more cost effective to affected private persons and equally effective in implementing the statutory policy or other provision of law.

V. Mitigation Measures Required by Regulatory Action:

The proposed regulatory action will have no negative impact on the environment; therefore, no mitigation measures are needed. The Commission anticipates benefits to the environment by initiating a greater deterrence to poaching crimes and increased penalties associated with poaching offenders.

VI. Impact of Regulatory Action:

The potential for significant statewide adverse economic impacts that might result from the proposed regulatory action has been assessed, and the following initial determinations relative to the required statutory categories have been made:

(a) Significant Statewide Adverse Economic Impact Directly Affecting Businesses, Including the Ability of California Businesses to Compete with Businesses in Other States:

The proposed action will not have a significant statewide adverse economic impact directly affecting business, including the ability of California businesses to compete with businesses in other states, because the proposed regulations do not add new uses or remove existing uses.

(b) Impact on the Creation or Elimination of Jobs Within the State, the Creation of New Businesses or the Elimination of Existing Businesses, or the Expansion of Businesses in California; Benefits of the Regulation to the Health and Welfare of California Residents, Worker Safety, and the State's Environment:

The Commission does not anticipate any significant impacts on the creation or elimination of jobs, the creation of new business, the elimination of existing businesses or the expansion of businesses in California because the proposed regulations do not add new uses or remove existing uses.

The Commission anticipates benefits to the health and welfare of California residents. Participation in hunting opportunities and the general positive support from representatives of legitimate ethical hunting

organizations fosters conservation through education and appreciation of California's wildlife.

The Commission does not anticipate any benefits to worker safety.

The Commission anticipates benefits to the State's environment. It is the policy of the State to encourage the conservation, maintenance, and utilization of the living resources. The proposed action will further this core objective.

(c) Cost Impacts on a Representative Private Person or Business:

The agency is not aware of any cost impacts that a representative private person or business would necessarily incur in reasonable compliance with the proposed action.

(d) Costs or Savings to State Agencies or Costs/Savings in Federal Funding to the State:

None.

(e) Nondiscretionary Costs/Savings to Local Agencies:

None.

(f) Programs Mandated on Local Agencies or School Districts:

None.

(g) Costs Imposed on Any Local Agency or School District that is Required to be Reimbursed Under Part 7 (commencing with Section 17500) of Division 4, Government Code:

None.

(h) Effect on Housing Costs:

None.

VII. Economic Impact Assessment:

This rulemaking process proposes to designate specified characteristics for select big game animals and wild turkeys, and establish criteria for fine assessments for individuals convicted of poaching listed animals. Fish and Game

Code Section 12013.3(a), specifies that the punishment for a violation involving big game, "*shall be a fine of not less than $5,000 nor more than $40,000*, and for wild turkey, "*a fine of not less than $2,000 nor more than $5,000, or imprisonment in the county jail for not more than one year, or both that fine and imprisonment.*"

If fine revenue is collected, 50% would be paid to the county in which the offense was committed and the remainder would be deposited in the Big Game Management Account or the Upland Game Bird Account.

A review of the Law Enforcement Division's citation statistics database for violations that involved trophy class animals suggests that the Department anticipates an average of ten cases per year. The actual fine assessed and judgement collection amounts will vary depending on the particulars of each case. If the penalty average is $10,000, then one half of the amount collected from ten cases per year would total to $50,000. However the actual judgement collection success rate may result in 40% less (approximately $30,000) in potential total additional fine revenue per year to the Department.

Table 1. Department Annual Enhanced Penalties Revenue Projection

Cases per Year	$10,000 Penalty	60 % Actual Collection
5	$ 25,000	$ 15,000
10	$ 50,000	$ 30,000
15	$ 75,000	$ 45,000
Expected Average Revenue		$ 30,000

Note: Fifty percent of the penalty revenue is shared with the county in which the violation occurred.

(a) Effects of the Regulation on the Creation or Elimination of Jobs Within the State:

The proposed amendments will not create or eliminate jobs within the state because the proposed regulations do not add new uses or remove existing uses.

(b) Effects of the Regulation on the Creation of New Businesses or the Elimination of Existing Businesses Within the State:

The Department does not anticipate the creation of any new businesses or the elimination of existing businesses because the proposed regulations do not add new uses or remove existing uses.

(c) Effects of the Regulation on the Expansion of Businesses Currently Doing Business Within the State:

The proposed amendments are not expected to result in the expansion of businesses currently doing business within the state because the proposed regulations do not add new uses or remove existing uses.

(d) Benefits of the Regulation to the Health and Welfare of California Residents:

The Commission anticipates benefits to the health and welfare of California residents. Participation in hunting opportunities and the general positive support from representatives of legitimate ethical hunting organizations fosters conservation through education and appreciation of California's wildlife.

(e) Benefits of the Regulation to Worker Safety:

The proposed regulations do not have foreseeable benefits to worker safety because the regulations do not address working conditions.

(f) Benefits of the Regulation to the State's Environment:

The proposed regulations are anticipated to benefit the State's environment by encouraging the conservation, maintenance, and sustainable harvest of the State's living resources.

Informative Digest/Policy Statement Overview

The Fish and Game Commission (Commission) proposes to implement the provisions of Fish and Game Code Section 12013.3 by adopting definitions of "trophy" deer, elk, antelope, bighorn sheep, and wild turkey for the purpose of enhanced fines and penalties for poaching animals meeting specified criteria as required below.

"(b) The Commission shall adopt regulations to implement this section, including establishing a trophy designation and monetary value based on the size or related characteristics of deer, elk, antelope, bighorn sheep, and wild turkey."

This rulemaking process proposes to add Section 748.6 to Title 14, California Code of Regulations to establish standards that can be used by the courts when imposing criminal fines in cases where individuals are convicted of the violations set forth in Fish and Game Code section 12013.3.

Summary of Proposed Additions
The Commission is proposing the following regulatory changes:

<u>Add Subsection (a) of Section 748.6</u>
For purposes of implementing the penalty enhancements set forth in Fish and Game Code section 12013.3, the following subsections will be added to Title 14 and animals meeting the criteria specified will be designated as trophies:

Add subsection (1) In deer hunting zones A, all B zones, D10, D11, D13, D15, and D16, any deer with four or more points on either antler (excluding eye guards) or with an outside antler spread of at least sixteen inches. In all other deer hunting zones (all X zones, all C zones, and zones D3, D4, D5, D6, D7, D8, D9, D12, D14, D 17, D19), any deer with four or more points on either antler (excluding eye guards) or with an outside antler spread of at least twenty-two inches.

For purposes of establishing a trophy standard for deer, California's deer hunting zones are divided into two groups each with a different standard that qualifies as a trophy.

Deer zones A, all B zones, D10, D11, D13, D15, D16: Deer having four or more points on at least one side not including eye guards or an outside spread of 16 inches or greater.

For all X zones and all C zones, and zones D3, D4, D5, D6, D7, D8, D9, D12, D14, D 17, D19 (there is no D18 zone): Deer having four or more points on at least one side not including eye guards or an outside spread of 22 inches or greater.

Add subsection (2) Any elk with five or more points on either antler (including eye guards);

The standard for seven of the eight western states that have standards for elk was either five or six antler points on at least one side. In California, public outreach to elk hunting and wildlife management groups consistently supported a standard of at least five points on one side. A standard of five points on one side is a preferred and widely regarded as a trophy quality elk in California.

Add subsection (3) Any pronghorn antelope with a horn that is at least fourteen inches in length;

The standard for seven of the eight western states that have standards for antelope was a 14-inch horn on at least one side. In California, public outreach to big game hunting and wildlife management groups consistently supported a standard of at least one horn greater than or equal to 14 inches on one side. A 14-inch standard on at least one side is preferred and widely regarded as a trophy quality antelope.

Add subsection (4) Any bighorn sheep ram as defined as follows: a male bighorn sheep (Ovis canadensis) having at least one horn, the tip of which extends beyond a point in a straight line beginning at the front (anterior) edge of the horn base, and extending downward through the rear (posterior) edge of the visible portion of the eye and continuing downward through the horn. All reference points are based on viewing the ram directly from a 90 degree angle from which the head is facing.

The standards for bighorn sheep horn size in six of the western states surveyed were between a one-half to three-quarter curl on at least one side. Measurement standards vary with how those curl sizes are measured, however. California hunters who are drawn via lottery to hunt bighorn sheep have been held to a very high standard since sheep hunting was authorized. The standard for measurement is inflexible, is reliable for hunters on a visual basis, and is within the range of the one-half to three-quarter size curl standard used in several other states.

The Commission proposes to use the standard similar to what is stated in Section 362(c), Title 14, CCR. Relying upon strict language in 362(c), Title 14, CCR, however, would inadvertently omit Sierra Nevada bighorn sheep, a protected endangered species that is not hunted in California, so the language is modified to apply to all bighorn sheep in California.

A mature bighorn sheep ram is defined as follows: a male bighorn sheep (*Ovis canadensis*) having at least one horn, the tip of which extends beyond a point in a straight line beginning at the front (anterior) edge of the horn base, and extending downward through the rear (posterior) edge of the visible portion of the eye and continuing downward through the horn. All reference points are based on viewing the ram directly from a 90 degree angle from which the head is facing.

Add subsection (5) Any wild turkey with either a spur that is at least one inch in length, or a beard (measured by the longest strand of one or more beards) that is eight or more inches.

No other state uses a measurement standard for wild turkey, so the Department proposed and solicited input from several representatives of various non-governmental hunting and wildlife conservation organizations.

The two most reliable reference points for measuring wild turkey used by hunters and biologists are the beard and spur lengths. The wild turkey beard is most prevalent on the males, is similar in look to a long tuft of hair, hence the term "beard" but in actuality is a group of modified feathers. Between 10 and 20 percent of females also have beards, but they are not usually as long, and an even lower percentage of hens have spurs.

The average lifespan of wild turkey is three years and it takes the average male bird, called a Tom, this long to develop a beard to reach a length of eight or more inches, and for the spurs to reach a length of at least one inch. Most hunters consider a bird with either of these two physical characteristics of this size a "trophy" sized animal.

Add Subsection (b) of Section 748.6
For purposes of measuring the attributes listed in Subsection (a) Section 748.6, to designate a game mammal or wild turkey a trophy, the following subsections will be added to Title 14:

Definitions.
(1) A point is a projection of the antler at least one inch long and longer than the width of its base.
(2) The outside antler spread is measured between perpendiculars at a right angle to the center line of the skull at the widest part, whether across the main beams or points.
(3) An eye guard is a projection on the lower one-third of the antler.
(4) The length of a pronghorn antelope horn is measured with a flexible measuring tape along the center of the outer curve from the tip of the horn to a point in line with the lowest edge base, using a straight edge to establish the line end.
(5) The length of a wild turkey's beard is the distance from the turkey's skin to the tip of the longest strand of one or more beards, and the length of a spur is measured along the outside curve of the spur.

The definitions section clarifies how the size characteristics are technically defined. They rely upon commonly used measurement standards in the hunting and outdoors industry, as well as insure that the regulations are clear and legally enforceable.

Add Subsection (c) of Section 748.6
For purposes of assessing penalties as set forth in Fish and Game Code section

12013.3(a), the following subsection will be added to Title 14 to aide in determining the appropriate fine within the range:

In determining the monetary value of any fine imposed pursuant to Fish and Game Code section 12013.3, courts should consider the totality of the circumstances, including but not limited to, the degree to which the standards set forth in subsection (a) are exceeded, and any prior violations of the defendant.

This subsection will implement Fish and Game Code Section 12013.3 by encouraging courts to consider the degree by which the trophy standards are exceeded in determining the amount of criminal fines.

Benefits of the Proposed Regulations
The Commission anticipates benefits to the environment by initiating a greater deterrence to poaching crimes and increased penalties associated with poaching offenders. It is the policy of the State to encourage the conservation, maintenance, and utilization of its living resources. The proposed regulations will further this core objective.

Consistency and Compatibility with Existing Regulations
The proposed regulations are neither inconsistent nor incompatible with existing State regulations. The Legislature has delegated authority to the Commission to adopt hunting regulations (Fish and Game Code, sections 200, 202 and 205). The proposed regulations are consistent with general hunting regulations in Chapters 1 and 3 of Subdivision 2 of Division 1, Title 14, CCR. No other State agency has authority to regulate the methods and the manner by which wildlife may be taken.

REGULATORY TEXT

Section 748.6, Title 14, CCR, will be added as follows:

§ 748.6. Standards for imposing penalty enhancements for illegal take of game with defined characteristics.

(a) For purposes of implementing the penalty enhancements set forth in Fish and Game Code section 12013.3, the following are designated as trophies:
(1) In deer hunting zones A, all B zones, D10, D11, D13, D15, and D16, any deer with four or more points on either antler (excluding eye guards) or with an outside antler spread of at least sixteen inches. In all other deer hunting zones (all X zones, all C zones, and zones D3, D4, D5, D6, D7, D8, D9, D12, D14, D 17, D19), any deer with four or more points on either antler (excluding eye guards) or with an outside antler spread of at least twenty-two inches.
(2) Any elk with five or more points on either antler (including eye guards);
(3) Any pronghorn antelope with a horn that is at least fourteen inches in length;
(4) Any bighorn sheep ram as defined as follows: a male bighorn sheep (*Ovis canadensis*) having at least one horn, the tip of which extends beyond a point in a straight line beginning at the front (anterior) edge of the horn base, and extending downward through the rear (posterior) edge of the visible portion of the eye and continuing downward through the horn. All reference points are based on viewing the ram directly from a 90 degree angle from which the head is facing.
(5) Any wild turkey with either a spur that is at least one inch in length, or a beard (measured by the longest strand of one or more beards) that is eight or more inches.
(b) Definitions.
(1) A point is a projection of the antler at least one inch long and longer than the width of its base.
(2) The outside antler spread is measured between perpendiculars at a right angle to the center line of the skull at the widest part, whether across the main beams or points.
(3) An eye guard is a projection on the lower one-third of the antler.
(4) The length of a pronghorn antelope horn is measured with a flexible measuring tape along the center of the outer curve from the tip of the horn to a point in line with the lowest edge base, using a straight edge to establish the line end.
(5) The length of a wild turkey's beard is the distance from the turkey's skin to the tip of the longest strand of one or more beards, and the length of a spur is measured along the outside curve of the spur.
(c) In determining the monetary value of any fine imposed pursuant to Fish and Game Code section 12013.3, courts should consider the totality of the circumstances, including but not limited to, the degree to which the standards set forth in subsection (a) are exceeded, and any prior violations of the defendant.

Note: Authority cited: Section 12013.3, Fish and Game Code. Reference: Section 12013.3, Fish and Game Code.

Enhanced Penalties for take of Specified Game Mammals and Wild Turkey

Patrick Foy
Captain, Law Enforcement Division

LAW REQUIRES REGULATION

- AB 1162 Chesbro, Chapter 590 (2012)
- Adds section 12013.3 to Fish and Game Code

1. Increases fines associated with poaching a trophy deer, elk, antelope, bighorn sheep, or wild turkey.

2. Requires the Commission adopt regulations to designate “trophy” for each of those species.

ENHANCED PENALTIES

California Fish and Game Code 12013.3

- Violation involved a trophy deer, elk, antelope, or bighorn sheep shall be a fine of not less than $5,000, nor more than $40,000
- Violation involved a wild turkey, a fine of not less than $2,000, nor more than $5,000
- Or imprisonment in the count jail for not more than one year, or both that fine and imprisonment

ENHANCED PENALTIES

Enhanced penalties shall also be applicable for the following violations:

1. Take outside the established season (FGC, Sec. 2001)
2. Spotlighting (FGC, Sec. 2005)
3. Baiting (Section 257.5, Title 14, CCR)
4. Wanton waste (FGC, Sec. 4304)
5. Take of deer without a tag (FGC, Sec. 4330)
6. Failure to procure the required license or tag prior to taking a deer, elk, antelope, or bighorn sheep (FGC, Section 1054.2)

Take home message: fines are in the statute!

REVENUES

California Fish and Game Code 12013.3 (c)

- Revenue from fines for deer, elk, antelope, and bighorn sheep violations shall be deposited in the Big Game Management Account and shall be used for big game management.
- Revenue from fines for wild turkey violations shall be deposited in the Upland Game Bird Account and shall be used for upland game bird conservation.
- 50 percent of the revenue from fines pursuant to this section shall be paid to the county in which the offense was committed, and the county shall use revenues to reimburse the costs incurred for investigation and prosecution

EXAMPLES OF POACHING VIOLATIONS

Used on front page of
San Francisco Chronicle

Western States Standards for Trophy Enhanced Penalties

- Nevada
- Arizona
- Colorado
- Idaho
- Oregon
- Washington
- Utah
- Montana
- New Mexico
- Wyoming - No size standards but increased penalties for out of season

Deer

- Most states use multiple standards
- Blacktail deer vs. Mule deer

Proposed Standard: Deer

- Mule deer
  - 4x4 or 22” antler spread
  - X zones, all C zones, and zones D3, D4, D5, D6, D7, D8, D9, D12, D14, D17, D19
- Blacktail deer
  - 4x4 or 16” antler spread
  - A zone, all B zones, D10, D11, D13, D15, and D16

Note: There is no zone D18

Proposed Standard: Elk

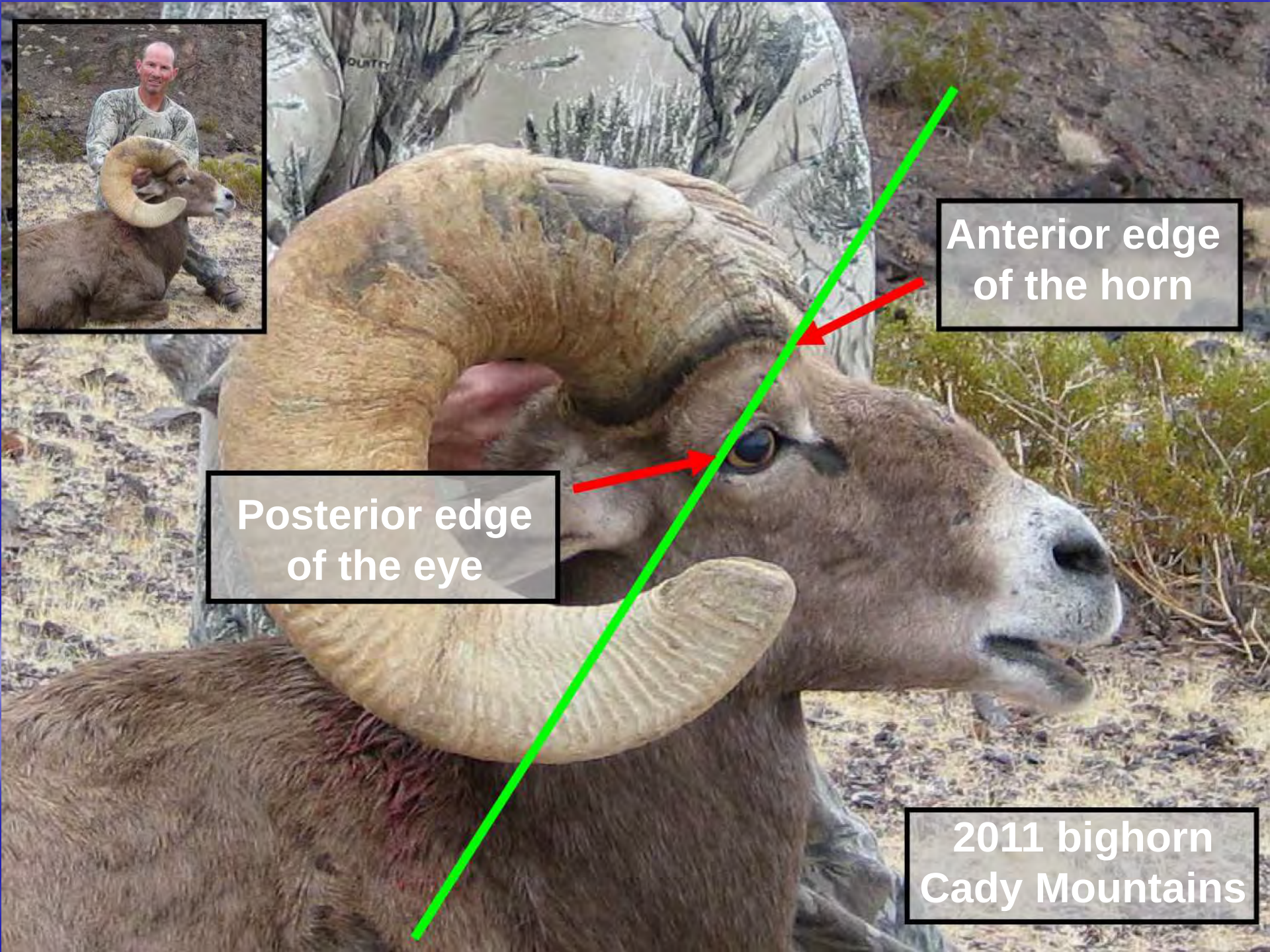
- 5 points on one side

Proposed Standard: Antelope

- At least one horn measured at 14”

Proposed Standard: Bighorn Sheep

- A male bighorn sheep (*Ovis canadensis*) having at least one horn, the tip of which extends beyond a point in a straight line beginning at the front (anterior) edge of the horn base, and extending downward through the rear (posterior) edge of the visible portion of the eye and continuing downward through the horn.
- All reference points are based on viewing the ram directly from a 90 degree angle from which the head is facing
- Similar to Section 362(c), Title 14, CCR


Anterior edge of the horn
Posterior edge of the eye
2011 bighorn Cady Mountains

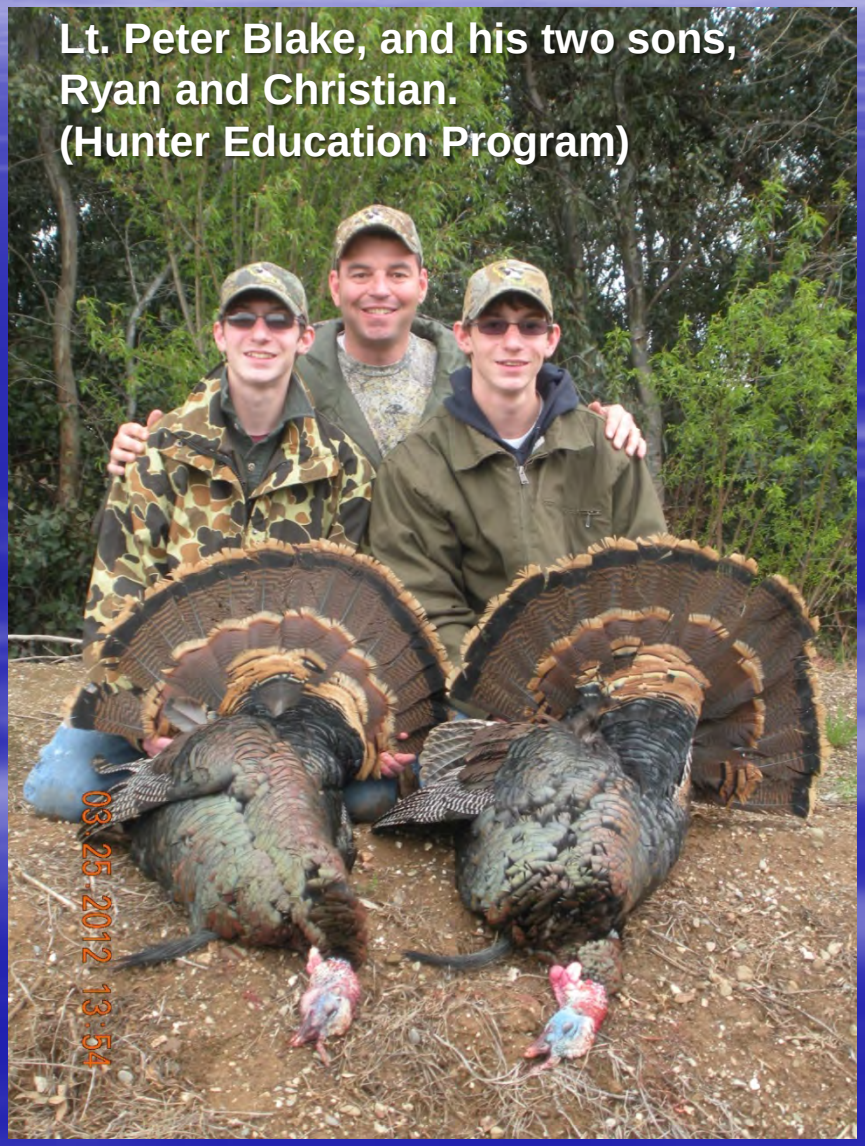
Proposed Standard: Wild Turkey

- 8 inch beard or
  1 inch spurs

The Good News

- This category of poaching is rare, and not anticipated to exceed a dozen or so annually
- A majority of hunters and anglers do the right thing
- A significant percentage of our cases come from tips from honest outdoors people
- Hunters and anglers are responsible for most conservation efforts through license sales/tags, and membership in conservation organizations

There are legitimate hunters, families and kids carrying on the tradition.



Lt. Peter Blake, and his two sons, Ryan and Christian.
(Hunter Education Program)

Volunteer California Hunter Education Instructor with his California Bighorn Sheep

09/09/2011: 14-year-old junior hunter Sage Gomes
Marble Mountains either sex junior elk hunt

State of California
Department of Fish and Wildlife

RECEIVED
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Memorandum

Date: May 31, 2016

To: Valerie Termini
Executive Director
Fish and Game Commission

From: Charlton H. Bonham
Director

Subject: **Agenda Item for the June 22-23, 2016, Fish and Game Commission Meeting Re: Request to Publish Notice of the Commission's Intent to Add Section 715, Upland Game Bird Special Hunt Drawing and Amend Section 702, Hunting Applications, Tags, Seals, Permits, Reservations and Fees, Title 14, California Code of Regulations.**

The Department of Fish and Wildlife (Department) requests that the Fish and Game Commission (Commission) authorize publication of notice of its intent to add Section 715 and amend Section 702, Title 14, California Code of Regulations.

The Department proposes to add a new Section 715 to establish an electronic random drawing for Upland Game Bird Special Hunt reservations in the Automated License Data System (ALDS). This drawing is currently conducted by staff in the Wildlife Branch. Establishing the random drawing in ALDS is necessary to ensure a fair and equitable distribution of limited hunts, control the cost of the process, and to place upland game bird drawing regulations in the same part of Title 14 as the big game and waterfowl drawings.

Section 702 is proposed to be amended to establish an Upland Game Bird Special Hunt drawing application fee of $5.00 in subsection (c)(1)(X). This fee amount has been determined sufficient to recover all reasonable administrative and implementation costs of the Department and Commission relating to the drawing in accordance with Section 1050, Fish and Game Code (FGC).

If you have any questions or need additional information, please contact Craig Stowers, Game Program Manager, at (916) 445-3553 or by email at Craig.Stowers@wildlife.ca.gov. For the public notice, Senior Environmental Scientist, Karen Fothergill should be identified as the Department's point of contact for this rulemaking. Ms. Fothergill may be reached at (916) 716-1461, or by email at Karen.Fothergill@wildlife.ca.gov.

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STATE OF CALIFORNIA
FISH AND GAME COMMISSION
INITIAL STATEMENT OF REASONS FOR REGULATORY ACTION
(Pre-publication of Notice Statement)

Add Section 715 and Amend Section 702
Title 14, California Code of Regulations
Re: Upland Game Bird Special Hunt Drawing and Application Fee

I. Date of Initial Statement of Reasons: April 29, 2016

II. Dates and Locations of Scheduled Hearings:

(a)	Notice Hearing:	Date:	June 23, 2016
		Location:	Bakersfield, CA
(b)	Discussion Hearing:	Date:	August 25, 2016
		Location:	Folsom, CA
(c)	Adoption Hearing:	Date:	October 20, 2016
		Location:	Eureka, CA

III. Description of Regulatory Action:

(a) Statement of Specific Purpose of Regulation Change and Factual Basis for Determining that Regulation Change is Reasonably Necessary:

The Department of Fish and Wildlife (Department) proposes to add a new Section 715 to Title 14, California Code of Regulations (CCR), to establish an electronic random drawing for Upland Game Bird Special Hunt reservations in the Automated License Data System (ALDS). Currently the draw is conducted by Wildlife Branch staff. Establishing the random drawing in ALDS is necessary to ensure a fair and equitable distribution of limited hunts, control the cost of the process, and to place upland game bird drawing regulations in the same part of Title 14 as the big game and waterfowl drawings.

At this time, big game and waterfowl hunt drawings are conducted through the ALDS. ALDS was implemented to centralize all data relating to hunting, fishing, commercial and other licenses and permits, and to collect related fees. Adding the Upland Game Bird Special Hunt will provide the public with an up-to-date method to apply for wild bird hunting opportunities. The ALDS drawing process:

- Provides great flexibility,
- Reduces error,
- Gives applicants the ability to select their first, second and third choice wild bird hunts,
- Quickly and accurately determines the successful applicants, and
- Provides for payment of the nonrefundable application fee set forth in amended Section 702.

The deadline for application will be 21 days prior to the first hunt date and the drawing will be conducted within 5 days following the deadline. Season openers are subject to change, but typically are:

Early Season Dove	September
Pheasant	November
Fall Turkey	November
Spring Turkey	March
Spring Apprentice Turkey	March

However, there may be times when the first available hunt date would not be on the season opener. ALDS is flexible and programmed for all contingencies, such as zone closures (fire and other natural causes), date changes, etc.

Proposed Regulations

Add new Section 715 in two parts:

Subsection 715(a) establishes the application procedure. ALDS allows the applicant to select their top three choices for upland game bird hunting opportunity, easily apply as an individual, a party leader, or as a party member, and assigns a Party Identification Number (PIN). The system then accepts payment of the application fee.

Subsection 715(b) establishes the drawing procedure. As with all other drawings in ALDS, each applicant PIN is assigned a random number and the applicants are then ranked in order lowest to highest, with first choice going to the lowest and so forth until all reservations are exhausted. Successful applicants are notified and information related to their hunt is provided. All applicants (identified by their PIN) may view their ranking on the Department's website, wildlife.ca.gov.

Amend Section 702:

An application fee of $5.00 will be established in a new subsection (c)(1)(X). This fee is an amount sufficient to recover all reasonable

administrative and implementation costs of the Department and Commission relating to the drawing in accordance with Section 1050, Fish and Game Code (FGC). All licenses, tags, permits, reservations or other entitlements purchased via ALDS are also subject to a three percent nonrefundable application fee in accordance with Section 700.4, Title 14, CCR. The fee will also be subject to an annual adjustment in accordance with Section 713, FGC.

(b) Authority and Reference from Fish and Game Code for Regulation:

Section 715:
Authority: Section(s) 200, 203, and 1050, Fish and Game Code.
Reference: Section(s) 1050, 3500, 3682.1, and 3683, Fish and Game Code.

Section 702:
Authority: Sections 200, 202, 203, 215, 220, 331, 332 and 1050, Fish and Game Code.
Reference: Sections 200, 202, 203, 203.1, 207, 215, 219, 220, 331, 332, 713, 1050, 1055, 1055.1, 1570, 1571, 1572, 1573, 3950, 3951, 4302, 4330, 4331, 4332, 4333, 4336, 4340, 4341, 4652, 4653, 4654, 4655, 4657, 4750, 4751, 4752, 4753, 4754, 4755, 4902, 10500 and 10502, Fish and Game Code.

(c) Specific Technology or Equipment Required by Regulatory Change: None.

(d) Identification of Reports or Documents Supporting Regulation Change: None

(e) Public Discussions of Proposed Regulations Prior to Notice Publication:

No public meetings are being held prior to the notice publication. The 45-day comment period provides adequate time for review of the proposed amendments.

IV. Description of Reasonable Alternatives to Regulatory Action:

(a) Alternatives to Regulation Change:

No alternatives were identified.

(b) No Change Alternative:

The Department would continue to conduct the drawings by using Wildlife Branch staff. This method is subject to error and is costly because of the

personnel involvement which is not reimbursed with a fee at this time. The ALDS system was established to provide this service to the public fairly and at a low-cost.

(c) Consideration of Alternatives:

In view of information currently possessed, no reasonable alternative considered would be more effective in carrying out the purpose for which the regulation is proposed, would be as effective and less burdensome to affected private persons than the proposed regulation, or would be more cost effective to affected private persons and equally effective in implementing the statutory policy or other provision of law.

V. Mitigation Measures Required by Regulatory Action:

The proposed regulatory action will have no negative impact on the environment; therefore, no mitigation measures are needed.

VI. Impact of Regulatory Action:

The potential for significant statewide adverse economic impacts that might result from the proposed regulatory action has been assessed, and the following initial determinations relative to the required statutory categories have been made:

(a) Significant Statewide Adverse Economic Impact Directly Affecting Businesses, Including the Ability of California Businesses to Compete with Businesses in Other States:

The proposed action will not have a significant statewide adverse economic impact directly affecting business, including the ability of California businesses to compete with businesses in other states. The proposed action automates an existing hunt drawing process through the use of ALDS. This proposal is economically neutral to business.

b) Impact on the Creation or Elimination of Jobs Within the State, the Creation of New Businesses or the Elimination of Existing Businesses, or the Expansion of Businesses in California; Benefits of the Regulation to the Health and Welfare of California Residents, Worker Safety, and the State's Environment:

The Commission anticipates benefits to the health and welfare of California residents. ALDS provides a single location for the public to apply for all department hunts including big game and waterfowl hunting opportunities. Data collected and compiled through ALDS will be accessible in a consistent format for the Department's use. Adding the

Upland Game Bird Special Hunt Drawing to ALDS will provide the same benefits of fairness and flexibility as well as important information necessary to properly manage upland game bird populations.

The Commission anticipates benefits to the State's environment in the sustainable management of natural resources. The proposed regulation could reduce the time required to apply for Upland Game special hunting opportunities and will improve the accuracy of the data collection. Adoption of regulations to increase sustainable hunting opportunity provides for the maintenance of sufficient populations of upland game birds to ensure their continued existence.

The Commission does not anticipate any impacts on the creation or elimination of jobs, the creation of new business, the elimination of existing businesses, or the expansion of businesses in California. The Commission does not anticipate any benefits to worker safety.

(c) Cost Impacts on a Representative Private Person or Business:

The Department proposes a modest fee to recover reasonable costs of the drawing as required by statute. The Commission is not aware of any cost impacts that a representative private person or business would necessarily incur in reasonable compliance with the proposed action.

(d) Costs or Savings to State Agencies or Costs/Savings in Federal Funding to the State: None.

(e) Nondiscretionary Costs/Savings to Local Agencies: None.

(f) Programs Mandated on Local Agencies or School Districts: None.

(g) Costs Imposed on Any Local Agency or School District that is Required to be Reimbursed Under Part 7 (commencing with Section 17500) of Division 4, Government Code: None.

(h) Effect on Housing Costs: None.

VII. Economic Impact Assessment:

The proposed regulatory action has been evaluated and it has been determined that the proposed action will not have a significant statewide adverse economic impact on individuals, businesses, or the state economy.

The fees for the upland game bird special hunt drawing application are proposed to recover the reasonable administrative costs for the provision of the program.

The start-up and ongoing costs are detailed in the Table 1. Item Fee Calculation for Cost Recovery. Based on the data in Table 1, a fee of $5.00 is proposed per drawing application. The payment of the fee is required as set forth in subsection 715(a)(3) and the fee amount will be listed in subsection 702(c)(1)(X), Hunting Applications, Tags, Seals, Permits, Reservations and Fees.

Table 1. Item Fee Calculation for Cost Recovery
Upland Game Bird Special Hunt Drawing Application
Number of items expected to be sold per year: 10,000

Start up Costs

Cost Description	Hours	Rate	Total
Regulations unit staff	0	$ 53.00	$ -
ALDS IT support: Item setup/ configuration /reporting			
Sr. ISA	16	$ 69.36	$ 1,109.76
Associate Programmer Analyst	8	$ 50.65	$ 405.20
Program review or Item Setup and configuration	8	$ 52.32	$ 418.56
LED review & training (optional)	4	$ 50.00	$ 200.00
Communications , Outreach & Training			$ -
Program specific Startup Costs			
Staff Time			
Classification I	0	$ -	$ -
Classification II	0	$ -	$ -
Fixed Costs			$ -
Total Startup Costs			**$ 2,133.52**
Amortized over 5 years:			**$ 426.70**

Ongoing Costs

Cost Description	Hours	Rate	Total
ALDS IT support: Item Review			
Sr. ISA	16	$ 69.36	$ 1,109.76
Associate Programmer Analyst	4	$ 50.65	$ 202.60
Program Staff Item review	8	$ 52.32	$ 418.56
LED review	4	$ 43.24	$ 172.96
Law Enforcement Costs	4	$ 45.62	$ 182.48
Program specific costs			
Application Printing (if applicable)			$ -
Application review time Per Application (if applicable)			
Interpreter II, Environmental Scientist (ES) , Staff ES, Senior ES, or H	0	$ 52.23	$ -
Environmental Program Manager	0	$ 67.59	$ -
Regional Manager	0	$ 76.88	$ -
Office Technician	0	$ 29.13	$ -
Communications , Outreach & Training			$ -
Program Operations Staff time (planning, labor, project tracking, etc)			
Classification I	200	$ 50.00	$ 10,000.00
Classification II	300	$ 40.00	$ 12,000.00
Program Operations Capital Outlay (vehicles, materials, etc)			$ -
Harvest Report Data Entry Staff	0	$ 19.21	$ -
Harvest Data Analysis	0	$ 46.18	$ -
Fixed costs (Milage)	0	$ 0.575	$ -
Ongoing Costs Total			**$ 24,086.36**
Amortized startup costs (from Above)			**$ 426.70**
Overhead	**35%**		**$ 8,579.57**
Item Total Annual Startup and Ongoing Costs			**$ 33,092.64**
Item Startup and ongoing cost per transaction			**$ 3.31**

Item Fee Calculation

Item Startup and ongoing cost per transaction			$ 3.31
ALDS System costs Per transaction			$ 0.78
LRB Operations costs Per transaction			$ 0.89
Item Fee			**$ 4.98**
Item Fee (rounded to nearest .25) per FGC Section 713			**$ 5.00**

(a) Effects of the Regulation on the Creation or Elimination of Jobs Within the State: The Commission does not anticipate any impacts to job creation or elimination within the state, because the proposed program will not reduce the number of hunters or hunting visits to areas of the state.

(b) Effects of the Regulation on the Creation of New Businesses or the Elimination of Existing Businesses within the State: The Commission does not anticipate any adverse impacts on the creation of new businesses or the elimination of existing businesses within the state, because the proposed program will not reduce the number of hunters or hunting visits to areas of the state.

(c) Effects of the Regulation on the Expansion of Businesses Currently Doing Business within the State: The Commission does not anticipate any adverse impacts on the expansion of businesses currently doing business within the state, because the proposed program will not reduce the number of hunters or hunting visits to areas of the state.

(d) Benefits of the Regulation to the Health and Welfare of California Residents: The Commission anticipates benefits to the health and welfare of California residents. Data collected and compiled through ALDS will be accessible in a consistent format for the Department's use. Adding the Upland Game Bird Special Hunt Drawing to ALDS will provide the same benefits of fairness and flexibility as well as important information necessary to properly manage upland game bird populations.

(e) Benefits of the Regulation to Worker Safety: The Commission does not anticipate any benefits to worker safety because the proposed program will not have direct impacts on working conditions.

(f) Benefits of the Regulation to the State's Environment: The Commission anticipates benefits to the State's environment in the sustainable management of natural resources. The proposed regulation could reduce the time required to apply for Upland Game special hunting opportunities and will improve the accuracy of the data collection. Adoption of regulations to increase sustainable hunting opportunity provides for the maintenance of sufficient populations of upland game birds to ensure their continued existence.

(g) Other Benefits of the Regulation: None.

Informative Digest/Policy Statement Overview

A new Section 715, Upland Game Bird Special Hunt Drawing, is proposed to establish the application and drawing procedures for wild upland game bird hunt reservations in the Automated License Data System (ALDS). ALDS is the central location for the public to apply for all Department licenses and hunting opportunities. The ALDS drawing process provides more accuracy and flexibility to the public and allows applicants to easily select their first, second and third choice wild bird hunts. A fee of $5.00 per application for the Upland Game Bird Special Hunt Drawing is proposed to be added in Section 702.

Benefits of the regulations

The Commission anticipates benefits to the health and welfare of California residents. ALDS provides a single location for the public to apply for all department hunts including big game and waterfowl hunting opportunities. Data collected and compiled through ALDS will be accessible in a consistent format for the Department's use. Adding the Upland Game Bird Special Hunt Drawing to ALDS will provide the same benefits of fairness and flexibility as well as important information necessary to properly manage upland game bird populations.

The Commission anticipates benefits to the State's environment in the sustainable management of natural resources. The proposed regulation could reduce the time required to apply for Upland Game special hunting opportunities and will improve the accuracy of the data collection. Adoption of regulations to increase sustainable hunting opportunity provides for the maintenance of sufficient populations of upland game birds to ensure their continued existence.

Non-monetary benefits to the public

The Commission does not anticipate non-monetary benefits to the protection of public health and safety, worker safety, the prevention of discrimination, the promotion of fairness or social equity and the increase in openness and transparency in business and government.

Consistency with State or Federal Regulations

The Fish and Game Commission, pursuant to Fish and Game Code Sections 200, 202 and 203, has the sole authority to regulate hunting in California. Commission staff has searched the California Code of Regulations and has found the proposed changes pertaining to reservation drawing selection for wild upland game bird hunting opportunities through ALDS to be consistent with the provisions of Title 14. Therefore the Commission has determined that the proposed amendments are neither inconsistent nor incompatible with existing state regulations.

PROPOSED REGULATORY LANGUAGE

Section 715 is hereby added to Title 14, CCR, to read as follows:

§ 715 Upland Game Bird Special Hunt Drawing.

(a) Upland Game Bird Special Hunts:

(1) The department shall establish the conditions of each hunt with consideration for hunter safety, hunt quality, and species abundance. The hunt conditions will include species, location, season, maximum party size, applicant attributes (age, disability, etc.), method of take and the number of reservations available.

(2) The department shall establish 'hunt groups' based on common conditions of hunts (species, season, method of take, etc.). Each hunt shall be assigned into a hunt group. The department will run a separate drawing for each hunt group.

(b) Upland Game Bird Special Hunt Application Procedures:

(1) Applicants may apply through the department's Automated License Data System (ALDS) at license agents, the department's license sales offices or on the department's website.

(2) An applicant may be a resident or nonresident and must possess an annual hunting license valid for the hunting season for which the applicant is applying.

(3) An applicant for an apprentice junior hunt must possess a junior hunting license valid for the hunting season for which the applicant is applying.

(4) Two-day nonresident hunting licenses shall not be used to apply for Upland Game Bird Special Hunt Drawings.

(5) The applicant shall submit a non-refundable fee as specified in Section 702 of these regulations for each drawing application submitted.

(6) An applicant may submit one application per hunt group with up to three hunt choices. An applicant may only be drawn once per hunt group.

(7) Applications must be submitted at least 21 days prior to the first hunt date for each hunt group.

(8) Each applicant shall specify if they are applying as an individual, as a party leader or if the applicant is joining an existing party.

(A) Each applicant applying as an individual or as a party leader shall be assigned a Party Identification Number from the department's Automated License Data System at the time of application.

(B) To apply as a party, the party leader shall apply first and provide the assigned Party Identification Number to the other party members.

(C) An applicant joining an existing party shall provide the Party Identification Number of the party leader. An applicant joining a party shall be assigned the same application choices in the same order as the party leader.

(c) Upland Game Bird Special Hunt Drawing Procedures:

(1) The department will conduct drawings by hunt group within five (5) business days following the application deadline for the hunt group.

(2) Draw-By-Choice Drawings. Each application shall be assigned a computer-generated random number. Each party application shall be assigned a single computer-

generated random number. Reservations are awarded to applications based on hunt choice and random number (lowest to highest) until the reservation quota has been met. A party application shall not be split to meet the number of reservations available.
(3) Successful applicants will be notified. Unsuccessful applicants will be not be notified. Drawing results will be available on the department website, wildlife.ca.gov.

Authority: Section(s) 200, 203, and 1050, Fish and Game Code.
Reference: Section(s) 1050, 3500, 3682.1, and 3683, Fish and Game Code.

PROPOSED REGULATORY LANGUAGE

Section 702, Title 14, California Code of Regulations is amended to read as follows:

§ 702. Hunting Applications, Tags, Seals, Permits, Reservations and Fees.

... [No changes to subsections (a) through (b)]

(c) Hunting Tags

(1)	*Tag/Application*	*~~Processing~~ Permit Fees*	*Processing Fees*
... [No changes to subsections (c)(1)(A) through (W)]			
(X)	Upland Game Bird Special Hunt Drawing Application Fee		$ 5.00

(d) Pursuant to the provisions of Section 699, Title 14, the department shall annually adjust the fees of all licenses, stamps, permits, tags, or other entitlement required by regulations set forth in this section.

Note: Authority cited: Sections 200, 202, 203, 215, 220, 331, 332 and 1050, Fish and Game Code. Reference: Sections 200, 202, 203, 203.1, 207, 215, 219, 220, 331, 332, 713, 1050, 1055, 1055.1, 1570, 1571, 1572, 1573, 3950, 3951, 4302, 4330, 4331, 4332, 4333, 4336, 4340, 4341, 4652, 4653, 4654, 4655, 4657, 4750, 4751, 4752, 4753, 4754, 4755, 4902, 10500 and 10502, Fish and Game Code.

State of California
Department of Fish and Wildlife

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COMMISSION

2016 AUG 15 PM 12: 16

Memorandum

Date: August 11, 2016

To: Valerie Termini
Executive Director
Fish and Game Commission

From: Charlton H. Bonham
Director

Subject: Agenda Item for the August 2016 Fish and Game Commission Meeting

Please find attached the Pre-Adoption Statement of Reasons and Addendum to the Final Environmental Document to amend Sections 550, 550.5, 551, 552, 630 and 702 and repeal subsections 703(a)(2) and 703(c), Title 14, California Code of Regulations. These regulations pertain to public uses of land under the jurisdiction of the Department of Fish and Wildlife. The following change to the originally proposed regulatory text is recommended:

- The proposed text of subsection 551(w)(23) consists of "Napa-Sonoma Marshes Wildlife Area". It should be amended to "Napa Sonoma Marshes Wildlife Area (Green Island Unit)". The effect of this change is to add only the Green Island Unit of the wildlife area to the Lands Pass Program rather than adding the entire wildlife area. This was the Department's original intent; however, the name of the unit was inadvertently omitted from the proposed text.

If you have any questions or need additional information, please contact Kari Lewis, Lands Program Manager, at (916) 445-3789 or at Kari.lewis@wildlife.ca.gov.

Attachment

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2016 AUG 15 PM 12: 10

STATE OF CALIFORNIA
FISH AND GAME COMMISSION
STATEMENT OF REASONS FOR REGULATORY ACTION
(Pre-adoption Statement of Reasons)

Amend Sections 550, 550.5, 551, 552, 630 and 702, and
Repeal Subsections 703(a)(2) and 703(c)
Title 14, California Code of Regulations
Re: Department of Fish and Wildlife Lands Pass Program and Lands Public Uses

I. Date of Initial Statement of Reasons: March 15, 2016

II. Date of Pre-adoption Statement of Reasons: August 1, 2016

III. Dates and Locations of Scheduled Hearings:

(a) Notice Hearing: Date: April 14, 2016
Location: Santa Rosa

(b) Discussion Hearing: Date: June 23, 2016
Location: Bakersfield

(c) Adoption Hearing: Date: August 25, 2016
Location: Folsom

IV. Description of Modification of Originally Proposed Language of Initial Statement of Reasons:

In accordance with Government Code Section 11346.8, the full text of a regulation change will be made available for at least 15 days prior to the adoption hearing of the resulting regulation unless the change is non-substantial, solely grammatical in nature, or sufficiently related to the original text that the public was adequately placed on notice that the change could result from the originally proposed regulatory action.

Lands Passes have been required to enter certain Department lands since 1988 pursuant to Fish and Game Code (FGC) Sections 1764 and 1765 and as implemented in current subsections 550.5(c)(6), 551(w), 630(c), Title 14, California Code of Regulations (CCR). Section 551(w) lists the designated wildlife areas where lands passes are required for entry. Originally proposed subsection 551(w)(23) would add the entire Napa-Sonoma Marshes Wildlife Area (NSMWA) to the Lands Pass Program. The current modification to this proposal would limit the Lands Pass requirement to the Green Island Unit of the NSMWA.

V. Reasons for Modification of Originally Proposed Language of Initial Statement of Reasons:

When the Department recently analyzed which properties would be practical and cost-efficient to include in the Lands Pass Program, the Green Island Unit of the NSMWA was specifically identified for inclusion, as opposed to including the entire wildlife area. The inclusion of the entire NSMWA in the proposed verbatim for subsection 551(w)(23) was an error. Unlike the Green Island Unit, the other units of this wildlife area do not have a dedicated parking area, do not include a trail that is concurrent with a regional trail system, and they are used primarily by hunters and anglers, who are not required to obtain a Lands Pass. The Green Island Unit is clearly separate from the other units of the wildlife area. According to FGC Section 1745, Lands Passes may only be required where signage about the Lands Passes is posted. The parking lot at the Green Island Unit provides a logical place for signage about the Lands Pass Program. Specifying that the Lands Pass is only required at the Green Island Unit of the NSMWA is a minor change because including this wildlife area in the program is already addressed in the initial regulation change proposal.

VI. Summary of Primary Considerations Raised in Opposition and in Support:

A total of three comments have been received to date in response to the publication of the notice on May 6, 2016.

- An email from The Newport Bay Conservancy (Conservancy) was received on June 20, 2016, outlining reasons for opposing the inclusion of the Upper Newport Bay Ecological Reserve (UNBER).

- The Conservancy also provided oral testimony and two maps at the Commission's discussion hearing on June 23, 2016, which echo the comments provided in their 2016 and 2013 letters.

- The City of Newport Beach (the City) on June 21, 2016. The comments were generally questions about the Lands Pass Program or reasons for opposing the continued inclusion of the Upper Newport Bay Ecological Reserve (UNBER), Orange County, in the program.

Reasons that the City and the Conservancy have in common for opposing the continued inclusion of UNBER in the Lands Pass program include:

1. The Conservancy, the City and County Parks already contribute to the management of the reserve through periodic projects that benefit the habitat or educational goals of UNBER. This support on behalf of the community should make it unnecessary to require a fee from adult visitors

who do not possess a hunting or fishing license.

Response: Many public lands benefit from a variety of funding sources, partnerships, management efforts of adjacent landowners, and the work provided by volunteers, while at the same time requiring an entrance fee. The Lands Pass Program ensures that all visitors participate in supporting the land that they utilize.

2. Visitors often spend more time on adjacent City or County property than they spend on the property under the Department's jurisdiction.

   Response:
   a) Providing for habitat protection and management on UNBER benefits wildlife and plant species that people enjoy observing on adjacent City and County land as well as on UNBER.
   b) UNBER consists of five discontinuous units. According to Fish and Game Code Section 1745(g)(1), the Lands Pass shall only be required where "a sign providing notice of the requirement has been posted at the department-managed land." The Department will work with its local partners at UNBER to post the requirement on the UNBER unit(s) where it is practical to implement the Lands Pass Program.

3. Implementation of the Lands Pass is impractical at UNBER because there are so many points of access to the property.

   Response: Regardless of the Department's efforts to inform the public, it is possible that some visitors may not comply with the requirement to carry a Lands Pass, particularly during the first year of implementation. Nevertheless, based on the Department's experience in land management, law enforcement, and public outreach, the Department's position is that it is worthwhile to implement the Lands Pass Program at UNBER. Also, please see Response 2b.

4. Because of the configuration of the City, County and Department properties, the public will be confused as to where a Lands Pass is required. Will it be needed by kayakers entering UNBER from the south on the water, by a cyclist transiting along Back Bay Drive who stops on the side of the road to fix a flat, or by the volunteers who donate hours to restoration or education efforts?

   Response: The Department will post signs and conduct additional outreach to inform the public about the Lands Pass requirement with the

understanding that comprehensive, widespread knowledge of this requirement will take time to develop and will require ongoing public education. As currently indicated by signs posted and visible from the water, launching and landing boats, and boating within "side channels" are prohibited within the Reserve to avoid impacts to the marsh habitat and sensitive species that nest at the site. Current law provides that rights of way, such as Back Bay Drive, are not subject to the Lands Pass requirement. Consequently, a cyclist who has stopped at the side of the road to safely fix a flat tire would not be subject to citation for not possessing a Lands Pass. A volunteer engaged in work at UNBER is considered to be conducting official business and is not considered a "visitor". (i.e., volunteers do not require a Lands Pass while engaged in volunteer work). When not engaged in an official capacity, volunteers (and CDFW staff) who visit Lands Pass properties for personal recreation are expected to carry a Lands Pass if they do not possess a hunting or fishing license.

Updated Informative Digest/Policy Statement Overview

The Current Lands Pass Program

The majority of lands managed by the Department of Fish and Wildlife (Department) are designated as wildlife areas or ecological reserves. Current regulations for the public use of Department lands include an entry pass program ("the Lands Pass Program") for visitors to certain wildlife areas and ecological reserves who do not possess a hunting, fishing or trapping license. This program was established by the Native Species Conservation and Enhancement Act of 1988 (Fish and Game Code (FGC) Sections 1750-1772).

The current Title 14, California Code or Regulations (CCR) regulations that address this program include:

- 550(c): This section discusses passes and entry permits for department lands in general. It does not distinguish between passes for hunting and Lands Passes. It explains that for properties that require a fee for entry, each visitor must purchase a pass and exchange that pass for an entry permit.
- 550.5(c): This section provides more detailed information about obtaining passes and entry permits and:
  - 550.5(c)(6) specifically explains that a daily or annual "wildlife viewing" pass (referred to as a Lands Pass in other Department publications) and an entry permit are required to enter properties listed in subsections 551(w) and 630(c). It also explains how the price of these passes is adjusted each year, and that visitors who present a valid hunting, fishing or trapping license are exempt from purchasing a daily or annual pass.
  - 550.5(c)(6) does not include the requirement in FGC section 1764 and 1765 that all visitors under the age of 16 are exempt from the pass requirement and that organized school and youth groups are exempt from the pass requirement.

For 2016, a daily Lands Pass costs $4.00 and an annual Lands Pass costs $22.50. The passes may be purchased online, from department license offices or authorized license agents through the Automated License Data System (ALDS). Like other permits or licenses sold by the Department, the price is adjusted annually according to Section 699, Title 14, CCR. Generally speaking, the price of Lands Passes increases by roughly two percent each year.

Five wildlife areas and two ecological reserves currently participate in the Lands Pass Program. They are:

- Gray Lodge Wildlife Area

- Grizzly Island Wildlife Area
- Los Banos Wildlife Area
- Imperial Wildlife Area
- San Jacinto Wildlife Area
- Elkhorn Slough Ecological Reserve
- Upper Newport Bay Ecological Reserve

Purpose of Amendments to Regulations Regarding the Lands Pass Program:

The Legislature has recognized that the Department does not receive adequate revenue to manage the fish and wildlife resources of the State (FGC Section 710). Voluntary programs, such as a Native Species Stamp, were initiated with a concerted campaign in the late 1980's and early 1990's in compliance with FGC sections 1763, 1766 and 1769. These programs were unsuccessful in generating sufficient revenue to cover their costs. The Legislature also directed that the segment of the public that uses Department lands, but does not support them through the purchase of hunting, fishing or trapping licenses, should provide support through purchase of Lands Passes for the use of designated properties (FGC sections 1745, 1764 and 1765).

By expanding the number of wildlife areas and ecological reserves that participate in the Lands Pass Program, the Department may receive additional funds to manage wildlife areas and ecological reserves. One aspect of the Lands Pass Program that has been impractical to implement, particularly since the adoption of the ALDS as the means for selling passes, is the requirement that Lands Passes be exchanged for an entry permit. This is due to the lack of staff available to exchange Lands Passes for entry permits.

If the proposed regulations are adopted, the following changes will be made to the Lands Pass Program through amendments to Sections 550, 550.5, 551,630 and 702, Title 14, CCR:

1. The Lands Pass Program will no longer require visitors to exchange their Lands Pass for an entry permit. This requires amendments to sections 550 and 550.5 to more clearly distinguish between passes issued for hunting, which are exchanged for entry permits, and Lands Passes which are not exchanged for entry permits.
2. In Section 551, the following 28 wildlife areas will be added to the Lands Pass Program:

Ash Creek Wildlife Area
Bass Hill Wildlife Area
Battle Creek Wildlife Area
Butte Valley Wildlife Area
Cache Creek Wildlife Area
Crescent City Marsh Wildlife Area
Eel River Wildlife Area
Elk Creek Wetlands Wildlife Area

Elk River Wildlife Area
Fay Slough Wildlife Area
Hollenbeck Canyon Wildlife Area
Honey Lake Wildlife Area
Hope Valley Wildlife Area
Horseshoe Ranch Wildlife Area
Lake Earl Wildlife Area
Mad River Slough Wildlife Area
Mendota Wildlife Area
Mouth of Cottonwood Creek Wildlife Area
Napa-Sonoma Marshes Wildlife Area
North Grasslands Wildlife Area
San Felipe Valley Wildlife Area
Shasta Valley Wildlife Area
South Spit Wildlife Area
Tehama Wildlife Area
Upper Butte Basin Wildlife Area
Volta Wildlife Area
Willow Creek Wildlife Area
Yolo Bypass Wildlife Area

3. In Section 630, the following eight areas will be added to the Lands Pass Program:

Batiquitos Lagoon Ecological Reserve
Boden Canyon Ecological Reserve
Bolsa Chica Ecological Reserve
Buena Vista Lagoon Ecological Reserve
Canebrake Ecological Reserve
North Table Mountain Ecological Reserve
San Elijo Lagoon Ecological Reserve
Woodbridge Ecological Reserve

<u>Purpose of Amendments to Other Wildlife Area and Ecological Reserve Title 14, CCR, Regulations:</u>

1. Three site-specific regulations that were inadvertently omitted when the land regulations were reorganized in 2014 will be re-entered into Section 551. The restrictions have been kept in place on a temporary basis under the authority of the Regional Manager for the subject areas. These regulations prohibit horses on the Battle Creek and Mouth of Cottonwood Creek Wildlife Areas, and prohibit non-hunting visitors from entering Shasta Valley Wildlife Area on shoot days during the waterfowl season.

2. Various changes are proposed in Section 552 for the National Wildlife Refuges that are also designated as state wildlife areas. These changes are proposed in order to improve the consistency of the state regulations with federal regulations for these refuges and were requested by the U.S. Fish and Wildlife Service.

3. Pursuant to FGC Section 3031, the age limit for people participating as junior hunters on Department lands increased from 15 years old, to persons who are under 18 years of age as of July 1 of the licensing year. This necessitated changes to wording to subsections of Section 550.5 that formerly did not include 16, 17 and 18 year olds as junior hunters. The end result in terms of the numbers of adults and younger people who can be included in a hunting party or

assigned to designated hunting zone, blind or pond is the same as with the existing regulations. The change in the age limit for junior hunters also necessitated adding language that 16 and 17 year olds who hunt without adult supervision may not be accompanied by visitors under 16 years of age.

4. Pursuant to FGC Section 3004.5, Section 550 was amended to require hunters to use ammunition consistent with Section 250.1, Title 14, CCR, (i.e., nonlead ammunition) when hunting on Department lands.

5. In Section 551, archery will be added as a method of take for the special wild pig hunt at the Joice Island Unit of the Grizzly Island Wildlife Area and all legal methods of take for big game will be allowed for the special tule elk hunt on that wildlife area. Visitors will also be allowed to resume off-highway vehicles on roads open to motor vehicles on the Tehama Wildlife Area.

6. Also in Section 551, the Green Island Unit of the Napa-Sonoma Marsh Wildlife Area will be opened for public use. This property was closed because it was the site of extensive, multi-phased habitat restoration projects, which are now complete. Opening the unit to public use is consistent with the management plan for the Wildlife Area.

7. FGC Section 1587 will be implemented by adding language to Section 630, Title 14, CCR, stating that the Mirage Trail on the Magnesia Springs Ecological Reserve is open for hiking from May 1 through January 31.

8. Subsection 703(a)(2) will be deleted. The fees for Special Use Permits will be relocated to Section 702, and the title of Section 702 will be amended to reflect that it includes fees for a variety of public uses on Department lands.

9. Subsections 702(d) and 703(c), which repeat the language in existing Section 699, are proposed for deletion to reduce duplicative regulations.

10. Additional minor editorial changes are also proposed to improve the clarity and consistency of the regulations, improve enforceability, correct typographical errors, and align regulatory language.

Benefits of the Regulations:

The addition of 36 properties to the Lands Pass Program may result in additional funds available for the management of wildlife areas and ecological reserves under the jurisdiction of the Department. The Lands Pass Program will be more practical to implement by discontinuing the requirement to obtain an entry permit in exchange for a daily Lands Pass or the presentation of an annual Lands Pass. The state regulations for public use of National Wildlife Refuges that are also designated as state wildlife areas will be consistent with federal regulations. Environmental quality is expected to benefit as a result of compliance with Section 250.1, Title 14, CCR, which prohibits the use of lead ammunition for hunting on Department lands.

Consistency with State Regulations

The Commission has conducted a search of the California Code of Regulations and has concluded that the proposed regulations are neither inconsistent nor incompatible with existing State regulations.

Update

Subsection 551(w), Title 14, CCR includes a list of the wildlife areas that participate in the Lands Pass Program. The Department inadvertently listed "Napa-Sonoma Marshes Wildlife Area" (NSMWA) as proposed subsection 551(w)(23). This would add the entire wildlife area to the Lands Pass Program. The intention was to add only the Green Island Unit of the wildlife area. The only recommended modification to the proposed regulatory text is to amend subsection 551(w)(23) to "Napa-Sonoma Marshes Wildlife Area (Green Island Unit)".

Updated Regulatory Language

Section 550, Title 14, CCR, is amended to read:

§ 550. General Regulations for Public Use on All Department of Fish and Wildlife Lands.

. . . [No additional changes to this section]

Section 550.5, Title 14, CCR, is amended to read:

§ 550.5. Reservations, Entry Permits, Fees, Passes, and Special Use Permits.

. . . [No additional changes to this section]

Section 551, Title 14, CCR, is amended to read:

§ 551. Additional Visitor Use Regulations on Department Lands Designated as Wildlife Areas.

. . . [No additional changes to subsections (a) to (v)]

(w) Wildlife Areas That Require ~~Entry Permits and Fees for Wildlife Viewing or Other Visitor Uses (pursuant to sections 550.5(c) (5) and 699 of these regulations and Fish and Game Code sections 713 and 1765):~~ a Daily or Annual Lands Pass for Authorized Uses Other than Hunting (Lands Pass): Pursuant to subsection 550(c) and 550.5(c) of these regulations. It shall be unlawful for a visitor to enter any wildlife area, or portion thereof listed in this section without carrying a valid Lands Pass or a valid hunting, fishing or trapping license on their person. A Lands Pass must be purchased in advance. Information on how to purchase a Lands Pass and exceptions to this requirement are provided in subsection 550.5(c).
(1) Ash Creek Wildlife Area
(2) Bass Hill Wildlife Area
(3) Battle Creek Wildlife Area
(4) Butte Valley Wildlife Area
(5) Cache Creek Wildlife Area
(6) Crescent City Marsh Wildlife Area
(7) Eel River Wildlife Area
(8) Elk Creek Wetlands Wildlife Area
(9) Elk River Wildlife Area
(10) Fay Slough Wildlife Area
~~(1)~~(11) Gray Lodge Wildlife Area
~~(2)~~(12) Grizzly Island Wildlife Area
(13) Hollenbeck Canyon Wildlife Area
(14) Honey Lake Wildlife Area
(15) Hope Valley Wildlife Area

(16) Horseshoe Ranch Wildlife Area
~~(3)~~(17) Imperial Wildlife Area (Wister and Finney-Ramer units)
(18) Lake Earl Wildlife Area
~~(4)~~(19) Los Banos Wildlife Area
(20) Mad River Slough Wildlife Area
(21) Mendota Wildlife Area
(22) Mouth of Cottonwood Creek Wildlife Area
(23) Napa-Sonoma Marshes Wildlife Area **(Green Island Unit)**
(24) North Grasslands Wildlife Area
(25) San Felipe Valley Wildlife Area
~~(5)~~(26) San Jacinto Wildlife Area
(27) Shasta Valley Wildlife Area
(28) South Spit Wildlife Area
(29) Tehama Wildlife Area
(30) Upper Butte Basin Wildlife Area
(31) Volta Wildlife Area
(32) Willow Creek Wildlife Area
(33) Yolo Bypass Wildlife Area

. . . [No additional changes to subsections (x) to (z)]

Section 552, Title 14, CCR, is amended to read:

§ 552. Public Use Regulations for National Wildlife Refuges That Are Also Designated as Wildlife Areas by the Commission.

. . . [No additional changes to this section]

Section 630, Title 14, CCR, is amended to read:

§ 630. Additional Visitor Use Regulations on Department Lands Designated as Ecological Reserves.

. . . [No additional changes to this section]

Section 702, Title 14, CCR, is amended to read:

§ 702. Hunting Applications, Tags, Seals, Permits, Reservations, and Fees; Department Lands Applications, Passes, Special Use Permits, and Fees.

. . . [No additional changes to this section]

Section 703, Title 14, CCR, is amended to read:

§ 703. Miscellaneous Applications, Tags, Seals, Licenses, Permits, and Fees.
(a) Applications, Forms and Fees for January 1 through December 31 (Calendar Year).

. . . [No additional changes to this section]

ADDENDUM

to the

FINAL ENVIRONMENTAL DOCUMENT FOR

PROPOSED REGULATIONS GOVERNING

PUBLIC USE OF CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE LANDS

prepared by the

STATE OF CALIFORNIA

THE NATURAL RESOURCES AGENCY

CALIFORNIA FISH AND GAME COMMISSION

as the

LEAD AGENCY UNDER THE CALIFORNIA

ENVIRONMENTAL QUALITY ACT for the

REGULATORY ACTION TO

AMEND SECTIONS 550, 550.5, 551, 552, 630 AND 702

REPEAL SECTIONS 703(a)(2) and 703(c)

OF TITLE 14, CALIFORNIA CODE OF REGULATIONS

August 5, 2016

I.

INTRODUCTION

The California Fish and Game Commission ("Commission") has prepared this Addendum to comply with the California Environmental Quality Act ("CEQA") (Public Resources Code section 21000 *et seq.).* The Commission is the lead agency under CEQA with respect to the proposed project that involves changes to existing regulations that govern the public use of lands under the jurisdiction of the California Department of Fish and Wildlife ("CDFW").

Generally, these lands are either ecological reserves (Fish and Game Code section 1580 *et seq.)* or wildlife areas (Fish and Game Code section 1525 *et seq.)* Ecological reserves are generally acquired to protect rare and/or endangered native plant and animal species and specialized habitat types. Wildlife areas are acquired for wildlife conservation and compatible recreational uses. For both of these categories of land, the Commission may adopt regulations that govern their use, operation, and protection. The existing regulations are found in sections 550, 551, 552, 553, 630 and 703 of Title 14 of the California Code of Regulations (CCR).

On June 20, 2012, the Commission approved amendments to these sections, with one addition (Section 550.5) and one repeal (Section 553). As part of this approval, the Commission prepared and certified a document that was the functional equivalent of an Environmental Impact Report ("EIR") as it is legally entitled to do under its Certified Regulatory Program ("CRP"). (Title 14, California Code of Regulations, section 781.5, 15251) A Notice of Determination was filed for this document on June 22, 2012.

This Addendum addresses various issues under CEQA associated with the proposed amendments to these sections, as well as amendments to Section 702. It is also prepared because the Commission has determined that some changes or additions are necessary to the previously certified functional equivalent document, but these changes do not call for the preparation of a subsequent environmental document. (Title 14, California Code of Regulations, section 15164) This Addendum is appropriate because the changes involve only minor technical changes or additions.

II.

BACKGROUND AND OVERVIEW OF THE COMMISSION'S OBLIGATIONS AS THE LEAD AGENCY UNDER CEQA FOR MODIFICATIONS TO THE PREVIOUSLY APPROVED REGULATIONS

In 2012, the Commission changed existing regulations governing the use of publicly-owned lands under the jurisdiction of, or managed by, the CDFW. The existing regulations were found in sections 550, 551, 552, 553, 630 and 703 of Title 14. Most of these sections were originally adopted in the late 1980s, early 1990s and have been amended numerous times since then. The purposes of the changes that were approved by the Commission in June 2012 were to consolidate and clarify the existing regulations, standardize the process used to issue special use permits, designate seven recently acquired properties as wildlife areas or ecological reserves, and make changes to or add regulations that would improve public safety and/or recreational opportunities without causing a significant effect on wildlife or habitat resources. As part of the effort to consolidate and clarify the regulations, the existing general and site specific regulations that governed the Department's then 111 wildlife areas and 136 ecological reserves were completely reorganized. The environmental document prepared in support of this reorganization was contained in the Initial Statement of Reasons ("ISOR") for the project and was approved at the same time as the regulations themselves. The Commission concluded that the adoption and implementation of those amendments would not result in any potentially significant adverse impacts under CEQA.

The amendments approved by the Commission in June, 2012, were ultimately disapproved by the Office of Administrative Law ("OAL") for reasons related to the Administrative Procedures Act ("APA") (Government Code section 11340 *et seq.).* As a result, the Commission revised the regulations themselves, as well as related APA documents to meet applicable legal requirements. An Addendum to the 2012 environmental document was prepared, the revised regulation package was approved by the Commission on April 16, 2014, and approval from OAL was granted on August 11, 2014.

During this period, statutes were approved by the legislature that necessitated additional changes to the land regulations:

1. FGC Section 1745 which addresses, among other topics, the implementation of the Lands Pass Program.
2. FGC Section 1587 regarding public use of the Mirage Trail at the Magnesia Springs Ecological Reserve

3. FGC Section 3004.5 regarding requirements for nonlead ammunition; and
4. FGC Section 3031 regarding the age limit for possessing a junior hunting license.

Changes were made to federal statutes for nine National Wildlife Refuges that are also designated as State Wildlife Areas. This necessitated changes to Section 552, Title 14, CCR in order to maintain consistency between state and federal regulations. The Department administers hunting programs on the federal refuges as part of a cooperative agreement with the U.S. Fish and Wildlife Service.

Additionally, some errors were discovered in the major reorganization of the land regulations from 2014 (e.g., some subsections were not properly relocated or inadvertently omitted during the reorganization), possible changes to the verbatim that would strengthen the enforceability of certain sections were identified, and it became apparent that there were a few remaining contradictions between regulations that had not been addressed during the 2012-2014 update.

It was decided to consolidate fees for Department lands in Section 702, which necessitated amendments to that section and the deletion of two subsections within Section 703.

The developments described above give rise to the current obligation of the Commission to comply with CEQA with respect to the currently-proposed technical changes.

According to CEQA, where a lead agency prepares an EIR or an environmental document pursuant to a CRP for a proposed project, no subsequent or supplemental analysis is required under CEQA unless one or more of the following occur:

- Substantial changes are proposed in the project which will require major revisions to the previous EIR or environmental document.
- Substantial changes occur with respect to the circumstances under which the project is being undertaken which will require major revisions to the previous EIR or environmental document.
- New information, which was not known and could not have been known at the time the previous EIR or environmental document was certified as complete, becomes available.

  (Pub. Resources Code, § 21166; Cal. Code Regs., tit. 14, § 15162, subd. (a).)

In general, new information and required revisions to a prior EIR or environmental document trigger the need to prepare subsequent or supplemental analysis under CEQA, only where changes to the project, changes in circumstances, or new information

reveal:

- A new potentially significant environmental impact not previously disclosed in the prior analysis; or
- A substantial increase in severity of a previously-identified potentially significant impact.
- *(Id.,* § 15162, subd. (a)(1)-(3).)

Stated another way, a subsequent EIR or environmental document or a supplement to such prior analysis, is not required under CEQA where substantial evidence in light of the whole record supports the Commission's determination that none of the conditions highlighted above are present. The Commission, as explained below, determines that no such conditions are present with respect to the proposed modifications to the existing regulations governing the use and operation of state-owned land that is held or managed by CDFW. The Commission, as a result, may properly prepare and rely on this Addendum to fulfill its obligations under CEQA with respect to the proposed project. *(Id.,* § 15164.)

III.

CONSIDERATION OF PROJECT CHANGES, CHANGED CIRCUMSTANCES AND POTENTIALLY SIGNIFICANT NEW INFORMATION

As noted above, in 2012, the Commission concluded that the adoption and implementation of that set of regulations would not result in any potentially significant environmental impacts. A major focus of the current regulation package is administrative changes to the Department's Lands Pass Program which will have no on-the-ground effect.

It should be noted that the new statutory language regarding the public use of the Mirage Trail on the Magnesia Springs Ecological Reserve and the age limit for possessing a junior hunting license does not give the Commission discretion over the specific requirements in these regulations but the Commission is including them in regulation in order to increase public awareness and compliance. Members of the public tend to refer to the regulations rather than the statutes when visiting Department land. A similar situation exists for adding a land regulation regarding the use of nonlead ammunition. That requirement already exists in Section 250.1, Title 14, CCR, a section that addresses ammunition, but adding it to the land regulations should increase public awareness and compliance on Department lands.

Subsection 551(k)(3) proposes to allow off-highway vehicles (OHV's) to be used only on

roads that are open to vehicle traffic on the Tehama Wildlife Area in Tehama County. OHV's have been used on the roads of the wildlife area since its establishment in 1968. Based on the experience of managing both the natural resources and public use of this property since 1968, the Department does not expect that the proposed regulation will have a significant environmental impact because:

- The system of dirt roads is so extensive and the off-road terrain is so rough that visitors (primarily hunters) were not prone to riding off-road during the many years that OHV's were allowed on the wildlife area. The area did not incur visible off-road damage. Hunters focused on reaching hunting areas or campsites as efficiently as possible, with their equipment and supplies intact.

- When OHVs are banned, the number of four-wheel-drive jeeps, SUV's and trucks on the roads increases considerably. These vehicles are much heavier than the OHV's and are causing more wear-related damage to the roads.

A proposed amendment to subsection 551(o)(39) would open the Green Island Unit of the Napa-Sonoma Marshes Wildlife Area to compatible uses other than hunting. Under the current version of this subsection, this unit has been closed to public use during a lengthy habitat restoration project. Because the habitat restoration project is complete, the Department proposes to open this relatively small unit to compatible uses other than hunting. This is consistent with the management plan for the Wildlife Area which underwent CEQA review and was finalized in 2011.

Proposed amendments to subsections 551(s)(8) and (s)(10) would allow any legal method-of-take for big game, pursuant to Sections 353 and 354, Title 14, CCR, for elk and wild pig special hunts on the Grizzly Island Wildlife Area (GIWA). Normally hunting with firearms on Type A and Type B wildlife areas is limited to shotguns, and is focused primarily on waterfowl and small upland game species. These hunts are a limited opportunity, with a relatively small number of tags made available. Based on experience and expertise in managing these species, the Department thinks this change is compatible with managing elk and wild pig populations at the GIWA and would allow these hunts to conform with statewide regulations for hunting big game.

In light of the preceding analysis and other substantial evidence in the administrative record of proceedings, the Commission does not believe that the proposed changes dated August 2016 governing the use and operation of CDFW-owned land will result in previously undisclosed, new significant environmental impacts or a substantial increase in the severity of previously disclosed impacts.

Newport Bay Conservancy

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Ron Yeo

June 20, 2016

Mr. C H Bonham
Director, Department of Fish and Wildlife
1416 9th Street, 12th Floor
Sacramento
CA 95814

Dear Mr. Bonham:

I am writing on behalf of the Newport Bay Conservancy to reiterate our strong concerns about the declared intent of your Department to implement a Lands Pass fee for entry into the Upper Newport Bay Ecological Reserve. We wrote in June 2013 when this idea was last put forward (copy attached) and our views on the subject have not changed.

Apart from the question of the justification for charging an entry fee to the Reserve, there are many practical difficulties as detailed in our previous letter. There is only one permitted trail within the Reserve, comprising a short (c. 800 yd) loop trail into Big Canyon, and the only other places the public can enter CDFW land are from a parking lot which is accessed from Back Bay Drive (a public street maintained by the City of Newport Beach) and on a small viewpoint known as Vista Point, which gives views over the Upper Bay. Water access by kayak and paddleboard is from either the Newport Aquatic Center or the Dunes resort, both of which lie outside the boundaries of the Reserve. It seems to us totally impractical to attempt to levy a charge on kayak or paddleboard customers from either of those bases when they may or may not choose to enter the Reserve waters.

UNB open space comprises lands owned by the State of California, the County of Orange and the City of Newport Beach. By far the largest numbers of visitors are either using trails on the Orange County Parks Nature Preserve which overlooks the Bay, or are hiking, biking or jogging on Back Bay Drive, which runs alongside the eastern boundary of the Reserve. In 2013, The City made it clear they would not allow any charge to be levied on users of this street, which is on City land and is a public highway.

Newport Bay Conservancy runs public kayak tours led by a trained naturalist every weekend, and leads environmental education tours for High School students into the Reserve by outrigger canoe on a regular basis. In total these are attended by around 2000 participants annually. We also lead free walking tours on Back Bay Drive which have been run continuously since 1968 when they were a focal point of the citizen's campaign to save the Bay from development.

Participant numbers for all these programs are provided to CDFW every year. Most of the schools who participate in the programs are in economically deprived areas within Orange County, and the students can participate only because we are able to obtain grants to defray the costs involved (for transportation, substitute teachers, and outrigger rental).

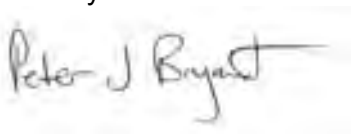
To: Mr C H Bonham
Director, Department of Fish & Wildlife

Lands Pass requirement at Upper Newport Bay Ecological Reserve /cont.

If members of the Commission are unfamiliar with the Upper Newport Bay Ecological Reserve we would be delighted to host a visit to demonstrate these programs and the challenges that a Lands Pass fee would present. I am sure members of the City Council would be happy to participate.

I am sending this letter by email because we were notified today that comments are due today to the Fish and Game Commission.

Sincerely



Peter J. Bryant, Ph.D.,
President, Newport Bay Conservancy
949 933 9654

cc. David Kiff, City Manager, City of Newport Beach
Carla Navarro, Reserve Manager, UNB Ecological Reserve
Richard Burg, Senior Environmental Scientist/ Supervisor, Lands Program, South Coast Region

Newport Bay Conservancy

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June 21, 2013

Mr C H Bonham
Director, Department of Fish & Wildlife
1416 9th Street, 12th Floor
Sacramento
CA 95814

Dear Mr Bonham

Lands Pass requirement at Upper Newport Bay Ecological Reserve

As two nonprofit organizations closely associated with Upper Newport Bay (UNB) we wish to register our deep concern with the declared intent to charge entry fees to members of the public entering the Upper Newport Bay Ecological Reserve.

From discussions with Carla Navarro, (Reserve Manager) we understand that there has been provision for an entry charge in the State Regulations for many years, albeit never enforced. Our organizations have been operating since the 1970's and yet were not aware of this provision.

Our concerns are:

1. Practicality

UNB is surrounded by urban development and has multiple entry points. Unlike other reserves, including Elkhorn Slough, it is an open reserve with no boundary fencing. There is also a Nature Preserve managed by Orange County Parks that is contiguous with the CDFW reserve but without any marked boundary between the two. Further, there is a City-maintained street (Back Bay Drive) that was in existence as a public highway for many years before the Reserve was established which runs for several miles just inside the eastern margin of the Reserve. This street is a popular route for recreational cyclists, with numbers running into several hundred daily on weekends. It is also popular with walkers and bird watchers, and those individuals with disabilities whose only means to view and enjoy the Reserve is by a drive along this road.

We do not understand how a charge can be fairly and effectively applied to all such users.

Other than this street, the only permitted public access to the Reserve on land comprises a half- mile loop trail, a parking lot adjacent to the City-maintained street, and a viewpoint (Vista Point) on the NE boundary of the Reserve. The latter relates to our second reason for objecting to the concept of a daily entry fee.

In reality, visitors and local residents tend to see the whole open space of the Bay and the surrounding bluffs as a single entity, and generally do not understand that elements of it are managed by CDFW, others by Orange County Parks, and still others by the City of Newport Beach.

2. Community contributions to upkeep of UNB Reserve

We understand that part of the rationale for implementing a fee is the view among hunting and fishing groups that other users of CDFW reserves are not contributing a fair share of the costs of maintaining them. As you will know, the UNB has a special history, in that it was only saved from development by a vigorous campaign by local citizens in the late 60s/early 70s. The Bay was subsequently established as an ecological reserve.

Since that time, significant funds have been raised by the local community on behalf of the Reserve. We understand the Back Bay Science Center was 80% funded by the City of Newport Beach. The above-mentioned Vista Point was proposed, designed and built with over $100,000 raised entirely from the local community. The short loop trail was constructed with funding from the City of Newport Beach and volunteer labor provided by the Newport Bay Naturalists and Friends (now the Newport Bay Conservancy). The latter organization has also raised over $50,000 – including $17,000 of its own funds - in a habitat restoration project on the western part of the Reserve and provides significant volunteer resources for habitat restoration and trash removal within the Reserve. Hence the reality is that in one way or another the local community has provided the bulk of the funds invested in educational and other public facilities over the years, and continues to provide the major part of "people" support with volunteers leading monthly walking tours, on the water kayak tours, and organizing and participating in ongoing habitat restoration in partnership with CDFW and the California Coastal Commission's community-based restoration program.

In summary, the Bay is a place near and dear to the communities around it, as is evidenced by these examples of active community involvement.

3. Facilities provided in the Reserve

It states in the CDFW website (Ecological Reserves – A Wild Time For Visitors) that the UNB Reserve has a visitor center "where staff and docents can direct or lead visitors to special points of interest" and that "children get to see marine life of the bay at the Marine Studies Center…". In fact the Back Bay Science Center is a locked facility 6 ½ days a week, only open for 4 hours on Sundays when City staff open it for members of the public to see the aquaria and marine exhibits.

To: Mr C H Bonham
Director, Department of Fish & Wildlife

Lands Pass requirement at Upper Newport Bay Ecological Reserve /cont.

For the reasons set out above, we cannot therefore understand why the UNB Reserve is one of the 7 CDFW reserves, out of the 716 managed by CDFW across the State, for which a Lands Pass is required. We strongly recommend a meeting with representatives of the City of Newport Beach, Orange County Parks and our own organizations to discuss the concerns raised above before further action is taken. The current approach can only antagonize the local community and those environmental organizations such as our own which provide significant levels of support to protect and preserve the Bay.

Sincerely,

HOWARD CORK
President,
Newport Bay Conservancy

JEAN WATT
President,
Friends of Harbors, Beaches and Parks

cc. Mr David Kiff, City Manager, Newport Beach
Ms Carla Navarro, Reserve Manager, UNB Ecological Reserve

CITY OF NEWPORT BEACH

Office of the City Manager

June 21, 2016

Mr. Charlton H. Bonham
Director, Department of Fish and Wildlife
1416 9th Street, 12th Floor
Sacramento, CA 95814

RE: Lands Pass requirement for Upper Newport Bay Ecological Reserve (2016)

Dear Director Bonham:

The following letter is consistent with the position of the Newport Beach City Council, taken in June 2013 as this issue arose then. This letter is a reiteration of the City of Newport Beach's (City) concern about the proposed "Lands Pass" requirement for the Upper Newport Bay Ecological Reserve (UNBER).

The City has long been a supporter of the California Department of Fish and Wildlife (CDFW) as it has managed UNBER. We think of UNBER and the surrounding County of Orange Nature Preserve as our backyard, and a very special one at that. CDFW has always been a strong partner in protecting the important ecological resources at UNBER.

Knowing the fiscal concerns of CDFW, we can somewhat see the rationale behind CDFW's application of its Lands Pass requirement across CDFW properties. However, we believe that the nature of UNBER is not conducive to collecting fees under the Lands Pass system, nor has the long-term partnership between CDFW, the City, and the County of Orange warranted its application.

We (and our residents) partner with you on restoration efforts, educational programs, the Back Bay Science Center, and even enforcement and rescue in UNBER. Dozens if not hundreds of access points allow our residents as well any Californian to access the resources within UNBER, and often they do so on a very brief basis. Our own Back Bay Drive goes across nearly the entirety of the eastern side of UNBER. This is a roadway that we maintain and operate, at our cost, to allow people to access the Upper Newport Bay as easily and safely as possible.

Respectfully, we think that CDFW's effort to collect the Lands Pass fee at UNBER will be minimally successful at best. At worst, thousands of individuals and groups will be confused as to precise Lands Pass requirements depending upon their use patterns. Will it be needed by kayakers entering the Reserve from the south on the water? A cyclist transiting along Back Bay Drive who stops on the side of the road to fix a flat? The volunteers who donate thousands of hours to restoration or education efforts?

There is a long history of no-fee partnership (including tens of thousands of volunteer hours) between our City, our residents and CDFW, and collecting the fee associated with the Lands Pass changes that long-standing relationship. Therefore, we urge you to reconsider the Lands Pass requirement at UNBER.

We thank you and your local staff for your dedicated service to the Upper Newport Bay and thank you for your consideration of this request. Should you have any questions about the City's position, please do not hesitate to contact me at 949-644-3001.

Sincerely,

Dave Kiff
City Manager
City of Newport Beach

cc: Members of the Newport Beach City Council
State Senator John MW Moorlach (35th Senate District)
Dr. Peter Bryant, President of the Newport Bay Conservancy
Ms. Carla Navarro, Reserve Manager, UNBER

STATE OF CALIFORNIA
FISH AND GAME COMMISSION
INITIAL STATEMENT OF REASONS FOR REGULATORY ACTION
(Pre-publication of Notice Statement)

Amend Sections 1.53 and 27.00 and
subsection (a) of Section 28.65,
Title 14, California Code of Regulations (CCR)
Re: Definitions for tidal waters and finfish gear restrictions in
San Francisco and San Pablo bays

I. Date of Initial Statement of Reasons: March 10, 2016

II. Dates and Locations of Scheduled Hearings:

(a) Notice Hearing: Date: April 14, 2016
Location: Santa Rosa

(b) Discussion Hearing: Date: June 23, 2016
Location: Bakersfield

(c) Adoption Hearing: Date: August 25, 2016
Location: Folsom

III. Description of Regulatory Action:

(a) Statement of Specific Purpose of Regulation Change and Factual Basis for Determining that Regulation Change is Reasonably Necessary:

The Department of Fish and Wildlife (Department) recommended, and the Fish and Game Commission (Commission) adopted, changes to sections 1.53 and 27.00, Title 14, CCR on December 10, 2015 in order to clarify definition of boundaries of “Inland Waters” in relation to San Francisco and San Pablo bays.

Section 1.53, Title 14, CCR, was amended as follows:

§ 1.53. Inland Waters.
Inland waters are all the fresh, brackish and inland saline waters of the state, including lagoons and tidewaters upstream from the mouths of coastal rivers and streams. Inland waters exclude the waters of San Francisco and San Pablo bays downstream from the west Carquinez Bridge, ~~the tidal portions of rivers and streams flowing into San Francisco and San Pablo Bays,~~ and the waters of Elkhorn Slough, west of Elkhorn Road between Castroville and Watsonville. Also see Section 27.00.

Section 27.00, Title 14, CCR, was amended as follows:

§ 27.00. Definition.
The Ocean and San Francisco Bay District consists of the open seas adjacent to the coast and islands or in the waters of those open or enclosed bays contiguous to the ocean, and including San Francisco and San Pablo bays ~~plus all their tidal bays, tidal portions of their rivers and streams, sloughs and estuaries~~ between Golden Gate Bridge and the west Carquinez Bridge~~, and the waters of Elkhorn Slough, west of Elkhorn Road between Castroville and Watsonville~~. Also see Section 1.53.

In summary, the effects of these two regulation changes made inland waters begin upstream of the mouth of any coastal river or stream, including all streams, rivers, and sloughs flowing into San Francisco and San Pablo bays west of the Carquinez Bridge. The original purpose of these amendments was to solve an enforcement issue on the Napa River caused by regulation ambiguity between sections 1.53, 27.00, and 28.65 (a).

As stated in the "Final Statement of Reasons:"

"Currently there are three sections dealing with the Ocean and San Francisco Bay District which describe regulations in different manners causing confusion for anglers and making enforcement of the regulations more difficult:

- *Section 27.00 defines the Ocean and San Francisco Bay District as waters of the open coast and includes San Francisco and San Pablo bays "plus all their tidal bays, tidal portions of their rivers and streams, sloughs and estuaries" between the Golden Gate Bridge and the Carquinez Bridge.*

- *Section 1.53 defines inland waters as all fresh, brackish and inland saline waters of the state, including lagoons and tidewaters upstream from the mouths of coastal rivers and streams. Inland waters exclude the waters of San Francisco and San Pablo Bays downstream from the Carquinez Bridge, the tidal portions of rivers and streams flowing into San Francisco and San Pablo bays, and the waters of Elkhorn Slough, west of Elkhorn Road between Castroville and Watsonville.*

- *Subsection 28.65(a) (which describes gear restrictions for fin fish) defines the area as San Francisco and San Pablo bays between the Golden Gate Bridge and the west Carquinez Bridge, where only one line with not more*

than three hooks may be used.

The different definitions of the same geographic area cause confusion as to applicable method of take as well as which set of regulations apply to the waters being fished.

An angler is allowed to use any number of hooks and lines in ocean waters (Section 28.65). In Inland waters only one closely attended line with no more than three hooks may be used (Section 2.00). Under the current regulations, a person could argue that tidal portions of the Napa River were not Inland Waters since subsection 28.65(a) did not include the tidal portions of river flowing into San Francisco and San Pablo bays. Under this interpretation, they could use any number of lines and hooks to fish in the Napa River. This would restrict waters of San Francisco and San Pablo bays to one line, then allow unlimited lines in the Napa River waters which were tidally influenced even though all inland waters are restricted to one line.

In addition, fishing regulations for Ocean Waters defined in Section 27.00 are different from Inland Waters as defined in Section 1.53. Since tidal influence cannot easily be determined, it is almost impossible to know which set of regulations apply in the tidally influenced waters. For instance is an undersized sturgeon caught in the Napa River a violation of Section 5.80 or Section 27.90?"

While the Department proposed the regulation change in a good faith effort to clarify regulations, it unfortunately created some unintended consequences making it difficult to enforce regulations in other portions of San Francisco and San Pablo bays. An example of a consequence of enacting the aforementioned changes is as follows: The tidal portion of Coyote Creek is located in the southern portion of San Francisco Bay and for much of this section is split approximately down the middle between Alameda and Santa Clara Counties. With the adoption of the December 2015 changes, this portion would be controlled by two different regulations (sections 7.00 (e)(3) and 7.50 (b)(50.8)) which would impose the season of "Last Saturday in April through November 15th" on the entire creek and on the Santa Clara County side would enact an additional restriction of artificial lures with barbless hooks. Both of these restrictions are unreasonable for the described area and thus would necessitate further regulation changes to correct the issue. There are other areas which would be burdened with similar de facto restrictions which are similarly unreasonable and were unintended consequences of the amended regulations.

In addition, the December 10, 2015, regulations deleted reference to Elkhorn Slough in Section 27.00, but not in Section 1.53, which created inconsistency.

A regulation change is necessary to correct the original problem with the Napa River and related gear restriction regulations, correct the inconsistency related to Elkhorn Slough between sections 27.00 and 1.53, and to avoid other unintended

consequences of the amendments adopted on December 10, 2015.

Under California law (Fish and Game Code sections 200 and 205), the Commission adopts regulations for the recreational fishery three miles out from the coast of California and in all bays, through the tidal waters and into freshwater.

Proposed Regulation Changes

(a) The Department proposes changes to Title 14 sections 1.53, 27.00, and 28.65 (a) to clarify the meaning of "inland waters" and the "Ocean and San Francisco Bay District" in order to facilitate compliance and enforcement of the gear restrictions and seasons that apply in those waters. In Section 27.00, the proposed changes would include addition of physical landmarks on the Napa River, Sonoma Creek, and the Petaluma River to delineate between "inland waters" and "San Francisco Bay" on those waterways. For Section 28.65 (a), there would be an added reference to the San Francisco Bay definition under Section 27.00.

By reverting back to language similar to pre-December 2015, for sections1.53 and 27.00, adding boundaries for specific waterways to Section 27.00, adding a needed clarification to Section 28.65 (a), and making other minor language corrections to all sections, the proposed amendments would effectively alleviate the concerns outlined in the original regulation change proposal while avoiding the unintended enforcement challenges from the current regulation.

<u>Proposal: Amend Section 1.53, Inland Waters, Section 27.00, Ocean and San Francisco Bay Definition, and subsection 28.65 (a), Line and hook restrictions within San Francisco and San Pablo bays.</u>

Amend the two regulations that define San Francisco Bay and Inland waters. Amend one regulation which addresses line and hook restrictions within San Francisco Bay. These changes will provide greater consistency among the sections, reduce the potential for confusion, and improve clarity.

(b) Authority and Reference Sections from Fish and Game Code for Regulation:

Authority Sections: 200, 202, 205, 215, 220, and 240, Fish and Game Code.
Reference Sections: 200, 202, 205, 206, 215, 220, 240 and 8585.5, Fish and Game Code.

(c) Specific Technology or Equipment Required by Regulatory Change:

None.

(d) Identification of Reports or Documents Supporting Regulation Change:

None.

(e) Public Discussions of Proposed Regulations Prior to Notice Publication:

No public meetings are being held prior to the notice publication. The 45-day comment period provides adequate time for review of the proposed amendments.

IV. Description of Reasonable Alternatives to Regulatory Action:

(a) Alternatives to Regulation Change:

No alternatives were identified by or brought to the attention of Commission staff that would have the same desired regulatory effect.

(b) No Change Alternative:

Not changing the regulation as written will allow inconsistent regulations to persist and perpetuate the unintended consequences of the regulations adopted on December 10, 2015.

(c) Consideration of Alternatives:

In view of information currently possessed, no reasonable alternative considered would be more effective in carrying out the purpose for which the regulation is proposed, would be as effective and less burdensome to affected private persons than the proposed regulation, or would be more cost effective to affected private persons and equally effective in implementing the statutory policy or other provision of law.

V. Mitigation Measures Required by Regulatory Action:

The proposed regulatory action will have no negative impact on the environment; therefore, no mitigation measures are needed.

VI. Impact of Regulatory Action:

The potential for significant statewide adverse economic impacts that might result from the proposed regulatory action has been assessed, and the following initial determinations relative to the required statutory categories have been made:

(a) Significant Statewide Adverse Economic Impact Directly Affecting Businesses, Including the Ability of California Businesses to Compete with

Businesses in Other States:

The proposed action will not have a significant statewide adverse economic impact directly affecting business, including the ability of California businesses to compete with businesses in other states.

There are no businesses that are expected to be impacted by the proposed regulatory changes to clarify definition of boundaries of “Inland Waters” in relation to San Francisco and San Pablo bays.

(b) Impact on the Creation or Elimination of Jobs Within the State, the Creation of New Businesses or the Elimination of Existing Businesses, or the Expansion of Businesses in California; Benefits of the Regulation to the Health and Welfare of California Residents, Worker Safety, and the State’s Environment:

The Commission does not anticipate any significant impacts on the creation or elimination of jobs, the creation of new business, the elimination of existing businesses or the expansion of businesses in California because the proposed definition changes will not affect angling effort.

The Commission anticipates benefits to the health and welfare of Calif ornia residents. Participation in sport fishing opportunities fosters conservation through education and appreciation of California’s wildlife.

The Commission does not anticipate any benefits to worker safety because the proposed changes do not address worker safety.

The Commission anticipates benefits to the environment by the sustainable management of California’s sport fishing resources.

(c) Cost Impacts on a Representative Private Person or Business:

The agency is not aware of any cost impacts that a representative private person or business would necessarily incur in reasonable compliance with the proposed action.

(d) Costs or Savings to State Agencies or Costs/Savings in Federal Funding to the State:

None.

(e) Nondiscretionary Costs/Savings to Local Agencies:

None.

(f) Programs Mandated on Local Agencies or School Districts:

None.

(g) Costs Imposed on Any Local Agency or School District that is Required to be Reimbursed Under Part 7 (commencing with Section 17500) of Division 4, Government Code:

None.

(h) Effect on Housing Costs:

None.

VII. Economic Impact Assessment

The regulation changes adopted on December 10, 2015 made inland waters begin upstream of the mouth of any coastal river or stream, including all streams, rivers, and sloughs flowing into San Francisco and San Pablo bays west of the Carquinez Bridge. The original purpose of these amendments was to solve an enforcement issue on the Napa River caused by regulation ambiguity between sections 1.53, 27.00, and subsection 28.65 (a), Title 14, CCR.

(a) Effects of the Regulation on the Creation or Elimination of Jobs Within the State:

The Commission does not anticipate any significant impacts on the creation or elimination of jobs within the State as a result of this regulatory change.

(b) Effects of the Regulation on the Creation of New Businesses or the Elimination of Existing Businesses Within the State:

The Commission does not anticipate significant statewide adverse economic impact directly affecting business, including the creation of new businesses or the elimination of existing businesses.

There are no businesses that are expected to be impacted by the proposed regulatory changes clarify definition of boundaries of “Inland Waters” in relation to San Francisco and San Pablo bays.

(c) Effects of the Regulation on the Expansion of Businesses Currently Doing Business Within the State:

The Commission does not anticipate any expansion of businesses currently doing business in California as a result of the proposed changes. The proposed amendments merely clarify the boundaries of “Inland Waters” in relation to San Francisco and San Pablo bays.

(d) Benefits of the Regulation to the Health and Welfare of California Residents:

The Commission anticipates benefits to the health and welfare of California residents. Participation in sport fishing opportunities fosters conservation through education and appreciation of California’s wildlife.

(e) Benefits of the Regulation to Worker Safety:

The Commission does not anticipate benefits to worker safety because this regulatory action does not address worker safety.

(f) Benefits of the Regulation to the State's Environment:

The Department anticipates benefits to the environment through the better management of toxic lead substances that can be deleterious to wildlife, including threatened and/or endangered species.

(g) Other Benefits of the Regulation:

None.

Informative Digest/Policy Statement Overview

Current laws provide for definitions of inland waters for the San Francisco Bay and San Pablo bays, as well as the Ocean and San Francisco Bay District. Current laws also define restrictions for the use of hooks and lines in certain waters. There are three sections dealing with the Ocean and San Francisco Bay District which describe regulations in different manners causing confusion for anglers and making enforcement of the regulations more difficult.

Summary of Proposed Amendments

The Commission proposes to amend Title 14 sections 1.53, 27.00, and 28.65 (a) to clarify the meaning of “inland waters” and the “Ocean and San Francisco Bay District” in order to facilitate compliance and enforcement of the gear restrictions and seasons that apply in those waters. In Section 27.00, the proposed changes would include addition of physical landmarks on the Napa River, Sonoma Creek, and the Petaluma River to delineate between “inland waters” and “San Francisco Bay” on those waterways. For Section 28.65 (a), there would be an added reference to the San Francisco Bay definition under Section 27.00. These changes will provide greater consistency among the sections, reduce the potential for confusion, and improve clarity.

By reverting back to language similar to pre-December 2015, for sections 1.53 and 27.00, adding boundaries for specific waterways to Section 27.00, adding a needed clarification to Section 28.65 (a), and making other minor language corrections to all sections, the proposed amendments effectively alleviate the concerns outlined in the original regulation change proposal while avoiding the unintended enforcement challenges from the current regulation.

Benefits of the Regulations

The proposed regulations clarify the boundaries between inland waters and the waters of San Francisco Bay, making it easier for anglers to understand which regulations apply to the waters being fished. The proposed amendments will also make it easier for wildlife officers to enforce angling regulations in and adjacent to San Francisco Bay.

Consistency and Compatibility with Existing Regulations

The proposed regulations are neither inconsistent nor incompatible with existing State regulations. The Legislature has delegated authority to the Commission to adopt sport fishing regulations (Fish and Game Code, sections 200, 202 and 205). The Commission has conducted a search of Title 14, CCR and determined that the proposed regulations are consistent with general sport fishing regulations in Chapters 1 and 4 of Subdivision 1 of Division 1, Title 14, CCR.

Regulatory Language

Amend Section 1.53, Title 14, CCR, to read:

§ 1.53. Inland Waters.
Inland waters are all the fresh, brackish and inland saline waters of the state, including lagoons and tidewaters upstream from the mouths of coastal rivers and streams. Inland waters exclude the waters of San Francisco Bay and ~~San Pablo bays downstream from the west Carquinez Bridge, and~~ the waters of Elkhorn Slough, west of Elkhorn Road between Castroville and Watsonville. ~~Also s~~See Section 27.00 for the description of San Francisco Bay.
Note: Authority cited: Sections 200, 202, 205, 215 and 220, Fish and Game Code. Reference: Sections 200, 202, 205, 206, 215 and 220, Fish and Game Code.

Amend Section 27.00, Title 14, CCR, to read:

§ 27.00. Definition.
The Ocean and San Francisco Bay District consists of the Ocean and San Francisco Bay, as described herein. The Ocean is the open seas adjacent to the coast and islands and ~~or in~~ the waters of ~~those~~ open or enclosed bays contiguous to the ocean, ~~and~~ including the waters of Elkhorn Slough, west of Elkhorn Road between Castroville and Watsonville. San Francisco Bay is the waters of San Francisco and San Pablo bays plus all their tidal bays, sloughs, estuaries, and tidal portions of their rivers and streams between the Golden Gate Bridge and the west Carquinez Bridge. For purposes of this section, waters downstream of the Trancas Bridge on the Napa River, downstream of the Highway 121 Bridge on Sonoma Creek, and downstream of the Payran Street Bridge on the Petaluma River are tidal portions of the Napa River, Sonoma Creek, and Petaluma River, respectively. Also see Section 1.53.
Note: Authority cited: Sections 200, 202, 205, 215 and 220, Fish and Game Code. Reference: Sections 200, 202, 205, 206, 215 and 220, Fish and Game Code.

Amend subsection (a) of Section 28.65, Title 14, CCR, to read:

§ 28.65. General.
Except as provided in this article, fin fish may be taken only on hook and line or by hand. Any number of hooks and lines may be used in all ocean waters and bays except:
(a) San Francisco Bay, as described in Section 27.00~~and San Pablo bays between the Golden Gate Bridge and the west Carquinez Bridge~~, where only one line with not more than three hooks may be used.
…[No changes are proposed to subdivisions (b) through (g).]
Note: Authority cited: Sections 200, 202, 205, 215, 220, 240 and 7071, Fish and Game Code. Reference: Sections 200, 202, 205, 206, 215, 220, 240 and 8585.5, Fish and Game Code.

State of California
Department of Fish and Wildlife

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CALIFORNIA
FISH AND GAME
COMMISSION

2016 AUG 15 PM 12: 10

Memorandum

Date: August 12, 2016

To: Valerie Termini, Executive Director
Fish and Game Commission

From: Charlton H. Bonham
Director

Subject: **Agenda Item for the August 24-25, 2016 Fish and Game Commission Meeting Re: Pre-adoption Statement of Reasons to Amend Sections 300, 311, and 745.5, Upland Game Birds, Methods of Take, and Revocation of Hunting Privileges, Title 14, California Code of Regulations**

Attached is the Pre-adoption Statement of Reasons and the Proposed Negative Declaration advising the Commission of the Department's proposal with respect to sage grouse hunting permits. No changes are made to any of the other proposals in the ISOR.

The Department is recommending no change to current regulations for sage grouse permits in Section 300(a)(1)(D)4, which provides 30 permits in the North Mono Zone and 0 permits in the 3 remaining zones: East Lassen, Central Lassen, and South Mono. Responses to comments received in opposition to sage grouse hunting are included in this statement.

If you have any questions or need additional information, please contact Rick Mayfield, Acting Wildlife Branch Chief, at (916) 445-3555 or by email at Rick.Mayfield@wildlife.ca.gov.

Attachment

ec: Department of Fish and Wildlife

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CALIFORNIA
FISH AND GAME
COMMISSION
2016 AUG 15 PM 12: 11

STATE OF CALIFORNIA
FISH AND GAME COMMISSION
STATEMENT OF REASONS FOR REGULATORY ACTION
(Pre-adoption Statement of Reasons)

Amend Sections 300, 311 and 745.5
Title 14, California Code of Regulations

Re: Upland Game Birds; Methods Authorized for Taking Resident Small Game; Revocation or Suspension of Hunting or Sport Fishing Privileges.

I. Date of Initial Statement of Reasons: March 11, 2016

II. Date of Pre-adoption Statement of Reasons: August 10, 2016

III. Dates and Locations of Scheduled Hearings:

(a) Notice Hearing: Date: April 14, 2016
Location: Santa Rosa, CA

(b) Discussion Hearing: Date: June 23, 2016
Location: Bakersfield, CA

(c) Adoption Hearing: Date: August 25, 2016
Location: Folsom, CA

IV. Description of Modification of Originally Proposed Language of Initial Statement of Reasons:

Amend subsection 300(a)(1)(D)4. Upland Game Birds. The Department is recommending the no change alternative for the number of permits issued for sage grouse.

The regulatory text in subsection 300(a)(1)(D)4. as originally proposed in the Initial Statement of Reasons would not be adopted and the current regulatory language would remain unchanged.

V. Reasons for Modification of Originally Proposed Language of Initial Statement of Reasons:

The Department is providing the Commission a recommendation to maintain the current number of sage grouse permits in only one zone for 2016 as follows:

East Lassen:	0 (2-bird) permits
Central Lassen:	0 (2-bird) permits
North Mono:	30 (1-bird) permits
South Mono:	0 (1-bird) permits

In spring 2016, the Department conducted lek counts in all 4 hunt zones

statewide (Table 1). Table 1 contains the 2016 lek counts with comparison to the 2012 lek counts, which was at the onset of the drought and following the Rush Fire which had a large impact to sage grouse habitats. Additionally, a projected fall population range is provided based on modeling of lek counts, which is the expected size of the population during the hunting season.

Both populations in the East and Central Lassen Zones remain below pre-fire levels, but increased in 2015 and 2016 following substantial declines in the first two years following the Rush Fire. Despite significant habitat losses, these populations have demonstrated some encouraging recovery. The population in the North Mono Zone decreased 9% from 2012, but numbers over the past 5 years still remain well above the long-term average. The population in the South Mono Hunt Zone declined 49% and has been on a steady decline since 2012.

The Department is recommending no change to permit numbers for sage grouse in 2016 to allow populations in both Lassen zones and the South Mono Zone more time to recover from habitat loss and drought. Therefore, sage grouse permits would remain at 2015 levels as provided in Table 1.

Table 1. 2016 Sage grouse lek counts, percent change from 2012, projected fall population size, and permit allocations.

Hunt Zone	2012 Males	2016 Males	Change From 2012	Projected Total Fall Population 2016	2015 Permits	2016 Permits (No Change)
East Lassen	393	285	-27%	368 - 589	0	0
Central Lassen	199	133	-33%	249 - 398	0	0
North Mono	433	395	-9%	739 - 1182	30	30
South Mono	307	158	-49%	295 - 473	0	0

VI. Summary of Primary Considerations Raised in Opposition and in Support:

The Department is providing the following preliminary responses addressing comments received regarding the proposal to modify sage grouse hunting permits in subsection 300(a)(1)(D)4. for 2016. No other comments have been received concerning any of the other proposals in the ISOR.

Center for Biological Diversity, Letters dated April 11 and August 3

The Center for Biological Diversity (Center) expressed opposition to the ranges of permits provided by the Department and urged the Commission to adopt 0 permits for sage grouse hunting in all zones. The comments by the Center are addressed by the Department in 4 main categories listed below:

1) The Center is concerned that the Department's proposal provides for a range of permits without scientific basis with limits as high as 100 permits in each Lassen Zone and 50 permits in each Mono Zone, and that the Department has not yet provided its recommendation for the 2016 season.

   Department response: As indicated in the Initial Statement of Reasons (ISOR), the Department establishes a range of permits while population surveys are being conducted so that current year data can be used to develop permit recommendations. The Department recognized at the discussion hearing in June that the permit range was misleading, and that the upper range was considerably higher than the number of permits that had been issued in recent years. The range in the ISOR is a simple round number that has been used for several years and the Department recognized that it does not have a well-founded scientific basis. The Department indicated that, in future years, it would develop a range based on more recent population trends. The Department's recommendation is for no change (30 permits in North Mono and 0 in the other three hunt zones) for 2016 and provided herein in advance of the adoption hearing.

2) The Center's primary concern is that hunting is an additional impact to already depleted and declining populations in all four zones.

   Department Response: The Center indicates that the Department's June 2016 presentation shows a long-term downward trend in all zones from 2012-2016. The Department's presentation at the June meeting showed fewer grouse in all 4 zones from 2012-2016 (see slide 9). These declines were expected due to the recent drought and the Rush Fire in Lassen County. A more detailed examination of this period was discussed at the June meeting, indicating that during this period the North Mono Zone has recorded the highest number of grouse in the past 50+ years and clearly is not in long-term decline (see slide 6). The two Lassen zones did decline in 2013-2014 following the Rush Fire and

have recovered more than expected with population growth in both 2015 and 2016 (see slide 8). Neither Lassen zone has been hunted since 2012, following the Rush Fire, as discussed in the ISOR. The South Mono Zone has steadily declined since 2012 following drought and the Department indicated that it had not been hunted since 2014 because of concern about the downward population trajectory (see slide 6).

3) The Center indicates that the Department has failed to adequately explain the basis for determining the number of permits proposed each year or to provide the number of birds killed each year. The Center is concerned that these population projections could be inflated.

Department Response: The Department provided the basic rules for selecting the number of proposed permits in the ISOR. These permit proposals are based on spring lek counts, conducted from March through May. The Department presented the results of the 2016 lek counts at the June discussion hearing shortly after finishing the surveys and compiling the data (see slide 9). The Department also presented the results of the previous hunt season, reviewed the number of permits issues from 2012-2015, and the number of birds killed in 2015 (see slide 10). The Department discussed the approach used to project population numbers in the fall from spring lek count data at the June meeting and made a point that a highly conservative population model, assuming no current year production, is used to derive permit proposals (see slide 9). The amount of available time at the meeting precluded a more extensive examination of the population projections which are discussed in more detail below.
The Department uses the following parameters to estimate population size at the time of the hunting season (the second Saturday in September extending for 2 days):

a) Male population size counted in the spring is 1.1 x peak lek attendance (the most males counted) from at least three surveys of each lek statewide. In other words, the Department assumes that 90% of the males are visibly counted on each lek.
b) The sex ratio for the population is 1:1. In other words, there are an equal number of females as males counted.
c) The recruited population (adult birds) experiences 15% mortality between spring and fall.
d) The high model assumes the population produces 1.2 chicks per female (this model is used to provide a range of population size, but is not used to derive permit numbers).
e) The low model assumes the population produces 0 chicks per female (this model is used to derive permit numbers).

Both the low and high fall population projections are considered conservative by the Department. Conservative assumptions are made when direct measures of

population parameters are not available, specifically with regard to the female population size and chick production. Sex ratios of 1:1 are used as a conservative approach, but sage grouse often have skewed sex ratios with more females than males. The low population projection, assuming no reproduction, is not a likely scenario except for the most extreme possible conditions, and the Department is using this model to avoid any potential errors in assumption of chick production. The Center comments several times incorrectly assuming that the Department is using the high range of the model with 1.2 chicks per female and indicates that "a truly conservative estimate would only include breeding age adults," which is, in fact, the approach the Department is using.

A criterion in the ISOR specifies that the number of permits proposed will not exceed 5% of the projected fall population size, which is among the most conservative scientific recommendations for allowable harvest. Additionally, the ISOR indicates that the Department will consider population trajectory in its recommendation. The Department presented at the June meeting that despite the model indicating higher numbers of permits would be allowable, no recommendations for increases have been made since 2012 in any zone, and recommendations of 0 permits have been made for both Lassen zones and the South Mono Zone in recent years because of concern about population trajectory (see slide 10).

The Department's conservative approach to estimating spring populations and projecting fall populations is designed to underestimate populations and there are likely more grouse on the landscape. The Department disagrees with the Center's statement that this approach is "non-precautionary."

4) The Center indicates that sage grouse should not be hunted in any of the four zones because of long-term population declines. Conservation efforts for the species could be undermined by the additive impact of hunting. Impacts of hunting threaten Bi-State population recovery efforts.

Department Response: The Department presented population trends for sage grouse in all four hunt zones at the June discussion hearing and likely causes of these changes (see slides 6 and 8). These trends demonstrate changing trajectories, but do not indicate a long-term decline in all four zones. Sage grouse populations are down in all four zones since 2012, which is to be expected based on habitat conditions including extreme drought and large-scale loss of habitat from wildfire. Sage grouse hunting has been managed in recent years with permit recommendations based on conservative estimates to reduce any likelihood of additive mortality. The North Mono Zone has been at record high population size since 2011, even though it declined in 2015 and 2016. The North Mono Zone does not have any significant loss of habitat and natural springs have mitigated the effects of drought. By the most conservative

population projections previously discussed, there will be between 739birds in the population at hunt time. The proposed issuance of thirty permits is extraordinarily low relative to this population size. Populations in both Lassen zones have grown in 2015 and 2016 despite habitat loss and drought, likely because of mesic conditions in high quality wetland areas and regeneration of these habitats. Despite this response and population growth, the Department is still not recommending any hunting permits to give this population continued opportunity to recover. The South Mono Zone is down 49% since 2012, likely because of a lack of upland irrigations in Long Valley during drought. With better habitat conditions, the Department expects this population to recover. In the meantime, the Department is still not recommending any permits to avoid any potential additive mortality in this population.

The Center cites scientific literature suggesting that the impacts of hunting in the South Mono Zone should be considered additive. Furthermore, the Center cites the U. S. Fish and Wildlife Service (USFWS) as indicating that Bi-State DPS sage grouse populations outside the two main populations are "below the theoretical minimum criteria for long-term persistence." The Department indicated in the ISOR that science from California has suggested additive mortality in the South Mono Zone. This science came from previous decades in the South Mono Zone when more permits were issued and recognized that the ease of access and hunting in that area made it particularly vulnerable to additive mortality. The Department recognized these concerns years ago by steadily reducing sage grouse permits based on increasingly conservative assumptions and better data, resulting in fewer permits.

The Center also provided science from populations of sage grouse located outside California where there was no support for additive mortality. The Department made the point at the June discussion hearing that sage grouse are only hunted in the four zones with the healthiest and most well-connected populations (see slide 5). The Department has recognized the vulnerability of small, peripheral populations by reducing the hunt zone area in South Mono to include only the most healthy and well-connected populations. The two hunt zones in Mono County only encompass the two main populations and do not include any of the outside populations about which the USFWS expressed concerns regarding long-term population persistence.

The Department integrates the body of science on the effects of sage grouse hunting by implementing one of the most conservative and controlled approaches in the species' range. The Department does not consider the issuance of 30 permits in the North Mono population as having any likelihood of additive mortality to that healthy sage grouse population where habitat remains intact and there are no significant threats. The Department is taking a highly conservative approach in recommending 0 permits for each of the remaining zones with any potential for additive mortality.

The Center provided a letter from the Mono County Supervisors in 2015 urging the Commission to stop sage grouse hunting in Mono County in support of the USFWS recent decision not to list the DPS. The Department helped develop the local conservation plan and recognizes these concerns by managing hunting as previously described to prevent the potential of additive mortality in the population. The Department is not recommending any permits for the South Mono Zone because of these concerns and is recommending no change for the North Mono Zone (30, 1-bird permits), which is 4% of the low projected population size, assuming no production. Past harvest trends would suggest that about 2.3 – 2.7% of this projected population will actually be harvested. In accordance with Fish and Game Code Section 1801(e), the Department considers the hunt in North Mono to be sustainable and not in conflict with the conservation plan for the Bi-State DPS.

Kimberly Richards, Oral Comments to Commission on June 23

Ms. Richards expressed her opposition to sage grouse hunting in any of the four zones, suggesting that the Department instead use grouse for translocation to other populations. Ms. Richards urged the Commission to support habitat restoration. Ms. Richards also indicated she was prepared to file a state listing petition if the Commission did not accept her proposal of no hunting.

Department Response: The Department has taken extraordinary caution to remove any potential of additive mortality to the population through hunting as discussed in detail above in the response to the Center for Biological Diversity and does not think that the existing regulation will impact sage grouse populations.

The Department is planning to translocate sage grouse in Mono County to Parker Meadows, owned by the Los Angeles Department of Water and Power. Genetic data suggests this population is inbred and therefore outbreeding with additional grouse is expected to improve its viability. The Department is not planning to move grouse to any other populations at this time because these populations are limited by habitat conditions and additional grouse are not expected to produce more viable populations. The Department agrees with Ms. Richards that habitat restoration is the primary need for sage grouse recovery. The USFWS determined that listing of sage-grouse was not necessary because the conservation plan developed by California and Nevada reduced the threats to the species. A state listing of the bird is not likely to have a net positive benefit, rather it would likely drive privately owned companies and citizens away from the conservation effort.

Email Form Letters – Private Citizens

Beginning August 2 and through August 9 at 1:00 PM, the Commission has received more than 1,650 email form comments, saying:

"I am writing to urge you to use your upcoming vote to end sage grouse hunting in California. In light of recent data showing startling and continuing declines for this species in all four management zones from 2012-2016, the commission should be taking steps to protect sage grouse, not allowing more to be killed. Please -- reject the proposal to allow a range of hunting permits for up to 100 grouse per zone and instead choose zero. There must be no sage grouse hunting in California during the 2016-2017 season for the sake of these rare and beautiful birds."

Department Response: Based on the results of spring lek counts and population projections for the fall of 2016, the Department recommends the Commission adopt the no change alternative with respect to sage grouse hunting permits in subsection 300(a)(1)(D)(4). This alternative would allow the issuance of a conservative 30 permits in the North Mono Zone, while allowing no sage grouse hunting in the other three zones.

Updated Informative Digest/Policy Statement Overview

The regulations in Section 300, Title 14, California Code of Regulations (CCR), provide general hunting seasons for taking resident and migratory upland game birds. Section 311 identifies the authorized methods of take for all resident small game species. Section 745.5 sets forth the procedures for the suspension or revocation of a person's hunting or sport fishing license or permit privileges. The Department is recommending the following regulation changes:

1. Adopt no change alternative to subsection 300(a)(1)(D)4.: No change to the annual number of General Season sage grouse hunting permits by zone for the 2016-17 season from the permit numbers for the 2015-2016 season.
2. Amend subsection 300(a)(1)(F): Deletes the current white-tailed ptarmigan hunting zone description and adds a new statewide area allowing ptarmigan to be taken anywhere they are found in California in accordance with the authorized season, bag limit, and possession limit.
3. Amend Section 311(e) by adding a new subsection (1): Requires the use of broad head blades which will not pass through a hole seven-eighths inch in diameter on hunting arrows and crossbow bolts for the take of wild turkey.
4. Amend Section 311(k) and add a new subsection (1): Authorizes possession of a firearm during archery-only seasons by hunters authorized to carry concealable firearms via a CCW permit or peace officer endorsement. Use of a firearm to hunt during archery only seasons is a violation.
5. Amend subsections 745.5(b) and (c). Authorizes revocation or suspension of hunting or sport fishing privileges by the Department for violation of Section 311 as amended.

Benefits of the Proposed Regulations

Adoption of sustainable upland game seasons, bag and possession limits, and authorized methods of take provides for the maintenance of sufficient populations of upland game birds to ensure their continued existence.

Non-monetary benefits to the public

The Commission does not anticipate non-monetary benefits to the protection of public health and safety, worker safety, the prevention of discrimination, the promotion of fairness or social equity and the increase in openness and transparency in business and government.

Evaluation of incompatibility with existing regulations

The Commission has reviewed its regulations in Title 14, CCR, and conducted a search of other regulations on this topic and has concluded that the proposed amendments to section 300, 311, and 74.5.5 are neither inconsistent nor incompatible with existing State regulations. No other State agency has the authority to promulgate hunting regulations.

Update:

The Commission anticipates benefits to the health and welfare of California residents. The proposed regulations are intended to provide continued recreational opportunity to the public. Hunting provides opportunities for multi-generational family activities and promotes respect for California's environment by the future stewards of the State's resources.

The Commission anticipates benefits to the environment by the sustainable management of California's upland game resources. The fees that hunters pay for licenses and stamps are used for conservation.

No changes to the regulatory text included in the initial public notice are proposed, except the current regulatory language of subsection 300(a)(1)(D)4 would remain unchanged as provided in the no change alternative. Based on the results of spring lek counts and population projections for the fall of 2016, the Department recommends the Commission adopt the no change alternative with respect to sage grouse hunting permits in subsection 300(a)(1)(D)4.

The Department recommends the Commission adopt the changes to the remaining subsections 300(a)(1)(F); 311(e); 311(k) and 745.5(b) and (c) as proposed in the Initial Statement of Reasons.

filed 7/26/16

Print Form

Appendix C

Notice of Completion & Environmental Document Transmittal

Mail to: State Clearinghouse, P.O. Box 3044, Sacramento, CA 95812-3044 (916) 445-0613
For Hand Delivery/Street Address: 1400 Tenth Street, Sacramento, CA 95814

SCH #

Project Title: Upland Game Bird Hunting Regulation Change Proposals

Lead Agency: Department of Fish and Wildlife
Contact Person: Scott Gardner
Mailing Address: 1812 9th St.
Phone: 916-445-5545
City: Sacramento, CA
Zip: 95811
County: Sacramento

Project Location: County: Statewide
City/Nearest Community:
Cross Streets:
Zip Code:
Longitude/Latitude (degrees, minutes and seconds): ____° ____′ ____″ N / ____° ____′ ____″ W Total Acres:
Assessor's Parcel No.:
Section: Twp.: Range: Base:
Within 2 Miles: State Hwy #: Waterways:
Airports: Railways: Schools:

Document Type:

CEQA:
- ☐ NOP
- ☐ Early Cons
- ☒ Neg Dec
- ☐ Mit Neg Dec
- ☐ Draft EIR
- ☐ Supplement/Subsequent EIR (Prior SCH No.)
- Other:

NEPA:
- ☐ NOI
- ☐ EA
- ☐ Draft EIS
- ☐ FONSI

Other:
- ☐ Joint Document
- ☐ Final Document
- ☐ Other:

Local Action Type:

- ☐ General Plan Update
- ☐ General Plan Amendment
- ☐ General Plan Element
- ☐ Community Plan
- ☐ Specific Plan
- ☐ Master Plan
- ☐ Planned Unit Development
- ☐ Site Plan
- ☐ Rezone
- ☐ Prezone
- ☐ Use Permit
- ☐ Land Division (Subdivision, etc.)
- ☐ Annexation
- ☐ Redevelopment
- ☐ Coastal Permit
- ☐ Other:

Development Type:

- ☐ Residential: Units Acres
- ☐ Office: Sq.ft. Acres Employees
- ☐ Commercial: Sq.ft. Acres Employees
- ☐ Industrial: Sq.ft. Acres Employees
- ☐ Educational:
- ☐ Recreational:
- ☐ Water Facilities: Type MGD
- ☐ Transportation: Type
- ☐ Mining: Mineral
- ☐ Power: Type MW
- ☐ Waste Treatment: Type MGD
- ☐ Hazardous Waste: Type
- ☐ Other:

Project Issues Discussed in Document:

- ☐ Aesthetic/Visual
- ☐ Agricultural Land
- ☐ Air Quality
- ☐ Archeological/Historical
- ☐ Biological Resources
- ☐ Coastal Zone
- ☐ Drainage/Absorption
- ☐ Economic/Jobs
- ☐ Fiscal
- ☐ Flood Plain/Flooding
- ☐ Forest Land/Fire Hazard
- ☐ Geologic/Seismic
- ☐ Minerals
- ☐ Noise
- ☐ Population/Housing Balance
- ☐ Public Services/Facilities
- ☐ Recreation/Parks
- ☐ Schools/Universities
- ☐ Septic Systems
- ☐ Sewer Capacity
- ☐ Soil Erosion/Compaction/Grading
- ☐ Solid Waste
- ☐ Toxic/Hazardous
- ☐ Traffic/Circulation
- ☐ Vegetation
- ☐ Water Quality
- ☐ Water Supply/Groundwater
- ☐ Wetland/Riparian
- ☐ Growth Inducement
- ☐ Land Use
- ☐ Cumulative Effects
- ☐ Other:

Present Land Use/Zoning/General Plan Designation:

Project Description: *(please use a separate page if necessary)*

Note: The State Clearinghouse will assign identification numbers for all new projects. If a SCH number already exists for a project (e.g. Notice of Preparation or previous draft document) please fill in.

Reviewing Agencies Checklist

Lead Agencies may recommend State Clearinghouse distribution by marking agencies below with and "X".
If you have already sent your document to the agency please denote that with an "S".

_____ Air Resources Board
_____ Boating & Waterways, Department of
_____ California Emergency Management Agency
_____ California Highway Patrol
_____ Caltrans District # _____
_____ Caltrans Division of Aeronautics
_____ Caltrans Planning
_____ Central Valley Flood Protection Board
_____ Coachella Valley Mtns. Conservancy
_____ Coastal Commission
_____ Colorado River Board
_____ Conservation, Department of
_____ Corrections, Department of
_____ Delta Protection Commission
_____ Education, Department of
_____ Energy Commission
_____ Fish & Game Region # _____
_____ Food & Agriculture, Department of
_____ Forestry and Fire Protection, Department of
_____ General Services, Department of
_____ Health Services, Department of
_____ Housing & Community Development
_____ Native American Heritage Commission

_____ Office of Historic Preservation
_____ Office of Public School Construction
_____ Parks & Recreation, Department of
_____ Pesticide Regulation, Department of
_____ Public Utilities Commission
_____ Regional WQCB # _____
_____ Resources Agency
_____ Resources Recycling and Recovery, Department of
_____ S.F. Bay Conservation & Development Comm.
_____ San Gabriel & Lower L.A. Rivers & Mtns. Conservancy
_____ San Joaquin River Conservancy
_____ Santa Monica Mtns. Conservancy
_____ State Lands Commission
_____ SWRCB: Clean Water Grants
_____ SWRCB: Water Quality
_____ SWRCB: Water Rights
_____ Tahoe Regional Planning Agency
_____ Toxic Substances Control, Department of
_____ Water Resources, Department of

_____ Other: _____
_____ Other: _____

Local Public Review Period (to be filled in by lead agency)

Starting Date _____ Ending Date _____

Lead Agency (Complete if applicable):

Consulting Firm: _____
Address: _____
City/State/Zip: _____
Contact: _____
Phone: _____

Applicant: _____
Address: _____
City/State/Zip: _____
Phone: _____

Signature of Lead Agency Representative: _____ **Date:** 7-26-16

Authority cited: Section 21083, Public Resources Code. Reference: Section 21161, Public Resources Code.

PROPOSED NEGATIVE DECLARATION

Pursuant to Title 14, California Code of Regulations, Sections 15070 and 15071, and in accordance with the Commission's certified regulatory program (CRP) approved by the Secretary for the California Resources Agency pursuant to Public Resources Code section 21080.5 (See generally Cal. Code Regs., tit. 14, §§ 781.5, and 15251, subd. (b).), the California Fish and Game Commission does prepare, make, declare, and publish this Negative Declaration for amending the upland game hunting regulations for 2016-17.

Brief description of the project: Amend existing upland game hunting regulations as follows:

1. Eliminate current hunt zone for white-tailed ptarmigan and authorize take state-wide where they are found;
2. Require the use of broadheads on arrows and crossbow bolts for the take of wild turkey.

Location of project: Hunting for upland game species will occur statewide.

Proposed finding: The Fish and Game Commission finds that there is no substantial evidence, in light of the record, that the project may have a significant effect on the environment. Specifically, the implementation of proposed hunting programs for the species indicated will not cause their populations to drop below self-sustaining levels. The following initial statement analysis (**Attachment A**) provides the basis to support adoption of the proposed finding and Negative Declaration.

PROJECT SUMMARY

UPLAND GAME HUNTING
(RESIDENT UPLAND GAME BIRD HUNTING)

The State's wildlife conservation policy contains, among other things, an objective of providing sport hunting use of selected species where such use is consistent with sustainable wildlife populations. The project being considered is a proposal to modify the current hunting regulations to: 1) remove a zone restriction to allow the take of non-native white-tailed ptarmigan anywhere they occur, and 2) require the use of broadheads on arrows and crossbow bolts for the take of wild turkey. The objectives of the proposal are to provide public sport hunting opportunities through regulated harvest while maintaining viable populations of upland game bird species.

INITIAL STUDY

2016-17 UPLAND GAME HUNTING

REGULATION CHANGE PROPOSALS

July 26, 2016

STATE OF CALIFORNIA
NATURAL RESOURCES AGENCY
DEPARTMENT OF FISH AND WILDLIFE

Initial Study Environmental Checklist Form

1. Project title:

   2016-17 Upland Game Hunting Regulatory Change Proposals

2. Lead agency name and address:

   California Fish and Game Commission
   1416 Ninth Street
   Sacramento, CA 95814

3. Contact person and phone number:

   Scott Gardner, (916) 445-5545

4. Project location: State-wide in various locations

5. Project sponsor's name and address:

   California Department of Fish and Wildlife
   Wildlife Branch
   1812 Ninth Street
   Sacramento, CA 95811

6. General plan designation: Various

7. Zoning: Various

8. Description of project: See **Attachment A**

9. Surrounding land uses and setting:

   The proposed regulatory changes identified in Attachment A generally affect activities normally conducted in rural settings including, but not limited to, private farm, grazing, and timber lands; federal lands including US Forest Service, BLM, and military installations; state-owned lands including wildlife areas and other lands legally open to hunting.

10. Other public agencies whose approval is required (e.g., permits, financing approval, or participation agreement.):

    None

ATTACHMENT A

PROPOSED CHANGES AND IMPACT EVALUATION
2016-17 UPLAND GAME HUNTING REGULATIONS

Proposal 1: Adjust annual number of sage grouse hunting permits by zone.

The Department is proposing no change to subsection 300(a)(1)(D).

Proposal 2: Amend subsection 300(a)(1)(F) to eliminate the current ptarmigan hunt zone.

Existing regulations in in Section 300 authorize the take of white-tailed ptarmigan (ptarmigan; *Lagopus leucura*) according to area, season, and bag and possession limits. Ptarmigan are a nonnative species which is now known to occur outside of the authorized ptarmigan hunt zone. This proposal deletes the current ptarmigan hunting zone description and adds a new statewide area allowing ptarmigan to be taken anywhere they occur in California in accordance with the current authorized season, bag limit, and possession limit.

Proposal 3: Amend Section 311 to require the use of broadheads on hunting arrows and crossbow bolts specifically for the take of wild turkey.

Existing regulations in Section 311 define the authorized methods of take for resident small game species. The proposal clarifies that broadheads are required for the take of wild turkey when using archery equipment or crossbows. This change will reduce the number of birds hit yet not retrieved (reducing the crippling rate) and should increase hunter success as arrows/crossbow bolts tipped with broadheads are more lethal and effective method for take than other arrow/bolt types.

Print Form

Appendix G

Environmental Checklist Form

NOTE: The following is a sample form and may be tailored to satisfy individual agencies' needs and project circumstances. It may be used to meet the requirements for an initial study when the criteria set forth in CEQA Guidelines have been met. Substantial evidence of potential impacts that are not listed on this form must also be considered. The sample questions in this form are intended to encourage thoughtful assessment of impacts, and do not necessarily represent thresholds of significance.

1. Project title: Upland Game Hunting Regulations for the 2016/17 hunting season.

2. Lead agency name and address:
   California Fish and Game Commission
   1416 9th Street, Room 1320
   Sacramento, CA 95814

3. Contact person and phone number: Scott Gardner, Wildlife Branch (916) 445-5545

4. Project location: Statewide

5. Project sponsor's name and address:
   California Department of Fish and Wildlife
   1416 9th Street, Room 1208
   Sacramento, CA 95814

6. General plan designation: NA

7. Zoning: NA

8. Description of project: (Describe the whole action involved, including but not limited to later phases of the project, and any secondary, support, or off-site features necessary for its implementation. Attach additional sheets if necessary.)
   Annual regulatory changes regarding hunting of upland game birds

9. Surrounding land uses and setting: Briefly describe the project's surroundings:
   Statewide on various habitats and land uses

10. Other public agencies whose approval is required (e.g., permits, financing approval, or participation agreement.)
    NA

ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED:

The environmental factors checked below would be potentially affected by this project, involving at least one impact that is a "Potentially Significant Impact" as indicated by the checklist on the following pages.

☐ Aesthetics	☐ Agriculture and Forestry Resources	☐ Air Quality
☐ Biological Resources	☐ Cultural Resources	☐ Geology /Soils
☐ Greenhouse Gas Emissions	☐ Hazards & Hazardous Materials	☐ Hydrology / Water Quality
☐ Land Use / Planning	☐ Mineral Resources	☐ Noise
☐ Population / Housing	☐ Public Services	☐ Recreation
☐ Transportation/Traffic	☐ Utilities / Service Systems	☐ Mandatory Findings of Significance

DETERMINATION: (To be completed by the Lead Agency)

On the basis of this initial evaluation:

☒ I find that the proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

☐ I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.

☐ I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

☐ I find that the proposed project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

☐ I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required.

Scott Gardner for Craig Stowers — 7/26/16
Signature — Date

[illegible] — 7/26/16
Signature — Date

EVALUATION OF ENVIRONMENTAL IMPACTS:

1) A brief explanation is required for all answers except "No Impact" answers that are adequately supported by the information sources a lead agency cites in the parentheses following each question. A "No Impact" answer is adequately supported if the referenced information sources show that the impact simply does not apply to projects like the one involved (e.g., the project falls outside a fault rupture zone). A "No Impact" answer should be explained where it is based on project-specific factors as well as general standards (e.g., the project will not expose sensitive receptors to pollutants, based on a project-specific screening analysis).

2) All answers must take account of the whole action involved, including off-site as well as on-site, cumulative as well as project-level, indirect as well as direct, and construction as well as operational impacts.

3) Once the lead agency has determined that a particular physical impact may occur, then the checklist answers must indicate whether the impact is potentially significant, less than significant with mitigation, or less than significant. "Potentially Significant Impact" is appropriate if there is substantial evidence that an effect may be significant. If there are one or more "Potentially Significant Impact" entries when the determination is made, an EIR is required.

4) "Negative Declaration: Less Than Significant With Mitigation Incorporated" applies where the incorporation of mitigation measures has reduced an effect from "Potentially Significant Impact" to a "Less Than Significant Impact." The lead agency must describe the mitigation measures, and briefly explain how they reduce the effect to a less than significant level (mitigation measures from "Earlier Analyses," as described in (5) below, may be cross-referenced).

5) Earlier analyses may be used where, pursuant to the tiering, program EIR, or other CEQA process, an effect has been adequately analyzed in an earlier EIR or negative declaration. Section 15063(c)(3)(D). In this case, a brief discussion should identify the following:

    a) Earlier Analysis Used. Identify and state where they are available for review.

    b) Impacts Adequately Addressed. Identify which effects from the above checklist were within the scope of and adequately analyzed in an earlier document pursuant to applicable legal standards, and state whether such effects were addressed by mitigation measures based on the earlier analysis.

    c) Mitigation Measures. For effects that are "Less than Significant with Mitigation Measures Incorporated," describe the mitigation measures which were incorporated or refined from the earlier document and the extent to which they address site-specific conditions for the project.

6) Lead agencies are encouraged to incorporate into the checklist references to information sources for potential impacts (e.g., general plans, zoning ordinances). Reference to a previously prepared or outside document should, where appropriate, include a reference to the page or pages where the statement is substantiated.

7) Supporting Information Sources: A source list should be attached, and other sources used or individuals contacted should be cited in the discussion.

8) This is only a suggested form, and lead agencies are free to use different formats; however, lead agencies should normally address the questions from this checklist that are relevant to a project's environmental effects in whatever format is selected.

9) The explanation of each issue should identify:

    a) the significance criteria or threshold, if any, used to evaluate each question; and

    b) the mitigation measure identified, if any, to reduce the impact to less than significance.

SAMPLE QUESTION
Issues:

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
I. AESTHETICS -- Would the project:				
a) Have a substantial adverse effect on a scenic vista?	☐	☐	☐	☒
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	☐	☐	☐	☒
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	☐	☐	☐	☒
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	☐	☐	☐	☒
II. AGRICULTURE AND FOREST RESOURCES: In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Dept. of Conservation as an optional model to use in assessing impacts on agriculture and farmland. In determining whether impacts to forest resources, including timberland, are significant environmental effects, lead agencies may refer to information compiled by the California Department of Forestry and Fire Protection regarding the state's inventory of forest land, including the Forest and Range Assessment Project and the Forest Legacy Assessment project; and forest carbon measurement methodology provided in Forest Protocols adopted by the California Air Resources Board. -- Would the project:				
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	☐	☐	☐	☒
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?	☐	☐	☐	☒
c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland	☐	☐	☐	☒

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
Production (as defined by Government Code section 51104(g))?				
d) Result in the loss of forest land or conversion of forest land to non-forest use?	☐	☐	☐	☒
de) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use?	☐	☐	☐	☒
III. AIR QUALITY -- Where available, the significance criteria established by the applicable air quality management or air pollution control district may be relied upon to make the following determinations. Would the project:				
a) Conflict with or obstruct implementation of the applicable air quality plan?	☐	☐	☐	☒
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	☐	☐	☐	☒
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?	☐	☐	☐	☒
d) Expose sensitive receptors to substantial pollutant concentrations?	☐	☐	☐	☒
e) Create objectionable odors affecting a substantial number of people?	☐	☐	☐	☒
IV. BIOLOGICAL RESOURCES -- Would the project:				
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	☐	☐	☐	☒
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Game or US Fish and Wildlife Service?	☐	☐	☐	☒
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of	☐	☐	☐	☒

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?				
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	☐	☐	☐	☒
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	☐	☐	☐	☒
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	☐	☐	☐	☒
V. CULTURAL RESOURCES -- Would the project:				
a) Cause a substantial adverse change in the significance of a historical resource as defined in § 15064.5?	☐	☐	☐	☒
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to § 15064.5?	☐	☐	☐	☒
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☐	☐	☐	☒
d) Disturb any human remains, including those interred outside of formal cemeteries?	☐	☐	☐	☒
VI. GEOLOGY AND SOILS -- Would the project:				
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:	☐	☐	☐	☒
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	☐	☐	☐	☒
ii) Strong seismic ground shaking?	☐	☐	☐	☒
iii) Seismic-related ground failure, including liquefaction?	☐	☐	☐	☒
iv) Landslides?	☐	☐	☐	☒

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
b) Result in substantial soil erosion or the loss of topsoil?	☐	☐	☐	☒
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?	☐	☐	☐	☒
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?	☐	☐	☐	☒
e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?	☐	☐	☐	☒
VII. GREENHOUSE GAS EMISSIONS -- Would the project:				
a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	☐	☐	☐	☒
b) Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	☐	☐	☐	☒
VIII. HAZARDS AND HAZARDOUS MATERIALS - Would the project:				
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☐	☐	☒
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☐	☐	☒
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☐	☐	☒
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	☐	☐	☒
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard	☐	☐	☐	☒

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
for people residing or working in the project area?				
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☒
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☐	☒
h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	☐	☐	☐	☒
IX. HYDROLOGY AND WATER QUALITY -- Would the project:				
a) Violate any water quality standards or waste discharge requirements?	☐	☐	☐	☒
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?	☐	☐	☐	☒
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?	☐	☐	☐	☒
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?	☐	☐	☐	☒
e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	☐	☐	☐	☒
f) Otherwise substantially degrade water quality?	☐	☐	☐	☒
g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	☐	☐	☐	☒

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
h) Place within a 100-year flood hazard area structures which would impede or redirect flood flows?	☐	☐	☐	☒
i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?	☐	☐	☐	☒
j) Inundation by seiche, tsunami, or mudflow?	☐	☐	☐	☒
X. LAND USE AND PLANNING - Would the project:				
a) Physically divide an established community?	☐	☐	☐	☒
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☐	☐	☒
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?	☐	☐	☐	☒
XI. MINERAL RESOURCES -- Would the project:				
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	☐	☐	☐	☒
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	☐	☐	☐	☒
XII. NOISE -- Would the project result in:				
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	☐	☐	☐	☒
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	☐	☐	☐	☒
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☐	☒
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☐	☒

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☒
f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☒
XIII. POPULATION AND HOUSING -- Would the project:				
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	☐	☐	☐	☒
b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒
XIV. PUBLIC SERVICES				
a) Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:				
Fire protection?	☐	☐	☐	☒
Police protection?	☐	☐	☐	☒
Schools?	☐	☐	☐	☒
Parks?	☐	☐	☐	☒
Other public facilities?	☐	☐	☐	☒
XV. RECREATION --				
a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☐	☒

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
b) Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?	☐	☐	☐	☒
XVI. TRANSPORTATION/TRAFFIC -- Would the project:				
a) Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit?	☐	☐	☐	☒
b) Conflict with an applicable congestion management program, including, but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways?	☐	☐	☐	☒
c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?	☐	☐	☐	☒
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☐	☐	☐	☒
e) Result in inadequate emergency access?	☐	☐	☐	☒
f) Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities?	☐	☐	☐	☒
XVII. UTILITIES AND SERVICE SYSTEMS -- Would the project:				
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	☐	☐	☐	☒
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☒
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which	☐	☐	☐	☒

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
could cause significant environmental effects?				
d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?	☐	☐	☐	☒
e) Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	☐	☐	☐	☒
f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	☐	☐	☐	☒
g) Comply with federal, state, and local statutes and regulations related to solid waste?	☐	☐	☐	☒
XVIII. MANDATORY FINDINGS OF SIGNIFICANCE --				
a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	☐	☐	☐	☒
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?	☐	☐	☐	☒
c) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	☐	☐	☐	☒

Note: Authority cited: Sections 21083, 21083.05, Public Resources Code. Reference: Section 65088.4, Gov. Code; Sections 21080, 21083.05, 21095, Pub. Resources Code; *Eureka Citizens for Responsible Govt. v. City of Eureka* (2007) 147 Cal.App.4th 357; *Protect the Historic Amador Waterways v. Amador Water Agency* (2004) 116 Cal.App.4th at 1109; *San Franciscans Upholding the Downtown Plan v. City and County of San Francisco* (2002) 102 Cal.App.4th 656.

California Bowmen Hunters/State Archery Association
CBHSAA

Date: 5/26/2016

From: Robert Moore
Legislative Coordinator
California Bowmen Hunters
State Archery Association

To: California Fish and Game Commission
1416 9th St.
Sacramento, Ca. 94244

Ref: Upland Game Bird Hunting, Title 14 CCR, Section 311 (e) Broadhead type blade for the take of Turkey's, (k) conceal carry during archery season for listed specific Penal code designations. Title 14 CCR, Section 745.5, the Revocation or Suspension of Hunting or Sport Fishing Privileges.

Dear Commissioners,

This letter is in support of the California Department of Fish and Wildlife (CDFW) proposed change to Title 14 CCR, sections 311(e), (k) and section745.5. CBHSAA has worked with CDFW and the National Wild Turkey Federation (NWTF) in a cooperative effort to address specific Wildlife Officers concerns. These proposed changes address those concerns and provides CDFW enforcement personnel the needed modifications to enhance their ability in enforcing state game laws.

Sincerely,

Robert Moore
California Bowmen Hunters
State Archery Association
7436 Convair Way
Citrus Heights, Ca, 95621
moorerobt@surewest.net

CENTER *for* BIOLOGICAL DIVERSITY *Because life is good.*

working through science, law and creative media to secure a future for all species, great or small, hovering on the brink of extinction.

VIA ELECTRONIC MAIL

August 3, 2016

Fish and Game Commission
1416 Ninth Street, Room 1320
Sacramento, CA 95814
fgc@fgc.ca.gov

Re: Comments on Proposed Amendment to 14 C.C.R. Section 300(a)(1)(D)4 -- Adjust the annual number of General Season sage grouse hunting permits by zone for the 2016-17 season; on Commission's August, 2016 Agenda

Dear Commissioners,

I am writing on behalf of the Center for Biological Diversity ("Center") regarding the proposed amendments to14 C.C.R. Section 300(a)(1)(D)4 to adjust the annual number of general season sage grouse hunting permits by zone for the 2016-17 season which is scheduled to be heard during the August 25-26, 2016 California Fish and Game Commission meeting. The Center provided the Commission with initial comments on the proposed regulations and changes to the greater sage grouse hunting limits on April 11, 2016 and at the April 2016 meeting when the Department of Fish and Wildlife requested approval to publish a notice of intent regarding this proposed change. The Center now timely provides these detailed comments regarding the proposed regulations.

The Center has serious concerns about the Department of Fish and Wildlife's proposal to adjust the upland bird hunting regulations and provide for a range of permits for sage grouse in the 2016-2017 season with limits as high as 50 two-bird permits or 100 one-bird permits in each of the four zones. The Center's primary concern is that hunting is an additional impact to already depleted and declining populations of sage grouse in all of the four zones. The most recent population data provided to the public and the Commission at the June 2016 meeting shows a long-term downward trend in all zones from 2012-2016. Given the precarious status of this rare bird, the Center urges the Commission to establish a ***zero*** limit in all zones and to not allow any hunting to occur in the 2016-2017 season in order to support conservation of California's sage grouse populations.

Alaska · Arizona · California · Florida · Minnesota · Nevada · New Mexico · New York · Oregon · Vermont · Washington, DC

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The Center is also concerned with the lack of transparency in this process. The Department's ISOR and presentation to the Commission in June 2016 failed to adequately explain the basis for determining the number of permits to issue each year and the Department has failed to timely provide the public or the Commission information regarding the number of permits issued or the number of birds killed each year as part of the hunt. For example, although the lek counts for males were completed in the spring and those numbers were presented to the Commission at the June 2016 meeting, as of this time, the Department has still failed to provide the Commission or the public with its *specific* recommendation on the actual number of permits to be issued in each zone for 2016-2017. The Department has also failed to provide detailed information about the methodology used to determine the overall population estimates, or the methodology used to determine number of permits the Department would recommend. This lack of transparency seriously undermines public participation in this process.

I. Introduction

All greater sage grouse populations in California should be protected. While in the past hunting has not been considered a *major* risk factor for declines in sage grouse populations, it is likely to have a more pronounced effect as the populations continue to shrink and fragment. As other major risk factors for the sage grouse population (habitat fragmentation, habitat loss, predator subsidies, and reduced success breeding) are increasing and continue to contribute to decreased viability of the population, the cumulative effect of those factors along with hunting will have an even more pronounced impact.

The Department manages four hunting zones for sage grouse in California, two in the Lassen area, and two in the Mono Basin. The two sage grouse hunting zones in the Mono Basin provide habitat for a distinct population segment of the sage grouse, now denoted as the Bi-State population, which is found only in Eastern California and Western Nevada. The Department's proposed regulations would once again set a wide range for sage grouse permits in each of the four zones, with the yearly limits being determined long after public comment could be taken on the actual proposed limits. As of this time, the Department has still failed to provide the Commission or the public with its recommendation on the actual number of permits it proposes to issue in any of the 4 zones for 2016-2017, thus undermining public participation in this process.

The Center is concerned that the proposed regulations do not adequately consider that the sage grouse populations are already at a historic low point and the Commission has failed to consider adopting a zero hunting limit in all zones to support recovery of the species. Moreover, even if it were appropriate for the Commission to set a range for the hunting limit and allow the Department to set the maximum, the proposed high-end of the range at 100 birds in each zone has no basis in science or the historic hunting levels in these zones. The proposed maximum allowable harvest of 5% of the projected fall population seems arbitrary and non-precautionary. Furthermore, the Department has not adequately explained how it reached the projected fall population numbers, presented at June 23, 2016 Fish and Game Commission meeting, stating only that the conservative estimate assumed 1.2 chicks per hen but not how the number of hens

were estimated (CFGC Meeting June, 2016). The Center is concerned that these population ranges could be overestimated. If so, allowing hunting of 5% of an inflated projected population number could result in far more than 5% of the actual population being killed in a hunt. Hunting sage grouse in the four zones at the elevated levels arrived at using the population projections and the 5% figure could contribute to ongoing declines and potentially extirpate small sub-groups within the zones, and significantly impact the ability of sage grouse populations in California to recover as efforts are made to reduce other threats to the species.

Efforts being made by many federal, state and local agencies to reduce threats to the sage grouse through the Bi-State Action Plan and other commitments may also be undermined by the additive impact of hunting on these populations. Last year the Mono County Board of Supervisor's, a participant in the Bi-State Action Plan, asked the Commission to end hunting of the sage grouse in 2015 and future years noting that continued hunting could undermine cooperative efforts to protect this sage grouse population and that those efforts were a key reason for the withdrawal of the listing proposal by the U.S. Fish & Wildlife Service. (Letter dated June 2, 2015, attached); *see also* USFWS 2015a (withdrawal of listing proposal).) In addition to the letter, District 1 Supervisor Larry Johnston of Mono County, representing the Board of Supervisors of Mono County, spoke at the June 2015 Commission meeting and stated that the County cannot condone recreational hunting in either North or South Mono, as it is contradictory to their efforts to conserve the greater sage grouse and avoid the need for a federal designation of the Bi-State sage grouse population as an endangered species. (CFGC Meeting June 11, 2015, Item #22 video). The County requested that the Commission reduce the limit to zero in the two Mono zones in the future so as not to jeopardize conservation efforts by the County and others for the Bi-State sage grouse population. (*Id*.)

Notably, former California Fish and Game Commissioner Michael Sutton has also long opposed hunting sage grouse in California until the populations in all zones completely recover. (CFGC Meeting June 11, 2015, Item #22 video.) As Commissioner Sutton noted, it does not seem logical to continue to hunt in the healthiest zone where there are currently the most sage grouse when other populations are in significant decline. (*Id*.)

II. Background

A. Greater Sage grouse

Greater sage grouse have low reproductive rates with populations that are relatively slow growing (USFWS 2013). They are long-lived for a bird species (3-6 years) and have low annual natural mortality, with a notably low mortality rate for winter (2-20%) (Reese and Connelly 2011). These characteristics factor in to their more K-selected strategy, in contrast to the r-selected strategy found in most upland game birds (Anderson 2002). With their higher over winter survival, lower clutch sizes, and longer life spans as a more K-selected species, hunting may pose a significant threat to species recovery. Hunting takes a more severe toll on K-strategists than r-strategists as K-strategists take longer to reproduce and repopulate (Anderson 2002).

These species characteristics indicate that the idea of compensatory harvest (where hunting eliminates birds that would inevitably die in the winter, therefore not affecting population levels) would not necessarily apply to the greater sage grouse. It therefore appears that hunting would have a greater effect on populations particularly when they are already small and geographically fragmented. Additionally, roughly one-third of sage grouse hunters view the species as a trophy game bird (Guttery *et al.* 2015). This could have a negative effect on the species' survival as trophy hunters often kill the most physiologically fit individuals (Coltman *et al.* 2003). This further impacts the population as a whole and reduces the possibility that hunting is compensatory for this species.

The sage grouse also shows a trend of cyclical abundance over time as the Department correctly noted at the June meeting (CFGC Meeting June, 2016). However, these cyclical trends are not addressed adequately by the Department in its proposal to allow hunting of 5% of the calculated fall population figures. An increase in hunting in years when the population is cyclically higher could lead to overhunting, which could cause sage grouse numbers to plummet when their populations naturally decrease in the cycle. We urge the Commission not to approve the proposed hunting regulations that could allow the Department to set limits that vary each year based on single-year surveys rather than long-term trends.

B. Bi-state Population Trends

The Bi-State population of greater sage grouse is especially important to conserve, as it is a genetically distinct meta-population of the species and is isolated from other populations found in the United States (Torregrosa et al. 2010). The Bi-state population near Mono Lake demonstrates some distinctive genetic characteristics which differ from other populations of greater sage grouse (Benedict et al. 2003). While in the past hunting has not been considered a *major* risk factor for the population (Bloomberg et al. 2013), it has a more pronounced effect as the population continues to shrink and fragment. Other major risk factors for this population (habitat fragmentation, reduced breeding success, and other threats) contribute to decreased viability of the population and may cause hunting to have a more pronounced impact.

The Bi-state population has fluctuated in numbers over multiple year periods. However, even with cyclical abundance explaining lower population numbers some years, it is recognized to be in decline overall due to the effects of habitat fragmentation/degradation, disease, invasive species, fire, etc. As the Bi-State population has decreased and become further fragmented, the California Bi-State sage grouse population is also increasingly more susceptible to stochastic events, which could decimate the population. Against this background, an increase in hunting in years with cyclic population increases could lead to overhunting in the longer term, causing numbers to plummet in years when sage grouse populations naturally decrease in the cycle. The proposed regulations do not explain how the Department will take into account *both* cyclic population changes *and* long-term declining trends in determining hunt limits.

III. Impacts of Hunting

A. Impacts of Hunting on Sage grouse in California Are Likely Additive

One of the most significant challenges that the Department has failed to fully address is determining if the effects of hunting on greater sage grouse are additive or compensatory. Additive harvest contributes to an overall decline in survival for a population, causing more deaths to occur in the population than would happen naturally in the system (Sedinger and Rotella 2005). Compensatory harvest assumes that hunting does not have a significant effect on the population's survival rate, but rather acts in place of other density dependent factors that would naturally cause more deaths (Connelly et al. 2004; Sedinger and Rotella 2005). Depending on the species or types of studies, hunting has been found to have varied effects on long-term population survival. For many ecological models, additive hunting is usually assumed (Caughley and Sinclair 1994). In contrast, for much of wildlife management, compensatory harvest is usually assumed (Errington 1946). This discrepancy could lead to a significant over-take in the practice of wildlife management if the ecological models which assume additive impact to the populations are accurate.

Studies have shown different species of game bird to follow either compensatory or additive harvest models based on species, habitat, life history, etc. Multiple studies have found harvesting of upland game birds to be partially additive (Robertson and Rosenberg 1988, Williams et al. 2004). Nevertheless, other studies have shown species of gamebird to follow compensatory models (such as the ruffed grouse in Devers et al. 2007). There are also contradictory studies on some species, such as the willow ptarmigan, where harvesting has been found to be compensatory in some studies and additive for others (Ellison 1991, Smith and Willebrand 1999, Pederson et al. 2003). While it may not be completely clear whether hunting of sage grouse is additive or compensatory, Blomberg *et al*. 2015 explains that conducting sage grouse hunts too late in the season will be more likely to produce an additive effect.

Hunting also has a larger impact on both small and isolated populations than large populations. Multiple studies suggest habitats at low elevations, near urban centers, and isolated populations may not be able to endure the same harvest rate as that of larger, more continuous population in mesic areas (Gibson 1998, Connelly et al. 2003). Because the remaining sage grouse populations in California are fragmented, isolated and have poor connectivity, any declines in population in one area cannot be compensated by sustainable numbers in other areas.

Some studies have considered that density dependent factors could be contributing to the decrease in the species' abundance (Sedinger and Rotella 2005).However, Connelly *et al.* (2003) found that hunting slowed down greater sage grouse population growth in Idaho (Connelly et al. 2003). Additionally, two different studies found that in areas closed off to hunting greater sage grouse population numbers increased whereas areas that were hunted showed a decreased abundance (Connelly et al. 2003, Gibson et al. 2011). As such, researchers like Gibson et al. (2011) argue that there is no strong evidence pointing to compensatory harvest for the greater sage grouse.

The length of the hunting season and time of year of the hunt can affect the age structure and sex ratios of the sage grouse populations, leading to potential negative effects in the future. An earlier hunting season could cause hunters to most easily prey on juveniles and hens in groups that have not yet dispersed (Caudill et al. 2014). This could cause a shift in age and sex structure in the population, and the productivity of the population could be negatively affected (Ellison 1991). In a study on the Idaho population, adult females suffered greater losses than males in the autumn harvest: 15% male mortality and 42% female mortality. In Nevada from 1996-2008, a range of 58-73% of adult birds hunted were females (NDOW 2009). In comparison, in the four months following the hunting season, both sexes experienced only 2% mortality (Connelly et al. 2000), highlighting the low mortality rates over winter. Yearling females have been shown to produce and raise fewer successful chicks than adult females; if adult females are being preferentially hunted there could be negative lag effects in the future as yearling females outnumber adult females (Moynahan et al. 2006). Additionally, adult females are more likely to survive predation than yearlings (Blomberg *et al.* 2013). If adult females are being preferentially hunted, but yearlings are more likely to die from predation, this would indicate that sage grouse populations are experiencing additive hunting impacts (discussed further in the section below).

Female survival is key to sage grouse population growth and sustainability, so a preference for bagging females, and a resulting higher female mortality, could be detrimental for a smaller population. Due to the fact that spring lek counts, the sage grouse surveys the Department relies on, only account for males, a sharp decline in females may not be immediately recognized. Hunting mortality could have a particularly negative effect on the sage grouse populations in California. Due to their small size and isolated nature, hunting could depress population levels and continually keep them below carrying capacity (Gibson 1998). This could cause continued population decline, cause the recovery of a population to be much slower, or cause the population to stabilize at a level lower than is sustainable over the long-term (Reese and Connelly 2011).

B. Impacts of Hunting on the Bi-State Population Threaten Recovery Efforts

While it is sometimes difficult to isolate hunting from the other density dependent factors affecting abundance, a 39-year study of the Mono populations of Bi-state sage grouse in California found additive effects of hunting over time (Gibson et al. 2011). After an increase in autumn harvesting, the quantity of males on leks in spring had notably decreased. This decrease in population size and long-term population sustainability suggests that additive hunting mortality is affecting this California population (Gibson et al. 2011). It is also suggests that hunting should be considered an increasingly important factor in decreasing populations, especially for the small and fragmented Bi-state population in California studied by Gibson et al. (2011).

Hunting practices pose additional threats for sage grouse. Grouse are often hunted from roads, where it is easiest to spot groups of juveniles, again affecting the age structure of the population (Caudill et al. 2014). Crippling losses (unretrieved kills) are often not factored in, and in Utah crippling losses were found to account for 5% of greater sage grouse losses (Caudill et

al. 2014). Most states open hunting seasons from 1 September – 5 October, with an average 10 day hunting season (Reese and Connelly 2011). Data from the 2007 hunting season revealed a 2 day hunting season which started in the second week of September, and the general structure of greater sage grouse hunting in California has not been altered much (Reese and Connelly 2011). Although it does not seem like a hunting period of two days would have much effect on a sage grouse population, Gibson et al. (2011) provided four factors that can contribute to potential detrimental effects on the California population. These factors included (1) the population's isolated nature allowing less immigration and emigration, (2) fluctuations in past population size, (3) multiple hunting pressures on the population (accessibility by a significant number of hunters from population centers over a short time period and occasional seasonal closures), and (4) the low reproductive success for this particular population.

Although the more stable, larger population of sage grouse in Nevada outside of the Bi-State area has shown variation independent of hunting mortality (Gibson 1998), Nevada has prohibited recreational hunting in Bi-State sage grouse populations (tribal lands excepted) since 1998, as the Bi-State sage grouse breeding population in Nevada is on or near the minimum threshold (Bi-State TAC 2012, USFWS 2015b).

Because Gibson et al. (2011) found additive mortality from hunting in the South Mono region, hunting should cease in both Mono zones for the foreseeable future to protect the Bi-State sage grouse populations. Greater conservation benefit would also be gained by the continuity of a no hunt zone for the entire Bi-State sage grouse population which would benefit management of this localized and imperiled population and support other conservation measures.

IV. Proposed Regulation

A. The Department Has Not Explained How Lek Data was Collected or How Fall Population Projections Were Made

The Department has previously stated that the number of permits within the range requested would be decided based on spring lek counts of males, however at the June 2016 meeting the Department explained that it now intends to determine the permit numbers based on projected estimates of fall population—allowing up to 5% of the population to be hunted in each zone, so long as the 5% is over 5 birds. (June 2016 presentation). Therefore, it is vital for the public and the Commission to understand how the male lek count data is obtained and how the fall population estimates are calculated. The Department has not provided sufficient information to support the proposed regulation; for example, the Department has not provided sufficient information on the data collection methods for the California sage grouse male lek counts, how fall population estimates were calculated, or how the 5% figure was chosen.

For the Bi-state population in California and Nevada, numerous agencies and volunteers from each state attempt to count known leks annually. Some areas are not counted due to lack of accessibility and personnel availability, producing variable survey efforts between the two states. California also tracks production, to monitor for anything unusual and to monitor major brood

rearing territories (Connelly et al. 2004). There is a bias in current surveys to favor known leks, and the annual surveys do not require a consistent sampling design (Bi-State TAC 2012). California's Bi-State population zones did not have a standardized system of lek surveys until 1987, and the surveys in Nevada have not been standardized, causing difficulty in comparing data across years and locations (USFWS 2015b).

The methodology the Department relied on for fall population estimates is unclear. The survey method of counting males on leks is generally assumed to err on the conservative side of population estimates; however, it does not take into account the number of females, which have been shown to be more heavily hunted than males (Bloomberg et al. 2013). The Department stated that it used a "conservative" assumption of 1.2 chicks per hen to estimate the low end for the population figures overall (CFGC June 2016 meeting, item #33), but did not explain how the number of females or hens was estimated or why chicks were included in the population estimate at all without reference to survival rates. A truly conservative estimate would only include breeding age adults. While in some instances "sex ratios of adult sage-grouse have been quantified from evaluation of wings obtained from hunters in the fall" (WAFWA 2015), here, the Department has not provided the public or the Commission with any detailed information on the actual sage grouse killed in hunting including sex ratio, therefore that methodology cannot be used for the population estimates. The public and the Commission are left in the dark as to how the Department arrived at the fall population estimates and the 5% threshold figure and, therefore, cannot fairly review the Department's proposal.

As most of the California Bi-State sage grouse populations are isolated, low density populations (the North and South Mono populations comprised 94% of males recorded in annual lek surveys), hunting of Bi-State sage grouse is only even considered in these two zones with more robust populations. (Bi-State TAC 2012, USFWS 2013). As stated by the USFWS 2013 report, Bi-State sage grouse populations in California outside of the main two in Mono County are "below the theoretical minimum criteria for long-term persistence." Given the precarious status of the Bi-State sage grouse populations in California and the lack of complete data, it makes no sense to allow hunting to further diminish the species and certainly not to allow the Department to increase hunting permits within such an enormous range to far above the number of permits actually issued in recent years.

B. There is No Scientific Basis for the Permit Range

The Department has provided no rational or scientific basis for the proposal to include a high-end range for sage grouse hunting permits of 100 birds in each zone. In 2014 and 2015, 30 single-bird hunting permits total were allocated in only one zone, North Mono, and in 2015 only 19 permits were actually issued in that zone. This year's proposed regulation which would continue to allow the Department to grant permits for up to 100 birds in each of the four zones could result in a maximum of 400 birds being harvested. This would be a significant increase from actual hunting in recent years, where 30 one-bird-permits were issued for each of the North and South Mono zones in 2011, and no increase in permit limits have been issued since 2009 (Bi-State TAC 2012). Generally since 1998, California has allocated no more than 20-35 single-bird permits for each of the two Mono zones, with the total birds harvested between the two

zones usually averaging around 40 birds for the year (USFWS 2015b). The proposed range for hunting permits with a high end of 100 birds in each zone is alarming and makes no sense for any of the populations in the four zones with consistently small and fragmented sage grouse populations.

There is no basis provided for the Commission to adopt the upper end of the range at all. Populations of sage grouse in California have declined significantly from historic numbers and continue to decline. This year at the June 23, 2016, Commission meeting the Department's Scott Gardner presented the 2016 lek count data which shows long-term declining population trends from 2012-2016 in all zones. Significant long term declines persist in South Mono (49%), East Lassen (27%), and Central Lassen (33%), although the two Lassen zones with no hunting had some increases in lek counts from 2014-2016. (CFCG Meeting June, 2016). In North Mono, the only zone in which hunting was allowed in recent years, the decline from 2012-2016 was 9%, and declines continued from 2015-2016 in the South Mono zone. (CFCG Meeting June, 2016). These data show that population declines may have been slightly ameliorated by an absence of hunting in the two Lassen zones. Furthermore, while hunting may not be the primary threat to sage grouse it could impact recovery and halt progress made by reducing other threats. Given the declining long-term trends in all sage grouse populations in California, any increase in hunting limits, which could be allowed under the range proposed by the Department, could have devastating impacts on these populations and should not be allowed.

The proposed regulations fail to explain how or whether the Department will take into account the fact that these sage grouse populations have already significantly declined and are highly fragmented making these populations particularly vulnerable to stochastic events. For example, the proposed regulations imply that if the lek data for the 2016 season showed an increase in population size, there could be a corresponding increase in permits in areas that might have superficially high numbers for the one year. Indeed, the Department's proposal to use estimated projected fall population figures and to allow hunting of up to 5% of the projected population in each zone is alarming given the ongoing declines. Moreover, because the species exhibits cyclic population trends, one year's higher abundance might not indicate the population trend is upward in the long-term or that the population is at sustainable long-term levels.

Because the high-end proposed range limits have no basis in science they should be rejected by the Commission. In light of the lack of scientific or rational basis for the proposed range of permits, the Center strongly urges the Commission to reject the Department's proposal and adopt a zero limit in all zones.[1]

[1] If however, the Commission refuses to end sage grouse hunting this year, it must at minimum amend the proposed regulations to set a high-end limit *far lower* than the 100 birds per zone requested by the Department and adopt instructions to the Department to ensure hunting limits are set based on conservation goals in light of the historic decline of the species and other threats, taking into account both the results of annual surveys *and* long-term trends of sage grouse populations in California.

V. Conclusion and Recommendations:

The Center urges the Commission to reject the Department's proposed regulatory change that would provide a range of permit limits for greater sage grouse in the 2016-2017 season and, rather, impose a ***zero*** limit for the 2016-2017 season in all zones as a key element protecting all California sage grouse populations in the face of multiple threats.

Sincerely,

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Attachment: June 2, 2015, Letter from County of Mono, Board of Supervisors to California Fish & Game Commission (http://fgc.ca.gov/meetings/2015/Aug/Exhibits/0805_Item_28_UplandGame.pdf at p.18).

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Attachment

Larry Johnston District One Fred Stump District Two Tim Alpers District Three
Tim Fesko District Four Stacy Corless District Five

BOARD OF SUPERVISORS
COUNTY OF MONO

P.O. BOX 715, BRIDGEPORT, CALIFORNIA 93517
(760) 932-5538 • FAX (760) 932-5531
Bob Musil, Clerk of the Board

June 2, 2015

Sonke Mastrup
Executive Director
California Fish and Wildlife Commission
1416 Ninth Street, Box 944209
Sacramento, CA 94244-2090

RE: ADJUSTMENT OF ANNUAL NUMBER OF SAGE GROUSE HUNTING PERMITS BY ZONE

Dear Mr. Mastrup,

Mono County supports legal and well-regulated hunting and appreciates the opportunity to work with the Commission and the Department of Fish and Wildlife in the stewardship of California's diverse wildlife populations. The County cannot, however, support continued recreational hunting of the Bi-State Distinct Population Segment (DPS) of the Greater Sage Grouse within the North and South Mono management zones, and requests the Commission reduce the number of permits to zero for the 2015 hunting season and future years.

As you are aware, the United States Fish and Wildlife Service proposed listing the Bi-State DPS as a threatened species under the Endangered Species Act, but issued a decision in April not to list based on conservation commitments by federal, state and local agencies, including Mono County, and participating agricultural operators. We understand that if the bird had been listed, hunting would have been prohibited as it is intentional take. In the wake of the decision not to list, proactively enacting this conservation measure would help ensure our unprecedented conservation effort is successful. Therefore, the County cannot support any intentional take, and believes that even well-regulated take may jeopardize our collaborative efforts.

Respectfully,

Timothy E. Fesko, Chairman
Mono County Board of Supervisors

2015 JUN -8 PM 1:42
RECEIVED CALIFORNIA FISH AND GAME COMMISSION

The Journal of Wildlife Management 79(5):695–703; 2015; DOI: 10.1002/jwmg.887

Commentary

The Influence of Harvest Timing on Greater Sage-Grouse Survival: A Cautionary Perspective

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ABSTRACT Understanding the influence of harvest regulations on wildlife populations is crucial for successful population management and species conservation. This is true of greater sage-grouse (*Centrocercus urophasianus*), a species of great conservation concern in western North America that is a candidate for protection under the United States Endangered Species Act and is hunted in nine states within the United States. Recent recommendations have proposed shifting hunting seasons to later in the year, with a goal of reducing harvest of adult female and juvenile sage-grouse. Foundational principles of harvest theory, however, suggest that such changes to harvest timing could have unintentional and adverse effects on greater sage-grouse populations. I used published estimates of seasonal survival to reconstruct weekly mortality curves for adult female and juvenile greater sage-grouse in Nevada, USA. Under a hypothesis of compensatory mortality, I then calculated the maximum harvest occurring during any 1-week interval that could be compensated by non-harvest mortality that occurs after the hunting season. This value universally declines as harvest is held later in the season. Under a hypothesis of additive mortality, I calculated the realized reductions in both survival and subsequent reproductive success that would be expected for a given level of harvest. Both of these values increase if harvest is conducted later in the season, resulting in a larger additive effect than if harvest had occurred earlier. If reduced mortality of specific age or sex classes is desired, I suggest managers employ reduced bag limits, shortened season lengths, or permit systems to meet this objective. Holding hunting seasons later in the year than is presently custom (i.e., beginning sometime during Sep) should be avoided unless specific information exists to predict the change in harvest rate that would occur following changes to harvest timing. © 2015 The Wildlife Society.

KEY WORDS additive mortality, *Centrocercus urophasianus*, compensatory mortality, density dependence, hunting.

The influence of human harvest on population dynamics is a prominent topic in wildlife conservation (Anderson and Burnham 1976, Boyce et al. 1999, Péron 2013). A key role of management is to ensure that modern regulated harvest avoids detrimental effects to the long-term viability of target species. The concepts of additive and compensatory mortality are central to this objective. These alternative hypotheses have received substantial treatment on a theoretical basis (e.g., Kokko and Lindström 1998, Boyce et al. 1999, Kokko 2001) and have been tested through a number of case studies (e.g., Anderson and Burnham 1976, Williams et al. 2004, Sedinger et al. 2010, Sandercock et al. 2011, Péron 2013). The degree to which harvest may be additive or compensatory with respect to other sources of mortality can be further subdivided into 5 discrete hypotheses: compensatory, additive, partially compensatory, superadditive, and overcompensation. (Sandercock et al. 2011). When harvest mortality is compensatory, losses due to harvest produce a density-dependent feedback on the subsequent survival of the population, such that losses are completely compensated by increased survival of individuals that remain following harvest. When harvest mortality is fully additive, no such density-dependent response exists, and harvest produces an increase in total mortality that is proportional to the harvest rate. Partial compensation, where harvest is neither completely compensatory nor fully additive, provides an intermediate hypothesis where some density-dependent feedbacks on survival exist, but these are insufficient to completely compensate for harvest mortality. Superadditive mortality represents a situation where the act of harvest reduces the post-harvest survival of remaining individuals above the mortality rate predicted in the absence of harvest (Kokko 2001). Superadditivity could occur, for example, if harvest disrupts population social structure, thus increasing mortality risk for individuals that are not harvested. In contrast, the overcompensation hypothesis suggests that survival may increase in response to low levels of harvest above that predicted in the absence of harvest (Boyce et al. 1999), for example, if harvest lowers density below some limiting threshold, releasing the population from density-dependent constraints.

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Greater sage-grouse (*Centrocercus urophasianus*) are a species of prominent conservation concern in western North America following the designation of endangered status in Canada, and candidacy for listing under the United States Endangered Species Act (Stiver 2011). As attention to the conservation status of sage-grouse has risen, increased scrutiny has also been placed on the role of sport hunting and its potential to negatively affect sage-grouse populations. Sage-grouse occur in 11 western states, and were hunted in 9 of them during the fall of 2014. Hunting regulations and harvest rates vary among and in some cases within states, but generally regulations consist of relatively short seasons (average length in 2014 was 12.7 days) that begin in September and feature conservative bag limits (average of 1.9 birds/day in 2014; Table 1). Hunting is not generally implicated as a causal agent in range-wide declines of sage-grouse (Reese and Connelly 2011), nor is it considered among the most prominent threats to sage-grouse populations (U.S. Fish and Wildlife Service 2010). However, the question of whether harvest has some measurable negative impact on sage-grouse populations is a subject of ongoing debate (Connelly et al. 2003, Sedinger and Rotella 2005, Sedinger et al. 2010, Gibson et al. 2011), and recently some states have proposed dramatic reductions or complete closures of sage-grouse hunting due to these concerns.

One suggestion that has been made with respect to sage-grouse harvest regulations is that hunting seasons should be held later in the fall to reduce the harvest risk of sex and age classes that are potentially more vulnerable during early fall (Reese and Connelly 2011, Caudill et al. 2014*a*,*b*). During late summer and early fall, juvenile (<1 year of age) sage-grouse remain aggregated with their mothers and siblings until the natal broods disband at 10–12 weeks of age (Schroeder et al. 1999). These brood aggregations often occur around discrete landscape features such as springs, seeps, and wet meadows (Casazza et al. 2011), and hunters may be likely to target such areas because of the increased density of birds that are present. Therefore, it is thought that juveniles and/or reproductive adult females (>1 year of age) may be more susceptible to harvest risk. Holding the hunting season later in the year would presumably allow for brood dispersal and reduce the concentrations of birds in seasonal high-density areas, thus potentially reducing the vulnerability of birds associated with broods.

Relationships between the timing of harvest and the timing of non-harvest mortality play an important role in affecting both additive and compensatory mortality (Kokko and Lindström 1998, Kokko 2001). Rationale for holding harvest at a later date can be drawn from the additive mortality hypothesis. Moving the hunting season to a later date could in fact lower the harvest rate through reduced hunter success. If harvest mortality is additive, this would lead to increased survival. Disruption of broods prior to their natural break-up could also increase mortality risk for surviving individuals; thus leading to superadditive mortality. Although these may represent plausible scenarios, to my knowledge, they have not been tested directly for sage-grouse. Alternatively, harvest theory suggests that in some situations, moving harvest to a later date may actually reduce survival, rather than increase it (Kokko 2001). The importance of timing in determining population response to harvest has been previously addressed (Kokko and Lindström 1998, Kokko 2001, Ratikainen et al. 2008) and here I extend these principles in a theoretical construct applied to harvest management of sage-grouse. I ask whether delaying harvest mortality by holding hunting seasons later has the potential to reduce sage-grouse survival, by either limiting the potential for compensation to occur, or by increasing negative impacts associated with additive mortality.

SEASONAL VARIATION IN HARVEST—A THEORETICAL BACKGROUND

The 5 hypotheses of harvest mortality can be formalized using a relatively simple model that was originally developed to better understand harvest dynamics in mallards (*Anas platyrhynchos*) but can easily be applied to other species (Anderson and Burnham 1976, Burnham and Anderson 1984, Burnham et al. 1984, Sandercock et al.

Table 1. Summary of harvest regulations (year = 2014) for greater sage-grouse in the 8 states in which they were hunted. I obtained information from each state's published harvest regulations.

State[a]	Opening date	Season length (days)	Bag limit	Possession limit	Permit required
California	13 Sep	2	1	1	Yes
Colorado	13 Sep	2	2	2	No
Colorado	13 Sep	7	2	4	No
Idaho	20 Sep	7	1	2	No
Montana	1 Sep	30	2	4	No
Nevada	25 Sep	15	2	4	No
Nevada	25 Sep	10	2	4	No
Nevada	4 Oct	2	2	4	No
Oregon	6 Sep	9	2	2	Yes
Utah	27 Sep	23	2	2	Yes
Utah	27 Sep	23	2	2	Yes
Utah	27 Sep	23	2	2	Yes
Utah	27 Sep	23	2	2	Yes
Wyoming	20 Sep	11	2	4	No
Wyoming	20 Sep	3	2	4	No

[a] Differences within states typically reflect varying regulations among geographic areas.

2011). During any time interval, the survival rate (S_a) of a harvested species is influenced by non-harvest mortality (M) and may also be influenced by the kill (harvest) rate (K). Survival during the interval between the onset of harvest and the following breeding season can be expressed using the equation $S_a = S_o(1 - bK)$, where $S_o = 1 - M$ and reflects survival in the absence of any harvest mortality, and b is a coefficient that describes the degree to which the kill rate is additive to non-harvest mortality. If harvest is completely compensatory $b = 0$ and $S_a = S_o$. If harvest is fully additive $b = 1$, $S_a < S_o$, and the reduction in S_a relative to S_o is determined by K. When $0 < b < 1$, harvest is said to be partially compensatory. In this case, $S_a < S_o$ but to some lesser degree than predicted solely by the fully additive model, as determined by b. When $b > 1$, harvest is superadditive, and when $b < 0$, harvest becomes overcompensatory. For the purpose of this exercise I will focus on additive and compensatory hypotheses (Fig. 1). This model assumes a species with birth-pulse population dynamics, and is often presented based on an annual life cycle where S_a is equivalent to the annual survival rate. An implicit assumption when S_a reflects annual survival is that harvest occurs instantaneously following the annual birth pulse (Kokko 2001). This assumption may be relaxed if we define S_a as the survival rate during the interval between the onset of harvest and the subsequent birth pulse, rather than the annual survival rate.

Compensatory Mortality

Under both full and partially compensatory hypotheses, a threshold harvest value (c) must exist. Above this threshold the kill rate exceeds the non-harvest mortality that would occur in the absence of harvest ($K > M$), and additional harvest mortality in excess of c must be considered additive (Burnham and Anderson 1984, Burnham et al. 1984). Logically, any compensation of harvest mortality must occur following harvest (Kokko 2001), which is to say that under compensatory mortality, K can only be offset by subsequent density-dependent decreases in M. The maximum potential harvest mortality (H) during period i that can be subsequently compensated by reduced non-harvest mortality is, therefore, given as:

$$H_i = 1 - \prod_{i=1}^{j} S_{i+1} \tag{1}$$

where H_i represents the maximum harvest rate that, if occurring at or prior to time i, will not surpass c and lead to a net reduction in S_a under fully compensatory mortality. The product of the interval-specific survival terms (S) between i+1 and j is equivalent to S_o. This value is a cumulative probability whose size in i+1 depends on the amount of mortality (M) that remains to occur prior to j (the end of the biological year); H_i becomes increasingly small as i approaches j. The potential for H to exceed M therefore increases as harvest is delayed, which implies that harvest mortality occurring later in the biological year (closer to the annual breeding season) is inherently more likely to produce additive mortality relative to harvest that occurs earlier in the year.

Additive Mortality

Under the additive mortality hypothesis, the timing of harvest also determines the extent to which harvest mortality reduces population-level survival (Kokko 2001). When harvest mortality is additive, the reduction in S_a is lower

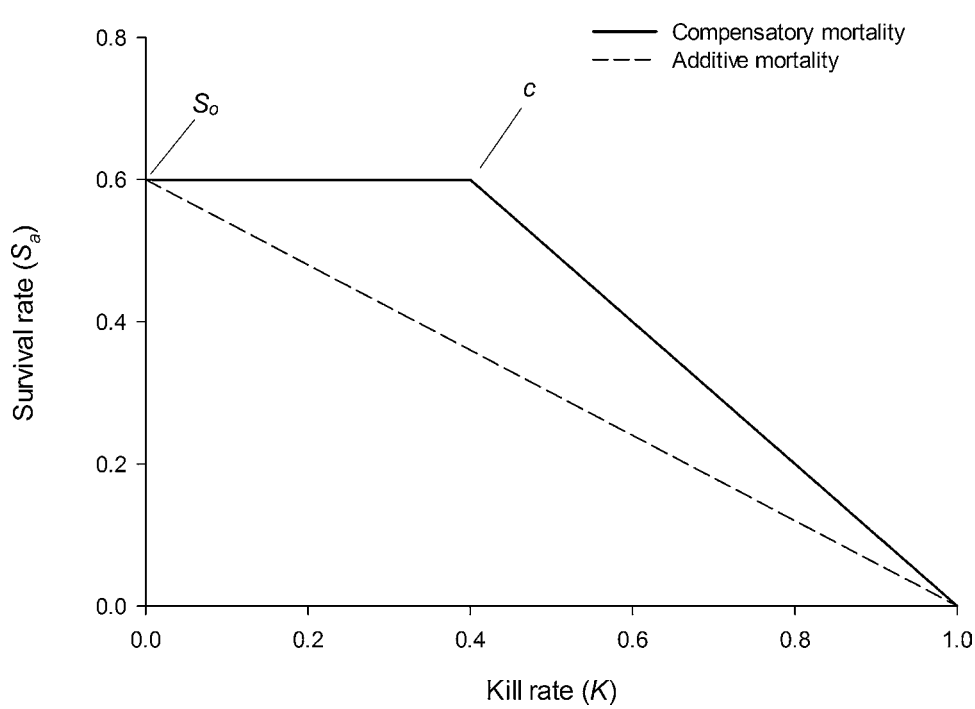

Figure 1. Conceptual models of the response of survival to increased harvest under compensatory and additive hypotheses. The survival rate in the absence of harvest mortality (S_o) and the threshold at which compensatory harvest becomes additive (c) are also identified. This figure was derived from models originally presented by Kokko (2001).

than the overall harvest rate K because individuals removed by harvest also had a $1 - S_o$ probability of dying prior to the subsequent breeding season. Said differently, some proportion of individuals removed through harvest would have otherwise died if they had not been harvested, and thus do not reflect a net loss to the subsequent breeding pool. Because S_o increases through time, the effect of K on S_a also increases when harvest occurs later in the year relative to earlier. The realized impact of additive harvest mortality on survival, which I will define as I_S, for harvest conducted during an occasion i, is given as:

$$I_{s(i)} = \left(\prod_{i=1}^{j} S_{i+1}\right) - \left(K \times \left(\prod_{i=1}^{j} S_{i+1}\right)\right) \quad (2)$$

where the first survival term gives S_o, and the product of K and the second survival term yields the proportion of harvested individuals that were likely to survive until the subsequent breeding season. As earlier, both product terms increase through time as i approaches j, so, if K is held constant, $I_{S(i)}$ increases through time and approaches K as i approaches j. If the harvest rate does not change, harvest conducted at an earlier date has an inherently smaller additive effect on survival than harvest conducted at a later date.

Individual Heterogeneity

Also of importance is the issue of heterogeneity among individuals, and the extent to which heterogeneity may affect either additive or compensatory processes within different subsets of a population (Kokko 2001, Lindberg et al. 2013). This is at least partially linked to the concept of reproductive value (Fisher 1958, MacArthur 1960). Individuals with greater mortality risk possess a lower reproductive value because they have a lower probability of surviving to subsequently breed, compared to individuals with lower mortality risk. Similarly, individuals with lower probability of reproductive success have a lower reproductive value. An optimal harvest strategy is one that seeks to remove animals with low reproductive value (Kokko 2001). In the case of compensatory mortality, an optimal strategy will avoid harvest above c for classes of individuals with high reproductive value. Harvest below c, by definition, will be compensated and will not reduce overall reproductive success. Because compensation can only occur below c, sex or age classes with higher non-harvest mortality (e.g., a higher value for c) have inherently greater room for compensation to occur than classes with low non-harvest mortality.

Under additive mortality, harvest management should seek to limit the degree to which additive harvest reduces the survival of individuals with high reproductive value. The impact of additive harvest in year t on the reproductive success in year $t+1$, which I will term I_R, can be estimated as $I_R = KS_oR$, where R is defined as per-capita reproductive success, and the product of K, S_o, and R yields the proportion of harvested individuals that were otherwise likely to survive until the subsequent breeding season and then breed successfully. If harvest removes individuals from class x at time i, the impact on the subsequent per-capita reproduction of class x can be estimated in a time-varying manner as:

$$I_{R(i)} = K_x\left(\prod_{i=1}^{j} S_{i+1}\right)R_x \quad (3)$$

which yields the expected reduction in per capita reproductive success for class x in year $t+1$ due to harvest. As earlier, I_R becomes increasingly large as i approaches j, meaning that additive mortality due to harvest conducted later will have a larger effect on future reproduction, compared to harvest that occurs earlier, again if K is held constant. Importantly, I_R is positively related to both R and S_o, meaning that additive harvest of individuals with high reproductive potential and low mortality will have the largest impact on future reproduction at the population level. In this context, I_R yields the absolute reduction in per capita reproductive success due to additive harvest mortality, and I assume no additional additive or compensatory effects on reproduction (i.e., R is independent of K).

APPLIED EXAMPLES FOR GREATER SAGE-GROUSE

Seasonal Timing of Sage-Grouse Mortality

Sage-grouse are commonly observed to survive at high rates during winter (e.g., Blomberg et al. 2013*a*, *b*), except in cases of extreme weather events (e.g., Moynahan et al. 2006). Previous authors have suggested that the potential for compensatory mortality in sage-grouse is low because the species does not fit the common small-game paradigm of high overwinter mortality (Reese and Connelly 2011). However, compensation of harvest losses through increased post-harvest survival can occur at any point between the timing of harvest mortality and the birth of young the following spring; compensation need not be restricted to the winter. Recent work has demonstrated that sage-grouse survival may be reduced during the fall for both juveniles (Blomberg et al. 2014, Caudill et al. 2014*b*) and adult females (Blomberg et al. 2013*b*, Davis et al. 2014). This period of high non-harvest mortality occurs between August–October (Blomberg et al. 2013*a*, *b*, 2014; Caudill et al. 2014*b*; Davis et al. 2014), and sage-grouse hunting seasons typically begin in September and may continue into October (Table 1). In Nevada, mortality during the fall is associated primarily with increased predation risk in high-density seasonal use areas, and predation accounts for 90% of mortalities (Blomberg et al. 2013*a*). Although disturbance associated with hunting may affect predation risk, mortality rates are elevated prior to the start of the hunting season (Blomberg et al. 2013*a*, Caudill et al. 2014*b*), which implies that high predation risk occurs during this time even in the absence of disturbance due to hunters. The close proximity of harvest mortality to non-harvest mortality during the fall also suggests that relatively small changes in the timing of hunting seasons could have important effects on compensatory and additive harvest dynamics in sage-grouse (Kokko 2001).

Compensatory Mortality

I used published monthly survival estimates (Table 2; Blomberg et al. 2013*b*, 2014) for adult females (i.e., the average adult female), for successfully reproducing adult females (raised ≥1 chick to 45 days of age), and for juvenile females to reconstruct weekly cumulative survival probabilities for each of these three groups between 1 August and 31 March. I chose 1 August as a starting point based on reported patterns in seasonal survival, and because this reflects the approximate point of fledging for juvenile sage-grouse. I chose 31 March based on the approximate onset of nesting for female sage-grouse (Blomberg et al. 2013*b*, 2014). I estimated the survival probability for any 1-week period as $S_{week} = S_{month}^{1/4}$, and the mortality risk during any given week as $M_{week} = 1 - S_{week}$. The probability that an individual alive during any week i would survive to 31 March is the product of the remaining survival probabilities between i and 31 March. Assuming complete compensation of harvest mortality, equation 1 provides the maximum sage-grouse harvest rate (H_i) that could occur during or prior to week i and be subsequently compensated through future reductions in non-harvest mortality.

The maximum harvest that does not exceed c, by week, differs for each class of females (Fig. 2). Based on survival rates in Nevada, a 10% harvest rate, which is commonly cited as an upper limit for harvest management of sage-grouse (Connelly et al. 2000, Reese and Connelly 2011), would exceed the potential for compensatory mortality and become additive on approximately the following dates for each class of female: average adult females = 7 October; successful adult females only = 14 October; juvenile females = 3 November. That is to say that 10% harvest of each age class that occurred prior to these dates has the potential to be compensatory, but at or following these dates some amount of harvest must be additive. Lower harvest levels would reduce the potential for harvest to become additive later in the season, and higher levels of harvest would become additive at earlier dates (Fig. 2). Although I used a 10% harvest rate for illustration purposes, the implications of alternative harvest rates can be inferred for all levels of harvest (see Fig. 2). Under fully compensatory mortality, a level of harvest that falls below the survival curve (see Fig. 2) on a given date should result in the same pre-breeding abundance otherwise predicted in the absence of harvest, whereas a harvest level that falls above the curve for a given date will tend to reduce the spring pre-breeding population.

Notably, H_i in this context certainly reflects an overestimate of the true total allowable harvest, because at H_i no additional mortality can occur between the culmination of the hunting season and the following spring breeding season. Even with a strong density-dependent response in survival that should result in complete compensation, some birds will certainly die by chance alone during the approximately 5-month period between harvest and spring breeding. Therefore, these estimates are not intended to be specific recommendations of allowable harvest rates, rather they are meant to illustrate that the potential for compensation becomes substantially reduced as the hunting season for sage-grouse is held later in the year. Also, the survival estimates I have used come from populations that experience either low (<2%; Blomberg et al. 2013*a*) or no harvest mortality. Adjusting S_{week} to discount this low level of harvest mortality does not change the interpretations I made above.

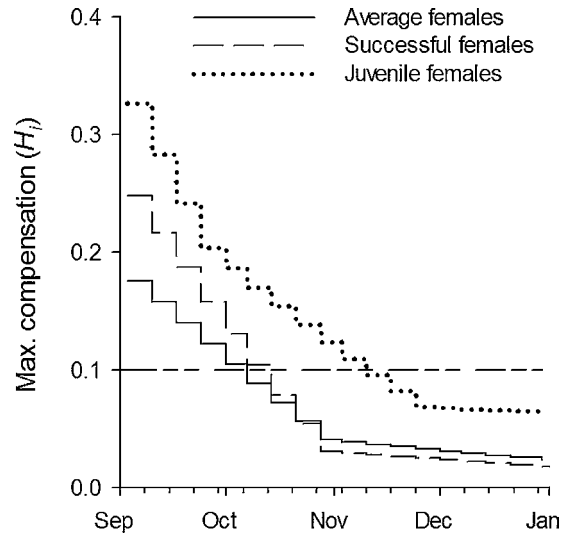

Figure 2. The theoretical maximum level of harvest (H_i) that could occur prior to any 1-week interval ($i+1$) and be compensated by subsequent density-dependent responses in non-harvest mortality for average adult female, successfully reproductive adult female, and juvenile female greater sage-grouse. These models are based on seasonal survival curves from Nevada, and assume that complete compensation of H_i will occur up to a harvest threshold c. The horizontal dashed line reflects a value of 10% total harvest that is commonly used as a recommended upper limit for allowable harvest of greater sage-grouse. Where the dashed line intersects the response curve, the threshold value c has been reached and no additional compensation is possible.

Table 2. Monthly survival estimates for female greater sage-grouse in Nevada, USA, which I used to reconstruct weekly seasonal survival curves. Values in parentheses indicate standard errors.

Month	Avg. adult[a]	Succ. adult[b]	Juvenile[c]
Aug	0.92 (0.02)	0.85 (0.03)	0.76 (0.06)
Sep	0.92 (0.02)	0.85 (0.03)	0.76 (0.06)
Oct	0.92 (0.02)	0.85 (0.03)	0.88 (0.04)
Nov	0.99 (0.001)	0.99 (0.001)	0.88 (0.04)
Dec	0.99 (0.001)	0.99 (0.001)	0.99 (0.01)
Jan	0.99 (0.001)	0.99 (0.001)	0.99 (0.01)
Feb	0.99 (0.001)	0.99 (0.001)	0.93 (0.03)
Mar	0.99 (0.001)	0.99 (0.001)	0.93 (0.03)

[a] Population average monthly survival for adult (>1 year old) female greater sage-grouse. Estimates taken from Blomberg et al. 2013*b*.
[b] Monthly survival for only those adult female greater sage-grouse that successfully raised a brood during the prior breeding season. Estimates taken from Blomberg et al. 2013*b*.
[c] Monthly survival for juvenile female greater sage-grouse. Estimates taken from Blomberg et al. 2014.

Additive Mortality

Assuming additive mortality and the same temporal variation in survival described above, equation 2 gives the expected reduction in sage-grouse survival due to harvest (I_S) that

occurs during or prior to *i*. These values differ for each group of females for each 1 week period (Fig. 3). Again, I chose a harvest rate of $K = 0.10$ for relevance to sage-grouse harvest management (Connelly et al. 2000, Reese and Connelly 2011). As expected, the effect of harvest on sage-grouse survival increases through time. A 10% additive harvest rate during the first week of September would reduce survival for juvenile, successful adult females, and average adult females by 0.067, 0.075, and 0.082, respectively. In contrast, 10% additive harvest occurring during the last week of October results in 0.088, 0.097, and 0.096 respective reductions in survival. At 10% harvest, this implies that delaying additive harvest by 1 month results in an approximately 0.01 reduction in the survival rate for each class of birds. Notably, the reduction in survival due to harvest is smaller for juvenile and successful adult females (Fig. 3) because of their inherently higher non-harvest mortality rates. These patterns will occur at any harvest level, with the scale of the y-axis shifting accordingly (Fig. 3). As harvest is conducted later in the year, the true impact to population survival will increasingly approach the total harvest rate.

Individual Heterogeneity Under Additive Mortality

To assess the importance of individual heterogeneity, I used estimated probabilities of reproductive success for adult female greater sage-grouse reported in Blomberg et al. (2013*b*). These values represented the probability that a female successfully raised ≥ 1 chick to 45 days of age, and encompassed the likelihood of a female initiating a nest, the nest hatching, and successful rearing of at least 1 chick. The estimates also inherently consider the potential for multiple reproductive attempts. They do not account for individual variation in all components of fecundity (e.g., clutch size or egg hatchability), and therefore should be viewed as conservative proxies to female reproductive success, rather than explicit measures of reproductive output (e.g., chicks per female). These values provide a useful metric to use with respect to individual heterogeneity, because previously successful females were found to be more than twice as likely to be reproductively successful the following year (0.24 ± 0.08 SE) compared with females that were previously not successful (0.10 ± 0.02 SE; Blomberg et al. 2013*b*). I lack comparable estimates for juvenile females with no previous reproductive history, and so I will use the population average for reproductive success for this age class (0.12 ± 0.02 SE). I believe this assumption is robust because age was not found to influence reproductive success in this system (Blomberg et al. 2013*b*).

The projected impact of additive harvest on female reproductive success increased when a fixed level of harvest occurred later in the season (Fig. 4). Again, I used a 10% additive harvest rate for illustration, but similar patterns will be present at all harvest rates. During the final week of October, 10% additive harvest was predicted to reduce the reproductive success of previously successful females by a greater amount ($I_S = 0.023$) compared to 10% additive harvest occurring during the first week of September ($I_S = 0.016$). This reflects an approximately 50% increase in I_S between the early and late harvest periods. Additive harvest of previously successful females also had a greater impact on per-capita reproductive success compared to unsuccessful or juvenile females (Fig. 4). However, harvest was expected to produce a relatively small reduction in per-capita reproductive success in this system for all classes of

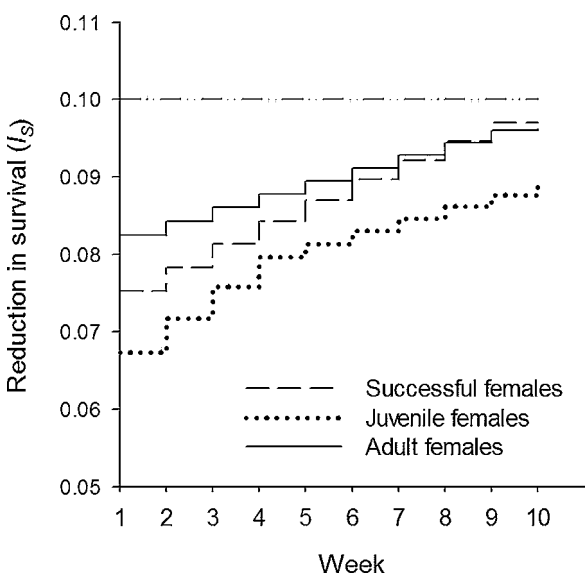

Figure 3. The expected reduction in survival (I_S) associated with 10% additive mortality (dot-dashed line) of female greater sage-grouse when harvest occurs on progressively later dates. These models are based on seasonal survival curves from Nevada, and assume that harvest is fully additive. I chose to depict 10% harvest because this value is commonly used as a recommended upper limit for allowable harvest of greater sage-grouse; however, similar relationships occur at all levels of harvest. Week 1 begins on 1 September.

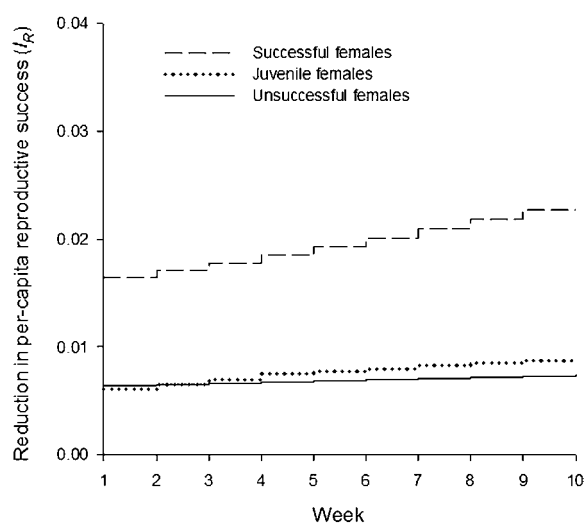

Figure 4. The expected reduction in per-capita reproductive success (I_R) associated with 10% additive mortality of female greater sage-grouse when harvest occurs on progressively later dates. These models are based on seasonal survival curves and estimates of per-capita reproductive success from Nevada, and assume that harvest is fully additive. I chose to depict 10% harvest because this value is commonly recommended as an upper limit for allowable harvest of greater sage-grouse; however, similar relationships occur at all levels of harvest. Week 1 begins on 1 September.

birds, including previously successful females. This can be illustrated using a hypothetical scenario, with 100 previously successful females expected to again raise broods successfully during $t+1$ in the absence of harvest. In that scenario, and based on the per-capita reduction in reproductive success (e.g., I_R), 10% additive harvest mortality is predicted to remove approximately 2 individuals that were otherwise expected to reproduce successfully in $t+1$.

These results are driven, in part, by the relatively low reproductive success of female sage-grouse. Although individual heterogeneity has been demonstrated for female sage-grouse (Blomberg et al. 2013*b,* Caudill et al. 2014*a,* Davis et al. 2014), reproductive success for sage-grouse is also low in general (Connelly et al. 2011) and in particular for this system. When coupled with lower survival due to reproductive costs (Blomberg et al. 2013*b*), only a small proportion of hens with broods that are removed through additive harvest are expected to reproduce successfully again the following year, had they not been harvested. As a consequence, additive harvest will have a substantially lower effect on future reproduction than expected based solely on the harvest rate (e.g., a harvest rate of 0.10 reduces per-capita reproductive success by approx. 0.02). However, the timing of harvest still affects this relationship and a given level of additive harvest mortality (e.g., 10%) that occurs early in the fall will produce a smaller reduction in future reproductive success compared to the same level of harvest occurring later in the fall.

IMPLICATIONS FOR SAGE-GROUSE HARVEST

Whether harvest mortality in sage-grouse is additive or compensatory is still a debate; however, I have demonstrated that shifting sage-grouse hunting seasons to later dates can have unintended consequences under each of these mutually exclusive hypotheses. If harvest mortality is compensatory, harvest occurring later in the year will reduce the potential for density-dependent compensation and increase the likelihood that harvest will become additive. If harvest mortality is additive, harvest occurring later in the year will produce a larger reduction in both survival and reproductive success compared to a similar level of harvest occurring earlier in the year. This has particularly important implications under proportional harvest strategies (Fryxell et al. 2005), which are commonly applied to upland game birds (Sandercock et al. 2011) including sage-grouse (e.g., the recommendation for harvest at 10% or less of fall population size; Connelly et al. 2000, Reese and Connelly 2011). Additive mortality will reduce survival by a greater extent if harvest is moved to a later date but the same fixed proportion of birds are removed. I present these considerations as alternative perspectives to the current trend of holding sage-grouse hunting seasons later in the year (Caudill et al. 2014*a*).

Despite the concerns I have raised, there are 2 scenarios where late harvest would be preferable to early harvest (sensu Caudill et al. 2014*a*, *b*). First, if harvest of adult females and/or juveniles associated with broods produces a superadditive effect on post-harvest survival, this may offset benefits associated with earlier harvest. Such superadditive mortality has been demonstrated at relatively high levels of harvest (30%) in willow ptarmigan (*Lagopus lagopus*; Sandercock et al. 2011), but to my knowledge has not been shown to occur at the comparatively low harvest mortality ($\leq$10%) that is typical for sage-grouse. Disruption of broods prior to their natural break up could reduce subsequent survival and produce superadditive effects. However current hunting seasons (Table 1) occur in close proximity to the timing of brood breakup (see Fig. 3 in Schroeder et al. 1999), and survival of juvenile sage-grouse does not appear to be buffered by extended parental care (Blomberg et al. 2014). Together, I believe these factors suggest that superadditive effects on sage-grouse survival are unlikely. Second, under additive harvest mortality, if harvest rates are reduced during later seasons because of lower hunter success, that would tend to counter-act any negative consequences associated with later harvest. Understanding such changes requires estimates of harvest risk by sex, age, and reproductive class during years when harvest occurred both prior to and after brood breakup. These estimates should also be collected using an experimental design that reduces other sources of confounding variation (sensu Sedinger and Rotella 2005). I am unaware of any such assessments that have been conducted for sage-grouse. If harvest mortality is compensatory, however, survival will remain constant regardless of harvest timing, assuming harvest remains below the threshold c (e.g., Fig. 1). As I have demonstrated, the likelihood of harvest exceeding c increases when hunting seasons are held on later dates.

The likelihood that additive or compensatory processes occur in a given system depends on the presence of density-dependence in survival (Boyce et al. 1999). To date only one study has evaluated specifically the relationship between sage-grouse harvest and survival in a direct test of evidence for additive versus compensatory mortality. Sedinger et al. (2010) used banding data from Colorado and Nevada, where harvest rates were near but generally below 10%, to correlate annual survival with band return rates while accounting for the inherent sampling covariance between these 2 parameters. The authors found no evidence for a negative process correlation between annual survival and recovery probabilities in either system, a criterion that is a prerequisite for additive mortality (Anderson and Burnham 1976). These results were later confirmed by Péron (2013) who concluded as part of a multi-taxon analysis that complete compensation of harvest mortality was possible for sage-grouse. Several investigators have demonstrated negative correlations between harvest rates and trends in sage-grouse abundance derived from lek counts (e.g., Connelly et al. 2003, Gibson et al. 2011). However, patterns in abundance are affected by both survival and rates of recruitment, and so these do not represent direct tests of compensatory versus additive mortality per se, because recruitment may also respond to harvest (Kokko 2001). Furthermore, lek counts may provide an incomplete picture of annual changes in abundance due to variation in male lek attendance rates (Blomberg et al. 2013*c*). Such assessments may also fail to completely separate the effects of harvest mortality from other density-dependent

processes (Sedinger and Rotella 2005), and/or do not (or at least have not to date) attempted to control for other important and potentially confounding drivers of population growth, such as weather (e.g., Blomberg et al. 2012). In other tetronids, before-after-control-impact (BACI) designs have been implemented to test explicitly for survival response to various harvest treatments (e.g., Devers et al. 2007, Sandercock et al. 2011). In these two examples, high levels of harvest (>15%) produced additive or superadditive effects for ptarmigan (Sandercock et al. 2011), whereas lower levels of harvest (<15%) were found to be compensatory for ruffed grouse (*Bonasa umbellus*; Devers et al. 2007). No such BACI experimental designs have been conducted for sage-grouse.

An optimal harvest strategy is one that removes individuals prior to the occurrence of other sources of mortality, and that also removes individuals with low reproductive value (Kokko 2001). There is a growing body of evidence that sage-grouse experience substantial non-harvest mortality during the months of August–October, particularly in the southeastern extent of their distribution (Blomberg et al. 2013*a*, *b*, 2014; Caudill et al. 2014*b*, Davis et al. 2014). I expect the negative consequences of delaying harvest to be particularly relevant in this region but less relevant in other regions that do not experience similar reductions in fall survival. The extent to which the concerns I have raised are relevant to specific populations of sage-grouse will depend on the patterns of seasonal survival within that system, the specific timing of harvest with respect to those seasonal patterns, and the overall harvest rate. Temporal patterns in mortality and relative harvest risk among age and reproductive classes of females are likely to be system-specific. When evaluating seasonal patterns in sage-grouse survival, it is important to consider the full scope of within-year variation in survival, as well as variation among age and reproductive classes. I suggest that during analyses, investigators always estimate full monthly variation in survival. Also, in a model selection framework, a month structure should be contrasted with any a priori hypotheses related to seasonal variation in survival. This approach will guard against erroneously identifying a best seasonal structure by virtue of simply not considering alternatives that reflect more accurately the true seasonal patterns in sage-grouse mortality. This also requires that a sufficient sample of radio-marked birds persist during all months of the year to detect seasonal patterns in survival, should they exist.

MANAGEMENT IMPLICATIONS

I suggest that managers err on the side of caution when they are considering a shift to later sage-grouse hunting seasons, for the reasons explained above. Earlier in the year the potential for compensation to occur is greatest, and if additive mortality does occur it will reduce both survival and future reproductive success to a lesser extent than later harvest. If reducing harvest of specific age or sex classes is desired, this may be accomplished using lower bag limits, shorter season lengths, or a permit system, rather than by moving the hunting season to a later time period. Finally, I recognize that harvest regulations are not based solely on biological criteria but are often designed to balance population objectives with social considerations and stakeholder expectations. Many hunters enjoy their time afield in sagebrush ecosystems each fall, and I do not mean to suggest that harvest should be moved to so early a date as to compromise hunter satisfaction and the sage-grouse hunting experience. Managers must also consider overlap with other hunting seasons, such as for big game or other popular upland species (e.g., chukar partridge; *Alectoris chukar*), and how these concurrent seasons could affect hunter opportunity and sage-grouse harvest risk. Most states currently begin hunting seasons at some point during September (Table 1), and based on mortality patterns in Nevada, California, and Utah, this approach seems reasonable. I caution against deviation from this standard in order to hold hunting seasons later in the year, because doing so may produce unintended negative consequences to sage-grouse populations.

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Author(s): Erik J. Blomberg, Daniel Gibson, James S. Sedinger, Michael L. Casazza & Peter S. Coates

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Original article

Intraseasonal variation in survival and probable causes of mortality in greater sage-grouse *Centrocercus urophasianus*

Erik J. Blomberg, Daniel Gibson, James S. Sedinger, Michael L. Casazza & Peter S. Coates

The mortality process is a key component of avian population dynamics, and understanding factors that affect mortality is central to grouse conservation. Populations of greater sage-grouse *Centrocercus urophasianus* have declined across their range in western North America. We studied cause-specific mortality of radio-marked sage-grouse in Eureka County, Nevada, USA, during two seasons, nesting (2008-2012) and fall (2008-2010), when survival was known to be lower compared to other times of the year. We used known-fate and cumulative incidence function models to estimate weekly survival rates and cumulative risk of cause-specific mortalities, respectively. These methods allowed us to account for temporal variation in sample size and staggered entry of marked individuals into the sample to obtain robust estimates of survival and cause-specific mortality. We monitored 376 individual sage-grouse during the course of our study, and investigated 87 deaths. Predation was the major source of mortality, and accounted for 90% of all mortalities during our study. During the nesting season (1 April - 31 May), the cumulative risk of predation by raptors (0.10; 95% CI: 0.05-0.16) and mammals (0.08; 95% CI: 0.03-013) was relatively equal. In the fall (15 August - 31 October), the cumulative risk of mammal predation was greater ($M_{(mam)} = 0.12$; 95% CI: 0.04-0.19) than either predation by raptors ($M_{(rap)} = 0.05$; 95% CI: 0.00-0.10) or hunting harvest ($M_{(hunt)} = 0.02$; 95% CI: 0.0-0.06). During both seasons, we observed relatively few additional sources of mortality (e.g. collision) and observed no evidence of disease-related mortality (e.g. West Nile Virus). In general, we found little evidence for intraseasonal temporal variation in survival, suggesting that the nesting and fall seasons represent biologically meaningful time intervals with respect to sage-grouse survival.

Key words: cause-specific mortality, Centrocercus urophasianus, cumulative hazard function, greater sage-grouse, hunting, predation, survival

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Survival of breeding-aged individuals is a fundamental component of avian population dynamics and, by extension, understanding the mechanisms that affect survival is important for grouse conservation. For species with relatively low intrinsic population growth rates, or in populations with generally low reproductive output, adult survival can be a major determinant of population growth (Sæther & Bakke 2000). For grouse species or populations that exhibit such characteristics, reduction in adult survival is likely to be detrimental to population persistence (Blomberg et al. 2012). Factors that influence survival are often complex, and survival may vary through time, space and among individuals. Often,

multiple sources of mortality may contribute to observed rates of survival, and understanding cause-specific mortality allows for partitioning of these sources of variation in survival.

To accurately estimate survival and quantify mortality risk from competing sources in a marked population, one must account for 1) staggered entry of individuals into the sample of marked animals, and 2) variable mortality risk during the study period (i.e. staggered exit), each of which lead to variability in sample size among sampling intervals (Heisey & Fuller 1985, Pollock et al. 1989, Heisey & Patterson 2006). These considerations are particularly important when mortality is temporally dynamic because mortality estimates are likely to be biased towards factors that occur when a greater number of individuals are available to die (Heisey & Patterson 2006).

Greater sage-grouse *Centrocercus urophasianus* (hereafter sage-grouse) are the largest grouse species in North America, and are endemic to sagebrush *Artemisia* spp. ecosystems in the western United States and Canada. Conservationists have expressed concern over the population status of sage-grouse since at least the early 20th century (Hornaday 1916). Recent declines have resulted in considerable interest in sage-grouse ecology (Knick & Connelly 2011). Taylor et al. (2012) showed that survival of adult female sage-grouse was a major determinant of population growth for most populations. Sage-grouse die for many reasons, including predation (Hagen 2011), collision (Stevens et al. 2012), disease (Walker & Naugle 2011), human harvest (Sedinger et al. 2010, Reese & Connelly 2011) and exposure to toxins (Blus et al. 1989). Many studies have evaluated sources of variation in sage-grouse survival (e.g. Zablan et al. 2003, Moynahan et al. 2006, Blomberg et al. 2013), and several authors have quantified cause-specific sources of mortality (Connelly et al. 2000, Beck et al. 2006). However, no sage-grouse studies have accounted for the aforementioned assumptions that are required to properly evaluate competing sources of cause-specific mortality in sage-grouse.

We evaluated weekly survival and cause-specific mortalities of radio-marked sage-grouse during two seasons: nesting (1 April - 31 May) and fall (15 August - 31 October). We selected these two seasons because we observed reduced seasonal survival rates during these periods relative to other times of the year (Blomberg et al. 2013), and we had detailed data during these two intervals. Our specific objectives were to 1) characterize sources of variation in survival within each seasonal period, 2) classify probable causes of sage-grouse mortalities, and 3) evaluate the relative risk to grouse from each mortality source.

Material and methods

Study area

Our study area encompassed approximately 6,500 km^2 in Eureka County, Nevada, USA (40°15'N, -116°30'E). This system contains landscape and habitat features typical of the American Great Basin. Shrub steppe communities were dominated by sagebrush species with Wyoming big *A. tridentata wyomingensis* and black sagebrush *A. nova* found at low elevations (< 2,000 m a.s.l.), and mountain big *A. tridentata vaseyana* and low sagebrush *A. arbuscula* found at high elevations. Other common shrub species within these communities included common snowberry *Symphoricarpos albus*, western serviceberry *Amelanchier alnifolia*, bitterbrush *Purshia tridentata*, basin big sagebrush *A. tridentata tridentata*, rabbitbrush *Chrysothamnus* spp. and greasewood *Sarcobatus vermiculatus*. Single-leaf pinyon pine *Pinus monophylla* and Utah juniper *Juniperus osteosperma* were common in our study area, but tended to be found as bands in mid-elevations between the two communities. Large-scale wildfires have converted much sagebrush steppe into grasslands dominated by invasive cheatgrass *Bromus tectorum* and planted exotic crested wheatgrass *Agropyron cristatum*. Topography was intermittent rugged mountain ranges and hills separated by broad xeric valleys. Sage-grouse were generally distributed across all sagebrush habitats during the nesting season, but during the dry fall season, moisture largely restricted them to either high-elevation mountain big sagebrush habitats or low-elevation agricultural areas (primarily irrigated pastures) adjacent to shrub steppe (Blomberg et al. 2013).

Predator communities in our study area were diverse. The most common mammalian predators were coyote *Canis latrans*, bobcat *Lynx rufus*, American badger *Taxidea taxus* and grey fox *Urocyon cinereoargenteus*. Common avian predators included golden eagle *Aquila chrysaetos,* prairie falcon *Falco mexicanus*, great-horned owl *Bubo virginianus*, northern goshawk *Accipiter gentilis*, Cooper's hawk *A. cooperii*, red-tailed hawk *Buteo jamaicensis*, ferruginous hawk *B. regalis* and northern harrier *Circus cyaneus*.

Field monitoring

We captured male and female sage-grouse during the spring breeding season around leks, and during the fall in high-elevation seasonal habitats using standard nightlighting techniques (Connelly et al. 2003). During 2008-2012, we captured birds from 1 March to 15 May and from 28 August to 26 September. Sage-grouse were aged as subadult (< 1 year old) or adult (> 1 year old) based on feather characteristics (Crunden 1963), and were banded with both a uniquely numbered aluminum leg band (National Band and Tag, Newport, Kentucky; size 14 for females, size 16 for males) and a 3-character plastic color band (Spinner Plastics, Springfield, Illinois). We fitted sage-grouse with a 22 g necklace-style radio-transmitter (Advanced Telemetry Systems, Isanti, Minnesota, model A4060) having a 'mortality switch' that doubled the signal pulse following eight hours of inactivity. Our monitoring of males during the spring was typically more sporadic than for females, and we were interested in the effect of nesting status on subsequent survival, so we only included females in analyses of nesting season data. However, we included both sexes in the analysis of fall-season survival when male live/dead status was recorded more regularly. All capture and monitoring of sage-grouse was approved by the University of Nevada Reno Institutional Animal Care and Use Committee (Protocol Numbers A05/06-22).

We analyzed data collected during 2008-2012 for the nesting seasons, and during 2008-2010 for the fall seasons. During the fall, we checked radio-signals for mortality pulse rate at least once every one to three days. Every three days during the nesting season, we also attempted to visually locate females to record nesting status (described in Blomberg et al. 2013). We typically used handheld receivers and three-element Yagi antennas; however, when necessary, we searched for missing birds from fixed-wing aircraft. Individual status was recorded as live/dead based on signal pulse rate, and upon indication of mortality, we located the transmitter to confirm mortality and estimate cause of death. We assumed predation when we found a carcass with muscle tissue clearly removed from bones, or when we found no carcass, but found remains (feathers, bone) that suggested predation (e.g. broken bones, teeth or claw marks on feathers). When we found no evidence of predation associated with a carcass, or when we presumed predation occurred and substantial tissue still remained, we collected and froze all remains for necropsy and disease testing. Necropsy and disease testing were conducted at Oregon State University's Veterinary Diagnostic Laboratory within the College of Veterinary Medicine. For assumed predation events, we also attempted to distinguish between mammalian and avian predators based on specific characteristics of remains. We assumed raptor predation in cases where contour feathers were cleanly plucked (Errington & Hamerstrom 1936), and were in a relatively neat pile at the kill site (i.e. a plucking mound). In contrast, we assumed mammalian predation in cases where feather vanes were crushed or sheared, and feathers were widely scattered around the kill site. These criteria were consistent with those used by Thirgood et al. (1998) to establish identity of predators of red grouse *Lagopus lagopus scoticus*. We also considered additional predator signs at the kill site, such as tracks or scat to evaluate causes of mortality; however, we considered such evidence to be of secondary value. Aluminum leg bands and radio-collars were stamped with telephone numbers to facilitate harvest reporting by hunters. The hunting season occurred 25 September - 9 October each year.

Analysis

We conducted two separate analyses as part of this research; a known-fate survival analysis (Sandercock 2006) to evaluate sources of individual and temporal variation in weekly survival, and a cumulative incidence function model (Heisey & Patterson 2006) to assess the relative risk of cause-specific sources of mortality. We conducted both analyses because the former allowed greater flexibility in evaluating sources of variation in mortality rates (1 - survival), whereas the later allowed us to directly compare relative risks among mortality factors. Because of the large temporal gap between the nesting and fall seasons (1 June - 14 August) and varying number of years of data available for analysis, we conducted separate analyses for each season.

Known-fate survival analysis

We first summarized live/mortality pulse rate signals into weekly encounter histories for each season, and estimated survival rates during weekly intervals using the known-fate module (a modified Kaplan-Meier analysis) of Program MARK (White & Burnham 1999). We tested for potential sources of temporal and/or individual variation in survival using a set of a priori general linear models. Temporal effects that were evaluated included annual, weekly and bi-

weekly variation, as well as models where we considered linear and quadratic time-varying trends on weekly survival. Individual effects included individual age (subadult < 1 year old, adult > 1 year old) and sex (male vs female; fall only). Individuals that were captured as subadults, but monitored for > 1 year, were classified as adults in subsequent years. We also considered an interaction effect between age and sex in the fall analysis.

For the nesting season, we evaluated whether females experienced greater mortality risk while incubating eggs compared to other periods. This question was confounded by survival, however, because females that survived an entire interval had an inherently longer time to be detected on a nest. For this reason, we only considered the effect of nesting status in week t on survival during week t+1, and included nesting status as a time-varying individual covariate.

We hypothesized that the timing of raptor migration may influence mortality in our system during the fall (Robinson et al. 2009). We obtained raptor migration data from HawkWatch International (http://www.hawkwatch.org) for their raptor migration site in the Goshute Mountains, located at a similar latitude and approximately 175 km east of our study site. We realize that data collected at this distance may not accurately reflect raptor abundance within our study site. However, we assumed raptor migration would follow a similar timing because both locations were at similar latitudes, and therefore, the Goshute Mountain data provided a useful approximating index to raptor migration within our study area. These data consisted of daily counts of individual raptors, by species, and were collected by HawkWatch personnel between 15 August and 5 November each year. For this analysis, we considered migration timing for all raptors, all *Accipiter* spp., all *Buteo* spp. and golden eagles only. We first adjusted raw counts to correct for daily variation in the number of observers or total hours of observation in a given day. We used the GENMOD procedure with a specified Poisson distribution in SAS (SAS Institute, Cary, North Carolina) to regress the daily count for each raptor group on the number of observers and total hours of observation recorded for that day. We calculated daily residual scores for each species or species group based on these regressions, and used these values as corrected estimates of daily passage rates. To evaluate correlations between timing of raptor migration and sage-grouse survival, we calculated mean weekly passage rates for each raptor group, and used these values as weekly group covariates in our survival analysis. Thus, we were able to test for potential effects of timing (within year) and magnitude (among years) of raptor passage rates on sage-grouse survival. Finally, we also examined the possibility of reduced survival during the 15-day sage-grouse hunting season by evaluating models where survival was constrained to be different during weekly intervals that overlapped the hunting season.

In each analysis, we evaluated support for individual and temporal covariates by comparing them to an intercept-only 'null' model (i.e. no meaningful variation in weekly survival) using an information theoretic approach (Burnham & Anderson 2002). Using Akaike's Information Criterion adjusted for small sample size (AIC_c), we considered any model within 2.0 ΔAIC_c of the best model to be competitive, but also assumed that those models that did not outcompete the null model did not explain any meaningful variation in weekly survival rates. We used model-averaging for all survival estimates ± SE, and calculated parameter coefficients (β) along with 85% confidence intervals (Arnold 2010), and considered covariate effects to be meaningful when 85% confidence intervals did not overlap 0.0, consistent with recommendations made by Arnold (2010). We report all parameter estimates (e.g. weekly survival) ± SE, unless otherwise indicated.

Cumulative incidence function model

Our second objective was to evaluate the relative risk to sage-grouse from differing sources of mortality (e.g. mammal vs raptor predation). Heisey & Fuller (1985) developed a modified Kaplan-Meier approach to estimate cause-specific mortality risk in a staggered entry design. In our study, individuals entered the sample in staggered intervals because they were radio-marked at different times, and the timing of different sources of mortality was not evenly distributed across sampling intervals (Fig. 1), so our data were appropriate for a staggered entry approach. We used the package wild1 in Program R (R Development Core Team 2011) to estimate nonparametric cumulative incidence functions, which describe the cumulative risk of cause-specific sources of mortality M(k) (e.g. human harvest) during successive study intervals (Heisey & Patterson 2006). This approach also allowed us to estimate the cumulative risk of mortality M(t) defined as the sum of each individual risk function, including mortalities that could not be attributed to a specific cause. This cumulative mortality risk should have

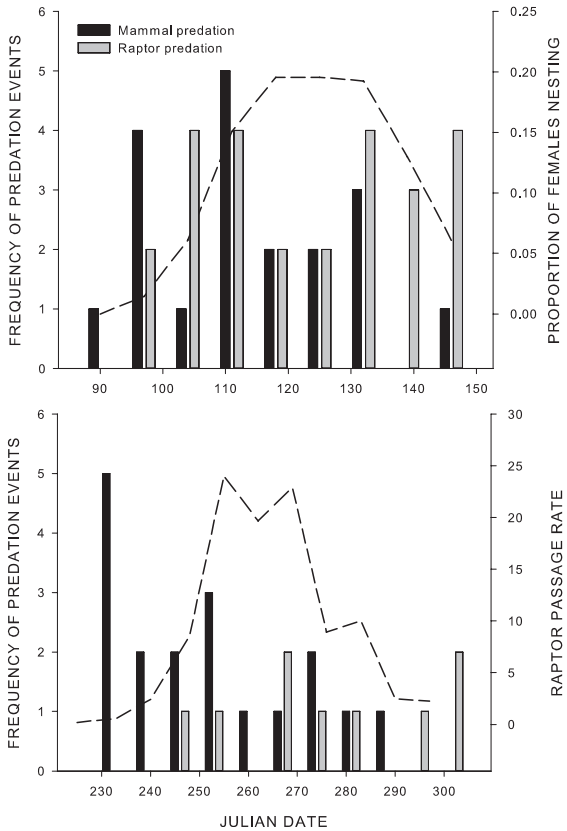

Figure 1. Distribution of sage-grouse predation events by predator type during the nesting and fall periods in Eureka County, Nevada. The proportion of radio-marked females known to be on a nest and the timing of annual raptor migration during the fall are identified by dashed lines and secondary y-axes. Raptor migration timing was estimated using data from the HawkWatch International Raptor Migration Study Site in the Goshute Mountains, located approximately 175 km east of our study site. Julian date 90 = 29 March and Julian date 230 = 16 August.

been the complement to overall fall survival probability based on known-fate estimates, that is $M(t) \sim 1 - \Phi_{(fall)}$, although we expected slight differences due to variation among the analytical methods. We calculated cumulative incidence functions for each weekly interval, and assessed risk individually for mammalian predation, raptor predation and mortality associated with human harvest (fall only). During each season, we also included a final 'unknown' category when we could not establish cause of mortality. In cases where cause could not be established, or when predator type was not clear, we included mortalities in the unknown category. Because these instances represented a relatively small proportion of total mortalities during our study, our estimates of predation risk should be viewed as conservative. Incorporation of an unknown risk category allowed for M(t) to reflect more accurately the survival of our sample.

Results

We monitored 203 individual female sage-grouse during the nesting season between 2008 and 2012, and 132 individual females and 41 individual male sage-grouse during the fall between 2008 and 2010. Of these individuals, 74 were classified as subadults during one nesting season, and 26 were classified as subadults during one fall season. We investigated 87 mortalities of radio-marked sage-grouse, which are summarized in Table 1. The most common source of mortality was predation, which accounted for 90% (N = 78) of all mortalities (see Table 1). During the nesting season, we classified 25 predation events as mammalian, 19 predations as raptors and four of unknown predator class. During the fall, we classified 18 predation events as mammalian, nine predation events as raptors and three of unknown predator class. Hunters legally harvested and reported two female and two male sage-grouse during the fall, and an additional female was determined through necropsy to have been shot and not recovered by the hunter. We classified four additional fall mortalities as unknown, two of which were not recovered quickly enough to establish cause of death, but evidence at the mortality site was consistent with either predation or scavenging. One bird was recovered with broken neck vertebra, and may have collided with a nearby (~ 20 m) barbed-wire fence. Finally, we observed a female sage-grouse on 2 October 2009 that was unable to fly and was recovered dead four days later before her mortality sensor activated. She was either predated or scavenged following death, but we could not establish the cause of her flightless condition; therefore, we classified her cause of mortality as unknown. This female and four others tested negative for West Nile Virus.

Weekly survival was correlated with year and individual age during the nesting season (Table 2). Adults had higher weekly survival ($\varphi = 0.99 \pm 0.01$) compared to subadults in their first breeding season ($\varphi = 0.98 \pm 0.01$). Model selection results also suggested annual variation in weekly survival rates. Although the range of weekly survival among years was relatively low (0.96 ± 0.02 - 0.98 ± 0.01), the total variation in nesting season survival ranged from a low of 0.72 ± 0.01 in 2008 to a high of 0.85 ± 0.01 in

Table 1. Summary of cause-specific mortalities of radio-marked sage-grouse in Eureka County, Nevada, USA, by season, sex and age class. Harvest only occurred during the fall season. Male sage-grouse were not including in the nesting season analysis.

	Cause of mortality				
Sex/age class	Raptor	Mammal	Unknown predator	Harvest	Undetermined
Fall					
Adult female	5	14	1	3	2
Subadult female	2	2	1	0	1
Adult male	1	2	0	1	1
Subadult male	1	0	1	1	0
Total fall	9	18	3	5	4
Nesting					
Adult female	11	17	2	-	0
Subadult female	8	8	2	-	0
Adult male	-	-	-	-	-
Subadult male	-	-	-	-	-
Total spring	19	25	4	-	0
Total study	28	43	7	5	4

2012. We found no evidence to suggest differing survival between nesting and non-nesting hens. There was suggestive evidence that female survival declined slightly throughout the nesting season (see Table 2). However, inclusion of the linear trend did not improve model fit, and confidence intervals on the parameter coefficient overlapped 0.0 ($\beta = -0.07$; 85% CI: -0.16 - 0.02). Based on model-averaged parameter estimates, the overall probability of a female sage-grouse surviving the eight-week nesting season was 0.79 ± 0.01.

In the fall, weekly survival was correlated with individual age and increased slightly throughout the fall season (Table 3). We found that average weekly survival was higher for adults ($\varphi = 0.98 \pm 0.03$) compared to hatch-year birds ($\varphi = 0.95 \pm 0.04$). Model results also suggested that weekly survival increased progressively during the fall period, based on support for a linear trend ($\beta = 0.09$; 85% CI: 0.01-0.17). However, a model that did not contain the weekly trend was also competitive ($\Delta AIC_c = 0.37$). In general, weekly survival was relatively invariant during the fall season, as indicated by inclusion of the intercept-only null model in the competitive model set ($\Delta AIC_c = 1.21$), and a relatively small amount of variation between minimum and maximum weekly survival estimates within the fall period. Model-averaged estimates of weekly survival ranged from 0.97 ± 0.01 to 0.98 ± 0.01, and the overall probability of a sage-grouse surviving the 10-week fall season was 0.79 ± 0.03. We found no support for an effect of raptor migration timing on weekly survival rates for any raptor species group we considered, and found no support for reduced weekly survival during the hunting season (see Table 3).

During the nesting season, predation risk was similar between raptor and mammalian predators (see Fig. 1). The cumulative risk of a female being killed by a mammalian predator during the entire eight-week study interval was 0.10 (95% CI: 0.05-0.16), whereas the cumulative risk of raptor preda-

Table 2. Model selection results for known-fate analysis of weekly survival for radio-marked female sage-grouse during the spring nesting season (1 April - 31 May) in Eureka County, Nevada, USA, 2008-2012. Model selection notation follows Burnham & Anderson (2002). Age = subadult (< 1 year of age) vs adult (> 1 year of age). BiWeek = weekly intervals grouped into sequential two-week periods. Weekly trend = a linear trend applied across one-week intervals. Nest = weekly nesting status (observed on a nest vs not observed on a nest). AIC_c = Akaikie's information criterion corrected for small sample size. ΔAIC_c = change in AIC_c relative to the top model. w_i = Akaike weights. K = number of model parameters.

Model	AIC_c	ΔAIC_c	w_i	K	Deviance
Year + Age	479.94	0.00	0.28	6	467.89
Year + Age + Weekly trend	480.57	0.63	0.20	7	466.51
Age	482.21	2.27	0.09	2	478.20
Year	482.53	2.60	0.08	5	472.50
Null	482.72	2.78	0.07	1	480.71
Weekly Trend	483.02	3.09	0.06	2	479.02
Year + Weekly trend	483.15	3.21	0.06	6	471.10
Year + (Weekly trend)^2	483.64	3.70	0.04	7	469.58
(Weekly trend)^2	483.84	3.90	0.04	3	477.83
Year + Nest	484.20	4.27	0.03	6	472.16
Nest	484.38	4.45	0.03	2	480.38
BiWeek	486.14	6.20	0.01	4	478.12
Year + BiWeek	486.18	6.24	0.01	8	470.10
Year + Week	490.38	10.44	0.00	13	464.19
Week	490.47	10.53	0.00	9	472.38

Table 3. Model selection results for known-fate analysis of weekly survival for radio-marked sage-grouse during the fall season (15 August - 31 October) in Eureka County, Nevada, 2008-2010. Model selection notation follows Burnham & Anderson (2002). Age = subadult (< 1 year of age) vs adult (> 1 year of age). Sex = male vs female. BiWeek = weekly intervals grouped into sequential two-week periods. Weekly trend = a linear trend applied across one-week intervals. Total raptor = weekly passage rate of all raptors recorded at the Goshute Mountain Raptor Migration site, after correcting for daily number of observers and total hours of observation. *Buteo* spp., *Accipiter* spp. and Golden eagle models represented weekly passage rates for each of these raptor species groups. Hunt = survival was modeled independently for hunting season and non-hunting intervals. AIC_c = Akaikie's information criterion corrected for small sample size. ΔAIC_c = change in AIC_c relative to the top model. w_i = Akaike weights. K = number of model parameters.

Model	AIC_c	ΔAIC_c	w_i	K	Deviance
Age + Weekly trend	388.49	0.00	0.17	3	382.48
Age	388.86	0.37	0.15	2	384.86
Null	389.70	1.21	0.10	1	387.70
Weekly trend	389.72	1.23	0.09	2	385.71
Age + Year + Weekly trend	389.90	1.41	0.09	5	379.86
Fall	390.43	1.94	0.07	2	386.43
(Weekly trend)^2	391.60	3.11	0.04	3	385.58
Golden eagle	391.61	3.12	0.04	2	387.61
Buteo spp.	391.64	3.15	0.03	2	387.63
Sex	391.66	3.17	0.03	2	387.66
Total raptor	391.67	3.18	0.03	2	387.67
Accipiter spp.	391.68	3.19	0.03	2	387.68
Sex + Weekly trend	391.69	3.20	0.03	3	385.68
Hunt	391.70	3.21	0.03	2	387.69
Year	392.06	3.57	0.03	3	386.05
Year + Weekly trend	392.17	3.68	0.03	4	384.15
Year + Hunt	394.05	5.56	0.01	4	386.03
Year + (Weekly trend)^2	394.10	5.61	0.01	5	384.06
Sex + Year + Weekly trend	394.16	5.67	0.01	5	384.13
BiWeek	395.41	6.92	0.01	5	385.37
Year + BiWeek	397.91	9.42	0.00	7	383.84

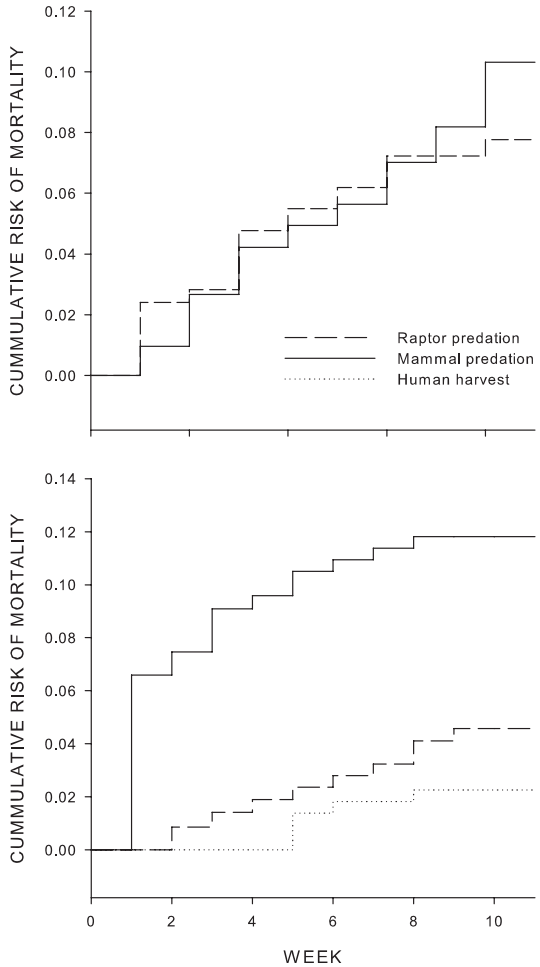

Figure 2. Cumulative incidence functions for competing risks of sage-grouse mortality during the nesting and fall periods in Eureka County, Nevada. Human harvest only occurred during the fall. Week 1 began on 1 April during the nesting season and on 15 August during the fall.

tion was 0.08 (95% CI: 0.03-0.13). We found no evidence that females were more susceptible to either competing mortality risks, and both risks appeared evenly distributed across the spring nesting period (Fig. 2). The cumulative risk of mortality during the entire nesting season, including sources of unidentified mortality, was 0.21 (95% CI: 0.16-0.26), which was consistent with our known-fate survival estimates for the same period ($\varphi = 0.79$; 95% CI: 0.77-0.81).

Predation by mammals represented the largest mortality risk to sage-grouse during the fall (see Fig. 1); cumulative hazard functions estimated the risk of mammal predation during the entire 11-week season to be 0.12 (95% CI: 0.04-0.19), and risk of mammalian predation was proportionally higher during the early portion of the season (see Fig. 2). Raptors were the second greatest risk, with a cumulative risk of 0.05 (95% CI: 0.00-0.10). In contrast to mammal predation, risk of predation by raptors was generally evenly spread across the fall season (see Fig. 2). Risk of human harvest was lower than either forms of predation risk ($M_{(hunt)} = 0.02$; 95% CI: 0.0-0.06), and occurred in conjunction with the annual sage-grouse hunting season (see Fig 2). After accounting for sources of unidentified mortality, the cumulative risk of mortality during the entire fall season was 0.23 (95% CI: 0.17-0.29), which was consistent with our estimate of cumulative survival based on the known-fate analysis ($\varphi = 0.79$; 95% CI: 0.73-0.85).

Discussion

As in other studies of sage-grouse (Hagen 2011), predation was the largest source of mortality. During the fall, we found risk of predation by mammals to be greater than that of raptors, whereas during the nesting season, the two predation risks were more equivalent. In contrast, we found relatively little evidence to support high levels of other sources of mortality during either season. During the fall, the cumulative risk of predation was nearly three times greater ($M_{(pred)} = 0.17$) than all other sources of mortality combined (hunting, collision, undetermined; $M_{(other)} = 0.06$), and during the nesting season, the risk of predation was six times greater ($M_{(pred)} = 0.18$) than other sources ($M_{(other)} = 0.03$). Attaching radio-transmitters may influence mortality risk for some species (Barron et al. 2010). Gibson et al. (in press) found that radio-transmitters influenced male sage-grouse breeding behaviour, but survival did not differ between males marked with radio-transmitters and those marked with tarsal bands only. We therefore assumed radio-marking did not influence survival and bias our results during this study.

Unlike some other studies of radio-marked sage-grouse, we did not find substantive mortality risk other than predation. Connelly et al. (2000) reported that 15% of male mortalities and 42% of female mortalities were caused by hunting. Beck et al. (2006) classified causes of mortality for juvenile (subadult) sage-grouse at two study sites and reported that mammal and raptor predation accounted for 27% and 36% of mortalities, respectively; hunting mortality accounted for an additional 27%. Mortality associated with West Nile Virus has been substantial for some sage-grouse populations (Moynahan et al. 2006, Walker & Naugle 2011). However, we did not detect this virus during our study nor has it been documented previously from our study area (Blomberg et al. 2013). However, direct comparison between our results and those of others is problematic because we are the first to account for potential sampling bias when evaluating mortality risk in sage-grouse (Heisey & Fuller 1985, Heisey & Patterson 2006). In addition, some previous studies reported proportional rates of mortality based on small samples of recorded mortalities.

Regardless of methods, we expected variation among studies in sources of mortality, which may result from population-level variation in predator communities, human disturbance, habitat composition and other factors. Such variation among grouse studies is common. For example, Wolfe et al. (2007) documented a substantial number of collision-related mortalities for lesser prairie chickens *Tympanuchus pallidicinctus* in Oklahoma and New Mexico. In contrast, Hagen et al. (2007) did not document any collision mortality of lesser prairie chickens in western Kansas. For black grouse *Tetrao tetrix*, major mortality rates have been attributed to collisions (Miquet 1990), predation primarily by raptors (Angelstam 1984) and a mixture of raptor and mammalian predation (Warren & Baines 2002).

With a few exceptions, we found little evidence of temporal variation in survival during either the nesting or fall periods. Survival appeared to vary among nesting seasons, which was consistent with a larger analysis of female seasonal survival in this system (Blomberg et al. 2013). We also found that weekly survival increased throughout the fall, and this effect was consistent with higher predation by mammals during the early weeks of the fall period (see Fig. 2). The nesting and fall seasons likely represent biologically meaningful time intervals for sage-grouse in our study area, because rates of predation were relatively constant within these time intervals, whereas survival was higher during the summer and winter periods (Blomberg et al. 2013).

Adult sage-grouse were less susceptible to predation than subadults. Of previous studies that have examined survival of both age-classes in a single analysis, we found no reports of a positive association between age and survival. Baxter et al. (2008) and Moynahan et al. (2006) reported no age-related variation in survival in Utah and Montana, respectively. In contrast to our results, Zablan et al. (2003) reported higher survival rates for subadult sage-grouse of both sexes in Colorado. Also, in contrast to Zablan et al. (2003), we found no effect of sex on survival during the fall, although our sample of males was relatively small compared to our sample of females.

Survival of female sage-grouse in this system is reduced during the nesting season relative to winter or summer (Blomberg et al. 2013). However, within the nesting season, we did not find evidence that incubating female sage-grouse had reduced survival compared to females not known to be on a nest. In our study, we typically did not detect females on nests until after the onset of incubation. If females were equally susceptible to predation during other stages of nesting, such as while prospecting for nest sites or

during egg laying, we were limited in our ability to detect such risks.

We found that weekly survival of sage-grouse was not correlated with timing of raptor migration during the fall. This result contrasts to a study of chukar *Alectoris chukar* conducted in western Utah, where 91% of known predation events were classified as raptor predation, and survival during the fall was reduced during the peak of raptor migration (Robinson et al. 2009). One possible explanation for the discrepancy between our two studies was that chukar, due to their smaller body size, are more vulnerable to a wider range of raptor species compared to sage-grouse. Although we observed predation of adult sage-grouse by raptors as small as Cooper's hawks, it has been generally assumed that large-bodied raptors such as golden eagles are the major source of raptor predation in sage-grouse (Schroeder & Baydack 2001). Given that predation risk from mammals was equal to, or greater than, that of raptors, little evidence for a negative association between raptor migration and sage-grouse survival was not surprising. However, we acknowledge that the raptor migration data we used was collected a substantial distance (~ 175 km) from our study area, and lack of support for a raptor migration effect may have reflected this separation. Also worth noting, is that we did not observe any instances of woodrat *Neotoma* spp. removal of radio-transmitters during our study, which was observed frequently during a study of chukar in western Utah (Larsen et al. 2008).

One potential limitation of our study is that we may have misclassified certain mortalities as mammalian predation that, in fact, represented scavenging by mammalian carnivores. However, we feel any error in this regard was minimal because we monitored birds with sufficient frequency to recover individuals prior to scavenging. Stevens et al. (2011) found that mean time to scavenging of female ring-necked pheasant *Phasianus colchicus* carcasses in sagebrush steppe habitats was 5.8 days, and reported a daily probability of initial scavenging of approximately 0.2. Based on these values and assuming a three-day sampling interval, a sage-grouse dying from non-predation mortality (e.g. collision) would have an approximately 0.51 probability of being scavenged prior to detection. We found three sage-grouse known to have died from causes other than predation or hunting during our study. A conservative estimate for misclassification would therefore be three mortalities misclassified as predation events that were in fact caused by other sources. Given the relatively large sample of total mortalities (N = 87) contained in our data set, we believe this potential error rate (~ 3.4%) is acceptable.

Hunting was probably a minor source of mortality in our study population. The nearest human population centers were relatively distant from our study area; driving distances from the cities of Reno and Elko, Nevada, were approximately 385 km and 145 km, respectively. However, fall sage-grouse habitats typically were accessible by road, and nearly all sage-grouse were found on public lands that were accessible to hunters. We also observed hunters in our study area during all years of our study. Our estimates of cumulative hazard risk for harvest-related mortality are analogous to an overall harvest mortality rate for this population, and included both harvest and crippling loss of shot sage-grouse. This harvest rate estimate (2%) was considerably lower than estimates from other sage-grouse populations, and accordingly harvest should operate in a compensatory manner (Sedinger et al. 2010, Reese & Connelly 2011). Moreover, survival did not decline during the hunting season relative to the rest of the fall period, so we infer that hunting was not adversely impacting the sage-grouse population in our study area.

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Research Article

Greater Sage-Grouse Juvenile Survival in Utah

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ABSTRACT Greater sage-grouse (*Centrocercus urophasianus*; sage-grouse) adult hen and juvenile survival have been shown to have significant influence on population growth rates. However, assessing the sensitivity of population growth rates to variability in juvenile survival has proven difficult because of limited information concerning the potentially important demographic rate. Sage-grouse survival rates are commonly assessed using necklace-type radio transmitters. Recent technological advances have lead to increased interest in the deployment of dorsally mounted global positioning system (GPS) transmitters for studying sage-grouse ecology. However, the use of dorsally mounted transmitters has not been thoroughly evaluated for sage-grouse, leading to concern that birds fitted with these transmitters may experience differential mortality rates. We evaluated the effect of transmitter positioning (dorsal vs. necklace) on juvenile sage-grouse survival using a controlled experimental design with necklace-style and suture-backpack very high frequency (VHF) transmitters. To evaluate the effects of temporal variation, sex, and transmitter type on juvenile sage-grouse survival, we monitored 91 juveniles captured in south-central Utah from 2008 to 2010. We instrumented 19 females with backpacks, 14 males with backpacks, 39 females with necklaces, and 19 males with necklaces. We used Program MARK to analyze juvenile survival data. Although effects were only marginally significant from a statistical perspective, sex ($P = 0.103$) and transmitter type ($P = 0.09$) were deemed to have biologically meaningful impacts on survival. Dorsally mounted transmitters appeared to negatively affected daily survival ($\beta_{\text{transmitter type}} = -0.55$, SE $= 0.32$). Temporal variation in juvenile sage-grouse daily survival was best described by a quadratic trend in time, where daily survival was lowest in late September and was high overwinter. An interaction between the quadratic trend in time and year resulted in the low point of daily survival shifting within the season between years (27 vs. 17 Sep for 2008 and 2009, respectively). Overall (15 Aug–31 Mar) derived survival ranged 0.42–0.62 for females and 0.23–0.44 for males. For all years pooled, the probability death was due to predation was 0.73, reported harvest was 0.16, unreported harvest was 0.09, and other undetermined factors was 0.02. We observed 0% and 6.8% crippling loss (from hunting) in 2008 and 2009, respectively. We recommend the adoption of harvest management strategies that attempt to shift harvest away from juveniles and incorporate crippling rates. In addition, future survival studies on juvenile sage-grouse should use caution if implementing dorsally mounted transmitters because of the potential for experimental bias. © 2014 The Wildlife Society.

KEY WORDS *Centrocercus urophasianus*, crippling, greater sage-grouse, harvest, juvenile, radio-telemetry, survival, unreported harvest.

Wildlife managers require better information regarding the factors affecting greater sage-grouse (*Centrocercus urophasianus*; sage-grouse) population growth to optimize the effect of management actions on species conservation. Taylor et al. (2012) argued that in the absence of quantitative data regarding population-specific mortality factors, management actions should focus ultimately on increasing hen and chick survival. However, they recognized that the lack of reliable estimates of juvenile survival may have resulted in the importance of this demographic rate being under emphasized in their analysis. Johnson and Braun (1999) previously concluded that both adult and juvenile survival were the demographic parameters most limiting to population growth for sage-grouse. Although a substantial amount of information is available concerning population dynamics of adults (Crawford et al. 2004), a gap remains range-wide regarding the dynamics of juvenile sage-grouse (e.g., survival, dispersal, predation, recruitment; Crawford et al. 2004, Beck et al. 2006, Taylor et al. 2012).

Stakeholders have expressed concern regarding the possible impacts of harvest on sage-grouse populations (Connelly et al. 2004) despite the lack of evidence to suggest that current hunting regulations pose a long-term risk to sage-grouse conservation (Reese and Connelly 2011). However, few studies have examined the effects of hunting on sage-grouse populations (Connelly et al. 2000, 2003, 2004; Reese and Connelly 2011). Reese and Connelly (2011) concluded

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appropriate harvest rates were 5–10% of the fall population. A complication in setting appropriate harvest rates is that relatively few studies have addressed the effects of crippling losses in upland gamebird populations. Those that have studied crippling losses have used varying methods and definitions making comparison and accuracy difficult to assess (see Haines et al. 2006).

Technological advances have resulted in the development and miniaturization of global positioning system (GPS) packages for use on avian species. Many GPS packages are mounted dorsally on avian species. Transmitter-type and method of attachment may constitute a potential source of experimental bias if they result in altered behavior or survival rates. Burkepile et al. (2002) demonstrated that small (<2 g) suture-on backpack transmitters were an effective means of monitoring sage-grouse chicks. Numerous authors have reported adverse effects of backpack-style transmitters on waterfowl (Pietz et al. 1993, Dzus and Clark 1996, Fleskes 2003, Robert et al. 2006) and gamebirds (Small and Rusch 1985, Marcström et al. 1989, Connelly et al. 2003). However, many authors attribute the adverse effects of backpack-style transmitters to the attachment harness, not the dorsal positioning of the transmitter. Some authors (Höfle et al. 2004, Conner et al. 2006) have incorporated acclimatization periods into their studies to mitigate potential effects of radio-marking individuals. Conversely, Holt et al. (2009) concluded the best estimates of survival are derived without the use of an acclimatization period.

The purpose of our research was to evaluate juvenile sage-grouse daily survival rates. Specifically, we assessed cause-specific mortality (e.g., predation, harvest) and tested the hypotheses that 1) overwinter survival was high, 2) mortality peaked in fall, 3) males had lower daily survival rates, and 4) dorsal orientation of transmitters reduced survival.

STUDY AREA

The study was conducted on Parker Mountain in south-central Utah. Parker Mountain lies at the southern edge of the sage-grouse range (Schroeder et al. 2004). Elevation ranges from 2,200 m to 3,000 m and rises in elevation gradually from east to west. Parker Mountain experiences 65–80 frost-free days and receives 40–50 cm of precipitation annually, most of which occurs during the dormant season as snow (60%), and the remainder as rain in the late summer (Jaynes 1982). The vegetation was primarily black sagebrush (*Artemisia nova*) on ridges and mountain big sagebrush (*A. tridentata vaseyana*) in the swales. Quaking aspen (*Populus tremuloides*) clones were present at higher elevations. Pinyon pine (*Pinus edulis*) and juniper (*Juniperus* spp.) occurred at lower elevations. Golden eagles (*Aquila chrysaetos*), weasels (*Mustela* spp.), badgers (*Taxidea taxus*), and coyotes (*Canis latrans*) are sage-grouse predators that occur on Parker Mountain. The study area consisted of lands managed by the Utah School and Institutional Trust Lands Administration, the Bureau of Land Management, and United States Forest Service. These agencies managed 46% (43,745 ha), 44% (42,643 ha), and 9% (8,327 ha) of the study area, respectively. Private lands accounted for 1% (1,363 ha) of the study area. The primary land use was cattle and sheep grazing. Big game and upland bird hunting, primarily sage-grouse, were important recreational uses. Because of the high degree of public ownership, Parker Mountain affords open public access.

The sage-grouse hunting seasons in 2008 and 2009 were 27 September–12 October and 26 September–11 October, respectively. In 2008, the Utah Division of Wildlife Resources (UDWR) issued 370, 2-bird permits on a first-come first-serve basis for the Parker Mountain unit. In 2009, the UDWR issued 265 2-bird permits on a draw basis.

METHODS

We captured juvenile birds using night spotlighting (Giesen et al. 1982, Wakkinen et al. 1992, Connelly et al. 2003) 1 August–30 September, annually. Capture effort ceased 2 days prior to the sage-grouse hunting season. Our capture effort concentrated on locations of radio-marked brood hens and areas where bird dogs detected broods. Upon capture, we distinguished adults from juveniles using characteristics of the first secondary flight feather (Beck et al. 1975). We ascertained sex in the field based on primary length and molt patterns (Beck et al. 1975 adapted from Eng 1955). For a subset of individuals ($n = 60$), we later confirmed sex through DNA analysis (Guttery et al. 2013*b*). We defined juvenile birds as young-of-the-year individuals >80 days of age through the beginning of the following breeding season. We chose 80 days because at this age sage-grouse consisted of enough body mass for instrumentation with adult-sized transmitters.

We fitted juveniles with suture-on backpack or necklace-style very high frequency (VHF) transmitters (American Wildlife Enterprises, Monticello, FL). All transmitters weighed 15 g and did not exceed 3% of the individual's body weight (Thirgood et al. 1995). The transmitters were battery powered and equipped with mortality switches (activated after 12 hours of inactivity). We randomly assigned the type of transmitter an individual received. We fitted backpack transmitters using the method described by Burkepile et al. (2002); however, we used a larger radio package and 2/0 suture thread. Suture-on backpack and necklace-style transmitters were physically identical, with the exception of mounting holes, to ensure the transmitter type comparison was between the positioning of the transmitter (i.e., necklace vs. dorsal). The study protocols were approved by the Utah State University Institutional Animal Use and Care Committee (IACUCC Number 942R).

We confirmed survival status remotely using the pulse signal emitted by the transmitters. We monitored radio frequencies from the ground daily from August–December, but did not always detect signals. During December–April, we monitored radio frequencies twice each month, largely from a fixed wing aircraft. Upon detection of mortality signals, we immediately located individuals. We classified mortalities into 4 groups: reported harvest, unreported harvest, predation, and other, using evidence from the site (e.g., marks on transmitter, feather patterns, tracks).

Reported harvests were events reported by hunters to either the UDWR or directly to investigators. We deemed a mortality to be an unreported harvest only if irrefutable evidence existed (e.g., lead shot in carcass, obvious shotgun wounds during necropsy, field dressed carcass). We defined crippled birds as a subset of unreported harvest. Cripples were sage-grouse found dead in the field with the carcass intact and with obvious shot wounds detected upon necropsy. We calculated the proportion of loss from crippling by hunters according to equation 6 in Haines et al. (2006).

To assess mortality causes and acclimatization to instrumentation period, we calculated maximum likelihood estimates and profile likelihood confidence intervals. We calculated mortality causes as conditional probabilities for each cause given death occurred. To assess the need or validity for an acclimation period, we calculated probability of mortality for the first 30 days post-capture (periods of 0–10, 11–20, and 21–30 days) for our sample of captured juveniles.

We used the nest survival model (Dinsmore et al. 2002) implemented in Program MARK (White and Burnham 1999) to estimate daily survival. We used the logit link function in all models. If an individual went missing during the study, we right-censored it on its last known survival date. We standardized time using 15 August as Day 1 and numbering sequentially through 31 March. For study Days 1–61, 1 model day equaled 1 calendar day. We compressed study Days 62–111 and 112–231 such that 1 model day equaled 10 and 15 calendar days, respectively. We compressed time in models to reflect differences in monitoring effort as a consequence of assumptions regarding survival (e.g., low winter mortality), and we explicitly accounted for the compression in Program MARK by adjusting interval lengths. We ranked models using Akaike's Information Criterion adjusted for sample size (AIC_c; Akaike 1973, Burnham and Anderson 2002), and we considered models with $\Delta AIC_c \leq 2$ equally supported by the data (Burnham and Anderson 1998). We modeled variation in survival from 15 August to 31 March as a function of sex, year, transmitter type, and temporal trends. We abbreviate quadratic trends (i.e., $T + T^2$) in time as T^2. We used a 2-step modeling approach in which we first evaluated models with 7 different time dynamics (Table 1) and then included the competing time models ($\Delta AIC_c \leq 2$) in our final analysis of covariates including sex, year, and transmitter type (Table 1). We used likelihood ratio tests to differentiate between competing models that were nested. We used the delta method (Seber 1982:7–9) to derive standard error estimates when daily survival rates were combined into longer intervals (e.g., fall, winter, total) of survival. To calculate confidence intervals for estimates derived using the delta method, we transformed estimates to the logit scale then back-transformed to the probability scale to ensure estimates were appropriately bounded at 0 and 1. For derived estimates and in our modeling framework we defined fall as the period from 15 August to 1 December, winter as 2 December to 31 March, and total as 15 August to 31 March.

Table 1. Two sets of a priori candidate models that include either time (time-structured models) or covariates (covariate models) used to evaluate daily survival of juvenile greater sage-grouse (*Centrocercus urophasianus*) on Parker Mountain, Utah, USA, 2008–2009. We used combinations of these models both additively and interactively to assess 29 candidate models of juvenile survival.

Time-structured models[a]	Covariate models
Constant	Transmitter type
Full Time Dependent	Sex
$Linear_{fall} + Constant_{winter}$	Year
$Constant_{fall} + Constant_{winter}$	Sex + transmitter type
$Quadratic_{fall} + Constant_{winter}$	Year + sex
Quadratic	Year + transmitter type
$Constant_{\text{Aug–Open of Hunting Season}} + Constant_{\text{Hunting Season}} + Constant_{\text{14 days post Hunting Season}} + Constant_{\text{Last week in Oct–30 Nov.}} + Constant_{winter}$	Year + sex + transmitter type

[a] fall = 15 Aug–30 Nov; winter = 1 Dec–31 Mar; models with no subscripts indicate we modeled the entire study period (15 Aug–31 Mar) similarly.

RESULTS

We captured 91 juvenile sage-grouse (8 female backpack, 7 male backpack, 10 female necklace, 5 male necklace in 2008; and 11 female backpack, 7 male backpack, 29 female necklace, 14 male necklace in 2009). Our sex assignment using Beck et al. (1975) was later confirmed 100% accurate ($n = 30$) by subsequent DNA analysis. However, in 5 instances (all females) 1 of the 2 primary length measurements (length of primary 10) for sex classification was inconclusive. Furthermore, at capture, molt had not progressed enough to implement the methods outlined by Beck et al. (1975). In these cases, we relied on DNA to classify sex. Probability of mortality was not higher during initial periods following instrumentation (Table 2). Consequently, we did not include an acclimatization period in the survival analyses.

We recorded 17 and 27 mortalities in 2008–2009 and 2009–2010, respectively. We did not record mortalities 4 January 2009–31 March 2009 (n alive = 7) or 1 December 2009–31 March 2010 (n alive = 27). The average number of model days (i.e., compressed time) from last live signal to mortality detection was 7.4 model days (SE = 1.02). The conditional probability of death was highest for predation and harvest (reported and unreported) contributed to mortality (Table 3). Harvest rate was 26.9% in 2008; 23.1% were reported as harvested and 3.9% were harvested but not reported (bird was found dressed in the field). Harvest rate was 9.3% in 2009; 2.3% were reported as harvested, and 7.0% were harvested but not reported (all were cripples).

We considered 2 time structure models to be competing (T^2 = top model and $T^2_{fall} + constant_{winter}$ $\Delta AIC_c = 2.02$) from our initial model evaluation step (1 other model was $\Delta AIC_c = 5.1$ and all others were $\geq \Delta AIC_c = 26.73$). We then combined these 2 time structures with our covariates into our 29 a priori candidate model set (Table 4). We considered 4

Table 2. Probabilities of death and 95% confidence intervals during the initial (i.e., acclimatization) period compared to 2 later periods in juvenile greater sage-grouse (*Centrocercus urophasianus*) on Parker Mountain, Utah, USA, 2008–2009.

Days post capture	2008			2009			Both years		
	No. at risk	Probability of death	95% CI[a]	No. at risk	Probability of death	95% CI[a]	No. at risk	Probability of death	95% CI[a]
0–10	30	0.100	0.026–0.239	61	0.098	0.04–0.189	91	0.099	0.049–0.171
11–20	27	0.296	0.148–0.482	55	0.073	0.023–0.161	82	0.134	0.072–0.219
21–30	19	0.158	0.042–0.36	51	0.137	0.061–0.249	70	0.143	0.074–0.237

[a] Profile likelihood confidence interval.

Table 3. Probability death was due to specific causes for juvenile greater sage-grouse (*Centrocercus urophasianus*) on Parker Mountain, Utah, USA, 2008–2010.

Mortality causes	2008–2009		2009–2010		Combined	
	Probability of death	95% CI[a]	Probability of death	95% CI[a]	Probability of death	95% CI[a]
Reported harvest	0.353	0.158–0.589	0.037	0.002–0.153	0.159	0.072–0.285
Unreported harvest	0.059	0.004–0.234	0.111	0.029–0.263	0.091	0.029–0.199
Predation	0.588	0.354–0.797	0.815	0.643–0.929	0.727	0.585–0.844
Other	0		0.037	0.002–0.153	0.023	0.001–0.096

[a] Profile likelihood confidence interval.

survival models to be competitive ($\Delta AIC_c < 2$; Table 4). Based on likelihood ratio tests, we considered sex ($\chi^2_1 = 2.654$, $P = 0.103$) and transmitter type ($\chi^2_1 = 2.873$, $P = 0.09$) to have had marginal effects on juvenile daily survival rates (Table 5). Consequently, we considered the general model biologically meaningful. The general model consisted of a quadratic relationship between time (T^2) elapsed from capture and probability of daily survival, an interaction between time and year, and an additive effect of both sex and transmitter. We did not model average parameter estimates because marginal evidence existed for an experimentally introduced source of bias in survival due

Table 4. Models evaluated in Program MARK to estimate juvenile greater sage-grouse (*Centrocercus urophasianus*) daily survival on Parker Mountain, Utah, USA, 2008–2010. AIC_c, Akaike's Information Criterion adjusted for sample size; ΔAIC_c, difference in AIC_c values between each model and the best model; ω_i, AIC_c weight; Model likelihood = ($\omega_i/\omega_{best\ model}$); *K*, number of parameters.

Model[a,b]	AIC_c	ΔAIC_c	ω_i	Model likelihood	*K*	Deviance
$T^2 \times$ year + sex + type	307.31	0.00	0.27	1.00	7	293.27
$T^2 \times$ year + type	307.95	0.65	0.20	0.72	6	295.92
$T^2 \times$ year + sex	308.17	0.86	0.18	0.65	6	296.14
$T^2 \times$ year	308.98	1.67	0.12	0.43	5	298.96
T^2 + year + sex + type	311.89	4.58	0.03	0.10	6	299.86
T^2 + year + type	312.03	4.73	0.03	0.09	5	302.01
$T^2 \times$ type	312.58	5.28	0.02	0.07	5	302.56
T^2 + sex + type	312.61	5.31	0.02	0.07	5	302.59
T^2 + year + sex	312.85	5.54	0.02	0.06	5	302.83
T^2_{fall} + sex + type + $constant_{winter}$	312.94	5.63	0.02	0.06	5	302.92
T^2 + year	313.04	5.73	0.02	0.06	4	305.02

[a] T^2 = quadratic trend in time (i.e., $T + T^2$); type = transmitter type; fall = 15 Aug–30 Nov; winter = 1 Dec–31 Mar; models with no time subscripts indicate we modeled the entire study period (15 Aug–31 Mar) similarly.

[b] Models with $\omega_i \leq 0.01$ not shown: T^2 + type; T^2_{fall} + year + sex + type + $constant_{winter}$; T^2_{fall} + year + type + $constant_{winter}$; $T^2 \times$ sex + type; T^2_{fall} + year + sex + $constant_{winter}$; T^2_{fall} + year + $constant_{winter}$; T^2 + sex; T^2_{fall} + type + $constant_{winter}$; T^2_{fall} + sex + $constant_{winter}$; T^2; $T^2_{fall} \times$ year + sex + type + $constant_{winter}$; $T^2_{fall} \times$ year + type + $constant_{winter}$; $T^2_{fall} \times$ year + sex + $constant_{winter}$; $T^2 \times$ sex; $T^2_{fall} \times$ type + $constant_{winter}$; $T^2_{fall} \times$ year + $constant_{winter}$; $T^2_{fall} \times$ sex + $constant_{winter}$; T^2_{fall} + $constant_{winter}$.

Table 5. Likelihood ratio test of top 4 models evaluated for juvenile survival (*S*) of greater sage-grouse (*Centrocercus urophasianus*) on Parker Mountain, Utah, USA, 2008–2010.

General model[a]	Reduced model[a]	χ^2	df	*P*	Hypothesis tested
$S(T^2 \times$ year + sex + type)	$S(T^2 \times$ year + type)	2.65	1	0.103	Sex-specific survival
$S(T^2 \times$ year + sex + type)	$S(T^2 \times$ year + sex)	2.87	1	0.090	Transmitter-specific survival
$S(T^2 \times$ year + sex + type)	$S(T^2 \times$ year)	5.69	2	0.058	Sex- and transmitter-specific survival

[a] T^2 = quadratic trend in time, type = transmitter type.

to transmitter type. Because transmitter type negatively influenced survival, we consider this approach to produce conservative survival estimates.

Female survival rates appeared to be higher (odds ratio = 1.7, 90% CI = 1.0–2.88) than males, and backpack radios appeared to negatively (odds ratio = 0.58, 90% CI = 0.34–0.98) affect survival (Tables 5 and 6). Survival was lower in 2008 than in 2009. In 2009, daily survival was lowest around 17 September, whereas in 2008 daily survival was lowest around 27 September (Figs. 1 and 2). Derived survival estimates varied 0.23–0.61, 0.33–0.62, and 0.69–0.98 by sex and year for total, fall, and winter, respectively (Table 7). We did not detect an acute transmitter-specific effect on mortality (i.e., mortality rates by transmitter type during all post-capture periods overlapped; Table 8).

DISCUSSION

The debate over radio handicapping of birds (see Guthery and Lusk 2004, Terhune et al. 2007) has led some researchers to question the use of radio transmitters for assessing survival. Using a controlled experimental design, we provide new evidence of differential survival rates by transmitter attachment type (dorsal vs. necklace) for juvenile sage-grouse. Although both necklace-style (Connelly et al. 1993, 2000; Schroeder and Robb 2003; Beck et al. 2006; Doherty et al. 2008) and harness-style backpack (Eng and Schladweiler 1972, Connelly et al. 1988) transmitters have been used to study sage-grouse, our results indicate that dorsal positioning of transmitters reduces survival. Our findings support additional studies that demonstrated other dorsal attachment methods (i.e., harness-style backpack transmitters) affect survival of gamebirds (Small and Rusch 1985, Marcström et al. 1989) and waterfowl (Pietz et al. 1993, Rotella et al. 1993, Ward and Flint 1995, Dzus and Clark 1996, Robert et al. 2006). However, some researchers have attributed the negative effect to the harness rather than the dorsal positioning of the transmitter. Several authors concluded radio-tags can cause adverse effects to individuals (Marks and Marks 1987, Caizergues and Ellison 1998, Bro et al. 1999), and conversely others have demonstrated appropriate (e.g., weight, size, color, etc.) radio packages have no measurable effects on survival of gamebirds (Boag et al. 1973, Hines and Zwickel 1985, Thirgood et al. 1995, Hagen et al. 2006, Terhune et al. 2007). Our results outline differential effects by attachment method and the need to consider appropriate positioning of transmitters on study subjects. We did not document any juvenile mortalities during winter of either year regardless of transmitter type, and consequently the negative effect of backpack-type transmitters relative to necklace-style transmitters appears to have resulted in increased mortality during the fall. Caution should be exercised when extending our results to other dorsal attachment methods (e.g., leg loop harness) for which reduced survival has not been explicitly tested.

Conflicting reports in the literature regarding the effect of marking method on gamebirds may be a consequence of capture myopathy, which can affect gamebird survival (Spraker et al. 1987, Nicholson et al. 2000, Höfle et al. 2004, Abbott et al. 2005, Conner et al. 2006). We did not control for the effect of handling time on backpack versus necklace birds, which could have influenced capture myopathy (Nicholson et al. 2000). Fitting a backpack transmitter required a longer handling time, but we did not document the actual difference in time. Despite our inability to formally evaluate the effect of handling time on survival, we contend any adverse effects of prolonged handling would have likely caused an acute effect on survival. However, our evaluation did not detect an acute transmitter-specific effect on survival (Table 8). Although capture method can affect capture myopathy in mallards (*Anas platyrhynchos*; Bollinger et al. 1989, Dabbert and Powell 1993) our method did not appear to cause acute mortality (Tables 2 and 8).

Survival estimates for juvenile sage-grouse are largely lacking (Taylor et al. 2012). On Parker Mountain, juvenile sage-grouse exhibited lower survival rates than reported by Beck et al. (2006), but similar juvenile female survival rates in fall, winter, and overall to those reported by Wik (2002). We found marginal evidence to support differential survival by sex similar to Swenson (1985) but in contrast to Beck et al. (2006). Our model indicated that in 2008–2009, the lowest survival was later in the season when compared to 2009–2010. The higher harvest rates in 2008–2009 in conjunction with later movements (Caudill 2011) to wintering areas, could have contributed to the lower overall survival rate. During our study, the majority of sage-grouse mortalities occurred during fall (15 Aug–1 Dec), which is a trend similar to the seasonal patterns reported by others (Wik 2002, Beck et al. 2006, Anthony and Willis 2009). Juvenile birds on Parker Mountain exhibited high overwinter survival, and severe winter weather did not appear to affect survival based on the 2 winters in this study. In 2009–2010, survival was high (0.98 and 0.97 for necklace-only females and males, respectively) even though winter snow depth was above average (Caudill et al. 2013), whereas in 2008–2009, winter survival was relatively low (0.8 and 0.69 for necklace-only females and males, respectively), and snow depth was below average (Caudill et al. 2013). Our findings agree with Zablan et al. (2003) but not Moynahan et al. (2006) who reported 1 severe winter, particularly a single storm, during the course of their 3-year study had a large negative impact on survival. Reported differences for the impact of winter weather may

Table 6. Parameter estimates for the model of juvenile greater sage-grouse (*Centrocercus urophasianus*) daily survival on Parker Mountain, Utah, USA, 2008–2010.

			90% CI	
Parameter	β	**SE**	**Lower**	**Upper**
Intercept	7.77	1.15	5.88	9.66
Year	1.21	0.85	−0.19	2.61
Sex	0.53	0.32	0.00	1.06
Transmitter type	−0.55	0.32	−1.08	−0.02
Time	−2.41	0.61	−3.41	−1.41
Time^2	0.35	0.08	0.22	0.48
Year × time^2	−0.08	0.03	−0.13	−0.03

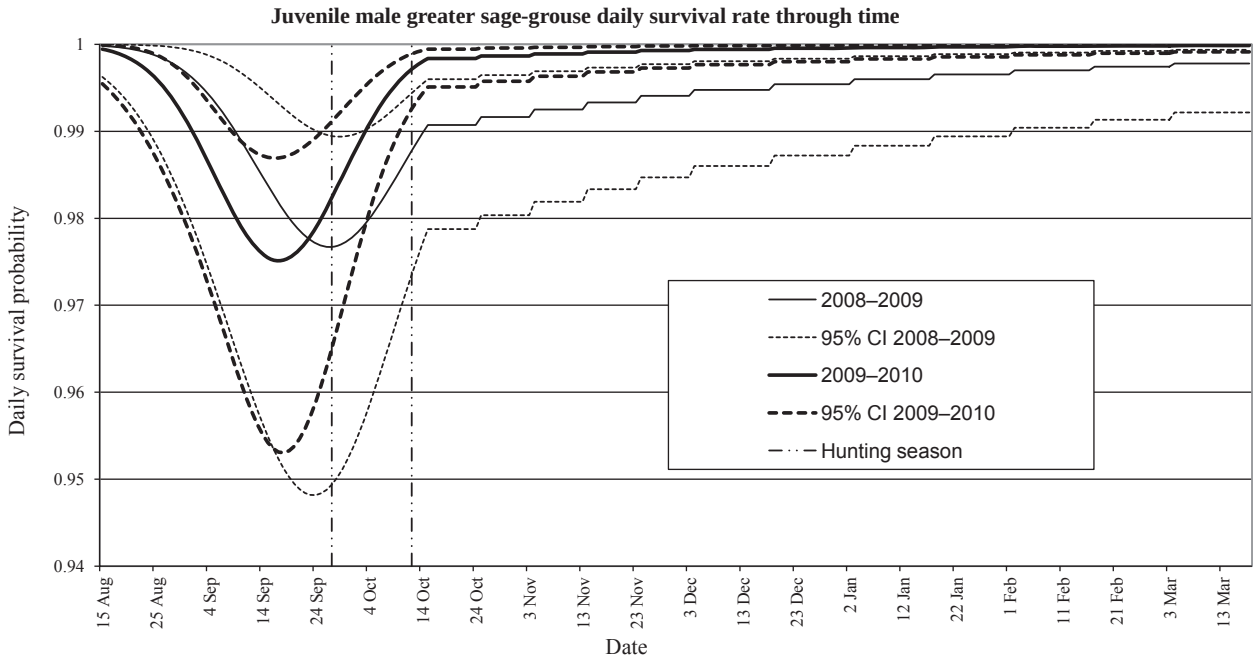

Figure 1. Juvenile male greater sage-grouse (*Centrocercus urophasianus*), fitted with necklace style radios, daily survival rate by day of study on Parker Mountain, Utah, USA, 2008–2010.

reflect differences in availability and quality of wintering habitats. The availability of lower elevation winter habitat sites in our study could have mitigated the effect of heavy snowfall (Caudill et al. 2013).

Sage-grouse may have evolved winter survival strategies such that high survival rates are positively correlated with snowpack, particularly in higher elevation habitats with substantial elevation gradients (i.e., migratory populations). As such, timing of transition from fall (i.e., high mortality) to winter survival (i.e., low mortality) strategies has major implications for population dynamics. Food is typically not a limiting factor for most grouse species during winter (Bergerud and Gratson 1988), as evidenced for sage-grouse based on substantial weight gain during winter (Beck and

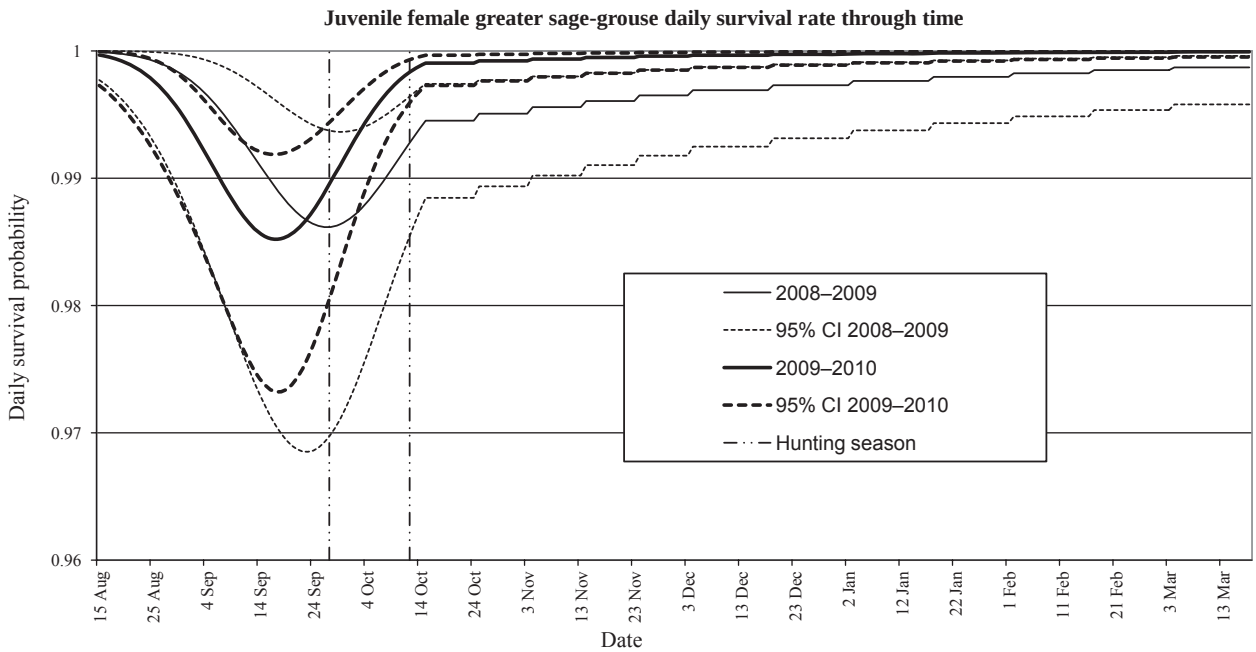

Figure 2. Juvenile female greater sage-grouse (*Centrocercus urophasianus*), fitted with necklace style radios, daily survival rate by day of study on Parker Mountain, Utah, USA, 2008–2010.

Table 7. Estimates of survival (S) for juvenile greater sage-grouse (*Centrocercus urophasianus*) using the model $S(T^2 \times \text{year} + \text{sex} + \text{transmitter type})$ and only individuals fitted with necklace-type transmitters on Parker Mountain, Utah, USA, 2008–2010. Survival rates are derived estimates using daily survival rates and the delta method.

			Necklace only	
Year	Sex	Season[a]	S	95% CI
2008	Female	Total	0.418	0.207–0.665
2008	Female	Fall	0.522	0.299–0.736
2008	Female	Winter	0.802	0.570–0.925
2008	Male	Total	0.228	0.067–0.548
2008	Male	Fall	0.332	0.131–0.621
2008	Male	Winter	0.687	0.371–0.891
2009	Female	Total	0.612	0.448–0.755
2009	Female	Fall	0.623	0.461–0.763
2009	Female	Winter	0.982	0.919–0.966
2009	Male	Total	0.435	0.245–0.647
2009	Male	Fall	0.449	0.258–0.656
2009	Male	Winter	0.969	0.861–0.994

[a] Total = 15 Aug–31 Mar; Fall = 15 Aug–30 Nov; Winter = 1 Dec–31 Mar.

Braun 1978) and high winter survival (see Connelly et al. 2004, this study). Consequently, avoidance of predation is likely the driver of winter population dynamics for most grouse species (i.e., Bergerud and Gratson 1988).

Previous research has shown that snowfall and snowpack influence the timing of migration from summer to wintering habitats (Dunn and Braun 1986), even before snow depth limits food availability in late summer habitats (Bergerud and Gratson 1988), as well as flock size for sage-grouse (Bergerud and Gratson 1988 adapted from Beck 1975, 1977). As such, climatic factors in late fall and winter may influence sage-grouse movement and flocking behaviors such that earlier and deeper snowpack may be conducive to high survival, as observed in our study. One possible explanation for high overwinter survival of sage-grouse could be that snow events result in dispersal and reduce mobility of avian and mammalian predators and alleviate predation pressure on grouse (Murray and Boutin 1991). Furthermore, sage-grouse use snow burrows (Back et al. 1987). Grouse species use snow burrows for both thermoregulation (Korhonen 1980, Marjakangas et al. 1984) and predator avoidance (Bergerud and Gratson 1988). Delayed onset and reduced depth of snow pack as a result of climate change (Mote et al. 2005, Knowles et al. 2006) may pose a threat to sage-grouse conservation by altering seasonal dynamics of sage-grouse such that juvenile survival diminishes (i.e., juveniles persist in fall survival strategy for longer periods of time). Similarly, Guttery et al. (2013*a*) suggest that reductions in snowpack may be a major threat to sage-grouse chick survival.

Although predation was the primary cause of juvenile sage-grouse mortality, non-native or human-subsidized predators are not common on Parker Mountain. Given the largely endemic predator community and contiguity of habitat, predation rates should be within historical levels (Hagen 2011). Consequently, harvest is the remaining mortality metric within the purview of managers. Reported and unreported harvest of sage-grouse varied annually in our study. The estimated crippling rates were 0% in 2008 and 6.8% in 2009, and were similar to those reported for other gamebirds (Braun and Beck 1985, Hoffman 1985, Small et al. 1991, Haines et al. 2006). However, our estimates are minimum values as monitoring effort was intense during the hunting season, but cripples could have been scavenged prior to investigator discovery and misclassified as predation. Dunn and Braun (1986) reported movement of juvenile sage-grouse was tied to snowfall. Earlier movements to the wintering areas in 2009–2010 versus 2008–2009 could have been a result of earlier snowfall events in 2009–2010 (Caudill 2011). Similar to the factors affecting blue grouse (*Dendragapus* spp.) harvest rates reported by Mussehl (1960), variable harvest rates on Parker Mountain could have been influenced by differing stages of the altitudinal migration between years during the hunting seasons. Our results support the need for incorporating crippling and other

Table 8. Mortality rates of juvenile greater sage-grouse (*Centrocercus urophasianus*) by transmitter type for 3 different periods post-capture on Parker Mountain, Utah, USA, 2008–2009.

		2008			2009		
Transmitter type	Days post capture	No. at risk	Probability of death	95% CI[a]	No. at risk	Probability of death	95% CI[a]
Backpack	0–10	15	0.067	0.004–0.262	18	0.111	0.019–0.305
Backpack	11–20	13	0.231	0.060–0.495	16	0.063	0.004–0.247
Backpack	21–30	9	0.333	0.096–0.655	15	0.267	0.092–0.515
Necklace	0–10	15	0.133	0.024–0.358	43	0.093	0.030–0.203
Necklace	11–20	12	0.250	0.069–0.528	39	0.154	0.064–0.287
Necklace	21–30	10	0.200	0.036–0.499	33	0.333	0.189–0.502

[a] Profile likelihood confidence interval.

unreported harvest loss when establishing sage-grouse harvest regulations. Further research into the effects of crippling on sage-grouse populations is needed.

Hunters and predators may key on clumped groups of juvenile and successful hen sage-grouse in late fall, and our harvest mortality results support other observations for sage-grouse (Connelly et al. 2000, Wik 2002) and blue grouse (Bendell and Elliot 1967, Redfield 1975). Habitat (Autenrieth 1981, Brøseth and Pedersen 2010), proximity to human access points (Fischer and Keith 1974, Brøseth and Pedersen 2000), and landownership (Small et al. 1991) have been shown to influence Tetraonidae harvest rates. The higher elevation swales of Parker Mountain provide the best brood habitat (Dahlgren et al. 2006), and as a result could lead to the relatively high-observed harvest rates on Parker Mountain due to clumped distributions (Bendell and Elliot 1967, Redfield 1975, Connelly et al. 2000, Wik 2002). Additionally, a majority of high elevation mesic habitats on Parker Mountain are proximal to roads, allowing access by hunters (Caudill 2011) to juveniles in clumped distributions. High accessibility, public ownership, and habitat characteristics pose unique challenges in harvest management, and mitigating actions could be necessary where these conditions cause a propensity towards higher harvest rates.

MANAGEMENT IMPLICATIONS

Our estimates of juvenile sage-grouse survival and factors affecting survival fill a knowledge gap in sage-grouse biology that has been identified as a significant driver of population growth rates. As a result, we provide managers with information to weigh decisions and trade-offs for promoting sage-grouse conservation. Additionally, we present evidence on differential survival by transmitter type that can guide researchers when designing future studies and managers with interpretation of research findings. Further, our results indicated juvenile survival may be more influenced by and susceptible to harvest than originally thought. Consequently, conservative harvest management is likely prudent. Shifting the hunting season to later in the year could allow for juveniles to intersperse with the larger population. Additionally, unreported harvest (mainly crippling) may have a larger impact on sage-grouse than was previously recognized. Our evidence in conjunction with previously published findings suggests managers should take into account an approximately 5% crippling and unreported harvest loss when determining sage-grouse harvest recommendations.

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Methods

Meteorology

A network of 14 meteorological stations was installed across the Annapurna range before the 1999 monsoon season, and expanded to 19 stations encompassing 28 rain gauges in 2000. Rainfall is totalled every 30 min. 'Look-down' distance rangers and γ-ray loggers measure snow depth and total water content, respectively, once a day at high elevations (>2,500 m in the Greater Himalaya). Only liquid precipitation is measured in the Tibetan zone, such that the annual (but not the monsoon) total is underestimated here. The data presented here (Fig. 2b) represent monsoon averages based on the longest record available from each station.

Apatite fission-track dating

Following mineral separation, apatites were polished, etched and irradiated. Standard and induced track densities were determined on Brazil ruby muscovite external detectors (geometry factor 0.5), and fossil track densities were determined on internal mineral surfaces. Ages were calculated using $\zeta = 359 \pm 20$ for dosimeter glass CN-5. All ages are central ages and are reported with 1σ errors. Long-term erosion rates are conservatively estimated on the basis of the fission-track age, and assuming a geothermal gradient of 100 °C km^{-1} and an annealing temperature of 140 °C.

Topographic analysis

A 3-arcsec (~90 m) digital elevation model (DEM) is the basis of all topographic analyses. Hillslope angles are calculated at every pixel in the DEM based on a 3 × 3 pixel (~180 × 180 m) grid. Mean hillslope angles were extracted from a moving, 5-km-radius window centred on the Marsyandi River. Maximum, minimum and mean elevation (Fig. 2) were calculated along a 50-km-wide swath oriented perpendicular to the strike of the range and centred on the Marsyandi River (or the Nar-Phu River above its confluence with the Marsyandi).

Equilibrium-line altitude

Glacial areas were calculated from present and reconstructed ice margins mapped on aerial photographs, and transferred first to 1:50,000 scale topographic maps and then to the digital topography. Based on glacial hypsometry, equilibrium-line altitudes were estimated with an assumed accumulation-area ratio of 0.65. To avoid uncertainty introduced by avalanches on to glaciers from adjacent high peaks, 29 small glaciers (95% are <2.5 km^2), lacking high headwalls, were analysed. The regional equilibrium-line altitude gradient shows little sensitivity to accumulation-area ratios ranging from 0.4 to 0.8.

Specific stream power

Analysis was focused on catchments ranging from 3 to 7 km^2 within the non-glaciated part (<4,200 m elevation) of the study area. These basins drain approximately half of the landscape and are sufficiently large to be fluvial, as opposed to colluvial/debris flow, channels. Monsoon rainfall was smoothed across the meteorological network to define an average precipitation gradient perpendicular to the strike of the topography. This gradient was then extrapolated parallel to strike across the study area. For each river segment ≥500 m long, channel gradients (S) were extracted from the DEM, and discharge (Q) was calculated as the product of upstream area and rainfall. Discharge is overestimated because all rainfall is assumed to enter channels. Channel width (W) is calculated as $10^{-2}\,Q^{0.4}$. Specific stream power (in GJ m^{-2} yr^{-1}) is calculated as $\rho_w gQS/W$, where ρ_w is the density of water and g is gravitational acceleration. Channel gradients and specific stream power are binned every 5 km.

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Undesirable evolutionary consequences of trophy hunting

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Phenotype-based selective harvests, including trophy hunting, can have important implications for sustainable wildlife management if they target heritable traits[1–3]. Here we show that in an evolutionary response to sport hunting of bighorn trophy rams (*Ovis canadensis*) body weight and horn size have declined significantly over time. We used quantitative genetic analyses, based on a partly genetically reconstructed pedigree from a 30-year study of a wild population in which trophy hunting targeted rams with rapidly growing horns[4], to explore the evolutionary response to hunter selection on ram weight and horn size. Both traits were highly heritable, and trophy-harvested rams were of significantly higher genetic 'breeding value' for weight and horn size than rams that were not harvested. Rams of

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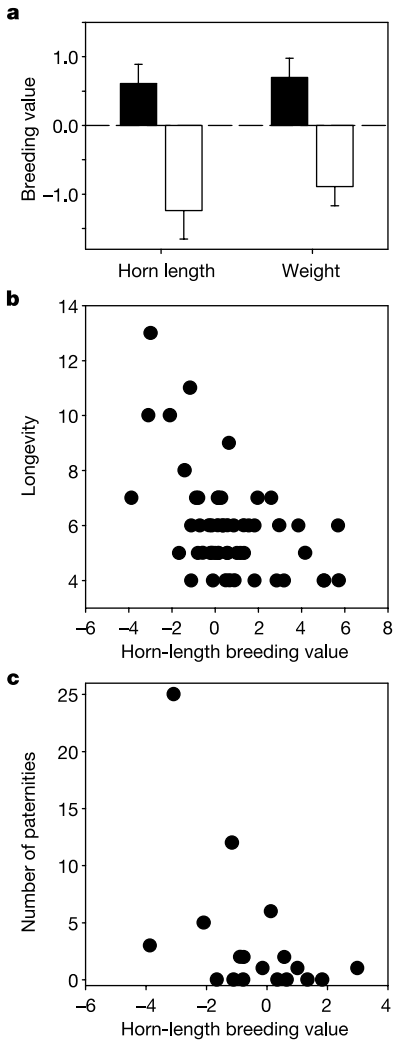

Figure 1 Selection against high-breeding-value rams imposed by trophy hunting. **a**, Breeding values (means ± s.e.m.) for horn length and weight of trophy-harvested rams (filled bars) and non-trophy-harvested rams (open bars). **b**, Relationship between the age at harvest for trophy-harvested rams and their breeding value. **c**, Relationship between the number of paternities assigned to trophy-harvested rams in their lifetime and their breeding value.

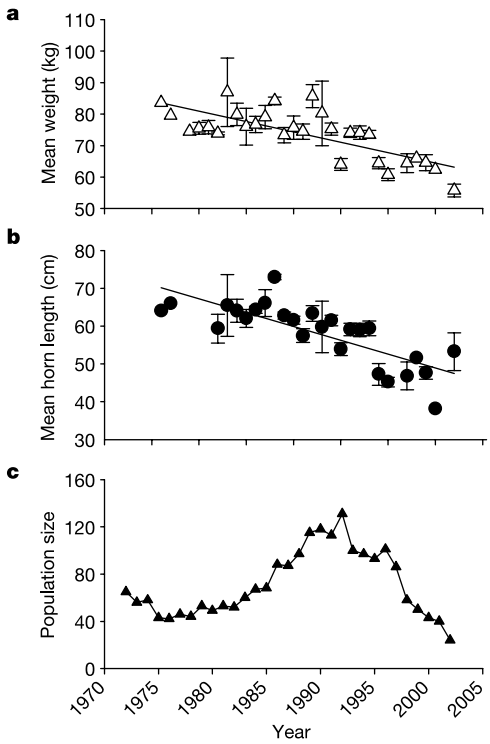

Figure 2 Observed changes in mean weight and horn length and in the population size from 1972 to 2002. **a**, Relationship between weight (mean ± s.e.m.) of 4-year-old rams and year ($N = 133$ rams). **b**, Relationship between horn length (mean ± s.e.m.) of 4-year-old rams and year ($N = 119$ rams). **c**, Changes in population size (taken as the number of ewes aged at least 2 years plus yearlings[17]) over time.

high breeding value were also shot at an early age, and thus did not achieve high reproductive success[5]. Declines in mean breeding values for weight and horn size therefore occurred in response to unrestricted trophy hunting, resulting in the production of smaller-horned, lighter rams, and fewer trophies.

Sport harvesting is one of the most pervasive and potentially intrusive human activities that affect game mammal populations globally[6]. Hunters are willing to pay large sums to hunt trophy mountain ungulates in various parts of the world, and many mountain sheep (*Ovis canadensis* and *O. dalli*) populations in North America are managed primarily to produce large-horned trophy rams for sport hunters. A world-class trophy ram is an extremely valuable commodity, and hunting permits have been auctioned for hundreds of thousands of dollars[7]. One sport hunter paid over Can$1 million in 1998 and 1999 for special permits to hunt trophy rams in Alberta, Canada[7]. In many parts of North America, sport harvest of mountain sheep is often restricted only by the availability of rams whose horns reach a minimum size prescribed by regulations. Although the use of income generated from sport hunting towards enhancing and conserving mountain ungulate habitat can be seen in a positive light[7], so far little attention has been paid to the potential evolutionary consequences, and hence the sustainability, of harvest regimes[2,3].

Wildlife management has traditionally focused on demographic and ecological factors that affect numbers and growth rates in harvested populations[8–11]. However, the life-history changes experienced by species subject to commercial fisheries strongly suggest that intensive harvesting practices can elicit an evolutionary response in wild stocks[12–15]. Experimental size-selective harvesting treatments on an exploited fish demonstrated evolutionary effects on somatic growth and population productivity in the opposite direction of the size bias of the harvest[13]. Recent reviews have called attention to the potential selective effects of sport hunting on wild ungulates, in which large-horned or large-antlered males are selectively targeted[2,3]. The increased frequency of tuskless elephants in many African populations has also been suggested to have occurred in response to selective ivory poaching[16]. Here we use data from the long-term study of a harvested bighorn sheep population at Ram Mountain, Alberta, Canada, to investigate the evolutionary consequences of more than 30 years of selective hunting of trophy rams.

Fifty-seven rams have been shot at Ram Mountain since 1975, or about 40% of the rams legally available for harvest in each year (see Methods), for a yearly harvest of between zero and six rams[17]. Most trophy-harvested rams were shot before reaching 8 years of age (45 of 57 rams), and nine were shot as early as the age of 4 years. In bighorn sheep, much of the total horn length is added from the ages of 2 to 4 years, and at Ram Mountain the probability of a ram being shot before the age of 6 years is positively correlated with cumulative horn growth over this interval[4]. 'Animal model'[18] quantitative genetic analysis of 395 horn-length and 447 weight measurements taken from 192 rams at ages 2, 3 and 4 years from 1971 to 2002 revealed narrow-sense heritabilities of 0.69 ± 0.10 and 0.41 ± 0.11

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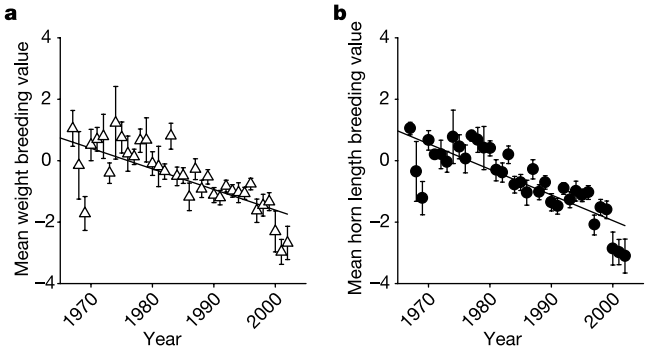

Figure 3 Changes in the mean breeding value of cohorts born between 1967 and 2002. **a**, Relationship between breeding value (mean ± s.e.m.) for weight and year of birth ($N = 783$ individuals). **b**, Relationship between breeding value (mean ± s.e.m.) for horn length and year of birth ($N = 783$ individuals).

(means ± s.e.m.), respectively (see Methods), and a strong positive additive genetic correlation between the two (+0.84 ± 0.10). Comparison of expected genetic 'breeding values' (twice the expected deviation of an individual's offspring phenotype from the population mean owing to the additive effect of the offspring's inherited genes[18]) extracted from this model (Fig. 1a) indicates that hunters selectively harvest rams with high breeding values for horn length (trophy-harvested mean, + 0.61 ± 0.28; non-harvested mean, −1.24 ± 0.48; *t*-test: $t_{148} = -4.16$, $P < 0.001$) and weight (trophy-harvested mean, +0.70 ± 0.28; non-harvested mean, −0.89 ± 0.48; *t*-test: $t_{148} = -3.26$, $P = 0.0014$).

Within seasons, mating success in bighorn sheep increases with dominance rank[19], age and horn length[5]. The positive effect of large horns on mating success increases from about 6 years of age[5], when rams are capable of defending oestrous ewes during the rut. The age at which a high-breeding-value ram is harvested is therefore likely to have an important impact on the number of offspring he can sire. We found a negative relationship between the age at which a trophy-harvested ram was shot and his breeding value for horn length (generalized linear model (GLM) with Poisson errors: $\chi^2_{(1)} = 4.64$, $P = 0.031$; Fig. 1b) but not for weight (GLM: $\chi^2_{(1)} = 1.80$, $P = 0.18$; data not shown). Trophy-harvested rams with high breeding values for body and horn size were therefore less likely to reach the ages at which they achieve high rates of paternity in this population[5]. As a consequence, there was a negative relationship between breeding value for horn length and lifetime mating success, measured as the number of paternities assigned over their lifetime, among trophy-harvested rams (GLM with negative binomial error: $\chi^2_{(1)} = 8.56$, $P = 0.0034$; Fig. 1c). The mean sire breeding value of individuals fathered by trophy-harvested rams was therefore significantly less than zero for both weight (one-sample *t*-test: mean = −2.41, s.e.m. = 0.37, $t_{59} = -6.50$, $P < 0.001$) and horn length (mean = −1.84, s.e.m. = 0.19, $t_{59} = -9.68$, $P < 0.001$). The mean sire breeding value of individuals fathered by rams that died a natural death was also significantly less than zero for both weight (one-sample *t*-test: mean = −1.24, s.e.m. = 0.17, $t_{182} = -7.14$, $P < 0.001$) and horn length (mean = −2.10, s.e.m. = 0.16, $t_{182} = -20.43$, $P < 0.001$). The low breeding values of rams not harvested (Fig. 1a) and the reduced longevity and potential reproductive output of the higher-quality trophy-harvested rams (Fig. 1b, c) combine to suggest that the selection imposed by trophy hunting had a negative impact on the evolutionary trajectory of horn length and body weight in this population during our study.

Is there evidence of a response to selective harvesting at the population level? Significant declines in both ram weight (linear mixed-effect model including year of birth and individual as a random effects, and age, time and resource index as fixed effects: $\beta_{\text{time}} = -0.30$, s.e.m. = 0.09, $t_{25} = -3.42$, $P = 0.0021$) and horn length (linear mixed-effect model including year of birth and individual as a random effects, and age, time and resource index as fixed effects: $\beta_{\text{time}} = -0.35$, s.e.m. = 0.12, $t_{23} = -2.97$, $P = 0.0068$) were observed over the course of the study (Fig. 2a, b) after controlling for environmental effects such as population density (Fig. 2c) using an index of resource availability (see Methods; weight: $\beta_{\text{resources}} = 0.81$, s.e.m. = 0.17, $t_{25} = 4.72$, $P < 0.001$; horn length: $\beta_{\text{resources}} = 0.72$, s.e.m. = 0.22, $t_{23} = 3.32$, $P = 0.0030$). These are very rapid rates of phenotypic change[20], corresponding to −0.30/12.9 = −0.023 and −0.35/13.6 = −0.026 standard deviations per year, or −0.14 and −0.15 haldanes (ref. 20) assuming a generation time of 6 years. Analyses of breeding values are consistent with genetically based responses (Fig. 3). Declines in breeding value (see Methods) were observed for both ram weight (linear mixed-effect model including year of birth as a random effect, and time and resource index as fixed effects: $\beta_{\text{resources}} = 0.037$, s.e.m. = 0.025, $t_{33} = 1.49$, $P = 0.15$; $\beta_{\text{time}} = -0.071$, s.e.m. = 0.012, $t_{33} = -6.02$, $P < 0.001$) and horn length (linear mixed-effect model including year of birth as a random effect, and time and resource index as fixed effects: $\beta_{\text{resources}} = 0.050$, s.e.m. = 0.024, $t_{33} = 2.08$, $P = 0.045$; $\beta_{\text{time}} = -0.075$, s.e.m. = 0.011, $t_{33=} - 6.76$, $P < 0.001$). Such declines in breeding value over time are indicative of a microevolutionary response to selection[21] in the Ram Mountain population.

Unrestricted harvesting of trophy rams has thus contributed to a decline in the very traits that determine trophy quality. Hunters have selectively targeted rams of high genetic quality before their reproductive peak, depleting the genes that confer rapid early body and horn growth. Wildlife harvesting that is selective and sufficiently severe might elicit an undesired evolutionary response when the target trait is heritable. There might also be unexpected effects on genetically correlated traits, such as female body weight or disease resistance[22], that could result in further genetic deterioration of harvested populations as anthropogenic selection pushes traits away from their naturally selected optima. Because such changes will be extremely difficult to reverse, wildlife managers must consider the genetic effects and the evolutionary implications of alternative harvest strategies[2,3]. The move to adopt a 'full curl' restriction in parts of Alberta in 1996, which limits harvest to rams with horns whose tip extends beyond the tip of the nose, is one strategy to minimize further deterioration of the genetic quality of bighorn sheep. □

Methods

Population and study site

The bighorn sheep population on Ram Mountain, Alberta, Canada (52° N, 115° W, elevation 1,080–2,170 m) has been monitored closely since 1971 (refs 17, 23). Immigration to Ram Mountain from the main species range has not been documented, and is probably rare because of isolation of the population by about 30 km of coniferous forest. Each year, sheep were captured in a corral trap baited with salt from late May to early October, and marked with coloured plastic ear tags or canvas collars for individual identification. Adult rams were captured once or twice in most summers from early June to mid-July. At each capture, sheep were weighed to the nearest 250 g with a Detecto spring scale. Horn length along the outside curvature was measured with tape. The longer of the left and right horn measurements was used, because rams can have a varying amount of horn removed by wear. For further details on field methods see refs 17, 23 and 24.

Bighorn males on Ram Mountain can be legally harvested by Alberta resident hunters from late August to the end of October. Until 1996, rams with horns describing at least four-fifths of a curl ('trophy' rams) could be harvested by any hunter holding a trophy sheep licence[17]. As any resident could purchase a licence, the harvest was limited only by the availability of trophy rams. A change in regulations in 1996 limited harvest to 'full-curl' rams. Consequently, only three rams have been shot since 1996. Individual weight and horn length measurements from rams captured between 1971 and 2002 were adjusted to 5 June (ref. 24). Because the youngest age at which rams were shot by hunters was 4 years, we used weight and horn length data from ages 2, 3 and 4 years to avoid bias due to hunter selection.

Pedigree reconstruction

Maternity was known from field observations for 709 of the 894 (79.3%) marked sheep

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whose fates have been followed since 1971. Tissue sampling for DNA analyses started in 1988. Blood samples were taken from all captured sheep until 1993 and stored in preservative at −20 °C. Sampling resumed in 1997, when hair samples were taken from all captured sheep by plucking 50–100 hairs including roots from the back or flank. Hairs were kept either in paper envelopes or plastic bags containing about 5 g of silica at room temperature. From 1998 to 2002, a tissue sample from each captured sheep was taken from the ear with an 8-mm punch. Ear tissue was kept at −20 °C in a solution of 20% dimethylsulphoxide saturated with NaCl. We sampled 433 marked individuals over the course of the study.

DNA was extracted from blood with a standard phenol–chloroform method, and from either 20–30 hairs including follicles or about 5 mg of ear tissue, using the QIAamp tissue extraction kit (Qiagen Inc., Mississauga, Ontario). Polymerase chain reaction amplification at 20 ungulate-derived microsatellite loci, 15 as described previously[5] plus MCM527, BM4025, MAF64, OarFCB193 and MAF92 (refs 25, 26), and fragment analysis were performed as described elsewhere[5]. After correction for multiple comparisons, we found no evidence for allelic or genotypic disequilibria at or among these 20 loci.

Paternity of 241 individuals was assigned by using the likelihood-based approach described in CERVUS[27] at a confidence level of more than 95% with input parameters given in ref. 5. After paternity analysis, we used KINSHIP[28] to identify 31 clusters of 104 paternal half-sibs among the unassigned offspring. A paternal half-sibship consisted of all pairs of individuals of unassigned paternity that were identified in the KINSHIP analysis as having a likelihood ratio of the probability of a paternal half-sib relationship versus unrelated with an associated $P < 0.05$ (ref. 28). Members of reconstructed paternal half-sibships were assigned a common unknown paternal identity for the animal model analyses. Paternal identity links in the pedigree were therefore defined for 345 individuals.

Animal model analyses

Breeding values, genetic variance components and heritabilities were estimated by using a multiple trait restricted-estimate maximum-likelihood (REML) model implemented by the programs PEST[29] and VCE[30]. An animal model was fitted in which the phenotype of each animal was broken down into components of additive genetic value and other random and fixed effects: $\mathbf{y} = X\mathbf{b} + Z\mathbf{a} + P\mathbf{c} + \mathbf{e}$, where $\mathbf{y}$ was a vector of phenotypic values, $\mathbf{b}$ was a vector of fixed effects, $\mathbf{a}$ and $\mathbf{c}$ were vectors of additive genetic and permanent environmental, $\mathbf{e}$ was a vector of residual values, and X, Z and P were the corresponding design matrices relating records to the appropriate fixed or random effects[18]. Fixed effects included age (factor) and the average weight of yearling ewes in the year of measurement (covariate), which is a better index of resource availability than population size because it accounts for time-lagged effects[4]. The permanent environmental effect grouped repeated observations on the same individual to quantify any remaining between-individual variance over and above that due to additive genetic effects, which would be due to maternal or other long-term environmental and non-additive genetic effects.

The total phenotypic variance (V_p) was therefore partitioned into three components: the additive genetic variance (V_a), the permanent environmental variance (V_e) and the residual variance (V_r), thus: $V_p = V_a + V_e + V_r$. Heritability was calculated as $h^2 = V_a/V_p$. The VCE[30] program returns standard errors on all variance components and ratios. Best linear unbiased predictors of individual breeding values were quantified by using REML estimates of the variance components obtained with PEST[29]. All statistical tests were conducted in SPLUS 6.1.

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The role of evolution in the emergence of infectious diseases

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It is unclear when, where and how novel pathogens such as human immunodeficiency virus (HIV), monkeypox and severe acute respiratory syndrome (SARS) will cross the barriers that separate their natural reservoirs from human populations and ignite the epidemic spread of novel infectious diseases. New pathogens are believed to emerge from animal reservoirs when ecological changes increase the pathogen's opportunities to enter the human population[1] and to generate subsequent human-to-human transmission[2]. Effective human-to-human transmission requires that the pathogen's basic reproductive number, R_0, should exceed one, where R_0 is the average number of secondary infections arising from one infected individual in a completely susceptible population[3]. However, an increase in R_0, even when insufficient to generate an epidemic, nonetheless increases the number of subsequently infected individuals. Here we show that,

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CHAPTER TWENTY-THREE

Hunting Lowers Population Size in Greater Sage-Grouse

Robert M. Gibson, Vernon C. Bleich, Clinton W. McCarthy, and Terry L. Russi

Abstract. How hunting mortality affects population size is an important but understudied problem in the applied ecology of grouse and other upland gamebirds. At issue is whether mortality from recreational hunting is additive and therefore depresses population size, or is compensatory and does not. Empirical analyses of this issue may be inconclusive if harvest levels increase with population size or if statistical analysis fails to control for serial dependence in estimates of population size. We examined the effect of hunting on population size in Greater Sage-Grouse (*Centrocercus urophasianus*) using a lek count time series from an intermittently hunted and relatively isolated population in eastern California. Over a 39-year study period (1960–1998), annual variation in harvest recorded in the field was uncorrelated with the previous spring's lek count. After controlling for a positive correlation between lek counts in successive years, numbers of males on leks in spring decreased significantly as harvest during the previous autumn increased. This pattern is expected if hunting mortality is additive and lowers population size. In light of this and similar results from an independent study in Idaho, we suggest that additive, rather than compensatory, hunting mortality should become the default assumption for wildlife managers when setting hunting regulations for Greater Sage-Grouse.

Key Words: Centrocercus urophasianus, hunting, population dynamics.

How recreational hunting affects population size is particularly relevant to biologists charged with the management of populations of grouse, several species of which are in decline worldwide (Storch 2007). Ecological models of harvesting, such as those used to predict maximum sustainable yield, typically assume that hunting is additive to other sources of mortality and hence reduces population size (Caughley and Sinclair 1994). If so, the short-term recreational benefits of hunting must be weighed against the effects of reduced population size on long-term population viability. In contrast, wildlife managers often assume that hunting is compensatory to

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other sources of mortality and hence that hunters take only a "doomed surplus" (Errington 1946). This view assumes that the hunting season occurs prior to a period of density-dependent mortality that would reduce population size to the same level as a reduction caused by hunting. Whether hunting mortality is additive or compensatory must therefore depend on the extent of harvest and details of a population's ecology. Not surprisingly, the few studies to have examined this issue have produced variable outcomes. For example, where it has been analyzed in upland gamebirds, hunting mortality is often at least partially additive to natural mortality (Robertson and Rosenberg 1988, Williams et al. 2004). However, Devers et al. (2007) report compensatory mortality in Ruffed Grouse (*Bonasa umbellus*), and the full range of outcomes from compensatory to completely additive hunting mortality has been reported from another species of grouse, the Willow Ptarmigan (*Lagopus lagopus*) (Ellison 1991, Smith and Willebrand 1999, Pedersen et al. 2003). Effects of hunting on mortality rates also vary between different species of waterfowl (Nichols 1991).

Attempts to determine the extent to which hunting depresses population size in gamebirds face at least two methodological difficulties. The first arises because wildlife managers may adopt more liberal hunting regulations as population size increases. Changes in management could confound attempts to demonstrate harvest effects in either of two ways. The first scenario assumes that variation in population size primarily reflects regulation around a stable equilibrium density. If so, population growth rate will decrease with increasing population size. Unfortunately, this is also the pattern expected to result from density-dependent harvest. Hence, under this model, the effect of additive hunting mortality would be difficult or impossible to disentangle from intrinsic density dependence (Sedinger and Rotella 2005). A second possible model assumes that variation in population size primarily represents density-independent variation in growth rate. If so, population growth rate would covary positively with population size, a pattern that could mask the effect of additive hunting mortality. Hence, regardless of which is the more appropriate model, to determine the impact of hunting, harvest levels should be manipulated independently of population size.

A second methodological difficulty concerns measurement of a population's response. Successive values in a population time series are likely to be positively correlated, because a population's size at time t constrains its possible size at time $t + 1$. Consequently, the size of a population following a harvest episode is not by itself a useful response measure. Population biologists sometimes attempt to solve this problem by estimating population growth rate as $r = \ln(N_{t+1}/N_t)$, where N is population size and t and $t + 1$ are consecutive time intervals (Royama 1992). However, this ratio covaries negatively with N_t even for a random time series, and thus exhibits spurious density dependence. Additionally, successive values of r are, by definition, not statistically independent. One solution is to evaluate the effect of harvest on N_{t+1} in a general linear model that includes N_t as a covariate. Use of N_t as a covariate ensures that the autocorrelation between N_t and N_{t+1} is removed prior to estimating the effect of harvest.

The effect of hunting on population size is increasingly relevant to management of the Greater Sage-Grouse (*Centrocercus urophasianus*). This specialized, lek-breeding species was once widely distributed and abundant in sagebrush dominated shrubsteppe habitats throughout western North America. It declined in the early part of the 20th century, staged a recovery in the late 1940s and 1950s, but more recently has declined again across much of its geographic range (Connelly and Braun 1997). Reported population declines are consistent with Schroeder et al.'s (2004) estimate that range-wide habitat for Greater Sage-Grouse has been reduced by 45% from pre-settlement to the present. Population declines have also been associated with habitat fragmentation (Braun 1995) and decreased breeding success (Connelly and Braun 1997). These changes have the potential to reduce population viability, making the effect of recreational hunting a relevant concern.

Over most of its geographic range, the Greater Sage-Grouse is counted on leks in spring and hunted in autumn after the reproductive season. Initial attempts to examine the relationship between hunting and population size correlated lek count time series with temporal variation in harvest levels and concluded that fluctuations in spring lek counts were not attributable to variations in harvest (Crawford 1982, Braun and Beck 1985). However, these studies cannot be considered conclusive, because they did not manipulate harvest levels independently of population size or control for prior population size when analyzing the effect of harvest. More recent studies using

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radio-tagged birds to estimate variation in mortality rates indicate that hunting mortality rates can be locally high, particularly for females (Connelly et al. 2000), and have associated spatial variation in hunting season mortality rates with variation in harvest (Moynahan et al. 2006, Sedinger et al., this volume, chapter 24). Winter mortality is reported to be low in some areas (Idaho: Connelly et al. 2000), but to exhibit spatial and/or annual variation in others (Montana: Moynahan et al. 2006, Nevada: Sedinger et al., this volume, chapter 24), and two studies have reported elevated mortality rates during severe winters (Moynahan et al. 2006, Anthony and Willis 2009). Low over-winter mortality appears to leave only limited scope for reduced density-dependent mortality to compensate for the effect of autumn hunting mortality on spring population size, which suggests that hunting mortality could often be additive.

The most direct test of the additive hunting mortality hypothesis has been undertaken by Connelly et al. (2003), who compared population growth rates of Greater Sage-Grouse over a seven-year period among 19 study areas in Idaho subject to moderate, limited, or no hunting. They reported that populations in areas closed to hunting grew faster and that depression of population growth by hunting may have been more marked in more xeric habitats. Connelly et al.'s conclusions were challenged by Sedinger and Rotella (2005), who suggested that initial lek sizes (an index of population size) were lower in non-hunted study areas and that under a density-dependent model (see above) these populations may have grown faster because they were initially smaller and not necessarily because additive mortality from hunting was absent. Subsequent clarification by Reese et al. (2005) revealed that Sedinger and Rotella's conclusion about initial lek size was relevant only for a subset of five study areas from mountain valleys. After removing this subset of areas from the sample, the remaining 14 lowland study areas still appeared to exhibit faster growth in areas when not hunted (Connelly et al. 2003). In short, despite Sedinger and Rotella's (2005) critique, Connelly et al.'s (2003) data from xeric, lowland study areas suggest that hunting may slow population growth in Greater Sage-Grouse.

In this paper, we evaluate the effect of hunting on population size using a lek count time series from a relatively isolated and intermittently hunted population of Greater Sage-Grouse in eastern California. Because a correlation between harvest and prior population size could confound analysis of the effect of harvest (see above), we first examined the relationships between spring lek counts and both hunting regulations and harvest the following autumn. Then we use the analytical approach proposed above to examine the effect of harvest on population size in the following spring.

METHODS

We analyzed the dynamics of a population of Greater Sage-Grouse at the southwestern edge of the species' geographic range, in Long Valley, Mono County, California over a 39-year period from 1960 to 1998. The study area is described by Bradbury et al. (1989a). Seasonal movements of Sage-Grouse in Long Valley are confined to the valley floor and surrounding foothills (Bradbury et al. 1989b, Gibson 1996, unpubl. data). The nearest sage grouse populations are in Adobe Valley, 25 km to the north, and the White Mountains 45 km to the east. A larger population occurs in the Bodie Hills, 55 km to the north-northwest. Spring lek counts in the Bodie Hills and Long Valley fluctuated independently during the study period (unpubl. data), indicating that any interchange of birds between these areas was insufficient to mask local population dynamics. The Adobe Valley and White Mountain populations are small, so there is limited potential for immigration from either area to influence population dynamics in Long Valley.

Lek Counts

We used the total count of males on a "core" set of eight leks as a relative measure of spring population size. Leks were counted near sunrise on at least three mornings annually during and immediately after the seasonal mating peak, when male lek attendance is highest. Counts conducted after the onset of mating activity include both territorial adults and non-territorial males of all ages (Dalke et al. 1963, R. Gibson, unpubl. data). From 1960 to 1982, most lek counts were conducted by California Department of Fish and Game (CDFG) biologists using methods described by Bradbury et al. (1989a). From 1983 to 1998, counts were conducted by the authors and their associates. As far as possible, we used teams of observers to count birds attending leks simultaneously during peak

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male attendance, rather than a single observer visiting leks sequentially, as had occurred before 1983. To avoid disturbing the birds, observers counted leks from a range of approximately 200 m. To minimize the influence of spuriously low counts resulting from bad weather or disturbance of the birds before observers arrived, we used the highest seasonal count at each lek as the annual value. Two steps were taken to avoid double counting of birds that moved among leks. First, where leks were close, and thus more likely to exchange birds on a daily basis, we used the highest daily count for the entire lek complex. Second, to avoid unrepresentative values generated by wintering flocks visiting leks before dispersing to other breeding areas (Bradbury et al. 1989b), we excluded any counts made before 20 March, the earliest copulation date recorded from 1984 to 1998 (R. Gibson, unpubl. data).

All eight core leks were counted annually from 1973 to 1998, except in 1978 and 1982, when only four leks were counted. From 1960 to 1972, coverage was less complete, with subsets of five to seven of the core leks counted annually, except in 1969, when only three sites were surveyed. To ensure that core lek totals were comparable across all years, we used complete core surveys from 1973–1998 (n = 23 yr) to develop linear regression models relating the core total to the total for each of the 5–7 lek subsets studied during 1960–1968 and 1970–1972. Counts from 1960–1968 and 1970–1972 were then scaled to the core lek total using the appropriate regression for the subset of leks counted in that year (adjusted r^2 values = 96.7–98.3%). We omitted three years (1969, 1978, and 1982), when four or fewer of the eight core leks were counted. To check the robustness of the core lek total, we compared it to the total for all active leks in the study area for 13 years between 1983 and 1998, when lek surveys were sufficiently extensive to have located all active leks. Within this sample, core leks accounted for 95.2 ± 0.8% of the total male count for Long Valley and accurately predicted the total count (adjusted r^2 = 0.994, $Y = 1.453 + 1.044X$, $P < 0.0001$).

Hunting Regulations and Harvest

Over the study period, hunting seasons opened between 1 September and 14 October and were for two days, with the exception of 1970–1972, when the season was three days. Bag limits varied from 0 (season closed) to 2 birds. Seasonal and daily limits were identical. After 1986, permit numbers were restricted (50–250 annually). In most years with a hunting season, check stations were set up on the two main access roads and hunters were interviewed as they left Long Valley. Because of the strategic locations of check stations and consistency in their locations and hours of operation, it is likely that the proportion of hunters sampled was high and relatively constant throughout the study period. We therefore used numbers of birds shot and hunters recorded at check stations as indices of the annual legal harvest and hunter effort. Other data suggest that illegal harvest was slight. Relevant observations include the near absence of harvest citations by game wardens patrolling Long Valley during hunting seasons (unpublished CDFG data) and a low incidence of illegal shooting of radio-tagged birds outside the hunting season (<2%, n = 215; R. Gibson, unpubl. data). Check station data were available for open seasons in 1963–1965, 1970–1982, 1987–1988, 1990–1992, and 1997. We assumed a harvest of zero in years when the season was closed.

Data Analysis

Wherever applicable, we used parametric statistical methods to maximize power. We square-root transformed core lek counts, numbers of hunters, and birds checked ("checked harvest") to normalize right-skewed distributions before statistical analysis. However, for clarity, untransformed values are plotted in the figures. We used nonparametric rank correlation (Kendall's) for two analyses where, despite transformations, bivariate relationships remained non-linear. In analyzing correlates of hunting regulations, we present analyses of the effects of bag limit and permit numbers only, because preliminary analyses indicated that date and season length did not predict either hunter participation or checked harvest. Descriptive statistics in the text are given as mean ±SE. P-values are based on two-tailed statistical tests.

RESULTS

Counts at core lek and hunting regulations varied during the study period from 1960 to 1998 (Fig. 23.1). Counts of males at core leks showed no significant linear trend over time (core lek count vs. year: $r = 0.049$, $n = 36$, $P = 0.779$). However,

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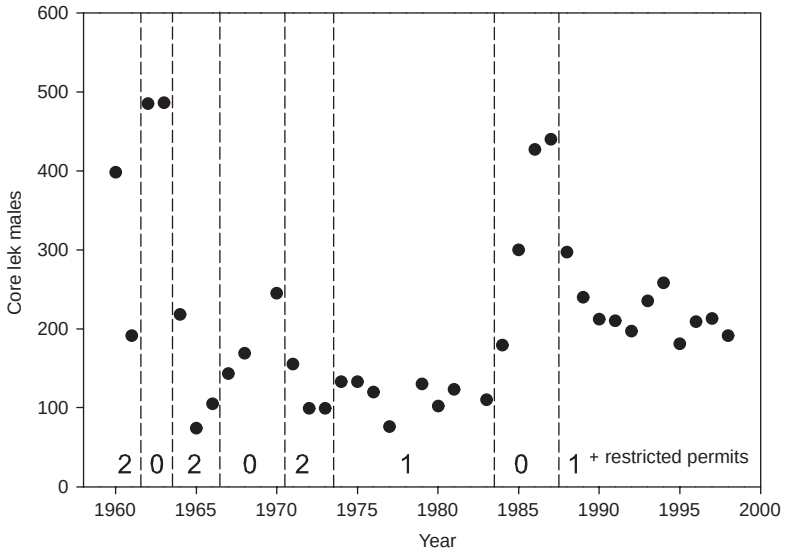

Figure 23.1. Annual variation in male numbers at eight core leks in Long Valley, California, 1960–1998. Vertical dashed lines separate periods with different hunting regulations where the line is drawn after the spring lek count for the year in which regulations changed. Numbers indicate bag limits.

lek counts were positively and significantly autocorrelated from one year to the next ($r = 0.654$, $n = 32$, $P < 0.0001$), though not over longer time lags (2 yr: $r = 0.312$, $n = 31$, $P = 0.088$; 3 yr: $r = 0.152$, $n = 30$, $P = 0.424$; 4 yr: $r = 0.079$, $n = 29$, $P = 0.680$).

Were Hunting Regulations and Harvest Independent of Prior Population Size?

Although managers may increase harvest by liberalizing hunting regulations as population size increases (e.g., Sedinger and Rotella 2005), we found only limited evidence that regulations were adjusted in response to population size and no correlation between checked harvest and lek counts the previous spring.

Hunting Regulations

From 1960 to 1986, three periods when the season was closed (1961–1962, 1966–1969, and 1983–1986) were separated by periods when it was open with bag limits of either one (1973–1982) or two birds (1960, 1963–1965, 1970–1972) (Fig. 23.1), but there was no direct regulation of the numbers of hunters. Over this period there was no statistical association between bag limit and core lek count the preceding spring ($r = 0.034$, $n = 24$, $P = 0.874$). From 1987 to 1998 the bag limit was one bird; permit numbers were regulated directly and were positively correlated with the previous spring's core lek count (Kendall's $\tau = 0.558$, $n = 12$, $P < 0.02$). Hence, hunting regulations tracked population size only during the last 12 years of the study.

As expected, more liberal regulations were correlated with increased harvest. For example, from 1960 to 1986, significantly more hunters and birds were checked in years with a two- than a one-bird bag limit (hunters: 469.3 ± 66.1 vs. 183.3 ± 14.7, birds: 253.0 ± 63.4 vs. 82.3 ± 7.3, $n = 10$ and 6, unequal variance $t = 5.03$ and 2.80, df = 6.4 and 5.4, $P = 0.002$ and 0.038). Also, during seasons with unregulated numbers of hunters (1960–1986), the mean checked harvest was higher than when permit numbers were restricted (1987–1998) (163 ± 127 vs. 65 ± 15 birds, $n = 18$ and 5, unequal variance $t = 2.92$, df = 19, $P = 0.009$). Permit numbers and harvest were also positively, though not significantly, correlated from 1987 to 1998 (Kendall's $\tau = 0.564$, $n = 5$, $P = 0.112$).

Harvest

The preceding data indicate both that less conservative regulations were correlated with increased harvest and that hunting regulations covaried

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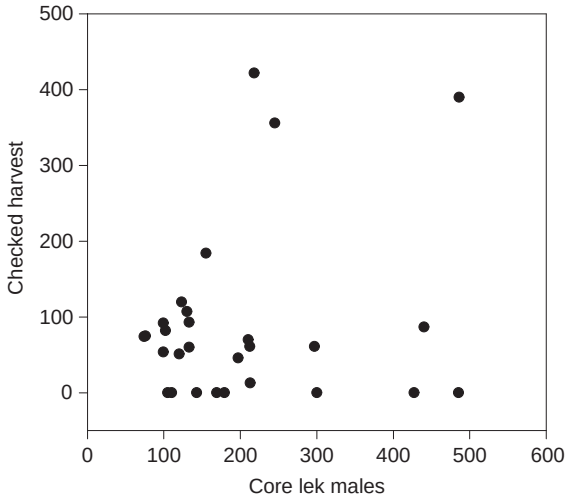

Figure 23.2. The relationship between harvest recorded at check stations and counts at core leks in the preceding spring.

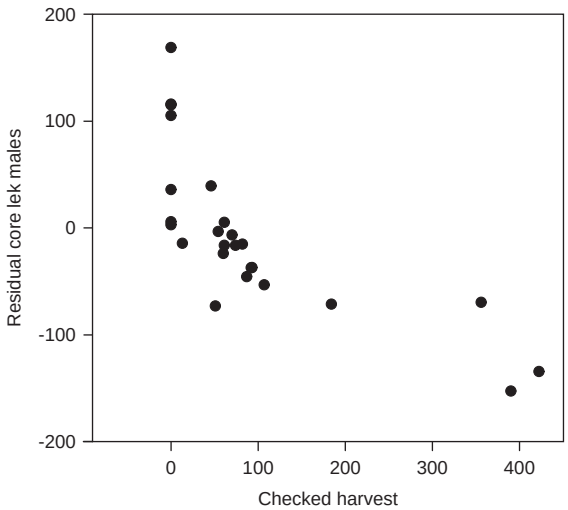

Figure 23.3. The relationship between the count of males at core lek in spring and harvest recorded at check stations in the previous autumn. Core lek counts are scaled as residuals from a regression of the count in year 2 on the count in year 1.

positively with core lek counts for the last 12 years of the study. However, over the entire study period, we found no relationship between spring core lek counts and checked harvest ($r = 0.042$, $n = 28$, $P = 0.831$; Fig. 23.2). The adjusted r^2 value for this relationship was zero, indicating that harvest was effectively independent of prior population size. Thus, retrospective analysis of the effect of harvest on subsequent population size was justified.

Did Harvest Depress Population Size?

Core lek counts increased during three periods when the hunting season was closed, but decreased to lower levels each time it was reopened (Fig. 23.1). As expected if hunting mortality were additive, core lek counts were negatively and significantly related to the previous fall's harvest in a model that also included the prior year's lek count as a covariate (overall model: $F_{2,22} = 104.321$, $P < 0.0001$; prior year's count: $b' = 0.797$, $P < 0.0001$; checked harvest: $b' = -0.572$, $P < 0.0001$; Fig. 23.3). Together, the prior year's lek count and checked harvest explained 89.6% of the annual variance in core lek counts the following spring (adjusted r^2 based on square-root transformed data).

DISCUSSION

Our analyses indicate that the short-term dynamics of the Long Valley population were dominated by annual variation in harvest, despite a short

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season (≤3 d) and low bag limits (≤2 birds). The population increased in each of three periods when the hunting season was closed and declined to lower levels each time hunting was resumed. Fall harvest levels were statistically independent of the previous spring's population size (indexed by lek counts) and, after controlling for a positive correlation between lek counts in successive years, harvest covaried negatively with lek counts the following spring. These results provide evidence that hunting depresses population growth and are not confounded by a correlation between harvest and prior population size (see Introduction).

As with any retrospective analysis, our conclusions are subject to the caveat that other environmental factors affecting population growth might have covaried with harvest rates over time in a way that mimicked the effects of additive hunting mortality. Indeed, it would be surprising if other factors affecting population growth did not exhibit temporal variation. However, our analysis controlled statistically for the most obvious candidate, population size, and it seems unlikely that other factors could have replicated the observed response of the population to the cessation and, particularly, the resumption of hunting during and after each of the three season closures (Fig. 23.1).

In light of the difficulty previous investigators have experienced in demonstrating harvest effects on population size in Greater Sage-Grouse, it may seem surprising that data from a population hunted intermittently for only 2–3 days per year reveal such a clear effect. Four factors may help to explain this. First, our study population is relatively isolated, reducing the opportunity for immigration or emigration to obscure locally determined population dynamics. Second, our statistical analysis accounted for variation in prior population size, a factor overlooked in some earlier studies. Third, due to periodic season closures and the accessibility of the area to large numbers of hunters from population centers in southern and central California when the season was open, the population was exposed to a wide range of hunting pressure. Finally, reproductive success in this population appears to be relatively low, as indicated by juvenile:adult female ratios in wings collected at check stations (CDFG, unpubl. data). Mean juvenile:adult female ratios in Long Valley for 1960–1984 (2.05 ± 0.50, n = 15 yr) and 1985–1995 (1.02 ± 0.15, n = 7) fall below mean values for six other western states compiled for the same periods by Connelly and Braun (1997) (2.33 and 1.74, respectively). Low reproductive success must limit population growth and therefore, indirectly, make population size more susceptible to variation in mortality rates.

Our analysis supports the contention of Connelly et al. (2003) that hunting can depress population growth rate in Greater Sage-Grouse. Importantly, our study and Connelly et al.'s derive the same conclusion from complementary lines of evidence (spatial vs. temporal variation in harvest rates) and from widely separated populations. At this point we are not aware of any compelling evidence for compensatory hunting mortality in Greater Sage-Grouse, though scenarios under which this might be the case are conceivable. For example, persistent, deep snow cover can greatly restrict the areas in which sage grouse are able to forage and seek cover during winter (Hupp and Braun 1989) and thus has the potential to cause density-dependent mortality via reduced food availability, increased exposure to predation, or both. If so, density-dependent winter mortality might compensate for the effect of hunting in years or areas subject to these conditions.

Currently, Greater Sage-Grouse are hunted in most states in which they occur and, consequently, each year biologists charged with their management must make decisions on hunting regulations. Both our results and those from low-elevation populations studied by Connelly et al. (2003) indicate that recreational hunting can depress population growth in this species. We therefore suggest that the assumption of additive, rather than compensatory, hunting mortality should be the starting point when setting hunting regulations for Greater Sage-Grouse. A consequence of this conclusion is that hunting should be placed among the factors capable of depressing population size, and hence potentially lowering the long-term viability of small and isolated populations.

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Declining populations of greater sage-grouse: hunter motivations when numbers are low

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Abstract

As a hunted species becomes increasingly rare, the effort required to locate and harvest an individual tends to increase. As rarity increases, governmental oversight, including changes in hunting regulations and protection of habitats and individuals using mechanisms such as the US Endangered Species Act (ESA), can be used to mitigate extinction risks. However, recent research has demonstrated the existence of a feedback mechanism through which increased rarity may increase hunter demand for opportunities to pursue rare species before the opportunity is lost. This phenomenon, referred to as the anthropogenic Allee effect, may exacerbate exploitation, thereby resulting in disproportionally large effects of harvest on vulnerable species. In 2010, the US Fish and Wildlife Service designated greater sage-grouse (*Centrocercus urophasianus*; sage-grouse) as a candidate for listing under the ESA. Although sage-grouse are a candidate for ESA listing, they are still hunted throughout much of their current range. In 2008, the demand for sage-grouse hunting permits in Utah exceeded their availability, raising questions about why hunters choose to pursue this species. We hypothesized that the pending ESA listing decision increased hunter demand for permits. We surveyed randomly selected hunters who obtained permits to hunt sage-grouse in Utah in 2008–2010 ($n = 838$) to determine their motivations for hunting sage-grouse and determinants of hunter satisfaction. The most commonly reported reasons for hunting sage-grouse were to spend time with family, for tradition and meat. Although the potential ESA listing was not a major motivational factor in 2009 or 2010, the percentage of respondents selecting this option did increase by 7%. Hunter awareness of the ESA listing petition also increased by 18% during this period. Our results provide new insights on the sociological importance and potential threats of hunting rare species.

Introduction

'When a wildlife population is threatened, deliberately killing individuals from it may seem perverse' (Loveridge, Reynolds & Milner-Gulland, 2007). Following the overexploitation of various wildlife species during the 19th century, conservation-minded sportsmen in the late 19th and early 20th centuries advocated for regulated hunting as a means of protecting wildlife populations (Trefethan, 1975). Subsequently, sport hunting of free-ranging wildlife has played a fundamental role in the evolution of wildlife conservation in North America. Pivotal legislation in the US, such as the Pittman-Robertson (PR) Federal Aid in Wildlife Restoration Act of 1937, established critical linkages between hunting and conservation funding (Smith, 1976; Mangun & Shaw, 1984) and most state wildlife management agencies currently depend upon PR funding to provide revenues for wildlife conservation. However, as populations of some game species decline, largely as a result of habitat loss and fragmentation, society has increasingly questioned the role hunting should play in contemporary wildlife management (Manfredo, Teel & Bright, 2003).

Regulated harvest has traditionally been believed to pose a minor threat of causing species extinction because of the 'law of diminishing returns' [i.e. hunters stop pursuing game if numbers decline to the point that harvest is unlikely (Strickland *et al*., 1996, although see Connelly, Gammonley & Peek, 2005)]. However, recent research in bio-economic theory has shown that increased rarity may result in increased demand for hunting opportunities by hunters who fear that the opportunity to pursue the species may be lost because of heightened governmental regulations aimed at protecting the species (Courchamp *et al*., 2006; Gault, Meinard & Courchamp, 2008; Hall, Milner-Gulland &

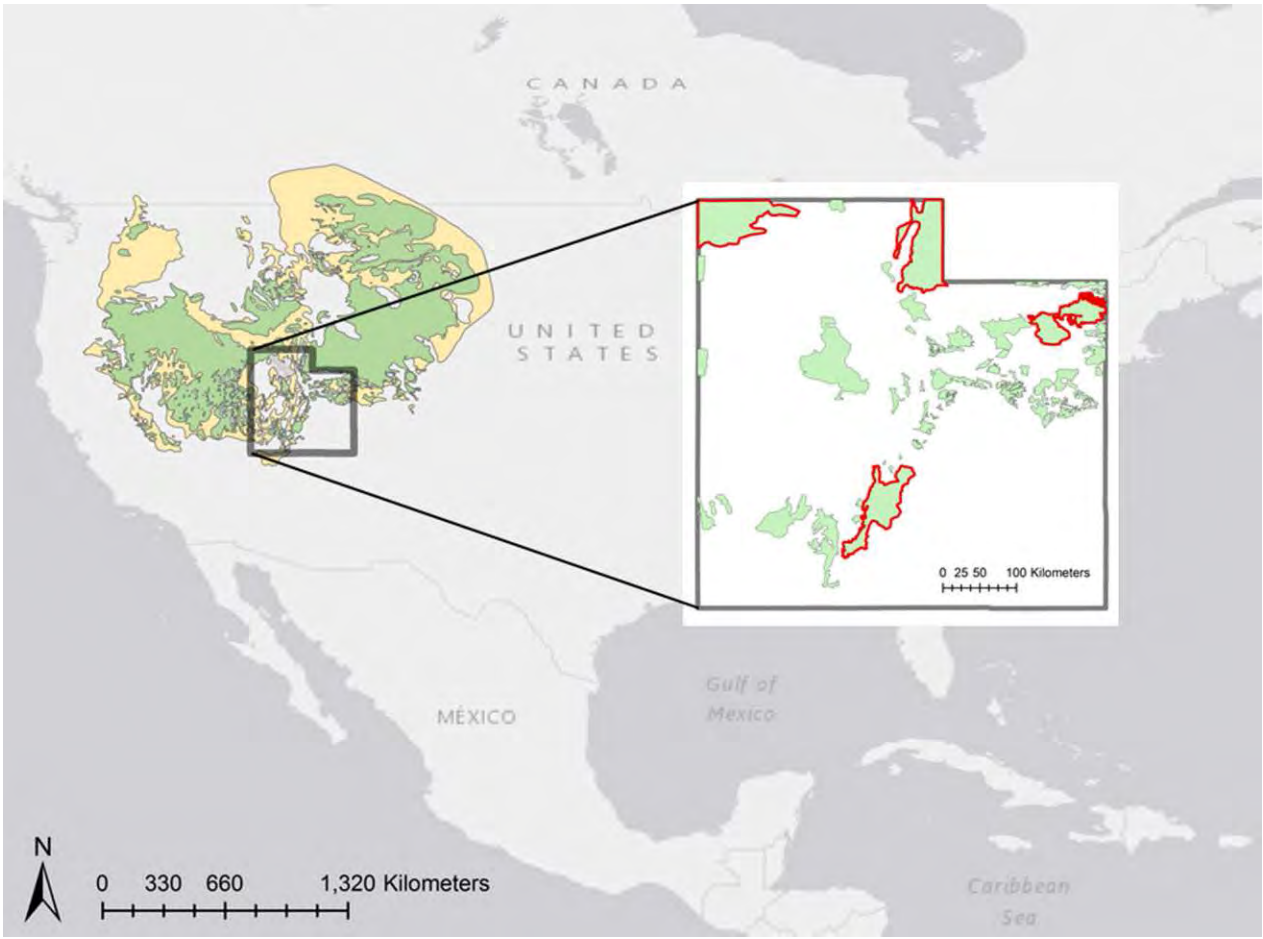

Figure 1 Map of the historic (yellow) and current (green) range of greater sage-grouse in North America. The map inset portrays areas currently occupied by greater sage-grouse in Utah. The four areas where hunting was permitted in Utah during the course of our study (2008–2010) are outlined in red.

Courchamp, 2008; Angulo *et al.*, 2009). These findings, commonly referred to as anthropogenic Allee effect, have increased concerns about the conservation of declining species and the interaction between environmental policy and harvest, particularly for trophy game species (Palazy *et al.*, 2012; Prescott *et al.*, 2012).

Large-scale anthropogenic alteration of biotic and abiotic systems further complicates the conservation of many species. Habitat loss caused by land-use change continues to threaten biodiversity at a global scale (Sala *et al.*, 2000). Contemporary climate change may pose an even greater threat to many species than habitat loss (Thomas *et al.*, 2004). The interactive effects of habitat loss and climate change may prove especially disastrous for species that are unable to adapt or migrate to climate refugia because of a lack of habitat connectivity resulting from habitat loss and/or fragmentation. The cumulative effects of these processes over time may exacerbate population declines of many hunted species thereby increasing public scrutiny of the role of hunter harvest in their management.

Greater sage-grouse (*Centrocercus urophasianus*; sage-grouse) are endemic to western North America and are obligates of sagebrush (*Artemisia* spp.) habitats (Fig. 1; Schroeder, Young & Braun, 1999). Sage-grouse populations experienced range-wide declines throughout the 20th century primarily as a result of habitat loss, fragmentation and degradation (Connelly & Braun, 1997; Knick & Connelly, 2011). During this period of population declines, state wildlife management agencies drastically limited sage-grouse harvest levels and, in some instances, prohibited the harvest of sage-grouse in response to concerns about the impacts of hunting on population trajectories (Rogers, 1964; Connelly, Gammonley & Keegan, 2012).

In addition to the persistent effects of habitat loss and fragmentation, recent research has indicated that sage-grouse populations have already, and will continue to be negatively impacted by climate change (Blomberg *et al.*, 2012; Guttery *et al.*, 2013; Caudill *et al.*, 2014). In 2010, the US Fish and Wildlife Service (USFWS) determined that sage-grouse warranted protection under the Endangered

Species Act of 1973 (ESA). However, protection was withheld in favor of species with greater conservation needs (USFWS, 2010). As a result of this 'warranted but precluded' decision, sage-grouse are currently considered a 'candidate species' and, as such, population status must be monitored by USFWS to determine if the species should be promoted to full 'threatened' or 'endangered' status (USFWS, 2010). Despite uncertainty about the long-term viability of this species, sage-grouse are still hunted in 10 of the 11 states in which the species occurs (Reese & Connelly, 2011).

Although hunting was not cited as a high-priority threat by the USFWS (2010), many stakeholders question why state wildlife agencies continue to allow hunters to harvest sage-grouse (Belton, Jackson-Smith & Messmer, 2009; UDWR, 2009). Currently, there is disagreement about the direct effects of hunting on sage-grouse populations. Several authors have attempted to assess the impacts of harvest on sage-grouse populations (Zunino, 1987; Stigar, 1989; Wik, 2002; Connelly *et al.*, 2003; Sika, 2006; Sedinger *et al.*, 2010). However, many of these studies were plagued by confounding factors (small sample sizes, lack of replication) or produced contradictory results regarding whether hunter harvest is additive or compensatory to natural mortality (Reese & Connelly, 2011).

Even given the inconsistent results, the biological impacts of hunting are far better understood than hunter motivations for pursuing this species. Currently, there are no published studies concerning the human dimensions of hunting sage-grouse. Further, because one of the basic tenets of harvest management is that only populations that are large and robust enough to sustain harvest be hunted (Connelly *et al.*, 2005), few opportunities currently exist to study hunters of rare, declining, or ESA candidate species in North America. Reese & Connelly (2011) concluded that the future of sage-grouse harvest management must be guided by both the biological and social implications of hunting this ESA candidate species.

Given recent findings about the interaction of rarity and hunter demand (Angulo *et al.*, 2009) and the potential cumulative threats posed by climate and land-use change on wildlife populations (Sala *et al.*, 2000; Thomas *et al.*, 2004), better information is needed regarding the potential effects of hunting on declining species. Because of their rare dual status as a candidate for ESA listing and a hunted species, we chose to use sage-grouse as a model species to evaluate the effects of real and proposed changes in conservation status and hunting regulations on hunter satisfaction and motivations in order to gain a better understanding of how hunting may affect this and other declining species. Specifically, we hypothesized that the pending ESA listing decision increased hunter demand for sage-grouse hunting permits. Additional objectives of our research were to (1) determine what factors contribute most to sage-grouse hunter satisfaction; (2) gain an understanding of why Utah hunters choose to hunt sage-grouse; (3) to determine if the possibility of heightened protection for sage-grouse has resulted in changes in hunter motivations.

Materials and methods

Survey design and implementation

The Utah Division of Wildlife Resources (UDWR) requires that hunters apply for and obtain special permits to hunt sage-grouse. Hunters who obtained permits were required to pay a $10 permit processing fee. During the course of our study, only four sage-grouse populations within the state were open to hunting (Fig. 1) and each permitted hunter was allowed to harvest, at most, two birds from one of the four designated populations (UDWR, 2009). The UDWR employs an adaptive harvest management strategy wherein the number of permits available in a given year is a function of the estimated autumn population size, previous hunter participation and harvest success rates (UDWR, 2009). Following the hunting season, UDWR conducts annual surveys of sage-grouse permit holders to determine hunt participation rates, harvest success, number of days hunted, number of birds harvested and hunter satisfaction. In 2008, the demand for sage-grouse hunting permits was so great that the permit application website crashed (the actual number of individuals attempting to access the site is unknown). In response to this unusually high demand for permits, UDWR modified the 2008 survey to include questions concerning motivations for obtaining a permit and factors contributing to hunter satisfaction. Each respondent was allowed to select up to two motivations. Additionally, beginning in 2008, and continuing throughout our study period, UDWR delayed the sage-grouse hunting season by 2 weeks (from mid-September to late September) to allow brood groups additional time to disband in hopes of reducing harvest rates for juveniles and reproductively successful hens (Ellison, 1991). Subsequently, hunters were asked if this regulatory change affected their interest in hunting sage-grouse. Finally, permit holders were asked about their knowledge of the petition to list sage-grouse under the ESA, and their plans to hunt sage-grouse in the future. The survey was modified slightly in 2009 to include additional questions about anticipated participation in upland game bird (i.e. birds other than waterfowl, typically of the order Galliformes or Columbiformes) hunting if the sage-grouse hunt were cancelled, whether a hunt could be satisfactory if the legal limit of two sage-grouse was not harvested and whether a hunt could be satisfactory if no sage-grouse were harvested (Supporting Information Appendix S1).

The UDWR survey sampling protocol required that a minimum of 25% of the permit holders for each of the four hunt areas in the state be contacted. Each permit holder was assigned a permit number and sampling was conducted by randomly selecting from these numbers. Surveys were conducted via telephone interviews during 2008 and 2009. In 2010, the UDWR elected to change the survey method. A sample of permit holders was initially invited to complete the survey online. Hunters who did not complete the online survey within 2 weeks were sent a paper copy of the survey with a pre-addressed postage-paid envelope to return the completed survey. In all years, if a permit holder could not

be reached or refused to participate in the survey, another permittee was randomly selected. The UDWR survey protocol did not include provisions for testing for nonresponse bias. Additionally, UDWR policies do not permit the release of hunter contact information to external parties, thereby precluding other options for testing for nonresponse biases. However, we do not suspect that such a bias existed as it has been shown that post-hunting season surveys generally yield accurate harvest data (Steinert, Riffel & White, 1994) and that even low response rates tend to be adequate to control for response biases (Hammitt & McDonald, 1982).

Statistical analysis

Because of the nested nature of the questions (e.g. permit holder who did not participate in the hunt were not asked to respond to hunt-related questions such as the number of sage-grouse harvested), sample sizes varied by survey question. Question-specific sample sizes are presented in Supporting Information Appendix S1. It is possible, even likely, that some hunters were randomly selected to participate in the survey in multiple years, thereby resulting in a possible lack of independence in some responses across years. Unfortunately, the data provided by UDWR did not include a unique identifier that would have allowed us to determine which, if any, hunters responded in multiple years. As such, all responses were treated as independent.

To assess what factors contributed most to hunter satisfaction (objective 1), survey respondents were asked to choose between five levels of satisfaction with their hunting experience (very unsatisfied, unsatisfied, neutral, satisfied and very satisfied). We used cumulative logit models with backward selection to determine which variables influenced hunter satisfaction. Explanatory variables included harvest success, number of days spent hunting and whether the permit holder was aware that sage-grouse had been petitioned for listing under the ESA. Predictor variables were tested for multicollinearity. The number of birds harvested was not used because this response was highly correlated with harvest success.

To address questions concerning hunter motivations (objectives 2 and 3), response frequencies of motivation options (question 8, Supporting Information Appendix S1) were calculated and comparisons of response categories were performed using chi-square tests. All analyses were performed using SAS v9.2 (SAS Institute Inc., Cary, NC, USA).

Results

During the course of the study (2008–2010), the number of permits issued ($n = 1120$, 834, 809, respectively) and number of hunters surveyed ($n = 318$, 288, 232, respectively) varied considerably. Most respondents were males (90%) with an average age of 42 years (range = 9 to 91). Minors (age < 18 years) constituted 14% of survey respondents. Overall, 78% of survey respondents participated in the sage-grouse hunt (2008 = 77.7%, 2009 = 76.0%, 2010 = 81.0%; question 1, Supporting Information Appendix S1). The median number of days spent hunting sage-grouse was one for all years (question 2, Supporting Information Appendix S1). In 2008, 61% of permit holders who participated in the sage-grouse hunt were successful in harvesting at least one bird (question 3, Supporting Information Appendix S1). The percentage of successful hunters increased to 67% in 2009 and increased to 70% in 2010. In 2008 and 2009, 70% of successful hunters harvested a limit of sage-grouse. This percentage increased to 79% in 2010. Across years, hunters who participated in the sage-grouse hunt harvested an average of 1.7 birds (question 4, Supporting Information Appendix S1).

During 2008–2009, approximately 58% of all survey respondents reported being aware that sage-grouse had been petitioned for listing under the ESA (question 7, Supporting Information Appendix S1). Following the species' designation as 'warranted but precluded' in early 2010, awareness increased to 76%. In 2008, a slightly larger percentage of respondents reported that they planned to obtain a sage-grouse permit during the following year (question 6, Supporting Information Appendix S1) than in 2009 or 2010 (84.6%, 76.0% and 79.3%, respectively).

Approximately 33% of respondents in 2008 reported that the change in sage-grouse hunting season dates had affected their interest in pursuing the species (question 12, Supporting Information Appendix S1). The percentage of respondents who reported that the change in season dates increased their interest was similar to the percentage who reported a decline in interest (15.4% and 17.3%, respectively). Hunting participation rates did not differ between groups who reported an increase or decrease in interest because of changes in season date ($\chi^2 = 0.630$, $n = 104$, d.f. = 1, $P = 0.571$). Additionally, respondents who reported that they were less interested in hunting sage-grouse were no less likely to report intentions of obtaining a permit the following year than were respondents who reported being more interested in pursuing the bird ($\chi^2 = 0.769$, $n = 104$, d.f. = 2, $P = 0.681$).

Fifty-six percent of respondents reported that their level of participation in upland game hunting would not be affected if the sage-grouse hunting season were closed, whereas 10% reported that they would no longer engage in upland game bird hunting if the sage-grouse hunt were cancelled (question 9, Supporting Information Appendix S1). The remaining 34% indicated that elimination of the sage-grouse hunting season would result in them hunting upland game less often.

Logit models for the three combined years of survey data indicated that satisfaction (question 5, Supporting Information Appendix S1) was best explained by whether or not a hunter was successful in harvesting at least one sage-grouse (Table 1, $R^2 = 0.168$). Whether successful or unsuccessful, reported satisfaction reflected the full range of satisfaction levels from 'very unsatisfied' to 'very satisfied' (Table 2). However, unsuccessful hunters were more likely than successful ones to report all levels of satisfaction except 'very satisfied' (Table 2). Successful hunters were 35% more likely to report that they were 'very satisfied' with their hunting

experience than unsuccessful hunters. When permit holders were presented with a hypothetical situation in which they were unsuccessful in harvesting a limit of sage-grouse, 45% responded that they would still be satisfied with their hunt while almost 50% reported that they would be very satisfied (question 10, Supporting Information Appendix S1). When respondents were presented with a situation in which they were unsuccessful in harvesting *any* sage-grouse, 50% reported that they would still be satisfied while over 39% said that they would be very satisfied with their hunt (question 11, Supporting Information Appendix S1).

In 2008, the most commonly cited reason for obtaining a sage-grouse permit was 'meat' (50.6%, Table 3), with 'tradition' (45.3%) being the second most frequently cited motivator (question 8, Supporting Information Appendix S1). Although a small percentage (7.2%) of hunters cited 'other' as a reason for obtaining a permit in 2008, the associated comments indicated that an additional motivation category was needed. Consequently, for the 2009 and 2010 surveys, we added the option of 'To spend time outdoors with family' to the survey. Because of this addition, motivation data from 2008 cannot be directly compared with data from subsequent years. In 2009 and 2010, 'family' was the dominant factor cited for why individuals chose to hunt sage-grouse (74.3% and 67.2%, respectively, Table 3). Although 'listing' was not a primary motivational factor in any year of the study (2008 = 13.8%, 2009 = 10.1%, 2010 = 17.2%), the percentage of respondents who selected this option did increase considerably between 2009 and 2010. This increase between 2009 and 2010 was similar in direction and magnitude to the increase in the percentage of hunters who reported that they were motivated by a view that sage-grouse are a trophy species (2009 = 22.9%, 2010 = 30.6%, Table 3). Across years, respondents who reported being motivated by 'listing' showed weak evidence of being more likely to report that they were also motivated by the perception of sage-grouse as a trophy species ('trophy'; $\chi^2 = 2.401$, $n = 658$, d.f. = 1, $P = 0.121$).

Table 1 Results of backward variable selection for model of greater sage-grouse (*Centrocercus urophasianus*) hunter satisfaction in Utah, USA, 2008–2010

Predictor of satisfaction	Wald χ^2 value	*P*-value
Aware of status[a]	1.365	0.243
Days hunted[b]	3.244	0.072
Successful[c]	105.279	**< 0.001**

The final model retained only the effect of successful harvesting at least one sage-grouse. Test statistics and *P*-values are presented for all explanatory variables initially included in the model as these results may aid in the design of similar research. The value in bold is statistically significant.

[a]Binary variable indicating whether hunters were aware of the petition to list sage-grouse under the ESA.

[b]Variable indicating the number of days spent hunting sage-grouse. Few hunters reported hunting more than 2 days so numbers greater than 2 were rounded down to 2.

[c]Binary variable indicating whether a hunter was successful in harvesting at least one sage-grouse.

Discussion

Our results suggest that sage-grouse in Utah do not appear to be strongly threatened by the anthropogenic Allee effect (i.e. our hypothesis that the petition to list sage-grouse under the ESA motivated hunters was not well supported). However, following the designation of sage-grouse as a candidate for ESA listing in early 2010, participation in the sage-grouse hunt increased and a greater percentage of respondents reported that they were influenced by the threat

Table 2 Reported levels of hunt satisfaction for successful and unsuccessful greater sage-grouse (*Centrocercus urophasianus*) hunters, Utah, USA, 2008–2010

Successful	Very unsatisfied	Unsatisfied	Neutral	Satisfied	Very satisfied
No	13.3	13.3	25.2	28.3	19.9
Yes	2.8	2.6	11.9	27.6	55.1

Values reported are the percentage of respondents reporting various levels of satisfaction and hunt success. Percentages are calculated from a sample of 654 hunters who participated in the Utah sage-grouse hunt during our study.

Table 3 Percentage of hunters who reported various reasons for obtaining a greater sage-grouse (*Centrocercus urophasianus*) hunting permit in Utah, USA, 2008–2010

Reasons for obtaining a permit	2008	2009	2010
View them as a trophy game bird (trophy)	29.2	22.9	30.6
Always hunted them (tradition)	45.3	27.8	37.1
Want to harvest one before ESA listing (listing)	13.8	10.1	17.2
New to upland game hunting, giving it a try (new)	19.2	14.2	8.6
Hunt them for meat (meat)	56.0	33.7	19.8
To spend time outdoors with family (family)	NA[a]	74.3	67.2
Other reasons (other)	7.2	2.4	15.5

Percentages within a column do not sum to 100% because hunters were allowed to select up to two motivating factors.

[a]Indicated that the associated response option was not applicable (i.e. NA) because of not being included in the survey until 2009.

of ESA listing and the perception of sage-grouse as a trophy species. These findings suggest that for rare or declining game species that are not primarily viewed as high-value trophies, the passage of protective regulations is unlikely to lead to a substantially increased threat from hunting via the anthropogenic Allee effect, provided that harvest is carefully regulated, as with sage-grouse harvest in Utah.

Hunting a declining species

The increased influence of the ESA listing petition in 2010 may be attributable to increased public awareness. However, a search for articles published in Utah newspapers between 1 January 2004 and 1 June 2008 yielded 25 entries that included the words 'sage-grouse' and 'Endangered Species Act' suggesting that many Utah residents had been exposed to information about the decline of sage-grouse prior to our study. Overall, our results suggest that Utah sage-grouse hunters were primarily motivated by affiliation- ('family' or 'tradition') and achievement-oriented ('meat' or 'trophy') factors (Decker & Connelly, 1989). These findings are corroborated by other studies (Hayslette, Armstrong & Mirarchi, 2001; Radder & Bech-Larsen, 2008) that highlighted the influence of tradition and companionship/socializing on hunter motivations. We did find weak evidence that respondents who reported being motivated by the perception of sage-grouse as a trophy species were also more likely to report being motivated by the possibility of losing the opportunity to pursue the species if it were listed as threatened or endangered. If the species continues to decline, it is possible that more hunters will be motivated by the threat of ESA listing and/or the desire to harvest a trophy gamebird.

Sage-grouse hunter participation rates declined by 1.6% between 2008 and 2009, continuing a trend documented by UDWR since 2004 (Supporting Information Appendix S2). However, reported participation rates increased by approximately 5.0% between 2009 and 2010. Although it is unclear why this increase occurred, the decision to list sage-grouse as a 'warranted but precluded' in early 2010 may have resulted in higher participation rates among hunters concerned about possibly losing the opportunity to hunt sage-grouse in the near future. Additionally, the highest documented rates of sage-grouse hunter participation in Utah were during the 2005 hunting season (Supporting Information Appendix S2), which was preceded in January of 2005 by a decision by the USFWS that sage-grouse did not warrant ESA protection (UDWR, 2009). This further suggests that the threat of increased regulation and/or increased media coverage of potential regulatory action may lead to increased participation in sage-grouse hunting. An association between increased regulation to protect a species and increased exploitation has previously been documented by other researchers (Rivalan *et al.*, 2007). However, in the years following the high participation rate of 2005 and the rebound of 2010, participation rates declined rapidly, suggesting that the effects of regulatory actions on participation rates are short-lived. Similarly, Koons, Rockwell, & Aubry (2014) reported that changes in harvest regulations for lesser snow geese (*Chen caerulescens caerulescens*) resulted in a temporary increase in harvest mortality, likely as a result in increased hunter participation rates, followed by a trend in harvest rates declining below the long-term average.

We obtained hunter predictions about whether further regulation (i.e. ESA listing) would affect their future participation in upland game bird hunting. Although most respondents reported that regulations resulting in a cancellation of the sage-grouse hunting season would not lead them to stop participating in upland game hunting, just under half of the respondents did report that termination of the sage-grouse hunt would result in reduced involvement in upland game hunting. We interpret this as evidence that there is a small population of devout sage-grouse hunters but that most hunters would shift the time normally spent pursuing sage-grouse to the pursuit of other upland game species. These results may suggest that wildlife management agencies may be able to impose stringent harvest restrictions for rare species without resulting in a reduction in hunting participation and associated revenues by offering opportunities to pursue more abundant species (Messmer & Enck, 2012).

Hunter satisfaction and the conservation of sage-grouse populations

Most respondents were satisfied with their hunting experience. Unlike other studies, which found that hunter satisfaction was affected by multiple factors (Decker, Brown & Gutierrez, 1980; Hammitt, McDonald & Patterson, 1990; Gigliotti, 2000; Frey *et al.*, 2003), our data suggested that the level of satisfaction was primarily influenced by hunter success. Messmer *et al.* (1998) reported a similar relationship for big game hunters in Utah. Early game management philosophy purported that successful hunters were satisfied hunters (Stankey, Lucas & Ream, 1973; Woods & Kerr, 2010). While our data appeared to support this idea, our model explained only 17% of the variation in hunter satisfaction. This suggests that other factors that we did not measure may be better determinants of satisfaction than hunter success (Messmer & Enck, 2012).

Unlike other rare game species in North America [e.g. bighorn sheep (*Ovis canadensis*)], sage-grouse are not viewed as a highly valuable trophy species at a national scale, nor does sage-grouse hunting have strong cultural or spiritual importance as is the case for hunting other ESA listed or candidate species such as the polar bear (*Ursus maritimus*; USFWS, 2008), ringed seal (*Phoca hispida*; NOAA, 2012) and Pacific walrus (*Odobenus rosmarus*; USFWS, 2011) in some Native American cultures (Wein, Freeman & Makus, 1996; Duhaime, Chabot & Gaudreault, 2002; Stirling, 2011).

Although trophy hunting has been shown to have negative evolutionary consequences (Coltman, O'Donoghue & Jorgenson, 2003), individual hunting permits for some trophy species may sell for hundreds of thousands of dollars (Loveridge *et al.*, 2007) thereby producing revenues that may facilitate conservation efforts at a minimal cost to the species being hunted. Some of our respondents reported

being motivated by the perception of sage-grouse as a trophy species and tradition. However, neither of these conditions appeared to occur at the levels documented for other trophy or culturally significant species.

The importance of funding for wildlife research and conservation cannot be ignored. Because the majority of funding for state wildlife management agencies comes from user fees (i.e. PR excise taxes, hunting license sales), these funding sources are essential to the conservation of all wildlife. Until wildlife agencies receive broader public funding, they must continue to balance social, biological and financial factors in addressing conservation concerns with user-based harvest management strategies that provide the majority of the agencies' revenue.

Given these conditions and our findings, conservation strategies for sage-grouse, or other rare or declining species, must carefully weigh the social and biological implications of hunting. The stringent harvest regulations adopted by UDWR that link sage-grouse hunting opportunities to annually estimated population sizes are an effective means of offsetting the threats predicted by the anthropogenic Allee effect hypothesis. However, it is also necessary to recognize that uncertainty about the effects of harvest on sage-grouse still exists. We recommend that if harvest of a species is deemed appropriate, conservative harvest management strategies be established using the best available science and that the long-term stability of the population take precedence over other factors (Connelly *et al*., 2005).

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Supporting information

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

Appendix S1. Utah greater sage-grouse hunting survey 2008–2010.

Appendix S2. Greater sage-grouse hunter participation rates in Utah, 2004–2014.

BioOne RESEARCH EVOLVED

Effect of harvest on sage-grouse *Centrocercus urophasianus* populations: what can we learn from the current data?

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SHORT COMMUNICATION

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Effect of harvest on sage-grouse *Centrocercus urophasianus* populations: what can we learn from the current data?

James S. Sedinger & Jay J. Rotella

Sedinger, J.S. & Rotella, J.J. 2005: Effect of harvest on sage-grouse *Centrocercus urophasianus* populations: what can we learn from the current data? - Wild. Biol. 11: 371-375.

Understanding the impact of human harvest is fundamental to the effective management of many wildlife populations. Such understanding has been elusive because harvest mortality may compensate for other sources of mortality when the mortality process is density dependent. This problem is exacerbated by the ubiquitous positive correlation between harvest regulations and population size: more harvest is allowed when populations are larger. Connelly et al. (2003) studied the impact of harvest regulations on sage-grouse *Centrocercus urophasianus* using three sets of regulations: closed season, 1-bird bag and seven-day season, 2-bird bag and 23-day season. Connelly et al. (2003) reported a generally negative correlation between harvest regulations and increase in number of males on leks for harvest regulations that ranged from a hunting closure to a 23-day season with a 2-bird bag. Because lek sizes were smaller where hunting was closed there was confounding between harvest and population density, making it difficult to distinguish harvest effects from those of population density. Based on a simple simulation the apparent effects of harvest on change in population size observed by Connelly et al. (2003) could be produced entirely by density-dependent phenomena. Additionally, λ (finite rate of population increase) was greater in areas with more restrictive harvest regulations. λ is a ratio of N_{t+1} to N_t, however, and there is a negative sampling covariance between λ and N_t; we expect λ to be larger when N_t is smaller based purely on this statistical fact. The study by Connelly et al. (2003) is an important attempt to study effects of harvest on population dynamics of sage-grouse. We do not argue that either additive mechanisms in survival or compensatory mechanisms in survival or reproduction influence the relationship between harvest and population dynamics of sage-grouse, but that correlation between population size and harvest regulations, combined with statistical issues make it impossible to distinguish between these two hypotheses in Connelly et al. (2003).

Key words: Centrocercus urophasianus, exploitation, harvest, population dynamics, sage-grouse

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Human harvest of wildlife has been a central issue in management of their populations for decades. For managers to effectively manage harvest, it is essential that they understand the impact of harvest on average survival rate at the population level. Errington & Hamerstrom (1935) proposed the idea of a harvestable surplus, in which habitat held numbers of a population that survived the most limiting season (typically winter in temperate North America) to below some threshold. Harvest of individuals above this threshold would have no effect on survival rate for the population as a whole because a number greater than that harvested would have died anyway. Anderson & Burnham (1976) formalized the concepts of additive and compensatory mortality for waterfowl harvest. Compensatory harvest mortality requires that harvest mortality reduces the mortality rate of the unharvested segment of the population such that there is no relationship between magnitude of the harvest and average survival rate in the population. Often, harvest is thought to be compensatory only below some threshold harvest rate that can be no greater than the mortality rate that exists in the absence of hunting (see Nichols 1991 for details). Additive harvest mortality, in contrast, adds to mortality in the population from sources other than hunting, resulting in reduced average survival at the population level in the face of hunting. A corollary of compensatory harvest mortality is that there must be some density dependence in the 'natural' mortality process.

Clearly, understanding the effect of harvest on annual survival in wild populations has important implications for managing these populations. In North America it has been difficult to understand the relationship between harvest and survival rates in harvested populations because managers typically reduce harvest rates when populations are low and increase harvest rates when populations are high (e.g. Sedinger & Rexstad 1994). Although managers view this approach as sound management, it completely confounds the effects of population density and harvest on annual survival. If survival rates decline at high harvest rates, is it because of the harvest rates themselves or because of the density-related effects of the corresponding high population level (Nichols et al. 1984, Nichols & Johnson 1989, Nichols 1991)?

Connelly et al. (2003) examined the effects of harvest of sage-grouse *Centrocercus urophasianus* in Idaho, USA, on changes in the sizes of leks in the studied populations. Understanding effects of harvest is an especially important issue for sage-grouse because their range has contracted significantly over the past several decades, and some local populations have declined (Connelly & Braun 1997, Schroeder et al. 1999, Connelly et al. 2000). Currently, all possible impacts on sage-grouse populations are being considered by managers.

Connelly et al. (2003) used three measures of population change to assess the effect of harvest regulations in two regions of Idaho on dynamics of sage-grouse populations. Data collection by Connelly et al. (2003:335) was conducted in the years immediately, "following a drought and widespread population declines". First, they examined response to hunting regulations of population rate of change for samples of individual leks. Specifically, they calculated rate of change in lek size before more restrictive hunting regulations were implemented and subtracted this rate of change from those calculated after regulations were implemented. Leks were assigned to one of three regulation packages: 1) closed season; 2) 7-day season with a 1-bird bag; and 3) 23-day season with a 2-bird bag. Second, Connelly et al. (2003) compared the maximum level of male attendance on leks during the first two years of implementation of more restrictive regulations versus the last two years of the study (four to five years after implementation of harvest treatments), calculated the increase and expressed it as λ, the finite rate of increase over the study. They then analyzed variation in λ in relation to region and hunting regulations using a two-factor Analysis of Variance (ANOVA). Third, they regressed the natural logarithm of lek attendance for each lek-survey route against year, calculated the slope (as a measure of population change over the study), and used ANOVA to assess variation in population change among regions and harvest treatments.

Connelly et al. (2003) found that leks in the area where harvest was closed grew more rapidly than did those experiencing harvest, although they found little difference between growth of leks experiencing 7-day sea-

sons with a 1-bird bag and those experiencing 23-day seasons with a 2-bird daily bag. They concluded that hunting may slow the growth of sage-grouse populations and that hunting restrictions combined with habitat conservation may be the most successful approach to recovering sage-grouse populations.

We believe there are two fundamental underlying problems with using the results of Connelly et al. (2003) to conclude that harvest affects sage-grouse populations. The first issue regards covariance between harvest regulations and population size, which has been ubiquitous in regulation of wildlife harvest in North America (Nichols et al. 1984, Nichols & Johnson 1989, Nichols 1991, Sedinger & Rexstad 1994) and made it difficult, if not impossible, to discern the role of harvest in regulation of wildlife populations. The second issue is statistical; use of ratios or percentage changes to assess relative rates of population change can introduce statistical artifacts into population analysis (Eberhardt 1970, Raubenheimer 1995). Specifically, in this case λ has a negative covariance with N_{t+1} even in the absence of any biological relationship between the two parameters. These two issues introduce the same biases into assessments of population regulation, albeit for different reasons; they cause managers to overestimate the effect of harvest. We examine these issues with respect to Connelly et al.'s (2003) analyses and conclusions.

Covariance between population size and harvest regulations, i.e. greater harvest rates at higher population densities, confounds the effects of population density and harvest. If density-dependent processes reduce population increase because of constraints on survival or fecundity, then a population's trajectory under density-dependent constraints will appear the same as it would under harvest management. More dense populations will grow more slowly, either because they are harvested more heavily or because of density-dependent processes. Such covariance existed in the Connelly et al. (2003) study. First, more restrictive harvest regulations were implemented (and data collection began) immediately after the region's populations went through a widespread population decline. Thus, populations would be expected to rebound (do better after this period) under a simple density-dependent explanation that does not involve effects of harvest. This has important implications for interpreting results of pre- and post-treatment comparisons. Second, in Connelly et al. (2003), average lek sizes at the start of the study were smaller in unharvested areas than in areas subjected to harvest (P = 0.09 based on a 2-factor (harvest level and community) ANOVA comparing mean lek sizes at the start of the study; Fig. 1). This covariance has important implications for interpreting results from different treatments as once again a density-dependent explanation could replace an additive-mortality explanation. To illustrate the potential of density-dependent mechanisms to produce results similar to those of Connelly et al. (2003) we simulated several populations of sage-grouse using a simple density-dependent discrete logistic model:

$$N_{t+1} = N_t \left(1 + R\left(1 - \frac{N_t}{K}\right)\right),$$

in which both R and K were random numbers drawn at each time step from normal distributions, N(0.2,0.1) and N(100,10), respectively. Means and variances were selected to approximate those in Connelly et al.'s (2003) study. We simulated populations with beginning sizes equal to mean lek sizes in each harvest treatment at the beginning of the Connelly et al. (2003) study (Connelly

Figure 1. Relationship between harvest regulations and mean initial lek size in Connelly et al. (2003).

Table 1. Mean of 10 trials of two-factor ANOVA of population trends (corrected for pre-treatment trend) comparable to Table 3 in Connelly et al. (2003). Initial lek sizes and population trajectories approximated those in Connelly et al. (2003) assigned to closed harvest, 1-bird bag and 2-bird bag harvest regulations. We simulated (10 times) a density-dependent model of population dynamics using beginning lek sizes identified in Connelly et al. (2003). Because our goal was to assess the potential role of density dependence we simplified the model and excluded area effects. Note the substantial apparent effect of harvest treatment when harvest did not influence dynamics of these populations. The apparent effect resulted from slower growth in populations that were on average at higher density, which in Connelly et al. (2003) were assigned to harvest treatments.

Source of variation	df	MS	F	P
Year	4	0.009828	6.231	0.00012
Harvest	2	0.1092	69.21	< 0.00001
Interaction	8	0.004283	2.715	0.00835
Error	135	0.00157		

et al. 2003: Tables 1 and 2). We repeated the simulations 10 times. We then used the methods employed by Connelly et al. (2003) on these simulated populations to assess the role of harvest. It is important to recognize that in our simulated populations, harvest had no effect on population dynamics; only the density-dependent mechanism affected population dynamics.

In our simulated populations, those experiencing the highest harvest rates grew more slowly than those experiencing lower rates of harvest or no harvest (Table 1). In our simulated populations, however, harvest did not actually influence population dynamics because no harvest effects were included in the model. Thus, simulation results in Table 1 are entirely a result of a density-dependent process and indicate the potential for such a process to have produced the results reported by Connelly et al. (2003). Based on this simple simulation, alternative interpretations of their results are clearly possible and should be considered.

It is important to note that the role of density-dependence in our simulations was influenced by our selection of a specific value for the mean of K. The value we chose ($\mu = 100$) is near the upper end of the distribution of lek sizes for sage-grouse (Connelly et al. 2004) and exceeded mean lek size in 12 of 19 areas considered by Connelly et al. (2003). To the extent that we underestimated the appropriate value of K, our results overestimated the potential for density dependence to explain the results of Connelly et al. (2003).

It is also important to recognize that both our simulations and the analyses of Connelly et al. (2003) were based on counts of the number of males on leks. In both cases we are assuming that these counts reflect dynamics of the local population. While we cannot be certain that the relationship between lek counts and true population size is constant among areas, lek counts are typically the only survey data available, and they are the generally accepted method of monitoring sage-grouse populations (Connelly et al. 2000). To the extent that this assumption might be violated our results should be viewed with caution.

Comparing λs among leks assigned to different harvest strategies has the potential for bias if mean lek size varied among harvest treatments (see Fig. 1). λ is the ratio between population size at time t+1 (N_{t+1}) and population size at time t (N_t). Bias occurs because of the statistical covariance between a ratio and the denominator in the ratio (Eberhardt 1970). All other things being equal, we expect the ratio (λ in this case) to be negatively correlated with the denominator of the ratio at a level of $r \sim -0.7$ (Eberhardt 1970). Connelly et al. (2003) did not strictly examine the correlation between λ and

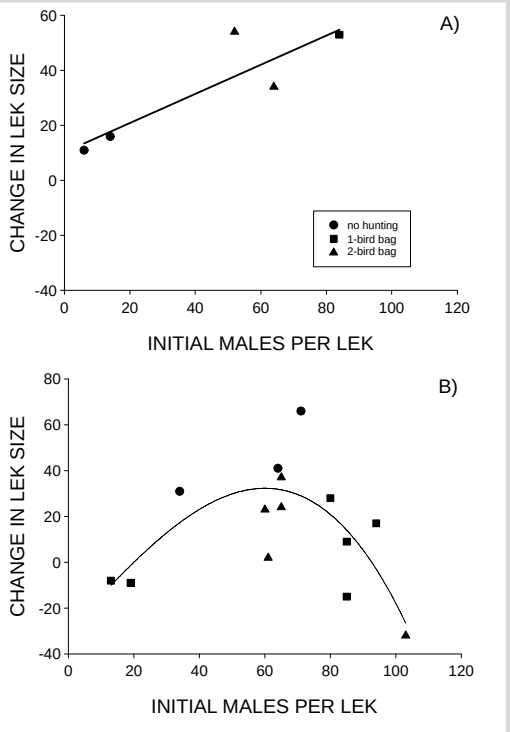

Figure 2. Relationship between change in lek size and initial lek size across a range of harvest treatments for sage grouse in Idaho. Data in A) are from mountain valleys in Connelly et al. (2003), and data in B) are from lowland areas in the same study.

population size. Rather, they used an ANOVA approach to compare λs among areas in which population size varied. Nevertheless, the principle provided by Eberhardt (1970) still applies; we expect λ to be smaller in areas where the initial population size was larger based on the statistical artifact created from these areas having a larger denominator when calculating λ. Thus, in Connelly et al. (2003), we would expect a negative correlation between λ (N_{t+1}/N_t) and harvest rate simply because sites without harvest had smaller initial N_t, whereas sites that experienced harvest had larger initial N_t.

Finally, as Figure 2 shows there is no consistent relationship between harvest regulations and absolute population growth in the Connelly et al. (2003) study. In fact, in mountain valleys, populations actually increased more rapidly when harvest regulations were more liberal (Fig. 2A), as pointed out by Connelly et al. (2003). In lowland areas (Fig. 2B), the pattern of increase is consistent with a pattern of density dependence. That is, rate of increase was highest at intermediate population levels and lowest at both low and high population levels, exactly the pattern one would expect under density de-

pendent population regulation. We note that there was no difference in population growth between populations experiencing 1-bird bags and short seasons and those experiencing 2-bird bags and longer seasons. Populations under closed seasons grew most rapidly, but these populations tended to be at intermediate levels where one might hypothesize that rate of population increase would be maximum, based solely on local population density. We recognize that it is most appropriate to measure rate of population increase on a per capita basis (i.e. λ). Because λ is a ratio, however, its use presents serious statistical problems as indicated above.

We laud the efforts of Connelly et al. (2003), an important attempt to assess the impact of harvest on sage-grouse population dynamics using experimental manipulation of harvest regulations. Overall, however, confounding between harvest regulations and population size, and the potential for statistical artifacts make it difficult to interpret the effects of harvest on sage-grouse population dynamics from this study. The statements made here neither espouse compensatory nor additive mortality in sage-grouse. Rather in our view, refinement of understanding of harvest effects on sage-grouse is an important question that will require decoupling regulations from population size (which was partially accomplished in this study). We also believe that direct assessment of the effect of harvest on the life-history stage directly affected by harvest, annual survival, will aid in the determination of harvest effects. To the extent, however, that density-dependent population regulation influences other life-history stages, such as juvenile recruitment (which if negatively related to density could, under some circumstances, allow populations to overcome additive harvest mortality), it will be necessary to study these aspects of sage-grouse life-history if it is important to understand the impact of harvest on population dynamics.

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BioOne RESEARCH EVOLVED

Assessing Compensatory Versus Additive Harvest Mortality: An Example Using Greater Sage-Grouse

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Tools and Technology Article

Assessing Compensatory Versus Additive Harvest Mortality: An Example Using Greater Sage-Grouse

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ABSTRACT We used band-recovery data from 2 populations of greater sage-grouse (*Centrocercus urophasianus*), one in Colorado, USA, and another in Nevada, USA, to examine the relationship between harvest rates and annual survival. We used a Seber parameterization to estimate parameters for both populations. We estimated the process correlation between reporting rate and annual survival using Markov chain Monte Carlo methods implemented in Program MARK. If hunting mortality is additive to other mortality factors, then the process correlation between reporting and survival rates will be negative. Annual survival estimates for adult and juvenile greater sage-grouse in Nevada were 0.42 $\pm$ 0.07 ($\bar{x} \pm$ SE) for both age classes, whereas estimates of reporting rate were 0.15 $\pm$ 0.02 and 0.16 $\pm$ 0.03 for the 2 age classes, respectively. For Colorado, average reporting rates were 0.14 $\pm$ 0.016, 0.14 $\pm$ 0.010, 0.19 $\pm$ 0.014, and 0.18 $\pm$ 0.014 for adult females, adult males, juvenile females, and juvenile males, respectively. Corresponding mean annual survival estimates were 0.59 $\pm$ 0.01, 0.37 $\pm$ 0.03, 0.78 $\pm$ 0.01, and 0.64 $\pm$ 0.03. Estimated process correlation between logit-transformed reporting and survival rates for greater sage-grouse in Colorado was $\rho = 0.68 \pm 0.26$, whereas that for Nevada was $\rho = 0.04 \pm 0.58$. We found no support for an additive effect of harvest on survival in either population, although the Nevada study likely had low power. This finding will assist mangers in establishing harvest regulations and otherwise managing greater sage-grouse populations.

KEY WORDS *Centrocercus urophasianus*, compensatory harvest, exploitation, Markov chain Monte Carlo, survival.

The notion that mortality associated with predation might be compensated by reduced mortality from other causes dates at least to Errington's ideas about the threshold of security (Errington and Hammerstrom 1935, Errington 1945). Anderson and Burnham (1976) formalized approaches to understanding additive, versus compensatory, harvest mortality. Their effort was devoted largely to using band-recovery data to understand the relationship between harvest and mortality rates. A fundamental problem in such analyses is that parameter estimates in multinomial models covary when they are estimated from the same data. In band-recovery models (Brownie et al. 1985), recovery rates reflect harvest rates and are negatively correlated with survival estimates, even in the absence of a biological relationship between recovery and survival rates (Anderson and Burnham 1976). Consequently, analyses of band recoveries can produce a negative correlation between band-recovery rates and survival, consistent with expectation under additive harvest mortality, even when harvest is completely compensatory.

Ad hoc approaches to overcoming this problem have included splitting the data into independent data sets (e.g., using even- and odd-numbered bands), then examining correlations between band-recovery rate (an index of harvest) and survival parameters across data sets (Nichols and Hines 1983). An alternative, comparison of harvest and survival rates across populations, provides a relatively weak approach to assessing the functional relationship between harvest and survival because confounding factors could vary among populations. We would expect annual survival to be lower in populations experiencing higher harvest rates under a hypothesis of additive harvest mortality. Without true, experimentally implemented harvest regulations, it is not possible to control for confounding variables that could influence both harvest and survival rates (Nichols et al. 1984). Covariance between population density and harvest rates is an example of such confounding.

Recent availability of Markov chain Monte Carlo (MCMC) estimation approaches provides a mechanism for estimating process correlation between parameters, thereby eliminating the problem created by sampling correlation (Gilks et al. 1996, Cam et al. 2002). Consequently, MCMC provides a tool for assessing hypotheses about compensatory, versus additive, harvest mortality. Negative process correlation between harvest and survival rates is consistent with an at least partially additive harvest effect on survival, whereas process correlations >0 are consistent with a hypothesis that harvest mortality is fully compensated by other sources of mortality (Anderson and Burnham 1976). The MCMC methods have the advantage over classical numerical estimation procedures for parameter estimation from multinomial models because MCMC approaches produce parameter estimates that are not influenced by sampling covariance and are consequently unbiased (Link et al. 2002).

Compensation for harvest has received considerable attention with respect to grouse in Europe (Myrberget 1985, Ellison 1991, Smith and Willebrand 1999, Pedersen et al. 2004). Most of these studies have relied primarily on

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population responses to harvest (but see Smith and Willebrand 1999). Managers are most concerned about population-level consequences of their management actions, but use of population-level response to assess harvest effects adds substantial complexity because populations may exhibit numerous covarying responses to harvest or other management actions. For example, juvenile red grouse (*Lagopus lagopus scotica*) typically disperse from areas where most territories are occupied (Jenkins et al. 1964, 1967; Brøseth et al. 2005). Immigration may mask effects of harvest, or emigration may exacerbate them (Pedersen et al. 2004) to the extent that total harvest covaries with population density (e.g., Lindén 1981, Sedinger and Rexstad 1994, Sedinger and Rotella 2005).

Additionally, statistical confounding problems may be more likely when indirect measures are used. Pedersen et al. (2004) demonstrated an apparently strong additive effect of harvest on population rate of change in willow ptarmigan (*Lagopus lagopus*); higher harvest as a percentage of population size resulted in smaller increases in $\ln(N_{t+1}/N_t)$. Their result, however, was likely influenced by the fact that $1/N_t$ must have increased substantially more rapidly than $\ln(1/N_t)$, virtually ensuring Pedersen et al. (2004) would observe a negative covariance between harvest and change in population size, even in the absence of a biological relationship between harvest rate and λ. To see how this could create a negative correlation, remember that $\ln(N_{t+1}/N_t)$ equals $\ln(N_{t+}1) - \ln(N_t)$, then plot $-\ln(N_t)$ against $1/N_t$, which represents the relationship between abscissa and ordinate. This is a special case of induced correlation because the same N_t values are used for both the independent and dependent variables (Eberhardt 1970).

We used band-recovery data from populations of sage-grouse in Colorado, USA, and Nevada, USA, and MCMC methods to estimate band-recovery and survival rates and the process correlation between these parameter estimates. Our objectives were to 1) assess the potential for MCMC approaches to test hypotheses about additivity of harvest, and 2) assess the hypothesis that harvest represented an additive source of mortality in sage-grouse.

STUDY AREA

We captured sage-grouse in Nevada, primarily near water sources in the Montana Mountains (41°N, 118°W) on the Nevada side of the Oregon, USA, border. The Montana Mountains range in elevation from 1,310 m to 2,130 m and were characterized by communities dominated by Wyoming big sagebrush (*Artemisia tridentata wyomingensis*), mountain big sagebrush (*Artemisia tridentata vaseyana*), and low sagebrush (*Artemisia arbuscula*; appendix N, North Central Local Area Conservation Plan, greater sage-grouse conservation plan for Nevada and California, Nevada Department of Wildlife, unpublished data). Sage-grouse banded in Colorado were banded in the North Park area of north-central Colorado (41°N, 106°W; Zablan et al. 2003). Mean elevation was approximately 2,500 m and dominant vegetation was Wyoming big sagebrush (Zablan et al. 2003).

METHODS

We captured sage-grouse in Nevada during July–August 2001–2004 by night lighting (Giesen et al. 1982). We gave each individual a size 14 (F) or size 16 (M) metal band (Zablan et al. 2003). We assigned individuals to age classes (juv, yearling, and ad) and gender based on characteristics of wing feathers (Dalke et al. 1963). We recovered bands at check stations, which we placed in hunting areas for banded sage-grouse shot by hunters. Personnel of the Nevada Department of Wildlife (NDOW) provided letters explaining the project to all contacted hunters entering the hunt area. The NDOW personnel also attended a check station at the egress point for the hunt area during both weekends of the 2-week hunting season. Personnel also attempted to contact hunters in the field during the hunting season. Personnel from NDOW checked all hunter bags for bands at check stations. Wing barrels were provided at 4 locations along roads in the hunt area; hunters provided bands from shot sage-grouse and wings for estimating composition of the harvest at these wing barrels (Eng 1955). All sage-grouse hunters also received a harvest questionnaire.

Capture of sage-grouse in Colorado was described by Zablan et al. (2003). Individual sage-grouse in Colorado were also captured by night lighting, but in contrast to Nevada, sage-grouse were captured in spring near leks during 1973 to 1989. Extensive effort was made to recover bands from shot sage-grouse, similar to that in Nevada. Personnel from the Colorado Division of Wildlife operated check stations at 2 or 3 locations during both days of the opening weekend and the second Sunday of the 2-week hunting season during the first 9 years of the Zablan et al. (2003) study. Check stations in Colorado were operated only during the first weekend of the hunting season during the remaining 6 years of the Zablan et al. (2003) study. All hunters received a harvest questionnaire.

We lacked reward bands, which are necessary for estimating the proportion of bands from harvested birds that are reported (Nichols et al. 1995). We estimated the proportion of bands that were recovered through agency solicitation efforts and unsolicited reports by assuming that unsolicited band-reports represented 30% of unsolicited band recoveries (e.g., Nichols et al. 1995). This approach likely produced conservative estimates of reporting rates for these 2 studies because of the intensive hunter contact efforts, which should have substantially reduced the number of hunters that were uninformed about the importance of reporting bands.

We analyzed band recoveries from both populations using the Seber (1970) parameterization of band-recovery models in Program MARK (White and Burnham 1999). We also present analyses from the Brownie et al. (1985) parameterization for band recoveries from Nevada. The 2 parameterizations differ slightly from each other in that for the Brownie parameterization, band-recovery rates (f) represent the probability that a bird is shot, retrieved, and the band reported to the bird banding laboratory. Thus, because estimates of band-recovery rates are directly convertible to

estimates of harvest rate if band-reporting rates (i.e., proportion of bands retrieved by hunters reported to NDOW) are known, recovery rates can be used to directly estimate harvest rates (Brownie et al. 1985). For the Seber parameterization, reporting rates (r) represented the probability that a banded bird is found dead, and the band was reported (Seber 1970). Band recovery rates are approximately related to Seber (1970) reporting rates by the equation $f = (1 - S) \times r$, where S is annual survival.

Zablan et al. (2003) considered a suite of models, the most general of which allowed both survival and reporting rate to vary between sexes, among age classes, and with time. The most general model we considered for Nevada sage-grouse allowed for additive effects of age–gender and year. We could not consider more general models because band-recovery data for Nevada were too sparse. We used information theoretic approaches for model evaluation in analyses of the Nevada data (Burnham and Anderson 2002).

We used MCMC methods implemented in Program MARK to estimate process correlation between band-reporting rates and annual survival on a logit scale (White and Burnham 1999, White et al. 2008). The MCMC simulations provided a mechanism for sampling Bayesian posterior distributions to produce estimates of parameters (e.g., means, variances). We calculated the integral of the posterior to produce estimates of the distributions of parameters of interest (Gilks et al. 1996). The MCMC approach provides a mechanism for solving such integrals by sampling from candidate distributions using simulation and can be viewed as a tool for producing parameter estimates that would otherwise be difficult or impossible (Link et al. 2002). The advantage of this approach over standard maximum-likelihood estimation is that parameters (e.g., survival estimates) can be treated as random variables whose variances and covariances can be estimated (Link et al. 2002). In MARK, samples from candidate distributions are produced using a Metropolis–Hastings sampler (Gilks et al. 1996, White et al. 2008). In our case, MCMC allowed us to estimate process correlation between band-reporting rates and annual survival rates, free from the sampling correlation that exists between such estimates in standard maximum-likelihood estimation (Anderson and Burnham 1976).

We based MCMC estimation on models allowing annual variation in both reporting and survival rates and full interaction among age, sex, and year, for both Nevada and Colorado, which was necessary to estimate process correlation between survival and reporting rates across years. We simulated a single chain with 4,000 tuning samples and a burn-in period of 1,000 samples. We used 10,000 samples from the Markov chain to generate posterior distributions. We assumed prior distributions on survival and reporting rates were normal (0, 1.75) variables on a logit scale (White et al. 2008). We assumed prior distributions on process variances of survival and reporting rates on the logit scale were inverse γ (0.001, 0.001). The prior distribution on the correlation between survival and reporting rates on the logit scale was uniform (-1, 1). We report parameter estimates ($\pm$SE) from the band-recovery analysis for Nevada and estimates of process correlation ($\pm$SE) based on posterior distributions of survival and reporting rates for Colorado and Nevada. We estimated process correlation between harvest and survival rates separately for sage-grouse from Nevada and Colorado to avoid the potential that variables were confounded with both survival and harvest between the states, for which we did not account, and influenced our estimate of the correlation between survival and harvest. To assess the effect of the length of study on process correlation, we truncated the North Park, Colorado, data to produce data sets that were 10 years and 4 years long, in addition to the original data. We used the same analytical procedures for these truncated data as we used for the full data set to produce estimates of process correlation between survival and reporting rate and associated standard errors, which we report.

Table 1. Numbers of greater sage-grouse banded and recovered in the Montana Mountains, northern Nevada, USA, during 2001–2004.

		No. of recoveries			
Yr released	***n***	**2001**	**2002**	**2003**	**2004**
Ad F					
2001	40	5	1	1	0
2002	47		4	1	0
2003	46			3	1
2004	82				7
Ad M					
2001	17	1	0	1	0
2002	47		6	3	0
2003	38			3	1
2004	45				5
Yearling F					
2001	6	0	0	0	0
2002	15		0	1	0
2003	7			1	0
2004	18				0
Yearling M					
2001	1	0	0	0	0
2002	23		1	1	1
2003	9			1	0
2004	8				0
Juv					
2001	113	6	6	0	1
2002	222		22	7	6
2003	192			16	6
2004	116				18

RESULTS

We captured and banded 1,092 sage-grouse between 2001 and 2004 in northern Nevada, resulting in 137 recoveries through 2004 (Table 1). Zablan et al. (2003) banded 6,021 sage-grouse and reported recoveries of 961 individuals between 1973 and 1990 in their study. The most competitive models in the Zablan et al. (2003) study allowed for an additive effect of sex on annual survival and a quadratic trend in survival, which varied among age classes (Zablan et al. 2003, table 2). All competitive models in Zablan et al. (2003) allowed for sex, age, and temporal variation in survival and reporting rates. Reporting rates

Table 2. Performance of models of band recoveries for greater sage-grouse in northern Nevada, USA, 2001–2004. Models were based on the Seber parameterization for band recoveries implemented in Program MARK. Models include annual survival (S) and reporting rate (r), which is the probability that an individual is found dead and the band reported. Because banded greater sage-grouse were in a remote area in Nevada, and hunters were contacted by staff of the Nevada Department of Wildlife, all reported bands were associated with greater sage-grouse shot by hunters. Parameters held constant across years are indicated by (.), whereas a and t represent differences among adults plus yearlings, and juveniles, and annual variation, respectively.[a]

Model	ΔAICc	w_i	No. of parameters	Deviance
S(.), r(.)	0.00	0.41	2	40.75
S(.), $r(a)$	1.10	0.24	3	39.83
$S(a)$, r(.)	1.91	0.16	3	40.64
$S(a)$, $r(a)$	2.73	0.10	4	39.45
$S(t)$, (a)	4.64	0.04	6	37.32
$S(a)$, $r(t)$	5.59	0.03	6	38.27
$S(a)$, $r(a + t)$	6.29	0.02	7	36.94
$S(a + t)$, $r(a + t)$	7.49	0.01	9	34.08

[a] ΔAICc, difference in Akaike's Information Criterion adjusted for small sample size; w_i, Akaike wt.

were best modeled using a linear time trend that differed across age and sex classes. Zablan et al. (2003, figs. 1, 2) reported substantial annual variation in survival (0.1–0.9) and reporting rate (<0.1–1.0), but a model allowing for full sex, age, and time interaction was not competitive, partially because it was so highly parameterized. A model in which both survival and reporting rates were held constant and did not vary among age classes or between genders for sage-grouse in Nevada was the best-supported model, receiving 41% of model weights (Table 2). Models allowing differences in survival or reporting rates between juveniles and adults plus yearlings received 40% of Akaike model weights. Annual survival estimates for Nevada sage-grouse age and gender classes pooled were 0.41 ± 0.054. Based on the Brownie parameterization, we estimated band-recovery rates averaged 0.09 ± 0.008 across years and age–gender classes, indicating that 9% of sage-grouse in the Nevada study area were harvested annually by hunters.

There was no clear relationship between annual survival rates and band-reporting rates across geographic locations or age and gender classes (Fig. 1). For example, yearling females in Colorado, which experienced the highest harvest rates, also had the highest annual survival rates. No bands from harvested grouse in Nevada were reported to NDOW outside of the solicitation process, thus, estimates of band-recovery rates provide a reasonable estimate of harvest rates in Nevada. For Colorado, we estimated that 91% and 82% of recovered bands were reported in 2 years (1976, 1977, respectively) for which sufficiently detailed information was available.

We estimated process correlation between band-recovery rate and survival rate on the logit scale to be $\rho = 0.68 \pm 0.26$ for North Park, Colorado, and $\rho = 0.04 \pm 0.58$ for northern Nevada. The estimate of process correlation for Colorado was consistent with a hypothesis of fully compensatory harvest mortality for that population. The estimate of process correlation for Nevada was much less

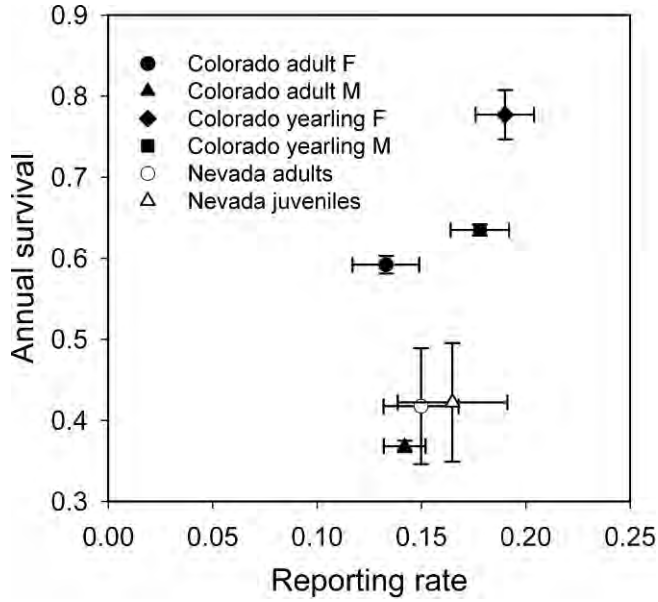

Figure 1. Estimates (±SE) of annual survival and reporting rates for greater sage-grouse from Colorado (1973–1990) and Nevada (2001–2004), USA. Colorado estimates from Zablan et al. (2003). Estimates were produced using the Seber parameterization for band recoveries in Program MARK.

precise than for Colorado and inconclusive with respect to a hypothesis of additive harvest mortality. Reducing the length of the data from Colorado from 18 years to 10 years and 4 years increased standard errors of our MCMC estimates of process correlation from 0.26 to 0.42 and 0.59,

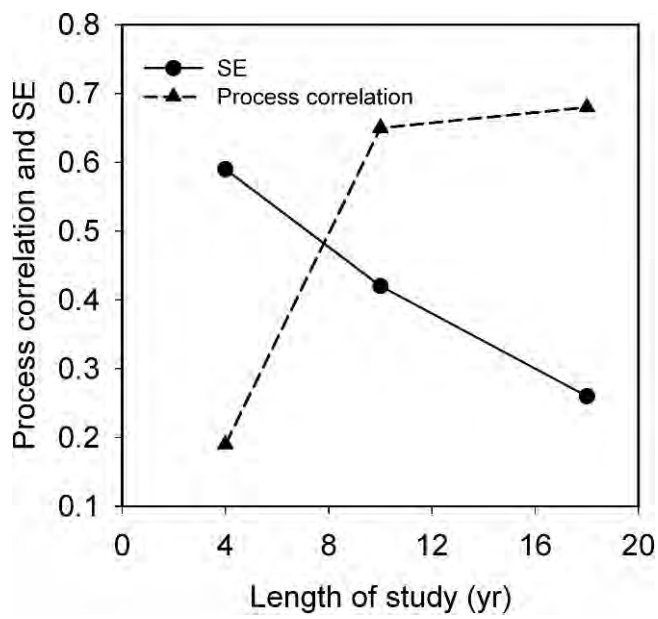

Figure 2. Estimated process correlation and standard error for banding studies of different length based on Markov chain Monte Carlo (MCMC) simulation in Program MARK. We banded greater sage-grouse in the Montana Mountains of northern Nevada, USA, 2001–2004, and in North Park, Colorado, USA, 1973–1989. We truncated the North Park Colorado data to produce data sets of 4 years and 10 years in length in addition to the entire data set of 18 years. We then fit an age × sex interactive model and estimated parameters in Program MARK. We used the MCMC simulation procedure to estimate process correlation and associated standard error.

respectively (Fig. 2). Point estimates of process correlation were robust to reduction of the data from 18 years to 10 years; estimated process correlation changed from 0.68 to 0.65 (Fig. 2), well within expected variation from the MCMC simulations. Reducing length of the band-recovery data to 4 years substantially changed our estimate of process correlation for the Colorado data to 0.19.

DISCUSSION

Estimates of process correlation between harvest and survival were either positive (CO) or near zero (NV); in neither area was there a negative process correlation required by a hypothesis of additive harvest mortality (Anderson and Burnham 1976). Process correlation for northern Nevada was estimated with relatively poor precision, a reflection of the relatively small number of recoveries (n = 137) and the short duration of the study (4 years). Additionally, our assessment of the effect of study duration on estimates of process correlation suggests that the relatively short duration of the Nevada study potentially caused us to underestimate process correlation between survival and reporting rates (Fig. 2). In contrast, the Colorado study (n = 961 recoveries, 17 estimates of survival) produced a reasonably robust and precise estimate of the correlation between harvest and survival probabilities. Visual examination of estimates of reporting rate and survival rate also do not indicate an additive effect of harvest on annual survival (Fig. 1). The 2 studies taken together do not support an additive effect of harvest on the annual mortality process in sage-grouse over the range of harvest rates experienced by these 2 populations. These studies also indicate that >10 years of banding and recoveries may be required to test hypotheses about additivity of harvest for sage-grouse.

The data we analyzed were not adequate for assessment of more complex hypotheses, including threshold effects of harvest, whereby harvest is compensatory below a particular level but becomes additive above that threshold. We can envision, however, experimental designs in which harvest rates are varied among spatial-temporal blocks, which would allow mangers to explore such hypotheses. We do not have a good foundation for simulations to assist with future study designs because neither study area produced a negative estimate of the harvest–survival correlation. Consequently, we do not have an estimate of the magnitude of the harvest–survival correlation under additive mortality, which is essential for simulations to assess sample size requirements for future studies. Clearly, the Nevada data set with 137 recoveries over 4 years did not produce an estimate of the harvest–survival correlation of sufficient precision to assess even strong additive harvest mortality, whereas the Colorado data, with 961 recoveries over 18 years, produced an estimate of process correlation that was sufficiently precise to detect even weakly additive harvest effects.

Negative associations between harvest and annual survival, suggestive of additive harvest mortality, have been observed in some waterfowl populations in North America (Smith and Reynolds 1992, Sheaffer et al. 2004, Sedinger et al. 2007; but see Sedinger and Rexstad 1994). For geese (Anserinae), the additive role of harvest in the annual mortality process is generally accepted (e.g., Sedinger et al. 2007). For ducks (Anatinae), however, harvest rates are virtually always confounded with population density; harvest rates are higher when populations are larger, so it is difficult to separate potential effects of harvest from those of density dependence (e.g., Sedinger and Rexstad 1994).

Earlier studies reached varying conclusions about the effect of hunting on sage-grouse populations. Braun and Beck (1985) and Wallestad (1975) concluded that harvest had little influence on sage-grouse populations, whereas Autenrieth (1981), Crawford and Lutz (1985), and Zunino (1987) believed that harvest could influence population dynamics in sage-grouse populations. Our conclusions differ from those in several other studies that concluded harvest mortality was additive. Fifteen percent and 42% of radiomarked male and female sage-grouse in southern Idaho, USA, were killed by hunting, and an additional 83% and 45% of males and females, respectively, were killed by predation (Connelly et al. 2000*a*). Mortality rates were low following the hunting season, providing little potential for compensation, and Connelly et al. (2000*a*) concluded that harvest mortality was likely to be additive to other forms of mortality. Connelly et al. (2000*a*) could not control for possible effects of radios on risk of harvest or predation mortality, which may have affected their conclusions. Sage-grouse in southern Idaho with radios had 23% (M) and 38% (F) higher harvest rates than sage-grouse that had received only metal bands (Connelly et al. 2000*a*, table 3). Connelly et al. (2003), in a different study, reported that leks increased more rapidly when harvest regulations were more restrictive, but Sedinger and Rotella (2005) showed that this result could have been caused by density-dependent processes, rather than harvest effects.

We cannot, however, rule out ecological differences in the mortality processes among Colorado, Nevada, and Idaho. We have observed the lowest monthly survival to occur during October–December on 2 different study areas in Nevada (Sedinger et al. 2010; J. S. Sedinger, University of Nevada–Reno, unpublished data), in contrast to low survival during spring–summer in Idaho (Connelly et al. 2000*a*). Our results indicate, however, that banding studies and MCMC estimation, especially combined with temporal–spatial variation in harvest rates, provide a reasonable approach to understanding the effect of harvest on sage-grouse populations.

Harvest rates and survival rates were remarkably similar between North Park, Colorado, and northern Nevada, with the exception of higher survival by females in North Park, Colorado compared with sage-grouse from northern Nevada. The generally positive association between survival and harvest rates suggests that environmental conditions that favor sage-grouse survival may also be consistent with greater harvest rates. We note that harvest rates were typically near or below general guidelines for sage-grouse harvest of 10% (Braun and Beck 1985, Connelly et al.

2000*b*). Our findings suggest these guidelines may be generally consistent with compensatory harvest mortality for many sage-grouse populations.

Our findings differ from those of some recent European studies of grouse, which concluded that harvest of grouse was largely additive. Harvest rates in many studies of willow ptarmigan are >20% of the fall population (Ellison 1991, Smith and Willebrand 1999, Pedersen et al. 2004). It is possible that at harvest rates >20%, harvest becomes at least partially additive (Anderson and Burnham 1976) in these populations, despite conclusions to the contrary for some populations (Jenkins et al. 1964, Ellison 1991). There are potential statistical artifacts in one assessment of harvest additivity at harvest rates >20% (Pedersen et al. 2004). Studies relying on radiotags to estimate harvest and survival estimates (e.g., Smith and Willebrand 1999) could not control for potential effects of the radios on either parameter, which can be variable (Miller et al. 1995, Steenhof et al. 2006, Terhune et al. 2007). Harvest rates may be correlated with local density, and it is possible that harvest is confounded with other density-related population processes, such as emigration and immigration. It is not clear how such confounding might affect harvest–survival relationships, but confounding could certainly influence indirect assessments (e.g., changes in N in shot and unshot areas) of harvest effects.

We believe that assessment of hypotheses about the effects of harvest on populations will be most powerful when harvest rates can be controlled and direct estimates of survival examined under preplanned harvest regimes. Direct assessments of the demographic trait influenced by harvest (i.e., annual survival) are most likely to yield clear results, uncompromised by confounding changes in other demographic parameters or ecological variables. Data from the populations we studied were not generated with the goal of examining additive versus compensatory mortality hypotheses, but we believe they demonstrate the potential power of using individually marked animals, combined with preplanned harvest regulations and MCMC estimation, for discriminating between these 2 important hypotheses.

MANAGEMENT IMPLICATIONS

Our results indicate that assessing process correlation between survival and harvest requires banding for ≥ 10 years. At harvest rates <11%, harvest is unlikely to have an important influence on local population dynamics of sage-grouse. Because most sage-grouse populations are harvested at rates comparable to, or lower than, those we analyzed, harvest is unlikely to have an important effect on the dynamics of these populations. Consequently, other factors, such as habitat, human development, and predation, should be considered as important factors influencing sage-grouse populations. We suggest that MCMC estimation in Program MARK, combined with well-designed banding studies, provides a useful approach for understanding the effect of harvest on local populations.

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GREATER SAGE-GROUSE POPULATION TRENDS:
AN ANALYSIS OF LEK COUNT DATABASES
1965-2015

Western Association of Fish and Wildlife Agencies, Cheyenne, WY

August 2015

Executive Summary - Counts of males attending leks in the spring have been the primary means employed by states to monitor status of greater sage-grouse (*Centrocercus urophansianus*) populations for over 75 years. Despite limitations and potential biases, lek count data remain the only long-term, range-wide dataset available for evaluating trends in sage-grouse populations. Using lek data provided by each state, we calculated the number of active leks, the average number of males per active lek each year, and modeled trends in male counts using a set of mixed-effects, Bayesian hierarchical models at range-wide, management zone, and state spatial scales for the 1965-2015 period. Trends within high population density core areas were compared to peripheral areas at range-wide and management zone scales. Trend estimates were also modeled at range-wide scales for the most recent 10-year period (2005-2015). Summary statistics on average males per lek indicate large variability in sage-grouse population size over time at all spatial and temporal scales. Our results support previous findings that have documented a long-term (1965-2015) decline of greater sage-grouse range-wide. The long-term (1965-2015) decline in average males per lek was estimated at 0.83% per year range-wide, and 2.7% and 0.5% for Management Zones I and II, and 0.70, 1.38, and 0.06% per year for Management Zones IV, V, and VI, respectively. Management Zone III showed an increasing trend in average males per lek of 0.19% per year. In 5 of 6 management zones, annual decreases were greatest in the periphery, and lower in core areas. This suggests that denser sage-grouse populations located within the core appear to be insulated more readily from population decline than those on the periphery. Modeling indicated positive trends in average males per lek since 1965 in Wyoming, Utah and Idaho, with negative trends in the 8 other sage-grouse states and declines greater than 1% per year in North Dakota, South Dakota, and Montana. The number of males counted on leks range-wide in 2015 (80,284) increased by 63% compared to the number counted in 2013 (43,397), the most recent trough. A minimum breeding population of 424,645 was estimated for 2015, which does not include grouse on unknown leks.

Introduction

The decline of greater sage-grouse (*Centrocercus urophansianus*) populations concerned naturalists at the turn of the century (Hornaday 1916) and has been a concern for biologists for nearly 30 years (Braun 1995, Connelly and Braun 1997, Aldridge and Brigham 2003, Schroeder et al. 2004). Some of the early concern has been reactive but most of the concern has been observed and documented through the loss of habitat and declines in abundance (Connelly and Braun 1997, Connelly et al. 2004). The primary approach to estimating abundance of greater sage-grouse has been by counting males when they attend strutting grounds (leks) in the spring (Connelly et al. 2003). Although this approach has been questioned because of the biased nature of data collection and the inference to population trends (Jenni and Hartzler 1978, Beck and Braun 1980, Walsh 2002) this is the primary data source available to monitor long-term trends of greater sage-grouse populations (Connelly et al. 2000, Connelly et al. 2003, Connelly et al. 2004). Standardized techniques for data collection were recommended by the Western Sage and Columbian Sharp-tailed Grouse Technical Committee (Technical Committee) under the auspices of their parent organization the Western Association of Fish and Wildlife Agencies (WAFWA). The WAFWA has signed at least 2 Memorandums of Understanding agreeing to collect trend data in a format that was recommended by the Technical Committee (Connelly et al. 2004, Stiver et al. 2006).

The United States Fish and Wildlife Service (USFWS) found greater sage-grouse warranted for protection under the Endangered Species Act in 2010, but that listing at that time was precluded by higher priorities (U.S. Fish and Wildlife Service 2010). A coalition of environmental groups sued the USFWS for failing to list greater sage-grouse and many other species. A settlement agreement was reached in 2011, under which the USFWS agreed to make

a listing determination for greater sage-grouse by 30 September, 2015. As a result, the USFWS issued a data call (U.S. Fish and Wildlife Service 2014) for the most recent information on greater sage-grouse populations and habitat to assist in their listing decision. Although each state is providing information on populations and habitat, WAFWA agreed to update its prior analysis of trends based on lek counts at range-wide, management zone, and state scales. To date, three separate analyses of male-count trends have occurred through WAFWA. The first was provided by Connelly et al. 2004, the second by the Technical Committee in 2008, and this report represents the most recent analysis of male-count data from 1965–2015 for the aforementioned grouse population designations.

Methods

Because sage-grouse gather on traditional display areas (leks) each spring, biologists typically use counts of displaying males as an index to track changes in breeding populations (Connelly et al. 2003). A large number of leks are regularly monitored each year throughout North America, many state databases have >50 years of information, and most states have conducted extensive searches for new leks. All state wildlife agencies monitor sage-grouse breeding populations using data from leks, but methods for gathering these data vary somewhat among agencies and sometimes within agencies among years (Connelly et al. 2004). Lek databases were obtained from each state containing data on number of males counted through 2015. See Appendix I for a discussion on limitations of lek data and pertinent assumptions.

Lek data filtering

For the purposes of this analysis, we defined a lek as a display site at a specific geographic location at which 2 or more males were counted in 2 or more years during the

assessment period (1965-2015). We assumed that if a state reported count data for a specific lek that those data were spatially associated with the location reported for that lek. However, in practice, the definition of a lek is more complicated. For example, a lek location can shift over time so that what is in effect the same lek can have 2 or more coordinates. Satellite leks can form near large leks during years with relatively high populations, and/or birds may use alternate display areas near leks, particularly if disturbance is common on the primary lek. Satellite and alternate lek locations may be considered independently in state databases, or may be combined under the primary lek count. In addition, observers may have considered multiple activity centers within a large lek as separate leks, all of which can affect count data reported for a specific lek location. To deal with these issues, we grouped spatially proximate leks using hierarchical clustering analysis (hclust function with complete method) in R (R Development Core Team 2015). Each lek was assigned to its own cluster and then the algorithm proceeds iteratively. At each stage, the two closest clusters are joined and the algorithm proceeds until there is just a single cluster. The distances between clusters were recomputed after each join by the Lance–Williams dissimilarity formula. Finally, we used cutree to separate clusters separated by greater than 1.2 km. Counts within these 1.2-km lek clusters were combined, and summed if they were counted in the same years.

State lek count databases are used to retain a variety of information about leks, and were not necessarily designed for this type of analysis so extensive filtering was necessary. Nevada, Oregon and Wyoming provided individual replicate count data for each year, other states provided peak count by year only. For Nevada, Oregon, and Wyoming datasets we attempted to standardize the data as much as possible by excluding data from: (1) counts conducted prior to 15 March or after 15 May; (2) counts conducted earlier than 0.5 hours before sunrise or later than

1.5 hours after sunrise (for Wyoming and Oregon only) (Braun 1995, Beck et al. 2003, Walsh et al. 2004); (3) entries without count data (e.g., "active", "sign present", "no count", etc.) or entries with ambiguous data (counts where no attempt was made to separate males from females, counts with some males identified and others unknown were retained); (4) duplicate records (i.e., those with the same observer, date, time, and count); and (5) aerial counts, which are likely to have different detection probabilities than ground-based counts. Peak counts were then calculated by taking the maximum of individual counts by lek and year. We did not exclude data from leks counted only once in a season, as most state databases do not contain information as to the number of counts, and Fedy and Aldrich (2011) found that at large spatial scales including >50 leks the absence of repeated counts within a year did not significantly alter population trend estimates or interpretation.

Data excluded from peak-count lek databases included: (1) lek counts prior to 1965, (2) entries for leks with fewer than 2 males for 2 or more years; (3) aerial counts, and (4) some zero counts. Many states continue to count leks that are no longer active which creates long strings of zero counts that don't contribute trend information. Consequently we excluded zero counts before calculating average males per active lek, and for the modeling effort we retained the first zero in any consecutive string of zeroes (to capture declining trends as counts go to zero and increasing trends from zero).

Duplicate entries of several types were encountered and resolved. Duplicates where all the same information was entered multiple times were identified and removed using the Excel remove duplicates feature. Some states group satellite and adjacent or nearby leks into lek complexes, and occasionally identical count information over a period of years was entered into 2 leks within a complex. These were identified by examining peak count data within complexes,

and removed after confirming with state biologists that these were duplicate entries. Finally, count information for some leks near state borders is maintained in both state databases although usually with different lek names and slightly different locations. To identify these, we examined all 1.2-km lek clusters containing leks from more than one state, and looked for substantially similar count information over time. Because state databases differed in the amount of count information on these shared leks, they were combined by giving them a common lek ID and then taking the maximum count by year. Although several states had duplicate information on shared leks with different IDs (CO/WY – 1, MT/WY – 5, MT/ND - 2), this was most common between California and Nevada where 133 leks occurred in both state databases.

Leks with different names but the same reported location were resolved prior to analysis. We also attempted to obtain any missing lek locations, but deleted several leks for which this information could not be obtained. Blank values in the field containing number of males counted were assumed to be dates or years in which no count was conducted (and not zeroes). There were some cases where this field was blank, and other information such as date, time, and observer name indicated a count was likely conducted. State biologists were able to confirm these should have been zeroes. In some cases, counts were made over a relatively short time frame or not made in consecutive years. For instance, North Dakota conducted all lek counts only during the third week of April, but has used this approach for well over 30 years.

Analysis Methods

We evaluated population status of sage-grouse in two ways. First we provide summary statistics on number of active (with one or more males) leks counted over time at range-wide, management zone, and state spatial scales, and calculated the average number of males counted per lek over time at each scale. The premise behind these summary statistics is this; recent

levels/trends should be considered in the context of historical trends; are "cyclic" lows and highs decreasing over time? Has the number of active leks decreased over time? Loss or degradation of existing habitat (decreased carrying capacity) should be reflected in a decline in average males per lek and a decrease in the number of active leks. In an attempt to deduce patterns in rate of population change from long-term lek counts, we developed models, described below and in Appendix II. Modeling was performed independently by Western Ecosystems Technology (WEST), an Environmental and Statistical Consulting firm based in Cheyenne, Wyoming.

Modeled Trend Analysis

Long-term trends in sage-grouse populations were estimated within the core area occupied by greater sage-grouse during the lekking season, the periphery (i.e., outside the core area), as well as the combined area (core + periphery; Fig. 1) within each management zone (Fig. 1). Core areas used were high population density areas that contained 75% of the average peak count from leks between 2010 and 2014. Leks were assigned to core or periphery based on information provided by the USFWS (Doherty, personal communication). Doherty et al. (2010) described the rationale behind the 75% core areas. Although methodology to define 75% cores has been refined, original cores depicted contained 75% of the population on just 27% of the overall range (Doherty et al. 2010).

Hierarchical models allow for modeling of trends specific to various geographic extents simultaneously. We developed a hierarchical model that followed individual leks through time and allowed trends at individual leks to inform estimates of trends within individual management zones and states. This approach reduced the potential bias that could result if larger leks tended to be monitored earlier (e.g., 1965–1980; larger lek = more males) and many smaller leks were only recently included in the monitoring efforts. This hierarchical modeling approach included

both fixed and random effects and was similar to approaches used to estimate trends in Breeding Bird Survey data (Sauer and Link 2002, 2011; Thogmartin et al. 2004; Nielson et al. 2008) and data from large-scale monitoring efforts like the west-wide golden eagle survey (Millsap et al. 2013, Nielson et al. 2014). A complete description of this modeling approach and assumptions made is included in Appendix II.

Ninety percent credible intervals (CRIs) – essentially the Bayesian form of a confidence interval – were calculated for all estimates of trend. If a 90% CRI included 0.0, then we concluded there was no evidence of trend in the data.

Finally, we used the results from Bayesian hierarchical model (equation [1]) and equation (6) [see Appendix II] to estimate all possible 10-year trends (e.g., 1965 – 1975, 1966 – 1976, …, 2005 – 2015) for the core, periphery, and combined areas range-wide.

It should be noted that a true understanding of the trend in sage-grouse populations over time would require modeling both the change in the number of leks and the change in the average number of males on each lek. We have no information to model change in the number of leks. There are inherent potential biases associated with a model based on average males per lek; if the small sample of leks in early years were larger than average, trends based on following those leks through time could be higher (more positive) than if trends were based on a representative sample of small and large leks. If smaller leks drop out over time, the average males per lek will be based on the larger leks that persist and may lead to inflated trends. In addition, excluding some zero counts in the modeling could result in optimistic estimates of trends, but that potential effect has not been investigated. We view average males per lek as a strong indicator of the health of a sage-grouse population, which is likely highly related to, but not directly equivalent to, population performance. Consequently we urge caution when

interpreting modeled trends; they may be more useful for relative comparisons across spatial scales and temporal periods than as absolute indicators of population status.

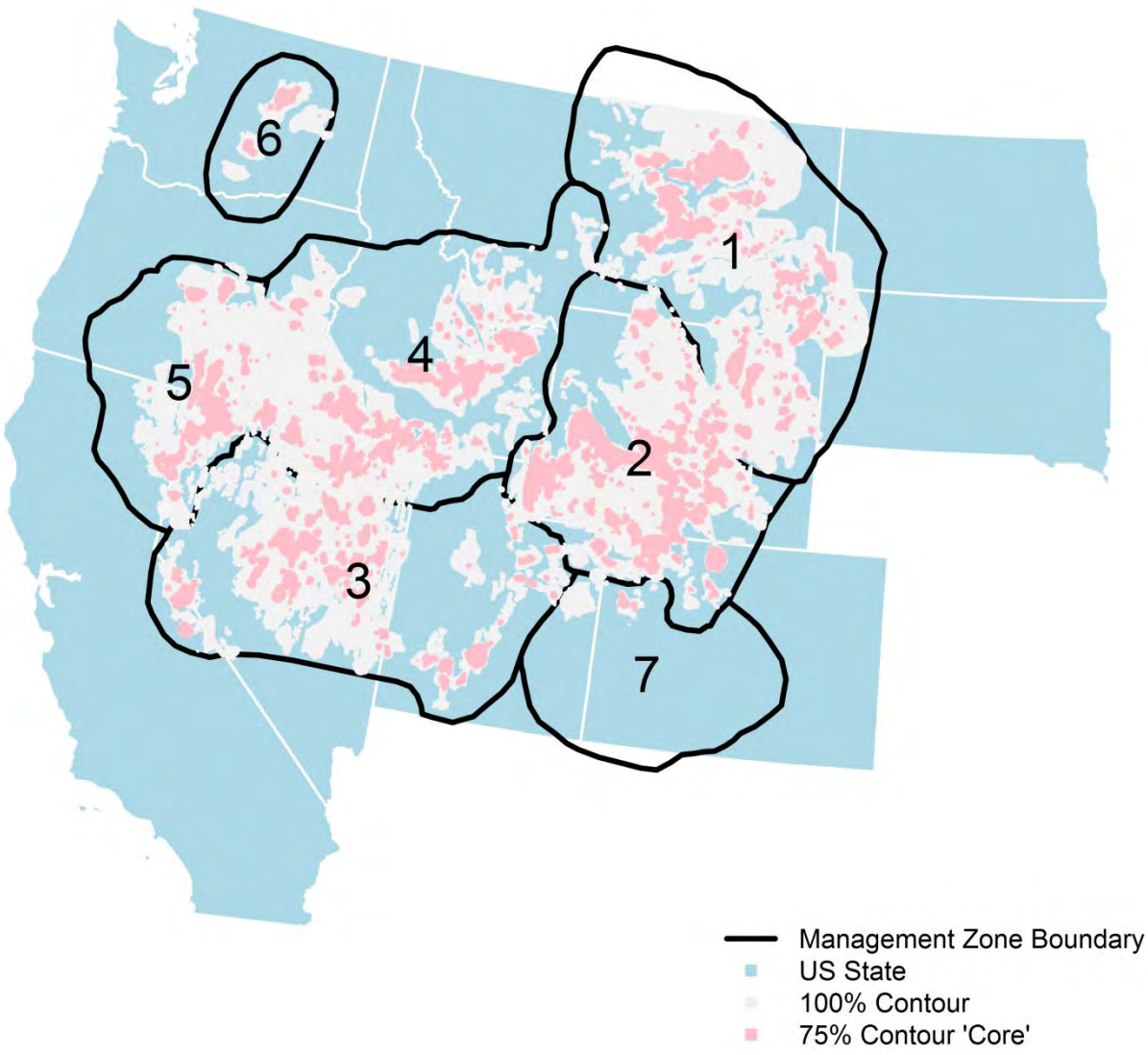


Figure 1. WAFWA sage-grouse management zones I (Great Plains), II (Wyoming Basins), III (Southern Great Basin), IV (Snake River Plain), V (Northern Great Basin), VI (Columbia Basin) and VII (Colorado Plateau) and 75% core areas around leks.

Results

Range-wide

Monitoring effort. The number of leks counted that met criteria for inclusion in the trend analysis increased markedly over the assessment period, from 267 in 1965 to 3,154 in 2015 (Fig. 1). This dramatic increase over time reflects increased efforts by state wildlife agencies and others in research, monitoring, and range-wide efforts to locate new leks as conservation concern over sage-grouse has grown.

Lek-count trends. Average males per lek has varied over the 1965-2015 interval, reflecting both cyclic or cycle-like trends in roughly 6-11 year intervals as described by Fedy and Doherty (2011) for Wyoming, and a long term decline (Fig. 1). Confidence intervals around males per lek estimates are large in the early years, and have declined over time as sampling intensity has increased (Fig. 1). Consequently, confidence in average males per lek values in the early analysis period is low, particularly since confidence intervals would not reflect bias in sampling; if larger leks were chosen for the relatively few leks counted, the true value of average males per lek would fall below the 95% confidence interval.

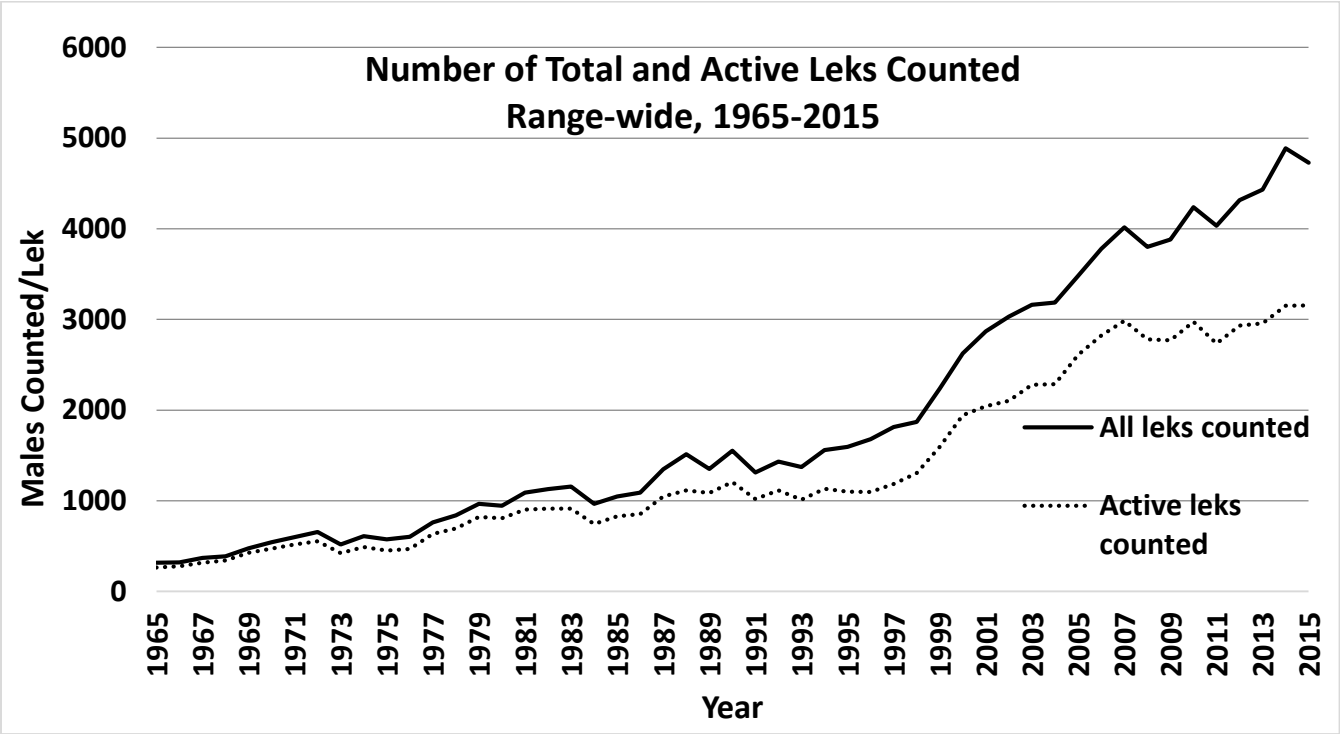
The model for the long term trend analysis (1965-2015) indicated a decreasing trend in average males per lek range-wide of 0.83% per year (90% CI: –0.76 to –0.90, Fig. 3 and Table 1). Estimates of trend (percent change per year) in the peak number of males per lek in the core areas generally showed less of a decline from 1965–2015 compared to estimates for leks in the periphery (non-core) and thus all leks combined (Figure 3, Table 1). The estimated percent change per year in the average number of males per lek in the core areas was -0.09% (90% CRI from 0.02 to -0.20; Table 1) and not statistically different from 0. However, estimates of trends for leks in the periphery and all leks regardless of location were negative (Table 1). All

combined 6,752 leks, regardless of core status, witnessed a significant average annual range-wide decline of -0.83% (-0.76% to -0.90%), with the 2,411 leks of the periphery driving much of that decline, with even greater annual declines of -1.23% (-1.09% to -1.39%).

The trend for the previous 10 years (2005-2015) was -0.07% per year (90% CRI from -0.29 to 0.15) for the core area (range-wide), -2.37% per year for the periphery (90% CRI from -2.89 to -1.87), and +0.78% per year for the combined area (90% CRI from 0.53 to 1.02). Estimates of all possible 10-year trends since 1965 for leks in the core areas ranged from -1.29 to 0.85. Estimates for leks in the periphery ranged widely from -8.23 to 7.74, and estimates for all leks regardless of location ranged from -4.36 to 2.64. These wide-ranges in trends indicate both variability in population trends and that short-term trends can be misleading.

Discussion. Although average males per lek declined significantly range-wide since peaking in 2006, the value they fell to at the lowest point in 2013 (16.7) was still above recent lows in 1995 (15.1) and 1996 (14.9), although below lows in 2002 (20.9) (Fig. 1). The peak in average males per lek in 2006 was the highest recorded since 1970, which was likely biased high. The number of active leks is a function of both sage-grouse population size and lek counting intensity. Although lek counting intensity (as measured by total number of leks counted, Fig. 1) continues to rise, an increasing portion of that effort appears directed at historic, inactive leks. There is no evidence that the number of active leks has declined recently (2,822 active leks in 2006 and 3,154 in 2015, Fig. 1).

At range-wide scales, core areas seem to be holding up well based on model results showing average males per lek trend estimates since 1965 that are not different than zero (stable). The most recent 10-year trend was increasing for all range-wide leks, stable for core leks, but negative for leks at the periphery.



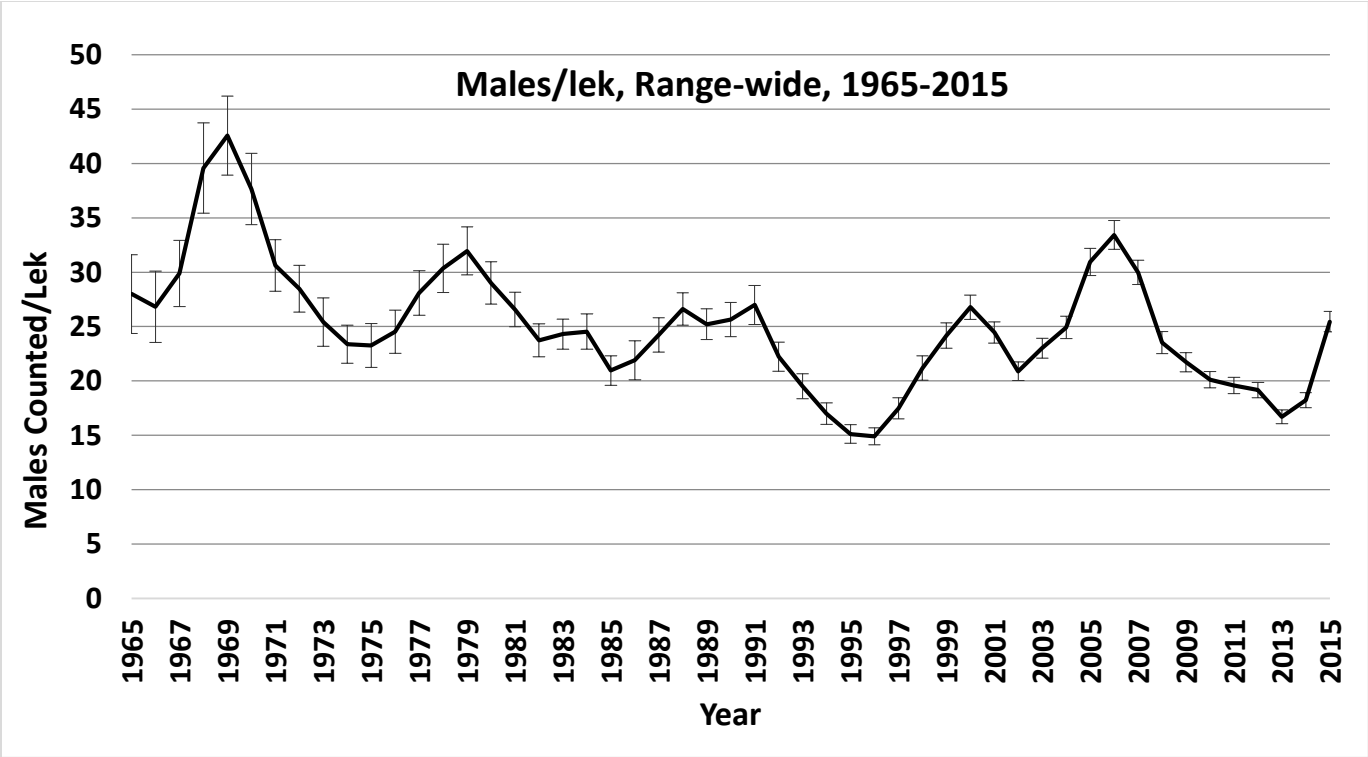


Figure 2. The number of total and active (1 or more males) leks counted, range-wide, 1965-2015 (top), and average number of males per lek, range-wide, 1965-2015 (bottom). Vertical bars represent 95% confidence intervals around the mean.

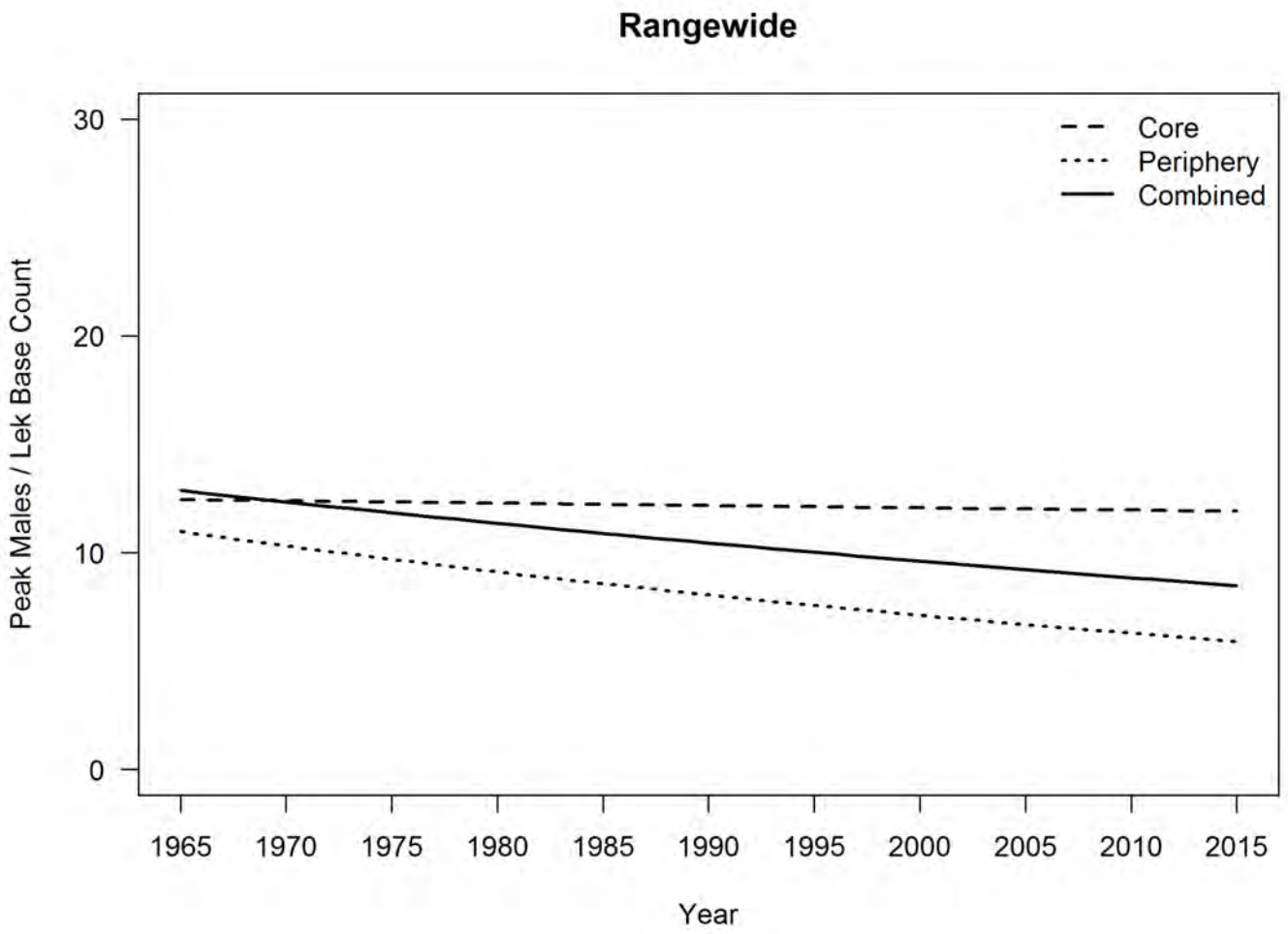


Figure 3. Trends in males per lek in core areas (containing 75% of males), peripheral areas, and combined areas, range-wide, 1965-2015.

Range-wide Population Estimate. There is considerable interest in estimating the current and historical population of sage-grouse at range-wide and other scales, and unsubstantiated estimates of 16 million historically have appeared in the popular media and even the Federal Register. The reality is, no scientifically defensible (estimates with defensible assumptions and bounded by confidence intervals) current or certainly historic estimate of population size is possible by extrapolation from lek counts, at least without marked individuals and a mark/resight

Table 1: Sample sizes (*N*; number of leks) and **e**stimates of trend (percent change per year) and 90% credible intervals for peak number of male sage-grouse on leks from 1965 to 2015 for individual WAFWA Management zones and U.S. States. Analyses based on Management zones focused on the all leks in the 75% core areas, periphery areas (non-core), and all leks, regardless of location within each zone. In addition, a weighted average of trends across management zones was calculated for an estimate of range-wide trends. Analyses based on state boundaries considered all leks identified in 1965 – 2015 within a state. Positive numbers indicate increases, while negative numbers indicate estimated declines. If a 90% credible interval does not contain 0.0, it is considered to be evidence of a statistically significant trend.

		Core		Periphery		All Combined	
Partition	Region	*N*	Estimated Annual % Change (90% Credible Interval)	*N*	Estimated Annual % Change (90% Credible Interval)	*N*	Estimated Annual % Change (90% Credible Interval)
Management Zone	1	877	-2.22 (-2.02 to -2.43)	657	-0.55 (-0.50 to -0.61)	1,534	-2.74 (-2.57 to -2.91)
	2 & 7	1,327	-0.40 (-0.25 to -0.54)	730	-1.09 (-0.95 to -1.22)	2,057	-0.53 (-0.45 to -0.60)
	3	464	+0.06 (0.00 to 0.10)	189	-1.90 (-1.55 to -2.25)	653	+0.19 (0.10 to 0.20)
	4	1,284	+0.98 (0.70 to 1.20)	668	-1.35 (-1.21 to -1.49)	1,952	-0.70 (-0.63 to -0.78)
	5	358	-0.91 (-0.54 to -1.28)	152	-1.69 (-1.22 to -2.17)	510	-1.38 (-1.05 to -1.72)
	6	31	+1.38 (0.50 to 2.30)	15	-2.82 (-0.95 to -4.46)	46	-0.06 (-0.04 to -0.09)
Range-wide		4,341	-0.09 (0.02 to -0.20)	2,411	-1.23 (-1.09 to -1.39)	6,752	-0.83 (-0.76 to -0.90)
State	CA					99	+0.08 (-0.06 to 0.20)
	CO					384	-0.51 (-0.34 to -0.68)
	ID					1,243	+0.91 (0.80 to 1.00)
	MT					1,126	-2.75 (-2.54 to -2.96)
	ND					39	-1.21 (-0.86 to -1.58)
	NV					946	-0.24 (-0.19 to -0.30)
	OR					490	-0.06 (-0.05 to -0.07)
	SD					43	-1.72 (-1.13 to -2.36)
	UT					395	+0.77 (0.60 to 1.00)
	WA					46	-0.06 (-0.03 to -0.09)
	WY					1,941	+0.30 (0.30 to 0.30)

approach (Walsh et al. 2010, Blomberg et al. 2013) or incorporation of demographic data from telemetry (Coates et al. 2014). It is possible to estimate minimum population size using assumptions that have measures of precision associated with them, and from that, and depending on one's comfort level, one can speculate about things that are not known (like proportion of unknown leks) and expand minimum population sizes to scenarios about total population size.

Range-wide, even 2 years from a "cyclic" low, states counted from the ground 80,254 males on 3,154 leks in 2015. An additional 5,390 males on 405 additional leks were either newly discovered in 2015 or counted from the air and excluded from this analysis, meaning a minimum of 85,674 males were counted in 2015 on 3,559 known leks. Few states (Colorado, Utah, North Dakota, South Dakota) attempt to count every known lek, and dual frame sampling approaches in Colorado suggest only 50-75% of leks are known. In states with large sage-grouse populations like Wyoming, Montana, Nevada, and Idaho, complete counts of known leks are not practical.

Walsh (2002) and Walsh et al. (2004, 2010) estimated the population of male sage-grouse in Middle Park, Colorado in 2001 using mark-resight approaches as 544 (370 adults and 174 yearlings), yet 14 counts throughout the season resulted in a maximum count of males of only 313 (57.5%). Using this correction factor, which is likely very conservative as they counted each lek 12-14 times and our database includes peak counts from leks typically counted 1-4 times per year, 148,998 males would be associated with known leks. Sex ratios of adult sage-grouse have been quantified from evaluation of wings obtained from hunters in the fall. Guttery et al. (2013) found 1.65 adult and yearling females per adult and yearling male from a single population in Utah, while Braun et al. (2015) found 1.65 and 2.10 breeding age females per breeding age male in 12 areas in Oregon and 10 in Colorado, respectively. Assuming that these fall ratios are

reflective of sex ratios in the spring, using a weighted average of 1.85 females per male, extrapolating would yield 275,647 females, for a total of 424,645 breeding sage-grouse representing known leks in the spring of 2015. This is a reasonable deductive inference using assumptions that have been evaluated to some extent, but extrapolating from this minimum to adjust for known leks not counted or for unknown leks is perilous because we don't know what we don't know, and the proportion of unknown leks certainly varies widely from virtually zero in places like North and South Dakota to substantial in states with large sage-grouse populations over large areas like Wyoming, Montana, Idaho, and Nevada. Estimates of the number of unknown leks have not been published, and have been obtained only for 1 population in Colorado (49% of leks and 80% of males known; Lukacs pers. comm.).

Trends within Management Zones

WAFWA, in its 2006 Greater Sage-Grouse Comprehensive Conservation Strategy, established 7 sage-grouse management zones based on populations within floristic provinces (Fig. 1). This scale, below range-wide but larger than states, is the scale likely to be most useful to the Fish and Wildlife Service and is the scale where we focused our analyses. Management Zone VII was established primarily for Gunnison sage-grouse in southwest Colorado and adjoining portions of southeast Utah but included a small area of greater sage-grouse as well. Count data was available from 1-29 active leks in Management Zone VII since 1965, but sample sizes were not adequate for trend analysis so these data were combined into Management Zone II.

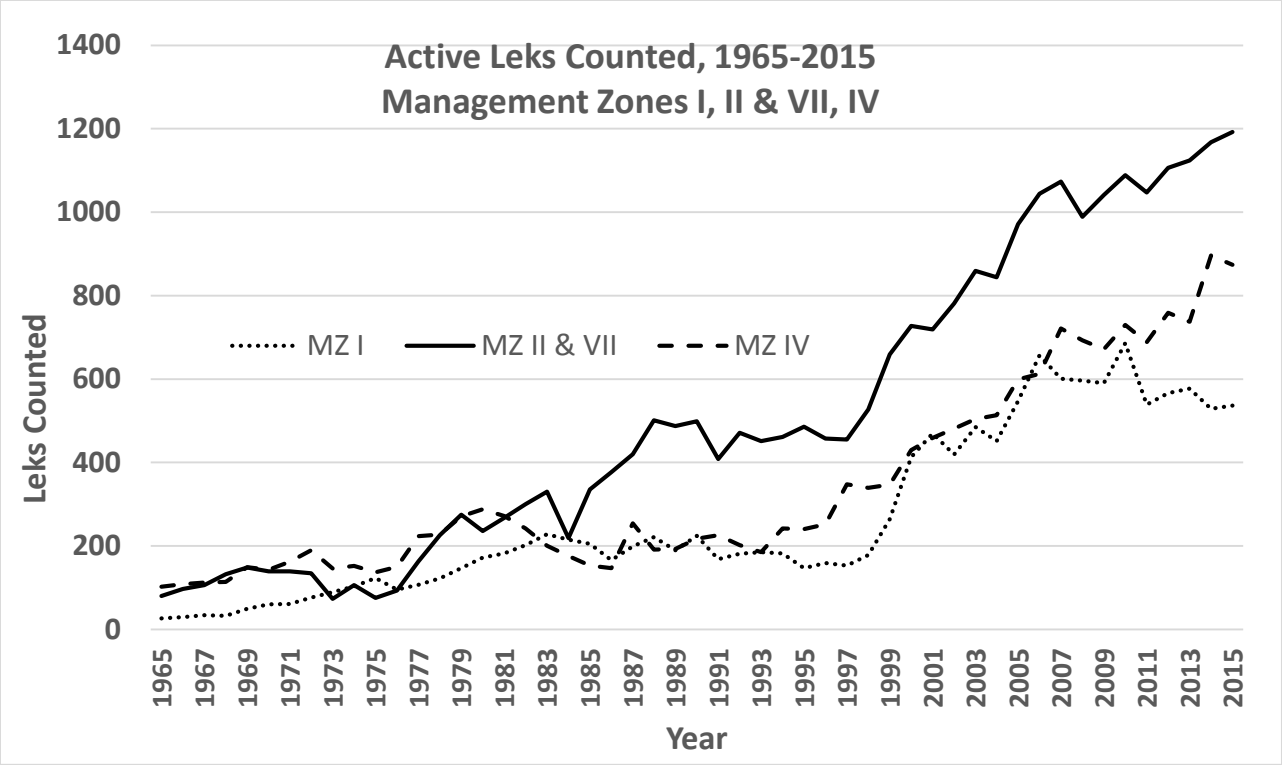
Management Zone I - Great Plains

Monitoring effort. Management Zone I accounted for 11.2% of all males counted from the ground in 2015. The number of active leks counted that met criteria for inclusion in the trend analysis increased over the assessment period, from 26 in 1965 to a peak of 686 in 2010, then declined to 529 in 2014 and 536 in 2015 (Fig. 4).

Lek-count trends. Average males per lek in Management Zone I has varied over time, with peak counts averaging between 25 and 30 males per lek and troughs averaging about 14-20 males per lek (Fig. 5). A recent peak in 2006 of 26.6 males per lek was followed by a decline in subsequent years to a low in 2014 of 9.6 males per lek before rebounding sharply to 16.8 in 2015 (Fig. 5).

Modeled estimates of annual percent change in the average peak number of male sage-grouse in Management Zone I leks from 1965 to 2015 were -2.22% (90% CRI = -2.02 to -2.43) in the 75% core area, -0.55% in the periphery (non-core) (90% CRI = -0.50 to -0.61), and for all leks combined -2.74% (90% CRI = -2.57 to -2.91) (Fig. 6, Table 1).

Discussion. Declines in Management Zone I are concerning, for several reasons. The magnitude of the annual decrease (-2.74% overall, -2.22% core) is large, the rate of decline appears to be increasing in recent years (Fig. 5), "cyclic" lows and highs are below historical norms (Fig. 5), and there appears to be a declining trend in the number of active leks in recent years (Fig. 4). The 78% increase in number of males counted in 2015 compared to 2014 is encouraging, but the males per lek average of 16.8 is still well below 2015 levels in other Management Zones (II&VII - 33.9, III - 22.1, IV - 21.6, V - 20.9), and below the 1965-2015 average (19.2).



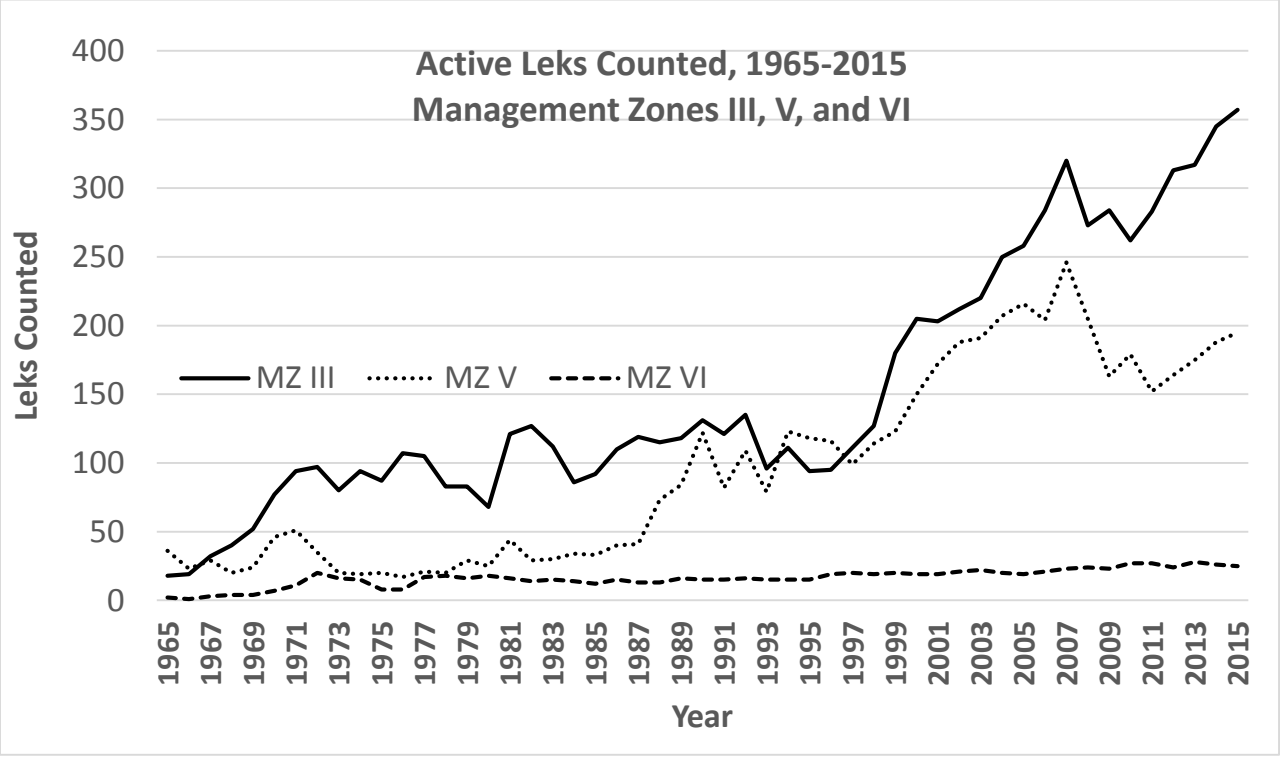


Figure 4. Number of active (1 or more males) leks counted in Management Zones I, II & VII, and IV (top), and Management Zones III, V, and VI (bottom), 1965-2015.

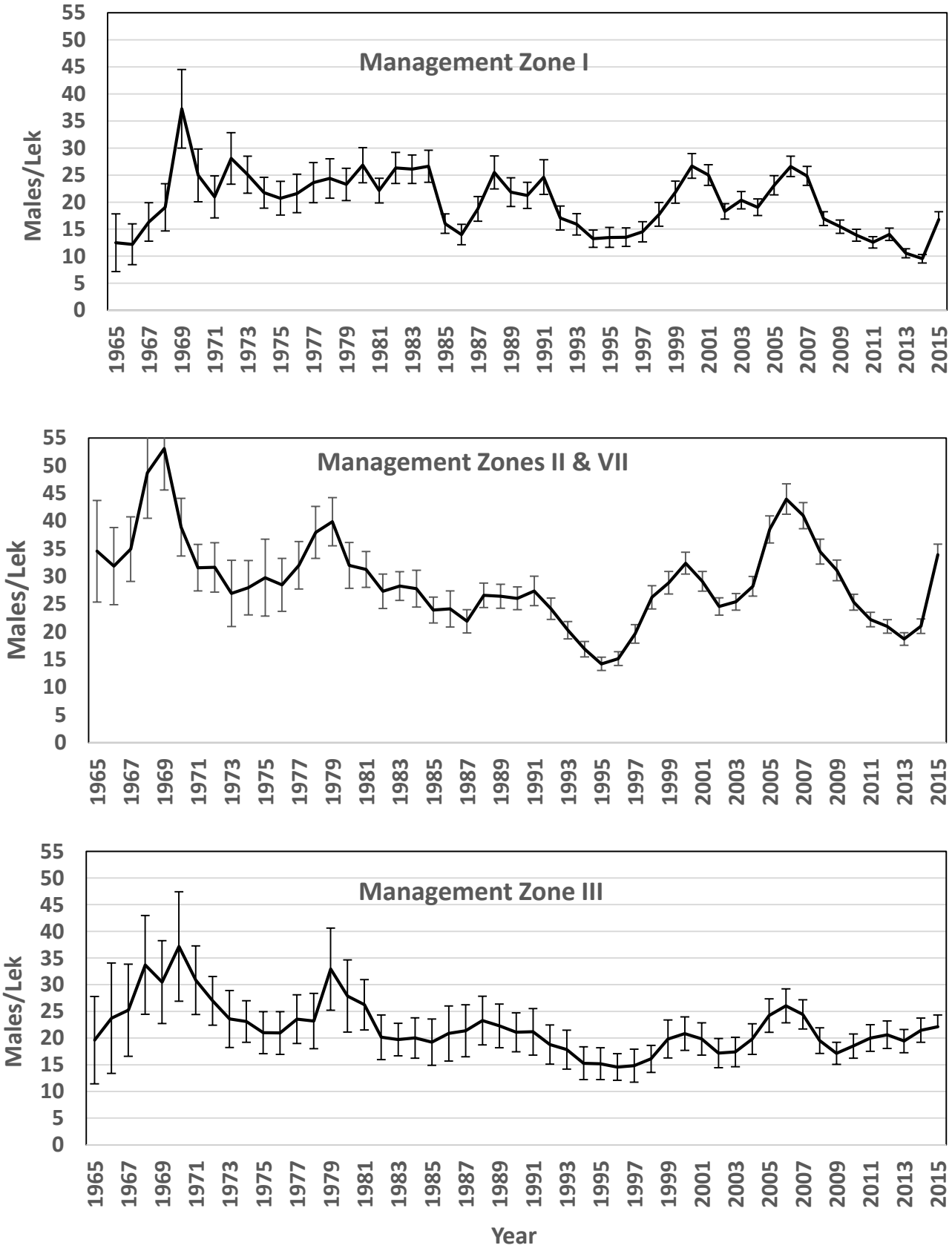


Figure 5. Mean number of males counted per active lek from 1965-2015 in Management Zones I, II & VII, and III. Vertical bars represent 95% confidence intervals around the mean.

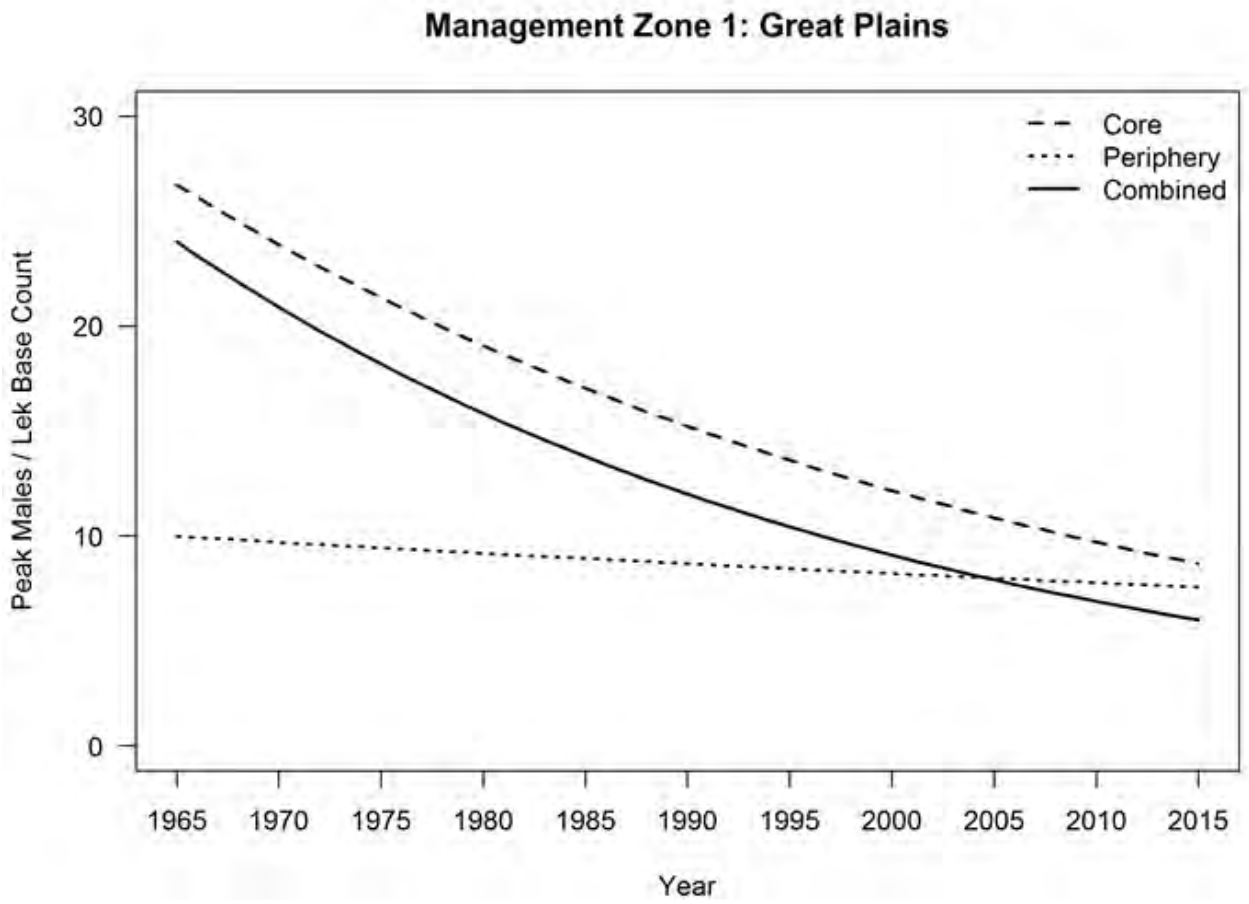


Figure 6. Estimated annual percent change in the average peak number of male sage-grouse on Management Zone I leks in the 75% core area (-2.22, 90% CRI=-2.02 to -2.43), periphery (non-core; -0.55%, 90% CRI=-0.50 to -0.61), and all leks combined (-2.74%, 90% CRI = -2.57 to -2.91).

Management Zone II and VII – Wyoming Basins and Colorado Plateau

Monitoring effort. Management Zone II and VII represented 50.4% (40,444/80,284) of males counted in 2015, virtually all of those in Management Zone II. The number of active leks counted that met criteria for inclusion in the trend analysis increased over the assessment period from 80 in 1965 to 1,192 in 2015 (Fig. 4).

Lek-count trends. Average males/lek in Management Zone II&VII experienced peaks in the late 1960s and late 1970s, with troughs in the mid-1970s and 1980s, before bottoming out in

the mid-1990s (Fig. 5). Confidence intervals around the mean number of males are relatively large prior to the 1980s, and may not contain the true mean in earlier years. More recently, average males per lek had a peak of about 32 around 2000, a larger peak of 44 in 2006, followed by a steady decline to 18.7 in 2013 before increasing to 21.0 in 2014 and 33.9 in 2015 (Fig. 5).

Modeling of percent annual change in Management Zone II and VII indicated peripheral areas have declined from 1965 to 2015 at a rate of 1.1% per year, but that core areas have declined at less than half that rate (0.4%; Fig. 6, Table 1). Overall, average males per lek in Management Zones II and VII have declined at a rate of 0.53% since 1965.

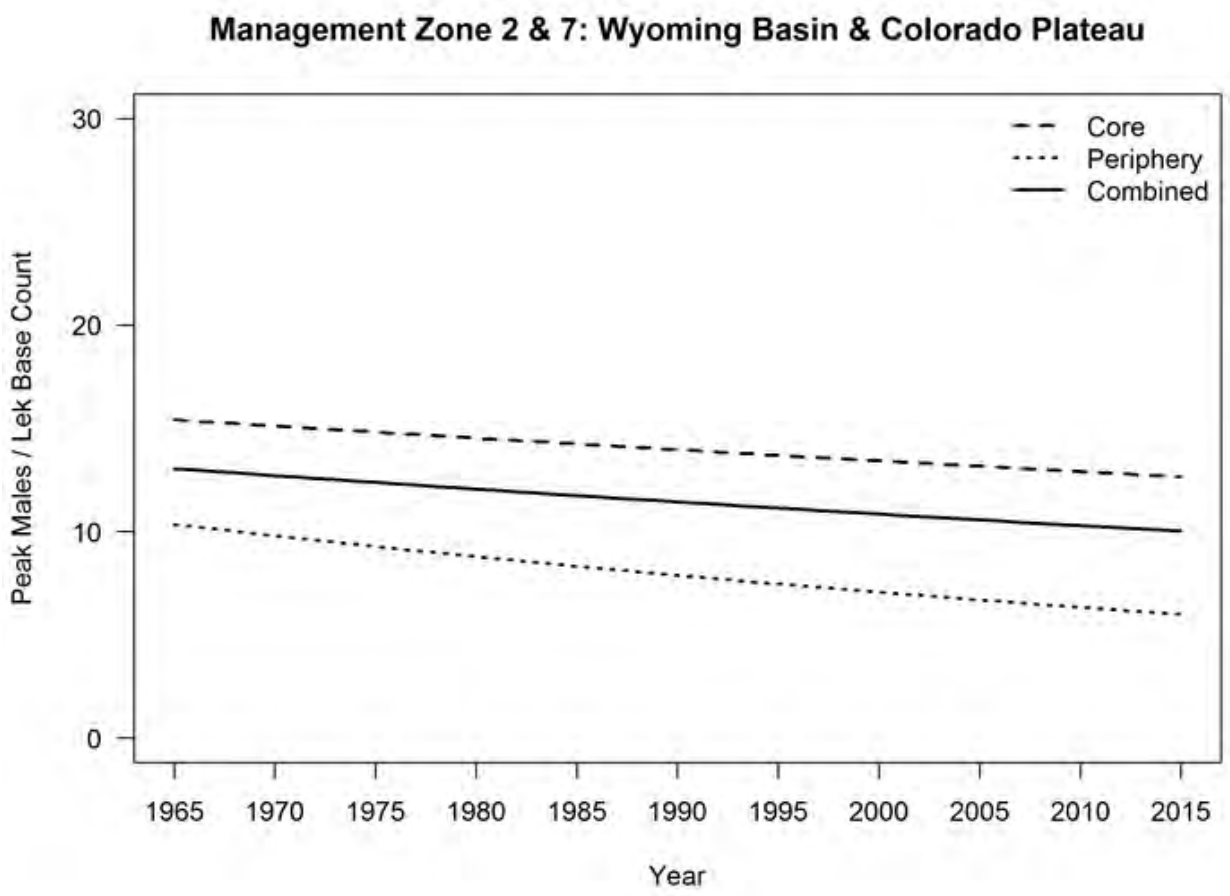


Figure 6. Estimated annual percent change in the average peak number of male sage-grouse on Management Zone II&VII leks in the 75% core area (-0.40, 90% CRI= - 0.25 to -0.54), periphery (non-core; -1.09, 90% CRI=-0.95 to -1.22), and all leks combined (-0.53, 90% CRI = -0.45 to -0.60).

Discussion. Although average males per lek declined recently over a prolonged period (2006-2013), the bottom (19.1) was still above the lows experienced in 1995 (14.3) and 1996 (15.2) (Fig. 5). The 2006 peak (44.0 males/lek) was the highest since 1969. The number of active leks has been on an increasing trend since the peak in 2006 (Fig. 4).

Management Zone III - Southern Great Basin

Monitoring effort. Management Zone III accounted for 7,897 of 80,284 males counted in 2015 (9.8%). The number of active leks counted that met criteria for inclusion in the trend analysis increased over the assessment period, from 18 in 1965 to 357 in 2015 (Fig. 4).

Lek-count trends. Average males per lek in Management Zone III showed large peaks around 1970 and 1979, and lower peaks between about 20 and 26 around 1988, 2000, and 2006 (Fig. 5). More recently, males per lek showed a trough of 17.1 in 2009, increased to about 20 in 2011-2013, before increasing to 21.5 in 2014 and 22.1 in 2015 (Fig. 5).

Modeling of percent annual change in Management Zone III indicated core and combined areas have increased from 1965 to 2015 at low levels (0.06%/year; 90% CRI 0.00 to 0.10 and 0.19%/year; 90% CRI 0.10 to 0.20, respectively), but peripheral areas have declined at a rate of 1.90%/year (90% CRI -1.55 to -2.25; Fig. 7, Table 1).

Discussion. Average males per lek declined after peaking in 2006, but the decline occurred earlier and to less of an extent than in other management zones. The bottom of 17.1 males per lek in 2009 was equal to the 2002 bottom, and above the 1996 low of 14.6. The peak in 2006 was the highest since 1979. Active leks declined from 2007 (320) to 2010 (262), but have increased steadily since to 357 in 2015. Models suggest stable to slightly increasing populations overall since 1965, with some decline in peripheral areas.

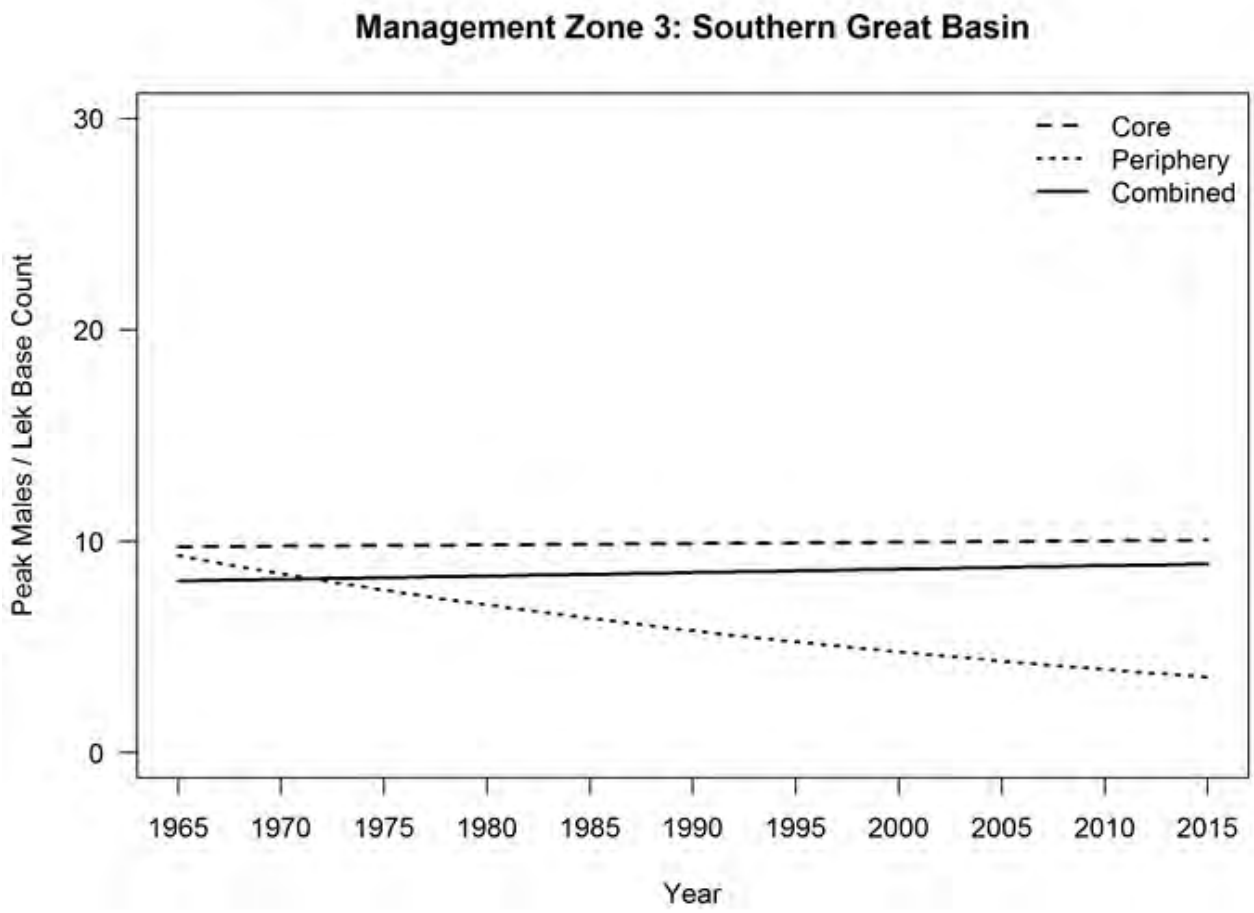


Figure 7. Estimated annual percent change in the average peak number of male sage-grouse on Management Zone III leks in the 75% core area (0.06; 90% CRI 0.00 to 0.10), periphery (non-core; -1.90 (90% CRI -1.55 to -2.25), and all leks combined (0.19; 90% CRI 0.10 to 0.20).

Management Zone IV - Snake River Plain

Monitoring effort. Management Zone IV represented 23.5% of males counted from the ground in 2015 (18,851/80,284). The number of active leks counted that met criteria for inclusion in the trend analysis increased over the assessment period, from 102 in 1965 to a high of 896 in 2014 (Fig. 4).

Lek-count trends. Average males per lek in Management Zone IV increased from around 30 in 1965-1966 to a peak of 47.3 in 1970, then declined to a low of 23.2 in 1974 (Fig. 8). Since then, peaks of around 30 males per lek have followed in the late 1970s, and late 1980s, with a

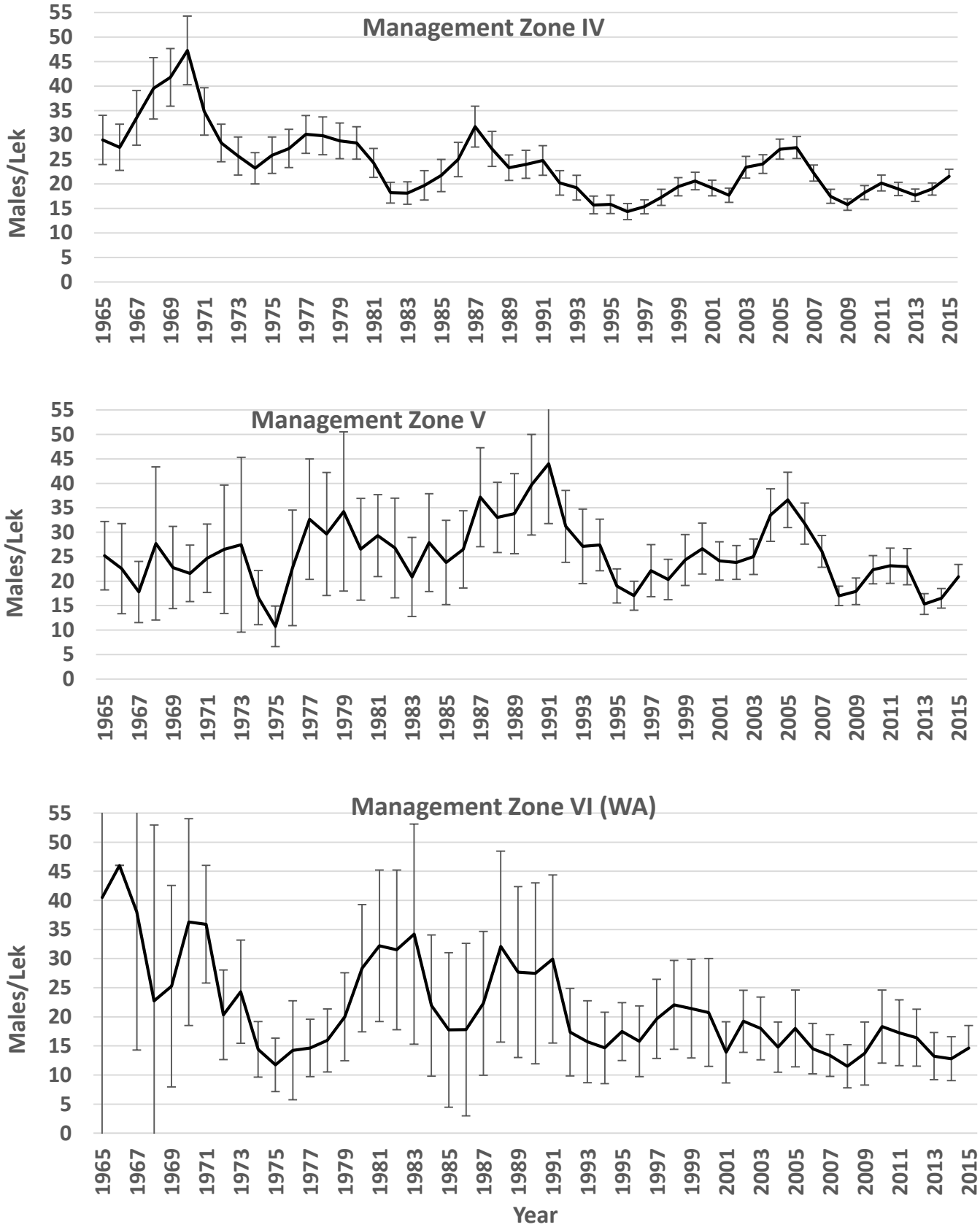


Figure 8. Mean number of males counted per active lek from 1965-2015 in Management Zones IV, V & VI. Vertical bars represent 95% confidence intervals around the mean.

lower peak of 27.4 in 2006. Troughs occurred in 1983 (18.1), 1996 (14.4), and 2009 (15.8) (Fig. 8). Average males per lek has varied between 18.2 and 21.6 since 2010 (Fig. 8).

The results of the modeling effort indicated average males per lek within core areas of Management Zone IV have been increasing since 1965 at about 1% per year (+0.98%, 90% CRI 0.70 to 1.20, Fig. 9, Table 1), but that peripheral areas have declined at a rate of -1.35% per year, resulting in an overall decrease of -0.7% per year (Fig. 9, Table 1).

Discussion. The 2006 peak in average males per lek in Management Zone IV (27.4) was the largest since 1987 (31.7), and comparable to the peak in the late 1970s (Fig. 8). The recent low in 2009 (15.8) was similar to lows in 2002 and in the late 1990s (Fig. 8). The number of active leks has varied somewhat since 2006, but on a generally increasing trend (Fig. 6). Core areas appear to be doing well, modeled declines since 1965 overall have been relatively low. Examining Figure 8 suggests most of this decline occurred from 1965 to the mid-1990s, and that populations have stabilized since then.

Management Zone V - Northern Great Basin

Monitoring effort. In 2015 biologists counted 4,080 male sage-grouse in Management Zone V, or 5.1% of the range-wide total. The number of active leks counted that met criteria for inclusion in the trend analysis increased over the assessment period, from 37 in 1965 to a high of 246 in 2007, then declined to 152 in 2011 before increasing again to 195 in 2015 (Fig. 4).

Lek-count trends. Fewer than 50 leks were counted each year until 1988, when sampling intensity increased (Fig. 4). Consequently, confidence limits around average males per lek in Management Zone V are quite large (43-130% of the average) prior to 1994, both because relatively few (<100) leks were counted, and because of high variability in lek counts (Fig. 8).

Confidence limits since 1994 have tightened as the number of leks counted has increased to between 150 and 246 (Fig. 4). Inferring any trends in average males per lek in early years is problematic given the variability around these averages. That said, unlike other Management Zones, the overall trend in average males per lek appears to be increasing from 1965 to about 1991, with an overall declining trend since 1991 or at least since the 2006 peak (Fig. 8).

Modeling results indicated average males per lek within Management Zone V has declined at a rate of 1.38% per year since 1965 (90% CRI -1.05 to -1.72), with declines substantially greater in peripheral areas than core areas (-1.69 vs -0.91; Fig. 10, Table 1).

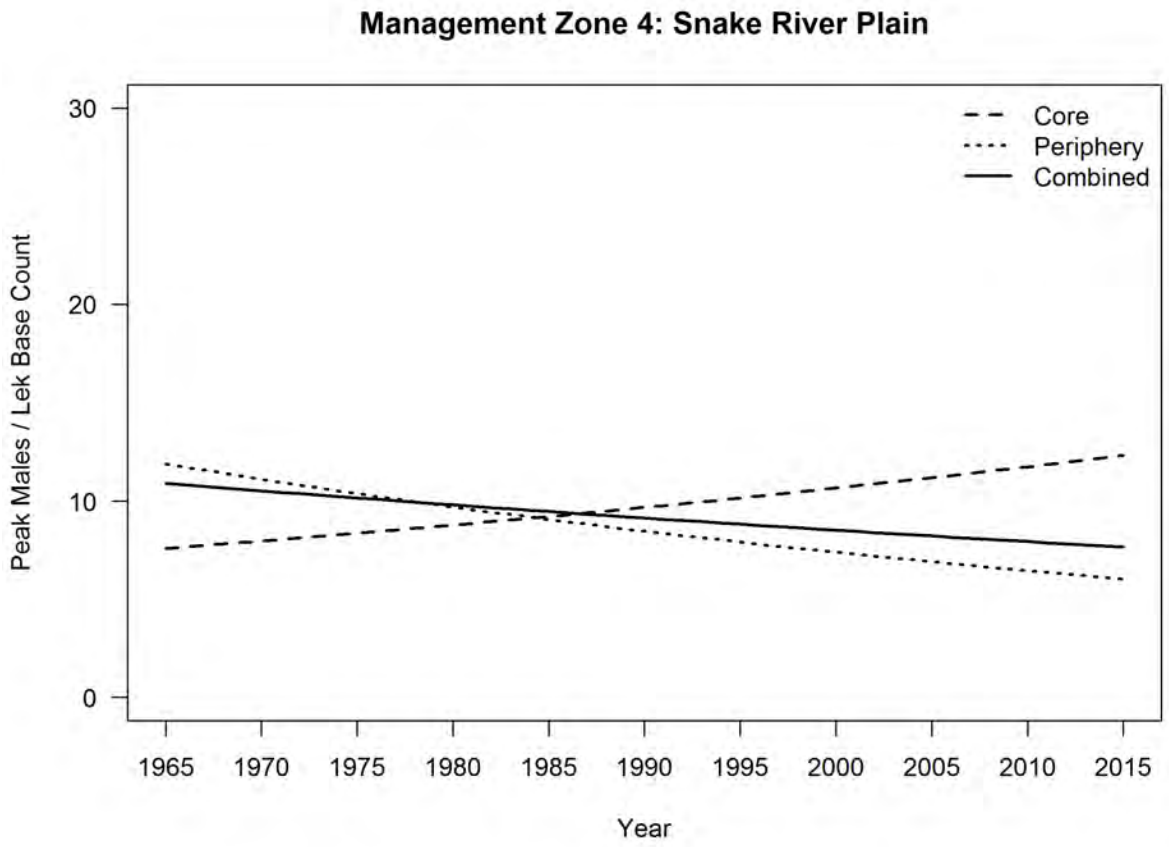
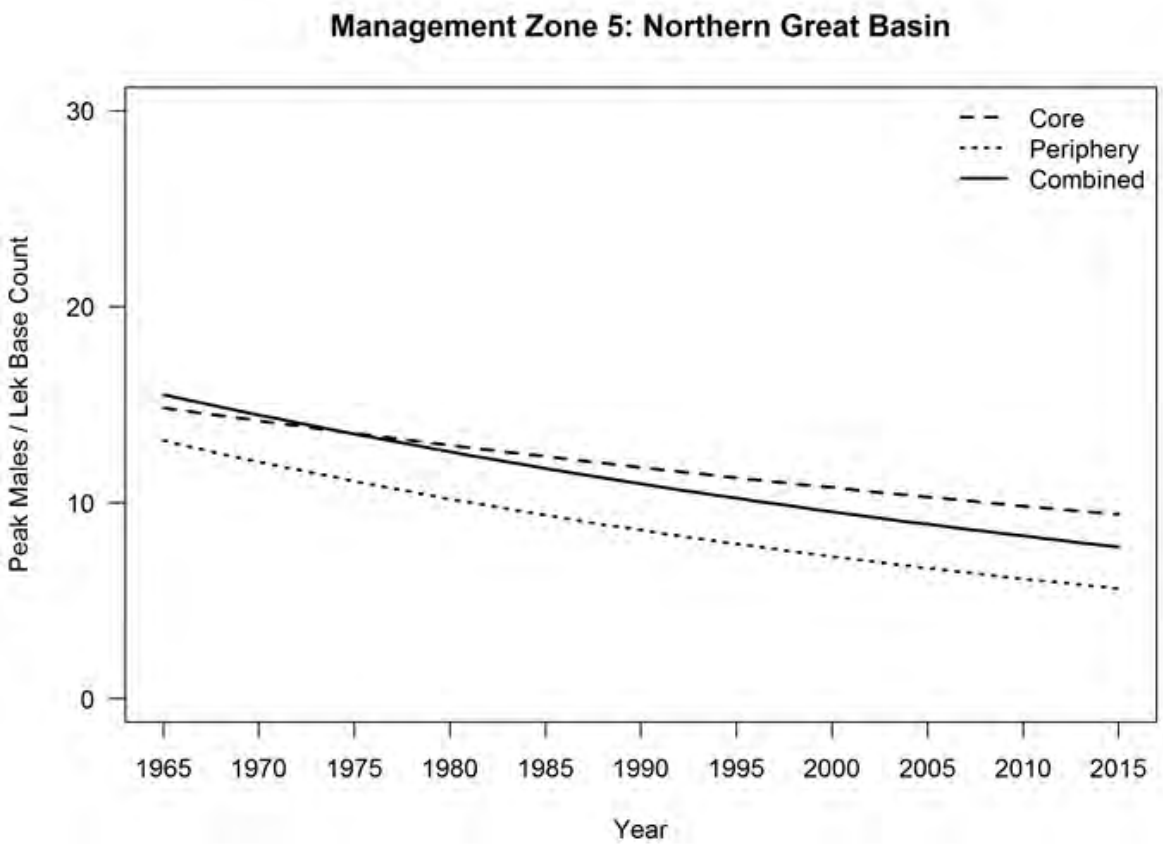


Figure 9. Estimated annual percent change in the average peak number of male sage-grouse on Management Zone IV leks in the 75% core area (0.98; 90% CRI 0.70 to 1.20), periphery (non-core; -1.35% (90% CRI -1.21 to -1.49), and all leks combined (-0.70; 90% CRI -0.63 to -0.78).



`Figure 10. Estimated annual percent change in the average peak number of male sage-grouse on Management Zone V leks in the 75% core area (-0.91; 90% CRI -0.54 to -1.28), periphery (non-core; -1.69% (90% CRI -1.22 to -2.17), and all leks combined (-1.38; 90% CRI -1.05 to -1.72).

Discussion. Declines in Management Zone V are concerning for several reasons. The magnitude of the modeled annual decrease (-1.38%) is significant, core and peripheral areas are both decreasing, and the rate of decline appears to be increasing in recent years (Fig. 8). In addition, "cyclic" lows and highs are somewhat below historic norms (Fig. 8), and there appears to be a declining trend in the number of active leks in recent years (Fig. 4). It is encouraging that the recovery from the recent trough in 2013 was significant, an increase of 52% in total males counted and an increase of 20 active leks (11%), which increased males per lek from 15.3 to 20.9 (Fig. 8).

Management Zone VI - Columbia Basin

Management Zone VI consists entirely of sage-grouse populations in the state of Washington. Average annual rates of change indicate that male counts in this management zone decreased an average of 0.06% per year from 1965-2015 (90% CI -0.04 to -0.09). See the section on Washington (below) for additional information.

State Level Analyses

Wyoming

Monitoring effort. Wyoming counted 34,518 males (excluding aerial counts) in 2015, which was 43% of the range-wide total. The number of active leks counted that met criteria for inclusion in the trend analysis increased over the assessment period from 28 in 1965 to a high of 1,052 in 2015 (Fig. 11). During the 1960s and 1970s about 24-54 leks were counted each year, increasing to over 200 per year after 1981, then increasing steadily until approximately 1,000 active leks were counted each year after 2006 (Fig. 11). Wyoming, like most states, maintains an inventory of historic lek locations which are checked for activity each spring, bringing the total number of leks counted to about 1,600 in recent years (Fig. 11). Counting over 1,500 sage-grouse leks each year is a monumental task, and Wyoming should be commended for their effort.

Lek-count trends. Confidence limits are relatively large around average males/lek until the 1980s when counting effort surpassed 200 leks annually (Fig. 11). A peak in 1968 of 58.8 males per lek was based on 68 leks counted. Subsequent peaks have been 40.1, 26.0, 33.3, and 44.9 males per lek in 1978, 1991, 2000, and 2006, respectively (Fig. 11). Troughs of 25.5, 20.2, 13.1, 23.0, and 17.4 males per lek occurred in 1971, 1987, 1996, 2002, and 2013, respectively (Fig. 11).

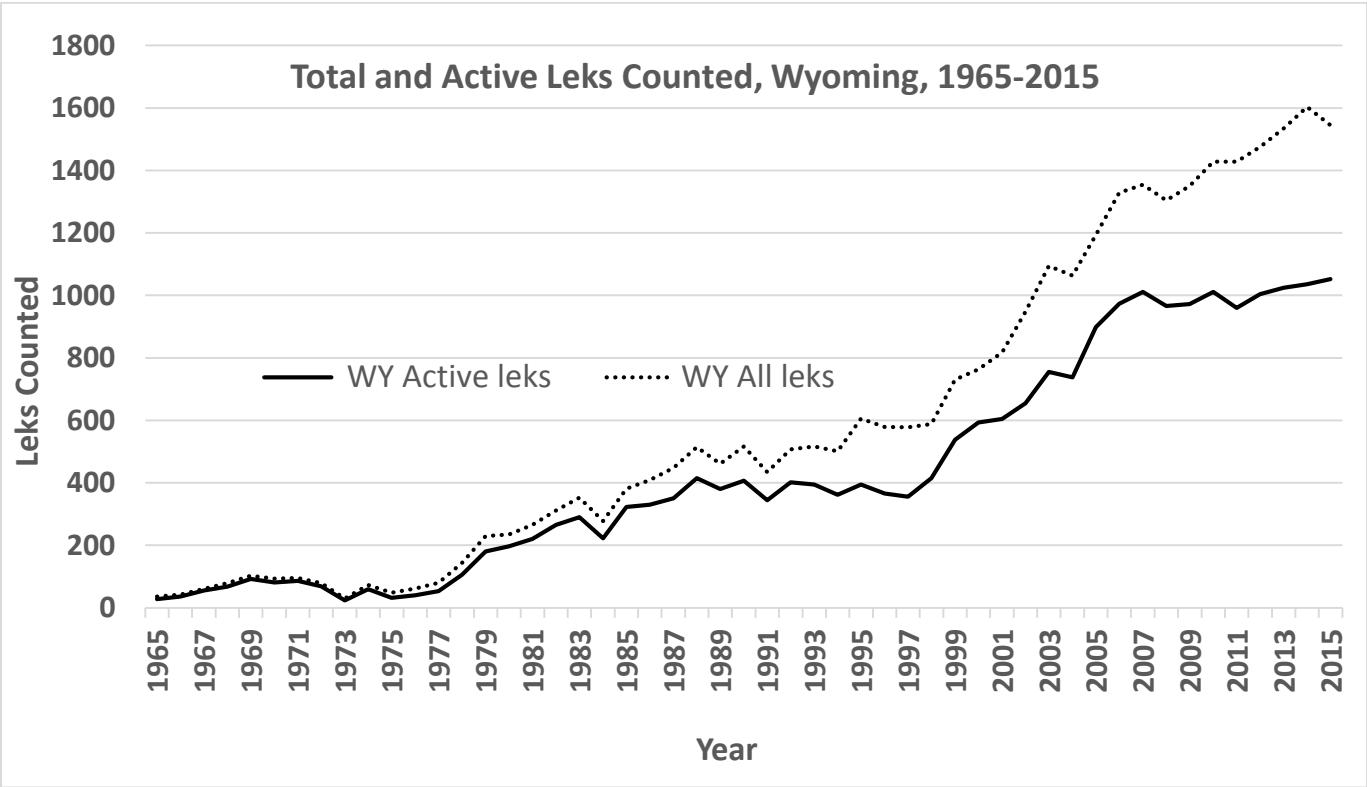
Modeling indicated average males per lek in Wyoming has increased over the 1965-2015 at a rate of 0.30% annually (Table 1).

Discussion. The 2006 peak was the highest average males per lek since 1968, which may have been biased high as relatively few leks were counted. This peak likely had a strong influence on the somewhat surprising modeling result that showed an annual increase since 1965 of 0.3%. Still, evidence suggests that Wyoming sage-grouse are doing well. Habitat supported a peak of 45 males per lek as recently as 2006. Recent lows in 2013, while below 2002 lows, were above mid-1990s lows and comparable to troughs in 1987 (Fig. 11). The number of active leks is stable to increasing in recent years (Fig. 11).

Idaho

Monitoring effort. Idaho counted 12,414 male sage-grouse in 2015, or 15.5% of the range-wide total. The number of leks counted that met criteria for inclusion in the trend analysis increased over the assessment period, from 67 in 1965 and 1966 to a high of 623 in 2014 (Fig. 12). The number of leks counted in Idaho ranged generally between 100 and 200 until 1997 (245) when a steady increase in counting effort began that continued until over 600 active leks were counted in 2014.

Lek-count trends. Average males per lek has varied over time but increased from 1965 to a peak of 53.3 in 1970, before a long term decline to a low of 15.3 males in 1983 (Fig. 12). Males per lek then increased to a peak of 33.8 in 1987 before a decline, with other peaks of 27.7 in 1991 and 29.1 in 2006 (Fig. 12). Average males per lek then declined to a low of 17.3 in 2009, before increasing slightly to 18.3-19.1 males per lek between 2009 and 2014 (Fig. 12). This increased to 22.4 in 2015 (Fig. 12).



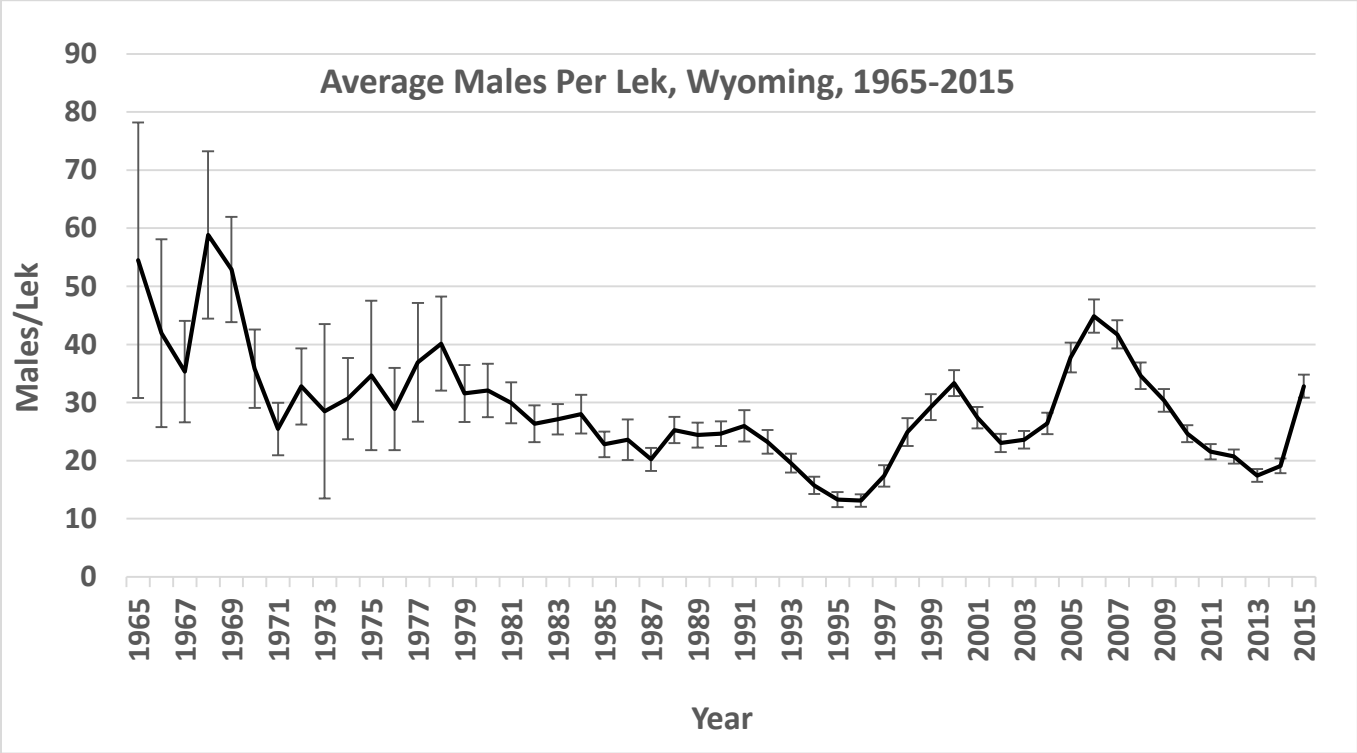


Figure 11. Number of total and active (1 or more males) leks counted from 1965-2015 in Wyoming (top), and mean number of males counted per active lek from 1965-2015 in Wyoming (bottom). Vertical bars represent 95% confidence intervals around the mean.

Since 1965, average males per lek in Idaho has increased at a rate of 0.91% per year according to modeling results (90% CRI 0.80 to 1.00, Table 1).

Discussion. Idaho sage-grouse populations have fluctuated less than those in many other states, particularly in recent years (Fig. 12). Recent peaks in 2006 in average males per lek were roughly comparable to earlier peaks, except for the 1969 peak which may have been biased high. Idaho did not experience the 2013 trough other states did. The last trough in 2009 was not as low as the mid-1990s trough, but comparable to other low periods.

Nevada

Monitoring effort. Nevada counted 8,994 male sage-grouse in ground counts in 2015 (11.2% of range-wide total), and an additional 2,822 males from aerial searches, or about 15% of all males counted by all means range-wide. The number of active leks counted that met criteria for inclusion in the trend analysis varied substantially over the assessment period, from 27-57 between 1965 and 1979, from 66 to approximately 150 until 1999, then increased to a high of 444 in 2007, and ranged from 284-376 between 2008 and 2015 (Fig. 12).

Lek-count trends. Confidence intervals around average males per lek are relatively large until the 1980s because of small sample sizes and variable count data, complicating interpretation of trends (Fig. 12). There were apparent pronounced peaks in 1970 of 45.4 and 1979 of 42.5, with troughs in 1975 of 16.6 and in 1982 of 19.9 (Fig. 12). Since then, average males per lek have fluctuated between about 16 and 27, with a smaller peak in 2004-2007 and a trough in 2008-2009 (Fig. 12).

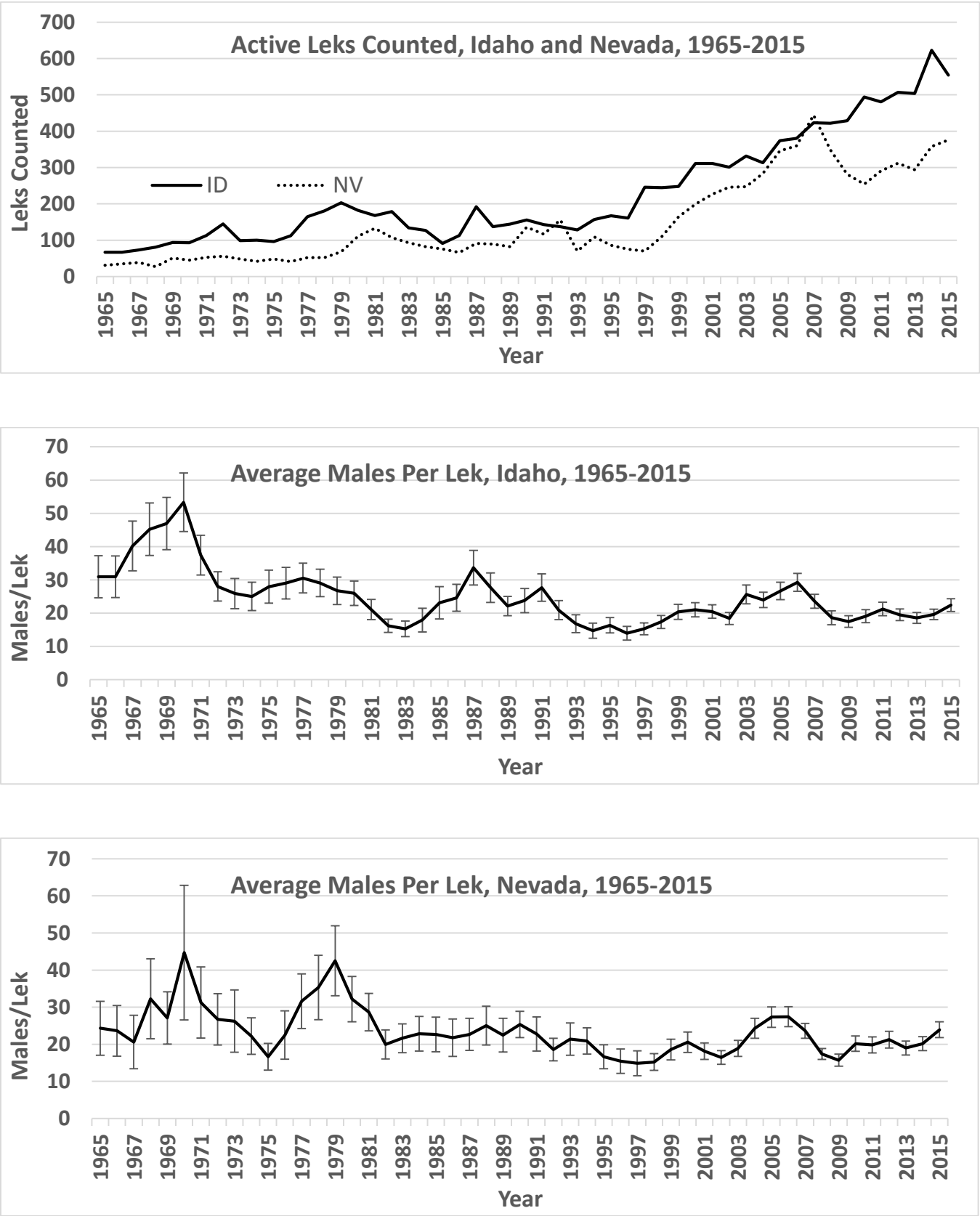


Figure 12. Number of active leks counted from 1965-2015 in Idaho (ID) and Nevada (NV) (top), and mean number of males counted per active lek from 1965-2015 in Idaho (middle) and Nevada (bottom). Vertical bars represent 95% confidence intervals around the mean.

Modeling results indicated a decline in average males per lek since 1965 of 0.24% per year (90% CRI -0.19 to -0.30; Table 1) in Nevada.

Discussion. Nevada, because many sage-grouse leks are located in remote, inaccessible locations, surveys many leks from the air (213 in 2015, vs. 462 leks counted from the ground). These aerial counts are excluded from our analysis because detectability of males is likely to differ in aerial and ground counts, and trends could be created as an artifact of changes in sampling intensity by air or ground. Still it complicates interpretation; did the number of active leks decline markedly from a peak in 2007 to 2010 because of a population decline, or because fewer leks were counted from the ground and more by air and thus not included in our sample? Similar to Idaho, average males per lek declined to a trough in 2009, and have generally increased since (Fig. 12). Figure 12 suggests most of the decline indicated by the model since 1965 likely occurred prior to the mid-1990s, and that population trends have been relatively flat since.

Oregon

Monitoring effort. Oregon accounted for 5.3% of males counted range-wide in 2015 (4,256/80,284). The number of active leks counted that met criteria for inclusion in the trend analysis increased significantly over the assessment period, ranging from 10-26 between 1965-1985, then increasing steadily to a high of 218 in 2010 (Fig. 13). Active leks counted declined to 163 in 2011. The number of active leks counted has increased markedly since 2011 to a high of 243 in 2015 (Fig. 13).

Lek-count trends. Confidence intervals around the average males per lek are very large until the 1990s when sample sizes increased, complicating interpretations of trends in the early

interval. Generally there was a declining trend in average males per lek from 1965 until the mid-1970s, an increasing period until 1991, then a decline until the mid-1990s, an increase that culminated in a large peak of 35.4 in 2005, followed by a decline and trough in 2008-2009 to about 14 (Fig. 13). Average males per lek has fluctuated between 13 and 20 since 2010 (Fig. 13).

Modeling indicated average males per lek has declined slightly, 0.06% per year since 1965 (90% CRI -0.05 to -0.07).

Discussion. As recently as 2005, average males peaked at 35.3, the highest peak recorded in the 1965-2015 interval. Troughs in average males per lek in 2013 and 2008-2009 were similar to troughs in prior decades. Number of active leks has fluctuated, but has generally increased since about 1994, which is likely indicative of increased effort. There is no evidence of a decreasing trend in active leks over that period.

Montana

Monitoring effort. Montana counted 7,136 males in 2015, 8.9% of the range-wide total. The number of leks counted that met criteria for inclusion in the trend analysis increased substantially over the assessment period, from 12 in 1965 to approximately 100-200 leks per year from 1977-1999 before increasing to a high of 519 in 2010, then dropping to between 380 and 435 active leks counted from 2011-2015 (Fig. 13).

Lek-count trends. Confidence limits around the mean number of males counted per lek are large until the late 1970s because of small sample sizes and variability in count data, complicating interpretation of trends (Fig. 13). Average males per lek generally increased from the mid-1970s through 1984, then declined to a low of 15.8 in 1986 before increasing to peaks of

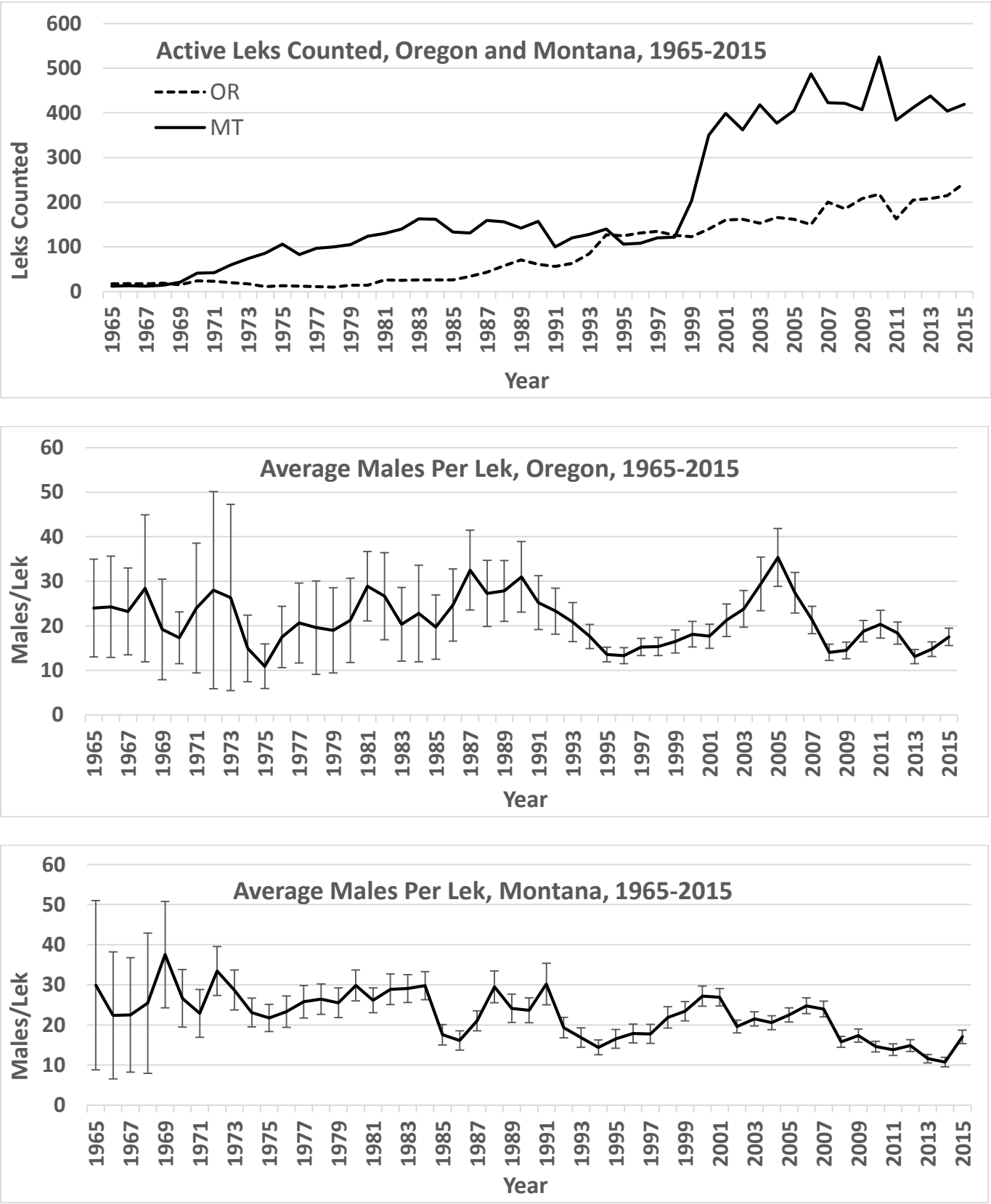


Figure 13. Number of active leks counted from 1965-2015 in Oregon (OR) and Montana (MT) (top), and mean number of males counted per active lek from 1965-2015 in Oregon (middle) and Montana (bottom). Vertical bars represent 95% confidence intervals around the mean.

29.3 in 1988 and 30.1 in 1991 (Fig. 13). Average males per lek then declined to a low of 14.3 in 1994, increased to 26.9 in 2000, ranged between about 20-25 from 2002-2007 before beginning a period of decline to a low of 10.7 in 2014 (Fig. 13). In 2015 average males per lek increased sharply to 17.0 (Fig. 13).

Modeling estimated that average males per lek has declined from 1965-2015 at a rate of 2.75% per year in Montana (Table 1, 90% CRI -2.54 to -2.96).

Discussion. It appears from examining Figure 13 that since the early 1990s, peaks in average males per lek in Montana have gotten lower and troughs deeper, which is consistent with modeled declines of 2.75% per year over the 1965-2015 interval.

Colorado

Monitoring effort. Colorado accounted for 7.7% of males counted in 2015 range-wide (6,199/80,284). The number of active leks counted that met criteria for inclusion in the trend analysis increased substantially over the assessment period, from a low of 24 active leks counted in 1975 to a high of 204 in 2015 (Fig. 14). There were several periods when the number of active leks declined, presumably because lek counting intensity dropped; from 1973-1976, from 1984-85, and from 1991-1994, so counts during these periods may not be representative of counts immediately before or after.

Lek-count trends. In the early analysis period there were pronounced peaks in average males per lek in 1969 (54.1) and 1979 (48.4), with troughs in between in 1974 (23.9) and 1984 (19.4) (Fig. 14). Both of these troughs coincided with declines in lek sampling intensity, particularly in Moffat County where some of the larger leks in CO occur, which may have exaggerated the extent of the decline. More recently peaks have averaged between 26 and 32 males per lek, with troughs around 16 or 17 males.

Modeling indicated a declining trend in average males per lek since 1965 of 0.51% per year (Table 1, 90% CRI -0.34 to -0.68).

Discussion. The average males per lek in Colorado has recovered to the point where the 2015 level of 30.4 is almost to the 2005 peak of 32.1, which was the highest peak since 1979. The number of active leks is on an increasing trend, with relatively similar effort across recent years.

Utah

Monitoring effort. Utah counted 5,451 males in 2015, which was 6.8% of the range-wide total. The number of active leks counted that met criteria for inclusion in the trend analysis increased significantly over the assessment period, from 15 in 1965 to a high of 245 in 2015 (Fig. 14).

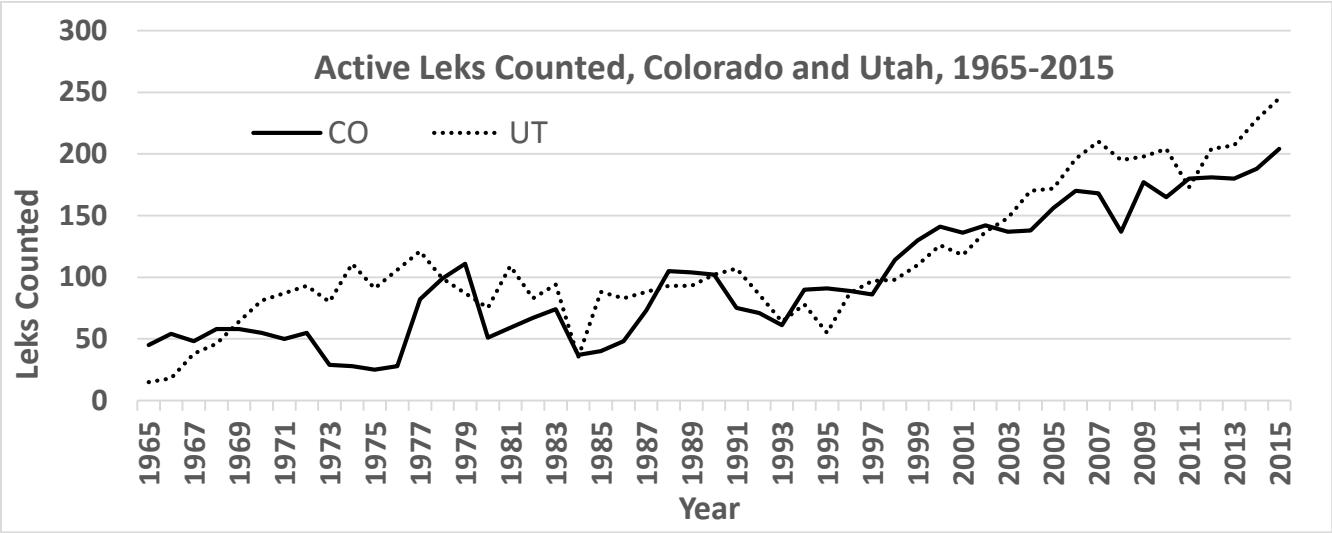
Lek-count trends. Average males per lek in Utah exhibited peaks in 1969 (36.6), 1979 (31.7), 1989 (27.8) and 2006 (29.8), with troughs generally in the 15-20 males per lek range in the intervening years (Fig. 14). Average males per lek declined from the 2006 peak to 16.1 in 2012, then increased steadily to 22.2 in 2015 (Fig. 14).

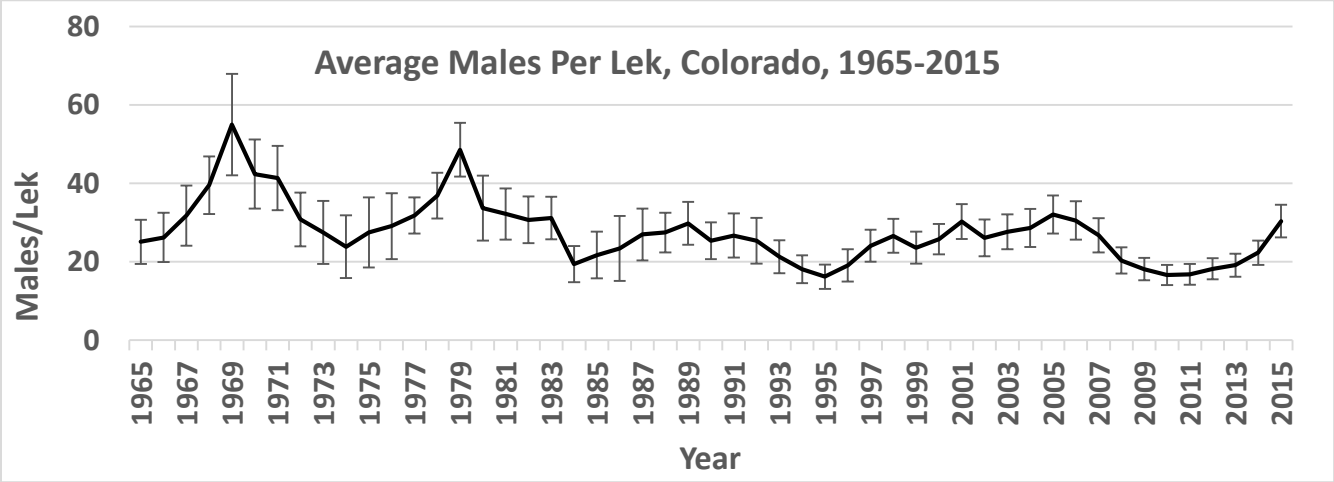
Modeling indicated that average males per lek in Utah have increased at a rate of 0.77% per year since 1965 (Table 1, 90% CRI 0.60 to 1.00).

Discussion. The recent 2006 peak in average males per lek was very similar to or above previous peaks back to the 1979 level, and the recent trough in 2010-2011 was similar to the bottom in the mid-1990s, but somewhat below previous troughs. The number of active leks has increased since 2011.

California

Monitoring effort. California counted 1,158 males in 2015, or 1.4% of the range-wide total. The number of active leks counted that met criteria for inclusion in the trend analysis increased significantly over the assessment period, from a low of 6 in 1978 to a high of 52 in 2004, and has ranged between 41-52 since 2000 (Fig. 15).





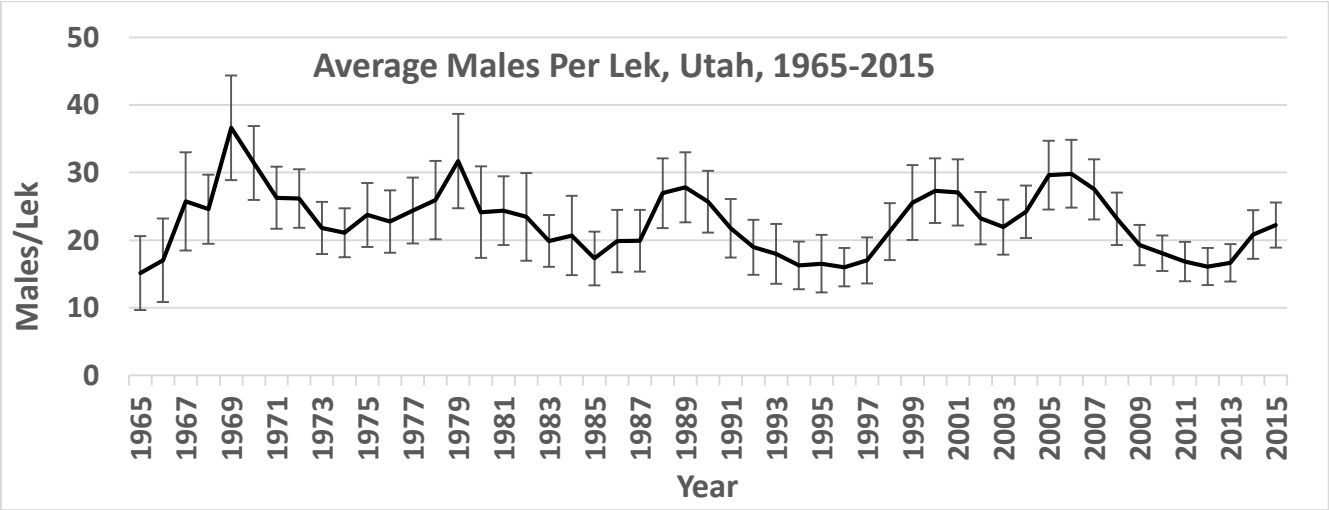


Figure 14. Number of active leks counted from 1965-2015 in Colorado (CO) and Utah (UT) (top), and mean number of males counted per active lek from 1965-2015 in Colorado (middle) and Utah (bottom). Vertical bars represent 95% confidence intervals around the mean.

Lek-count trends. Average males per lek in California has varied significantly over the 1965-2015 time period, although large confidence limits around the average complicates interpreting trends (Fig. 15). Average males per lek peaked in 1969 (29.7), 1980 (35.5), 1987 (45.3), 1991 (64.3), 2000 (40.5), 2005 (29.5) and 2012 (34.4) (Fig. 15). There were significant troughs in average males per lek in 1967, 1978, 1983, 1996, 2002, and 2008, with values ranging from 11.7-22.6 (Fig. 15).

Modeling results indicated average males per lek has been stable since 1965 (0.06% per year, but 90% CRI includes zero, Table 1).

Discussion. Average males per lek increased from the mid-1960s to a peak of 67.7 in 1991, but has generally decreased since. The 1991 peak is largely an artifact of several large leks in close proximity being clustered which formed two, 300-bird leks which raised the per lek average considerably. The recent trough in average males per lek in 2008 (18.2) was lower than troughs in 2002 and 1996 (23.7 & 24.2, respectively), but similar to the trough in 1983 (18.1). In the last 5 years average males per lek in California has fluctuated between 25 and 35 (Fig. 15).

Washington

Monitoring effort. Washington counted 366 males in 2015, which represented 0.5% of the range-wide total. The number of leks counted that met criteria for inclusion in the trend analysis increased over the assessment period, from 2 in 1965 to a high of 28 in 2013 before declining to 26 in 2014 and 25 in 2015 (Fig. 15).

Lek-count trends. Confidence intervals around average males per lek are very large until lek counting effort increased to over 20 leks in the mid-1990s. Counts in the 1965-1970 interval included average males per lek as high as 36, 38, 40 and 46, (Fig. 15), but these were based on

counts of only 1-7 leks (Fig. 15). Subsequent peak and trough counts ranged between 30-34 and 12-18, respectively through 1991, but counts since then have averaged between 10 and 21 males per lek (Fig. 15).

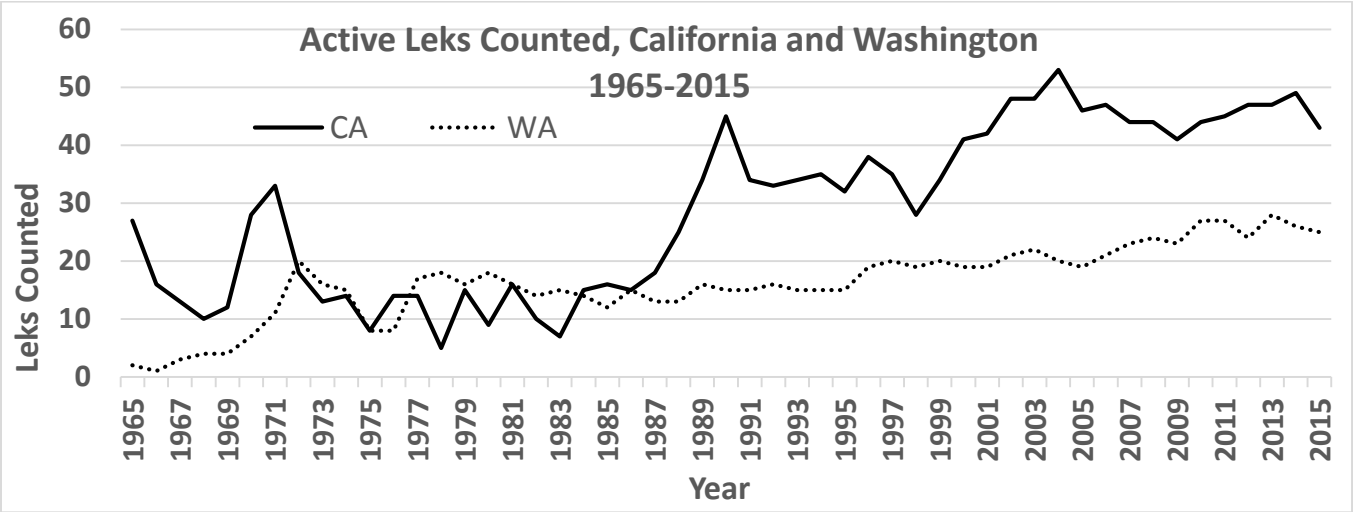
Washington had a declining trend in average males per lek since 1965 of 0.06% per year overall, but a decline of 2.8% per year in peripheral areas (see Management Zone 6, Table 1) based on modeling results (Table 1.)

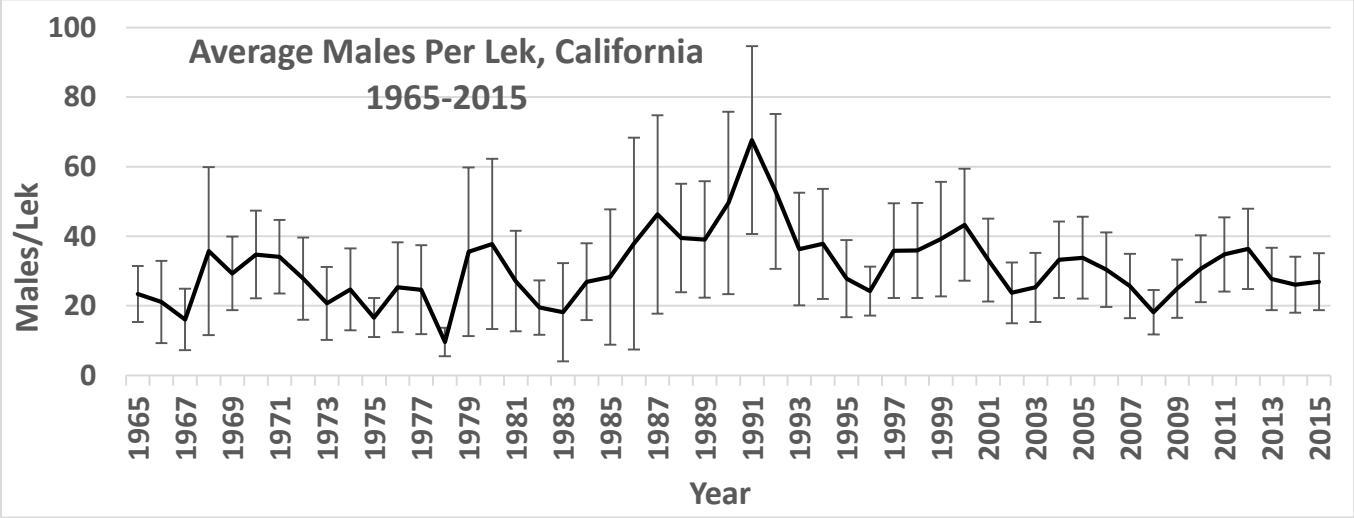
Discussion. While a small population, continuing decreases in peripheral areas within Washington (15 of 46 total leks) could lead to concerns about eventual sage-grouse extirpation in the near future.

South Dakota

Monitoring effort. South Dakota counted 146 males in 2015, or less than 0.2% of the range-wide total. Lek count data was not available from 1965-1970, or for 1972. The number of active leks counted that met criteria for inclusion in the trend analysis increased over the assessment period, from 4 in 1971 to a high of 28 in 2012 (Fig. 16). Active leks counted declined to 21 in 2013 and 2014, and 15 in 2015 (Fig. 16).

Lek-count trends. Confidence intervals around average males/lek were very high in the 1971-1989 interval because of small sample sizes and high variability in lek counts, complicating interpretation of trends (Fig. 16). Average males per lek declined from a high of about 30 in 1971 (average of only 4 leks) to a low of 1.2 males on 5 leks counted in 1988, before rebounding to between 15-21 males per lek in 1989-1994 as the number of leks counted increased (Fig. 16).





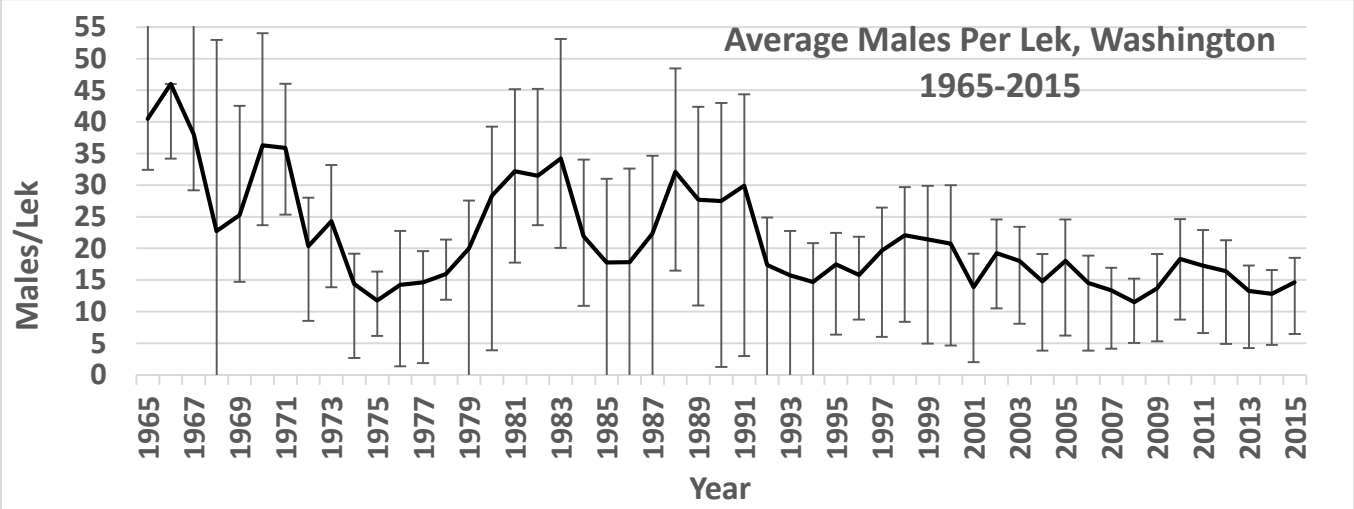


Figure 15. Number of active leks counted from 1965-2015 in California (CA) and Washington (WA) (top), Mean number of males counted per active lek from 1965-2015 in California (middle) and Washington (bottom). Vertical bars represent 95% confidence intervals around the mean.

Average males per lek declined in South Dakota in the mid- to late-1990s to between 5 and 10 males per lek before increasing to about 23 in 2006-2007 (Fig. 16). Average males per lek declined steadily after 2007 to 5.2 in 2014, but increased to 9.7 in 2015 (Fig. 16).

In the trend analysis, the model showed a declining trend in average males per lek of 1.72% per year (90% CRI -1.13 to -2.36, Table 1).

Discussion. South Dakota, at the eastern edge of the range, has seen a decline in the number of active leks, and a decrease since 2006 in the average number of males before increasing last year. With only 15 active leks, average males per lek below 10 in recent years, and a long term declining trend this population must be considered at risk of extirpation.

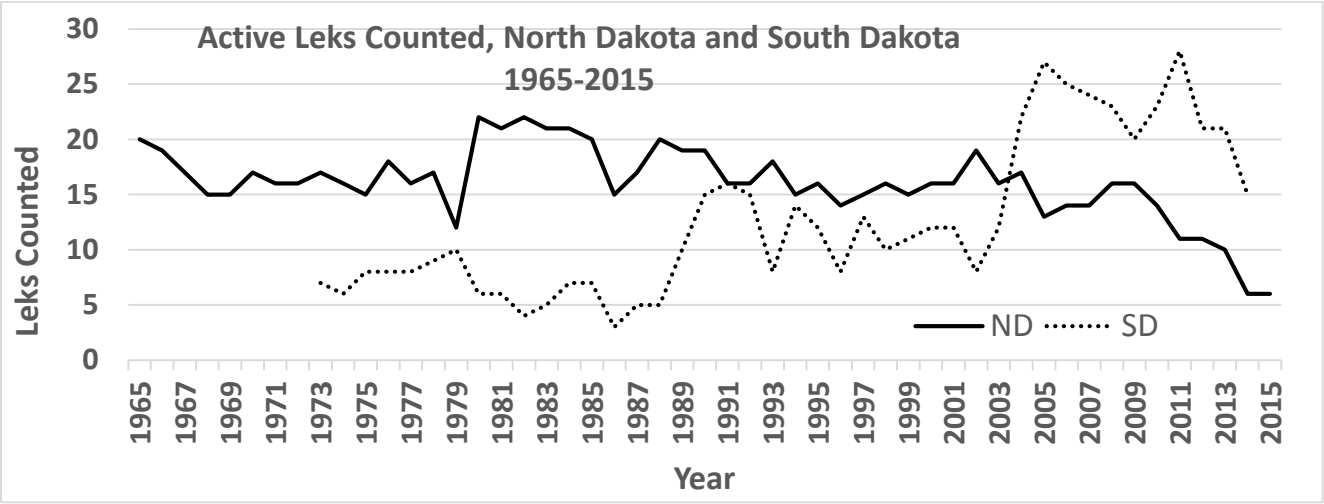
North Dakota

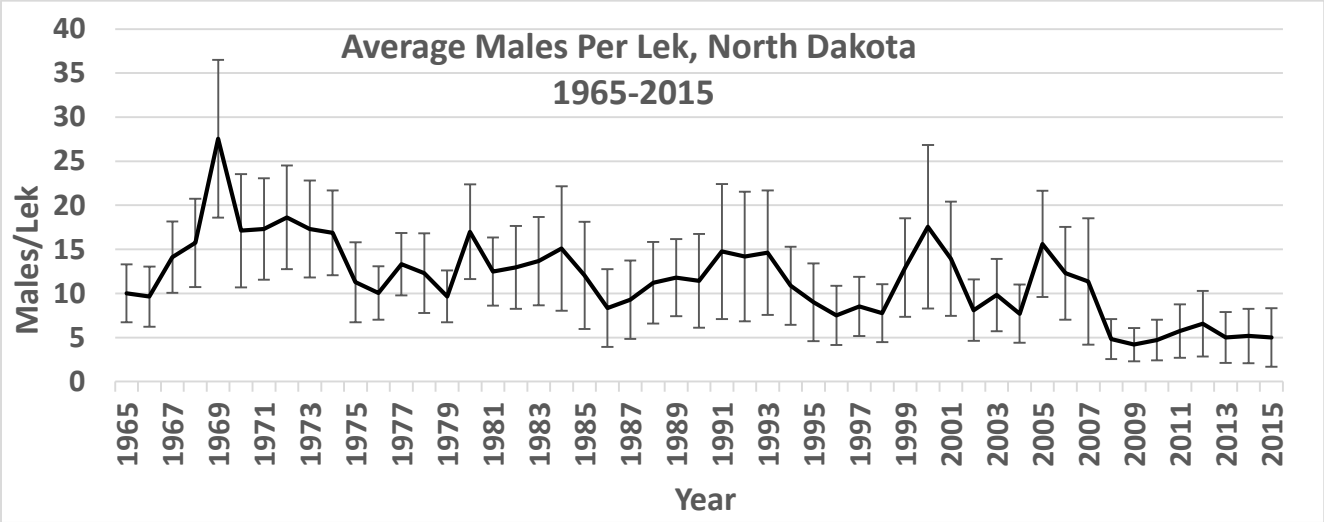
Monitoring effort. North Dakota counted 30 males on 6 active leks in 2015 (<0.1% of range-wide total). The number of active leks counted that met criteria for inclusion in the trend analysis declined significantly over the assessment period, peaking at 22 leks in 1980 and 1982, then declining to a low of 6 leks in 2014 and 2015 (Fig. 16).

Lek-count trends. Confidence intervals around average males per lek are large because of relatively small sample sizes and variable counts. Average males per lek in North Dakota has fluctuated over time at relatively low levels; between about 10 and 20 males per lek from 1965 to 2007, but has ranged from 4 to 6 males per lek since (Fig. 16).

The model for the long term trend analysis (1965-2015) showed a declining trend of 1.21% per year in North Dakota (90% CI: –0.086 to –1.58, Table 1).

Discussion. The number of active leks has declined significantly since 2002, as has average males per lek since 2000. With only 6 active leks averaging 5 males, this population is at a very high risk of extirpation.





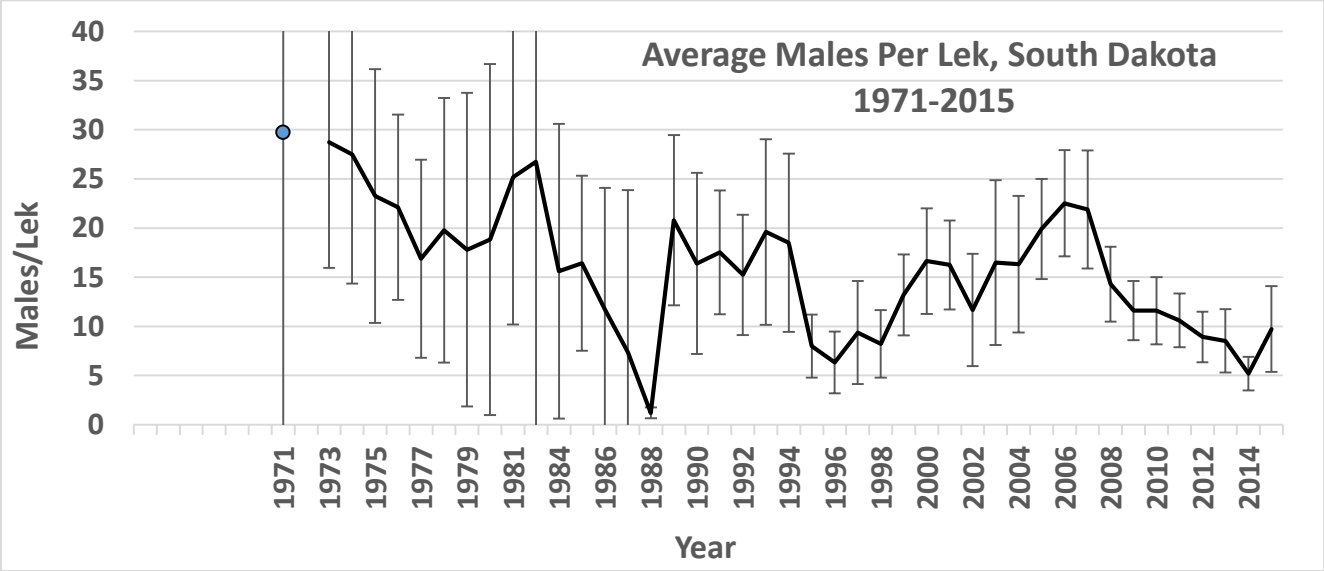


Figure 16. Number of active leks counted from 1965-2015 in North Dakota (ND) and South Dakota (SD) (top), and mean number of males counted per active lek from 1965-2015 in North Dakota (middle) and from 1971-2015 in South Dakota (bottom). Vertical bars represent 95% confidence intervals around the mean.

Appendix I - Limitations of Lek Data and Assumptions

Because sage-grouse gather on traditional display areas (leks) each spring, biologists typically use counts of displaying males as an index to track changes in breeding populations (Connelly et al. 2003). A large number of leks are regularly monitored each year throughout North America, many state databases have >50 years of information, and most states have conducted extensive searches for new leks. All state wildlife agencies monitor sage-grouse breeding populations using data from leks, but methods for gathering these data vary somewhat among agencies and sometimes within agencies among years (Connelly et al. 2004).

Although information on number of females observed during lek counts is often recorded, female attendance is so variable that only male peak counts are used as an index to population trends. Attendance by yearling males is lower than for adult males, and highly variable (Walsh et al. 2004). The implicit assumption is that peak counts of males are representative of trends in the population as a whole, which may not be accurate given that females represent about 60-66% of the population (Guttery et al. 2013, Braun et al. 2015).

For the lek count index to be representative of trends in male populations over time the leks chosen for counting must be representative of the total universe of leks. Ideally, a random sample would be selected for counting from the total population of leks in each state, but many lek locations are not known. The assumption that the size and trends of counted leks is representative of all leks may be reasonable in recent years when 2-3,000 leks have been counted across the range each year, but is highly suspect in the early years of the analysis period when individual states counted a handful of leks. For instance, California counted 10-32 leks until 1989, Colorado counted 20-60 leks until 1977, Idaho counted less than 100 until 1970, Montana counted less than 50 leks until 1972, Nevada counted approximately 50 leks until 1979, Oregon

counted less than 25 until 1988, Washington counted less than 10 leks until 1971. Wyoming, which has counted around 1,000 leks in recent years, counted as few as 24 in 1973 and 36 in 1966, and did not count more than 100 leks until 1978. Lek sizes can vary from as few as 2 males to as many as 300. If larger leks were chosen for sampling in the relatively limited counting done in the earlier years of the analysis period, then the average males per lek would be inflated and a negative bias introduced in trend analysis over time. Smaller leks are also less likely to be detected so that they can be counted. When systematic, area-based sampling was done to search for previously unknown leks in Colorado and Montana, newly discovered leks had significantly fewer males than previously known leks (Lukacs personal communication), which indicates summary statistics like males per lek will decline as lek counting intensity increases independent of other population influences.

Another implicit assumption when inferring population trends from male lek counts is that detectability of males does not change over time. Detectability of males does vary from year to year, because observers change and weather conditions may influence strutting behavior and the ability of observers to get to leks during periods of peak attendance. The proportion of males detected at leks likely also varies as a function of the proportion of yearlings in the male population. Blomberg et al. (2013) evaluated the extent to which variation in annual lek attendance by males influenced estimated population trends, and concluded that such variance made inferences on trends between years unreliable, but longer term (8 years in their study) trend inferences were not affected. Variation in apparent detectability is likely greater in this analysis where most leks were counted 1-4 times per year as opposed to their study where each lek was counted an average of 9 times per year and weather was not mentioned as a factor.

The lek count data contain many missing values (years in which no count was conducted at a given lek). Given limited information available as why a lek was not counted in a particular year and the short time-frame for this analysis, we must assume the data are missing completely at random (Rubin 1976, Gelman et al. 2003). This assumption requires that the probability of all possible patterns of missing data are the same for all values of the missing data and the probability of all possible patterns of observed data are the same for all values of the missing data (Rubin 1976). No missing values were imputed.

One missing value problem should be particularly noted with this data set. Surveying a particular lek typically only occurs after it is found with grouse on it. Therefore, very few leks are included in the data set starting with a zero. As a result, the initial establishment of a lek with a small number of male grouse and its concurrent increase from zero to a positive number of grouse is generally missing from these data. This could lead to negatively biased estimates of trend in male count.

Measurement error is known to exist in the count data. Measurement error arises from several sources including variation in detectability, observer acuity, and number of counts conducted for a given lek in a year. The number of counts within a given year is important because increasing the number of counts within a year increases the chance of getting a higher male count. Therefore, if the number of counts of a lek within a year has increased over time, then the trend could be positively biased.

Appendix II – Methodology used in Modeled Trend Analysis

Trends in the true peak number of males at a lek may vary over time and space. For example, localized areas may support stable greater sage-grouse populations, while a larger geographic extent of sage-grouse may be experiencing population declines or increases. Hierarchical models allow for modeling of trends specific to various geographic extents simultaneously. We developed a hierarchical model that followed individual leks through time and allowed trends at individual leks to inform estimates of trends within individual Management zones and states. This approach reduced the potential bias that could result if larger leks tended to be monitored earlier (e.g., 1965 – 1980; larger lek = more males) and many smaller leks were only recently included in the monitoring efforts. This hierarchical modeling approach included both fixed and random effects and was similar to approaches used to estimated trends in Breeding Bird Survey data (Sauer and Link 2002, 2011; Thogmartin et al. 2004; Nielson et al. 2008) and data from large-scale monitoring efforts like the west-wide golden eagle survey (Millsap et al. 2013, Nielson et al. 2014).

We fit overdispersed Poisson regression models to peak male attendance data for each individual lek, within each management zone and state. Within a Management zone or state (*i*), counts $Y_{i,j,t}$ (*i* for Management zone/state, *j* for lek, and *t* for year) were assumed to be independent Poisson random variables with means $\lambda_{i,j,t}$. The means were log-linear with respect to explanatory variables, i.e.,

$$\ln(\lambda_{i,j,t}) = \mu_i + a_j + (\beta_i + b_j)(t - t^*) + \varepsilon_{i,j,t}. \quad (1)$$

Explanatory variables included in equation (1) include a_j and b_j, a random intercepts and slopes for individual leks, respectively, while parameters μ_i and β_i represent fixed effects for the overall intercept (centered on the median year 1990) and slope for the individual Management zone or state. Additionally, *t* represents year, while t^* represents the baseline year of 1990; the difference $t - t^*$ centered the model at the median year 1990. Finally, $\varepsilon_{i,j,t}$ represents overdispersed error terms specific to the lek, Management zone/state, and year.

We fit the overdispersed Poisson models using Bayesian hierarchical framework and Markov-chain Monte Carlo (MCMC) methods (Gelman et al. 2007, Gelman and Hill 2007). MCMC methods require specification of random effects and priors, respectively. We set μ_i and β_i, to originate from a multivariate normal:

$$\begin{bmatrix}\mu_i \\ \beta_i\end{bmatrix} \sim MVN \begin{bmatrix}\sigma_\mu & \rho\sigma_\mu\sigma_\beta \\ \rho\sigma_\mu\sigma_\beta & \sigma_\beta\end{bmatrix}, \tag{2}$$

with intercept and slope standard-deviation priors, σ_μ and σ_β , respectively, set to a Uniform(0, 100), and their correlation (ρ) prior set to a Uniform(-1, 1). The overdispersed error term ($\varepsilon_{i,j,t}$) was sampled from a mean-zero normal distribution with a tolerance prior of Gamma(0:001, 0:001), where tolerance equaled the 1/variance.

Estimation of grouse count indices ($n_{i,t}$) in the *i*th management zone or state, at time *t*, were calculated using

$$n_{i,t} = e^{\mu_i + \beta_i(t - t^*) + \frac{1}{2}\sigma_\varepsilon^2}, \tag{3}$$

where σ_ε^2 was the variance of the overdispersed error term, μ_i was the overall intercept, and β_i was the overall slope estimated for the *i*th Management zone or state.

The individual Management zone trend parameters, as estimated with the Bayesian hierarchical model described above, describe the average trend effect, on a per-year basis, for the entire fifty-one-year study period. While informative, analysis of data with a cyclical nature benefits from a more nuanced statistic that emphasizes temporally local trends, pertaining to a subset of years, rather than a global trend that encompasses all years. The estimated trend, for Management zone / state *i* across a time period (t_a to t_b; e.g., 1965 – 2015), was calculated as (Sauer and Link 2011)

$$B_i = \frac{n_{i,t_b}}{n_{i,t_a}}^{\frac{1}{t_b - t_a}}. \tag{4}$$

Equation (4) represents a geometric mean of the count indices n_{i,t_a} and n_{i,t_b}, calculated over the difference in the number of years $t_b - t_a$.

Equation (3) allowed for the estimation of counts of peak males over individual Management zones or states for individual years. We estimated range-wide (across Management zones) trends by calculating weighted means of the estimated peak male attendance within each Management zone *i* within year *t* $(n_{i,t})$ using

$$n_t = \frac{\sum_{i=1}^{6} n_{i,t} w_{i,t}}{\sum_{i=1}^{6} w_{i,t}} \quad , \tag{5}$$

where the weights $(w_{i,t})$ were based on the number of leks within each Management zone during year *t*. The estimated range-wide trend between years t_a to t_b was calculated using

$$B = \frac{n_{t_b}}{n_{t_a}}^{\frac{1}{t_b - t_a}} \quad , \tag{6}$$

which is similar to equation (4).

Estimation of posterior distributions via the MCMC methodology utilized WinBUGS (Kéry 2010) for all models. We used a burn-in of 76,000 initial samples, after which another 4,000 samples formed the simulation sample from which posterior distributions were obtained. We did not thin (i.e., discard) any of the 4,000 follow-up samples; in this way, all replicates following burn-in contributed to estimation of posterior distributions. Ninety percent credible intervals (CRIs) – essentially the Bayesian form of a confidence interval – were calculated for all estimates of trend. If a 90% CRI included 0.0, then we concluded there was no evidence of trend in the data.

Finally, we investigated how analysis of data from different time periods could effect estimates of trends using the results from Bayesian hierarchical model (equation [1]) and equation (6) to estimate all possible 10-year trends (e.g., 1965 – 1975, 1966 – 1976, …, 2005 – 2015) for the core areas, periphery, and the combined areas data across the entire range of greater sage-grouse.

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From: Cybele Knowles
To: FGC
Subject: End Sage Grouse Hunting in California
Date: Tuesday, August 02, 2016 12:18:34 PM

I am writing to urge you to use your upcoming vote to end sage grouse hunting in California. In light of recent data showing startling and continuing declines for this species in all four management zones from 2012-2016, the commission should be taking steps to protect sage grouse, not allowing more to be killed. Please -- reject the proposal to allow a range of hunting permits for up to 100 grouse per zone and instead choose zero. There must be no sage grouse hunting in California during the 2016-2017 season for the sake of these rare and beautiful birds.

Sincerely,

Cybele Knowles
[redacted]

CALIFORNIA FISH AND GAME COMMISSION
DECISION LIST FOR REGULATORY ACTION THROUGH JUN 23, 2016
Revised 08-10-2016

FGC - California Fish and Game Commission **DFW** - California Department of Fish and Wildlife **WRC** - Wildlife Resources Committee **MRC** - Marine Resources Committee

Grant: FGC is *willing to consider* the petition through a process **Deny:** FGC is *not willing to consider* the petition **Refer:** FGC *needs more information* before deciding whether to grant or deny the petition

Green cells: Referrals to DFW for more information
Lavender cells: Accepted and moved to a rulemaking
Blue cells: Referrals to FGC staff or committee for more information
Yellow cells: Current action items

Tracking No.	Date Received	Response Due (10 work days)	Response letter to Petitioner	Accept or Reject	Name of Petitioner	Subject of Request	Code or Title 14 Section Number	Short Description	Staff Recommendation	FGC Decision
2016-006	4/18/2016	5/1/2016	5/31/2016	A	Dennis Haussler	Fresh water spearfishing	200, 202, 205, 210	Amend fresh water spearfishing regulations to be same as fresh water bow and arrow regulations.	GRANT; refer to 2017 sport fishing rulemaking for 2018 season.	RECEIPT: 6/22-23/2016 **ACTION: Scheduled 8/24-25/16**
2016-007	4/29/2016	5/13/2016	5/31/2016	A	Michael Newdow	Display of personally-collected fish	200, 202, 205 and 210	Permit take of fish for display in personal fish tanks.	DENY; FGC does not support take or possession of wildlife as domesticated pets.	RECEIPT: 6/22-23/2016 **ACTION: Scheduled 8/24-25/16**
2016-008	5/26/2016	6/10/2016	5/31/2016	A	Pat Wright	Domestic ferrets	2118	Remove domestic ferrets from the list of prohibited species.	DENY; FGC previously directed that any new petitioner would need to fund the preparation of an environmental document before any consideration (See www.dfg.ca.gov/wildlife/nongame/nuis_exo/ferret/).	RECEIPT: 6/22-23/2016 **ACTION: Scheduled 8/24-25/16**
2016-010	6/8/2016	6/22/2016	6/14/2016	A	J.D. Mostoufi	Sage grouse permits	311	Proposes sage grouse permit holders be awarded a preference point similar to big game drawings.	REFER to DFW for evaluation and recommendation.	RECEIPT: 6/22-23/2016 **ACTION: Scheduled 8/24-25/16**
2016-011	6/10/2016	6/24/2016	6/14/2016	A	Paul Weiland	Black bass and striped bass	1.05	Increase the size and bag limits for black bass and striped bass in Sacramento-San Joaquin Delta and rivers tributary to the Delta.	DENY; scientific study and evaluation is underway to inform DFW recommendation and future action by FGC.	RECEIPT: 6/22-23/2016 **ACTION: Scheduled 8/24-25/16**
2016-012	6/17/2016	7/1/20116	6/28/2016	A	Troy Morris	Falconry	670	Repeal provisions of the falconry regulations concerning DFW ability to conduct unannounced inspection visits.	DENY; provisions are proposed to be amended rather than removed under falconry rulemaking scheduled for notice at August 2016 meeting.	RECEIPT: 6/22-23/2016 **ACTION: Scheduled 8/24-25/16**

2016-006
Tracking Number: (Freshwater spearfishing change)

To request a change to regulations under the authority of the California Fish and Game Commission (Commission), you are required to submit this completed form to: California Fish and Game Commission, 1416 Ninth Street, Suite 1320, Sacramento, CA 95814 or via email to FGC@fgc.ca.gov. Note: This form is not intended for listing petitions for threatened or endangered species (see Section 670.1 of Title 14).

Incomplete forms will not be accepted. A petition is incomplete if it is not submitted on this form or fails to contain necessary information in each of the required categories listed on this form (Section I). A petition will be rejected if it does not pertain to issues under the Commission's authority. A petition may be denied if any petition requesting a functionally equivalent regulation change was considered within the previous 12 months and no information or data is being submitted beyond what was previously submitted. If you need help with this form, please contact Commission staff at (916) 653-4899 or FGC@fgc.ca.gov.

SECTION I: Required Information.

Please be succinct. Responses for Section I should not exceed five pages

1. **Person or organization requesting the change (Required)**
   Name of primary contact person: Dennis Haussler
   Address: [redacted]
   Telephon
   Email ad

2. **Rulemaking Authority (Required)** - Reference to the statutory or constitutional authority of the Commission to take the action requested: Fish and Game code, sections 200, 202, 205, 210.

3. **Overview (Required)** - Summarize the proposed changes to regulations: Make the freshwater spearfishing regs the same as freshwater bow and arrow regs.

4. **Rationale (Required)** - Describe the problem and the reason for the proposed change: Bow and arrow is allowed all year, and any waters with the exception of designated salmon spawning areas. Freshwater spearfishing is allowed may 1 thru sept 15, valley district only, excepting designated salmon spawning areas. There are a lot of lakes and rivers where we could be hunting invasive species such as suckers, squawfish, carp, if we were allowed the same regs as bow and arrow. We have the ability to take some of the predacious fish out of the systems where they feed on trout, salmon and steelhead. Allowing this opportunity will also decrease the pressure on the saltwater fish, as divers from the valley will use this as an opportunity to hunt without having to travel 5 hrs or more to spear. We also have the opportunity to contribute the take to organic farms to use in composting.

SECTION II: Optional Information

5. **Date of Petition: 4/15/16**

6. **Category of Proposed Change**
   ☒ Sport Fishing

☐ Commercial Fishing
☐ Hunting
☐ Other, please specify: Click here to enter text.

7. **The proposal is to:** (*To determine section number(s), see current year regulation booklet or https://govt.westlaw.com/calregs*)
☒ Amend Title 14 Section(s):2.30
☐ Add New Title 14 Section(s): Click here to enter text.
☐ Repeal Title 14 Section(s): Click here to enter text.

8. **If the proposal is related to a previously submitted petition that was rejected, specify the tracking number of the previously submitted petition** Click here to enter text.
Or ☒ Not applicable.

9. **Effective date**: If applicable, identify the desired effective date of the regulation.
If the proposed change requires immediate implementation, explain the nature of the emergency: 2017

10. **Supporting documentation:** Identify and attach to the petition any information supporting the proposal including data, reports and other documents: Click here to enter text.

11. **Economic or Fiscal Impacts:** Identify any known impacts of the proposed regulation change on revenues to the California Department of Fish and Wildlife, individuals, businesses, jobs, other state agencies, local agencies, schools, or housing: none

12. **Forms:** If applicable, list any forms to be created, amended or repealed:
Click here to enter text.

SECTION 3: FGC Staff Only

Date received: Click here to enter text.

FGC staff action:
☒ Accept - complete
☐ Reject - incomplete
☐ Reject - outside scope of FGC authority

Tracking Number

Date petitioner was notified of receipt of petition and pending action: May 31, 2016

Meeting date for FGC consideration: June 22-23, 2016

FGC action:
☐ Denied by FGC
☐ Denied - same as petition _____
Tracking Number
☐ Granted for consideration of regulation change

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COMMISSION
2016 MAY 31 AM 8:2

2016-007

Tracking Number: (~~Aurora 2016-04-29~~)

To request a change to regulations under the authority of the California Fish and Game Commission (Commission), you are required to submit this completed form to: California Fish and Game Commission, 1416 Ninth Street, Suite 1320, Sacramento, CA 95814 or via email to FGC@fgc.ca.gov. Note: This form is not intended for listing petitions for threatened or endangered species (see Section 670.1 of Title 14).

Incomplete forms will not be accepted. A petition is incomplete if it is not submitted on this form or fails to contain necessary information in each of the required categories listed on this form (Section I). A petition will be rejected if it does not pertain to issues under the Commission's authority. A petition may be denied if any petition requesting a functionally equivalent regulation change was considered within the previous 12 months and no information or data is being submitted beyond what was previously submitted. If you need help with this form, please contact Commission staff at (916) 653-4899 or FGC@fgc.ca.gov.

SECTION I: Required Information.

Please be succinct. Responses for Section I should not exceed five pages

1. **Person or organization requesting the change (Required)**
   Name of primary contact person: Michael Newdow
   Address: [redacted]
   Telephon[redacted]
   Email ad[redacted]

2. **Rulemaking Authority (Required) -** Reference to the statutory or constitutional authority of the Commission to take the action requested: Sections 200, 202, 205 and 210 of the Fish and Game Code.

3. **Overview (Required) -** Summarize the proposed changes to regulations: I would like the public to be permitted to place the fish they lawfully catch into fish tanks for viewing.

4. **Rationale (Required) -** Describe the problem and the reason for the proposed change: The placement of fish in fish tanks (aquaria) is a practice that has been in existence for at least 2,000 years. Being able to view fish provides pleasure, education and an appreciation of nature for millions. It is the reason we have such facilities as the Monterey Bay Aquarium, the Aquarium of the Bay in San Francisco, the Aquarium of the Pacific in Long Beach, and myriad others, not only in California and the entire United States, but throughout the world. In addition to these large municipal institutions, countless individuals are hobbyists who spend extraordinary amounts of time, money and energy in maintaining aquaria. As you likely are aware, there is even a renowned television program, *Tanked*, solely on this activity. Following responsible practices, observing nature's work in a fish tank is a marvelous way to appreciate our environment and educate ourselves as we directly view the beauty of those creatures that live in our lakes, streams and oceans. California actively supports this practice, licensing tropical fish stores, etc., for its citizens to participate in tank-related activities. Unfortunately, through some bizarre logic, it limits the involvement of those who catch fish in its lakes. Fishermen who catch fish can eat those fish, dissect those fish, feed them to their pets, or do just about anything else they wish ... except put those fish into an aquarium so as to relish their magnificence and get a close-up view of their behaviors. Of course, they can go to a local supplier and purchase fish – even

of the same species – to place in their aquaria. But to view the fish one has herself caught, and to get a specimen far more valuable in terms of size as well as personal connection, is prohibited. This is the case even though – as just noted – that same individual can take the fish out of the lake and kill it. Such a regulation seems utterly inane. Undoubtedly there are some valid reasons for regulating the practice, and no one is objecting to reasonable regulations. Thus, prohibiting the introduction of a fish into another body of water, or somehow placing the same lake or stream at risk of the spread of disease, etc. should certainly be regulated. But having a blanket prohibition against taking a fish and placing it in an aquarium simply makes no sense.

SECTION II: Optional Information

5. Date of Petition: April 29, 2016

6. Category of Proposed Change

☒ Sport Fishing
☐ Commercial Fishing
☐ Hunting
☐ Other, please specify: Click here to enter text.

7. The proposal is to: (*To determine section number(s), see current year regulation booklet or https://govt.westlaw.com/calregs*)

☐ Amend Title 14 Section(s):Section 1.63
☐ Add New Title 14 Section(s): Click here to enter text.
☐ Repeal Title 14 Section(s): Click here to enter text.

8. If the proposal is related to a previously submitted petition that was rejected, specify the tracking number of the previously submitted petition Click here to enter text.
Or ☒ Not applicable.

9. Effective date: If applicable, identify the desired effective date of the regulation.
If the proposed change requires immediate implementation, explain the nature of the emergency: Desired date: May 1, 2016. There is no emergency, except that the regulations are currently hindering the enjoyment of the State's residents and visitors with no apparent good reason.

10. Supporting documentation: Identify and attach to the petition any information supporting the proposal including data, reports and other documents: Common sense.

11. Economic or Fiscal Impacts: Identify any known impacts of the proposed regulation change on revenues to the California Department of Fish and Wildlife, individuals, businesses, jobs, other state agencies, local agencies, schools, or housing: No significant impact. We are talking about taking fish for which people already have licenses.

12. Forms: If applicable, list any forms to be created, amended or repealed:

Click here to enter text.

SECTION 3: FGC Staff Only

RECEIVED
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COMMISSION
2016 APR 29 PM 2:06

Date received: Click here to enter text.

FGC staff action:

- ☐ Accept - complete
- ☐ Reject - incomplete
- ☐ Reject - outside scope of FGC authority

Tracking Number

Date petitioner was notified of receipt of petition and pending action: May 31, 2016

Meeting date for FGC consideration: June 22-23, 2016

FGC action:

- ☐ Denied by FGC
- ☐ Denied - same as petition _____
  Tracking Number
- ☐ Granted for consideration of regulation change

Tracking Number: (2016-008)

To request a change to regulations under the authority of the California Fish and Game Commission (Commission), you are required to submit this completed form to: California Fish and Game Commission, 1416 Ninth Street, Suite 1320, Sacramento, CA 95814 or via email to FGC@fgc.ca.gov. Note: This form is not intended for listing petitions for threatened or endangered species (see Section 670.1 of Title 14).

Incomplete forms will not be accepted. A petition is incomplete if it is not submitted on this form or fails to contain necessary information in each of the required categories listed on this form (Section I). A petition will be rejected if it does not pertain to issues under the Commission's authority. A petition may be denied if any petition requesting a functionally equivalent regulation change was considered within the previous 12 months and no information or data is being submitted beyond what was previously submitted. If you need help with this form, please contact Commission staff at (916) 653-4899 or FGC@fgc.ca.gov.

SECTION I: Required Information.

Please be succinct. Responses for Section I should not exceed five pages

1. **Person or organization requesting the change (Required)**
   Name of primary contact person: Pat Wright
   Address: [redacted]
   Telephon[redacted]
   Email ad[redacted]

2. **Rulemaking Authority (Required) -** Reference to the statutory or constitutional authority of the Commission to take the action requested: Fish and Game Code 2118

3. **Overview (Required) -** Summarize the proposed changes to regulations: Remove domestic ferrets from the list of prohibited wildlife

4. **Rationale (Required) -** Describe the problem and the reason for the proposed change: Domestic ferrets are legal in 48 states and the Fish and Game Commission has never been able to document any harm that ferrets have done elsewhere, or even the large number of illegal ferrets already in California has done. Previous requests on my part have resulted in "we don't have time for this" from Commissioners. .

SECTION II: Optional Information

5. **Date of Petition: 05-26-2016**

6. **Category of Proposed Change**
   ☐ Sport Fishing
   ☐ Commercial Fishing
   ☐ Hunting
   ☒ Other, please specify: Fish and Game Code 2118

7. **The proposal is to:** (*To determine section number(s), see current year regulation booklet or https://govt.westlaw.com/calregs*)
☒ Amend Title 14 Section(s):§ 671. Importation, Transportation and Possession of Live Restricted Animals. (2) Class Mammalia-Mammals (K) Order Carnivora-Raccoons, Ringtailed Cats, Kinkajous, Coatis, Cacomistles, Weasels, Ferrets, Skunks, Polecats, Stoats, Mongoose, Civets, Wolves, Foxes, Coyotes, Lions, Tigers, Ocelots, Bobcats, Servals, Leopards, Jaguars, Cheetahs, Bears, etc.
☐ Add New Title 14 Section(s): Click here to enter text.
☐ Repeal Title 14 Section(s): Click here to enter text.

8. **If the proposal is related to a previously submitted petition that was rejected, specify the tracking number of the previously submitted petition** Click here to enter text.
Or ☒ Not applicable.

9. **Effective date**: If applicable, identify the desired effective date of the regulation.
If the proposed change requires immediate implementation, explain the nature of the emergency: Click here to enter text.

10. **Supporting documentation:** Identify and attach to the petition any information supporting the proposal including data, reports and other documents: **ANALYSIS OF THE POTENTIAL IMPACTS OF DOMESTICATED FERRETS UPON WILDLIFE, AGRICULTURE, AND HUMAN HEALTH IN NORTH AMERICA, WITH A FOCUS UPON CALIFORNIA, BASED UPON LITERATURE REVIEW AND SURVEY OF NORTH AMERICAN GOVERNMENTAL AGENCIES and jCEQA Environmental Checklist**

11. **Economic or Fiscal Impacts:** Identify any known impacts of the proposed regulation change on revenues to the California Department of Fish and Wildlife, individuals, businesses, jobs, other state agencies, local agencies, schools, or housing: Increased economic activity for the pet trade, decrease in Fish and Wildlife enforcement expenses.

12. **Forms:** If applicable, list any forms to be created, amended or repealed:
Click here to enter text.

SECTION 3: FGC Staff Only

Date received: May 26, 2016

FGC staff action:
☒ Accept - complete
☐ Reject - incomplete
☐ Reject - outside scope of FGC authority

Tracking Number

Date petitioner was notified of receipt of petition and pending action: May 31, 2016

Meeting date for FGC consideration: June 22-23, 2016

FGC action:

- ☐ Denied by FGC
- ☐ Denied - same as petition _____
  Tracking Number
- ☐ Granted for consideration of regulation change

2016-010

Tracking Number: (Click here to enter text.)

To request a change to regulations under the authority of the California Fish and Game Commission (Commission), you are required to submit this completed form to: California Fish and Game Commission, 1416 Ninth Street, Suite 1320, Sacramento, CA 95814 or via email to FGC@fgc.ca.gov. Note: This form is not intended for listing petitions for threatened or endangered species (see Section 670.1 of Title 14).

Incomplete forms will not be accepted. A petition is incomplete if it is not submitted on this form or fails to contain necessary information in each of the required categories listed on this form (Section I). A petition will be rejected if it does not pertain to issues under the Commission's authority. A petition may be denied if any petition requesting a functionally equivalent regulation change was considered within the previous 12 months and no information or data is being submitted beyond what was previously submitted. If you need help with this form, please contact Commission staff at (916) 653-4899 or FGC@fgc.ca.gov.

SECTION I: Required Information.

Please be succinct. Responses for Section I should not exceed five pages

1. **Person or organization requesting the change (Required)**
   Name of primary contact person: J.D. Mostoufi
   Address: [redacted]
   Telephon[redacted]
   Email ad[redacted]

2. **Rulemaking Authority (Required) -** Reference to the statutory or constitutional authority of the Commission to take the action requested: Fish and Game code sections 200, 202, 203, 355

3. **Overview (Required) -** Summarize the proposed changes to regulations: I propose that hunters who apply for a sage grouse permit and are unsuccessful in the drawing be awarded a preference point similar to the CDFW Big Game Drawing, so that unsuccessful hunters will receive preference in future years over hunters who have recently drawn a sage grouse permits.

4. **Rationale (Required) -** Describe the problem and the reason for the proposed change: Currently, sage grouse permits are given away in a random fashion. If approximately 350 hunters put in for 30 sage grouse permits in the North Mono Zone, the odds of drawing a permit would be 1 in 11.67. If the CDFW switched over to a draw system similar to the big game drawing system, then hunters who have been unsuccessful in the sage grouse permit draw over the years would build up preference points which would help the unsuccessful hunter have a better chance at drawing a permit in future years. This system would be fair and equitable to all and it would not be difficult to accomplish, as hunters in California are already using this system to be awarded big game tags. Additionally, hunters are already using the Online Licensing system to apply for sage grouse permits; the change would only be to give unsuccessful applicants a better chance in the future to draw a permit. If approximately 350 hunters applied every year for sage grouse permits, then within 10-11 years, most if not all the applicants would have a chance to draw a sage grouse permit.

SECTION II: Optional Information

5. Date of Petition: June 6, 2016

6. Category of Proposed Change

☐ Sport Fishing
☐ Commercial Fishing
☒ Hunting
☐ Other, please specify: Click here to enter text.

7. The proposal is to: (*To determine section number(s), see current year regulation booklet or https://govt.westlaw.com/calregs*)

☒ Amend Title 14 Section(s):Amend Title 14, FGC section 300
☐ Add New Title 14 Section(s): Click here to enter text.
☐ Repeal Title 14 Section(s): Click here to enter text.

8. If the proposal is related to a previously submitted petition that was rejected, specify the tracking number of the previously submitted petition Click here to enter text.
Or ☒ Not applicable.

9. Effective date: If applicable, identify the desired effective date of the regulation.
If the proposed change requires immediate implementation, explain the nature of the emergency: I recommend that the desired changes be implemented immediately, as there is a meeting of the FGC on June 22,23 2016 and the next drawing period for sage grouse hunts in California would be in August 2016. The drawing could be accomplished without problem this year, as the preference points would not come into play in the drawing until August 2017, which would allow one year to make changes to track and implement a preference point system for sage grouse permits.

10. Supporting documentation: Identify and attach to the petition any information supporting the proposal including data, reports and other documents: Click here to enter text.

11. Economic or Fiscal Impacts: Identify any known impacts of the proposed regulation change on revenues to the California Department of Fish and Wildlife, individuals, businesses, jobs, other state agencies, local agencies, schools, or housing: I do not foresee any economic impacts caused by the proposed change as it has no bearing on the number of permits that are issued or areas were sage grouse hunting is allowed.

12. Forms: If applicable, list any forms to be created, amended or repealed:

Click here to enter text.

SECTION 3: FGC Staff Only

Date received: Click here to enter text.

FGC staff action:

☒ Accept - complete
☐ Reject - incomplete

☐ Reject - outside scope of FGC authority

Tracking Number

Date petitioner was notified of receipt of petition and pending action: June 14, 2016

Meeting date for FGC consideration: June 22-23, 2016

FGC action:

☐ Denied by FGC

☐ Denied - same as petition _____

Tracking Number

☐ Granted for consideration of regulation change

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COMMISSION
2016 JUN -8 PM 1:55

2016-011
Tracking Number: (Click here to enter text.)

To request a change to regulations under the authority of the California Fish and Game Commission (Commission), you are required to submit this completed form to: California Fish and Game Commission, 1416 Ninth Street, Suite 1320, Sacramento, CA 95814 or via email to FGC@fgc.ca.gov. Note: This form is not intended for listing petitions for threatened or endangered species (see Section 670.1 of Title 14).

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SECTION I: Required Information.

Please be succinct. Responses for Section I should not exceed five pages

1. **Person or organization requesting the change (Required)**
   Name of primary contact person: Coalition for a Sustainable Delta, California Chamber of Commerce, California Farm Bureau Federation, Kern County Water Agency, Metropolitan Water District of Southern California, Northern California Water Association, San Joaquin Tributaries Authority, Southern California Water Committee, State Water Contractors, Western Growers
   Address: [redacted]
   Telephone number: [redacted]
   Email address: [redacted]

2. **Rulemaking Authority (Required) -** Reference to the statutory or constitutional authority of the Commission to take the action requested: Fish and Game Code sections 200, 202, 205, and 220.

3. **Overview (Required) -** Summarize the proposed changes to regulations: The proposed changes would increase the size and bag limits for black bass and striped bass in the Sacramento-San Joaquin Delta and rivers tributary to the Delta. In section 5.00(a)(1), with respect to black bass, the size limit would be decreased from 12 inches to 8 inches and the daily bag limit would be increased from 5 fish to 10 fish. In section 5.75, with respect to striped bass, the bag limit in subsection (b) would be increased from 2 fish to 6 fish and the size limit in subsection (c) would be decreased from 18 inches to 12 inches.

4. **Rationale (Required) -** Describe the problem and the reason for the proposed change: The purpose of the proposed changes is to reduce predation by non-native black bass and striped bass on fish that are native to the Sacramento-San Joaquin Delta and listed as threatened or endangered under the federal or California Endangered Species Act. The fact that predation is a major source of mortality of listed fish including Central Valley spring-run Chinook salmon, Central Valley steelhead, Delta smelt, and Sacramento River winter-run Chinook salmon is well documented. For example, in a 2011 report to this Commission, the then Department of Fish and Game concluded "studies of striped bass feeding habits indicate they consume an enormous volume of fish, overlap in their geographic range with the listed species, and have historically consumed listed species, at times in very substantial quantities." [5]

More recently, in its 2014 Recovery Plan for Central Valley Salmonids, the National Marine Fisheries Service ranked predation in the highest stressor category in its threat assessments for Central Valley spring-run Chinook salmon, Central Valley steelhead, and Sacramento River winter-run Chinook salmon. [7]

These reports from the state and federal agencies entrusted to manage fish populations within California are reinforced by outside experts. For example, in a 2008 report on the Central Valley Project Improvement Act fisheries program, a blue-ribbon panel of scientists characterized predation as a "key limiting factor" on Central Valley salmonids and concluded that predation reduction efforts are among those actions that have the "greatest ability to improve anadromous fish populations in the near term." [3] Furthermore, the populations of a number of these fish are at or near historic lows. For example, the four major indices of Delta smelt abundance – the spring Kodiak trawl, the 20mm survey, the summer townet survey, and fall midwater trawl – all indicate the species is at the lowest point on record. The population of winter-run Chinook salmon is also severely depressed, which led this Commission at its February 2016 meeting at the urging of the Department of Fish and Wildlife to close a reach of the Sacramento River downstream of Keswick dam to recreational fishing.

There is ample precedent for regulatory action to address impacts of predators on native fish. For example, in the Columbia River system, resource managers have taken steps to control predation by birds, marine mammals, and fish on salmonids. [1] There, the effort to address northern pikeminnow predation on young salmon was initiated in 1990 and is credited with reducing predation on outmigrants by more than 35 percent. [1] Washington also has removed size and bag limits on warm-water fishes above the McNary Dam on the Columbia River to reduce predation on native fish. [12] Utah has mandated that on Green River tributaries anglers harvest four nonnative predators – burbot, northern Pike, smallmouth bass, and walleye – in order to protect native species including the endangered Bonytail chub, Colorado pikeminnow, razorback sucker and humpback chub. [11] Similarly, in its 2016 sport fishing regulations, Oregon removed bag limits for warm-water fish in the Columbia River and for smallmouth bass in the John Day and Umpqua Rivers to reduce predation on salmonids. [8,9]

The regulatory change sought will advance the co-equal goals (Cal. Water Code, § 85054) of providing a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem, because the change will reduce the adverse effects of predation by non-native fish on fish species that are native to the Delta ecosystem and in danger of extinction or likely to become in danger of extinction in the foreseeable future. By contributing to the conservation of native species, the regulatory change will allow for more water management flexibility and reduce the need to address this significant stressor on native species through other actions, including imposition of limits on water supplies. This regulatory change will also help realize the full benefits of various upstream actions that have and will continue to be taken to help recover native salmon and steelhead species.

We encourage the Commission to work in cooperation with the Department to implement this regulatory change in a manner that allows for adaptation in response to information regarding the effects of the change on both predator and prey populations. This can occur consistent with the Commission's past practices, which provide for annual review of and adjustment to sport fishing regulations and, in unusual circumstances, in-season changes to such regulations where warranted. An adaptive approach to implementation of regulatory changes is based on the acknowledgement that any regulatory rule-set implemented in a complex ecosystem may have unanticipated effects. While active adaptive management is not feasible in this circumstance, data collection, analysis, and learning is both feasible and necessary in order to achieve sensible resource management.

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2016 JUN 10 AM 8: 28

SECTION II: Optional Information

5. **Date of Petition:** Click here to enter text.

6. **Category of Proposed Change**
   ☒ Sport Fishing
   ☐ Commercial Fishing
   ☐ Hunting
   ☐ Other, please specify: Click here to enter text.

7. **The proposal is to:** (*To determine section number(s), see current year regulation booklet or https://govt.westlaw.com/calregs*)
   ☒ Amend Title 14 Section(s):5.0, 5.75
   ☐ Add New Title 14 Section(s): Click here to enter text.
   ☐ Repeal Title 14 Section(s): Click here to enter text.

8. **If the proposal is related to a previously submitted petition that was rejected, specify the tracking number of the previously submitted petition** Click here to enter text.
   Or ☒ Not applicable.

9. **Effective date**: If applicable, identify the desired effective date of the regulation.
   If the proposed change requires immediate implementation, explain the nature of the emergency: Immediately upon approval by the Commission consistent with legal requirements.

10. **Supporting documentation:** Identify and attach to the petition any information supporting the proposal including data, reports and other documents:
    1. Bonneville Power Administration, Predator Control Helps Salmon (available at http://www.salmonrecovery.gov/Files/Fact%20sheets/Predator%20control%20-%20Sept%202010.pdf).
    2. California Department of Fish and Wildlife, Delta Science Program, National Marine Fisheries Service, Annotated Bibliography, Predation Workshop July 22-23, 2013.
    3. Cummins, Ken et al., Listen to the River: An Independent Review of the CVPIA Fisheries Program, December 2008.
    4. Department of Fish and Game, Striped Bass Sport Fishing Regulation Amendment Proposal, dated Dec. 5, 2011.
    5. Department of Fish and Game, Report and Recommendation to the Fish and Game Commission in Support of a Proposal to Revise Sportfishing Regulations for Striped Bass, dated Dec. 2011.
    6. Grossman, Gary et al., Effects of Fish Predation on Salmonids in the Sacramento River – San Joaquin Delta and Associated Ecosystems, dated Sept. 25, 2013.
    7. National Marine Fisheries Service, Recovery Plan for Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead, dated July 2014.
    8. Oregon Fish and Game Commission, Oregon Sport Fishing Regulations 2016 (http://www.eregulations.com/oregon/fishing/pageFlip/).
    9. Oregon Fish and Game Commission, September 3-4, 2015 Commission Agenda, Exhibit B, Attachment 1 (available at http://www.dfw.state.or.us/agency/commission/minutes/15/09_september/Exhibit_B_Attachment_1_Ag

enda_Item_Summary.pdf).
10. U.S. House of Representatives, Committee on Natural Resources, Subcommittee on Water, Power, and Oceans, Hearing Memo re Oversight Hearing on "The Costly Impacts of Predation and Conflicting Federal Statutes on Native and Endangered Fish Species," dated Feb. 8, 2016.
11. Utah Fishing Guidebook 2015 (available at http://wildlife.utah.gov/guidebooks/2015_pdfs/2015_fishing_low.pdf).
12. Washington Sport Fishing Rules 2015-16 (available at http://wdfw.wa.gov/publications/01726/wdfw01726.pdf).

11. Economic or Fiscal Impacts: Identify any known impacts of the proposed regulation change on revenues to the California Department of Fish and Wildlife, individuals, businesses, jobs, other state agencies, local agencies, schools, or housing: The proposed change in regulation is likely to have positive short-term impacts on a very narrow segment of the State's economy by contributing to an increase in sport fishing, which may be expected to increase license revenue to the Department of Fish and Wildlife as well as the revenues of certain businesses that support recreational fishing. In addition, the proposed change in regulation is likely to have on-going and increasing positive impacts on a broad base of the State's economy by contributing to the conservation of populations of multiple native fish species, which will both allow regulators to reduce limits on commercial harvest of Chinook salmon (benefitting the industry that relies on such harvest) and also lead to increased operational flexibility of the Central Valley Project and State Water Project that provide water for tens of millions of agricultural, industrial, and municipal water users across the State, fueling the economy.

12. Forms: If applicable, list any forms to be created, amended or repealed:

Click here to enter text.

SECTION 3: FGC Staff Only

Date received: Click here to enter text.

FGC staff action:

- ☒ Accept - complete
- ☐ Reject - incomplete
- ☐ Reject - outside scope of FGC authority

Date petitioner was notified of receipt of petition and pending action: June 14, 2016
Tracking Number

Meeting date for FGC consideration: June 22-23, 2016

FGC action:

- ☐ Denied by FGC
- ☐ Denied - same as petition _____
  Tracking Number
- ☐ Granted for consideration of regulation change

Tracking Number: 2016-012 (Click here to enter text.)

To request a change to regulations under the authority of the California Fish and Game Commission (Commission), you are required to submit this completed form to: California Fish and Game Commission, 1416 Ninth Street, Suite 1320, Sacramento, CA 95814 or via email to FGC@fgc.ca.gov. Note: This form is not intended for listing petitions for threatened or endangered species (see Section 670.1 of Title 14).

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SECTION I: Required Information.

Please be succinct. Responses for Section I should not exceed five pages

1. **Person or organization requesting the change (Required)**
   Name of primary contact person: American Falconry Conservancy – Troy Morris - President
   Address: [redacted]
   Telephone number: [redacted]
   Email address: president@falconryconservancy.org

2. **Rulemaking Authority (Required) -** Reference to the statutory or constitutional authority of the Commission to take the action requested: Fish & Game Code 395

3. **Overview (Required) -** Summarize the proposed changes to regulations: Repeal FGC 670 (J)(1)(A) and 670 (J)(1)(B) 670(J)(1)(A) The department may conduct unannounced visits to inspect facilities, equipment, or raptors possessed by the licensee, and may enter the premises of any licensed falconer during a reasonable time of the day and on any day of the week. The department may also inspect, audit, or copy any permit, license, book, or record required to be kept by the licensee under these regulations at any time. 670(J)(1)(B) If a licensee's facilities are not on property owned by the licensee, he/she shall submit to the department's License and Revenue Branch a signed and dated statement indicating the property owner agrees that the falconry facilities and raptors may be inspected by the department without advance notice.

4. **Rationale (Required) -** Describe the problem and the reason for the proposed change: **Rationale** – These regulations were not promulgated in compliance with California Administrative Procedures Act (APA). The APA establishes rulemaking procedures and standards for state agencies in California. The requirements set forth in the APA are designed to provide the public with a meaningful opportunity to participate in the adoption of state regulations and to ensure that regulations are clear, necessary and legally valid. The failure to comply with the APA CS11349(a), CS11349(b) and CS 11349(e) has resulted in regulations which violate the 4th Amendment of the US Constitution and threaten the personal security of the citizens of California from law enforcement abuses. APA Authority and Reference standard - The APA requires that regulation must satisfy the Authority and Reference standards. Complying with the Authority and Reference standards involves a rulemaking

agency in two activities: picking appropriate Authority and Reference citations for the note that follows each regulation section to be printed in the California Code of Regulations, and adopting a regulation that is within the scope of the rulemaking power conferred on the agency. Each regulation section printed in the California Code of Regulations must have a citation to the specific statutory authority under which it was enacted and a citation to the specific statute or other provision of law that the regulation is implementing, interpreting, or making specific. APA 11349(b) "Authority" means the provision of law which permits or obligates the agency to adopt, amend, or repeal a regulation. APA 11349(e) "Reference" means the statute, court decision, or other provision of law which the agency implements, interprets, or makes specific by adopting, amending, or repealing a regulation. Although the following is the Department's claims of "Authority" and "Reference" these have never been printed in the California Code of Regulations. In its Final Statement of Reasons ("FSR") pertaining to the California falconry regulations (51 Cal. 4th 1074, 1098, 2012) the Department supports either "authority" or "reference" (its unclear which since the citations were never printed in the CCR's) by referring to *People v. Maikhio*. *People v. Maikhio* rules only that a warden does not violate the Fourth Amendment by stopping the vehicle to demand the display of all fish or game that have recently been taken when a game warden reasonably believes that an occupant of a vehicle has recently been fishing or hunting. In Maikhio, the warden observed a man "handlining" (an illegal method of lobster fishing) from a pier and pull something from the water, which he placed in a black bag. The defendant got in his car, drove away and was stopped by the warden. The warden's further search of the Defendant's bag was supported because the warden had probable cause to perform the same, when Defendant lied about not having fish or a lobster in the black bag, in violation of California Fish and Game code 2012. Despite Department's use of this case in its FSR, the case is not applicable to residential searches without a warrant. This case only provides support for vehicle stops when a person has recently been hunting or fishing. Furthermore, the warden had probable cause to perform his search of the Defendant's bag after the stop. As a result, *People v. Maikhio* actually contradicts the Department's claim to legal residential searches. Further, the Department asserted in Commission hearings that California Fish and Game Code section 1006 provides further support for warrantless falconry inspections. This code section was reserved for commercial uses and permits, not residential searches of sportsmen. Fish and Game Code section 1006 reads as follows: The department may inspect the following: (a) All boats, markets, stores and other buildings, *except dwellings,* and all receptacles, except the clothing actually worn by a person at the time of inspection, where birds, mammals, fish, reptiles, or amphibia may be stored, placed, or held for sale or storage. (b) All boxes and packages containing birds, mammals, fish, reptiles, or amphibia which are held for transportation by any common carrier. [Emphasis Added]. The Code clearly and specifically prohibits the search of dwellings, not because the search of all other personal property is allowed, simply than many commercial facilities that processed fish and game products at that time also had caretaker facilities on site. This attempt by the legislator to clarify the protection of personal property from warrantless administrative search is being misconstrued to suggest that one's cartilage is not offered 4th Amendment protection. In *People v. Maikhio* the Supreme Courts explains 1006: *Section 1006 is derived from former section 23 of the original Fish and Game Code as enacted in 1933 (Stats.1933, ch. 73, § 23, p. 396). Former section 23 provided in relevant part: "The commission shall inspect regularly (1) all boats, markets, stores and other buildings, except dwellings, and all receptacles except the clothing actually worn by a person at the time of inspection, where birds, mammals, fish, mollusks, or crustaceans may be stored, placed, or held for sale or storage...) In providing for the regular inspection of the specified locations, former section 23 was evidently intended to authorize game wardens to conduct repeated inspections of places where fish and game were likely to be kept for sale or storage, and was not primarily directed at more ad hoc, in-the-field stops of noncommercial anglers and hunters by game wardens seeking the display of required licenses or any fish or game that have been caught or taken.* The Department has cited also *Betchart v. Fish and*

Game 158 Cal.App.3d 1104 as authority for warrantless searches. *Betchart* is inapposite, only allowing wardens to patrol private lands where game is present and hunting is actively occurring and specifically exempted the home from the same searches. It clearly states, *Wild game hunting is not a commercial enterprise (as are the liquor and firearms industries). Nevertheless, hunting takes place in "open fields" whether publicly or privately owned; this is a convincing factor that plaintiff's expectation of privacy while hunting is unreasonable. [7] Open field sites are regarded as so public in nature that searches are justifiable without any particular showing of cause or exigency. (People v.Dumas (1973) 9 Cal.3d 871, 882 & fn. 10 [109 Cal.Rptr. 304, 512 P.2d 1208].) "This hierarchy of protection arises not from the application of differing constitutional standards to various locales, but rather from an application of a single standard of reasonableness to all places in accordance with a fundamental understanding that a particular intrusion into one domain of human existence [such as the home] seriously threatens personal security, while the same intrusion into another domain does not." (Id, at pp. 882 883; see also Joseph v. Masonite Corp. (1983) 148 Cal.App.3d 6, 11 12 [195 Cal.Rptr. 629].) [Emphasis added].* Finally the Department claims warrantless searches are required by Federal regulation. The CCR cites Title 50, Code of Federal Regulations, Parts 21.29 and 21.30 as Reference for these warrantless administrative searches. While it is clear that the Federal regulation contains inspection language, it is equally clear that this regulatory language was recently added with nothing in statute or law supporting this disregard of Fourth Amendment protections. Agency regulations, Federal or State, do not meet the definition of "Reference" required by APA 11349 (a) or "Authority" required by APA 11349(b). California law requires that statute and law support the creation of regulation. One regulation cannot support the creation of another. Such circular logic leads to one illegal regulation creating another, thereby circumventing legislators' intentions and authority. The Federal authority to regulate migratory birds is provided by the Migratory Bird Treaty Act (MBTA), which does not authorize warrantless administrative searches. The MBTA is a strict liability statute and because of this, the Supreme Court has stated that such legislation and subsequent regulations must be explicit since citizens are held to higher standards since no intent of wrong doing is required for arrest, trial or conviction. Below is the explicit language provided in the MBTA authorizing searches. *706. Arrests; search warrants Any employee of the Department of the Interior authorized by the Secretary of the Interior to enforce the provisions of this subchapter shall have power, without warrant, to arrest any person committing a violation of this subchapter in his presence or view and to take such person immediately for examination or trial before an officer or court of competent jurisdiction; shall have power to <u>execute any warrant</u> or other process issued by an officer or court of competent jurisdiction for the enforcement of the provisions of this subchapter; and <u>shall have authority, with a search warrant, to search any place</u>. The several judges of the courts established under the laws of the United States, and United States magistrate judges may, within their respective jurisdictions, upon proper oath or affirmation <u>showing probable cause, issue warrants in all such cases.</u>* APA Necessity standard - In the *record of the rulemaking proceeding* (record), the agency must state the specific purpose of each regulatory provision and explain why the provision is reasonably necessary to accomplish that purpose. It must also identify and include in the record any materials relied upon in proposing the provision and any other information, statement, report, or data the agency is required by law to consider or prepare in connection with the rulemaking action. Each regulation must satisfy the Necessity standard. APA 11349(a) "Necessity" means the record of the rulemaking proceeding demonstrates by substantial evidence the need for a regulation to effectuate the purpose of the statute, court decision, or other provision of law that the regulation implements, interprets, or makes specific, taking into account the totality of the record. The Necessity of these two regulations to effectuate the purpose of the statute is unknown since this does not appear to have been stated on the public record. Had the Department complied with APA 11349(a) and attempted to document the need for a regulation to effectuate the purpose of the statute, they likely would have realized that the proposed provision of the regulation was inapplicable to the

statute. In any case the Necessity standard of APA 11349(a) has not been satisfied. As previously shown the Authority and References claimed by the Department are in conflict with the court decisions of *Betchart v. Fish and Game* and *People v. Maikhio* and the Fourth Amendment of the US Constitution. The Fourth Amendment provides that "[t]he right of the people to be secure in their persons, houses, papers and effects, against unreasonable searches and seizures, shall not be violated, and no warrants shall issue, but upon probable cause, supported by oath or affirmation, and particularly describing the place to be searched, and the persons or things to be seized." **Conclusion:** These regulations were not promulgated in compliance with the APA CS11349(a), CS11349(b) and CS 11349(e). The legal authority cited by the Department is invalid or inapplicable, and, in most cases, contradictory to its stated position. The administrative searches of a falconer's home and related areas violate the California Constitution and the Fourth Amendment of the United States Constitution.

SECTION II: Optional Information

5. **Date of Petition: 6/17/2016**

6. **Category of Proposed Change**
   ☐ Sport Fishing
   ☐ Commercial Fishing
   ☐ Hunting
   ☐ Other, please specify: falconry

7. **The proposal is to:** (*To determine section number(s), see current year regulation booklet or https://govt.westlaw.com/calregs*)
   ☐ Amend Title 14 Section(s):Click here to enter text.
   ☐ Add New Title 14 Section(s): Click here to enter text.
   ☐ Repeal Title 14 Section(s): FGC 670 (J)(1)(A) and 670 (J)(1)(B)

8. **If the proposal is related to a previously submitted petition that was rejected, specify the tracking number of the previously submitted petition** Click here to enter text.
   Or ☐ Not applicable.

9. **Effective date**: If applicable, identify the desired effective date of the regulation.
   If the proposed change requires immediate implementation, explain the nature of the emergency: 7/1/2016

10. **Supporting documentation:** Identify and attach to the petition any information supporting the proposal including data, reports and other documents: Click here to enter text.

11. **Economic or Fiscal Impacts:** Identify any known impacts of the proposed regulation change on revenues to the California Department of Fish and Wildlife, individuals, businesses, jobs, other state agencies, local agencies, schools, or housing: Click here to enter text.

12. **Forms:** If applicable, list any forms to be created, amended or repealed:

    Click here to enter text.

RECEIVED
CALIFORNIA
FISH AND GAME
COMMISSION

2016 JUN 17 AM 11:33

SECTION 3: FGC Staff Only

Date received: Click here to enter text.

FGC staff action:

- ☒ Accept - complete
- ☐ Reject - incomplete
- ☐ Reject - outside scope of FGC authority

Tracking Number

Date petitioner was notified of receipt of petition and pending action: June 27, 2016

Meeting date for FGC consideration: August 24-25, 2016

FGC action:

- ☐ Denied by FGC
- ☐ Denied - same as petition _____

Tracking Number

- ☐ Granted for consideration of regulation change

Exhibit 38A.8: Summary Table of Comments Received on Petition #2016-008

Petition #2016-008 - Request to remove domestic ferrets from the list of prohibited species

Comment Type	Brief Description	Number Received	Support for Petition (Y/N)
1	LegalizeFerrets.org letter containing signatures in support of petition	1376	Y
2	Letter of support based on experience as New York State Department of Conservation employee; do not pose significant threat to public or environment	1	Y
3	Letters of support noting requirements for spay/neutering, vaccination, and license/fees	4	Y
4	Letters of support noting no evidence of ferrets posing a significant threat to public or State	3	Y
5	Letters of support noting lack of incidences in other states, no documentation of feral ferrets existing, and game wardens have better things to do	2	Y
6	General letter of support	2	Y
	TOTAL	**1388**	

Comment Example #1

RECEIVED
CALIFORNIA
FISH AND GAME
COMMISSION

2016 JUL 19 PM 3:25

MLS

Pat Wright
LegalizeFErrets.org
[redacted]

July 15, 2016

Erin Chappell, Wildlife Advisor
California Fish and Game Commission
1416 Ninth Street, Suite 1320
Sacramento, CA 95814

Hi Erin,

Attached are signatures gathered in support of our petition for regulation change – legalizing the domestic ferret in California.

We do want some limitations:

- Not allow breeding of ferrets, only sterilized ferrets legalized.
- $100 one-time license fee at the time of purchase to discourage impulse buying and fund local animal control agencies.
- Some sort of rabies vaccination schedule - to be determined

I hope we are able to get far enough to discuss them. As I mentioned ferrets are the only domestic animal under Fish and Wildlife jurisdiction, it was explained to me it is because they are considered "exotic."

We are hoping to have a group of us at the meeting on the 25th cheering our legalization prospects. I sent you an email earlier in the week – is it reasonable to be there at noon and not miss anything?

Sincerely,

Pat Wright

1 **Joe Ferret**
La Mesa, California United States

2 **james leon**
Oakland, California 94607 United States

3 **cary chitwood**
Riverside, California 92509 United States

4 **Marissa Constantine**
Whittier, California 90603 United States

5 **Jess James**
Palmdale, California 93551 United States

6 **Ken Edelberg**
Burbank, California 91501 United States
It's about time we legalize ownership of ferrets in California of a domesticated animal for thousands of years. The fears you've ginned up to keep the ban is the same argument we could use to ban all domesticated cats.

7 **Christopher Karjala**
Costa Mesa, California 92627 United States

8 **Hannah Meyers**
Villa Park, California 92861 United States

9 **Elizabeth Line**
Ridgecrest, California 93555 United States

10 **Nicole Walsworth**
San Jose, California 95121 United States

11 **Kenneth Liddle**
San Marcos, California 92069 United States

12 **Ricky Lloyd**
Edwards, California 93524 United States

13 **Jodie swiderski**
Branford, Connecticut 6405 United States
"it's quite ridiculous that ferrets are legal in all states except California. I have owned ferrets, and they are far from wild dangerous animals. get with the program California!"

14 **jennifer blackwell**
Tulare, California 93274 United States
ferrets are cute and they are not dangerouse animals they are pets that need love and if raised right they are great for family pets

Comment Example #2

RECEIVED
CALIFORNIA
FISH AND GAME
COMMISSION
2016 JUL 13 PM 2:50
MLS

KATHLEEN M. SHEA, ESQ.
[redacted]

Valerie Termini, Executive Director
California Fish and Game Commission
1416 Ninth Street, Ste 1320
Sacramento, CA 95814

RE: <u>Petition for change of regulations pertaining to domestic ferret ownership in California</u>

Dear Director Termini:

As a member of the group known as Legalizeferrets.org, I understand that the California Fish and Game Commission has accepted the group's petition for a regulation change regarding domestic ferrets in California. Accordingly, I would like to share with you my experience and insight with regard to these animals.

First, while now a legal, full-time resident of Arizona, I am originally from New York. I was born on Long Island, and lived in various places there for the first 47 years of my life, before relocating to Glendale, AZ. While living on Long Island, I had more pets than I can really remember, and, among them, some 13 ferrets. During that time (the late 1980's through early 1990's) ferret ownership in New York State came with the requirement to obtain a permit issued by the New York State Department of Conservation (DEC). Ironically, I worked for that very agency, as an attorney, for some 5 – 6 years during that same timeframe. In my employment, I was assigned to handle cases involving the State's tidal wetlands regulations, but I was also well acquainted with the staff of the DEC Office of Fish and Wildlife, which issued the ferret permits.

Many of my fellow DEC employees in the Office of Fish and Wildlife also owned ferrets . . . we formed an informal group of ferret-owners, and, as such, spent quite a bit of time discussing our pets and their behaviors. This is important because the DEC Fish and Wildlife staff would have immediately received information about ferret "attacks" on any humans throughout New York; likewise, any incidences of the establishment of feral ferret colonies would have been a concern. However, I wish to inform you that at no time during my years of employment at DEC were we ever made aware of any such attacks or incidences, nor have I heard of any such occurrences since that time.

From a more personal standpoint, as indicated, we moved to Arizona some eight years ago, and have traveled to California numerous times, visiting sites throughout your beautiful state, from the northern area, along the coast, and down through the south. We have several friends in California, and were greatly looking forward to regular visits to see them upon our relocation to Arizona. However, about five years ago, we happened upon two ferret kits in a local pet store, and could not resist them . . . soon thereafter, we purchased two more, and we now share our home with four ferrets.

Comment Example #2

When we last owned ferrets in NY, I was aware that, though considered domestic, these animals were illegal in California . . . however, I had no idea, and never would have imagined, that, twenty-five years later, this was still the case. I suppose I just assumed that during that twenty-five year timeframe, since there haven't been hundreds of vicious attacks by ferrets upon humans in the US, and since feral ferret colonies have not been formed by escaped animals throughout the country, the ban on these delightful domestic pets would have been lifted long ago. It was a great disappointment to my family and me to learn that this was not the case.

Accordingly, our wonderful trips to California (we spent weeks in areas such as Santa Rosa, San Francisco, Los Angeles, San Diego, and Coronado -- which we had been visiting every year during the Christmas holidays) –abruptly ended. And, I have several friends here in Arizona who also own ferrets and are in the same situation: all would love to visit and vacation in California, but none will risk having their family pets confiscated. To me, this seems to be a "lose – lose" situation; a loss for people who want to visit your beautiful state; and an additional loss for California, which foregoes hundreds of thousands in tourist-related revenue on an annual basis from people who simply will not risk the danger of losing members of their family.

This is truly frustrating, and I do believe that anyone who examines this matter rationally will quickly realize that there is no reason whatsoever for a ban on ferret ownership/possession to exist in modern-day California. No ferret I have ever known has ever "attacked" a human; and please believe me when I say, additionally, that no ferret I have ever known would be capable of surviving in the wild. Though known to be "fun and feisty," they are actually extremely fragile. Ferret owners who think and act otherwise generally have pets that do not survive for any great length of time.

Accordingly, I urge you to take advantage of this opportunity to reconsider the regulations in your state, and act now to allow legal ownership and possession of domestic ferrets.

Thank you so much for your consideration of this matter

Very truly yours,

KATHLEEN M. SHEA, ESQ.

From: FGC
To: FGC
Subject: FW: Petition to legalize the domestic ferret
Date: Monday, July 11, 2016 2:04:52 PM

Re petition 2016-008

From: [redacted]
Sent: Monday, July 11, 2016 12:54 PM
To: FGC
Subject: Petition to legalize the domestic ferret

Attn: Ms. Valerie Termini

I am writing to urge you to approve the petition to legalize the domestic ferret in California.

When the domestic ferret was placed on the prohibited list in the 1930's, it was a sound decision. However, the reasons for that ban being a sound decision no longer exist. Ferrets are spayed/neutered before sent to pet stores for sale by the breeders now. Also, the scent glands are removed. Ferrets a fed a diet of quality kibble and possibly some raw or cooked meat. If they are fed a raw diet, they do not hunt for this food. It is prepared by cutting into small pieces and put in a bowl for them. They would have no idea how to hunt and kill for food. There are also very few areas in California where climate would allow the ferret to live as they cannot withstand heat over 75 F or an extended period of time.

California is the only state in the 48 contiguous states that maintains a ban on the domestic ferret. There have been no reports of feral colonies being established in any of those states. Ferrets are a legal pet in Alaska and one would think that state would ban them because of their concerns for their environment. Ferrets have posed no threat to the ecosystem in that state either.

The pet industry calculates that hundreds of thousands of dollars are being spent already for ferret merchandise and supplies being shipped to California. Why not have some of that money being spent here in the state and sales tax collected on it?

This is an unfair ban as there is currently no ban on imported hampsters, Guienna pigs, rabbits or even the domestic rat. None of these animals are spayed/neutered before sale and multiply like - well - rabbits. There is also no ban on other "pets" such as boas or pythons. These are dangerous when in captivity or when released by people who didn't realize it would grow to be so large.

All we are asking for is that **domestic Ferret** be removed for the banned species list. Please do not confuse it with the Black Footed Ferret which is NOT a domesticed

species and only a cousin to the domestic Ferret.

Thank you for your consideration of our petition.

Legeda Landis
[redacted]

From:	[redacted]
To:	FGC
Cc:	[redacted]
Subject:	The Allied Fishing Groups Exhibit #1 for the Commission Re: #2016-011
Date:	Wednesday, August 03, 2016 3:53:10 PM
Attachments:	AFG"s_CF&GC_Exhibit_1_8.3.2016.docx AFG_Exhibit_3_Losses_Final_8.3.16.docx Activities_to_Terminate_StripedBass.docx

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California Fish and Wildlife Commission:

Attached below you will find three email attachments of Exhibits that The Allied Fishing Groups are submitting as our Exhibits #1,3 and 4 in opposition to Petition #2016-011. We were instructed by the Commissions staff to send these Exhibit Documents by email as attachments and assured they would be placed in the binders of each Commissioner prior to the Commission hearing Petition #2016-011. I was also advised that the Commission would reply by email that they have received these documents. Please send this confirmation to me at the email address above.

We will be sending our 4th and final Exhibit to the Commission upon its completion. We have been advised that Exhibit #2 will be included as our second Exhibit in our submittal of Exhibits to the Commission.

Sincerely,

John Beuttler
Conservation Director
Allied Fishing Groups
1360 Neilson St.
Berkeley, CA 95702
510.526.4049
[redacted]

Allied Fishing Groups

1360 Neilson St. / Berkeley / CA 94702 / 510.526.4049

Black Bass Action Committee - Bass Classics of Santa Clara - California Fly Fishers Unlimited
California Sportfishing Protection Alliance - California Striped Bass Association – Chico Flyfishers - Crockett Striped Bass Club
Delta Bass Tactics – Delta Fly Fishers - Diablo Valley Fly Fishermen - E.C. Powell Fly Fishers - Fishery Foundation of California
Fly Fishers For Conservation - Fly Casters of San Jose - Fly Fishers of Davis - Friends of Butte Creek - Gold Country Fly Golden
Gate Angling & Casting Club - Golden West Women Flyfishers - Granite Bay Flycasters - Grizzly Peak Flyfishers
Hi's Tackle Box San Francisco - ICON Products Inc. - Lock Lomond Live Bait - Mission Peak Fly Anglers
Monterey Peninsula Flycasters - Northern California Council of International Federation of Fly Fishers - NORCAL Kayak
Pacific Coast Federation of Fishermen's Association - Pasadena Casting Club - Peninsula Fly Fishers
Recreational Fishing Alliance - Salmon Restoration Association - Santa Cruz Fly Fisherman – Shasta Trinity Fly Fishers
Southwest Council of International Federation of Fly Fishers - Striperfest -Tracy Fly Fishers - Tri-Valley Fly Fishers
United Anglers of California - USA Fishing - Wilderness Fly Fishers

August 3, 2016

Response to the Petition #2016-011 by Allied Fishing Groups Conservation Director John Beuttler & Science Advisor David J. Ostrach, Ph.D.
provided by email to fgc@fgc.ca.gov/

AFG Exhibit #1: Failure to Comply with the California Fish and Game Code that Require Sustainable Fishery Management"

Mr. Eric Sklar, President & Members of the Commission
California Fish and Game Commission
1416 Ninth Street Suite 1320
Sacramento, CA 95814

Allied Fishing Groups, representing thousands of anglers and some forty sportfishing organizations and businesses, are submitting the following comments regarding the proposal to change sportfishing regulations for striped bass and black bass that inhabit the Sacramento-San Joaquin Delta and tributaries rivers as submitted by "Citizens for a Sustainable Delta".

Adopting this proposal would be a violation of the Department's and the Commission's fiduciary obligations to hold the public's fish and wildlife resources in trust for the public and to manage them at sustainable population levels in accordance with the Commission's policies and statutory responsibilities, including

the Commission's Striped Bass Management Policy and Fish and Game Code sections: 703, 711.7, 1017, 1301, 1600, 1700, 1802, 7050, 7070 and 7072. The striped bass fishery has declined from some 3 to 4 million adult fish in the 1960's to 200,000 today. Its collapse has paralleled that of runs of listed salmonids and other species that utilize the Bay-Delta estuary. Sportfishing regulations should protect fishery resources by being designed to manage fisheries on a sustainable basis and not encourage or result in their decline.

The regulations changes proposed by the Citizen's for a Sustainable Delta are not based on the best available peer reviewed science to manage the striped bass and black bass fisheries as required under the Fish and Game Code. Using the best available peer review science in making regulation decisions is essential if fishery management is to meet the standard of professional natural resource management and maintain sustainable fisheries.

In 2010 the "Coalition for a Sustainable Delta" (CSD) suffered a federal court's ruling that stated, in part, that their motion for summary judgment against the California Department of Fish and Game was without merit due to the CSD's failure to demonstrate that striped bass predation had a population level impact on any of the listed fish species in the delta or its tributaries. Federal Court Justice Oliver Wanger's Summary Judgment found against CSD on every predation issue they raised because the pseudo-science they used to support their case on predation had not been peer reviewed, and was not based on sound scientific principles.

We believe it is essential to promulgate good science and that the Commission should stress the importance of utilizing peer reviewed science in making fisheries management decisions. Section 703.3 of the Fish and Game Code is a valuable tool in this regard and states: "It is the policy of the state that the Department and Commission use ecosystem-based management informed by credible science in all resource management decisions to the extent feasible. It is further the policy of the State that all resource management decisions of the Department and Commission,

be governed by a scientific quality assurance and integrity policy, and follow well-established standard protocols of the scientific profession, including, but not limited to, the use of peer review, publication, and science review panels where appropriate. Resource management decisions of the Department and Commission should also incorporate adaptive management to the extent possible."

Given the 50 year decline of the striped bass fishery, we are reminded of the clear warning from highly respected fishery scientists in the academic community, Drs. Peter Moyle and Bill Bennett (U.C. Davis), that striped bass predation on a delta forage species "inland silversides" plays a significant role in reducing the silverside's predation on delta smelt eggs and larvae (an ESA listed species). Further degradation of the striped bass fishery could have serious unintended consequences for this listed species as well as significant adverse effects on the estuary's ecology and food web. (See letter from Moyle and Bennett to the Commission dated 08/26/2010)

The CSD's proposal fails to take into consideration the very serious potential health impacts to the public that would occur by allowing increased harvest of striped bass**.** The Office of Environmental Health Hazard Assessment has posted heath warnings regarding the health hazards for the consumption of striped bass as they are contaminated with mercury and polychlorinated biphenyls (PCBs) that can have disastrous health impacts on children and unborn fetuses. Given the current advisory on striped bass consumption from the Department of Health, sportfishing regulations should be designed to help ensure the public complies with the fish consumption guidelines while discouraging consumption harmful to public health.

Due to the plight of our listed salmon, steelhead, and delta smelt**,** we are cognizant that the striped bass fishery must be managed in a manner consistent with the Department's long-term mission and public trust responsibilities. Unfortunately, none of the Central Valley anadromous fisheries are being managed at sustainable levels! We therefore urge the Commission to establish with CDFW the absolute importance

of managing all of the fisheries and the San Francisco Bay-Delta Estuary's food web on a sustainable basis as required by the Fish and Game Code. The proposed regulations by CSD would have just the opposite effect and establish an egregious precedent not supported by the science or the Fish and Game Code.

For all of the preceding reasons, we urge you to not adopt the proposed regulations. Instead, we recommend the Commission inform the Department that they should focus their resources on the significant impacts caused to the estuary's ecosystem and fisheries by the State and Federal water projects if we are to stop the collapse of the estuary's productivity and the prolonged decline of its fisheries.

Allied Fishing Groups

1360 Neilson St. / Berkeley / CA 94702 / 510.526.4049

Black Bass Action Committee - Bass Classics of Santa Clara - California Fly Fishers Unlimited
California Sportfishing Protection Alliance - California Striped Bass Association – Chico Flyfishers - Crockett Striped Bass Club
Delta Bass Tactics – Delta Fly Fishers - Diablo Valley Fly Fishermen - E.C. Powell Fly Fishers - Fishery Foundation of California
Fly Fishers For Conservation - Fly Casters of San Jose - Fly Fishers of Davis - Friends of Butte Creek - Gold Country Fly Golden
Gate Angling & Casting Club - Golden West Women Flyfishers - Granite Bay Flycasters - Grizzly Peak Flyfishers
Hi's Tackle Box San Francisco - ICON Products Inc. - Lock Lomond Live Bait - Mission Peak Fly Anglers
Monterey Peninsula Flycasters - Northern California Council of International Federation of Fly Fishers - NORCAL Kayak
Pacific Coast Federation of Fishermen's Association - Pasadena Casting Club - Peninsula Fly Fishers
Recreational Fishing Alliance - Salmon Restoration Association - Santa Cruz Fly Fisherman – Shasta Trinity Fly Fishers
Southwest Council of International Federation of Fly Fishers - Striperfest -Tracy Fly Fishers - Tri-Valley Fly Fishers
United Anglers of California - USA Fishing - Wilderness Fly Fishers

July 31, 2016

Response to the Petition #2016-011 by Allied Fishing Groups
Science Advisor David J. Ostrach, Ph.D.
provided by email to fgc@fgc.ca.gov/

"Exhibit #2: Scientific evaluation and comments on the Coalition for a Sustainable Delta's proposed fishing regulation changes and their potential adverse effects on the SFE ecosystem.

Mr. Eric Sklar, President & Members of the Commission
California Fish and Game Commission
1416 Ninth Street Suite 1320
Sacramento, CA 95814

Dear President Sklar and Commission members:

I am a Research Scientist and former director of the Pathobiology, Conservation & Population Biology Laboratory at UC Davis. I have been studying the collapse of the fisheries in the San Francisco Bay Estuary ecosystem using striped bass as a biological model for ecosystem health for 29 years (1987 – 2016) in my research at U.C. Davis and my consulting firm. My laboratory was an integral part of the Pelagic Organism Decline research team supported by various State and Federal agencies. I work in close collaboration and communication with the other laboratories and State & Federal agencies working on the problems related to the collapse of fisheries and the San Francisco Bay Delta ecosystem.

I have reviewed the Coalition for a Sustainable Delta's petition requesting fishing regulation changes for striped bass and black bass with the rationale that these regulation changes would somehow reduce predation on salmon and assist population level recovery of listed species. I'm deeply disturbed that we are forced to waste

taxpayer time and money as well as NGO and conservation group's time and money on this issue again. I presented documentation the last time a regulation change was requested for striped bass based on false predation claims. There is absolutely no new credible scientific evidence since that time that should alter the last Fish and Game Commission's ruling on this subject and the fishing regulations should not be changed.

In fact the striped bass population has continued to decline dramatically since the last time this issue was brought before the Commission. The current status of the striped bass population is that it's in severe decline and is not currently managed at a sustainable level. Changing the regulations would not only destroy more of the fishery adversely affecting the striped bass population, it would also likely be extremely detrimental to salmon and delta smelt. Striped bass feed on several other species including inland silversides and native pike minnow. Reducing striped bass numbers would almost certainly increase the population of inland silversides and pike minnows (1, 2, 4, 6 & 7). The inland silverside is a highly invasive introduced species that has supplanted the ecological niche of the delta smelt, it feeds on its eggs and larvae and it competes for the same food sources as juvenile salmon. The pike minnow is one of the most voracious predators on juvenile salmon and other small native fish. An increase of its population would certainly have a deleterious effect on listed species and the ecosystem.

The San Francisco Bay Estuary ecosystem is in collapse. It is irresponsible to further perturb the ecosystem by anthropomorphic intervention to attempt to assist one species that is not based on any credible scientific evidence. In fact the current peer-reviewed and sound scientific evidence suggests that this type of regulation change most likely would adversely affect the ecosystem (1, 3, 4, 6 & 7). I feel the Commission should be made aware that there is <u>no valid scientific evidence</u> that striped bass and black bass predation on native endangered <u>species has any effect on their population levels</u> (2). The vast majority, if not all independent scientists, conclude that predation is one of the lowest level stressors affecting the health of the San Francisco Estuary ecosystem and its fisheries.

There are far too many important stressors/problems with the San Francisco Bay-Delta estuary ecosystem that require immediate action as identified by leading scientists investigating the Pelagic Organism Decline, CALFED, a State Water Resources Control Board expert review panel investigating predation and a National Science Foundation independent expert review panel investigating predation. All of these experts have come to the same conclusion using sound scientific principles and peer reviewed science. Striped bass predation and predation in general <u>is not affecting population levels of listed species</u> and is one of the lowest level stressors on the ecosystem. The major stressors that are causing the collapse of the listed species being the loss of appropriate habitat for salmon and delta smelt and the lack of adequately timed river flows and temperatures. These problems are caused by water project engineering and operations and must be corrected if we are to recover the estuary and its ecosystem.

Vilifying fish that have coexisted in the ecosystem at sustainable levels for over 150 years is not the answer. This request to deregulate the striped bass and black bass sport

fisheries is an attempt by water contractors to distract attention from the problems responsible for the ecosystems collapse caused by the water projects. The manner in which the State and Federal projects are operated and the removal of more than 50% of the ecosystem's water is what scientific experts have determined is responsible for the collapse of the estuary and its listed species.

There is absolutely no credible scientific evidence that striped bass or black bass predation on salmon, delta smelt or any endangered species is responsible for the decline of these species. If I thought that striped bass or black bass was adversely affecting endangered fish or the ecosystem I would be the first person raising a red flag and asking for action. However this is just not the case. Striped bass, salmon, delta smelt and various other fish populations coexisted and thrived in this estuary for over a hundred and fifty years when the estuary was a healthy environment for aquatic life. Sadly, we are now faced with a collapsing ecosystem. According to the best available science, the small amount of unnatural predation that does take place will not impact the populations of listed species (2, 4, 5 & 6).

All of the research groups from various universities, State and Federal agencies are working together to understand the collapse of the fish populations and ecosystem in general. In none of these studies or biological opinions is striped bass or black bass predation considered even remotely the cause of the fish declines in this ecosystem. Rather, it is the combined effect of what we term multiple stressors on the ecosystem including: the impacts from water project operations pumping 5 to 6 million acre feet of water out of the system on average per year, lack of appropriately timed river flows in proper amounts and temperatures, the impacts of toxic pollution and their effects in the delta's waters, unintentionally introduced invasive clams, fish & zooplankton species, habitat deterioration as well as climate change (1,2,4 & 6).

We no longer have a dynamic estuary ecosystem with appropriate river flows, tidal influences, salt marshes and the natural habitat required for salmon, delta smelt and striped bass populations to survive, recover and thrive. What we have now in the San Francisco Estuary is a severely altered ecosystem operated as if it were a huge freshwater reservoir suitable for fish like large mouth bass, small mouth bass and the plant life found in such a habitat. It's clear that estuarine zooplankton and fish species can no longer survive and thrive in this essentially freshwater ecosystem. This along with other stressors such as contaminants and introduced invasive clams/zooplankton is why all of these fish populations including striped bass have concurrently declined to extremely low levels some bordering on extinction.

These population declines are not due to striped bass or black bass predation. Managing and maintaining a healthy striped bass population would be one of the best things for this ecosystem. If the striped bass population were healthy, it would indicate a healthy **estuarine ecosystem** for all of the local endangered endemic fish whose populations would all benefit. This is not only my opinion but one held by many other fisheries biologists including Dr. Peter Moyle the pre-eminent freshwater/estuarine fishery biologist on the West Coast of the United States.

In the following, please note my responses to the statements and citations in the petition submitted by Coalition for a Sustainable Delta and additional information I feel is important for the committee to understand when evaluating the merits of their petition.

1) In first paragraph of CSD'S petition it says "The fact that predation is a major source of mortality of listed fish including Central Valley Spring run Chinook salmon, Central Valley steelhead, delta smelt, and Sacramento River winter run Chinook salmon is well documented." This statement is misleading and not representing the true picture of predation. There is no evidence that predation is a major source of mortality for delta smelt or any of the wild run-non-hatchery salmon listed in their comment. It is well documented that unnatural predation is occurring at hotspots where water project operations and engineering have put salmon in the position of essentially being food fed to predators like you would feed a fish tank in your home aquarium. These operations and hotspots attract not only fish predators but a variety of avian and mammalian predators as well. This documented and unnatural predation needs to be mitigated by reengineering the hotspots not by vilifying fish predators. Additionally, they state in the petition that the report says "studies of striped bass feeding habits indicate they consume an enormous volume of fish, overlap in their geographic range with the listed species, and have historically consumed listed species, at times in substantial quantities." (CSD's reference #5). Striped bass are a piscivorous fish. Their diet consists mainly of eating other fish and they fill the apex predator niche in this ecosystem. So to say they eat large quantities of fish is akin to saying that cows eat a lot of grass. The areas in which striped bass geographically overlap with the other species they fail to mention striped bass are feeding exclusively on non-listed species such as inland silversides and American shad. The statement is inaccurate in there is not historical data that striped bass have consumed listed species in substantial quantities (except that water project operation hotspots). In fact the two populations survived and thrived for over 150 years in balance with the healthy ecosystem. The ecosystem is no longer healthy and is in a state of collapse. <u>There is no peer-reviewed scientific evidence that indicates that predation by striped bass or black bass is affecting population levels of salmon.</u> The information they cite is the report that was submitted to the Fish and Game Commission the last time regulation changes were requested for the same erroneous reasons (CSD's reference #5). It is a California Department of Fish and Game report not a peer-reviewed document. At that time the Commission found the report not to be based on good scientific principles or peer-reviewed science and rejected the arguments keeping the fishing regulations the same. At the end of the first paragraph it is stated that in the 2014 recovery plan for Central Valley Salmonids the National Marine Fisheries Service placed predation in the "highest stressor category" (CSD's reference #7). This partial quote is taken out of context. National Marine Fisheries Service developed a lifecycle stressor matrix in the report listing many stressors of "Very High importance." In this matrix they state "Predation during juvenile rearing and outmigration" (by birds, mammals and fish) as an important stressor on juvenile salmon." As previously mentioned the predation on juvenile

salmonids during rearing and outmigration is well documented and occurs at water project operations where habitat has been altered leaving the juvenile salmon no areas to hide and feed and at project hotspots. This is unnatural predation caused by the water project operations and the hotspots. In the National Marine Fisheries Service report they further go on to say that predation needs to be minimized "at weirs, diversions, and related structures outside of the Delta". We all agree predation needs to be minimized at these water project operations and hotspots. The way to accomplish this is by restoring habitat, reengineering water project operations and the hotspots they create not by vilifying predator fish. However, it needs to be restated that this predation has not been demonstrated in any peer-reviewed scientific study to affect population levels of salmon or listed species.

2) In paragraph two of their petition they state in "for example, in a 2008 report on the Central Valley Project Improvement Act Fisheries Program (CSD's reference #3), a blue ribbon panel of scientists characterize predation as a "key limiting factor" on Central Valley salmonids and they concluded that predation reduction efforts are among these actions that have the greatest ability to improve fish populations in the near term." This is a portion of a quote taken out of context to serve their purposes. In that 100 page report the word predation is mentioned a total of eight times. The report provides significant information on various restoration efforts needed to improve anadromous fishes and although predation is mentioned a few times (predation at barriers and water project operations) it is certainly not considered to be the main thrust of what is necessary to recover the anadromous fish populations. The quote they use is not from the report but from the appendix where it documents questions and answers to the panel from the audience. The quote is found in Appendix A: Critical Questions and Panel Responses . These were questions asked to panel members directly after presentations and prior to the panel reviewing all materials, writing a final report and coming to their conclusions. To provide a quote from an appendix citing the report in its petition to the Commission is unprofessional at least if not unethical. It's an attempt I believe to mislead Commission members into believing that this is the conclusion the blue ribbon panel came to when it is not. They provided this partial quote completely out of context. The full quote from the panel member's response to the audience question is: "Programs designed to increase flow, remove barriers, improve water quality, and reduce predation appear to have the greatest ability to improve anadromous fish populations in the near term. However in the long term, the synergies among the tools can also be considered but only when implemented in concert with other activities designed to restore ecosystem function." CSD states at the end of their paragraph that "Furthermore, the populations of a number of these fish are at or near historic lows. For example, the four major indices of delta smelt abundance-the spring Kodiak trawl, the 20 mm survey, the summer townet survey, and fall midwater trawl-all indicate the species is at the lowest point on record." This quote is referring to delta smelt not salmon, and there is no evidence that striped bass or black bass predation is in any way related to the collapse of the delta smelt population. What they failed

to mention is the same indices indicate that the striped bass population has collapsed and is at an all-time historic record low as well along with other Delta fish populations including threadfin shad and longfin smelt. All of these fisheries have collapsed due to the reengineering and managing the Delta environment as essentially a freshwater reservoir where these estuarine species cannot survive and thrive.

3) Paragraph 3 of their petition states "There is ample precedent for regulatory action to address impacts of predators on native fish." They cite what's being done in the Columbia River system, a river system that is not comparable to the San Francisco Bay Delta Estuary. It's like comparing apples and watermelons with the only commonality being predation and that the predation on the Columbia and Snake Rivers and the others described is due to water project operations and structures such as dams. However pike minnow sitting at the base of dams waiting for fish to come down the fish ladders in the Columbia River is not comparable to striped bass or black bass and what the juvenile salmon face in the Bay Delta estuary system. Pike minnow fills a different ecological niche, the predation caused in these river systems again is unnatural predation caused by water project operations and the methods being used to remove the predators at these water project operations using nets or angling. Reference #1 in this paragraph of their petition is a Bonneville Power Administration website advertising various habitat improvement projects they have been forced to undertake. Bonneville Power is responsible for the water project operations and dams on these River systems that have been responsible for the collapse of the salmon in these River systems. As such Bonneville Power is being held responsible for mitigating and restoring the populations. This website is merely a public service message advertisement not a peer-reviewed statement or agency report. We should hold our water contractors accountable as the Bonneville Power administration is being held accountable and require they reengineer water project operations and hotspots. They cite several other instances where fishing regulations have been changed in an attempt to control predators reference numbers 8, 9, 11 & 12 (CSD's reference #9 is a link that does not work and I cannot find the information to evaluate it). In every case the attempt is being made to control predators at water project operations and dams <u>in river systems not estuaries</u>. With the exception of some success on the Colombia and Snake Rivers the other programs have been largely unsuccessful. These are River systems not estuaries and the types of problems salmon encounter in our Bay Delta system are more complex and not comparable. Attempts at predator control in the Bay Delta estuary will not solve the issue responsible for the collapse of virtually all of the Bay Delta's once great fisheries removing over 50% of the water from the system. In estuarine and riverine systems it is well documented that if you remove 50% or more of the water from the system it results in ecosystem collapse.

4) In paragraph 4 CSD claims "The regulatory change sought will advance coequal goals of providing a more reliable water supply for California and protecting, restoring, enhancing the Delta ecosystem, because the change will reduce the

adverse effects of predation by non-native fish and fish species that are native to the Delta ecosystem in danger of extinction or likely to become endangered extinction in the foreseeable future." They go on to reveal their true intentions later in the paragraph where they suggest that this action will allow them more flexibility to manage water/pump more water and that the regulatory change will "help realize the full benefits of various upstream actions that have and will continue to be taken to help recover native salmon and steelhead species." The upstream efforts dealing with habitat restoration that help to recover salmon is laudable but has nothing to do with this regulation. The majority of the upstream predators on the native and endangered fish are not striped bass or black bass. They are the native pike minnows, birds and mammals and this regulation change has nothing to do with solving these unnatural predation issues.

5) National Marine Fisheries Service lead scientist on the projects investigating salmon decline and predation in the Bay Delta Sean Hayes made a presentation to the California State water resources control Board in April 2016 on the decline of salmon and the effects of predation and predator control on salmon and listed species (6). In this presentation he describes how this unnatural predation is really a function of poor habitat conditions/habitat altered by water project operations and emphasizes the need for hotspot predation control. He provided a detailed example of why predator control won't work in the Bay Delta and it would likely be like opening "Pandora's box" and likely have adverse effects on the ecosystem. So NMFS's lead scientist on the project clearly believes predator control is in no way the answer to restoring salmon or other listed species and would likely cause more harm than good.

6) National Marine fisheries service scientists published a paper modeling striped bass predation and its potential effect on Chinook salmon extinction (5). The papers purpose was to try and determine what would happen if the current striped bass population (estimated at that time to be 700,000 adults) was artificially enhanced and tripled using various mitigation techniques. They had no accurate predation rates for the Bay Delta and used predation rates from squaw fish (which fill a completely different ecological niche than striped bass or black bass) which most scientists agree are 2 to 3 times higher than predation rates in the Bay Delta by striped bass. Their conclusion using elevated predation rates was <u>that "at current striped bass population levels there is no statistical difference between the quasi-extinction of Chinook salmon as compared to zero striped bass in the model."</u> This means that if you removed every striped bass from the Bay Delta system the model shows that it would have no effect on the potential extinction of Chinook salmon in the ecosystem. The striped bass population has declined to approximately 200,000 adults since the paper was published which indicates striped bass predation would have even less effect than what was calculated in the manuscript and <u>has no effect on salmon population levels.</u> Additionally in the same manuscript the authors state that "The predicted decline of the adult striped bass population from 700,000 to 512,000 contributes a smaller effect to increase survival probability then does the effect of conservation measures." Again, supporting the notion that the

striped bass population at current levels does not have any significant effect on the quasi-extinction of Chinook salmon and that conservation measures would have a greater effect on restoration of salmon populations.

7) Another example indicating that massive mortalities on juvenile salmon occur where there are no or very few striped bass and black bass was shown in radio acoustic tagged studies performed in 2007. An array of radio receivers was placed from the upper reaches of the rivers to the Golden Gate Bridge such that radio tagged fish movements can be tracked in real time with the lead person in charge being a NMFS scientist and colleague Bruce McFarlane. Results from the 2007 tagging of late fall Chinook smolts and juvenile steelhead indicate survival estimates of ~20% from the release point at Coleman Hatchery (near Red Bluff) to ORD Bend near Chico (see short narrative and graph at the end of this document). Although there may be a very few individual striped bass and a small population of black bass in the area of ORD Bend and downstream, over 95% of the striped bass population and the black bass populations are located much further downstream in the estuary with the striped bass at that time (when salmon are released from the hatchery) located mainly at the confluence of the Sacramento and San Joaquin Rivers. Only during the spawning run (April-May) do significant numbers of striped bass inhabit the upper Sacramento (or other rivers) and only travel up river to the area between Knights Landing and Colusa which is downstream of ORD Bend where 95% of the juvenile salmon mortality is occurring. However, the native Sacramento pike minnow inhabits these sections of the river and are known to congregate and feed on salmon smolts and juvenile steelhead along with thousands of birds and mammals. In a 2008 attempt to avoid pike minnow & other predators, aggregations of tagged fish were released at 3 sites downriver of the hatchery and the survival to ORD Bend was similar (pers. communication with Dr. Pete Klimley on 4/20/09). This suggests the vast majority of mortality is occurring in areas where striped bass and black bass are not present and that other factors such as other predators (eg. pike minnow, birds and mammals), water quality, river flows, river temperature and food are responsible for the vast majority of salmon smolt and Steelhead mortality seen in recent years.

8) Predation on early life stages of fish with reproductive strategies such as Chinook salmon, steelhead and striped bass is a normal natural part of the food web, and part of ecosystem checks and balances in a healthy environment. For a young salmon to survive it must grow as fast as it can because the larger it gets the likelihood of predation becomes less, and then it must get to the ocean as fast as possible. This requires good water quality, appropriate habitat and adequate food supplies. Current river flows and water quality has been shown to be poor, habitat has deteriorated or been destroyed, and food for salmon smolts is much less abundant now that in the past when the population was healthy.

9) Striped bass, Chinook salmon & steelhead populations co-existed and thrived in this Estuary/ecosystem for over 150 years together. It was not until multiple stressors beginning with water project operations in the 1960s followed by

contaminants, unintentionally introduced invasive clams and zooplankton, poor river flows and extensive habitat deterioration that all of the species including striped bass concurrently began and continue to decline. Striped bass and salmon populations on the East Coast of the US have co-existed and thrived for thousands of years. So to conclude that striped bass in this ecosystem are causing the decline of salmon and other species has no credible scientific basis and in my opinion is absurd.

10) I have been involved in electro-fishing for adult striped bass for laboratory spawning and research during the spring spawning runs every year from 1988-2009. In examining the gut contents of hundreds of adult male and female striped bass I have never found a salmon smolt, delta smelt or adult salmon. The gut contents of striped bass during the spring spawning run are made up almost exclusively of American shad. Striped bass prefer much larger prey than salmon smolts and the shad run the river at the same time as striped bass.

11) Would the proposed new regulation attempting to control striped bass predation be effective and allow the endangered species populations to increase? The answer is no. So many other factors are suppressing fish populations ranging from exporting massive amounts of water out of the delta, other water project operations, contaminants, wastewater discharges, inadequate timing and amount of delta inflows controlled by the water projects, increasing water temperatures as well as unfavorable ocean conditions (for salmon). All of these stress fish potentially changing behavior making it likely they are less able to avoid predation. A predator removal program would also have to be complete to be effective. Predation control could not just focus on two species (striped bass & black bass) but would have to focus on all possible predators including channel catfish, Sacramento pike minnow, steelhead, sea lions, otters and fish-eating birds. Where does it stop? Efforts would be better spent on restoring the delta habitat to estuarine conditions and in changing water project operations to protect fish and to remove hot spots of predation rather than singling out and vilifying striped bass and black bass.

12) An important food source for adult striped bass has historically been juvenile striped bass. So if we allow anglers to overfish the adult population it is likely that the juvenile survival rates would increase. Due to habitat changes juvenile striped bass no longer have the previously abundant *neomysis* shrimp to eat (their historical food source) and have switched to benthic (more contaminated) prey and small fish to survive. The proposed change in the fishing regulations could possibly increase juvenile striped bass predation on salmon smolts and other listed fish species.

13) Predation by striped bass on juvenile salmon and steelhead is documented, but there is no evidence it makes a difference to numbers of returning salmon (5). The majority of salmon that are eaten by striped bass are confused naive hatchery fish. These are fish that have never lived in a river or ecosystem but only in a controlled hatchery with artificial conditions and are newly released

into the delta ecosystem. This problem is more likely to be alleviated by changing hatchery rearing and release practices rather than attempting to eradicate the striped bass and black bass populations.

14) There are serious human health and social justice implications if the proposed regulations are adopted: By changing the sport fishing regulations anglers will likely first overfish the largest striped bass. These large fish are known to be laden with mercury, PCB's, PBDE's and other contaminants. Human consumption guidelines have been in place for years such that only a few fish at most should be eaten every month. Human consumption of striped bass from this estuary is discouraged as they are regarded as unsafe to eat. It is unlikely that anglers would catch and discard the fish (not eat them) in an effort to eradicate striped bass. If any regulations should be changed there are good reasons for a catch-and-release fishery with no human consumption allowed. The adverse human health risks and social justice implications of low income anglers that fish to provide food for their families is unacceptable! Changing the striped bass fishing regulations as suggested would encourage subsistence fishermen in the delta to catch and eat more contaminated and unhealthy (to consume) striped bass. Is that something that the Fish and Game Commission or CSD really wants to advocate?

15) In May 2016 preeminent West Coast fishery ecologist Dr. Peter Moyle and his colleagues at UC Davis Andrew Sih, Anna Steel, Carson Jeffres and William Bennett published online an article titled "Understanding Predation Impacts on Delta Native Fishes" (7). These authors are highly respected independent academic scientists with no vested interest in the predation issue other than to understand the health of and collapse of the Bay Delta ecosystem and its fisheries. Their article is extremely clear and goes through various scenarios regarding predation and potential predator removal in the Bay-Delta ecosystem. Their conclusion is that "All this indicates that programs aimed at direct striped bass control are as likely to have no or negative effects, as to have positive effects, on populations of desirable fishes." I've included the entire article at the end of this document and urge the Commissioners to read it as I believe it will clarify the predation problem and potential solutions in a clear and concise manner.

16) In the most recent peer-reviewed publication on the subject published in July 2016 "Predation on fishes in the Sacramento-San Joaquin Delta: current knowledge and future directions" (Grossman, G.D., 2016) the author comes to the same conclusion as almost every independent scientist "the most likely outcome of striped bass removal is the competing predator will increase in abundance and there will be little reduction in predation mortality for Chinook salmon. It is likely that the most productive management strategy for decreasing predation on Chinook salmon and other delta fishes is to restore natural habitat and flows, especially in predation hotspots."

Am I wrong? Are Dr. Peter Moyle, NMFS lead scientist Sean Hayes, the POD agencies/scientists, the State Water Resources Control Board panel of expert scientists, the National Science Foundation expert scientific panel investigating predation as the cause of the decline of listed species and the preponderance of peer reviewed scientific literature on the subject all wrong? How can the proponents for changing the striped bass fishing regulations expect serious consideration when the experts working on delta problems and the independent science panels all came to the same conclusions? They all agree that predation is an extremely low priority stressor and that the most significant stressors, poor delta water management and habitat needs to be addressed immediately?

I implore you to reject the Coalition for Sustainable Delta's request to change the regulations regarding striped bass and black bass fishing in the San Francisco Bay Delta Estuary ecosystem. If these recommended regulations are approved, it will do nothing to restore California's once great salmon fisheries. It provides absolutely no benefit to the estuary's ecosystem and in fact would likely cause further ecosystem harm.

I am available to meet with the Commission staff or the Commission to discuss this further. If you require any additional information or clarification please don't hesitate to contact me.

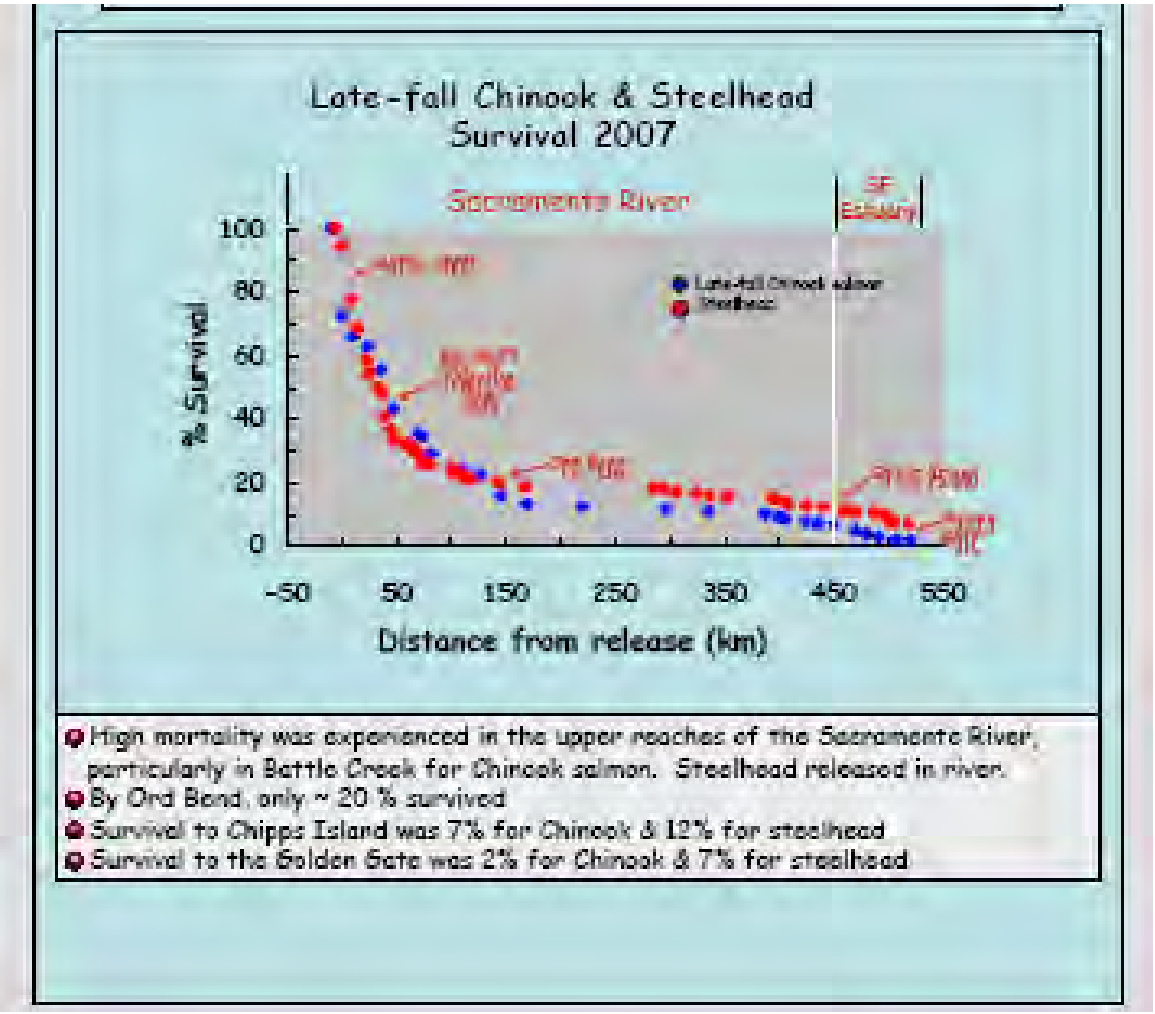
Sincerely,

David J. Ostrach Ph.D.

References

1) Moyle, P B. (2011). Striped bass control: cure worse than disease? California Water Blog. January 1, 2011.
2) Grossman, G., Essington, T., Johnson, B., Miller, J., Monsen, N. and T. Pearsons. 2013. Effects of fish predation on salmonids in the Sacramento River – San Joaquin Delta and associated ecosystems. Report for Cal. Fish Wildlife/Delta Stewardship Council/NMFS.
3) Doherty, T. S. and Ritchie, E. G. (2016), Stop Jumping the Gun: A Call for Evidence-Based Invasive Predator Management. CONSERVATION LETTERS. doi:10.1111/conl.12251
4) Grossman, Gary D.(2016). Predation on Fishes in the Sacramento–San Joaquin Delta: Current Knowledge and Future Directions. *San Francisco Estuary and Watershed Science*, 14(2). jmie_sfews_31669. Retrieved from: http://escholarship.org/uc/item/9rw9b5tj
5) Lindley, S.T. and M.S. Mohr. 2003. Modeling the effect of striped bass (Morone saxatilis) on the population viability of Sacramento River winter-run Chinook salmon (Oncorhynchus tshawytscha). Fishery Bulletin 101:321-331
6) Hayes, Sean, NMFS lead scientist presentation to the California State Water Resources Control Board April 19, 2016. Factors that influence salmon predation in the Sacramento-San Joaquin Delta. (http://waterboards.ca.gov/board_info/media/apr2016/swrcb_brdmtg041916.shtml - his presentation starts at approximately 3:45 minute mark and runs for about 45 minutes).
7) Moyle, Andrew Sih, Anna Steel, Carson Jeffres and William Bennett, (2016). Understanding predation impacts on Delta native fishes. Published by U.C. Davis Center for Watershed Sciences on the California Water blog May 22,2016. (https://californiawaterblog.com/2016/05/22/6206/)

The graph below is a portion of a poster titled: Survival & Migratory Patterns of Central Valley Juvenile Salmonids: Overview (McFarlane et al., 2007). It shows as discussed in comment #7 above salmon smolt and steelhead mortality from the release points indicating approximately 80% mortality by the time they reach ORD bend. This is an area of the river not inhabited by significant numbers of striped bass during the late-fall Chinook and Steelhead migration.



Understanding predation impacts on Delta native fishes

Posted on May 22, 2016 by UC Davis Center for Watershed Sciences

Native threespine sticklebacks pumped from the stomach of a single 22 inch striped bass. The bass was feeding in water being drained from a duck club in Suisun Marsh, The sticklebacks were abundant, concentrated, and confused so were easy prey for the bass. Sticklebacks continue to be one of the most abundant fish in Suisun Marsh. Photos by Teejay O'Rear April 2010.

By Peter Moyle, Andrew Sih, Anna Steel, Carson Jeffres, William Bennett of University of California, Davis.

Will endangered fishes, such as Chinook salmon, delta smelt, and longfin smelt, benefit from control of predators, especially of striped bass? This question is of interest because if the answer is 'yes', then predator control might increase the benefits of other actions, such as provision of environmental water for native species. In this blog we express our skepticism of large-scale predator control as a conservation tool, based on eight principles.

1. ***Predation 'problems' do not have simple solutions.***
   Predation is one of many stressors affecting declining species. In ecosystems such as the Delta, predator-prey relationships are complex. Many predators forage opportunistically on whatever prey species are most abundant and accessible at any time and place. As a result, predator control can have unintended consequences. For example, reducing striped bass populations might cause an increase in important prey species, such as Mississippi silverside, that prey on delta smelt eggs and larvae. In other words, controlling striped bass may backfire and increase predation on delta smelt. Grossman et al. (2013) have written a good overview of predator-prey dynamics in the Sacramento River. This review provides a basis for the above statements and the conclusion that predator control in the Delta will likely create more problems

than it solves. This conclusion can be applied broadly to predator control programs, such as those for invasive mammals. However, more research could provide a better understanding of predation as a stressor of fish populations, provided that such studies are linked with modeling, focusing on predator-prey interactions in the Delta (similar to work done for the lower Columbia River).

2. ***The best long-term strategy for increasing populations of small fish (prey) is to improve the ability of the ecosystem to support them.***
   In a healthy ecosystem, multiple predators and multiple prey typically co-exist in dynamic fashion. Prey species such as delta smelt have highly effective predation defense mechanisms that operate best in an environment similar to the one in which they evolved. For the Delta, we suggest that ecosystem recovery efforts should focus on the arc of habitat that includes the Yolo Bypass, the Lindsey-Cache slough region, the Cosumnes-Mokelumne river region, the Sacramento River, Sherman Island and Suisun Marsh (similar to the String of Pearls concept for Chesapeake Bay). This region is tied together (the string) by the interaction of Sacramento River flows with tidal flows and contains the highest concentrations of native fishes in the upper estuary.

3. ***Bypassing problem areas can reduce predation impacts.***
   Increasing flows from the Sacramento River down the Yolo Bypass in winter could carry large number of juvenile salmon from upstream areas to productive habitat in the Yolo Bypass. Such flows can also attract fishes such as splittail, and perhaps smelt from the Delta into the Bypass. Fish using the Bypass avoid the rip-rapped channels and likely high predation areas in the western Delta and lower Sacramento River. A similar strategy might work for the San Joaquin River and southern Delta if fish (except smelt) were directed towards the pumping plants and then trucked past predation hot spots in the Delta. This strategy will only work if predation on trucked fish is reduced by modifying the pumping facilities and adopting different release strategies (#4, #5).

4. ***Changing release strategies of captive fish can reduce predation mortality***.
   Salmon and other fishes are most vulnerable to predation when they are transported to a release site, usually by truck, and then dumped into the water in large numbers in one place. This release strategy, used by the pumping plants in the South Delta and by many hatcheries, caters to predator behavior, because predators are attracted to concentrations of prey, especially prey that are confused following release. Release strategies need to be developed and carefully monitored, such as slow releases from barges towed at random times of day and night, which do not habituate predators to concentrations of prey. Similar release strategies are needed for hatchery salmon releases as well (#8).

5. ***The solution to reducing effects of predation 'hot spots' is to move prey around them (see #3) or to reduce their attractiveness to predators.***
   Predatory fishes such as striped bass move around a lot. Therefore, predator control on a hot spot has to be continuous and intensive, because as predators are removed new ones are likely to move in. However, each hotspot has its own

problems that have to be dealt with individually. For example, Sabal et al. (2016) found striped bass consumed 8-29% of juvenile salmon passing through Woodbridge Irrigation District Dam on the Mokelumne River and reducing the numbers of adult striped bass could temporarily reduce predation rates. It helped that the 'hot spot' was some distance upstream from the Delta, where most bass reside. Their conclusion was not that universal striped bass control was needed but that " …it is important to consider habitat alterations and interactive effects when estimating large-scale predation impacts and when planning local management strategies (p 318)."This conclusion applies to Clifton Court Forebay, which is well-documented as one of the hottest of the predation hotspots. Striped bass and other predators concentrate there to feed on small fish drawn towards the giant pumps at the state pumping plant. Modifying its structure or operation should be the best way to reduce predation impacts in the forebay. In this light, the National Marine Fisheries Service is currently requiring that both long-term and interim measures to reduce predation on endangered fishes be implemented (letter from Maria Rea to Carl Torgersen, January 22, 2016). Essentially, NMFS is saying that just studying the problem is no longer a sufficient response to the documented high predation rates at this facility.

7. ***Striped bass are not the problem.***
Striped bass get blamed for declines of native fishes because they are an abundant, voracious, non-native predator. Yet striped bass have been part of the Delta ecosystem for nearly 150 years, plenty of time for co-adaptation of predator and prey. In periods when delta smelt, longfin smelt, and salmon were abundant in the past, striped bass were much more abundant than they are today, suggesting that the same factors that drive native fish declines are also driving striped bass populations. As generalist, wide-roaming predators, they feed on the most abundant prey available, which is often the result of 'ringing the dinner bell' release strategies of captive fish (see #4, above). *If* striped bass regulate populations of any other fishes, their effects will be mostly on small, consistently abundant prey fishes such as Mississippi silverside and threadfin shad that may compete with or prey on smelt and juvenile salmon. By reducing competition or predation by silversides or shad on smelt, striped bass might actually have a net positive effect on smelt. Indeed, other managers have found, to their distress, that reducing top predators has backfired because of this 'enemy of my enemy is my friend' effect. Repeating this error in our system would be unfortunate. All this indicates that programs aimed at direct striped bass control are as likely to have no or negative effects, as to have positive effects, on populations of desirable fishes.

7. ***Having a prey species in a predator's diet does not mean the predator controls the prey's populations.***
Dietary studies of predators in the Delta have often concentrated in areas where predation is perceived to be a problem, such as predation by striped bass near water diversion structures on salmon in the Delta and Sacramento River or below hatchery release sites. It is not surprising that prey are seen in predator

stomachs in those situations. Prey fish have evolved strategies to minimize the effect of predators. For example, a natural predation-reduction strategy of juvenile salmon is to migrate to the ocean in pulses, usually when river flows are high and muddy from run-off. Striped bass and other predators might have stomachs full of juvenile salmon at this time but the percentage of total population is likely to be low. Granted, such strategies may no longer be fully effective under conditions of drought, warm winters and reduced population sizes; however, reduction of overall striped bass predation will likely increase predation by other organisms, taking advantage of whatever increase in prey the absence of striped bass might cause.. In short, a predator control program based mainly on dietary studies is too simplistic to serve as a basis for management to increase prey populations.

8. ***Hatchery-reared salmon are exceptionally vulnerable to predation.*** Hatchery salmon start life packed together in cement troughs, with food pellets raining down from above. This does not give the fish much chance to learn how to avoid predators. They are then either released directly into a river or trucked to a release point in the estuary. It is scarcely surprising that predators take advantage of these naïve and fat-laden prey, gorging themselves. Many of these salmon die of stress and other causes. They are then scavenged by unlikely predators such as white catfish. Studies on the Yolo Bypass indicate that about 30% of hatchery salmon die within a day or two after release into food rich, nearly predator-free environments, in which most wild salmon thrive (Jacob Katz, unpublished data). Release of hatchery fish into rivers in large numbers mimics, to a certain extent, the predator-swamping strategy used by wild fish. But the rivers are rarely high and muddy during the release and the fish lack the behavior to avoid predation in clearer water, so predation rates are high. In short, heavy predation on juvenile hatchery salmon is more a reflection of hatchery practices than of un-natural rates of predation by striped bass and other predators.

Conclusion. It seems unlikely that a large-scale predator removal program focused on striped bass would have a sustainable, measurable effect on populations of its prey species, specifically protected smelts and salmon. However, if managers deem enough uncertainty exists about the importance of predation as a source of mortality relative to other factors, then an integrated program of empirical studies and modeling should be instituted. If a control program moves forward despite scientific uncertainty, it should be implemented as an experiment, focusing on data collection and modeling to determine if the program achieves carefully specified objectives.

Further reading

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Allied Fishing Groups

1360 Neilson St. / Berkeley / CA 94702 / 510.526.4049

Black Bass Action Committee - Bass Classics of Santa Clara - California Fly Fishers Unlimited
California Sportfishing Protection Alliance - California Striped Bass Association – Chico Flyfishers - Crockett Striped Bass Club
Delta Bass Tactics – Delta Fly Fishers - Diablo Valley Fly Fishermen - E.C. Powell Fly Fishers - Fishery Foundation of California
Fly Fishers For Conservation - Fly Casters of San Jose - Fly Fishers of Davis - Friends of Butte Creek - Gold Country Fly Golden
Gate Angling & Casting Club - Golden West Women Flyfishers - Granite Bay Flycasters - Grizzly Peak Flyfishers
Hi's Tackle Box San Francisco - ICON Products Inc. - Lock Lomond Live Bait - Mission Peak Fly Anglers
Monterey Peninsula Flycasters - Northern California Council of International Federation of Fly Fishers - NORCAL Kayak
Pacific Coast Federation of Fishermen's Association - Pasadena Casting Club - Peninsula Fly Fishers
Recreational Fishing Alliance - Salmon Restoration Association - Santa Cruz Fly Fisherman – Shasta Trinity Fly Fishers
Southwest Council of International Federation of Fly Fishers - Striperfest -Tracy Fly Fishers - Tri-Valley Fly Fishers
United Anglers of California - USA Fishing - Wilderness Fly Fishers

Response to the Petition #2016-011 by Allied Fishing Groups Conservation Director John Beuttler & Science Advisor David J. Ostrach, Ph.D.

August 3, 2016 by email to fgc@fgc.ca.gov/

"AFG Exhibit #: 3 The Primary Causation for the Decline of the Bay-Delta's Fishery Resources and Ecosystem."

Mr. Eric Sklar, President & Members of the Commission
California Fish and Game Commission
1416 Ninth Street Suite 1320
Sacramento, CA 95814

The Allied Fishing Groups, representing some forty sportfishing organizations and businesses are submitting the following comments regarding the petition to change sportfishing regulations for Striped Bass and Black Bass that inhabit the Bay-Delta estuary as proposed by the "Citizens for a Sustainable Delta".

There has been a concerted effort by some of the beneficiaries of the State and Federal Water Projects to compel the destruction of Black Bass and Striped Bass fisheries of the Bay-Delta estuary because they apparently choose not to be responsible for the environmental impacts to the estuary cause by the State and Federal Water Projects.

Over the past sixty years many of sportfishing anglers, commercial fishermen and sportfishing businesses have endured the consequences of the failure of the State and Federal government to properly manage the operation of the State Water Project (SWP) and Federal Central Valley Water Project (CVP). These consequences included Central Valley salmon, steelhead and striped bass fisheries that fell into prolonged decline with some runs being listed under the ESA (winter-run and spring-salmon, steelhead, and delta smelt). The collapse of the fall-run salmon, striped bass, and sturgeon soon followed as the ecosystem continued to decline.

In our efforts to help restore the estuary's fisheries, we have learned that SWP and CVP have killed many millions of salmon, striped bass, steelhead and other fish while they've ramped up delta water exports. These increases in water exports further exacerbated the impacts to the ecosystem by degrading its ability to produce the food web upon which life in the estuary is dependent. These monumental losses of fish are due to the "direct" and "indirect impacts" of the water projects.

To give you an accurate estimate of these fishery losses is not possible due to the lack of pertinent data on the estimated fish losses caused by the State and Federal Water Projects. Based upon a document from the Department of Fish & Wildlife of February 2015 entitled the "Delta Pumping Plant Fish Protection Agreement Fish Mitigation Report February 2015", we were able to review estimated fish losses for the period of 1986 to 2013 for salmon, striped bass and steelhead.

We are making an estimate of some of the fish that have been killed by the projects during this period to provide the Commission with an understanding as to the extent of the impact the SWP and the CVP have had on the public's fishery resources. The direct fish losses for the period of 1986 thru 2013 that follow are express as "smolt equivalents" for salmon and "yearlings equivalents" for striped bass and steelhead loss estimates provided by the CDFW and DWR. These estimates should not be confused with adult fish.

Losses from 1986 to 2013:

Salmon smolts: 11,779,656 / Striped Bass: 10,699,815 / Steelhead: 460,362

As far as we know, there is little if any meaningful data on their direct fish losses cause by the projects prior to 1986. However, from a historic perspective the impacts prior to 1986 are considered greater because the fishery populations that existed then were larger and more resilient. If we combined the losses after 1986 with those of the period when the project's came on until 1986, it would at least double the number of fish lost. The combined losses for prior to 1986 and from 1986 to 2013 are:

Salmon: 23,559,312 smolts - Striped Bass ye: 21,399,630 - Steelhead ye: 920,724

There are also significant fish losses caused by the federal CVP that exports water from the southern Delta. To the best of our knowledge there is no estimate for the federal project losses even though they were operating a decade before the SWP and had entered into the "Tracy Fish Agreement" with the DF&G to do so. For a ballpark estimate we used the losses from the SWP that assumed CVP losses would have been the same as the SWP. This doubled the direct losses. It is the opinion of several biologists we consulted that the CVP caused much higher fish losses than the SWP for most of it existence. Without those losses being documented, the best we could do was to assume the SWP and CVP estimated losses were the same. They are:

Salmon: 47,118,624 smolts - Striped Bass: 42,798,720 ye - Steelhead: 1,841,448 ye

It is important to note that the SWP has attempted to mitigate for the direct losses the project has caused to these fisheries, while the CVP has <u>not complied</u> with their "Tracy Fish Agreement" with the CDFW by refusing to mitigate for the direct losses cause by the CVP's direct impacts.

Our attempt to provide the Commission with a "rough estimate" of the number of

salmon smolts, striped bass and steelhead yearling equivalents lost due to the SWP and the CVP, does not include the indirect losses of these fish. Indirect losses occur when fish moving down river migration corridors to the ocean are pulled out of their normal migration paths and into the central and southern Delta by the pull of SWP and CVP pumps taking water out of the delta. As far we know, there is not an estimate for these losses. Several retired CDFW fisheries biologists believe that these indirect losses would be at least an order of magnitude greater than the direct losses as many of the fish die prior to being entrained into the project facilities.

If that were the case, we could increase the indirect losses by ten times! We know where all the fish have gone, along with the productivity of estuary's ecosystem. When over half of the water that flows into the delta is exported, at least half of the food production capacity of the ecosystem goes with it. Since this is usually happens on an annual basis, the ecosystem has lost it ability to support the dynamic productivity necessary to prevent the collapse of the estuarine food web.

If we are to restore what many considered to be one of the greatest estuaries on the North American continent, we urge the Commission to take a leadership role in concert with the CDFW and your constituency to rectify the damage that has been done to estuary and its fisheries by excessive water exports. There is precious little time left to save and restore the estuary and rebuild the productivity of the ecosystem for the fish and wildlife that are dependent upon it for their existence.

Allied Fishing Groups

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July 31, 2016

Response to the Petition #2016-011 by Allied Fishing Groups Conservation Director John Beuttler & Science Advisor David J. Ostrach, Ph.D.
provided by email to: fgc@fgc.ca.gov/

"Exhibit #4: Our comments on the Petition's Failure to Comply with California Fish and Game Code that Require Sustainable Fishery Management" as requested by the Coalition for a Sustainable Delta, et. al."

Summary of Actions to Terminate the Striped Bass Fishery

Background: Striped bass were intentionally introduced into the Delta in 1879 from several East Coast Rivers to create an estuarine sport fishery. They adapted well and became the premier sport fishery of the Bay-Delta estuary including San Francisco Bay and near shore ocean waters. During the 1960's impacts from the State and Federal Water Projects began to noticeably affect their population and that of Central Valley salmon. Over the next 50 years the population of striped bass continued to declined from an estimated 4 million adult fish to less than 300,000. This fishery's decline coincides with the declines of Central Valley salmon, steelhead, sturgeon, delta smelt and the collapse of the estuary's ecosystem and food web. While there a number of factors involved, the impacts of the State and Federal Water Projects are the dominant causative factors in the decline of the estuary's productivity, its collapsed food web and the Central Valley fisheries.

This highly valued sport fishery still manages to be an economic asset to the state by making the Bay-Delta estuary a world-class fishing destination that contributes hundreds of millions of dollars annually to the economy of state. Unlike salmon, steelhead, sturgeon and delta smelt, striped bass are a non-native fish and cannot be listed under the Endangered Species Act to prevent their extinction. However, it is an intentionally introduced fishery that is a significant part of public's natural resources protected under the Fish and Game Code and under the Public Trust

Doctrine of law that contributes hundreds of millions of dollars annually to our economy and is of critical importance to the economy of the Delta.

Litigation: On January 29, 2008, the "Coalition for a Sustainable Delta" and three water districts filed suit in federal court against the California Department of Fish & Game (CDFG) alleging that striped bass fishing regulations resulted in the unlawful "take" of the salmon, steelhead, and delta smelt listed under the Endangered Species Acts in direct violation of Section 10. The California Sportfishing Protection Alliance, the California Striped Bass Assoc., and the Northern California Council of the Federation of Fly Fishers along with the Delta Water Agencies, were granted status as Defendant Interveners in support of the DFG's regulatory authority over the fishery.

The federal court ruled on July 21, 2010 that the plaintiffs' motion for Summary Judgment was denied. The primary basis for the court's decision was that the peer reviewed science on striped bass predation in the Delta found that predation did not impact the population levels on any of the ESA listed species in the estuary. Hence, the current striped bass regulations did not facilitate a population impact on any of the fisheries listed under the ESA according to the best available science. The court rejected every cause of action cited by the plaintiff for this reason and the fact that the "science" they used had not been peer-reviewed to give legitimacy to their litigation.

Settlement Agreement: The plaintiffs and the CDFG entered into a Settlement Agreement that required the CDFG to develop a "Regulatory Proposal" to modify sportfishing regulations that would substantially increase the harvest of striped bass while significantly reducing predation on ESA listed species in the estuary. This was in direct opposition to the court's Summary Judgment ruling and would have caused a further decline to the fishery already on the brink of extinction. This proposal also contravened state law that requires the public's fishery resources to be managed at sustainable levels of abundance. Defendant Interveners strenuously objected to the Settlement Agreement to no avail as the Governor Schwarzenegger had made his decision to support the water districts.

Legislation: While the litigation above was in process, water districts mounted an attack on the striped bass fishery by having Assembly Member Fuller introduce legislation in 2009. Assembly Water, Parks & Wildlife Committee (AWPWC) heard AB 1253 that would terminate the striped bass status as a sport fish and allow an unregulated harvest of the fishery. Given the fishery's 50-year decline, this bill would have destroyed a resource of significant recreational and economic importance to the public, sportfishing business and other economic interests and the State based upon an inaccurate assertion that striped bass predation had an impact on the population level of salmon and other fish listed under the ESA.

Due to the effort mounted by the sportfishing community including the Golden Gate Salmon Association, environmental organizations and the academic community, the bill was "gutted and amended" by the author just prior to its Committee hearing. It was turned into a "study bill" by the author and passed out of the AWPWC. Due to

substantial opposition when it arrived in the Senate Appropriations Committee, the bill was placed on suspense and later gutted and amended to address a totally different issue.

Introduced in 2010, AB 2336 Fuller's bill was heard by the AWPWC. It proposed to do additional studies of striped bass predation in the estuary. It passed the committee after being amended to require a review of all predation impacts in the estuary, instead of just that caused by striped bass. Following additional author amendments not in accordance with those made in the AWPWC, the bill died in the Senate Natural Resources & Water Committee.

Fish & Game Commission: The CDFG's regulatory proposal was heard by the Fish & Game Commission on February 2, 2011 with the Allied Fishing Groups (AFG) taking the lead in opposing the proposal. The CDFG spokesmen, and consultants from the "Coalition for a Sustainable Delta" (aka Water Contractors) spoke in favor of the proposed regulations. Highly summarized, the Allied Fishing Groups presented the counter argument that if the Commission were to adopt the proposed regulations they would be in violation of their fiduciary obligations to hold the public's fish and wildlife resources in trust for the public and insure their proper management.

During the hearing, the Allied Fishing Groups noted that the Commission's policies and statutory responsibilities, including their "Policy on Striped Bass Management", required them to preserve and protect the public's striped bass fishery by ensuring they were managed at sustainable population levels. The proposed regulations clearly did not meet these criteria since the regulations they sought to amend had not prevented the fishery's precipitous decline. Following presentation by the Department and consultants of the "Citizens for a Sustainable Delta, the Commission voted unanimously to reject the proposal.

Predation Workshop*: The California Department of Fish & Wildlife with support from National Marine Fishery Service, the U.S. Fish & Wildlife Service and the Delta Science Program convened the "State of the Science Workshop on Fish Predation on Central Valley Salmonids in the Bay-Delta Watershed" on July 22-23, 2013 at the University of California Davis. The purpose of the Workshop was to have an independent panel of expert national scientists summarize the current state of knowledge on predation of Central Valley salmonids by other fish.

The results of their evaluation were released in September 2013. Highly summarized, the Panel stated that available data did not provide unambiguous and comprehensive estimates of fish predation rates on juvenile salmon or steelhead nor did they demonstrate that population-level impacts to these species were taking place. However, given the extensive impacts by the State and Federal Water Projects to the Delta and its tributaries, the public's fishery resources have suffered dilatory flow modification, significantly altered habitat conditions, temperature and dissolved oxygen limitations, massive fish losses and an overall reduction in historical salmon population size. They could find no credible peer-reviewed scientific studies that demonstrated predation by non-native fish species was an obstacle to the restoration of any of the fisheries listed under the ESA.

Their finding substantiated previous findings by the National Academy of Sciences "Independent Review Panel" and a scientific panel of anadromous fish experts convened by the State Water Resources Control Board that found striped bass predation to be the lowest level stressor in the estuary and one that did not impact the populations of those species listed under the ESA.

* The Science Panel's report from the Predation Workshop can be found at http://deltacouncil.ca.gov/sites/default/files/documents/files/Fish_Predation_Final_Report_9_30_13.pdf

briansak
outdoor communications

August 10, 2016

Eric Sklar, Jacque Hostler-Carmesin, Anthony C. Williams, Russell E. Burns, Peter S. Silva
Commissioners
Fish and Game Commission
1416 Ninth Street
Room 1320
Sacramento, CA 95814

Dear Fish and Game Commission,

This letter is respectfully in opposition to the proposed creel and minimum size limit regulation changes for Black Bass and Striped Bass utilizing the Sacramento-San Joaquin River Delta system (Delta).

Since 1996 I have worked as a freelance outdoor journalist covering mainly California's Largemouth Bass, Smallmouth Bass and Spotted Bass fisheries for magazines that include California Game & Fish, Gary Yamamoto's Inside Line, and Bassmaster. Over the past 25 years I have also been employed as a fishery biologist for a relatively large Bay Area water utility where I have been involved in Salmonid restoration efforts since 1998. My work as a writer has provided me with the opportunity to research the history of bass introductions in the West. And although the projects that I have been a part of as a biologist do not involve the Delta, they are directly related to the predation issue.

While working on an article for the January/February 1996 issue of Bass West magazine entitled *Go West, Young Bass* (see attached) I conducted an extensive literature review of Black Bass introductions in states west of the Rocky Mountains. For California the documentation clearly indicates that Black Bass were brought here (Smallmouth Bass first introduced in 1874 and Largemouth Bass first introduced in 1879) to supplement already severely declining Salmon and Steelhead populations. These native species fisheries were declining due to habitat alterations, water diversions and water pollution, all resulting from the rapid expansion of the state's human populations. Although Striped Bass were first introduced (1879) in efforts to create a new commercial fishery, they too were eventually looked at as filling the role of one of California's premier sport fish. It was the job of state resource agency staff to provide viable angling opportunities for California's residents. Striped Bass and Black Bass were intentionally introduced to meet those obligations. Both met managers' goals then. And both continue to exceed expectations today.

Brian Sak PO Box 1870 Bethel Island CA 94511-1870 bsak@briansak.com (925)963-3291

One of the projects I worked on as a fishery biologist, as part of a National Marine Fisheries Service Biological Opinion requirement, was the evaluation of the impacts that Largemouth Bass were having on an adfluvial *Oncorhynchus mykiss* population. The study looked at predation of juvenile *O. mykiss* migrating downstream from their natal river into a moderately sized reservoir with a relatively large bass population. The benefits of this study, in comparison to similar studies conducted on the Delta, are the relatively small size of watershed and the system's enclosed nature (it was much easier to get a handle on what is happening). The study had two important findings related to the proposed bass regulation changes in the Delta. First, the only location in which bass were found to be consuming *O. mykiss* was the study site at the mouth of the tributary that the juveniles were migrating through. *Oncorhynchus mykiss* were never found in Largemouth Bass stomachs sampled from fish at a control site away from the tributary. Secondly, at the mouth of the tributary in which predation was occurring, the percent occurrence (number of bass stomachs sampled containing *O. mykiss* / total number of bass stomachs sampled) of O. *mykiss* in stomachs was lower than expected (12% in 2004 and 6% in 2005). Invertebrates were the most often-consumed prey types at both the tributary and control sample sites. Although more studies may be warranted, the initial findings indicate that bass likely have little impact on *O. mykiss* recruitment.

In summary, it is understood that the accidental introduction of invasive species can present serious problems to regional ecosystems and native species. It is also understood that the role of the Fish and Game Commission has been expanded to not only serve anglers and hunters in the conservation of fish and game, but to protect all listed native species. In this case, however, Black Bass and Striped Bass were brought here intentionally to serve a purpose as a result of already declining native species populations. And bass continue to serve that purpose in the Delta today as they provide one of the best sport fisheries in not only the state but also the country. It is my opinion that by changing the Black Bass and Striped Bass creel and minimum size limits in the Delta you will be directly contradicting one of your directives and doing a great disservice to California anglers and local communities. It is also my opinion, based on studies that I have worked on and studies conducted by UC Davis, that the negative impact of bass on native fishes is minimal making the proposed changes unnecessary in the first place. The Commission would, in my opinion, be better served by concentrating their efforts on regulation changes and additions addressing habitat restoration and improved flow regimes through better management practices.

Sincerely,

Brian Sak
Fishery Biologist
Freelance Writer and Photographer

Story & Photos by Brian Sak

Go West, Young Bass

Black Bass Manifest Destiny

Wouldn't it be great to gather your boat, rods, reels and bass tackle together, step into a time machine and travel back 150 years to your favorite western waters, to fish for your favorite species of black bass? With all your modern gear that unsuspecting bass have never seen, the fishing would be as you've never experienced before. Unfortunately, you will be casting in vain, because black bass are nowhere to be found west of the Rocky Mountains in 1846.

The black bass you find in the West today originated in the eastern and midwestern United States. Fossils from western states show that relatives of the sun fish family, to which black bass belong, were present here more than 25 million years ago.

However, the creation of mountain ranges and the increasingly dry climate seem to have eliminated them west of the Rockies. The only modern day relative of the black bass native to the West is the Sacramento perch. Through transplanting by man, some type of black bass can now be found in every western state except Alaska.

The reason for introducing black bass to the West can be summed up in a single word—urbanization! As the size of human populations grew in the West, the physical and chemical makeup of freshwater habitats changed.

Dams for power production and drinking water storage were constructed. These dams changed steadily flowing cool- or cold-water rivers and streams into warm-water reservoirs. Dams also blocked upstream and downstream fish migrations.

Mining, logging, agriculture and water diversions changed the drainage bottom types, water clarity and flow patterns. Lakes and ponds were built where none existed before. Industry, agriculture and the human populations themselves began dumping huge quantities of pollutants into the water.

With this surge of human activity, a "multi-use concept" had to be developed for freshwater that would keep everyone satisfied. Environmental managers realized that the freshwaters of the region would have to accommodate the needs of the growing human population, including recreational needs. Recreational activities include fishing, meaning that the waters of the region must support fish populations large enough to keep anglers happy.

The native fish of the West had, and still have, a hard time coping with changes to their environment. Many salmon and steelhead couldn't migrate back to their spawning grounds because of changes in flow patterns and dams blocking their routes. Many of those that did find their way couldn't spawn, because the original gravel bottoms had been silted in.

Fisheries managers needed to find a fish worthy of an angler's time that could survive in this new environment. Black bass offered an attractive opportunity to provide new food and game fishes to the West. Managers knew of the popularity of black bass in the East, but little was known about their biology and whether they would survive out West. In an attempt to increase western fishing opportunities, attempts have been made to transplant four types of black bass.

The California Delta

One of the best black bass fisheries in California and on the West Coast is found in the California Delta system. Dennis Lee, Senior Fishery Biologist with the California Department of Fish and Game, says that "based on a combination of the quality of both catch rates and the average size of the fish, the Delta comes out on top." One hundred years ago there wasn't a black bass to be found anywhere in the system. According to Lee, largemouth bass were introduced into the Delta "probably after the turn of the century."

The southward flowing Sacramento River and the northward flowing San Joaquin River come together in America's fourth largest metropolitan region, the San Francisco Bay Area. These two river systems combine to drain almost half of California's freshwater runoff. The meeting of the river flow with the seawater from the Pacific ocean through the San Francisco Bay create the West Coast's largest estuary (where freshwater meets seawater). The San Francisco Bay Estuary is a prime example of the impact that people can have on their environment.

Since the Spanish discovered the Bay Area in 1769, a variety of human activities have completely altered the size and shape of the San Francisco Bay Estuary. Much of the Estuary was filled or drained to produce farmland. A series of canals, dams and reservoirs were constructed which created the world's largest manmade water system, providing water for drinking and irrigation throughout the state. The Estuary's channels were deepened by dredging to accommodate boat traffic. In an effort to allow the regions population to engage in a variety of activities including fishing, recreation, agriculture, shipping and commerce, these alterations created the California Delta as it exists today.

The California Delta is made up of 57 islands and more than 1,100 miles of levees. The western end of the once steadily flowing river system is now a maze of 700 miles of winding rivers, sloughs and channels, with flow rates far below historic levels. Due to the sharp increase in human activities, water pollution levels also increased dramatically in the Delta.

The development of the California Delta system proved devastating for the native gamefish populations. In an attempt to increase fishing opportunities in the Delta, largemouth bass were introduced into the system in the early 1900's. The relatively slow moving water, miles upon miles of rip-rap covered levees, and abundant tule beds provide an ideal habitat for these immigrants from the East. The California Delta system is so suited to non-native largemouth bass that it has become one of the top largemouth fisheries in the West.

Superior Smallmouth

Pound for pound, smallmouth bass were considered superior sportfish compared to largemouth bass in the 1800's. Even though smallmouth have greater restrictive habitat requirements, they were the first bass transplanted in the West due to its tenacity.

The first shipment of smallmouth bass came from Lake Champlain in Vermont and the St. Joseph River in Michigan in 1874. These fish were distributed to the Napa River and Alameda Creek in California. The offspring of these fish were then spread throughout the central and northern parts of the state. Eventually

smallmouth were also transferred to Southern California.

In 1888, the Carson City region was the first area planted with smallmouth bass in Nevada. Fish were placed in the Carson River, Washoe Lake, and several private ponds. Additional smallmouth were planted in Stone Cabin in Nye County in 1911. Contrary to reports, smallmouth bass were never stocked in Lake Mead. There was a report of an angler catching a smallmouth from Mead in 1942, but fisheries biologists didn't see the fish, and its existence was not confirmed.

Smallmouth bass were not distributed to the remaining western states until the early 1900's. Smallmouth were planted in the American and Gravelly Lakes in Washington in 1904. In 1905, Muldoon Lake in Idaho received a shipment of smallmouth bass. Both Oregon and Utah first transplanted smallmouth in 1912. Fish were placed in Carleton Lake in Oregon and Utah Lake in Utah. An attempt to establish smallmouth bass in New Mexico took place at Throttle Pond in 1913. Smallmouth bass were introduced to Arizona in the early 1940's, probably 1941, but the location of the original plantings is unknown.

Because of the restrictive habitat requirements of smallmouth bass and lack of

Black Bass, though not native to the western United States were planted in late 19th and early 20th centuries. Interestingly, all four varieties were introduced first in California:

Smallmouth

Largemouth

Spotted &

Redeye

knowledge about their biology, transplantings were not always successful. The distribution of smallmouths today is limited to those waters with suitable habitat for the bass not only to survive but to successfully reproduce.

LARGEMOUTH BASS DOMINATE

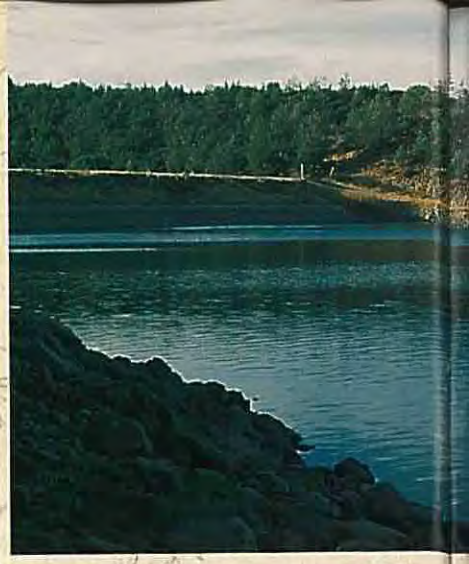
Because of the high tolerance of largemouth to a variety of water conditions, attempts were soon begun again, and all western states were stocked with largemouth prior to 1900.

Largemouth bass first arrived in the West in 1879, when 22 fish were planted in Crystal Springs Reservoir in California. There was a report of a sportsmen's club placing a few largemouth in Lake Temescal shortly before this, but the exact time is uncertain. In 1891, additional largemouth bass were brought from Quincy Illinois and stocked in Lake Cuyamaca and the Feather River. Offspring of the Crystal Springs Reservoir bass were distributed widely over the state.

The next western states to receive largemouth bass were Idaho and Oregon. A private group of anglers supplied the first batch of largemouth to Idaho in 1887, when they stocked several private ponds in the Boise region. Another private group of anglers brought largemouth to Oregon in 1888 and placed them in Willamette Reservoir.

Utah and Washington first planted largemouth bass in 1890. Utah received a mixed carload of largemouth bass, sunfish, crappie and perch from the Illinois River. One quarter of these fishes were stocked in the Weber River at Ogden and the rest were placed in Utah Lake. The first largemouth to reach Washington were stocked in Lake Colville and Loon Lake. Additional largemouth bass were widely introduced to several Washington Lakes between 1890 and 1895.

New Mexico was supplied with largemouth bass in 1891



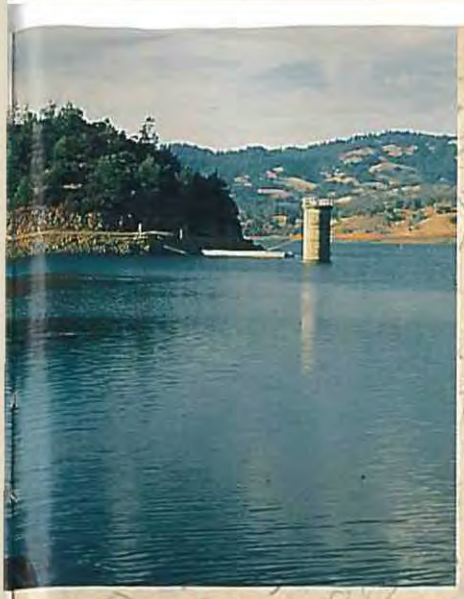
and Arizona was supplied the following year. Several private ponds in the Rio Grande area of New Mexico were stocked with these first bass. In Arizona, the bass were distributed to reservoirs, lakes, ponds and the slower downstream portions of larger streams throughout the state.

The records of when largemouth bass were first distributed to Nevada are incomplete. Prior to 1900, the Fish Commission reports didn't differentiate between largemouth and smallmouth bass. The first reliable records postdate 1900 but the location of the transplants is unknown. Biologists have good reason to believe that largemouth were brought into Nevada long before 1900. Largemouth bass were well established in several ponds in the Reno area by 1909.

Because largemouth bass are highly adaptable to a variety of environmental conditions, their transplants were much more successful than smallmouth bass. Today, the distribution of largemouth in the West is widespread. They are found in just about every suitable warmwater reservoir, lake, and pond, in addition to many slow moving rivers, streams, sloughs and channels.

SPOTTED BASS FILL A GAP

As smallmouth bass have relatively restrictive habitat requirements and largemouth bass are highly adaptable, spotted bass fall somewhere in between. Records indicate that spotted bass



were not introduced into the West until almost the mid 1900's. Introductions may have unknowingly occurred at an earlier date because until 1927 fisheries biologists didn't consider spotted bass and largemouth bass different fish. Spotted bass were ultimately brought to the West to occupy foothill river habitat that fell between that preferred by smallmouth and largemouth.

Spotted bass were not distributed widely in comparison to smallmouth and largemouth bass. The relatively small size and slower growth rate of spotted bass led fisheries managers to show little interest in them. Only fishery managers in California, Arizona and New Mexico requested shipments of spots.

The first batch of spotted bass reached the West in 1933. Several northern spotted bass were flown into California from Ohio and retained at the Central Valley's State Fish Hatchery. Spotted bass produced at the hatchery were stocked in several foothill streams of the Sacramento and San Joaquin valleys. Fish were also planted in several lakes and ponds. In 1973 Alabama spotted bass were brought into California and planted in Perris Reservoir.

Spotted bass were transplanted into the Verde River system of Arizona in 1942. The dispersal of fish was very low in the Verde system for unknown reasons. The exact year that spotted bass were brought to New Mexico is unclear. Sometime prior to 1957, fish were stocked in the lower Pecos River near Carlsbad, New Mexico.

Rare redeye bass

Redeye bass have the most restrictive habitat requirements of all the basses. This, along with its relatively small size, has attracted very little attention from fishery managers. This is unfortunate, because although redeye are smaller than other basses, their tenacity as fighters is great, and they would provide formidable opponents where other bass are scarce.

The only state to receive redeye bass has been California. Fishery managers requested them because the many small foothill streams of the Sierra Nevada resemble the redeye's native habitat. In 1953, 39 redeye bass were brought to the Central Valley Hatchery; however, none survived past 1955. Approximately 3,000 fish from Georgia and Tennessee were transplanted in Alder Creek, the Stanislaus River and the Sisquoc River in 1962. A few other rivers were planted with redeye bass in 1964 and 1965.

Final results

A major objective of early western fishery managers, to provide a quality sportfish to waters altered by human activities, has been met remarkably well by black bass. Although not all of the introductions of bass were successful, the range of habitats that smallmouth, largemouth, spotted and redeye bass occupy make most freshwaters inhabitable by a least one type of black bass. The wide success of the black bass in the West has made them the number-one warmwater gamefish in most western states. Many people look at urbanization as a detriment to the environment. Bass anglers can look at urbanization and be thankful that it allowed our favorite basses to move west.

August 11, 2016

Mr. Eric Sklar
President, California Fish and Game Commission
1416 Ninth Street, Suite 1320
Sacramento, CA 95814

Dear President Sklar and Commissioners:

Our organizations, representing millions of sportsmen and women nationwide including tens of thousands in California, are writing to express our opposition to petition #2016-011 submitted by the Coalition for a Sustainable Delta and other water and agriculture interests. The petition proposes to decrease size limits and increase bag limits on striped bass and black bass fishing. Such action is a scientifically unjustified attempt to reduce gamefish populations and divert attention from practicable solutions to salmon recovery. This would negatively impact the robust, lucrative fishery that striped, smallmouth, and largemouth bass provide in California. It also fails to account for the recreational, conservation, and economic benefits the state and public derive from flourishing bass fisheries. We respectfully request that the Commission not further consider the petition.

No Science Supports Reducing Bass Populations to Benefit Salmon
First, this proposal is refuted by science. Peter Moyle, Ph.D. of the Davis campus of the University of California and scientists at the National Oceanic and Atmospheric Administration's Southwest Fisheries Science Center have conducted ecological research on predation in the San Joaquin River and greater Delta and concluded a predator removal program is not an effective means of restoring salmon[1][2].

Striped bass and black bass are well-established in the Central Valley aquatic ecosystem and have co-existed with salmon for over a century. These bass were part of California long before

[1] Peter Moyle, Ph.D., University of California Davis Center for Watershed Sciences, "Striped bass control: cure worse than disease?" January 31, 2011
[2] Demetras, Nicholas J., et al. "Development of underwater recorders to quantify predation of juvenile Chinook salmon (Oncorhynchus tshawytscha) in a river environment." Fishery Bulletin 114.2 (2016).

their waters were diverted for the commercial production of almonds, cotton, and pomegranates. Over time, the once abundant salmon fishery has become a shadow of its former self primarily because 65 million acres of historic wetlands and flood plains have been altered. Now the channelized river system has disadvantaged juvenile salmon to the point where something as minor as a diversion dam can leave them vulnerable to a multitude of ecological stressors[3].

No scientific evidence demonstrates a strong correlation between bass diets and salmon survival. Salmon smolts are a small portion of the striped bass diet, which includes crayfish, other fish like pike minnow, and in some cases each other. Moreover, bass are not the most voracious aquatic predator in the Central Valley. If regulations called for by the petition were successful at lowering bass numbers, other predators, including channel catfish and white catfish, which are also preyed upon by striped bass, would fill the niche left by striped bass. According to the National Marine Fisheries Service, bass likely have a stabilizing influence in the Delta and provide a net positive benefit.

Most importantly, predation is natural and is particularly difficult to confront without affecting other parts of the complex ecosystem. As Dr. Moyle wrote in May 2016[4], "Many predators forage opportunistically on whatever prey species are most abundant and accessible at any time and place. As a result, predator control can have unintended consequences." Predation, no matter the degree to which it influences other fish, or whether the predators are native or non-native, is a consequence of graver and more pressing matters afflicting the state: water conservation and management practices.

Attention is Being Misdirected Away from Productive, Cost-Effective Solutions

We understand that this petition is aimed at reducing the potential effects of predatory species and competitors on native species. More than any other stakeholder group, anglers are acutely concerned with reviving California's salmon populations, which entails making policy and regulatory changes. Due to drought, the little water that is available to salmon migrating through the Delta and down the Sacramento River is shallow and too warm. It has been shown that in wetter years when more water is kept in the Delta, more juvenile salmon survive the migration out to the ocean[5]. Efforts and resources must be concentrated on careful management of water storage and pumping operations and on improving habitat, not killing off sport fish.

Additionally, we support the state and federal environmental laws in place to protect threatened runs of salmon, and if the intent of water and agricultural interests is to safeguard dwindling salmon runs, we would expect these user groups to comply with the water pumping

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[3] Sean Hayes, Ph.D., National Marine Fisheries Service, Southwest Fisheries Science Center, Informational update to State Water Resources Control Board, April 19, 2016

[4] Peter Moyle, Ph.D., University of California Davis Center for Watershed Sciences, "Understanding predation impacts on Delta native fishes" May 22, 2016

[5] Sabal, Megan, et al. "Habitat Alterations and a Nonnative Predator, the Striped Bass, Increase Native Chinook Salmon Mortality in the Central Valley, California." North American Journal of Fisheries Management 36.2 (2016): 309-320.

restrictions in place. Because of their repeated lobbying for permitting more pumping, surely they are grasping for ulterior answers and striped bass and black bass are being unfairly incriminated for the demise of salmon.

Cutting into the Bass Fishery Would Cause a Significant Socio-Economic Loss to the State
Attempts to "fish down" bass species completely ignore the substantial economic and conservation benefits provided by these game fish. Just as farmers and California residents have seen the drought deteriorate the landscape and affect their livelihoods over the past few years, the fishing industry has suffered immensely too. Recreational fishermen along the coast are in dire straits because just one of the four historic runs of Chinook salmon is viable and permissible to fishing. In addition to the impact on the industry, it is obvious from the popularity of bass fishing that the public wants these resources kept intact for their recreational value.

Each year, over 1.7 million people fish recreationally in California, generating $4.6 billion in economic activity and accounting for nearly 36,000 California jobs, in addition to generating approximately $334 million in state and local tax revenues[6]. Bass species are no small part in this equation, as up to 51 percent of freshwater fishing is for striped and black bass[7]. Threatening the long-term viability of species anglers enjoy pursuing would result in reduced angling participation and significant losses in all of the areas mentioned above. In addition to these direct economic impacts, reductions in angler participation and opportunities pose a threat to state fisheries management, as the State of California relies on both fishing license fees and excise taxes collected from the sale of fishing tackle and motorboat fuel to help fund state fisheries management carried out by state fish and wildlife department. In 2014 alone, sales of fishing licenses and tags generated nearly $65 million[8] in revenue for the state's natural resource management efforts, while excise taxes on fishing tackle and motorboat fuel accounted for an additional $17 million[9], all of which is funneled back into conservation.

There are Creative Alternatives to Recover and Protect Salmon
The human-altered landscape and environmental conditions have led to high predation rates in certain "hot spots." As previously described, some sections of the river would remain concentrated with predators even if bass numbers were reduced, in which case predator-prey dynamics would still be at a peak in those areas. A more sound approach is a strategic control program that targets known focal areas by reengineering habitat features and causing predators to disperse while giving salmon opportunities to seek refuge and bypass predators.

A great deal of time has been devoted to developing projects to reverse habitat loss and mitigate predation hot spots. They vary in scope and complexity, but some creative alternatives

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[6] Southwick Associates. Sportfishing in America: An Economic Force for Conservation. Produced for the American Sportfishing Association (ASA) under a U.S. Fish and Wildlife Service (USFWS) Sport Fish Restoration grant (F12AP00137, VA M-26-R) awarded by the Association of Fish and Wildlife Agencies (AFWA), 2012.
[7] U.S. Fish and Wildlife Service, 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation
[8] U.S. Fish and Wildlife Service, 2015 National Fishing License Report
[9] U.S. Fish and Wildlife Service, Sport Fish Restoration Program

have been implemented already with great success. Going forward, we encourage that salmon recovery projects be implemented in a manner consistent with scientific understanding of what will have the most positive impact on salmon while minimizing adverse effects on sport fish and the ecosystem. Upon request, it would be our pleasure to provide complete details on those projects to you.

In sum, we are troubled that the petition (#2016-011) and agenda item to be discussed at your August 24-25 meeting is a distraction from tackling longer term, albeit challenging, tasks related to fish habitat and water management. We again urge you not to consider this matter any further or to refer it to the California Department of Fish and Wildlife.

Please let us know if you would like additional information. Thank you for your consideration.

Scott Gudes
Vice President of Government Affairs
American Sportfishing Association

Gene Gilliland
Conservation Director
B.A.S.S

Marko Mlikotin
Executive Director
California Sportfishing League

Bill Shedd
Chairman
Coastal Conservation Association-California

Dan Wolford
President
Coastside Fishing Club

Andy Treharne
Western States Director
Congressional Sportsmen's Foundation

Kathy Fennel
President of Operations Division
Fishing League Worldwide

David Dickerson
Vice President of State Government Relations
National Marine Manufacturers Association

Richard Pool
President
Water4Fish

Morton and Associates
Manufacturers Representatives

American Sportfishing Association

The Fish Sniffer

Water4Fish.org

Pro-Troll

California Sportsmen
Saturdays 6-8AM
Sports Rite

FLW

Ultimate Bass

Vance's Tackle Co

Calif. Striped Bass Assoc.

Johnson's Bait
Tackle & Fly Shop

Allied Fishing Groups

California Delta Chambers & Visitors Bureau

Golden Gate Fishermen's Association
GGFA

Bass Conservation

NorCal

Big Rock Sports

Tackle Warehouse

Shimano

AFTCD

NorCal.FishReports.com

San Francisco Crab Boat Owners Association

Fred Hall Shows

okuma
Inspired Fishing

International Sportsmen's Expos

Subject – A new and better proposal for The California Fish and Game Commission to consider in its deliberations on the petition to change size and bag limits of striped bass and black bass. Petition #2016-011. Submitted by the coalition of the Striped Bass Industry, the Black Bass Industry and the Salmon Industry.

August 10, 2016

Mr. Eric Sklar
President California Fish and Game Commission
1416 Ninth Street Suite 1320
Sacramento, CA 95814

Dear President Sklar and Commissioners:
In accordance with the Commission procedures, we submit this public comment letter in regards to the Commission's striped bass agenda and petition #2016-011.

Those organizations signing this letter request that the Commission consider an alternate and more effective salmon recovery plan to help restore the Central Valley salmon populations and to eliminate unnatural predation "hotspots". The plan is titled "Fifty Three Non-Lethal Central Valley Predation Control Projects". A copy of that plan is attached to this letter.

For decades, salmon, striped bass and black bass successfully co-existed in this watershed. Yet, the continuing deterioration of juvenile salmon survival is now a major issue and must be dealt with. The root cause of this crisis is due to the way the Central Valley water delivery system was developed and is now operated. When juvenile salmon emerge from the gravel as fry they can barely swim. As they grow and begin their downstream migration they must find food and places to hide or they soon become weakened and subject to unnatural predation.

Traditionally, as the rivers meandered they created broad areas of shallow grassy floodplain zones where the juvenile salmon could hide and feed. Most of these areas are now gone. Much of the Sacramento River has been rip rapped and channelized into a narrow water delivery canal. The habitat that is needed is gone and the weakened juvenile salmon cannot avoid the unnatural predation. Another part of the problem occurs in the Delta where the juveniles are

pulled out of their migration corridors into the southern Delta where they are subject to entrainment and massive predation losses at the State and Federal pumping plants.

The current proposal before the Commission blames the predators for the estuary's massive fishery declines and seeks to further reduce their populations. We do not think that is the answer. The overwhelming majority of scientists studying the Bay-Delta and its Central Valley tributaries classify unnatural predation at hotspots as the result of the problems with habitat and the water delivery system and it is not the fundamental cause of the salmon fishery's decline.

We believe there is a better way to help salmon and other listed species in the estuary. It is embodied in the alternate plan that the coalition is proposing for your consideration. The plan was developed by the Golden Gate Salmon Association and has two elements. It first reconfigures much of the upper Sacramento River by re-opening many side channels and shallow areas where the out migrating juvenile salmon can safely rear and feed. Thirteen of these sites have been identified and in some cases all that is needed is to remove gravel that has been blocking the access to the habitat.

The second part of the plan deals with hotspots where water flows and the design of water project facilities concentrate the juvenile salmon in areas where they become easy prey. At many of these sites engineering solutions need to be implemented to provide salmon places to hide or to remove the places where predators can congregate. The attached plan details more than thirty of these sites.

In summary the advantages of the coalition's plan are:

- The plan does not kill any Central Valley gamefish species. Neither does it attempt to reduce the natural populations of striped bass and black bass. Its strategy is based on improving the upriver habitat for juvenile salmon and physically separating the juvenile salmon from the predators at hotspot locations. The plan targets fifty-three known locations where engineering solutions can reduce predation and improve salmon survival.
- Six of our projects have been accepted by the CVPIA wild salmon rebuilding program run by the U.S. Fish and Wildlife Service and the Bureau of Reclamation. They are being funded for implementation in 2017. This is a good start.
- Fifty-one of the projects provide direct assistance to the ESA listed winter-run salmon. This run is near extinction and these projects are critical to improve the winter-run survival. These same fifty-one projects also help the listed Sacramento steelhead.
- In May of 2016, Dr. Peter Moyle and the UC Davis Center for Watershed Sciences released a paper with its recommendations on what to do and what not to do to reduce predation on the juvenile salmon. The stakeholders' program aligns closely with those recommendations. The conclusion of the watershed paper says, *"It seems unlikely that a large scale predator removal program focused on striped bass would have a sustainable, measurable effect on populations of its prey species, specifically protected smelts and salmon …. programs aimed at direct striped bass control are as likely to have no or negative effects, as to have positive effects, on populations of desirable fishes."*

• The plan is in compliance with scientific studies on new rearing sites and the locations of hotspots as well as how the salmon and the predators can be separated. Most of the projects were developed by the Salmon Rebuilding Task Force which completed its work in 2012. The science for that project was provided by the Natural Resource Scientists consulting group. All three of the fishery agencies assigned senior scientists to the project to provide technical support.

Those organizations supporting this letter respectfully recommend that the Commission not approve the bag and size limit regulations. Instead, we urge acceptance of this far more positive approach. We encourage the Commission to endorse our proposal by requesting that the California Department of Fish and Wildlife and the other fish and water agencies aggressively move forward with the elements outlined in this stakeholder coalition sponsored fisheries management and salmon recovery plan to address unnatural predation and hot spots.

Yours Truly,
The Stakeholders Coalition

For the Salmon Industry
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For the Bass Industry
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925-684-9904
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Attachment: The list of supporters of this letter.
Link to Bass Industry Video Statement:
https://www.youtube.com/watch?v=6zCTgZI_Tgc&list=PLtpmQrPagWagPSdLGL5F28BSAV40iBPfd

Opponents of the Reg Change Plan and Supporters of the Coalition's Plan

Intro	Name	Title	Organization	City
Mr.	Aaron Bate	Fisherman	Striper, Bass Salmon Supporter	Diamond Springs
Mr.	Aaron Munoz	Fisherman	Striper, Bass Salmon Supporter	Valley Springs
Mr.	Aaron Zanocco	Fisherman	Striper, Bass Salmon Supporter	Yuba City
Mr.	Adam Andreini	Fisherman	Striper, Bass Salmon Supporter	Orland
Mr.	Adam Coca	Fisherman	Striper, Bass Salmon Supporter	Pinole
Mr.	Adam Smith	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Adrian Rodriquez	Fisherman	Striper, Bass Salmon Supporter	Manteca
Mr.	Adrian Saechao	Fisherman	Striper, Bass Salmon Supporter	Oakland
Mr.	Adrienne Burris	Fisherman	Striper, Bass Salmon Supporter	Napa
Mr.	Aimee Russell	Fisherman	Striper, Bass Salmon Supporter	Elk Grove
Mr.	Al Kalin	Fisherman	Striper, Bass Salmon Supporter	Westmorland
Mr.	Alan Anderson	Fisherman	Striper, Bass Salmon Supporter	Folsom
Mr.	Alan Kabert	Fisherman	Striper, Bass Salmon Supporter	Gilroy
Mr.	Alan Keller	Fisherman	Striper, Bass Salmon Supporter	Oakland
Mr.	Alan Lewis	Fisherman	Striper, Bass Salmon Supporter	Los Gatos
Mr.	Alan Pong	Fisherman	Striper, Bass Salmon Supporter	Half Moon Bay
Mr.	Alan Rea	Fisherman	Striper, Bass Salmon Supporter	Marysville
Mr.	Alan Voigt	Fisherman	Striper, Bass Salmon Supporter	San Anselmo
Mr.	Alan Wise	Fisherman	Striper, Bass Salmon Supporter	Fairfield
Mr.	Albert Berends	Fisherman	Striper, Bass Salmon Supporter	Granite Bay
Mr.	Albert Kung	Fisherman	Striper, Bass Salmon Supporter	Oakland
Mr.	Albert Reveles	Fisherman	Striper, Bass Salmon Supporter	Riverbank
Mr.	Alex Contreras	Fisherman	Striper, Bass Salmon Supporter	Modesto
Mr.	Alexander Smith	Fisherman	Striper, Bass Salmon Supporter	Stockton
Mr.	Alfonso Ferrel	Fisherman	Striper, Bass Salmon Supporter	Santa Rosa
Ms.	Alicia Velasquez	Fisherman	Striper, Bass Salmon Supporter	Lockeford
Mr.	Alireza Poursafar	Fisherman	Striper, Bass Salmon Supporter	San Francisco
Mr.	Alixandra Tageson	Fisherman	Striper, Bass Salmon Supporter	Clayton
Capt.	Allen Chin	Owner	Tigerfish Charters	Emeryville
Mr.	Allen S Lydon	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	Allen Wetzel	Fisherman	Striper, Bass Salmon Supporter	Santa Cruz
Ms.	Allison Costa	Fisherman	Striper, Bass Salmon Supporter	Fresno
Ms.	Alma Ah Mu	Fisherman	Striper, Bass Salmon Supporter	Cool
Ms.	Alyce Love	Fisherman	Striper, Bass Salmon Supporter	San Lorenzo
Ms.	Amalia Gauci	Fisherman	Striper, Bass Salmon Supporter	Pittsburg
Mr.	Amando Ahumada	Fisherman	Striper, Bass Salmon Supporter	San Leandro
Mr.	Andrew Bowen	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Andrew Clemons	Fisherman	Striper, Bass Salmon Supporter	Gale
Mr.	Andrew Mathias	Fisherman	Striper, Bass Salmon Supporter	Oakley
Mr.	Andrew Mercado	Fisherman	Striper, Bass Salmon Supporter	Greenbrae
Mr.	Andrew Rau	Fisherman	Striper, Bass Salmon Supporter	Stockton
Mr.	Andrew Simmons	Fisherman	Striper, Bass Salmon Supporter	Martnez
Mr.	Andy Farro	Fisherman	Striper, Bass Salmon Supporter	Discovery Bay
Mr.	Andy Ngo	Fisherman	Striper, Bass Salmon Supporter	Roseville
Ms.	Angel Quiroz	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Ms.	Angela Amaral	Fisherman	Striper, Bass Salmon Supporter	Clearlake
Ms.	Ann Dum	Fisherman	Striper, Bass Salmon Supporter	Brentwood
Ms.	Ann Lammon	Fisherman	Striper, Bass Salmon Supporter	Vallejo

Opponents of the Reg Change Plan and Supporters of the Coalition's Plan

Intro	Name	Title	Organization	City
Ms.	Ann Mendoza	Fisherman	Striper, Bass Salmon Supporter	Cameron Park
Ms.	Anna Jones	Fisherman	Striper, Bass Salmon Supporter	Modesto
Ms.	Anna Nolen	Fisherman	Striper, Bass Salmon Supporter	Bakersfield
Mr.	Anoop Sagar	Fisherman	Striper, Bass Salmon Supporter	Elk Grove
Mr.	Anthony Berry	Fisherman	Striper, Bass Salmon Supporter	Dixon
Mr.	Anthony Bush	Fisherman	Striper, Bass Salmon Supporter	Fair Oaks
Mr.	Anthony Wong	Fisherman	Striper, Bass Salmon Supporter	Vacaville
Mr.	Anthony Zabala	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	Antonio Ascaso	Fisherman	Striper, Bass Salmon Supporter	Modesto
Mr.	Anyouson Heu	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Arick Biggs	Fisherman	Striper, Bass Salmon Supporter	Reno
Ms.	Arlene Trompczynski	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Armando Diaz	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	Arturo Bermudez	Fisherman	Striper, Bass Salmon Supporter	Fremont
Mr.	Asiel Van Cleave	Fisherman	Striper, Bass Salmon Supporter	Newark
Mr.	Atom Vaughn	Fisherman	Striper, Bass Salmon Supporter	Roseville
Mr.	Austen Schmalz	Fisherman	Striper, Bass Salmon Supporter	San Carlos
Ms.	Barbara Haddad	Fisherman	Striper, Bass Salmon Supporter	Salem
Ms.	Barbara Mcclure	Fisherman	Striper, Bass Salmon Supporter	Novato
Ms.	Barbara Nolan	Fisherman	Striper, Bass Salmon Supporter	San Carlos
Ms.	Barbie Baio	Fisherman	Striper, Bass Salmon Supporter	Auburn
Mr.	Barrett Jensen	Fisherman	Striper, Bass Salmon Supporter	Elk Grove
Mr.	Barry Leamon	Fisherman	Striper, Bass Salmon Supporter	West Sacramento
Mr.	Bart Hall	Producer	Fred Hall Shows	Long Beach
Mr.	Beau Bettencourt	Fisherman	Striper, Bass Salmon Supporter	Hanford
Mr.	Ben Mechling	Fisherman	Striper, Bass Salmon Supporter	Martinez
Mr.	Benito Lucero	Fisherman	Striper, Bass Salmon Supporter	Srockton
Mr.	Benjamin Kronick	Fisherman	Striper, Bass Salmon Supporter	Walnut Creek
Capt.	Benji Shake	Owner	Monterey Sportfishing Center	Monterey
Capt.	Benji Shake	Owner	Princess Charters	Monterey
Mr.	Benny Oates	Fisherman	Striper, Bass Salmon Supporter	Turlock
Mr.	Beth Holmea	Fisherman	Striper, Bass Salmon Supporter	Janesvikke
Mr.	Biff Renkert	Fisherman	Striper, Bass Salmon Supporter	Citrus Heights
Mr.	Bill Fall	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	Bill Fraser	Fisherman	Striper, Bass Salmon Supporter	Fairfield
Mr.	Bill Jennings	President	Calif. Sportfishing Protection Allance	Stockton
Mr.	Bill Sartain	Fisherman	Striper, Bass Salmon Supporter	Dixon
Mr.	Bill Shedd	President	AFTCO	Costa Mesa
Mr.	Bill Simmons	Fisherman	Striper, Bass Salmon Supporter	Marysville
Mr'	Bill Wells	President	Delta Chamber of Commerce	Rio Vista
Mr.	Bill Woodard	Fisherman	Striper, Bass Salmon Supporter	Stevenson Ranch
Mr.	Billy Davis	Fisherman	Striper, Bass Salmon Supporter	Oakley
Mr.	Binh Phi	Fisherman	Striper, Bass Salmon Supporter	Milpitas
Mr.	Blaine Craig	Fisherman	Striper, Bass Salmon Supporter	Bakersfield
Mr.	Bob Boucke	Owner	Johnson's Bait and Tackle	Yuba City
Mr.	Bob Conner	Fisherman	Striper, Bass Salmon Supporter	Pleasant Hill
Capt.	Bob Ingles	Owner	Queen Of Hearts Charters	Half Moon Bay
Mr.	Bob Miller	Fisherman	Striper, Bass Salmon Supporter	Santa Rosa

Opponents of the Reg Change Plan and Supporters of the Coalition's Plan

Intro	Name	Title	Organization	City
Mr.	Bob Perry	Fisherman	Striper, Bass Salmon Supporter	Vacaville
Mr.	Bob Santora	Fisherman	Striper, Bass Salmon Supporter	Stockton
Capt.	Bob Sparre	Owner	Bob Sparre's Guide Service	Fair Oaks
Mr.	Bob Wigham	Fisherman	Striper, Bass Salmon Supporter	Redding
Mr.	Bobby Barrack	Owner	Bobby Barrack Fishing Guide Service	Oakley
Mr.	Bobby Sheets	Fisherman	Striper, Bass Salmon Supporter	Fresno
Ms.	Bonnie Sullivan	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Brad Gamble	Fisherman	Striper, Bass Salmon Supporter	Santa Rosa
Mr.	Brad Maness	Fisherman	Striper, Bass Salmon Supporter	Anderson
Mr.	Bradley Lua	Fisherman	Striper, Bass Salmon Supporter	Clayton
Mr.	Brandon Bugge	Fisherman	Striper, Bass Salmon Supporter	Santa Rosa
Mr.	Brandon Peebles	Fisherman	Striper, Bass Salmon Supporter	Livermore
Mr.	Brandon Rose	Fisherman	Striper, Bass Salmon Supporter	Mountain House
Mr.	Brandon Zine	Fisherman	Striper, Bass Salmon Supporter	Elverta
Mr.	Brant Douglas	Fisherman	Striper, Bass Salmon Supporter	Redding
Mr.	Breana Nolen	Fisherman	Striper, Bass Salmon Supporter	Visalia
Mr.	Breanna De Mello	Fisherman	Striper, Bass Salmon Supporter	Applegate
Mr.	Brennen Newland	Fisherman	Striper, Bass Salmon Supporter	Woodbridge
Mr.	Brent Homan	Fisherman	Striper, Bass Salmon Supporter	Temple
Mr.	Brent Rusert	Fisherman	Striper, Bass Salmon Supporter	Fort Bragg
Mr.	Bret Phillips	Fisherman	Striper, Bass Salmon Supporter	Fresno
Mr.	Bret Stringfellow	Fisherman	Striper, Bass Salmon Supporter	Ripon
Mr.	Brett Chamberlain	Fisherman	Striper, Bass Salmon Supporter	Stockton
Mr.	Brett Lawson	Fisherman	Striper, Bass Salmon Supporter	Millbrae
Mr.	Brian Day	Fisherman	Striper, Bass Salmon Supporter	Rancho Santa Margarita
Mr.	Brian Donnalley	Fisherman	Striper, Bass Salmon Supporter	Rancho Murieta
Mr.	Brian Flaherty	Fisherman	Striper, Bass Salmon Supporter	Rio Vista
Mr.	Brian Fuentes	Fisherman	Striper, Bass Salmon Supporter	Cameron Park
Mr.	Brian Gangler	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Brian Joergensen	Fisherman	Striper, Bass Salmon Supporter	Livermore
Mr.	Brian Kesler	Fisherman	Striper, Bass Salmon Supporter	Antelope
Mr.	Brian Layng	Owner	International Sportsmens' Expos	Vancouver WA
Mr.	Brian North	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Brian Okamoto	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	Brian Peterson	Fisherman	Striper, Bass Salmon Supporter	Elk Grove
Mr.	Brian Popek	Fisherman	Striper, Bass Salmon Supporter	Aptos
Mr.	Brian Rossi	Fisherman	Striper, Bass Salmon Supporter	Santa Cruz
Mr.	Brian Sasaki	Fisherman	Striper, Bass Salmon Supporter	Reedley
Mr.	Brian Schuler	Fisherman	Striper, Bass Salmon Supporter	New Orleans
Mr.	Brian Stompe	Fisherman	Striper, Bass Salmon Supporter	Novato
Mr.	Brian Wagner	Fisherman	Striper, Bass Salmon Supporter	Roseville
Mr.	Brielle Duncan	Fisherman	Striper, Bass Salmon Supporter	San Juan Bautista
Mr.	Brigham Vang	Fisherman	Striper, Bass Salmon Supporter	Fresno
Mr.	Bruno Cates	Fisherman	Striper, Bass Salmon Supporter	Hayfield
Mr.	Bryan Buterbaugh	Fisherman	Striper, Bass Salmon Supporter	Manteca
Mr.	Bryan Church	Fisherman	Striper, Bass Salmon Supporter	Belmont
Mr.	Bryan Francis	Fisherman	Striper, Bass Salmon Supporter	Modesto
Mr.	Bryan Lange	Fisherman	Striper, Bass Salmon Supporter	Citrus Heights

Opponents of the Reg Change Plan and Supporters of the Coalition's Plan

Intro	Name	Title	Organization	City
Mr.	Bryan Lindsey	Fisherman	Striper, Bass Salmon Supporter	Tehachapi
Mr.	Bryant Smith	Fisherman	Striper, Bass Salmon Supporter	Castro Valley
Mr.	Bryce Nickel	Fisherman	Striper, Bass Salmon Supporter	Suisun City
Mr.	Bryon Ruelas	Fisherman	Striper, Bass Salmon Supporter	Oakland
Mr.	Cal Kellogg	Fisherman	Striper, Bass Salmon Supporter	Foresthill
Mr.	Cameron Beck	Fisherman	Striper, Bass Salmon Supporter	Fair Oaks
Mr.	Cameron Clay	Fisherman	Striper, Bass Salmon Supporter	Modesto
Mr.	Cameron Jackson	Fisherman	Striper, Bass Salmon Supporter	Stockton
Mr.	Canada Sythong	Fisherman	Striper, Bass Salmon Supporter	Sac
Ms.	Candy Kelp	Fisherman	Striper, Bass Salmon Supporter	Isleton
Mr.	Carl Wakeland	Fisherman	Striper, Bass Salmon Supporter	Scotts Valley
Mr.	Carlisle Bright	Fisherman	Striper, Bass Salmon Supporter	Sunnyvale
Mr.	Carlton Ingram	Fisherman	Striper, Bass Salmon Supporter	Napa
Capt.	Carol Jones	Owner	Kahuna Sportfishing	Moss Landing
Ms.	Carol Pickard	Fisherman	Striper, Bass Salmon Supporter	Yuba City
Mr.	Casey Code	Fisherman	Striper, Bass Salmon Supporter	Vacaville
Mr.	Casey Dunn	Fisherman	Striper, Bass Salmon Supporter	North Highlands
Mr.	Cedric Wong	Fisherman	Striper, Bass Salmon Supporter	Folsom
Mr.	Cesar Gomez	Fisherman	Striper, Bass Salmon Supporter	Fairfield
Mr.	Cesar Laguna	Fisherman	Striper, Bass Salmon Supporter	Galt
Mr.	Chad Lemert	Fisherman	Striper, Bass Salmon Supporter	Brawley
Mr.	Chad Liff	Fisherman	Striper, Bass Salmon Supporter	Martinez
Mr.	Chad Woods	President	Nor Cal Fish Reports	Sparks NV
Mr.	Chapin Fowler	Fisherman	Striper, Bass Salmon Supporter	Lodi
Mr.	Charles Edwards	Fisherman	Striper, Bass Salmon Supporter	S.S.F.
Mr.	Charles Hadley	Fisherman	Striper, Bass Salmon Supporter	Pinole
Mr.	Charles Jackson	Fisherman	Striper, Bass Salmon Supporter	Manteca
Mr.	Charles Jones	Fisherman	Striper, Bass Salmon Supporter	Modesto
Mr.	Charles Kessler	Fisherman	Striper, Bass Salmon Supporter	Sutter
Mr.	Charles Quiros	Fisherman	Striper, Bass Salmon Supporter	Belmont
Mr.	Charles Tucker	Fisherman	Striper, Bass Salmon Supporter	Eustis
Mr.	Charles Williams	Fisherman	Striper, Bass Salmon Supporter	Brentwood
Mr.	Charlie Owens	Fisherman	Striper, Bass Salmon Supporter	Concord
Mr.	Chelsey Dittmer	Fisherman	Striper, Bass Salmon Supporter	Foresthill
Mr.	Cheng Saetern	Fisherman	Striper, Bass Salmon Supporter	North Highlands
Mr.	Chong Xyong	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Chou Lee	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Capt.	Chris Arcoleo	Owner	Caroline Charters	Monterey
Capt.	Chris Arcoleo	Owner	Chris Fishing Trips Center	Monterey
Capt.	Chris Arcoleo	Owner	Deck Mate Charters	Monterey
Capt.	Chris Arcoleo	Owner	Star Of Monterey Charters	Monterey
Mr.	Chris Barger	Fisherman	Striper, Bass Salmon Supporter	Novato
Capt.	Chris Chang	Owner	Ankeny Charters	Half Moon Bay
Mr.	Chris Ditter	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Capt.	Chris Duba	Owner	Silver Fox Charters	San Francisco
Mr.	Chris Frazier	Fisherman	Striper, Bass Salmon Supporter	Yuba City
Mr.	Chris Fullerton	Fisherman	Striper, Bass Salmon Supporter	Brooks
Mr.	Chris Jimmerson	Fisherman	Striper, Bass Salmon Supporter	Citrus Heights

Opponents of the Reg Change Plan and Supporters of the Coalition's Plan

Intro	Name	Title	Organization	City
Mr.	Chris Olsen	Fisherman	Striper, Bass Salmon Supporter	Brentwood
Mr.	Chris Owens	Fisherman	Striper, Bass Salmon Supporter	Roeland Park
Mr.	Chris Padilla	Fisherman	Striper, Bass Salmon Supporter	Ripon
Mr.	Chris Perez	Fisherman	Striper, Bass Salmon Supporter	Lincoln
Mr.	Chris Potter	Fisherman	Striper, Bass Salmon Supporter	Ukiah
Mr.	Chris Quinones	Fisherman	Striper, Bass Salmon Supporter	Windsor
Capt.	Chris Smith	Owner	Captain Hook Charters	Berkeley
Mr.	Chris Stockdale	Fisherman	Striper, Bass Salmon Supporter	Oceanside
Mr.	Chris Tabieros	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Chris Zolling	Fisherman	Striper, Bass Salmon Supporter	Plumas Lake
Mr.	Christian Hambrecht	Fisherman	Striper, Bass Salmon Supporter	Atwater
Mr.	Christopher Bautista	Fisherman	Striper, Bass Salmon Supporter	Rancho Cordova
Mr.	Christopher Clifford	Fisherman	Striper, Bass Salmon Supporter	
Mr.	Christopher Gauci	Fisherman	Striper, Bass Salmon Supporter	Pittsburg
Mr.	Christopher Polk	Fisherman	Striper, Bass Salmon Supporter	Fremont
Mr.	Chuck De Lucci	Fisherman	Striper, Bass Salmon Supporter	Auburn
Mr.	Chuck Hammerstad	Fisherman	Striper, Bass Salmon Supporter	San Jose
Capt.	Chuck Louie	Owner	Chucky's Pride Charters	San Francisco
Mr.	Chuck Mazza	Fisherman	Striper, Bass Salmon Supporter	Waterford
Mr.	Chutu Yang	Fisherman	Striper, Bass Salmon Supporter	Olivehurst
Mr.	Clark Wright	Fisherman	Striper, Bass Salmon Supporter	Auburn
Mr.	Cliff Gyotoku	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	Cliff King	Fisherman	Striper, Bass Salmon Supporter	Herald
Mr.	Clint Sattler	Fisherman	Striper, Bass Salmon Supporter	Biggs
Mr.	Clyde Pendergras	Fisherman	Striper, Bass Salmon Supporter	Colusa
Mr.	Cody Cox	Fisherman	Striper, Bass Salmon Supporter	Tracy
Mr.	Cody Hoppes	Fisherman	Striper, Bass Salmon Supporter	Martinez
Mr.	Cole Daniel	Fisherman	Striper, Bass Salmon Supporter	Hollister
Mr.	Colin Harrison	Fisherman	Striper, Bass Salmon Supporter	Chico
Ms.	Colleen Youngblood	Fisherman	Striper, Bass Salmon Supporter	Pollock Pines
Ms.	Connie Norden	Fisherman	Striper, Bass Salmon Supporter	Fairfield
Ms.	Connie Yamamoto	Fisherman	Striper, Bass Salmon Supporter	Alameda
Mr.	Cordell Meidinger	Fisherman	Striper, Bass Salmon Supporter	Lodi
Mr.	Corvette Skundberg	Fisherman	Striper, Bass Salmon Supporter	Manteca
Mr.	Cory Farinella	Fisherman	Striper, Bass Salmon Supporter	Jamaica Plain
Mr.	Craig Bark	Fisherman	Striper, Bass Salmon Supporter	Sunnyvale
Mr.	Craig Bevan	Fisherman	Striper, Bass Salmon Supporter	Alameda
Capt.	Craig Hanson	Owner	Argo Charters	San Francisco
Mr.	Craig Shiraishi	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	Crazy Rick	Member	WCB	Calif.
Mr.	Crista Grech	Fisherman	Striper, Bass Salmon Supporter	Fairfield
Mr.	Croix Baio	Fisherman	Striper, Bass Salmon Supporter	Auburn
Mr.	Cruz Calderon	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Curt Cotner	Fisherman	Striper, Bass Salmon Supporter	Gilroy
Ms.	Cynthia Yandow	Fisherman	Striper, Bass Salmon Supporter	Pine Grove
Mr.	Dahl Anthony	Fisherman	Striper, Bass Salmon Supporter	Salinas
Mr.	Dale Kirk	Fisherman	Striper, Bass Salmon Supporter	Chico
Mr.	Dale Michael	Fisherman	Striper, Bass Salmon Supporter	Carmichael

Opponents of the Reg Change Plan and Supporters of the Coalition's Plan

Intro	Name	Title	Organization	City
Mr.	Dale Morioka	Fisherman	Striper, Bass Salmon Supporter	South San Francisco
Capt.	Dale Walters	Owner	Que Sera Sera Charters	Half Moon Bay
Mr.	Dale White	Fisherman	Striper, Bass Salmon Supporter	Anderson
Mr.	Dalton Deornellas	Fisherman	Striper, Bass Salmon Supporter	Oakley
Mr.	Dalton Heryford	Fisherman	Striper, Bass Salmon Supporter	Roseville
Mr.	Dan Blanton	Fisherman	Striper, Bass Salmon Supporter	Morgan Hill
Mr.	Dan Clark	Fisherman	Striper, Bass Salmon Supporter	Oakdale
Mr.	Dan Lizardo	Fisherman	Striper, Bass Salmon Supporter	Yuba City
Mr.	Dan Novak	Fisherman	Striper, Bass Salmon Supporter	Elk Grove
Mr.	Dan Silva	Fisherman	Striper, Bass Salmon Supporter	Elk Grove
Mr.	Dan Skaggs	Fisherman	Striper, Bass Salmon Supporter	Oroville
Mr.	Dan Sozzi	Fisherman	Striper, Bass Salmon Supporter	El Dorado Hills
Mr.	Dan Waligoea	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Dan Whooley	Fisherman	Striper, Bass Salmon Supporter	
Ms.	Dana Griffin	Fisherman	Striper, Bass Salmon Supporter	Belmont
Ms.	Dania Jimmerson	Fisherman	Striper, Bass Salmon Supporter	Citrus Heights
Mr.	Daniel Bacher	Editor	The Fish Sniffer	Sacramento
Mr.	Daniel Fall	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Daniel Fong	Fisherman	Striper, Bass Salmon Supporter	Antioch
Mr.	Daniel Herrera	Fisherman	Striper, Bass Salmon Supporter	Pittsburg
Mr.	Daniel Huber	Fisherman	Striper, Bass Salmon Supporter	Woodbridge
Mr.	Daniel Majhor	Fisherman	Striper, Bass Salmon Supporter	Stockton
Mr.	Daniel Silva	Fisherman	Striper, Bass Salmon Supporter	Oroville
Mr.	Daniel Vella	Fisherman	Striper, Bass Salmon Supporter	Modesto
Mr.	Daniel Wheeler	Fisherman	Striper, Bass Salmon Supporter	Acampo
Mr.	Daniel Wulff	Fisherman	Striper, Bass Salmon Supporter	Manteca
Mr.	Danniel Ybarra	Fisherman	Striper, Bass Salmon Supporter	Coalinga
Mr.	Danny Sozzi	Fisherman	Striper, Bass Salmon Supporter	Folsom
Ms.	Darlene Wise	Fisherman	Striper, Bass Salmon Supporter	Montebello
Mr.	Darrell Lahman	Fisherman	Striper, Bass Salmon Supporter	Pittsburg
Mr.	Darrell Machalek	Fisherman	Striper, Bass Salmon Supporter	Le Claire
Mr.	Darrell Marks	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Darrell Musick	Fisherman	Striper, Bass Salmon Supporter	Los Altos
Mr.	Darren Anderson	Fisherman	Striper, Bass Salmon Supporter	Benicia
Mr.	Darren Butler	Fisherman	Striper, Bass Salmon Supporter	Oranangevale
Mr.	Darren Mayhew	Fisherman	Striper, Bass Salmon Supporter	North Highlands
Mr.	Daryl Donofrio	Fisherman	Striper, Bass Salmon Supporter	Campbell
Mr.	Daryn Avalos	Fisherman	Striper, Bass Salmon Supporter	Yuba Citu
Mr.	Dave Adler	Fisherman	Striper, Bass Salmon Supporter	Concord
Mr.	Dave Degere	Fisherman	Striper, Bass Salmon Supporter	Daly City
Mr.	Dave Gallagher	Fisherman	Striper, Bass Salmon Supporter	Clayton
Mr.	Dave Kubo	Fisherman	Striper, Bass Salmon Supporter	Morgan Hill
Mr.	Dave Lafferty	Fisherman	Striper, Bass Salmon Supporter	Oakley
Mr.	Dave Romuar	Fisherman	Striper, Bass Salmon Supporter	Stockton
Mr.	Dave Stoner	Fisherman	Striper, Bass Salmon Supporter	Rocklin
Mr.	David & Betty Scatena	Fisherman	Striper, Bass Salmon Supporter	Stockton
Mr.	David Barker	Fisherman	Striper, Bass Salmon Supporter	Rocklin
Mr.	David Borofka	Fisherman	Striper, Bass Salmon Supporter	Modesto

Opponents of the Reg Change Plan and Supporters of the Coalition's Plan

Intro	Name	Title	Organization	City
Mr.	David Chastain	Fisherman	Striper, Bass Salmon Supporter	Carmichael
Mr.	David Cook	Fisherman	Striper, Bass Salmon Supporter	Carmichael
Mr.	David Cordova	Fisherman	Striper, Bass Salmon Supporter	Winters
Mr.	David Cosimano	Fisherman	Striper, Bass Salmon Supporter	
Mr.	David Depaoli	Fisherman	Striper, Bass Salmon Supporter	
Mr.	David Devault	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	David Dozler	Fisherman	Striper, Bass Salmon Supporter	Napa
Mr.	David Elliott	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	David Evans	Fisherman	Striper, Bass Salmon Supporter	Yuba City
Mr.	David Hardt	Fisherman	Striper, Bass Salmon Supporter	Discovery Bay
Mr.	David Hemm	Fisherman	Striper, Bass Salmon Supporter	Oakdale
Mr.	David Hood	Fisherman	Striper, Bass Salmon Supporter	
Mr.	David Horigan	Fisherman	Striper, Bass Salmon Supporter	Dixon
Mr.	David Klein	Fisherman	Striper, Bass Salmon Supporter	Castro Valley
Mr.	David Lipscomb	Fisherman	Striper, Bass Salmon Supporter	Lafayette
Mr.	David Mendoza	Fisherman	Striper, Bass Salmon Supporter	Milpitas
Mr.	David Merin	Fisherman	Striper, Bass Salmon Supporter	Lodi
Mr.	David Modena	Fisherman	Striper, Bass Salmon Supporter	El Granada
Mr.	David Ostrack	Legal Council	Allied Fishing Groups	Woodland
Mr.	David Pisani	Fisherman	Striper, Bass Salmon Supporter	Esparto
Mr.	David Rosa	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	David Ross	Fisherman	Striper, Bass Salmon Supporter	Santa Cruz
Mr.	David S Balaba	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	David Segretto	Fisherman	Striper, Bass Salmon Supporter	Sf
Mr.	David Tomlinson	Fisherman	Striper, Bass Salmon Supporter	Groveland
Mr.	David Turner	Fisherman	Striper, Bass Salmon Supporter	Davis
Mr.	David Vingom	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	David Willems	Fisherman	Striper, Bass Salmon Supporter	Manteca
Mr.	Davin Schreindl	Fisherman	Striper, Bass Salmon Supporter	Paradise
Mr.	Dean Higa	Fisherman	Striper, Bass Salmon Supporter	Santa Clara
Mr.	Dean Woon	Fisherman	Striper, Bass Salmon Supporter	Vallejo
Ms.	Debbie Lawrence	Fisherman	Striper, Bass Salmon Supporter	Woodland
Ms.	Debora Neiland	Fisherman	Striper, Bass Salmon Supporter	San Pablo
Mr.	Delbert Geraty	Fisherman	Striper, Bass Salmon Supporter	Dixon
Ms.	Denise Campbell	Fisherman	Striper, Bass Salmon Supporter	Fresno
Mr.	Dennis Andrade	Fisherman	Striper, Bass Salmon Supporter	Citrus Heights
Capt.	Dennis Baxter	Owner	New Captain Pete Charters	Half Moon Bay
Mr.	Dennis Hoover	Fisherman	Striper, Bass Salmon Supporter	Vacalle
Mr.	Dennis Lowry	Fisherman	Striper, Bass Salmon Supporter	Napa
Mr.	Dennis Ocallaghan	Fisherman	Striper, Bass Salmon Supporter	Vacaville
Mr.	Dennis Palmer	Fisherman	Striper, Bass Salmon Supporter	Pinole
Mr.	Dennis Sanchez	Fisherman	Striper, Bass Salmon Supporter	Ceres
Mr.	Dennis Stanley	Fisherman	Striper, Bass Salmon Supporter	Woodland
Mr.	Dennis Sullivan	Fisherman	Striper, Bass Salmon Supporter	
Mr.	Derek Yonekura	Fisherman	Striper, Bass Salmon Supporter	Salinas
Mr.	Deren Kozenko	Fisherman	Striper, Bass Salmon Supporter	Santa Rosa
Mr.	Derrell Bridgman	Fisherman	Striper, Bass Salmon Supporter	Pleasanton
Mr.	Derrick Compton	Fisherman	Striper, Bass Salmon Supporter	Elk Grove

Opponents of the Reg Change Plan and Supporters of the Coalition's Plan

Intro	Name	Title	Organization	City
Mr.	Derrick Paiva	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Devin Benzler	Fisherman	Striper, Bass Salmon Supporter	Oakley
Mr.	Devin Delarosa	Fisherman	Striper, Bass Salmon Supporter	Rio Vista
Mr.	Devin Dick	Fisherman	Striper, Bass Salmon Supporter	Woodland
Mr.	Devin Kilpatrick	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	Devin Schmitt	Fisherman	Striper, Bass Salmon Supporter	Castroville
Mr.	Dewayne Dixon	Fisherman	Striper, Bass Salmon Supporter	Fairfield
Mr.	Dezarae Dolan	Fisherman	Striper, Bass Salmon Supporter	Crockett
Ms.	Diana Canevaro	Fisherman	Striper, Bass Salmon Supporter	Rio Vista
Ms.	Diana Tran	Fisherman	Striper, Bass Salmon Supporter	Los Angeles
Mr.	Dianna Osullivan	Fisherman	Striper, Bass Salmon Supporter	Elk Grove
Mr.	Diego Mercado	Fisherman	Striper, Bass Salmon Supporter	Elk Grove
Mr.	Don Baughman	Fisherman	Striper, Bass Salmon Supporter	Antelope
Mr.	Don Clausen	Fisherman	Striper, Bass Salmon Supporter	Danville
Mr.	Don Hunter	Fisherman	Striper, Bass Salmon Supporter	El Dorado Hills
Mr.	Don Mittelstaedt	Fisherman	Striper, Bass Salmon Supporter	
Mr.	Don Moura	Fisherman	Striper, Bass Salmon Supporter	Concord
Mr.	Don Overacker	Fisherman	Striper, Bass Salmon Supporter	Milpitas
Mr.	Don Pearson	Fisherman	Striper, Bass Salmon Supporter	Roseville
Mr.	Don Petty	Fisherman	Striper, Bass Salmon Supporter	Sutter
Mr.	Don Skoglund	Fisherman	Striper, Bass Salmon Supporter	Pleasant Hill
Capt.	Don Wong	Owner	C-gull Charters	Emeryville
Mr.	Donald Baker	Fisherman	Striper, Bass Salmon Supporter	Newark
Mr.	Donald Camozzi	Fisherman	Striper, Bass Salmon Supporter	San Leandro
Mr.	Donald Christian	Fisherman	Striper, Bass Salmon Supporter	Salinas
Mr.	Donald Dambrosio	Fisherman	Striper, Bass Salmon Supporter	Millbrae
Mr.	Donald Dicostanzo	Fisherman	Striper, Bass Salmon Supporter	Commack
Mr.	Donald Geranen	Fisherman	Striper, Bass Salmon Supporter	Sunnyvale
Mr.	Donald Longton	Fisherman	Striper, Bass Salmon Supporter	Atwater
Mr.	Donald Maher	Fisherman	Striper, Bass Salmon Supporter	Fairfield
Mr.	Donald Miller	Fisherman	Striper, Bass Salmon Supporter	Oakland
Mr.	Donald Nolen	Fisherman	Striper, Bass Salmon Supporter	Arbuckle
Mr.	Donald Paganelli	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Donald Platner	Fisherman	Striper, Bass Salmon Supporter	Merced
Mr.	Donald Weems	Fisherman	Striper, Bass Salmon Supporter	Manteca
Ms.	Donna Murphy	Fisherman	Striper, Bass Salmon Supporter	Salida
Mr.	Doug Chew	Fisherman	Striper, Bass Salmon Supporter	Sunnyvale
Mr.	Doug Lasko	President	OKUMA Fishing Tackle	Southern Calif.
Mr.	Doug Place	Fisherman	Striper, Bass Salmon Supporter	Lathrop
Mr.	Douglas Cole	Fisherman	Striper, Bass Salmon Supporter	Livermore
Mr.	Douglas Witmore	Fisherman	Striper, Bass Salmon Supporter	Livermore
Mr.	Doyle Ketcherside	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Doyle Miller	Fisherman	Striper, Bass Salmon Supporter	Eureka
Mr.	Duane White	Fisherman	Striper, Bass Salmon Supporter	Stockton
Mr.	Durie Foster	Fisherman	Striper, Bass Salmon Supporter	Pittsburg
Mr.	Dustin Keen	Fisherman	Striper, Bass Salmon Supporter	Cameron Park
Mr.	Ed Bassett	Fisherman	Striper, Bass Salmon Supporter	Zephyr Cove
Mr.	Ed Cole	Fisherman	Striper, Bass Salmon Supporter	Oakdale

Opponents of the Reg Change Plan and Supporters of the Coalition's Plan

Intro	Name	Title	Organization	City
Mr.	Ed Dum	Fisherman	Striper, Bass Salmon Supporter	Brentwood
Mr.	Ed Lee	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	Eddie Estabrook	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Edgar Sprague	Fisherman	Striper, Bass Salmon Supporter	Stockton
Mr.	Edward Bullock	Fisherman	Striper, Bass Salmon Supporter	Winton
Mr.	Edward Croft	Fisherman	Striper, Bass Salmon Supporter	San Mateo
Mr.	Edward Dolores	Fisherman	Striper, Bass Salmon Supporter	Fair Oaks
Mr.	Edward Mcmahon	Fisherman	Striper, Bass Salmon Supporter	Citrus Heights
Mr.	Edward Paul	Fisherman	Striper, Bass Salmon Supporter	Sebastopol
Mr.	Edward Ueckert	Fisherman	Striper, Bass Salmon Supporter	Marysville
Mr.	Edwin Turman	Fisherman	Striper, Bass Salmon Supporter	Discovery Bay
Ms.	Elaine Jordan - Adams	Fisherman	Striper, Bass Salmon Supporter	Concord
Mr.	Eldee Ferland	Fisherman	Striper, Bass Salmon Supporter	Citrus Heights
Mr.	Eleazar Selga	Fisherman	Striper, Bass Salmon Supporter	Stockton
Ms.	Elizabeth Glasco	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Ms.	Elizabeth Wight	Fisherman	Striper, Bass Salmon Supporter	Antioch
Mr.	Eric Alicia	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Eric Callahan	Fisherman	Striper, Bass Salmon Supporter	Modesto
Mr.	Eric Dahl	Fisherman	Striper, Bass Salmon Supporter	Sunnyvale
Mr.	Eric Davis	Fisherman	Striper, Bass Salmon Supporter	Weymouth
Mr.	Eric Day	Fisherman	Striper, Bass Salmon Supporter	Oakland
Mr.	Eric Harnois	Fisherman	Striper, Bass Salmon Supporter	Vallejo
Mr.	Eric Houk	Fisherman	Striper, Bass Salmon Supporter	Carmichael
Mr.	Eric Pickard	Fisherman	Striper, Bass Salmon Supporter	Elk Grove
Mr.	Eric Stafford	Fisherman	Striper, Bass Salmon Supporter	El Dorado Hills
Mr.	Eric Suto	Fisherman	Striper, Bass Salmon Supporter	Concord
Mr.	Eric Taylor	Fisherman	Striper, Bass Salmon Supporter	Woodland
Mr.	Erick Leland	Fisherman	Striper, Bass Salmon Supporter	Colfax
Capt.	Erik Anfinson	Owner	The Bass Tub	San Francisco
Mr.	Erik Lupercio	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	Erik Regala	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	Erik Rott	Fisherman	Striper, Bass Salmon Supporter	Woodland
Mr.	Ernest Davis	Fisherman	Striper, Bass Salmon Supporter	San Mateo
Mr.	Ernest Guillen	Fisherman	Striper, Bass Salmon Supporter	San Diego
Mr.	Ernst Michaelis	Fisherman	Striper, Bass Salmon Supporter	Salida
Mr.	Ethan Clark	Fisherman	Striper, Bass Salmon Supporter	Elk Grove
Mr.	Ethan Collins	Fisherman	Striper, Bass Salmon Supporter	Salisbury
Mr.	Ethan Worthley	Fisherman	Striper, Bass Salmon Supporter	Fresno
Mr.	Eugene Cesca	Fisherman	Striper, Bass Salmon Supporter	San Bruno
Mr.	Eugene Rawlins	Fisherman	Striper, Bass Salmon Supporter	Manteca
Mr.	Evan Reublin	Fisherman	Striper, Bass Salmon Supporter	Suisun
Ms.	Frances Burke	Fisherman	Striper, Bass Salmon Supporter	Davis
Ms.	Frances Mullenaux	Fisherman	Striper, Bass Salmon Supporter	Murrieta
Ms.	Francesca Rosinski	Fisherman	Striper, Bass Salmon Supporter	Pleasanton
Ms.	Franchesca Scalise	Fisherman	Striper, Bass Salmon Supporter	Lafayette
Mr.	Francos Daoheuang	Fisherman	Striper, Bass Salmon Supporter	San Leandro
Mr.	Frank Domeier	Fisherman	Striper, Bass Salmon Supporter	Auburn
Capt.	Frank Rescino	Owner	Lovely Martha Charters	San Francisco

Opponents of the Reg Change Plan and Supporters of the Coalition's Plan

Intro	Name	Title	Organization	City
Mr.	Frank Shaffer	Fisherman	Striper, Bass Salmon Supporter	Hollister
Mr.	Frankie Mendes	Fisherman	Striper, Bass Salmon Supporter	Modesto
Mr.	Franklin Bodwin	Fisherman	Striper, Bass Salmon Supporter	Foster City
Mr.	Fred Strausbaugh	Fisherman	Striper, Bass Salmon Supporter	Haddon Heights
Mr.	Freddie Ulloa	Fisherman	Striper, Bass Salmon Supporter	Gilroy
Mr.	Fredrick Burse	Fisherman	Striper, Bass Salmon Supporter	Manteca
Mr.	Freud Farley	Fisherman	Striper, Bass Salmon Supporter	San Rafael
Mr.	Fulton Haight	Fisherman	Striper, Bass Salmon Supporter	Glendale
Mr.	Gabe Esteves	Fisherman	Striper, Bass Salmon Supporter	West Sacramento
Mr.	Gabriel Quinones	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Gabriel Stanbery	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	Garey Young	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Capt.	Garry Palmer	Owner	Fly by Night Fishing Excursions	Santa Rosa
Mr.	Garry Wilson	Fisherman	Striper, Bass Salmon Supporter	Tracy
Mr.	Gary Arroyo	Fisherman	Striper, Bass Salmon Supporter	Oakley
Mr.	Gary Bradford	Western Ops Director	FLW Fishing League Worldwide	Canyon Lake
Mr.	Gary Coslovoch	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	Gary Degracia	Fisherman	Striper, Bass Salmon Supporter	
Mr.	Gary Den	Fisherman	Striper, Bass Salmon Supporter	Orangevale
Mr.	Gary Edwards	Fisherman	Striper, Bass Salmon Supporter	Long Beach
Mr.	Gary Ehrlich	Fisherman	Striper, Bass Salmon Supporter	Antioch
Mr.	Gary Harrison	Fisherman	Striper, Bass Salmon Supporter	Palmdale
Mr.	Gary Melot	Fisherman	Striper, Bass Salmon Supporter	Oakley
Mr.	Gary Peterson	Fisherman	Striper, Bass Salmon Supporter	Santa Clara
Mr.	Gary Ray Adams	Fisherman	Striper, Bass Salmon Supporter	Concord
Mr.	Gary York	Fisherman	Striper, Bass Salmon Supporter	Fairfax
Mr.	Gary Zurn	Vice President	Big Rock Sports	Fresno
Mr.	Gayle Cheatwood	Fisherman	Striper, Bass Salmon Supporter	Holtville
Mr.	Gene Alvarez	Fisherman	Striper, Bass Salmon Supporter	Garland
Mr.	Gene Asai	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Gene Borne	Fisherman	Striper, Bass Salmon Supporter	Woodland Hills
Mr.	Geoff Talbot	Fisherman	Striper, Bass Salmon Supporter	Lafayette
Mr.	George	Fisherman	Striper, Bass Salmon Supporter	Belmont
Capt.	George Castagnola Iii	Owner	Maria E Charters	Bodega Bay
Capt.	George Castagnola Jr.	Owner	Sandy Ann Charters	Bodega Bay
Mr.	George Kramer	Fisherman	Striper, Bass Salmon Supporter	Lake Elsinore
Mr.	George Lewright	Fisherman	Striper, Bass Salmon Supporter	Brentwood
Mr.	George Loveless	Owner	Guns, Fishing and Other Stuff	Vacaville
Mr.	George Macato	Fisherman	Striper, Bass Salmon Supporter	Stockton
Mr.	George Saksa	Fisherman	Striper, Bass Salmon Supporter	Berkeley
Mr.	George Simpier	Fisherman	Striper, Bass Salmon Supporter	Fairfield
Mr.	George Tani	Fisherman	Striper, Bass Salmon Supporter	Millbrae
Mr.	Ger Xiong	Fisherman	Striper, Bass Salmon Supporter	Fresno
Mr.	Gerald Cook	Fisherman	Striper, Bass Salmon Supporter	Iroville
Mr.	Gerald Neuburger	Fisherman	Striper, Bass Salmon Supporter	Lodi
Mr.	Gerald Saito	Fisherman	Striper, Bass Salmon Supporter	Campbell
Mr.	Geralx Hess	Fisherman	Striper, Bass Salmon Supporter	Santa Rosa
Mr.	Gerard Doyle	Fisherman	Striper, Bass Salmon Supporter	Lindenhurst

Opponents of the Reg Change Plan and Supporters of the Coalition's Plan

Intro	Name	Title	Organization	City
Mr.	Gilberr Campos	Fisherman	Striper, Bass Salmon Supporter	Ceres
Mr.	Gilbert Munz	Fisherman	Striper, Bass Salmon Supporter	San Rafael
Mr.	Gilbert Sontag	Fisherman	Striper, Bass Salmon Supporter	Napa
Mr.	Gino Guerrero	Fisherman	Striper, Bass Salmon Supporter	Elk Grove
Mr.	Glen Hogerton	Fisherman	Striper, Bass Salmon Supporter	Pacifica
Mr.	Glen Lublin	Fisherman	Striper, Bass Salmon Supporter	Visalia
Mr.	Glenn Abuelhaj	Fisherman	Striper, Bass Salmon Supporter	Manteca
Mr.	Glenn Foster	Fisherman	Striper, Bass Salmon Supporter	Martinez
Mr.	Glenn Fukumoto	Fisherman	Striper, Bass Salmon Supporter	Los Osos
Mr.	Glenn Lamb	Fisherman	Striper, Bass Salmon Supporter	Martinez
Mr.	Glenn Meeks	Fisherman	Striper, Bass Salmon Supporter	Angels Camp
Mr.	Glenn Morris	Fisherman	Striper, Bass Salmon Supporter	Stockton
Mr.	Gloria Henderson	Fisherman	Striper, Bass Salmon Supporter	Ahwahnee
Mr.	Gordon Beasley	Fisherman	Striper, Bass Salmon Supporter	Ukiah
Ms.	Graciela Jaramillofarris	Fisherman	Striper, Bass Salmon Supporter	Rio Linda
Mr.	Grant Ingalls	Fisherman	Striper, Bass Salmon Supporter	Napa
Mr.	Grant Phillips	Fisherman	Striper, Bass Salmon Supporter	Yuba City
Mr.	Greg Camper	Fisherman	Striper, Bass Salmon Supporter	Linden
Mr.	Greg Cook	Fisherman	Striper, Bass Salmon Supporter	Stockton
Mr.	Greg Fava	Fisherman	Striper, Bass Salmon Supporter	Redwood City
Mr.	Greg Hicks	Fisherman	Striper, Bass Salmon Supporter	Rescue
Mr.	Greg Kenyon	Fisherman	Striper, Bass Salmon Supporter	San Pablo
Mr.	Greg Pishkur	Fisherman	Striper, Bass Salmon Supporter	Flagstaff
Mr.	Greg Roberson	Fisherman	Striper, Bass Salmon Supporter	Tracy
Mr.	Greg Smith	Fisherman	Striper, Bass Salmon Supporter	Gardent Valley
Mr.	Greg Wilhoit	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Gus Gabriel	Fisherman	Striper, Bass Salmon Supporter	Suisun City
Mr.	Guy Kelley	Fisherman	Striper, Bass Salmon Supporter	Brentwood
Mr.	Guy Kilburn	Fisherman	Striper, Bass Salmon Supporter	Vallejo
Mr.	Harold Toland	Fisherman	Striper, Bass Salmon Supporter	Walnut Creek
Mr.	Harold V Smith	Fisherman	Striper, Bass Salmon Supporter	Pt. Richmond
Mr.	Harry Delacruz	Fisherman	Striper, Bass Salmon Supporter	Santa Clara
Mr.	Harry James	Fisherman	Striper, Bass Salmon Supporter	Union City
Mr.	Harry Linsenbach	Fisherman	Striper, Bass Salmon Supporter	Woodland
Mr.	Hassan Sharifi	Fisherman	Striper, Bass Salmon Supporter	Oakley
Ms.	Heather Abbott	Fisherman	Striper, Bass Salmon Supporter	Vallejo
Ms.	Heather Galindez	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Ms.	Heidi Ahearne	Fisherman	Striper, Bass Salmon Supporter	Napa
Ms.	Heidi Mitchell	Fisherman	Striper, Bass Salmon Supporter	Monrovia
Mr.	Henry Peterson	Fisherman	Striper, Bass Salmon Supporter	San Francisco
Mr.	Herb Stansbury	Fisherman	Striper, Bass Salmon Supporter	Chico
Ms.	Holly Mayfield	Fisherman	Striper, Bass Salmon Supporter	Sonoma
Mr.	Howard Arnold	Fisherman	Striper, Bass Salmon Supporter	Vacaville
Mr.	Howard Swarts	Fisherman	Striper, Bass Salmon Supporter	Davis
Mr.	Hugh Reynolds	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	Hugh Simmons	Fisherman	Striper, Bass Salmon Supporter	San Carlos
Mr.	Hung Truong	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	Ian Mcgrath	Fisherman	Striper, Bass Salmon Supporter	Marysville

Opponents of the Reg Change Plan and Supporters of the Coalition's Plan

Intro	Name	Title	Organization	City
Mr.	Ignacio Estrada	Fisherman	Striper, Bass Salmon Supporter	Lockeford
Mr.	Ihosvani Fornaris	Fisherman	Striper, Bass Salmon Supporter	Stockton
Mr.	Ingolf Suhmann	Fisherman	Striper, Bass Salmon Supporter	Galt
Mr.	Irene Inmon	Fisherman	Striper, Bass Salmon Supporter	South Gate
Mr.	Isaac Middendorf	Fisherman	Striper, Bass Salmon Supporter	Belmont
Capt.	Ivan Hotz	Owner	Jade Rose Charters	Berkeley
Mr.	Ivan Wiker	Fisherman	Striper, Bass Salmon Supporter	Oakley
Mr.	J David Duvall	Fisherman	Striper, Bass Salmon Supporter	Springfield
Mr.	J K	Fisherman	Striper, Bass Salmon Supporter	Paso Robles
Mr.	J Salomon	Fisherman	Striper, Bass Salmon Supporter	Rio Vista
Ms.	Jabyne Trujillo	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Jack Brassington	Fisherman	Striper, Bass Salmon Supporter	Roseville
Mr.	Jack Christianson	Fisherman	Striper, Bass Salmon Supporter	Fresno
Mr.	Jack Christianson	Fisherman	Striper, Bass Salmon Supporter	Fresno
Mr.	Jack Hepworth	Fisherman	Striper, Bass Salmon Supporter	Manteca
Mr.	Jack Meyer	Fisherman	Striper, Bass Salmon Supporter	Campbell
Mr.	Jack Naves	Fisherman	Striper, Bass Salmon Supporter	Roseville
Capt.	Jacky Douglas	Owner	Wacky Jacky Charters	San Francisco
Mr.	Jacob Penny	Fisherman	Striper, Bass Salmon Supporter	Oceanside
Ms.	Jacqueline Lermusik	Fisherman	Striper, Bass Salmon Supporter	El Sobrante
Ms.	Jaime Guillen	Fisherman	Striper, Bass Salmon Supporter	Fresno
Mr.	Jake Cutri	Fisherman	Striper, Bass Salmon Supporter	Santa Rosa
Mr.	Jake Moxon	Fisherman	Striper, Bass Salmon Supporter	Hydesville
Mr.	James Bane	Fisherman	Striper, Bass Salmon Supporter	Royal Oaks
Mr.	James Bolinguit	Fisherman	Striper, Bass Salmon Supporter	Dublin
Mr.	James Brobeck	Fisherman	Striper, Bass Salmon Supporter	Chico
Mr.	James Brock	Fisherman	Striper, Bass Salmon Supporter	Elk Grove
Mr.	James Christopher	Fisherman	Striper, Bass Salmon Supporter	Newark
Mr.	James Dammann	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	James Duncan	Fisherman	Striper, Bass Salmon Supporter	Meridain
Mr.	James Ferguson	Fisherman	Striper, Bass Salmon Supporter	Manteca
Mr.	James Fritz	Fisherman	Striper, Bass Salmon Supporter	Los Gatos
Mr.	James Hedvall	Fisherman	Striper, Bass Salmon Supporter	Belmont
Mr.	James Houlihan	Fisherman	Striper, Bass Salmon Supporter	Campbell
Mr.	James Kennedy	Fisherman	Striper, Bass Salmon Supporter	Wilton
Mr.	James Kesser	Fisherman	Striper, Bass Salmon Supporter	Santa Rosa
Mr.	James Kinyon	Fisherman	Striper, Bass Salmon Supporter	Clearlake Oaks
Mr.	James Koskiniemi	Fisherman	Striper, Bass Salmon Supporter	Oakley
Mr.	James Lewis	Fisherman	Striper, Bass Salmon Supporter	Colfax
Mr.	James Maloney	Fisherman	Striper, Bass Salmon Supporter	Elk Grove
Mr.	James May	Fisherman	Striper, Bass Salmon Supporter	Yuba City
Capt.	James Mc Cormick	Owner	Becky Ann Charters	San Francisco
Mr.	James Mclemore	Fisherman	Striper, Bass Salmon Supporter	Stockton
Mr.	James Milbourn	Fisherman	Striper, Bass Salmon Supporter	Rancho Cordova
Mr.	James Nuckols	Fisherman	Striper, Bass Salmon Supporter	Greensboro
Mr.	James Parson	Fisherman	Striper, Bass Salmon Supporter	W Sac
Mr.	James Rios	Fisherman	Striper, Bass Salmon Supporter	Brentwood
Mr.	James Robbins	Fisherman	Striper, Bass Salmon Supporter	Chico

Opponents of the Reg Change Plan and Supporters of the Coalition's Plan

Intro	Name	Title	Organization	City
Mr.	James Sanchez	Fisherman	Striper, Bass Salmon Supporter	Ceres
Mr.	James Sinkay	Fisherman	Striper, Bass Salmon Supporter	Concord
Capt.	James Smith	Owner	California Dawn Charters	Berkeley
Mr.	James Smith	Fisherman	Striper, Bass Salmon Supporter	Lakewood
Mr.	James Smith	Fisherman	Striper, Bass Salmon Supporter	El Sobrante
Mr.	James Snyder	Fisherman	Striper, Bass Salmon Supporter	Lodi
Mr.	James Spicer	Fisherman	Striper, Bass Salmon Supporter	Antioch
Capt.	James Stone	Owner	Elite Sportsmen Guide Service	Calif.
Capt.	James Townsend	Owner	Osprey Charters	Point Richmond
Mr.	James Vaughns	Fisherman	Striper, Bass Salmon Supporter	Oakland
Mr.	James Vella	Fisherman	Striper, Bass Salmon Supporter	Bakersfied
Mr.	James Wayne	Fisherman	Striper, Bass Salmon Supporter	Aptos
Mr.	James Weeks	Fisherman	Striper, Bass Salmon Supporter	Livermore
Ms.	Jamie Davis	Fisherman	Striper, Bass Salmon Supporter	Springfield
Ms.	Jamie Sheffiled	Fisherman	Striper, Bass Salmon Supporter	Citrus Heights
Mr.	Jamieson Heaney	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Ms.	Jan Hannah	Fisherman	Striper, Bass Salmon Supporter	San Lorenzo
Ms.	Jan McCleery	Owner	Duck Pond Software	Calif.
Ms.	Jan Van Zandt	Fisherman	Striper, Bass Salmon Supporter	Newark
Ms.	Jan Warren	Fisherman	Striper, Bass Salmon Supporter	Walnut Creek
Mr.	Jaramy Canha	Fisherman	Striper, Bass Salmon Supporter	Antioch
Mr.	Jared Shake	Fisherman	Striper, Bass Salmon Supporter	Merced
Mr.	Jason Alger	Fisherman	Striper, Bass Salmon Supporter	Placerville
Mr.	Jason Benzel	Fisherman	Striper, Bass Salmon Supporter	Yuba City
Mr.	Jason Carlisle	Fisherman	Striper, Bass Salmon Supporter	Elk Grove
Mr.	Jason Cravenho	Fisherman	Striper, Bass Salmon Supporter	Foresthill
Mr.	Jason Cullen	Fisherman	Striper, Bass Salmon Supporter	Santa Rosa
Mr.	Jason Grow	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Jason Jacobs	Fisherman	Striper, Bass Salmon Supporter	Livermore
Mr.	Jason Littlefield	Fisherman	Striper, Bass Salmon Supporter	Pinole
Mr.	Jason Marlow	Fisherman	Striper, Bass Salmon Supporter	Pioneer
Mr.	Jason Maupin	Fisherman	Striper, Bass Salmon Supporter	Antioch
Mr.	Jason Moran	Fisherman	Striper, Bass Salmon Supporter	Ripon
Capt.	Jason Russey	Owner	Longfin Charters	Berkeley
Mr.	Jason Samayoa	Fisherman	Striper, Bass Salmon Supporter	Campbell
Mr.	Jason Sharp	Fisherman	Striper, Bass Salmon Supporter	Aromas
Mr.	Jason Smartt	Fisherman	Striper, Bass Salmon Supporter	Oceanside
Mr.	Javier Reza	Fisherman	Striper, Bass Salmon Supporter	Capitola
Mr.	Jay Berryman	Fisherman	Striper, Bass Salmon Supporter	Tucson
Capt.	Jay Lopez	Owner	Righthook Charters	Berkeley
Mr.	Jay Tipple	Fisherman	Striper, Bass Salmon Supporter	Roseville
Capt.	Jay Yokomizo	Owner	New Huck Finn Charters	Emeryville
Mr.	Jb Tamari	Fisherman	Striper, Bass Salmon Supporter	San Jose
Capt.	JD Richey	Owner	Fish With JD	Calif.
Ms.	Jeanne Guerinoni	Fisherman	Striper, Bass Salmon Supporter	Santa Rosa
Mr.	Jeff Creech	Fisherman	Striper, Bass Salmon Supporter	Chowchilla
Mr.	Jeff Harris	Fisherman	Striper, Bass Salmon Supporter	Citrus Heights
Mr.	Jeff Lamy	Fisherman	Striper, Bass Salmon Supporter	San Jose

Opponents of the Reg Change Plan and Supporters of the Coalition's Plan

Intro	Name	Title	Organization	City
Mr.	Jeff Mathias	Fisherman	Striper, Bass Salmon Supporter	Westport
Mr.	Jeff Newrider	Fisherman	Striper, Bass Salmon Supporter	Rio Linda
Mr.	Jeff Ratlief	Fisherman	Striper, Bass Salmon Supporter	Upland
Mr.	Jeff Richards	Fisherman	Striper, Bass Salmon Supporter	San Carlos
Mr.	Jeff Robinson	Fisherman	Striper, Bass Salmon Supporter	Plumas Lake
Mr.	Jeff Sylvia	Fisherman	Striper, Bass Salmon Supporter	
Mr.	Jeffery Caldwell	Fisherman	Striper, Bass Salmon Supporter	Modesto
Mr.	Jeffery Gross	Fisherman	Striper, Bass Salmon Supporter	Santa Rosa
Mr.	Jeffrey Grech	Fisherman	Striper, Bass Salmon Supporter	Manteca
Mr.	Jeffrey Hamamoto	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Jeffrey Moebius	Fisherman	Striper, Bass Salmon Supporter	Oakdale
Ms.	Jen Wilner	Fisherman	Striper, Bass Salmon Supporter	Stockton
Ms.	Jenna Bowles	Fisherman	Striper, Bass Salmon Supporter	Napa
Ms.	Jennifer Davey	Fisherman	Striper, Bass Salmon Supporter	Richmond
Ms.	Jennifer Duggan	Fisherman	Striper, Bass Salmon Supporter	Elk Grove
Ms.	Jennifer Edlinger	Fisherman	Striper, Bass Salmon Supporter	Oakland
Mr.	Jeremy Chaney	Fisherman	Striper, Bass Salmon Supporter	Fairfield
Mr.	Jeremy Grimes	Owner	Fishermans Friend	Lodi
Mr.	Jeremy Hislop	Fisherman	Striper, Bass Salmon Supporter	Richmond
Mr.	Jeremy Kangas	Fisherman	Striper, Bass Salmon Supporter	Martinez
Mr.	Jeremy Nagy	Fisherman	Striper, Bass Salmon Supporter	Salinas
Mr.	Jeremy Rollins	Fisherman	Striper, Bass Salmon Supporter	Stockton
Mr.	Jerome Meyer	Fisherman	Striper, Bass Salmon Supporter	Santa Clara
Mr.	Jeromy Simonoff	Fisherman	Striper, Bass Salmon Supporter	Cameron Park
Mr.	Jeromy Thomason	Fisherman	Striper, Bass Salmon Supporter	Elk Grove
Mr.	Jerry Armstrong	Fisherman	Striper, Bass Salmon Supporter	Davis
Mr.	Jerry Hathcoat	Fisherman	Striper, Bass Salmon Supporter	Twain Harte
Mr.	Jerry Krohn	Fisherman	Striper, Bass Salmon Supporter	Pacifica
Mr.	Jerry Ly	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	Jerry Stewart	Fisherman	Striper, Bass Salmon Supporter	Petaluma
Mr.	Jerry Trafton	Fisherman	Striper, Bass Salmon Supporter	Galt
Mr.	Jerry Walser	Fisherman	Striper, Bass Salmon Supporter	Lathrop
Mr.	Jerry Williams	Fisherman	Striper, Bass Salmon Supporter	Carmichael
Mr.	Jerry Yuke	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Jesse Hall	Fisherman	Striper, Bass Salmon Supporter	Elk Grove
Mr.	Jesse Roe	Fisherman	Striper, Bass Salmon Supporter	Chico
Ms.	Jessica Ostrowski	Fisherman	Striper, Bass Salmon Supporter	Suisun
Ms.	Jessica Spencer	Fisherman	Striper, Bass Salmon Supporter	Yuba City
Ms.	Jessika Johnson	Fisherman	Striper, Bass Salmon Supporter	Susanville
Mr.	Jesus Campos	Fisherman	Striper, Bass Salmon Supporter	Bakersfield
Ms.	Jill Callahan	Fisherman	Striper, Bass Salmon Supporter	Modesto
Mr.	Jim And Betty Mae Lock	Fisherman	Striper, Bass Salmon Supporter	Lodi
Mr.	Jim Ayling	Fisherman	Striper, Bass Salmon Supporter	El Cajon
Mr.	Jim Cox	President	Calif. Striped Bass Association	Stockton
Mr.	Jim Hodges	Fisherman	Striper, Bass Salmon Supporter	Rio Vista
Mr.	Jim Leimbach	Fisherman	Striper, Bass Salmon Supporter	7
Capt.	Jim Robertson	Owner	Outer Limits Charters	Sausalito
Mr.	Jim Robinson	Fisherman	Striper, Bass Salmon Supporter	San Marcos

Opponents of the Reg Change Plan and Supporters of the Coalition's Plan

Intro	Name	Title	Organization	City
Mr.	Jimmie Davis	Fisherman	Striper, Bass Salmon Supporter	El Cajon
Mr.	Jimmie Mccants	Fisherman	Striper, Bass Salmon Supporter	Elmira
Mr.	Jimmie Trejo	Fisherman	Striper, Bass Salmon Supporter	West Sacramento
Mr.	Jimmy Rupe	Fisherman	Striper, Bass Salmon Supporter	Galt
Mr.	Jimmy Xiong	Fisherman	Striper, Bass Salmon Supporter	Hayward
Ms.	Joan Turner	Fisherman	Striper, Bass Salmon Supporter	Davis
Ms.	Jody Yang	Fisherman	Striper, Bass Salmon Supporter	
Mr.	Joe Ard	Fisherman	Striper, Bass Salmon Supporter	Patterson
Mr.	Joe Coloutti	Fisherman	Striper, Bass Salmon Supporter	Rutland Vt.
Mr.	Joe Fraga	Fisherman	Striper, Bass Salmon Supporter	San Pablo
Mr.	Joe Gallegos	Fisherman	Striper, Bass Salmon Supporter	Woodland
Mr.	Joe Rodriguez	Fisherman	Striper, Bass Salmon Supporter	Los Banos
Mr.	Joe Stayton	Fisherman	Striper, Bass Salmon Supporter	Brentwood
Mr.	Joe Tomlinson	Fisherman	Striper, Bass Salmon Supporter	Citrus Heights
Mr.	Joe Vanich	Fisherman	Striper, Bass Salmon Supporter	Citrus Heights
Mr.	Joe Von Linden	Fisherman	Striper, Bass Salmon Supporter	Shingle Springs
Mr.	Joe Xiong	Fisherman	Striper, Bass Salmon Supporter	Fresno
Capt.	John Atkinson	Owner	New Rayann Charters	Sausalito
Mr.	John Basham	Fisherman	Striper, Bass Salmon Supporter	Yuba City
Mr.	John Beuttler	Executive Director	Allied Fishing Groups	Berkley
Mr.	John Booke	Fisherman	Striper, Bass Salmon Supporter	Manteca
Mr.	John Caulfield	Fisherman	Striper, Bass Salmon Supporter	Elk Grove
Mr.	John Charles	Fisherman	Striper, Bass Salmon Supporter	Lakewood
Mr.	John Clark	Fisherman	Striper, Bass Salmon Supporter	San Pablo
Mr.	John Costanzo	Fisherman	Striper, Bass Salmon Supporter	Fairfield
Mr.	John Danielson	Fisherman	Striper, Bass Salmon Supporter	Vacaville
Mr.	John Dorenbecher	Fisherman	Striper, Bass Salmon Supporter	Yountville
Mr.	John Duggan	Fisherman	Striper, Bass Salmon Supporter	Elk Grove
Mr.	John Fedi	Fisherman	Striper, Bass Salmon Supporter	Stockton
Mr.	John Fein	Fisherman	Striper, Bass Salmon Supporter	Santa Rosa
Mr.	John Gardner	Fisherman	Striper, Bass Salmon Supporter	Alameda
Mr.	John Gray	Fisherman	Striper, Bass Salmon Supporter	Antelope
Mr.	John Gross	Fisherman	Striper, Bass Salmon Supporter	Half Moon Bay
Mr.	John Halseth	Fisherman	Striper, Bass Salmon Supporter	Hayward
Mr.	John Hancock	Fisherman	Striper, Bass Salmon Supporter	
Mr.	John Harrison	Fisherman	Striper, Bass Salmon Supporter	Martinez
Mr.	John Hennecke	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	John Hutchinson	Fisherman	Striper, Bass Salmon Supporter	Elk Grove
Mr.	John Kennedy	Fisherman	Striper, Bass Salmon Supporter	Manitowoc
Mr.	John Kirk	Vice President	International Sportsmens' Expos	Vancouver WA
Mr.	John Lopes	Fisherman	Striper, Bass Salmon Supporter	
Mr.	John Mann	Fisherman	Striper, Bass Salmon Supporter	
Mr.	John Marcacci	Fisherman	Striper, Bass Salmon Supporter	Homewood
Mr.	John Marian	Fisherman	Striper, Bass Salmon Supporter	Tracy
Mr.	John Mcgee	Fisherman	Striper, Bass Salmon Supporter	Vacaville
Mr.	John Medina	Fisherman	Striper, Bass Salmon Supporter	San Mateo
Mr.	John Mendoza	Fisherman	Striper, Bass Salmon Supporter	Stockton
Mr.	John Morris	Fisherman	Striper, Bass Salmon Supporter	Moraga

Opponents of the Reg Change Plan and Supporters of the Coalition's Plan

Intro	Name	Title	Organization	City
Mr.	John Pelster	Fisherman	Striper, Bass Salmon Supporter	Longview
Mr.	John Pollock	Fisherman	Striper, Bass Salmon Supporter	Brookdale
Mr.	John Richardson	Fisherman	Striper, Bass Salmon Supporter	Rio Linda
Mr.	John Robirds	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	John Santin	Fisherman	Striper, Bass Salmon Supporter	Elk Grove
Mr.	John Tanquary	Fisherman	Striper, Bass Salmon Supporter	Newcastle
Mr.	John Wells	Fisherman	Striper, Bass Salmon Supporter	Tracy
Mr.	John Whipple	Fisherman	Striper, Bass Salmon Supporter	Napa
Mr.	Johnny Ly	Fisherman	Striper, Bass Salmon Supporter	Richmond
Mr.	Jon Harrison	Fisherman	Striper, Bass Salmon Supporter	Orangevale
Mr.	Jon Hensley	Fisherman	Striper, Bass Salmon Supporter	
Mr.	Jon Osaki	Fisherman	Striper, Bass Salmon Supporter	San Mateo
Mr.	Jon Schatmeier	Fisherman	Striper, Bass Salmon Supporter	Manteca
Capt.	Jon Yokomizo	Owner	Sea Wolf Charters	Emeryville
Mr.	Jonah Li	Owner	Hi's Tackle Box	S. San Francisco
Mr.	Jonathan Daniels	Fisherman	Striper, Bass Salmon Supporter	Antioch
Mr.	Jonathan Harwood	Fisherman	Striper, Bass Salmon Supporter	Oxnard
Mr.	Jonathan Houston	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Jonathon Bradford	Fisherman	Striper, Bass Salmon Supporter	Elk Grove
Mr.	Jordan Dertinger	Fisherman	Striper, Bass Salmon Supporter	Novato
Mr.	Jose Parreno	Fisherman	Striper, Bass Salmon Supporter	Vacaville
Mr.	Jose R Montes	Fisherman	Striper, Bass Salmon Supporter	Salinas
Mr.	Jose Rocha	Fisherman	Striper, Bass Salmon Supporter	Windsor
Mr.	Jose Roman	Fisherman	Striper, Bass Salmon Supporter	Madera
Mr.	Joseph Ambrosino	Fisherman	Striper, Bass Salmon Supporter	Antioch
Mr.	Joseph Arata	Fisherman	Striper, Bass Salmon Supporter	Pacifica
Mr.	Joseph Bernhardt	Fisherman	Striper, Bass Salmon Supporter	Hollister
Mr.	Joseph Desalvo	Fisherman	Striper, Bass Salmon Supporter	Chula Vista
Mr.	Joseph Felix	Fisherman	Striper, Bass Salmon Supporter	Fair Oaks
Mr.	Joseph Frigge	Fisherman	Striper, Bass Salmon Supporter	Pixley
Capt.	Joseph Gallia Sr.	Owner	New Easy Rider	Berkeley
Mr.	Joseph Grulich	Fisherman	Striper, Bass Salmon Supporter	Petaluma
Mr.	Joseph Klaker	Fisherman	Striper, Bass Salmon Supporter	Marysville
Mr.	Joseph Moreira	Fisherman	Striper, Bass Salmon Supporter	Benicia
Capt.	Joseph Nazar	Owner	Happy Day Charters	San Francisco
Mr.	Joseph Russo	Fisherman	Striper, Bass Salmon Supporter	San Diego
Mr.	Joseph Schwark Jr	Fisherman	Striper, Bass Salmon Supporter	San Leandro
Mr.	Joseph Torres Jr	Fisherman	Striper, Bass Salmon Supporter	Stockton
Mr.	Joseph Wong	Fisherman	Striper, Bass Salmon Supporter	Berkeley
Mr.	Josh Palmer	Fisherman	Striper, Bass Salmon Supporter	Lodi
Mr.	Josh Porter	Fisherman	Striper, Bass Salmon Supporter	Pacifica
Mr.	Josh Ruiz	Fisherman	Striper, Bass Salmon Supporter	Dixon
Mr.	Joshua Donald	Fisherman	Striper, Bass Salmon Supporter	San Mateo
Mr.	Joshua Drake	Fisherman	Striper, Bass Salmon Supporter	Stockton
Mr.	Joshua Grech	Fisherman	Striper, Bass Salmon Supporter	Fairfield
Mr.	Joshua Krause	Fisherman	Striper, Bass Salmon Supporter	Modesto
Mr.	Joshua Wise	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Joshua Wright	Fisherman	Striper, Bass Salmon Supporter	Suisun City

Opponents of the Reg Change Plan and Supporters of the Coalition's Plan

Intro	Name	Title	Organization	City
Ms.	Joy Lee	Fisherman	Striper, Bass Salmon Supporter	West Sacramento
Mr.	Juan Flores	Fisherman	Striper, Bass Salmon Supporter	Victor
Mr.	Justin Clark	Fisherman	Striper, Bass Salmon Supporter	Santa Rosa
Mr.	Justin Comages	Fisherman	Striper, Bass Salmon Supporter	Chico
Mr.	Justin Georg	Fisherman	Striper, Bass Salmon Supporter	Napa
Mr.	Justin Havel	Fisherman	Striper, Bass Salmon Supporter	Gerber
Mr.	Justin Hitzel	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	Justin Martin Del Camp	Fisherman	Striper, Bass Salmon Supporter	Tracy
Mr.	Justin Rausch	Fisherman	Striper, Bass Salmon Supporter	Oakdale
Mr.	K Ryan	Fisherman	Striper, Bass Salmon Supporter	Oakdale
Ms.	Kana Spelman	Fisherman	Striper, Bass Salmon Supporter	Citrus Heights
Ms.	Karen Munoz	Fisherman	Striper, Bass Salmon Supporter	Cameron Park
Ms.	Karen Naifeh	Fisherman	Striper, Bass Salmon Supporter	San Mateo
Ms.	Karen Wilson	Fisherman	Striper, Bass Salmon Supporter	Tracy
Ms.	Karena Acree-paez	Fisherman	Striper, Bass Salmon Supporter	Alameda
Ms.	Katherine Row	Fisherman	Striper, Bass Salmon Supporter	Bakersfield
Ms.	Kathi Fujita	Fisherman	Striper, Bass Salmon Supporter	El Sobrante
Ms.	Kathy Baker	Fisherman	Striper, Bass Salmon Supporter	Antioch
Ms.	Kathy Patterson	Fisherman	Striper, Bass Salmon Supporter	Lodi
Ms.	Kay Vise	Fisherman	Striper, Bass Salmon Supporter	Grants Pass
Mr.	Kein Tau	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	Keith Ahmann	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	Keith Fraser	Owner	Loch Lomand Live Bait	San Rafael
Mr.	Keith Hamamoto	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Keith Mcgraw	Fisherman	Striper, Bass Salmon Supporter	Chowchilla
Mr.	Keith Pineo	Fisherman	Striper, Bass Salmon Supporter	Antelope
Mr.	Keith Shein	Fisherman	Striper, Bass Salmon Supporter	Novato
Mr.	Keith Sullivan	Fisherman	Striper, Bass Salmon Supporter	Buckner
Mr.	Keith Viramontes	Fisherman	Striper, Bass Salmon Supporter	Vallejo
Mr.	Kelby Springer	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Kelvin Farley	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	Ken Gotelli	Fisherman	Striper, Bass Salmon Supporter	Pleasanton
Mr.	Ken Guerinoni	Fisherman	Striper, Bass Salmon Supporter	Santa Rosa
Mr.	Ken Reed	Fisherman	Striper, Bass Salmon Supporter	Antioch
Mr.	Ken Schwehr	Fisherman	Striper, Bass Salmon Supporter	Milpitas
Capt.	Ken Stagnaro	Owner	Legacy Charters	Santa Cruz
Capt.	Ken Stagnaro	Owner	Stagnaro Charters Center	Santa Cruz
Capt.	Ken Stagnaro	Owner	Velocity Charters	Santa Cruz
Mr.	Ken Steinbach	Fisherman	Striper, Bass Salmon Supporter	Sunnyvale
Mr.	Kendra Buddell	Fisherman	Striper, Bass Salmon Supporter	Clayton
Mr.	Kenneth Baccetti	Fisherman	Striper, Bass Salmon Supporter	San Francisco
Mr.	Kenneth Cook	Fisherman	Striper, Bass Salmon Supporter	Pittsburg
Mr.	Kenneth Duthler	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Kenneth Kosich	Fisherman	Striper, Bass Salmon Supporter	Alamo
Mr.	Kenneth Louis	Fisherman	Striper, Bass Salmon Supporter	El Cajon
Mr.	Kenneth Tetzel	Fisherman	Striper, Bass Salmon Supporter	Livermore
Mr.	Kenny Horton	Fisherman	Striper, Bass Salmon Supporter	Elk Grove
Mr.	Kenny Silva	Fisherman	Striper, Bass Salmon Supporter	Stockton

Opponents of the Reg Change Plan and Supporters of the Coalition's Plan

Intro	Name	Title	Organization	City
Mr.	Kent Bagnaschi	Fisherman	Striper, Bass Salmon Supporter	Pittsburg
Mr.	Kent Brown	President	Ultimate Bass	Sacramento
Mr.	Kevin Affleck	Fisherman	Striper, Bass Salmon Supporter	San Leandro
Mr.	Kevin Carmichael	Fisherman	Striper, Bass Salmon Supporter	Marysville
Mr.	Kevin Cornwell	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Kevin Devoid	Fisherman	Striper, Bass Salmon Supporter	American Canyon
Mr.	Kevin Dorn	Fisherman	Striper, Bass Salmon Supporter	Yuba City
Mr.	Kevin Eckels	Fisherman	Striper, Bass Salmon Supporter	Davis
Mr.	Kevin Jaime	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Kevin Krause	Fisherman	Striper, Bass Salmon Supporter	Tracy
Mr.	Kevin Mulvaney	Fisherman	Striper, Bass Salmon Supporter	Camp Connell
Mr.	Kevin Nunes	Fisherman	Striper, Bass Salmon Supporter	
Mr.	Kevin Reed Sr	Fisherman	Striper, Bass Salmon Supporter	Modesto
Mr.	Kevin Rowell	Fisherman	Striper, Bass Salmon Supporter	Winters
Mr.	Kevin Sherry	Fisherman	Striper, Bass Salmon Supporter	Ojai
Mr.	Kevin Siville	Fisherman	Striper, Bass Salmon Supporter	Sonora
Mr.	Kevin Yost	Buyer	Guns, Fishing and Other Stuff	Vacaville
Mr.	Khris Karambela	Fisherman	Striper, Bass Salmon Supporter	Turlock
Mr.	Kim Sackett	Fisherman	Striper, Bass Salmon Supporter	
Ms.	Kim Zetterberg	Fisherman	Striper, Bass Salmon Supporter	San Clemente
Mr.	Kin Lee	Fisherman	Striper, Bass Salmon Supporter	San Gabriel
Mr.	Kirby Wallace	Fisherman	Striper, Bass Salmon Supporter	
Mr.	Kirk Gossett	Fisherman	Striper, Bass Salmon Supporter	Temecula
Mr.	Kirk Mathew	Fisherman	Striper, Bass Salmon Supporter	Watsonville
Mr.	Kolin Sullivan	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Kris Miller	Fisherman	Striper, Bass Salmon Supporter	Somerset
Mr.	Kris Salomon	Fisherman	Striper, Bass Salmon Supporter	Rio Vista
Ms.	Kristine Frost	Fisherman	Striper, Bass Salmon Supporter	Gold River
Mr.	Kyle Garcia	Fisherman	Striper, Bass Salmon Supporter	Santa Clara
Mr.	Kyle Sherman	Fisherman	Striper, Bass Salmon Supporter	Livermore
Mr.	Kyle Stone	Fisherman	Striper, Bass Salmon Supporter	Modesto
Mr.	Kyle Thompson	Fisherman	Striper, Bass Salmon Supporter	Antelope
Mr.	Kyoo Choe	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	Lalo Flores	Member	Contra Costa Bass Club	Fairfield
Mr.	Lalo Flores	Fisherman	Striper, Bass Salmon Supporter	Fairfield
Mr.	Lance Cowley	Fisherman	Striper, Bass Salmon Supporter	Lincoln
Mr.	Larry Arcadi	Fisherman	Striper, Bass Salmon Supporter	Fremont
Mr.	Larry Burt	Fisherman	Striper, Bass Salmon Supporter	Orland
Mr.	Larry Collins	President	San Francisco Crab Boat Owners Assn.	San Francisco
Mr.	Larry Dennis	Fisherman	Striper, Bass Salmon Supporter	Union City
Mr.	Larry Kenney	Fisherman	Striper, Bass Salmon Supporter	San Rafael
Mr.	Larry Moore	Fisherman	Striper, Bass Salmon Supporter	Corning
Mr.	Larry Squiers	Fisherman	Striper, Bass Salmon Supporter	Fremont
Mr.	Larry Squiers	Fisherman	Striper, Bass Salmon Supporter	Fremont
Mr.	Laurence Nelson	Fisherman	Striper, Bass Salmon Supporter	Oakland
Mr.	Lawrence Kamp	Fisherman	Striper, Bass Salmon Supporter	Lafayette
Mr.	Lawrence Lowe	Fisherman	Striper, Bass Salmon Supporter	Yuba City
Mr.	Lawrence Smith	Fisherman	Striper, Bass Salmon Supporter	Tracy

Opponents of the Reg Change Plan and Supporters of the Coalition's Plan

Intro	Name	Title	Organization	City
Mr.	Layne Filbrun	Fisherman	Striper, Bass Salmon Supporter	Modesto
Mr.	Laythe Moore	Fisherman	Striper, Bass Salmon Supporter	Banning
Mr.	Lee Miller	Fisherman	Striper, Bass Salmon Supporter	Stockton
Mr.	Lee Mitchell	Fisherman	Striper, Bass Salmon Supporter	Seaside
Ms.	Leila Navarette	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	Leo Saechao	Fisherman	Striper, Bass Salmon Supporter	Richmond
Mr.	Leonard Ciokewicz	Fisherman	Striper, Bass Salmon Supporter	Rio Linda
Mr.	Leonard Orman	Fisherman	Striper, Bass Salmon Supporter	Brentwood
Mr.	Leonard Valverde	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	Lester Hearron	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Ms.	Linda Caruso	Fisherman	Striper, Bass Salmon Supporter	Walnut Creek
Ms.	Linda George	Fisherman	Striper, Bass Salmon Supporter	Napa
Ms.	Linda Morse-robertson	Fisherman	Striper, Bass Salmon Supporter	Knightsen
Ms.	Lisa Schmitt	Fisherman	Striper, Bass Salmon Supporter	Manteca
Mr.	Lloyd Higgins	Fisherman	Striper, Bass Salmon Supporter	Modesto
Mr.	Lloyd Hiramoto	Fisherman	Striper, Bass Salmon Supporter	Sunnyvale
Mr.	Lloyd Slaton	Fisherman	Striper, Bass Salmon Supporter	Salinas
Mr.	Long Nguyen	Fisherman	Striper, Bass Salmon Supporter	San Jose
Ms.	Loren Kitamura	Fisherman	Striper, Bass Salmon Supporter	Sallinas
Mr.	Lou Caruso	Fisherman	Striper, Bass Salmon Supporter	West Babylon
Mr.	Louis Bacciocco	Fisherman	Striper, Bass Salmon Supporter	Novato
Ms.	Louis Fry	Fisherman	Striper, Bass Salmon Supporter	Novato
Ms.	Louis Rojas	Fisherman	Striper, Bass Salmon Supporter	Chowchilla
Ms.	Louis Vierra	Fisherman	Striper, Bass Salmon Supporter	Oakdale
Mr.	Lucas Snider	Fisherman	Striper, Bass Salmon Supporter	Dixon
Mr.	Luis Romero	Fisherman	Striper, Bass Salmon Supporter	Vallejo
Mr.	Luke Lum	Fisherman	Striper, Bass Salmon Supporter	Sunnyvale
Mr.	Lyle Vandeburgh	Fisherman	Striper, Bass Salmon Supporter	Stockton
Mr.	Madison Malicki	Fisherman	Striper, Bass Salmon Supporter	Vacaville
Mr.	Mahmoud Cardin	Fisherman	Striper, Bass Salmon Supporter	Fremont
Mr.	Marc Menezes	Fisherman	Striper, Bass Salmon Supporter	Manteca
Mr.	Marc Norton	Fisherman	Striper, Bass Salmon Supporter	Zamora
Ms.	Margie Siegal	Fisherman	Striper, Bass Salmon Supporter	Oakland
Ms.	Maria Dicoio	Fisherman	Striper, Bass Salmon Supporter	Bayside
Mr.	Mario Novoa	Fisherman	Striper, Bass Salmon Supporter	Hercules
Mr.	Mark Capra	Fisherman	Striper, Bass Salmon Supporter	Fremont
Capt.	Mark Chow	Owner	Magic Woman Charters	Berkeley
Mr.	Mark Fehrenbach	Fisherman	Striper, Bass Salmon Supporter	Rio Vista
Mr.	Mark Gangler	Fisherman	Striper, Bass Salmon Supporter	Carmichael
Mr.	Mark Gomez	Fisherman	Striper, Bass Salmon Supporter	Turlock
Mr.	Mark Haworth	Fisherman	Striper, Bass Salmon Supporter	Hollister
Mr.	Mark Keller	Fisherman	Striper, Bass Salmon Supporter	Benicia
Mr.	Mark Kwiatkowski	Fisherman	Striper, Bass Salmon Supporter	Lodi
Mr.	Mark Malliot	Fisherman	Striper, Bass Salmon Supporter	Healdsburg
Capt.	Mark Mlcoch	President	Nor-Cal River Guides Assn.	Anderson
Mr.	Mark Nomura	Fisherman	Striper, Bass Salmon Supporter	Fremont
Mr.	Mark Poulson	Fisherman	Striper, Bass Salmon Supporter	Oakley
Mr.	Mark Ruef	Fisherman	Striper, Bass Salmon Supporter	Yuba City

Opponents of the Reg Change Plan and Supporters of the Coalition's Plan

Intro	Name	Title	Organization	City
Mr.	Mark Stam	Fisherman	Striper, Bass Salmon Supporter	Carmichael
Mr.	Mark Thielke	Fisherman	Striper, Bass Salmon Supporter	Elk Grove
Mr.	Mark Torrez	President	California B.A.S.S. Nation	West Sacramento
Mr.	Mark Turner	Fisherman	Striper, Bass Salmon Supporter	Suisun City
Mr.	Marshall Briggs	Fisherman	Striper, Bass Salmon Supporter	Napa
Mr.	Martin Plotkin	Fisherman	Striper, Bass Salmon Supporter	Livermore
Mr.	Marty Boyle	Fisherman	Striper, Bass Salmon Supporter	Warsaw
Mr.	Marty Culverwell	Fisherman	Striper, Bass Salmon Supporter	Reno
Mr.	Marty Lentini	Fisherman	Striper, Bass Salmon Supporter	Walnut Creek
Mr.	Marvin Alovera	Fisherman	Striper, Bass Salmon Supporter	Daly City
Mr.	Marvin Hatfield	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Ms.	Mary Davis	Fisherman	Striper, Bass Salmon Supporter	Arcadia
Ms.	Mary Steinert	Fisherman	Striper, Bass Salmon Supporter	
Mr.	Mathias Lallas	Fisherman	Striper, Bass Salmon Supporter	Oakley
Mr.	Matt Atkins	Fisherman	Striper, Bass Salmon Supporter	Redding
Mr.	Matt Beckett	Fisherman	Striper, Bass Salmon Supporter	El Dorado Hills
Mr.	Matt Conant	Fisherman	Striper, Bass Salmon Supporter	Camp Pendleton
Mr.	Matt Dittmer	Fisherman	Striper, Bass Salmon Supporter	Foresthill
Mr.	Matt Gallagher	Fisherman	Striper, Bass Salmon Supporter	Killington
Mr.	Matt Ingersoll	Fisherman	Striper, Bass Salmon Supporter	Sonoma
Mr.	Matt Lipary	Fisherman	Striper, Bass Salmon Supporter	Vacaville
Mr.	Matt Olrich	Fisherman	Striper, Bass Salmon Supporter	Novato
Mr.	Matt Tozer	Fisherman	Striper, Bass Salmon Supporter	Newcastle
Mr.	Matthew Farrand	Fisherman	Striper, Bass Salmon Supporter	El Dorado Hills
Mr.	Matthew Gibson	Fisherman	Striper, Bass Salmon Supporter	Davis
Mr.	Matthew Hughes	Fisherman	Striper, Bass Salmon Supporter	Rohnert Park
Mr.	Matthew Kania	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Matthew Noel	Fisherman	Striper, Bass Salmon Supporter	Dixon
Mr.	Matthew Rosenberg	Fisherman	Striper, Bass Salmon Supporter	Fairfield
Mr.	Matthew Sterling	Fisherman	Striper, Bass Salmon Supporter	Modesto
Mr.	Matthias Schwartz	Fisherman	Striper, Bass Salmon Supporter	Santa Cruz
Mr.	Matts Madsen	Fisherman	Striper, Bass Salmon Supporter	San Francisco
Mr.	Maurice White	Fisherman	Striper, Bass Salmon Supporter	Red Bluff
Mr.	Max Jeffries	Fisherman	Striper, Bass Salmon Supporter	Meadow Vista
Mr.	Mcelroy E Mcginty	Fisherman	Striper, Bass Salmon Supporter	Sunnyvale
Mr.	Melanie Giuntoli	Fisherman	Striper, Bass Salmon Supporter	Rio Vista
Ms.	Melissa Glover	Fisherman	Striper, Bass Salmon Supporter	Lodi
Mr.	Melvin Takahashi	Fisherman	Striper, Bass Salmon Supporter	Rocklin
Mr.	Meng Xyong	Fisherman	Striper, Bass Salmon Supporter	Fresno
Mr.	Merlin Dais	Fisherman	Striper, Bass Salmon Supporter	Lodi
Mr.	Merrill Utzig	Fisherman	Striper, Bass Salmon Supporter	Lockeford
Mr.	Michae Woodmam	Fisherman	Striper, Bass Salmon Supporter	Grass Valley
Mr.	Michael Anderson	Fisherman	Striper, Bass Salmon Supporter	Patterson
Mr.	Michael Avila	Fisherman	Striper, Bass Salmon Supporter	West Sacramento
Mr.	Michael Buentello	Fisherman	Striper, Bass Salmon Supporter	Hanford
Mr.	Michael Chavez	Fisherman	Striper, Bass Salmon Supporter	Discovery Bay
Mr.	Michael Dezonia	Fisherman	Striper, Bass Salmon Supporter	El Dorado Hills
Mr.	Michael Dickman	Fisherman	Striper, Bass Salmon Supporter	Ripon

Opponents of the Reg Change Plan and Supporters of the Coalition's Plan

Intro	Name	Title	Organization	City
Mr.	Michael Enos	Fisherman	Striper, Bass Salmon Supporter	Lafayette
Mr.	Michael Esposito	Fisherman	Striper, Bass Salmon Supporter	Livermore
Mr.	Michael Faught	Fisherman	Striper, Bass Salmon Supporter	Lodi
Mr.	Michael H Gover	Fisherman	Striper, Bass Salmon Supporter	Yosemite National Park
Mr.	Michael Hale	Fisherman	Striper, Bass Salmon Supporter	Novato
Mr.	Michael Hirasaki	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	Michael Juanes	Fisherman	Striper, Bass Salmon Supporter	Sunnyvale
Mr.	Michael Khinoo	Fisherman	Striper, Bass Salmon Supporter	Modesto
Mr.	Michael Lawless	Fisherman	Striper, Bass Salmon Supporter	El Monte
Mr.	Michael Lupo	Fisherman	Striper, Bass Salmon Supporter	San Dirgo
Mr.	Michael Matulovich	Fisherman	Striper, Bass Salmon Supporter	Walnut Creek
Mr.	Michael Mcgregor	Fisherman	Striper, Bass Salmon Supporter	Loomis
Mr.	Michael Moniz	Fisherman	Striper, Bass Salmon Supporter	Discovery Bay
Mr.	Michael Murphy	Fisherman	Striper, Bass Salmon Supporter	Boulder Creek
Mr.	Michael Profumo	Fisherman	Striper, Bass Salmon Supporter	Auburn
Mr.	Michael Rapp	Fisherman	Striper, Bass Salmon Supporter	Palmdale
Mr.	Michael Raynal	Fisherman	Striper, Bass Salmon Supporter	Camino
Mr.	Michael Rea	Fisherman	Striper, Bass Salmon Supporter	Point Reyes Station
Mr.	Michael Regan	Fisherman	Striper, Bass Salmon Supporter	Pacifica
Mr.	Michael Rettie	Fisherman	Striper, Bass Salmon Supporter	Alameda
Mr.	Michael Ridola	Fisherman	Striper, Bass Salmon Supporter	Morgan Hill
Mr.	Michael Rose	Fisherman	Striper, Bass Salmon Supporter	Fremont
Mr.	Michael Scaglione	Owner	Pacific Catch	Grass Valley
Mr.	Michael Seewald	Fisherman	Striper, Bass Salmon Supporter	Encinitas
Mr.	Michael Smith	Fisherman	Striper, Bass Salmon Supporter	Discovery Bay
Mr.	Michael Snelling	Fisherman	Striper, Bass Salmon Supporter	Sutter
Mr.	Michael Sorensen	Fisherman	Striper, Bass Salmon Supporter	Yuba City
Mr.	Michael Swift	Fisherman	Striper, Bass Salmon Supporter	Richmond
Mr.	Michael Tarango	Fisherman	Striper, Bass Salmon Supporter	Salinas
Mr.	Michael Tobey	Fisherman	Striper, Bass Salmon Supporter	Vacaville
Mr.	Michael Trujillo	Fisherman	Striper, Bass Salmon Supporter	Acampo
Mr.	Michel Rudovsky	Fisherman	Striper, Bass Salmon Supporter	Concord
Mr.	Mickey Chaboya	Fisherman	Striper, Bass Salmon Supporter	Santa Clara
Mr.	Miguel Galindo	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Mikaela Liest	Fisherman	Striper, Bass Salmon Supporter	
Mr.	Mike Ayers	Fisherman	Striper, Bass Salmon Supporter	Petaluma
Mr.	Mike Bogges	Fisherman	Striper, Bass Salmon Supporter	Santa Rosa
Mr.	Mike Chavez	Fisherman	Striper, Bass Salmon Supporter	El Sobrante
Mr.	Mike Cloud	Fisherman	Striper, Bass Salmon Supporter	Oviedo
Mr.	Mike Dickman	Fisherman	Striper, Bass Salmon Supporter	Ripon
Mr.	Mike Edwards	Fisherman	Striper, Bass Salmon Supporter	Rocklin
Mr.	Mike Gofff	Fisherman	Striper, Bass Salmon Supporter	Antalope
Mr.	Mike Gorman	Fisherman	Striper, Bass Salmon Supporter	Chico
Mr.	Mike Haley	Superintintendent	McGuire Hester	Oakland
Mr.	Mike Hall	Fisherman	Striper, Bass Salmon Supporter	Brentwood
Mr.	Mike Hammond	Fisherman	Striper, Bass Salmon Supporter	San Francisco
Mr.	Mike Lam	Fisherman	Striper, Bass Salmon Supporter	Ssf
Mr.	Mike Landy	Conservation Director	California B.A.S.S. Nation	West Sacramento

Opponents of the Reg Change Plan and Supporters of the Coalition's Plan

Intro	Name	Title	Organization	City
Mr.	Mike Leahy	Fisherman	Striper, Bass Salmon Supporter	Marysville
Mr.	Mike Lum	General Manager	Fred Hall Shows	Long Beach
Mr.	Mike Mcgee	Fisherman	Striper, Bass Salmon Supporter	Oroville
Mr.	Mike Melrose	Fisherman	Striper, Bass Salmon Supporter	Modesto
Mr.	Mike Normoyle	Fisherman	Striper, Bass Salmon Supporter	Fort Bragg
Mr.	Mike Rutherdale	Fisherman	Striper, Bass Salmon Supporter	Pescadero
Mr.	Mike Schaffer	Fisherman	Striper, Bass Salmon Supporter	Hayward
Mr.	Mike Schiller	Fisherman	Striper, Bass Salmon Supporter	Oakhurst
Mr.	Mike Shannon	Fisherman	Striper, Bass Salmon Supporter	Yuba City
Mr.	Mike Switzer	Fisherman	Striper, Bass Salmon Supporter	Gilroy
Mr.	Mike Tran	Fisherman	Striper, Bass Salmon Supporter	American Canyon
Mr.	Mike Verrone	Fisherman	Striper, Bass Salmon Supporter	Vacaville
Mr.	Mike Wynn	Fisherman	Striper, Bass Salmon Supporter	Napa
Mr.	Milo Vukovich	Fisherman	Striper, Bass Salmon Supporter	Vista
Mr.	Milt Mossi	Fisherman	Striper, Bass Salmon Supporter	
Mr.	Milton Bosch	Fisherman	Striper, Bass Salmon Supporter	Napa
Ms.	Miriam Gilchrist	Fisherman	Striper, Bass Salmon Supporter	Redwood City
Mr.	Misty Gnapp	Fisherman	Striper, Bass Salmon Supporter	Elk Grove
Mr.	Mitch Phillips	Fisherman	Striper, Bass Salmon Supporter	Modesto
Mr.	Morgan Read	Fisherman	Striper, Bass Salmon Supporter	Berkeley
Ms.	Nai Saelee	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Ms.	Natalie Peatman	Fisherman	Striper, Bass Salmon Supporter	Napa
Mr.	Nate Bronner	Fisherman	Striper, Bass Salmon Supporter	Lincoln
Mr.	Neil Tyler	Fisherman	Striper, Bass Salmon Supporter	Hollister
Mr.	Nelson Loo	Fisherman	Striper, Bass Salmon Supporter	Elk Grove
Mr.	Nelson Vineyard	Fisherman	Striper, Bass Salmon Supporter	Vacaville
Mr.	Nelson Wakimoto	Fisherman	Striper, Bass Salmon Supporter	Davis
Mr.	Neng Vang	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Nicholas Deferrari	Fisherman	Striper, Bass Salmon Supporter	Felton
Mr.	Nicholas Goulart	Fisherman	Striper, Bass Salmon Supporter	Suisun City
Mr.	Nicholas Wiseman	Fisherman	Striper, Bass Salmon Supporter	Manteca
Mr.	Nick Andrews	Fisherman	Striper, Bass Salmon Supporter	Rio Linda
Mr.	Nick Berry	Fisherman	Striper, Bass Salmon Supporter	Pleasant Hill
Mr.	Nick Matulich	Fisherman	Striper, Bass Salmon Supporter	Stockton
Mr.	Nick Purcell	Fisherman	Striper, Bass Salmon Supporter	Mckinleyville
Mr.	Nicklos Smith	Fisherman	Striper, Bass Salmon Supporter	Stockton
Mr.	Nickolas Ingersoll	Fisherman	Striper, Bass Salmon Supporter	Rio Linda
Ms.	Nicole Cook	Fisherman	Striper, Bass Salmon Supporter	Fairfield
Ms.	Nicole Impagliazzo	Fisherman	Striper, Bass Salmon Supporter	Pleasanton
Ms.	Nicole Stinnett	Fisherman	Striper, Bass Salmon Supporter	Suisun City
Mr.	Nina Knight	Fisherman	Striper, Bass Salmon Supporter	Citrus Heights
Mr.	Norm Lee	Fisherman	Striper, Bass Salmon Supporter	Elk Grove
Ms.	Norma Baker	Fisherman	Striper, Bass Salmon Supporter	San Leandro
Mr.	Norman Moriguchi	Fisherman	Striper, Bass Salmon Supporter	Lodi
Mr.	Norman Soderberg	Fisherman	Striper, Bass Salmon Supporter	Galt
Mr.	Omar Gutierrez	Fisherman	Striper, Bass Salmon Supporter	Bay Point
Mr.	P Prevost	Fisherman	Striper, Bass Salmon Supporter	Antioch
Mr.	Pao Saefong	Fisherman	Striper, Bass Salmon Supporter	Oakland

Opponents of the Reg Change Plan and Supporters of the Coalition's Plan

Intro	Name	Title	Organization	City
Mr.	Par Lowe	Fisherman	Striper, Bass Salmon Supporter	Yuba City
Mr.	Pat Negroni	Principal	Dixon Boat and Fishing Club	Dixon
Mr.	Pat Young	Fisherman	Striper, Bass Salmon Supporter	Manton
Mr.	Patrick Carden	Fisherman	Striper, Bass Salmon Supporter	Carmichael
Mr.	Patrick Crain	Fisherman	Striper, Bass Salmon Supporter	Davis
Mr.	Patrick Eodice	Fisherman	Striper, Bass Salmon Supporter	Salinas
Mr.	Patrick Van Treeck	Fisherman	Striper, Bass Salmon Supporter	Antelope
Mr.	Patrick Villiados	Fisherman	Striper, Bass Salmon Supporter	Milpitas
Mr.	Patsie Lee	Fisherman	Striper, Bass Salmon Supporter	Fair Oaks
Mr.	Paul Ancelli	Fisherman	Striper, Bass Salmon Supporter	Westfield
Mr.	Paul Carruth	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Paul Gamache	Fisherman	Striper, Bass Salmon Supporter	Tracy
Mr.	Paul Jung	Fisherman	Striper, Bass Salmon Supporter	San Mateo
Mr.	Paul Nadarisay	Fisherman	Striper, Bass Salmon Supporter	American Canyon
Mr.	Paul Nagata	Fisherman	Striper, Bass Salmon Supporter	Concord
Mr.	Paul Sieg	Fisherman	Striper, Bass Salmon Supporter	Antioch
Mr.	Paul Smilanick	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Paul Velez	Fisherman	Striper, Bass Salmon Supporter	San Leandro
Mr.	Paul Wong	Fisherman	Striper, Bass Salmon Supporter	Antioch
Ms.	Paulette Kenyon	Fisherman	Striper, Bass Salmon Supporter	Pleasanton
Mr.	Per Person	Fisherman	Striper, Bass Salmon Supporter	Antelope
Capt.	Perry Kerson	Owner	Sea Turtle Charters	Sausalito
Capt.	Peter Bruno	Owner	Chubasco Charters	Monterey
Capt.	Peter Bruno	Owner	Randy's Fishing Trips Center	Monterey
Capt.	Peter Bruno	Owner	Sir Randy Charters	Monterey
Mr.	Peter Douglas	Fisherman	Striper, Bass Salmon Supporter	San Mate4o
Mr.	Peter Levikow	Fisherman	Striper, Bass Salmon Supporter	Grass Valley
Mr.	Peter Reyes	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	Peter Shifman	Fisherman	Striper, Bass Salmon Supporter	Langely
Mr.	Peter Simpson	Fisherman	Striper, Bass Salmon Supporter	San Bruno
Capt.	Phil Havlicek	Owner	Reel Time Charters	Sausalito
Mr.	Phil Morlock	Dir. Environmental Aff.	Shimano American	Irvine
Mr.	Phil Rathbone	Fisherman	Striper, Bass Salmon Supporter	Fresno
Mr.	Philip Nagata	Fisherman	Striper, Bass Salmon Supporter	Valley Springs
Mr.	Phillip Vasquez	Fisherman	Striper, Bass Salmon Supporter	Suisun City
Mr.	R Montgomery	Fisherman	Striper, Bass Salmon Supporter	Jackson
Mr.	Rae Regala	Fisherman	Striper, Bass Salmon Supporter	Campbell
Mr.	Ralph Nice	Fisherman	Striper, Bass Salmon Supporter	Castro Valley
Mr.	Randal Morrison	Fisherman	Striper, Bass Salmon Supporter	Sebastopol
Mr.	Randall Patterson	Fisherman	Striper, Bass Salmon Supporter	Burlingame
Mr.	Randall Ratterman	Fisherman	Striper, Bass Salmon Supporter	Lakeport
Mr.	Randolph Williamson	Fisherman	Striper, Bass Salmon Supporter	Pollock Pines
Mr.	Randy Ciampi	Fisherman	Striper, Bass Salmon Supporter	Martinez
Mr.	Randy Ladd	Fisherman	Striper, Bass Salmon Supporter	Willows
Mr.	Randy Paculba	Fisherman	Striper, Bass Salmon Supporter	Stockton
Ms.	Raquel Williams	Fisherman	Striper, Bass Salmon Supporter	Escalon
Mr.	Ray Sugai	Fisherman	Striper, Bass Salmon Supporter	Vacaville
Mr.	Raymond Binner	Fisherman	Striper, Bass Salmon Supporter	Cedar Ridge

Opponents of the Reg Change Plan and Supporters of the Coalition's Plan

Intro	Name	Title	Organization	City
Mr.	Raymond Peoro	Fisherman	Striper, Bass Salmon Supporter	Folsom
Mr.	Rebecca Crane	Fisherman	Striper, Bass Salmon Supporter	Benicia
Ms.	Reeta Roo	Fisherman	Striper, Bass Salmon Supporter	Occidental
Ms.	Renee Cibulka	Fisherman	Striper, Bass Salmon Supporter	Escondido
Mr.	Reynaldo Cantu	Fisherman	Striper, Bass Salmon Supporter	Newark
Mr.	Rich Caro	Fisherman	Striper, Bass Salmon Supporter	Santa Rosa
Mr.	Rich Knifsend	Fisherman	Striper, Bass Salmon Supporter	Walnut Creek
Mr.	Rich Mendoza	Fisherman	Striper, Bass Salmon Supporter	
Capt.	Rich White	Owner	Shark Bait Charters	Bodega Bay
Mr.	Rich Zeilenga	COO	Tackle Warehouse	San Luis Obispo
Mr.	Richard Baxter	Fisherman	Striper, Bass Salmon Supporter	Livermore
Mr.	Richard Boyd	Fisherman	Striper, Bass Salmon Supporter	Ripon
Mr.	Richard Bozzano	Fisherman	Striper, Bass Salmon Supporter	Stockton
Mr.	Richard Britschgi	Fisherman	Striper, Bass Salmon Supporter	La Center
Mr.	Richard Davilla	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	Richard Embody	Fisherman	Striper, Bass Salmon Supporter	Alameda
Mr.	Richard Falletti	Fisherman	Striper, Bass Salmon Supporter	Alameda
Mr.	Richard Fuchs	Fisherman	Striper, Bass Salmon Supporter	Burlingame
Mr.	Richard Gander	Fisherman	Striper, Bass Salmon Supporter	Truckee
Mr.	Richard King	Fisherman	Striper, Bass Salmon Supporter	San Francisco
Mr.	Richard Kong	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	Richard Lam	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Richard Lamb	Fisherman	Striper, Bass Salmon Supporter	Santa Rosa
Mr.	Richard Langley	Fisherman	Striper, Bass Salmon Supporter	Galt
Mr.	Richard Long	Fisherman	Striper, Bass Salmon Supporter	Lodi
Mr.	Richard Lyons	Fisherman	Striper, Bass Salmon Supporter	Antioch
Mr.	Richard Morthole	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Richard Nield	Fisherman	Striper, Bass Salmon Supporter	Castro Valley
Mr.	Richard Parker	Fisherman	Striper, Bass Salmon Supporter	West Sacramento
Mr.	Richard Pool	President	Pro-Troll Fishing Products	Concord
Mr.	Richard Pool	President	Water4Fish	Concord
Mr.	Richard Ross	Fisherman	Striper, Bass Salmon Supporter	Concord
Mr.	Richard Serrato	Fisherman	Striper, Bass Salmon Supporter	Sj
Mr.	Richard Spring	Fisherman	Striper, Bass Salmon Supporter	Grass Valley
Mr.	Richard Toll	Fisherman	Striper, Bass Salmon Supporter	Napa
Mr.	Richard Torres	Fisherman	Striper, Bass Salmon Supporter	Elk Grove
Mr.	Richard Torres	Fisherman	Striper, Bass Salmon Supporter	Oroville
Mr.	Richard Waters	Fisherman	Striper, Bass Salmon Supporter	Milpitas
Mr.	Rick Bright	Fisherman	Striper, Bass Salmon Supporter	Arbuckle
Mr.	Rick Fried	Fisherman	Striper, Bass Salmon Supporter	Sutter Creek
Capt.	Rick Powers	Owner	New Sea Angler Charters	Bodega Bay
Capt.	Rick Powers	Owner	Surf Scooter Charters	Bodega Bay
Mr.	Rick Sanchez	Fisherman	Striper, Bass Salmon Supporter	Sunnyvale
Mr.	Ricky Lam	Fisherman	Striper, Bass Salmon Supporter	San Francisco
Mr.	Rob Clarke	Fisherman	Striper, Bass Salmon Supporter	Woodland
Mr.	Rob Van Niel	Fisherman	Striper, Bass Salmon Supporter	
Mr.	Rob Vanleemput	Fisherman	Striper, Bass Salmon Supporter	Marysville
Mr.	Robby Nixon	Fisherman	Striper, Bass Salmon Supporter	Lodi

Opponents of the Reg Change Plan and Supporters of the Coalition's Plan

Intro	Name	Title	Organization	City
Mr.	Robert Akers	Fisherman	Striper, Bass Salmon Supporter	Oakland
Mr.	Robert Batsford	Fisherman	Striper, Bass Salmon Supporter	San Carlos
Mr.	Robert Campbell	Fisherman	Striper, Bass Salmon Supporter	Fresno
Mr.	Robert Cooley	Fisherman	Striper, Bass Salmon Supporter	Fair Oaks
Mr.	Robert Cooper	Fisherman	Striper, Bass Salmon Supporter	Citrus Heights
Mr.	Robert Crawford	Fisherman	Striper, Bass Salmon Supporter	Chico
Mr.	Robert Dallas	Fisherman	Striper, Bass Salmon Supporter	Atwater
Mr.	Robert Davenport	Fisherman	Striper, Bass Salmon Supporter	San Diego
Mr.	Robert Dong	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Robert Douangmala	Fisherman	Striper, Bass Salmon Supporter	Woonsocket
Mr.	Robert Eastwood	Fisherman	Striper, Bass Salmon Supporter	Stockton
Mr.	Robert Filbrun	Fisherman	Striper, Bass Salmon Supporter	Modesto
Mr.	Robert Fletcher	Fisherman	Striper, Bass Salmon Supporter	Livermore
Capt.	Robert Gallia	Owner	El Dorado I Charters	Berkeley
Mr.	Robert Graves	Fisherman	Striper, Bass Salmon Supporter	Granite Bay
Mr.	Robert Hammer	Fisherman	Striper, Bass Salmon Supporter	Elk Grove
Mr.	Robert Hennecke	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Robert Hicks	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Robert Jozaityis	Fisherman	Striper, Bass Salmon Supporter	San Ramon
Mr.	Robert Kaib	Fisherman	Striper, Bass Salmon Supporter	Concord
Mr.	Robert Kearns	Fisherman	Striper, Bass Salmon Supporter	Anderson
Mr.	Robert Lalum	Fisherman	Striper, Bass Salmon Supporter	Rancho Cordova
Mr.	Robert Loggins	Fisherman	Striper, Bass Salmon Supporter	Tracy
Mr.	Robert Lucero	Fisherman	Striper, Bass Salmon Supporter	Woodbridge
Mr.	Robert Marcipan	Fisherman	Striper, Bass Salmon Supporter	Pleasanton
Mr.	Robert Matzke	Fisherman	Striper, Bass Salmon Supporter	Williams
Mr.	Robert Moreno	Fisherman	Striper, Bass Salmon Supporter	Turlock
Mr.	Robert Nash	Fisherman	Striper, Bass Salmon Supporter	South Lake Tahoe
Mr.	Robert Olsen	Fisherman	Striper, Bass Salmon Supporter	Bethel Island
Mr.	Robert Pene	Fisherman	Striper, Bass Salmon Supporter	Live Oak
Mr.	Robert Riblett	Fisherman	Striper, Bass Salmon Supporter	Hayward
Mr.	Robert Ripley	Fisherman	Striper, Bass Salmon Supporter	Sutter
Mr.	Robert Roina	Fisherman	Striper, Bass Salmon Supporter	Citrus Heights
Mr.	Robert Short	Fisherman	Striper, Bass Salmon Supporter	
Mr.	Robert Smolke	Fisherman	Striper, Bass Salmon Supporter	Lodi
Mr.	Robert Sonoma	Fisherman	Striper, Bass Salmon Supporter	Vallejo
Mr.	Robert Taylor	Fisherman	Striper, Bass Salmon Supporter	Los Altos
Mr.	Robert Tomlin	Fisherman	Striper, Bass Salmon Supporter	Castaic
Mr.	Robert Torre	Fisherman	Striper, Bass Salmon Supporter	Santa Rosa
Mr.	Robert Valentine	Fisherman	Striper, Bass Salmon Supporter	San Rafael
Mr.	Robert Visger	Fisherman	Striper, Bass Salmon Supporter	Rancho Cordova
Mr.	Robert Waldron	Fisherman	Striper, Bass Salmon Supporter	Concord
Mr.	Robert Weidner	Fisherman	Striper, Bass Salmon Supporter	Lodi
Mr.	Robin Duncan	Fisherman	Striper, Bass Salmon Supporter	Hollister
Ms.	Robin Heal	Fisherman	Striper, Bass Salmon Supporter	Livermore
Mr.	Rodney Coleman	Fisherman	Striper, Bass Salmon Supporter	Citrus Heights
Mr.	Rodney Furlani	Fisherman	Striper, Bass Salmon Supporter	Napa
Mr.	Rodney Mcclelland	Fisherman	Striper, Bass Salmon Supporter	Antioch

Opponents of the Reg Change Plan and Supporters of the Coalition's Plan

Intro	Name	Title	Organization	City
Mr.	Rodney Scott	Fisherman	Striper, Bass Salmon Supporter	Yuba City
Mr.	Rodney Smith	Fisherman	Striper, Bass Salmon Supporter	Vallejo
Mr.	Roger Bitz	Fisherman	Striper, Bass Salmon Supporter	Acampo
Mr.	Roger Bland	Fisherman	Striper, Bass Salmon Supporter	San Francisco
Mr.	Roger Choate	Fisherman	Striper, Bass Salmon Supporter	Livermore
Mr.	Roger George	Fisherman	Striper, Bass Salmon Supporter	Fresno
Mr.	Roger Gomez	Fisherman	Striper, Bass Salmon Supporter	Oakland
Mr.	Roger Jeong	Fisherman	Striper, Bass Salmon Supporter	Palo Alto
Capt.	Roger Thomas	President	Golden Gate Fisherman's Assoc.	Sausalito
Capt.	Roger Thomas	Owner	Salty Lady Charters	Sausalito
Mr.	Roland Robertson	Fisherman	Striper, Bass Salmon Supporter	North San Juan
Mr.	Roland Sapigao	Fisherman	Striper, Bass Salmon Supporter	Sparks
Mr.	Roman Yankov	Fisherman	Striper, Bass Salmon Supporter	Brentwood
Mr.	Roman Zamora	Fisherman	Striper, Bass Salmon Supporter	
Mr.	Ron Bernhardt	Fisherman	Striper, Bass Salmon Supporter	Livermore
Mr.	Ron Davis	Fisherman	Striper, Bass Salmon Supporter	Forest Knolls
Mr.	Ron Fletcher	Fisherman	Striper, Bass Salmon Supporter	Antioch
Mr.	Ron Gall	Fisherman	Striper, Bass Salmon Supporter	Manteca
Mr.	Ron Hensic	Fisherman	Striper, Bass Salmon Supporter	Sonoma
Mr.	Ron Hicks	Fisherman	Striper, Bass Salmon Supporter	Yuba City
Mr.	Ron Hipp	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Ron Howe	Fisherman	Striper, Bass Salmon Supporter	Elk Grove
Mr.	Ron Licari	Fisherman	Striper, Bass Salmon Supporter	Castaic
Mr.	Ron Ratlief	Fisherman	Striper, Bass Salmon Supporter	Lake Havasu City
Mr.	Ron Rhone	Fisherman	Striper, Bass Salmon Supporter	Pinole
Mr.	Ron Stam	Fisherman	Striper, Bass Salmon Supporter	Citrus Heights
Mr.	Ron Tietze	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	Ron Vander Groen	Fisherman	Striper, Bass Salmon Supporter	Walnut Creek
Mr.	Ron Vise	Fisherman	Striper, Bass Salmon Supporter	Grants Pass
Mr.	Ron Vogt	Fisherman	Striper, Bass Salmon Supporter	Meadow Vista
Mr.	Ron Westgate	Fisherman	Striper, Bass Salmon Supporter	Pleasant Hill
Mr.	Ron Zigelhofer	Fisherman	Striper, Bass Salmon Supporter	Camino
Mr.	Ronald Brown	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Ronald La Force	Fisherman	Striper, Bass Salmon Supporter	Yuba City
Mr.	Ronald Owen	Fisherman	Striper, Bass Salmon Supporter	Brawley
Mr.	Rory Ahrens	Fisherman	Striper, Bass Salmon Supporter	Grassvalley
Ms.	Rose Bischoff	Fisherman	Striper, Bass Salmon Supporter	
Ms.	Rosemary Season	Fisherman	Striper, Bass Salmon Supporter	San Rafael
Mr.	Roy Bitz	Fisherman	Striper, Bass Salmon Supporter	La Quinta
Mr.	Roy Gray	Manufacturers Rep	Roy Gray and Associates	Auburn
Mr.	Roy Kemp	Fisherman	Striper, Bass Salmon Supporter	Concord
Mr.	Roy Yamanouchi	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	Ruben Castillo	Fisherman	Striper, Bass Salmon Supporter	Porterville
Mr.	Russ Smith	Fisherman	Striper, Bass Salmon Supporter	Grass Valley
Mr.	Rusty Boro	Fisherman	Striper, Bass Salmon Supporter	Shingle Springs
Mr.	Ryan Bochmann	Fisherman	Striper, Bass Salmon Supporter	Oakdale
Mr.	Ryan Bradford	Fisherman	Striper, Bass Salmon Supporter	Yuba City
Mr.	Ryan Cecil	Fisherman	Striper, Bass Salmon Supporter	Stockton

Opponents of the Reg Change Plan and Supporters of the Coalition's Plan

Intro	Name	Title	Organization	City
Mr.	Ryan Demello	Fisherman	Striper, Bass Salmon Supporter	Castro Valley
Mr.	Ryan Forsyth	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Ryan Grisso	Fisherman	Striper, Bass Salmon Supporter	Pinole
Mr.	Ryan Horath	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Ryan Kihm	Fisherman	Striper, Bass Salmon Supporter	Wilton
Mr.	Ryan Ng	Fisherman	Striper, Bass Salmon Supporter	Modesto
Mr.	Ryan Pruitt	Fisherman	Striper, Bass Salmon Supporter	Turlock
Mr.	Ryan Scott	Fisherman	Striper, Bass Salmon Supporter	El Dorado Hills
Mr.	Sal Tova	Fisherman	Striper, Bass Salmon Supporter	Tracy
Mr.	Sam Bone	Fisherman	Striper, Bass Salmon Supporter	Lodi
Mr.	Sam Chamberlin	Fisherman	Striper, Bass Salmon Supporter	El Macero
Mr.	Samuel Medina	Fisherman	Striper, Bass Salmon Supporter	Woodland
Mr.	Samuel Saguindel	Fisherman	Striper, Bass Salmon Supporter	Antioch
Mr.	Sao Vue	Fisherman	Striper, Bass Salmon Supporter	
Mr.	Satyanarayana Kunche	Fisherman	Striper, Bass Salmon Supporter	Milpitas
Mr.	Scott Bixler	Fisherman	Striper, Bass Salmon Supporter	Menifee
Mr.	Scott Caven	Fisherman	Striper, Bass Salmon Supporter	Santa Rosa
Mr.	Scott Fincher	Fisherman	Striper, Bass Salmon Supporter	Yuba City
Mr.	Scott Gleba	Fisherman	Striper, Bass Salmon Supporter	Auburn
Mr.	Scott Granzella	Fisherman	Striper, Bass Salmon Supporter	Elsobrante
Mr.	Scott Gudes	Vice President	American Sportfishing Association	Fairfax, VA
Mr.	Scott Head	Fisherman	Striper, Bass Salmon Supporter	Oakley
Mr.	Scott Headington	Fisherman	Striper, Bass Salmon Supporter	Folsom
Mr.	Scott Kirk	Fisherman	Striper, Bass Salmon Supporter	Windsor
Mr.	Scott Lawrence	Fisherman	Striper, Bass Salmon Supporter	Woodland
Mr.	Scott Morgan	Fisherman	Striper, Bass Salmon Supporter	Petaluma
Mr.	Scott Vaughn	Fisherman	Striper, Bass Salmon Supporter	El Dorado Hills
Mr.	Scott Wellwood	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	Scott Yamaji	Fisherman	Striper, Bass Salmon Supporter	Mtn. View
Capt.	Sean Daugherty	Owner	Sean Daugherty Charters	San Rafael
Mr.	Sean De Hart	Fisherman	Striper, Bass Salmon Supporter	Rancho Cordova
Capt.	Sean Hodges	Owner	Hog Heaven Charters	Sausalito
Mr.	Sean Impeartrice	Fisherman	Striper, Bass Salmon Supporter	Los Banos
Mr.	Sean Wayman	Fisherman	Striper, Bass Salmon Supporter	Gilroy
Ms.	Seana Tilton	Fisherman	Striper, Bass Salmon Supporter	Daly City
Mr.	Seng Xiong	Fisherman	Striper, Bass Salmon Supporter	West Sacramento
Mr.	Sep Hendrickson	President	California Sportsmen Radio	Sacramento
Mr.	Seth Cramlet	Fisherman	Striper, Bass Salmon Supporter	Snelling
Mr.	Seth Johnson	Fisherman	Striper, Bass Salmon Supporter	Carmichael
Ms.	Shanda King	Fisherman	Striper, Bass Salmon Supporter	Martinez
Mr.	Shane Burton	Fisherman	Striper, Bass Salmon Supporter	Chico
Ms.	Shannon Lowe	Fisherman	Striper, Bass Salmon Supporter	Yuba City
Ms.	Sharon Cabebe	Fisherman	Striper, Bass Salmon Supporter	Campbell
Ms.	Sharon Fox	Fisherman	Striper, Bass Salmon Supporter	Fresno
Mr.	Shaun Heaney	Fisherman	Striper, Bass Salmon Supporter	Antioch
Mr.	Shaun Johnson	Fisherman	Striper, Bass Salmon Supporter	Elk Grove
Mr.	Shawn Copelin	Fisherman	Striper, Bass Salmon Supporter	Shasta Lake City
Mr.	Shawn Gallaty	Fisherman	Striper, Bass Salmon Supporter	Cottonwood

Opponents of the Reg Change Plan and Supporters of the Coalition's Plan

Intro	Name	Title	Organization	City
Mr.	Shawn Hill	Fisherman	Striper, Bass Salmon Supporter	Manteca
Mr.	Shawn Otis	Fisherman	Striper, Bass Salmon Supporter	Roseburg
Mr.	Shawn Stearns	Fisherman	Striper, Bass Salmon Supporter	Redding
Mr.	Sheldon Bisbee	Fisherman	Striper, Bass Salmon Supporter	Rio Linda
Mr.	Shon Logan	Fisherman	Striper, Bass Salmon Supporter	Meadow Vista
Ms.	Shylen Narayan	Fisherman	Striper, Bass Salmon Supporter	Sacramentp
Mr.	Son Dao	Fisherman	Striper, Bass Salmon Supporter	Milpitas
Ms.	Stacey Barrack	Fisherman	Striper, Bass Salmon Supporter	Oakley
Ms.	Stacey Stoicheff	Fisherman	Striper, Bass Salmon Supporter	Angels Camp
Mr.	Stan Bailey	Fisherman	Striper, Bass Salmon Supporter	Roseville
Mr.	Stan Boerner	Fisherman	Striper, Bass Salmon Supporter	Lynchburg
Mr.	Stan Koenigsberger	Fisherman	Striper, Bass Salmon Supporter	Brentwood
Mr.	Stan Suposs	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Stanley Pleskunas	Fisherman	Striper, Bass Salmon Supporter	Royal Oaks
Mr.	Stephan Schneeberger	Fisherman	Striper, Bass Salmon Supporter	Suisun City
Mr.	Stephan Thomason	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Ms.	Stephanie Hester	Fisherman	Striper, Bass Salmon Supporter	Citrus Heights
Mr.	Stephen Mendes	Fisherman	Striper, Bass Salmon Supporter	Watsonville
Mr.	Stephen Pritchard	Fisherman	Striper, Bass Salmon Supporter	Lodi
Mr.	Steve Andersen	Fisherman	Striper, Bass Salmon Supporter	Tracy
Mr.	Steve Baham	Fisherman	Striper, Bass Salmon Supporter	Jackson
Mr.	Steve Brown	Fisherman	Striper, Bass Salmon Supporter	Boulder Creek
Mr.	Steve Collins	Fisherman	Striper, Bass Salmon Supporter	Sac
Mr.	Steve Frazier	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	Steve Gessner	Fisherman	Striper, Bass Salmon Supporter	Santa Rosa
Mr.	Steve Hall	Fisherman	Striper, Bass Salmon Supporter	Roseville
Mr.	Steve Henderson	Fisherman	Striper, Bass Salmon Supporter	Manteca
Mr.	Steve Hunt	Fisherman	Striper, Bass Salmon Supporter	El Sobrante
Mr.	Steve Jones	Fisherman	Striper, Bass Salmon Supporter	Watsonville
Mr.	Steve Ju	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Steve Maiolini	Fisherman	Striper, Bass Salmon Supporter	Millbrae
Mr.	Steve Molina	Fisherman	Striper, Bass Salmon Supporter	Ontario
Mr.	Steve Newton	Fisherman	Striper, Bass Salmon Supporter	Lincoln
Mr.	Steve Poytress	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Steve Proctor	Fisherman	Striper, Bass Salmon Supporter	Danville
Mr.	Steve Quinn	Fisherman	Striper, Bass Salmon Supporter	Brainerd
Mr.	Steve Rosemont	Fisherman	Striper, Bass Salmon Supporter	Concord
Mr.	Steve Satake	Fisherman	Striper, Bass Salmon Supporter	
Mr.	Steve Skanderson	Fisherman	Striper, Bass Salmon Supporter	Rohnert Park
Mr.	Steve Snyder	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	Steve Swaggerty	Fisherman	Striper, Bass Salmon Supporter	Vista
Capt.	Steve Talmage	Owner	Flash Charters	San Francisco
Mr.	Steven Ahlwardt	Fisherman	Striper, Bass Salmon Supporter	Pittsburg
Mr.	Steven Coyle	Fisherman	Striper, Bass Salmon Supporter	Cottonwood
Mr.	Steven Gardner	Fisherman	Striper, Bass Salmon Supporter	Lodi
Mr.	Steven Lau	Fisherman	Striper, Bass Salmon Supporter	Daly City
Mr.	Steven Mcbane	Fisherman	Striper, Bass Salmon Supporter	San Pablo
Mr.	Stu Carty	Fisherman	Striper, Bass Salmon Supporter	Sacramento

Opponents of the Reg Change Plan and Supporters of the Coalition's Plan

Intro	Name	Title	Organization	City
Mr.	Suchan Vince Saichow	Fisherman	Striper, Bass Salmon Supporter	Pinole
Ms.	Sue Booth	Fisherman	Striper, Bass Salmon Supporter	Shingle Springs
Mr.	Sunny Lampe	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Ms.	Susan Leland	Fisherman	Striper, Bass Salmon Supporter	Colfax
Ms.	Suzanne Miller	Fisherman	Striper, Bass Salmon Supporter	Menifee
Mr.	Tai Tran	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	Tao Her	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Ted Freitas	Fisherman	Striper, Bass Salmon Supporter	Vallejo
Mr.	Temo Regalado	Fisherman	Striper, Bass Salmon Supporter	Fresno
Ms.	Teresa Young	Fisherman	Striper, Bass Salmon Supporter	Pasadena
Mr.	Terri Moote	Fisherman	Striper, Bass Salmon Supporter	Lincoln
Mr.	Terry Chenowth	Fisherman	Striper, Bass Salmon Supporter	Santee
Mr.	Terry Dillard	Fisherman	Striper, Bass Salmon Supporter	Belmont
Mr.	Terry Hahner	Fisherman	Striper, Bass Salmon Supporter	Rio Linda
Mr.	Terry Lang	Fisherman	Striper, Bass Salmon Supporter	Tracy
Mr.	Theadore Vlahos	Fisherman	Striper, Bass Salmon Supporter	Roseville
Mr.	Thomas Beckering	Fisherman	Striper, Bass Salmon Supporter	Castro Valley
Mr.	Thomas Coss	Fisherman	Striper, Bass Salmon Supporter	Brentwood
Mr.	Thomas Curran	Fisherman	Striper, Bass Salmon Supporter	Middlebury
Mr.	Thomas Dinger	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	Thomas Dum	Fisherman	Striper, Bass Salmon Supporter	Livermore
Mr.	Thomas Garcia	Fisherman	Striper, Bass Salmon Supporter	Tracy
Mr.	Thomas Goyert	Fisherman	Striper, Bass Salmon Supporter	Soquel
Mr.	Thomas Hoogkamer	Fisherman	Striper, Bass Salmon Supporter	Winlock
Mr.	Thomas Larkins	Fisherman	Striper, Bass Salmon Supporter	Concord
Mr.	Thomas Lopez	Fisherman	Striper, Bass Salmon Supporter	Antioch
Mr.	Thomas Peters	Fisherman	Striper, Bass Salmon Supporter	Eureka
Mr.	Thomas Powell	Fisherman	Striper, Bass Salmon Supporter	Reno
Mr.	Thomas Richards	Fisherman	Striper, Bass Salmon Supporter	San Carlos
Mr.	Thomas Sanders	Fisherman	Striper, Bass Salmon Supporter	Brentwood
Mr.	Thomas Van Ormer	Fisherman	Striper, Bass Salmon Supporter	Lafayette
Ms.	Tifini Vega	Fisherman	Striper, Bass Salmon Supporter	San Jose
Capt.	Tim And Sherry Klassen	Owner Operator	Reel Steel Sportfishing	Eureka
Mr.	Tim Curtis	Fisherman	Striper, Bass Salmon Supporter	Elk Grove
Mr.	Tim Tillman	Fisherman	Striper, Bass Salmon Supporter	Galt
Mr.	Tim Wong	Fisherman	Striper, Bass Salmon Supporter	Santa Rosa
Mr.	Timothy Carnahan	Fisherman	Striper, Bass Salmon Supporter	Fairfield
Mr.	Timothy Despain	Fisherman	Striper, Bass Salmon Supporter	Redwood City
Mr.	Timothy Zimmer	Fisherman	Striper, Bass Salmon Supporter	Fremont
Mr.	Tina Toulze	Fisherman	Striper, Bass Salmon Supporter	Sonoma
Mr.	Todd Leonard	Fisherman	Striper, Bass Salmon Supporter	Gustine
Capt.	Todd Magaline	Owner	Blue Runner Charters	Sausalito
Mr.	Todd Ringoen	Fisherman	Striper, Bass Salmon Supporter	San Mateo
Mr.	Todd Stanley	Fisherman	Striper, Bass Salmon Supporter	Cameron Park
Mr.	Todd Stevens	Fisherman	Striper, Bass Salmon Supporter	Cameron Park
Mr.	Todd Storm	Fisherman	Striper, Bass Salmon Supporter	Davis
Mr.	Todd Towne	Fisherman	Striper, Bass Salmon Supporter	Newhall
Mr.	Todd Wiederhold	Fisherman	Striper, Bass Salmon Supporter	Grass Valley

Opponents of the Reg Change Plan and Supporters of the Coalition's Plan

Intro	Name	Title	Organization	City
Mr.	Todd Wilson	Fisherman	Striper, Bass Salmon Supporter	Brentwood Ca
Mr.	Tom Beard	Fisherman	Striper, Bass Salmon Supporter	Pinole
Mr.	Tom Higgins	Fisherman	Striper, Bass Salmon Supporter	San Anselmo
Capt.	Tom Joseh	Owner	Fish On Sportfishing	Santa Cruz
Mr.	Tom Mcgee	Fisherman	Striper, Bass Salmon Supporter	Pacifica
Mr.	Tom Mcgonigle	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Tom Nelson	Fisherman	Striper, Bass Salmon Supporter	Rio Vista
Mr.	Tom Radovich	Fisherman	Striper, Bass Salmon Supporter	Union City
Mr.	Tom Rafanan	Fisherman	Striper, Bass Salmon Supporter	Dixon
Mr.	Tom Wardrope	Fisherman	Striper, Bass Salmon Supporter	Pleasanton
Capt.	Tom Zizzo	Owner	Wild Wave Charters	San Francisco
Mr.	Tony Ageno	Fisherman	Striper, Bass Salmon Supporter	Morgan Hill
Mr.	Tony Aguado	Fisherman	Striper, Bass Salmon Supporter	Pacifica
Mr.	Tony Castle	Fisherman	Striper, Bass Salmon Supporter	Paso Robles
Mr.	Tony Cha	Fisherman	Striper, Bass Salmon Supporter	Fairfield
Mr.	Tony Henderson	Fisherman	Striper, Bass Salmon Supporter	Ahwahnee
Mr.	Tracy Pitman	Fisherman	Striper, Bass Salmon Supporter	Santa Rosa
Mr.	Travis Huckaby	Fisherman	Striper, Bass Salmon Supporter	Modesto
Mr.	Travis Walker	Fisherman	Striper, Bass Salmon Supporter	Redwood City
Capt.	Trent State	Owner	Biteme Charters	San Rafael
Mr.	Trevor Pullen	Fisherman	Striper, Bass Salmon Supporter	Rio Vista
Mr.	Trey Yates	Fisherman	Striper, Bass Salmon Supporter	Keller
Capt.	Troy Barr	Owner	Troy's Guide Service	Dixon
Mr.	Ty Roland	Fisherman	Striper, Bass Salmon Supporter	Antelope
Mr.	Tyler Dossen	Fisherman	Striper, Bass Salmon Supporter	Chualar
Mr.	Tyler Rose	Fisherman	Striper, Bass Salmon Supporter	Riverbank
Mr.	Tyler Studebaker	Fisherman	Striper, Bass Salmon Supporter	Hayward
Ms.	Valarie Loera	Fisherman	Striper, Bass Salmon Supporter	Gilroy
Ms.	Valerie Seewald	Fisherman	Striper, Bass Salmon Supporter	Encinitas
Mr.	Vance Staplin	Caif. Sales Rep	Morton and Associates	Citrus Heights
Mr.	Vance Staplin	President	Vance's Tackle	Citrus Heights
Mr.	Vance Staplin	Fisherman	Striper, Bass Salmon Supporter	Citrus Heights
Ms.	Verda Boyd	Fisherman	Striper, Bass Salmon Supporter	Fremont
Ms.	Vickie Purcell	Fisherman	Striper, Bass Salmon Supporter	Carson City
Mr.	Victor Garingarao	Fisherman	Striper, Bass Salmon Supporter	American Canyon
Mr.	Victor Khoshaba	Fisherman	Striper, Bass Salmon Supporter	Plumas Lake
Mr.	Victor Turner	Fisherman	Striper, Bass Salmon Supporter	Manteca
Mr.	Vijay Malhotra	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Vince Lanchinebre	Fisherman	Striper, Bass Salmon Supporter	Ssf
Mr.	Vince Stone	Fisherman	Striper, Bass Salmon Supporter	Vacaville
Mr.	Vincent Brady	Fisherman	Striper, Bass Salmon Supporter	Manteca
Mr.	Virginia Beucler	Fisherman	Striper, Bass Salmon Supporter	El Sobrante
Mr.	Vitaliy Matsuka	Fisherman	Striper, Bass Salmon Supporter	North Highlands
Mr.	Vladimir Quijano	Fisherman	Striper, Bass Salmon Supporter	Redwood City
Mr.	Walter Gonzalez	Fisherman	Striper, Bass Salmon Supporter	El Cerrito
Mr.	Walter Temming	Fisherman	Striper, Bass Salmon Supporter	Brentwood
Mr.	Walter Thiel	Fisherman	Striper, Bass Salmon Supporter	Fair Oaks
Mr.	Walter Thompson	Fisherman	Striper, Bass Salmon Supporter	Suisun City

Opponents of the Reg Change Plan and Supporters of the Coalition's Plan

Intro	Name	Title	Organization	City
Mr.	Warren Mauran	Fisherman	Striper, Bass Salmon Supporter	Los Angeles
Mr.	Waylon Chen	Fisherman	Striper, Bass Salmon Supporter	Sunnyvale
Mr.	Wayne Antoine	Fisherman	Striper, Bass Salmon Supporter	San Francisco
Mr.	Wayne Buirch	Fisherman	Striper, Bass Salmon Supporter	Lodi
Mr.	Wayne Burkdoll	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Wayne Cateron	Fisherman	Striper, Bass Salmon Supporter	Paradise
Mr.	Wayne Grosjean	Fisherman	Striper, Bass Salmon Supporter	Sparks
Mr.	Wayne Hagen	Professor	UC Davis	Davis
Mr.	Wes Roberts	Fisherman	Striper, Bass Salmon Supporter	Rocklin
Mr.	Wesley Cook	Fisherman	Striper, Bass Salmon Supporter	Fairfield
Mr.	Wilbur Roper Jr	Fisherman	Striper, Bass Salmon Supporter	Rio Linda
Mr.	Will Ebersman	Fisherman	Striper, Bass Salmon Supporter	Los Angeles
Mr.	Will Palmer	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	Will Risseeuw	Fisherman	Striper, Bass Salmon Supporter	Redwood City
Mr.	Will Sakata	Fisherman	Striper, Bass Salmon Supporter	Lodi
Mr.	William Chandler	Fisherman	Striper, Bass Salmon Supporter	Woodland
Mr.	William Dalton	Fisherman	Striper, Bass Salmon Supporter	Union City
Mr.	William Darby	Fisherman	Striper, Bass Salmon Supporter	Martinez
Mr.	William Frank	Fisherman	Striper, Bass Salmon Supporter	Woodland
Mr.	William Graham	Fisherman	Striper, Bass Salmon Supporter	Salinas
Mr.	William Hagen	Fisherman	Striper, Bass Salmon Supporter	Davis
Mr.	William Hall	Fisherman	Striper, Bass Salmon Supporter	Grass Valley
Mr.	William Higginson	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	William L Martin	Fisherman	Striper, Bass Salmon Supporter	San Francisco
Mr.	William Light	Fisherman	Striper, Bass Salmon Supporter	Benicia
Mr.	William Mcdaid	Fisherman	Striper, Bass Salmon Supporter	Antioch
Mr.	William Mokoid	Fisherman	Striper, Bass Salmon Supporter	Pennsville
Mr.	William Moriarity	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	William Nakaki	Fisherman	Striper, Bass Salmon Supporter	Tracy
Mr.	William North	Fisherman	Striper, Bass Salmon Supporter	Corte Madera
Mr.	William Rietman	Fisherman	Striper, Bass Salmon Supporter	Santa Rosa
Mr.	William Tubbs	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	William Walker	Fisherman	Striper, Bass Salmon Supporter	Sonoma
Mr.	William Wickliffe	Fisherman	Striper, Bass Salmon Supporter	San Anselmo
Mr.	William Wright	Fisherman	Striper, Bass Salmon Supporter	Elizabethton
Mr.	Wlliam Smith	Fisherman	Striper, Bass Salmon Supporter	Tigard
Mr.	Wolfgang Gielisch	Fisherman	Striper, Bass Salmon Supporter	Fremont
Mr.	Xeng Yang	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Yaminah Bailey	Fisherman	Striper, Bass Salmon Supporter	West Sacramento
Mr.	Yao Saechao	Fisherman	Striper, Bass Salmon Supporter	Stockton
Mr.	Yee Vue	Fisherman	Striper, Bass Salmon Supporter	Sacramento
Mr.	Yolanda Hale	Fisherman	Striper, Bass Salmon Supporter	Clearlake
Ms.	Yvonne Mills	Fisherman	Striper, Bass Salmon Supporter	Los Gatos
Mr.	Zac Guenrinoni	Owner	Biwaa Fishing Performance	Windsor
Mr.	Zac Guerinoni	Fisherman	Striper, Bass Salmon Supporter	Santa Rosa
Mr.	Zach Couch	Fisherman	Striper, Bass Salmon Supporter	Hughson
Mr.	Zach Taber	Fisherman	Striper, Bass Salmon Supporter	Clovis
Mr.	Zachary Aramian	Fisherman	Striper, Bass Salmon Supporter	Fresno

Opponents of the Reg Change Plan and Supporters of the Coalition's Plan

Intro	Name	Title	Organization	City
Mr.	Zachary Robinson	Fisherman	Striper, Bass Salmon Supporter	San Jose
Mr.	Zackary Kennedy	Fisherman	Striper, Bass Salmon Supporter	Oakley
Mr.	Zane Hemphill	Fisherman	Striper, Bass Salmon Supporter	Orangevale

GoldenGate Salmon Association

Fifty Three Non-Lethal Central Valley Predation Control Projects

A Better Predation Plan

July 2016

GoldenGate Salmon Association

Golden Gate Salmon Association Fifty Three Central Valley Predator Project Proposals

Updated August 1, 2016

In 2011, The Golden Gate Salmon Association began development of a series of projects to rebuild the salmon stocks of the Central Valley. Most of the science work was performed by the consulting group, Natural Resource Scientists, which has extensive experience on salmon and predation in the Central Valley. The project also received technical assistance from the three fishery agencies. The unique approach of the task force was to first look at the primary locations where and why the juvenile and adult salmon were being lost. The next step was to identify investments and operational strategies that would reduce the losses. The plan was completed in late 2012.

In the process of developing the plan, a number of predation hotspots were identified. In - tially, thirty one locations were identified where physical changes could be made that would physically separate the juvenile salmon from the predators. Later, this list was expanded to fifty-three locations

Two improvement strategies were used. One would give the juvenile salmon places to hide and the other would take away the locations where predators could congregate to attack the juvenile salmon. In no case is it proposed that the predators be targeted for eradication. Unfortunately, to date, none of the proposals have been completed by the three fish agencies or the water delivery agencies (US Bureau of Reclamation and CA Dept. of Water Resources). However, several of the projects are now beginning or are scheduled for implementation.

Predation is primarily a secondary effect of lack of flow in the Central alley rivers and in the Delta due to extensive water diversions. Heavy Sacramento River flows in very wet years always leads to big salmon returns two and three years later. Flow stirs up turbidity which provides the natural camouflage juvenile salmon need to avoid predation. Highe , more natural flows in the spring speed the movement of juvenile salmon downstream, making it harder for predators to intercept them and greatly increasing their survival rates. As greater water diversions reduce the river and Delta flows, predation has become a major harm to salmon, especially in low flow drought years. This paper provides a summary of the flow and habitat actions that are needed.

High river flows that mimic pre-dam levels stir sediment creating turbidity which hides juvenile salmon from predators while speeding the young salmon safely downstream. Lacking flows, predation flourishes in the rivers and elsewhere.

Golden Gate Salmon Association
53 Identified Predator Hotspot Locations

Delta Predation Projects

D.5 Recreate Shallow Water Habitat in the Delta Migration Routes	3	#
D.10 Reduce Predator Habitat at Clifton Court Forebay	1	#
D.17 Upgrade the Delta Pump Fish Salvage System - Nets or Barges	1	#
D.12 Reduce Predator Habitat at Freeport Pipe	1	#
D.13 Reduce Predator Habitat at the Tracy Fish Facility - Crowd/CO2	1	#
D.14 Feather Back Breached Delta Levees	6	#
D.20 Separate Salmon from Predators at Corridor Docks and Marinas	10	#

Total Delta Projects	**23**	

River Predation Projects

D.2 Support for Barging Smolts Around the Delta	1	
D.3 Improve Trucking Techniques and Reduce Straying	1	
C.2 Restore Rearing and Side Channels in the Upper Sacramento	13	#
C.1 Natural and Artificial Rearing Structures in the Upper Sacramento	1	#
D.6 Eliminate or Reduce Lighting at In-River Structures	5	#
D.7 Study and Modify Predation Habitat at ACID Dam	1	#
D.9 Reduce Predator Habitat at Eight Large Screen Structures	8	#

Total River Projects	**30**	

Grand Total Predation Impact Projects	**53**	

 # Project helps recover the near extinct winter-run and other wild populations. These projects will also provide significant help to the listed steelhead runs.

Salmon fry are only an inch or two long and the have eight large fins they use to try to stabilize themselves in the fast moving water. They are very vulnerable.

Project D.2 Support for Barging Smolts Around the Delta

Commercial salmon fishermen along with the California Department of Fish and Wildlife are working to complete a five year study to evaluate the barging of salmon smolts from the hatcheries to the Golden Gate. If successful, this could eliminate the river and Delta losses of the fish released at the hatcheries in low water years and will also allow the fis to imprint as they move down the river which hopefully will minimize straying.

This project was initiated in 2012. A generous offer was made by Captain Michael McHenry to experimentally barge enhancement Feather River hatchery smolts in his bait boat from Elkhorn Slough near the Sacramento Airport to Fort Baker in San Francisco Bay. McHenry financed the original barging costs.

In May of 2012, 100,000 smolts were loaded onto McHenry's bait boat and transported over two days to Fort Baker near the Golden Gate where they were released on an outgoing tide. For comparison, 100,000 smolts were also released at Elkhorn Slough and 100,000 were trucked and released at Fort Baker. Each batch of these fish had unique coded wire tags so that they can be distinguished when they return as adults in 2014. The barging was closely monitored by California Fish and Wildlife biologists and results are being calculated as the tag data becomes available.

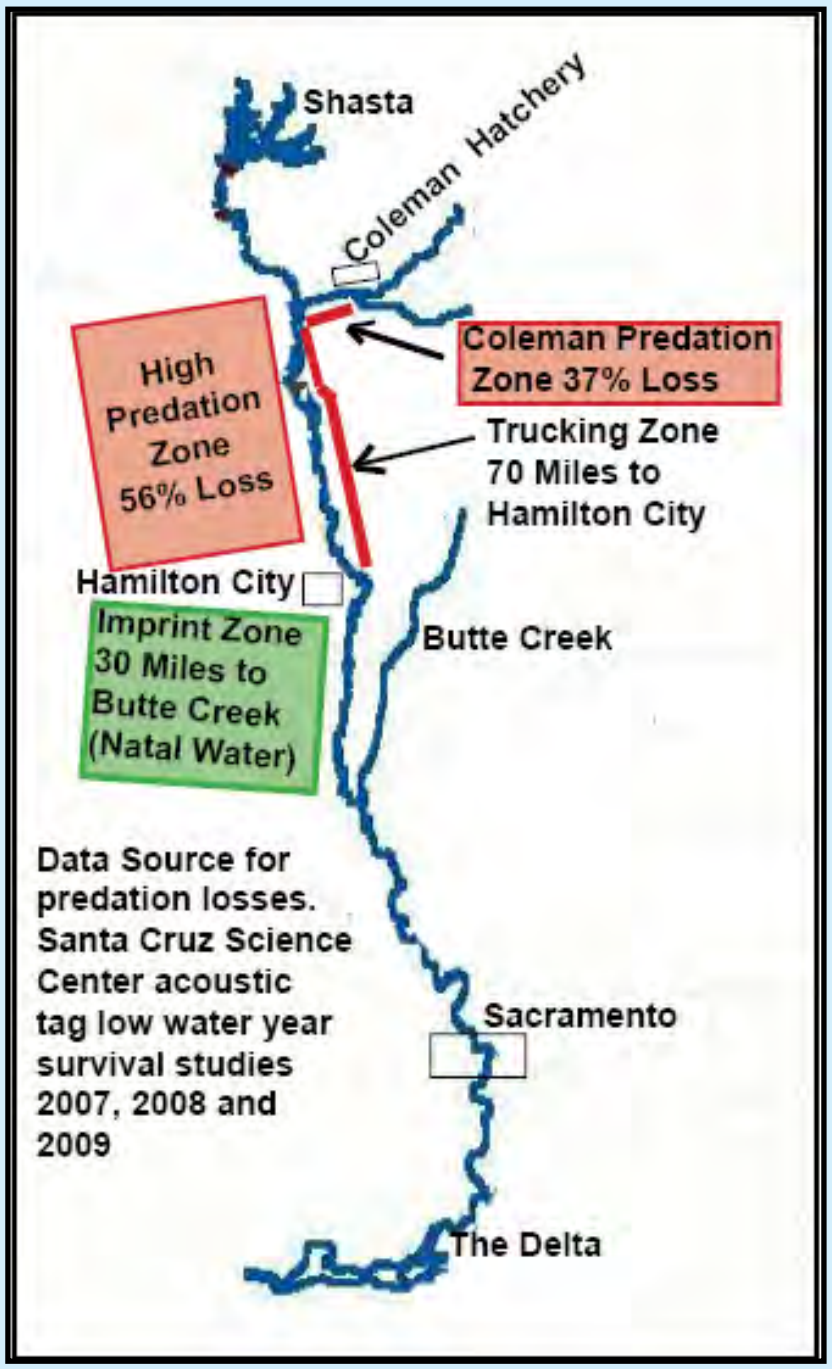
In 2013, another 100,000 smolts were moved with the same procedure and in 2014 the final 100,000 were moved. Over first three years, the total test moved 300,000 smolt by barge, 300,000 were trucked and 300,000 were released at Elkhorn Slough. The coded wire tags from all the batches of fish will be read and evaluated for the number of returns and degree of straying. At that point, decisions can be made as to further barging practices. Success in this program could open significant new methods of producing and handling hatchery fish while avoiding the high predator Delta losses and potentially reducing straying.

Project D.3 - Improve Trucking Techniques for Hatchery Salmon

Trucking juvenile salmon from Central Valley hatcheries to areas downstream of the Delta is known to increase overall fish survival. This is a vital program in maintaining a viable commercial and recreational fisher , and escapement back to the Central Valley. However, that action also increases straying of adult fish to non-natal areas which is considered undesirable. This project proposes to implement studies and pilot projects to improve the survival of hatchery fish while minimizing straying of returning adult salmon.

Smolts are loaded into special chilled trucks at the hatcheries and are then transported to safe areas beyond the Delta. They are then held in net pens for a few hours to reduce stress and to allow then to adapt to the new salinity and temperature. They are then released into the current.

The Feather River and the Mokelumne hatcheries currently truck almost all of their smolts around the Delta to safe areas where they will not be impacted by the river losses or the Delta pumps. They are placed into net pens for a few hours to allow them to recover from stress and adapt to the salinity and temperature conditions at the nets. Survival is estimated to be near 100% at the net locations. Survival at the Golden Gate is estimated to be about 40%. The current 40% trucking survival vastly exceeds any other path of smolts migrating down the Sacramento or San Joaquin Rivers and through the Delta.

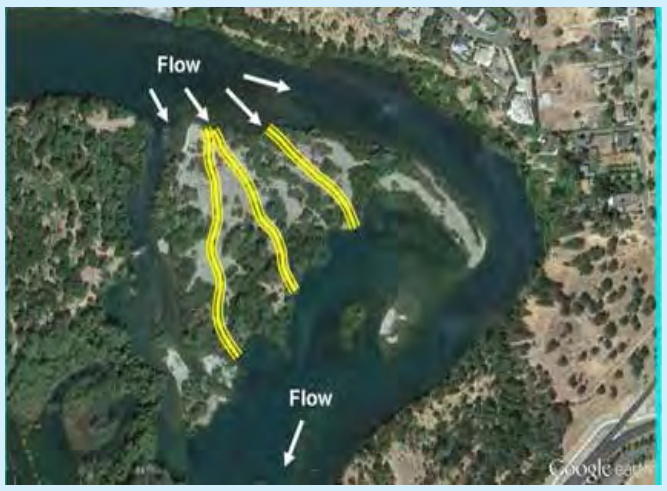


This proposal suggests an experiment with the trucking and net penning of some Coleman hatchery fall-run smolts part way down the Sacramento River to see if a better compromise between low survival and high straying can be reached. Currently, the coded wire tag data shows that when the smolts are released at the Coleman hatchery, very poor returns result except in highwater years. Predation losses in the Sacramento River and the Delta during low water years are the primary cause. When the smolts are trucked to San Pablo Bay, returns are high but straying increases. This proposal suggests a trucking and net pen location 60 or 70 miles down the river be tested where the worst predation can possibly be avoided. Below Hamilton City, there is still over 30 miles of natal Sacramento water where imprinting can take place before reaching Butte Creek, the next major tributary.

Project C.2 Restore Rearing and Spawning Side Channels in the Upper Sacramento and Feather Rivers

A large amount of spawning habitat for adult salmon and rearing habitat for young salmonids was lost in areas upstream of Shasta and Keswick dams on the Sacramento River following dam construction. Large amounts downstream of the dams have also been lost to dikes, levees, and drainage and conversion to ag or other development. Fish produced within the mainstem reaches downstream of the dams are forced to spawn and rear in a large river channel formed by historical high flows because of the change in the species geographic distribution.

As soon as flows pick up, juvenile salmon move downstream because of lack of good rearing areas in the upper river. Recently emerged fry prefer different habitats for rearing than larger-sized juvenile fish which can reside in the higher velocity regions of the mainstem channel. Much of the main river channel is devoid of food and shelter necessary for fry rearing; however, historic side channels now dry have lots of both can easily be restored to their original condition. In some cases this is as easy as removing gravel plugs at the upstream end of the channels.



Approximate Turtle Bay locations where new side channels are proposed

The Feather River also has several locations where rearing side channels can be opened with significant benefits to that watershe

This project would create up to 13 new rearing side channels at a number of locations in the upper Sacramento River basin and several more on the Feather River. Restored side channels on these rivers are expected to improve both growth and predation survival for both listed and non-listed salmon runs.

This is a Priority 1 Project with Major Salmon Improvement Potential

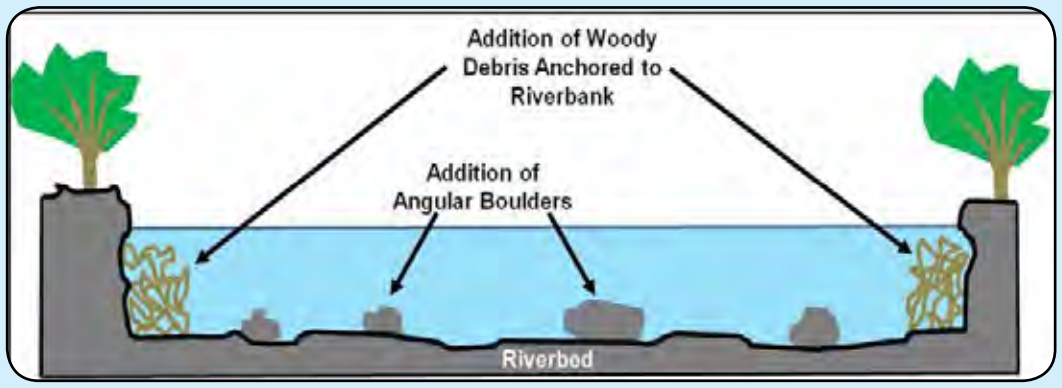
Project C.1 - Natural and Artificial Rearing Structures in the Upper Sacramento.

This project proposes to add natural and artificial salmon fry rearing structures in the upper main-stem Sacramento River in the reach around and above the City of Redding where the majority of optimal spawning habitats exist. This is the primary spawning area for the winter-run salmon and the winter-run fry will be the primary beneficiaries Underwater observations of salmon fry in the main-stem Sacramento River suggest that optimal habitats may be limited. If salmon fry emerging from mid-channel redds can survive to find improved areas, there will be significantly more survival. No , much of the edge areas lack suitable habitat complexity.

Upper Sacramento River where the winter-run spawning takes place.

The project is sponsored by **River Garden Farms** of Knights Landing Calif. and GGSA. Supporters include American Rivers, Cal Trout and the Northern California Water Association.

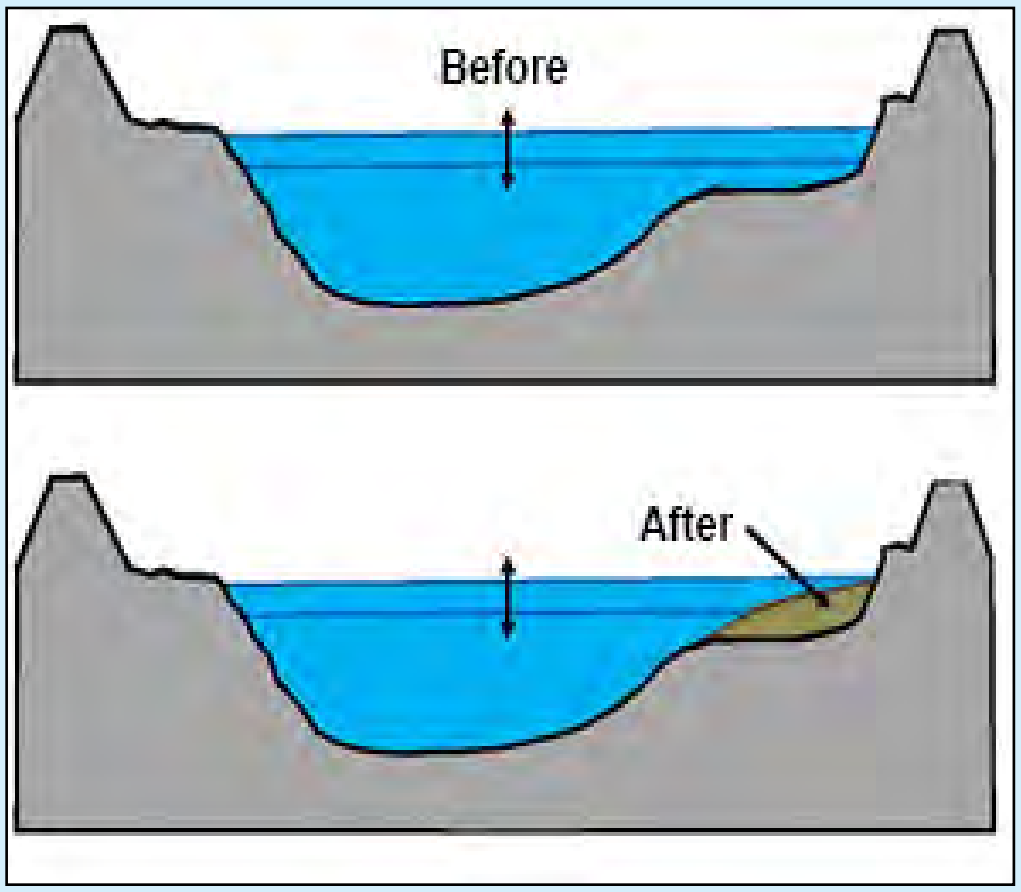
The project would begin initially as a pilot-level project where natural and artificial rearing structures would be placed at strategic locations and evaluated. If the pilot project evaluation demonstrates the structures are beneficial, additional structures would be added at other sites on a larger-scale project. The intent of the rearing structures is to provide velocity refugia and feeding areas for salmon fry while simultaneously protecting the fish from larger-sized predatory fish



Woody debris will be installed at the edges of the river to give the fry someplace to hide from predators. This project will also open additional rearing habitat areas in the upper river for the fry.

D.15 Recreate Shallow Water Habitat in the Delta Migration Routes

The loss of shallow-water rearing locales for salmon in the Delta has been severe. The available habitats where U.S. Fish and Wildlife personnel can seine in the Delta to monitor the relative abundance and distribution of rearing fish are limited due to the low presence of naturally occurring shallow-water areas. In some instances, recreational swimming beaches and boat ramps have been used to sample fish because most areas are deep and rip-rapped. In studies where fish sampling to compare shallow beaches with rip-rapped zones was achieved, salmon fry densities were higher in shallow beach areas. An obvious restoration measure which should be pursued to a larger degree because of its high probability of success is the re-creation of shallow, near-shore water habitats that juvenile salmon prefer in the Delta as required by the 2009 salmon biop, (as contrasted to flooded islands). Importantly, these sites must be designed to avoid creation of predatory fish habitats and be established in locations likely to be utilized within the principal fish migration corridors. Much state and federal work, mostly studies, is underway.



This project proposes to initially create shallow-water rearing habitats in several locations as large-scale demonstration projects to be evaluated for effectiveness. If the initial habitat restoration projects are successful as determined through monitoring, the creation of additional shallow-water rearing habitats would be significantly expanded.

Project D.10 Reduce Predator Habitat at Clifton Court Forebay

Clifton Court Forebay is a 2,000-acre lake that feeds Delta water to the State Water Project Banks pumping plant. It has long been known as a major loss location for juvenile salmon smolts from the San Joaquin and Sacramento Rivers. A number of studies have confirmed that survival of San Joaquin smolts through the Delta is between 2% and 5%. Because of this, there is virtually no current contribution of San Joaquin salmon to the ocean fishery in most years. Clifton Court losses are likely the number one contributor to these failures.

In 2013, the Department of Water Resources (DWR) completed a study of predation losses in Clifton Court using PIT tagged salmon smolts. The conclusion of the study was that 81% of the smolts were lost to predation before they got to the louvers at the pumps. Further studies revealed that Clifton Court is packed with striped bass, catfish and black bass predators. Most of the striped bass were small in the eight to fourteen inch range, however, many large striped bass are known to reside in the area immediately inside and outside of the radial gates.

DWR has initiated a 3 year test predator removal and relocation program based on electro shocking in the forebay. The predators are being relocated to Bethany Reservoir near Byron. In 1991, DWR contracted with a commercial fisherman to seine Clifton Court. In 1993, that program removed more than 32,000 predators including 29,000 striped bass. Other removal techniques could also be candidates. Estimates of the number of striped bass in Clifton Court have run as high as 200,000.

In 2009, the National Marine Fisheries Service released a salmon biological opinion that included RPA (IV.4.2 (2) requiring that by 2011 a project must be scoped to reduce the pre-screen predation at Clifton Court to 40% of what it was in 2009. The project was to be completed by 2014. There have too many delays in getting this project on line.

In that same biological opinion, NMFS required that predation also be reduced at the salvage discharge facilities by 50% (GGSA project D.17). That measure also required an evaluation of net pens as alternate to pipe discharges. That evaluation has not been completed. Both the Clifton Court and the salvage projects are badly needed for the benefit of the salmon

Project D.17 - Upgrade the Delta Pump Fish Salvage System

High losses of juvenile salmon and other native fish species occur at state and federal salvage release site facilities. A 2010 study titled "Release Site Predation Study" by DWR, USBR and CDFW identified that up to 100% predation occurs at the end of the pipes that currently return the salvaged fish to the Delta. The conclusion of the study states, *"Results of the release site predation monitoring suggest that predation at the release site by several species of fish and birds could have a substantial effect on the number of fish surviving the release phase of the salvage process."*

Pipes at the DWR Horeshoe Bend release site deliver the salvaged fish into deep water. In studies, Didson cameras show that hundreds of predators await the stressed fish at the end of the pipe.

This project proposes that pipe releases be terminated and the salvaged fish be released into net pens to improve survival. Net pens are a proven better technology. An alternate to net pens is also receiving study. It would set up barges where the salvage trucks could drive onto. The salvaged fish could then be offloaded in a variety of locations where predators do not reside. Evaluations and conclusions on these options are needed. In 2009, the National Marine Fisheries Service released a biological opinion that requires these operations to reduce predation by 50%. It also required an evaluation of net pens or other better technologies. None of these have been completed or implemented.

Salmon smolts are loaded into a net pen at Jersey Point. Following stabilization, the pen will be towed to the center of the San Joaquin River and the fish will be released.

With one of these technologies, substantial improvements in juvenile salmon survival are expected during the peak Delta migration months of January through May. It is possible that older and larger Delta Smelt (50 to 70 mm) may also be salvaged.

This is a Priority 1 Project with Major Salmon Improvement Potential

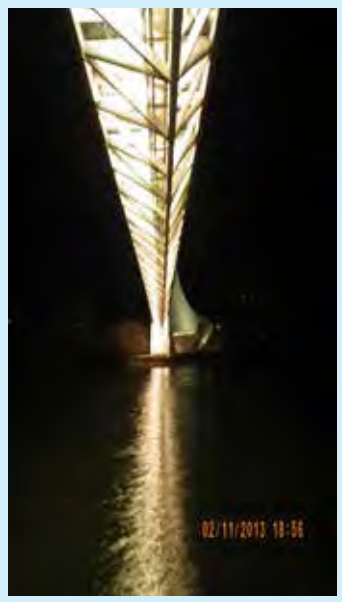
Project B.6 Assess Predator Impact of Lighting at River Structures

Project has been Partially Completed

Bright lights shining into the water at night from bridges and other structures in the Sacramento River and its tributaries create a significant predation hazard for salmon fry and smolts. These fish tend to move at night when they can avoid predators. When they encounter bright lights they become disoriented and are easy predator prey.

One of the prominent problem bridges was the Sundial foot bridge which crosses the Sacramento River in Redding. Lowering the very bright lights on the bridge was taken up as a project by the regional office of the California Department of Fish and Wildlife. The City of Redding cooperated and the intensity of the lights has been lowered significantl . They have also been redirected away from the water. The next step was the installation of lower intensity LED lights which was completed and further lowered the light level and also saved electricity.

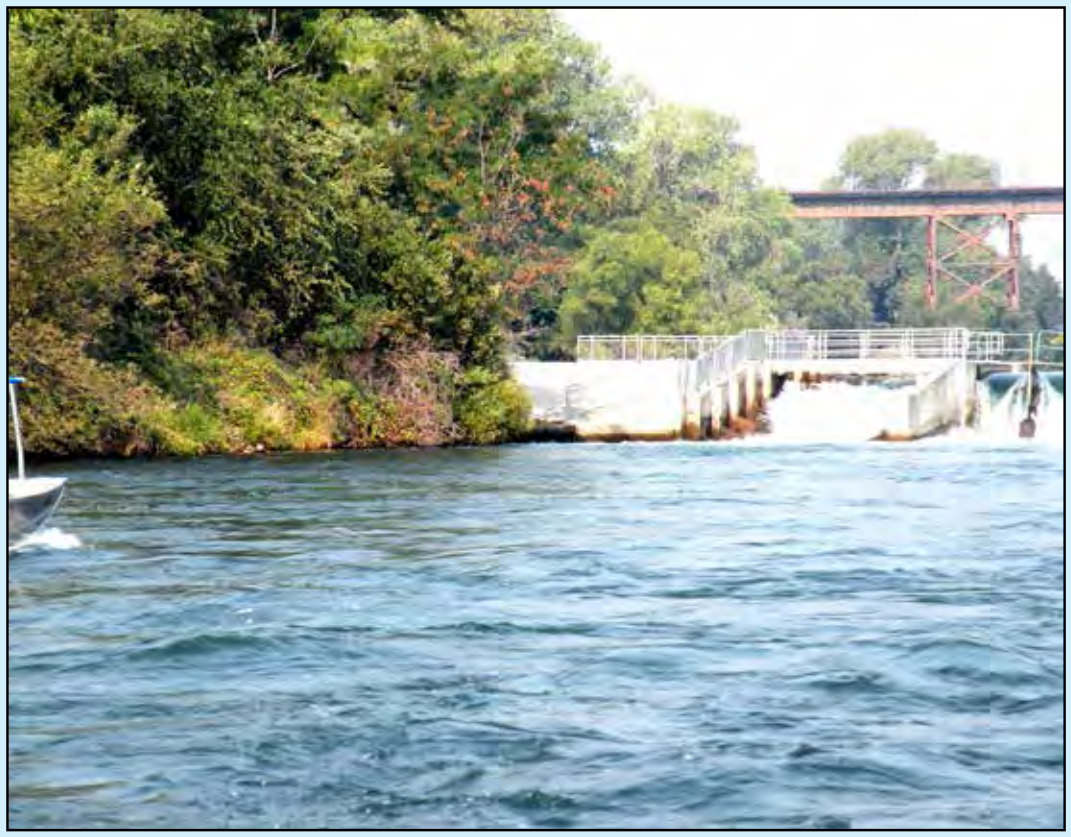
There are many other bridges and structures along the river that need modifications of this type.



The two pictures on the left show the bridge before the lights were lowered and the picture on the right shows it after they were lowered. Photos by Andrew Jensen, California Dept. of Fish and Wildlife

Project D.7 - Study and Modify Predation Habitat at ACID Dam

Although no thorough evaluations of predation just downstream of the Anderson-Cottonwood Irrigation District (ACID) on the Sacramento River have been conducted, the conditions at the site are ideal for predation. Spawning gravel replenishment projects have been ongoing in areas upstream of ACID dam with positive responses observed for salmon spawning in that reach.



The ACID Dam is located on the Sacramento River just north of Redding. Millions of fry and smolts hatch above the dam and must migrate over the dam. It is a potential predation site and should be evaluated.

Because salmon fry emigrating from areas upstream of ACID dam must pass over the dam, its fish ladders, or through the ACID canal fish screen bypass, protecting those fish is important. This project proposes to perform a thorough study of potential predation, and if significant problems exist, implement appropriate remedial actions.

Project D.9 - Reduce Predator Habitat at Large Screen Structures

The project proposes to implement and evaluate measures to reduce or eliminate predatory fish habitat in the vicinity of large water intake structures in the Sacramento River with the objective of reducing predation on juvenile salmon. During the past decade there have been numerous large water intakes screened to prevent entrainment of fish (primarily fry and juvenile salmonids) into diversion facilities. The screening facilities were designed to meet State and Federal criteria for fish protection (e.g., small screen mesh size, approach (through-screen) velocities, sweeping flows, etc.). Although these structures are highly effective in eliminating fish entrainment, there are elements associated with large water intake facilities that can make juvenile salmon more prone to predation.

The area at the end of the screen provides an ideal location for predators to hide in calm water and then attack juvenile salmon as they pass.

Top view. Areas that can provide predatory fish habitats.

There are situations where the design of new fish screens has inadvertently created favorable predatory fish habitat just upstream and downstream of the fish screens and along the face of the screens.

This project proposes to reduce back-eddies near the fish screens and alter the screen wiper blade assemblies where predatory fish may reside and provide refugia for young fish. It is recommended that two large fish screen facilities be chosen to implement suite of measures to reduce predatory fish habitat and evaluate the e fectiveness of those measures. If successful, the actions would be expanded to 6 or 8 other screen facilities.

Project D.12 - Reduce Predator Habitat at the Freeport Waste Water Treatment Plant Dispersion Pipe in the Sacramento River.

This project proposes to reduce predation on outmigration juvenile salmon during the spring at a localized site near a pipeline in the riverbed near Freeport, California. A large pipe partially buried in the riverbed perpendicularly across the river channel adjacent to the Freeport Waste Water Treatment Plant outfall in the Sacramento River provides favorable conditions for predatory fish and it is considered a hot spot for predation. This particular area is highly popular with striped bass anglers who are frequently seen anchoring and fishing at the site. Didson sonar camera footage and angling at the pipeline revealed that the fish species at the time of the survey were striped bass and white catfish. Depending on seasonal timing, downstream migrating juvenile anadromous fish near the riverbed at this location would be expected to be highly prone to predation. Except during periods when the Yolo Bypass floods, all downstream migrating juvenile salmonids from the Sacramento River and its tributaries must pass over this pipeline. It is estimated that predation here takes up to 15 % of the passing smolts including the ESA listed species.

In the spring, the Freeport pipe is a favorite fishing location for striped bass fishermen. There are always plenty of stripers at the pipe.

This project proposes to modify the pipeline with a different downstream configuration to minimize the creation of predatory fish habitat. The action will require approvals of the Regional Water Quality Control Board to ensure sufficient dilution and dispersal of waste water effluent occurs at the site

The Waste Water Treatment plant is willing to pay for the modifications to the pipe if it is determined that this site is a significant predator hotspot

Project D.13 - Reduce Predator Habitat at the Tracy Fish Facility

Mortality of juvenile salmon and other native fish species is known to be extremely high in the vicinity of the Tracy Fish Facilities at the federal water export facilities in the south Delta. The source of mortality is primarily caused by predation on small fish. Numerous actions have been attempted over many years to alleviate the predation mortality problem.

This project proposes a much more aggressive program to remove and relocate predatory fish. The U.S. Bureau of Reclamation plans to test an electronic crowder system at the site to remove and relocate predators between the trash racks and the louvers. Another option is to bubble CO2 gas in the area causing the predators to float to the surface where they can be retrieved and relocated. A separate installation is needed between the trash racks and the debris boom.

During cleaning operations, predators get inbetween the Tracy trash racks and the fish louvers. Once they get in there, there is currently no way to get them out. They devour huge numbers of juvenile fish.

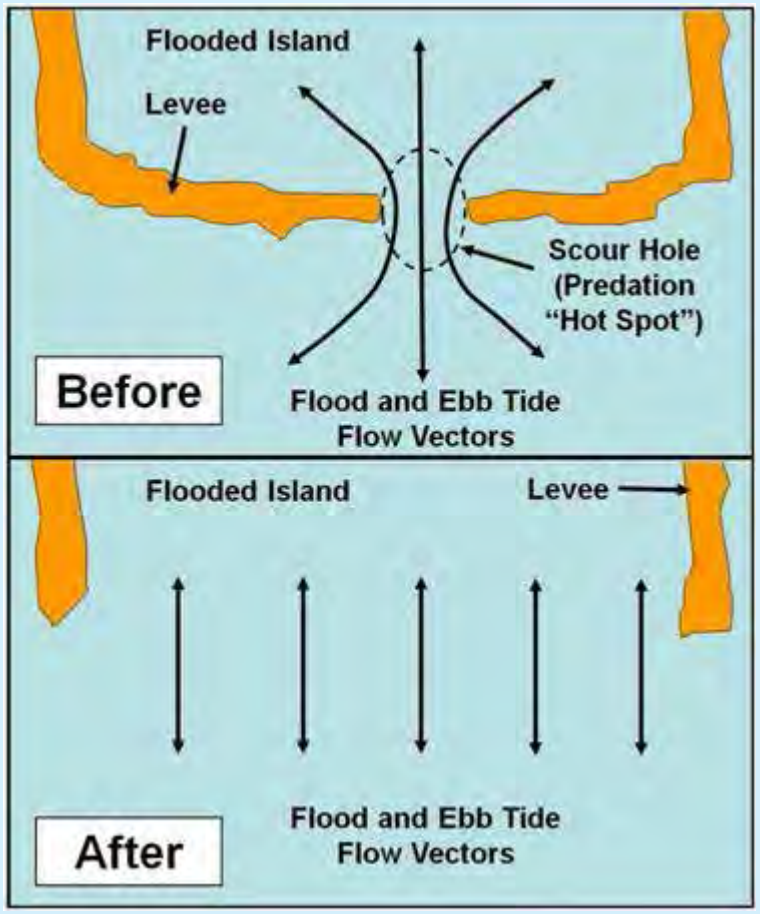
Outside the debris boom and in the surrounding Old River area, an aggressive hook and line removal is proposed for sport fishermen. An incentive for this should be considered. If this does not work well enough, a commercial fishing contract should be considered. The months of January through May should be targeted because those months generally represent when the largest numbers of listed and non-listed salmon are present.

The benefits to salmon survival from this project are likely to be very high if the estimated current loss of 25% or more can be substantially reduced. This project along with completion of the net pen salvage project (D.17) should show dramatic results.

This is a Priority 1 Project with Major Salmon Improvement Potential

Project D.14 Reconfigure Breached Delta Levees

There have likely been significant adverse, unintended consequences of breaching levees in the Delta. There is a high probability that site-specific conditions at the breaches have resulted in hazards for juvenile anadromous fish through the creation of favorable predator habitats. The breaches have changed the tidal prisms in the Delta and can change the degree in which juvenile fish are affected back and forth with the tides. Additionally, many of the breaches are narrow which have created deep scour holes favoring predatory fish and high presence of striped bass. These areas are now predation "hot spots". Sport anglers are often seen fishing for striped bass at these sites during floo or ebb tides. Breaching the levees at Liberty Island is an example. Recent acoustic-tagging of striped bass in this vicinity confirmed this. Many of these levee breaches have been present for numerous years, but nevertheless still pose significant hazards for juvenile anadromous fish.



This project proposes to significantly widen the breaches to eliminate the scouring a fect.

Project D.20 Separate Salmon from Predators at Docks and Marinas

This project proposes to install smolt deflectors at marina docks and structures. The purpose is to move smolts away from the predator locations. Installation of new boat docks and marinas in the Delta has not been adequately studied to quantify potential increased predator concentrations (e.g., largemouth bass). The overall impact of these facilities on juvenile anadromous fish migrating through the area is unknown. Surprisingly, the relevance of the issue has not been evaluated even though it is generally assumed that predatory fish can be concentrated in those areas. Construction of boat docks and marinas within flowing water where salmon must migrate creates ideal conditions for predation. Invariably, marina structures require vertical posts driven in the channel bed with supporting overhead structure (e.g., docks, shade canopies, etc.). The potential problem may be particularly acute when the marina and dock structures are positioned over a considerable portion of the cross-sectional profile of the river channel where many salmon must transit. Large quantities of water move under these structures and juvenile anadromous fish moving with the flow under the structure are exposed to conditions favorable to predatory fish habitat. Tidal surging may cause exposure to the predatory fish habitats not just once, but likely several times, as the fis move back and forth with the tides.

OAKDALE IRRIGATION DISTRICT

RECEIVED
CALIFORNIA
FISH AND GAME
COMMISSION

2016 JUL 29 PM 4: 10

MLS

July 27, 2016

Mr. Eric Sklar
Commission President
California Fish and Game Commission
P.O. Box 944209
Sacramento, CA 94244-2090

Re: Petition to California Fish and Game Commission to Address Predation

Commission President Sklar:

We are writing to urge your support of the petition to the California Fish and Game Commission to address predation of at-risk fish native to the Delta by non-native predators. As salmon and smelt continue to decline, it is increasingly important for the Commission to take all appropriate action to address predation.

Predation of endangered and threatened fish, including Central Valley spring-run Chinook salmon, Central Valley steelhead, delta smelt, and Sacramento River winter-run Chinook salmon, by non-native striped bass and black bass is well documented. Yet, predation in the Delta has gone unaddressed. This modest proposal is a reasonable step for the Commission to begin identifying methods to limit predation on native species in the Delta.

While California is often at the forefront of environmental protection, state regulators have lagged behind on this issue. Other western states, such as Washington, Oregon, and Utah, have implemented similar strategies to protect endangered fish from non-native predators as part of comprehensive species conservation efforts. California should do the same.

We greatly appreciate your consideration of this important effort to protect and restore endangered fish species in the Delta.

Respectfully,

OAKDALE IRRIGATION DISTRICT

Steve Knell, P.E.
General Manager

SK;lfp

1205 East F Street / Oakdale, CA 95361 / (209) 847-0341 / Fax (209) 847-3468
www.oakdaleirrigation.com

cc: Governor Edmund G. Brown Jr.
Jacque Hostler-Carmesin, California Fish and Game Commission Vice-President
Anthony Williams, California Fish and Game Commission Member
Russell Burns, California Fish and Game Commission Member
Peter Silva, California Fish and Game Commission Member
Valerie Termini, California Fish and Game Commission Executive Director
Charlton H. Bonham, California Department of Fish and Wildlife Executive Director
John Laird, Natural Resources Agency Secretary
Janelle Beland, Natural Resources Agency Undersecretary
Mark Cowin, Department of Water Resources Director
Keely Bosler, Office of the Governor Cabinet Secretary
Kim Craig, Office of the Governor Deputy Cabinet Secretary
Felicia Marcus, State Water Resources Control Board Chair
Frances Spivy-Weber, State Water Resources Control Board Vice-Chair
Tam Doduc, State Water Resources Control Board member
Dorene D'Adamo, State Water Resources Control Board member
Steven Moore, State Water Resources Control Board member

OAKDALE IRRIGATION DISTRICT

July 27, 2016

The Honorable Jerry Brown
Governor of the State of California
California State Capitol, First Floor
Sacramento, CA 95814

Re: Petition to California Fish and Game Commission to Address Predation

Dear Governor Brown:

As a broad, statewide coalition of business, water users, and agricultural interests, we want to make you aware of and urge your support of our petition (attached) to the California Fish and Game Commission to address predation of endangered species in the Delta. As delta smelt and salmon continue to decline, the Commission should take all appropriate action to protect and restore these species, including approving the petition.

Predation of endangered and threatened fish in the Delta, including Central Valley spring-run Chinook salmon, Central Valley steelhead, delta smelt, and Sacramento River winter-run Chinook salmon, by non-native striped bass and black bass is well documented. Recent reports by state and federal fish agencies indicate that bass consume an enormous volume of fish, including listed species such as Sacramento River winter-run Chinook salmon and delta smelt. Predation ranks among the top stressors for Central Valley spring-run Chinook salmon, Central Valley steelhead, and Sacramento River winter-run Chinook salmon in threat assessments by the National Marine Fisheries Service. The California Natural Resources Agency's recently released Delta Smelt Resiliency Strategy also correctly acknowledges the critical need to address predation.

State and federal regulators have taken aggressive actions to protect endangered fish species, particularly during the extended drought. However, these efforts have focused almost exclusively on increased flows, water temperature controls, and increased water pumping restrictions. Other stressors must also be addressed. Federal and state regulators agree on this point, but in the past the Commission has turned a blind eye to the issue of predation.

For example, in 2010, the National Marine Fisheries Service submitted a letter to the Commission requesting the elimination of size and bag limits for striped bass, but the Commission took no action on the request. Likewise, in 2011, the then Department of Fish and Game, the U.S. Fish and Wildlife Service, and the National Marine Fisheries Service submitted a joint recommendation to the

1205 East F Street / Oakdale, CA 95361 / (209) 847-0341 / Fax (209) 847-3468
www.oakdaleirrigation.com

Commission to evaluate changes to size and bag limits for striped bass identical to those included in the petition. Again, the Commission rejected the recommendation.

As a result, predation by non-native species has gone largely unaddressed. By decreasing the size limits and increasing the bag limits for these predators, the State can better protect endangered species and help stabilize water supplies for millions of California families, farms, and businesses.

The petition is based on proactive actions taken by other western states. In recent years, Washington and Oregon have both utilized this common sense approach to reduce the impacts of predation. It is long overdue for the Fish and Game Commission to begin addressing predation and its continuing impact on endangered populations in the Delta. This petition is a measured first step to begin reasonably and effectively identifying methods to limit predation.

We greatly appreciate your attention to and consideration of this important effort and look forward to working with you and your administration further on this important issue.

Respectfully,

OAKDALE IRRIGATION DISTIRCT

Steve Knell, P.E.
General Manager

SK;lfp

cc: Eric Sklar, California Fish and Game Commission President
Jacque Hostler-Carmesin, California Fish and Game Commission Vice-President
Anthony Williams, California Fish and Game Commission Member
Russell Burns, California Fish and Game Commission Member
Peter Silva, California Fish and Game Commission Member
Valerie Termini, California Fish and Game Commission Executive Director
Charlton H. Bonham, California Department of Fish and Wildlife Executive Director
John Laird, Natural Resources Agency Secretary
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Keely Bosler, Office of the Governor Cabinet Secretary
Kim Craig, Office of the Governor Deputy Cabinet Secretary
Felicia Marcus, State Water Resources Control Board Chair
Frances Spivy-Weber, State Water Resources Control Board Vice-Chair
Tam Doduc, State Water Resources Control Board member
Dorene D'Adamo, State Water Resources Control Board member
Steven Moore, State Water Resources Control Board member

August 1, 2016

Mr. Eric Sklar
Commission President
California Fish and Game Commission
P.O. Box 944209
Sacramento, CA 94244-2090

Re: Petition to California Fish and Game Commission to Address Predation

Commission President Sklar:

On behalf of the Board of Directors of South San Joaquin Irrigation District (SSJID) and our agency, I am writing to urge your support of the petition to the California Fish and Game Commission to address predation of at-risk fish native to the Delta, and also specifically the Stanislaus River (our source of water for irrigation and treated drinking water), by non-native predators. As salmon and smelt continue to decline, it is critically important for the Commission to take all appropriate action to address predation.

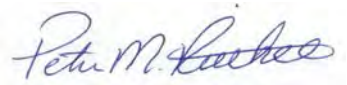
Predation of endangered and threatened fish, including Stanislaus River spring-run Chinook salmon, steelhead, delta smelt, and Sacramento River winter-run Chinook salmon, by non-native striped bass and black bass is well documented. At SSJID, we are intensely focused on the health of our watershed and waterways. We have worked extensively with Doug Demko, president of FISHBIO, a fisheries consulting firm and one of the leading experts on non-native fish predation. His February 10 testimony before the House Subcommittee on Water, Power and Oceans provided convincing statistical evidence that proves predation is a major factor hampering our efforts to protect endangered native fish species.

Yet, predation on the Stanislaus, the Delta, and other rivers that feed the San Joaquin River has gone unaddressed. This modest proposal is a reasonable and much needed step for the Commission to begin identifying methods to limit predation on native species in our rivers and the Delta region.

While California is often at the forefront of environmental protection, state regulators have lagged behind on this issue. Other western states, such as Washington, Oregon, and Utah, have successfully implemented similar strategies to protect endangered fish from non-native predators as part of comprehensive species conservation efforts. California should do the same.

We greatly appreciate your consideration of this important effort to protect and restore endangered fish species in all California rivers.

Respectfully,



Peter Rietkerk
General Manager
South San Joaquin Irrigation District

CC: Governor Edmund G. Brown Jr.
Jacque Hostler-Carmesin, California Fish and Game Commission Vice-President
Anthony Williams, California Fish and Game Commission Member
Russell Burns, California Fish and Game Commission Member
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Steven Moore, State Water Resources Control Board member

Exhibit 38A.15: Summary Table of Comments Received In Opposition to Petition #2016-011

Petition #2016-011 - Request to change size and bag limits for striped and black bass in the Delta

Comment Type	Brief Description	Number Received
2	Emails via Fish Reports: Opposition to changing striped bass and black bass regulations	1472
3	Emails: Vote NO on Agenda Item #38 - Protect CA Stripers and Bass	67
4	Letter/email in opposition to changing striped bass and black bass regulations citing Peter Moyle study, economic anlysis prepared for DFW, and results from 2013predation workshop	19
5	General emails and letters in opposition to changing striped bass and black bass regulations	19
6	KeepAmericaFishing petition in opposition to changing striped bass and black bass regulations.	1794
7	California Striped Bass Association petition in opposition to changing striped bass and black bass regulations	129
	TOTAL	**3500**

Note: Comments received as of 5:00 p.m. Aug 11, 2016

Example Comment #1

From: [redacted]
To: FGC; Wildlife DIRECTOR
Subject: Please support increases in bag limits and minimum size for black bass and stripers
Date: Monday, August 08, 2016 8:39:37 AM

August 8, 2016

California Fish and Game Commissioners
1416 Ninth Street Suite 1320
Sacramento, CA 95814

Dear President Sklar and Commissioners:

Please register my strong support to the proposal by the Coalition for a Sustainable Delta to increase the bag limits and decrease the size limits for black bass and stripers.

I am a dedicated fisherman of California native fish including salmon. Predation is a problem and one way to negate some of the negative impacts is to stop protecting invasive predatory fish like black bass and striped bass. The salmon industry has developed a plan that will protect the juvenile salmon and would be enhanced by removing protections from stripers or the black bass. I call upon you to strongly support the size limit and bag limit proposal unlike your predecessors did in 2012 and demand that the fish agencies do their jobs and protect endangered native fish species by increases limits on predatory, non-native, invasive species like black bass and stripers.

The economics of the potential improved salmon industry could provide billions of dollars in economic benefits for California as well as recreation, food, ESA regulation savings, and jobs for hundreds of thousands of residents. Fishing is my recreation and my passion. You need to protect me and all of the fishermen of Northern California. I urge your support of the bag and size limit proposal.

Sincerely,

Nick Bauer
[redacted]
CC: Chuck Bonham, Director, California Department of Fish and Wildlife.

Example Comment #2

From: David Patrick via FishReports
To: FGC
Subject: Opposition to changing striped bass and black bass regulations
Date: Thursday, August 11, 2016 11:01:22 AM

August 11, 2016

California Fish and Game Commissioners
1416 Ninth Street Suite 1320
Sacramento, CA 95814

Dear President Sklar and Commissioners:

Please register my strong protest to the proposal by the Coalition for a Sustainable Delta to increase the bag limits and decrease the size limits for black bass and stripers.

I am a dedicated fisherman and fish for bass, striped bass and salmon. Predation is a problem but the way to solve it is not to destroy one gamefish to save another. The Sustainable group proposal is not the
answer. The salmon industry has developed a plan that will protect the juvenile salmon without any harm to the stripers or the black bass. I call upon you to strongly reject the size limit and bag limit proposal as your predecessors did in 2012 and demand that the fish agencies do their jobs and implement better options like the salmon industry plan.

When the economics of the salmon, black bass and striped bass industries are combined, they generate billions in economic benefits for California and they provide recreation, food and jobs for hundreds of thousands of residents. Fishing is my recreation and my passion. You need to protect me and all of the fishermen of Northern California. I urge your rejection of the bag and size limit proposal and instead lead the way to do the job right. I support the proposal by the striper, black bass and the salmon coalition which will allow all of these species to survive and prosper.

Sincerely,

David Patrick
[redacted]
CC: Chuck Bonham, Director, California Department of Fish and Wildlife.

Example Comment #3

From: [redacted]
To: FGC
Subject: Vote NO on Agenda Item #38: Protect CA Stripers and Bass
Date: Thursday, August 11, 2016 8:46:17 AM

Dear Fish and Game Commission, the insanity has to stop ! we need to work on our water system not pass the buck and blame two species of fish ! I have heard the invasive pitch, and they eat too many salmon and so on for too long ! !t's just a sales pitch for the big wigs down south to get WATER, you know it and I know it. Truth is that everyone today is invasive, so what do we do? get rid of people too? People, this has to stop, sure the fish eat the salmon and some other types also, always have, and always everything has gotten along until now. The fish and game has always taken care of stripers and blackbass, part of their job as I recall, so don't let this get away now and pass the blame ! We need to vote NO on this foolish self centered idea and work on our water, it can be done, just do it !

Example Comment #4

Chico Bass Conservation Club

P.O. Box 1195 • Chico, CA 95927

RECEIVED
CALIFORNIA
FISH AND GAME
COMMISSION

2016 AUG -1 PM 2:11

MLS

July 25, 2016

California Fish and Game Commissioners
1416 Ninth Street, Suite 1320
Sacramento, CA 95814

Re: Predation

Dear Executive Director Termini, President Sklar and Game Commissioners:

We are writing to register our strong opposition to the Petition submitted by the Coalition for a Sustainable Delta. Their petition to increase bag limits and decrease size limits for striped bass and black bass due to predation of listed species could have many negative consequences for the entire SF Bay-Delta ecosystem and economy. Regulations currently in place were to protect these public trust resources from overharvest and provide fishermen and women angling opportunities.

The largest indiscriminate predator in the Delta is the export pumps that destroy millions of fish annually through direct and indirect losses. In addition, pumping operations also remove millions of acre feet of habitat and nutrients from the ecosystem. The export of habitat also reverses the flow of rivers, drawing listed species including winter-run Chinook salmon and Delta smelt, as well as other fish, to their doom.

Dr. Peter Moyle of U.C. Davis, the expert on the Delta ecosystem, recently wrote about striped bass predation and found predation of listed species is insignificant. Targeting striped bass could also have negative unintended consequences for the rest of the ecosystem. His study and article, Striped bass control: cure worse than disease? Can be found at the following link:
https://californiawaterblog.com/2011/01/31/striped-bass-control-the-cure-worse-than-the-disease

In addition, an Economic Analysis of Striped Bass, Steelhead, Salmon, Halibut and Sturgeon Fishing in a 31 County area of Northern California was prepared for the California Department of Fish and Wildlife by The Program for Applied Research and Evaluation at California State University, Chico, CA. The study started in 2010 and was completed in April 2013. The bottom line of this in depth analysis showed that 162,002 Bay Delta Complex Anglers contributed $470,280,821.00 in pursuit of their sport.

The Coalition litigated to remove striped bass, but the Fresno Federal Court ruled on July 21 2010, that the peer reviewed science did not support any of the plaintiff's contentions regarding striped bass predation impacts on salmon, steelhead and delta smelt listed under the Endangered Species Act.

Example Comment #4

Chico Bass Conservation Club

P.O. Box 1195 • Chico, CA 95927

A Science Panel convened by the State Water Resources Control Board in 2010 on Delta Flow Criteria arrived at the same scientific findings based on peer review scientific studies.

In 2013, an independent panel of national expert fisheries scientists was convened by the California Department of Fish & Wildlife and NOAA Fisheries to evaluate predation impacts in the estuary. They found that the removal of non-native fish is absolutely unnecessary, logistically impossible and would open a Pandora's Box of adverse ecological effects within the estuary ecosystem.

We hope you will find that the Coalition's petition is counterproductive and will reject their request to change regulations on these public trust resources.

Sincerely,

Rodney L Miller

Rod Miller, President Chico Bass and Conservation Club
P.O. Box 1195
Chico, CA 95927

Example Comment #5

From: [redacted]
To: FGC
Subject: Striped Bass & Black Bass Regulations
Date: Tuesday, July 26, 2016 8:39:21 AM

Dear Sirs:
I'm writing on behalf of the dwindling populations of Striped Bass and Black Bass to request that you do not change the current regulations for same. Fisheries everyone are being threatened every day and we should not add to it by changing the regulations. Thank you for your consideration.

Respectfully,

Terry Sternberg

Terry Sternberg
[redacted]

From: John Stillwagon
To: FGC
Subject: Opposition to petition 2016-011
Date: Thursday, August 11, 2016 9:53:56 AM
Attachments: image001.png
CA_Sportfish_Petition_Signers_081116.pdf

Dear Commissioners,

We are aware that you will be considering petition 2016-011, agenda item #38 at your meeting on August 24-25.

In response to your request for input, Keep America Fishing posted an online petition which gathered 1,794 signatures of recreational fishermen who strongly oppose the proposed regulations.

Attached is an PDF file of the **1,794** Keep America Fishing Supporters who signed our online petition. I exported this file on August 11, 2016 and it is a true and correct copy of the signer's information. The petition text is also included in the PDF.

Thank you for your consideration.

Warmest Regards,

John Stillwagon

John Stillwagon
KeepAmericaFishing Online Community Manager
[redacted]
www.KeepAmericaFishing.org

Example Comment #6

KEEPAMERICAFISHING™

We, the undersigned, are opposed to changes to California's striped bass and black bass fishing regulations. The proposed changes are not based on sound science but rather for the purpose of diverting attention from the real problem, reduced freshwater flows. Reducing that fishery to an unsustainable level will diminish long-term fishing opportunities without meaningfully addressing the decline of California's Chinook salmon.

For the following reasons, we urge you to deny any regulatory proposals that would weaken sound fisheries management decisions and sacrifice a valuable bass sport fishery:

1. Salmon have thrived alongside striped bass for over 100 years without predation becoming a threat to salmon populations. Changes in water moving down the Sacramento River through the Delta and the human-altered environment make young salmon more vulnerable to all predators, native and non-native. The decline of Chinook salmon and other species is caused by poor water and habitat management, not striped and black bass. This petition is brought by water users as a distraction from the real issue, water diversions that are destroying California's Delta.

2. Experts say that removing striped bass would be ineffective because other predators like pike minnow and channel catfish would both increase in abundance and have more access to salmon as prey. In fact, striped bass likely play a stabilizing role.

3. The bass fishery in California is an asset to both resident and visitor anglers. The fishing license dollars purchased by anglers go to the state for conservation, which totaled $65 million in 2015, not to mention the money anglers spend on sportfishing related purchases. Striped and black bass represent up to 51% of California's freshwater fishing economic impacts.

4. The state has done a good job managing its fisheries with the Commission and Department of Fish and Wildlife working hand and glove. If a legitimate problem is identified with bass and striped bass regulations and predation on salmon, then alternative means of controlling predation rates should be considered. There are a number of projects underway and proposed that can target hot spots where salmon are particularly susceptible. These would not put the striped bass or black bass fisheries at risk and would improve habitat of the river system and Delta.

Example Comment #7

Joseph Schloderer
[redacted]
Date Signed: 8/4/2016 12:16:00 PM

Anne Thompson
[redacted]
Date Signed: 8/4/2016 12:17:00 PM

Frank Ledesma
[redacted]
Date Signed: 8/4/2016 12:17:00 PM

Howard Childs
[redacted]
Date Signed: 8/4/2016 12:18:00 PM

John Sperry
[redacted]
Date Signed: 8/4/2016 12:18:00 PM

Jerry Sutton
[redacted]
Date Signed: 8/4/2016 12:18:00 PM

Gary Evans
[redacted]
Date Signed: 8/4/2016 12:19:00 PM

Example Comment #6

Larry Armstrong
[redacted]
Date Signed: 8/4/2016 12:20:00 PM

Raymond Mangahas
[redacted]
Date Signed: 8/4/2016 12:20:00 PM

Dave Holsonback
[redacted]
Date Signed: 8/4/2016 12:21:00 PM

Daniel Foster
[redacted] 12:22:00 PM

Brant McGlothlin
[redacted]
Date Signed: 8/4/2016 12:22:00 PM

philip fordahl
[redacted]
Date Signed: 8/4/2016 12:22:00 PM

John Batts
[redacted]
Date Signed: 8/4/2016 12:22:00 PM

Example Comment #7

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CALIFORNIA
FISH AND GAME
COMMISSION

2016 JUL 27 PM 2:16 MLS

7/25

To Fish & Game Commission:

129 signatures to save our fisheries from CSBA.

Ca Striped Bass Association

PO BOX 292783

Sacramento, CA 95829

Petition to Save Our Delta Fisheries

The Coalition for a Sustainable Delta has proposed changes to Fish and Wildlife regulations that would decimate the Striped Bass and Black Bass fisheries. This is the fourth attempt by the Coalition to change these regulations, none have passed in the past. They claim that these non-native species are preying on juvenile salmon an endangered and protected specie. Their evidence is not science based or peer reviewed. In a recent court case all their evidence of this predation was dismissed by the court for not being science based. These regulation changes would decimate both the Striped Bass and Black Bass fisheries, and not save salmon. A recent workshop on Salmon predation, consisting of a panel of fishery and delta experts concluded that predation was the LEAST stressor on salmon, and water diversions are the highest stressor.

The Coalition for Sustainable Delta is comprised of all water and irrigation districts that benefit from the water diversions. We ask the California Fish and Game Commission to not attempt to solve water diversion problems with fishing regulation changes. Join us in urging the California Fish and Game Commission to protect our public trust resource that generates hours of enjoyment and a 550 million dollar delta recreational economy. These fisheries are too valuable to allow their decimation for increased water diversions.

	Print Name	Signature	Address	Date
1	Andre Sims	[illegible]	[redacted]	
2	Jonathan Mason	[illegible]		7/17
3				
4				
5				
6				
7				
8				
9				
10				
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Example Comment #7

Petition to Save Our Delta Fisheries

The Coalition for a Sustainable Delta has proposed changes to Fish and Wildlife regulations that would decimate the Striped Bass and Black Bass fisheries. This is the fourth attempt by the Coalition to change these regulations, none have passed in the past. They claim that these non-native species are preying on juvenile salmon an endangered and protected specie. Their evidence is not science based or peer reviewed. In a recent court case all their evidence of this predation was dismissed by the court for not being science based. These regulation changes would decimate both the Striped Bass and Black Bass fisheries, and not save salmon. A recent workshop on Salmon predation, consisting of a panel of fishery and delta experts concluded that predation was the LEAST stressor on salmon, and water diversions are the highest stressor. The Coalition for Sustainable Delta is comprised of all water and irrigation districts that benefit from the water diversions. We ask the California Fish and Game Commission to not attempt to solve water diversion problems with fishing regulation changes. Join us in urging the California Fish and Game Commission to protect our public trust resource that generates hours of enjoyment and a 550 million dollar delta recreational economy. These fisheries are too valuable to allow their decimation for increased water diversions.

	Print Name	Signature	Address	Date
1	Ramiro Casillas	[illegible]	[redacted]	2016
2	Steven Kolb	[illegible]		7/19
3	Chris Macomber	[illegible]		7-19
4	Clarence Hughes	[illegible]		7/20
5	Joe Shuck	[illegible]		7/20
6	Laurie Schroeder	Laurie Schroeder		7/20
7	JOSEPH TORO	Joseph Toro		7/21
8				7/21
9				
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Example Comment #7

Petition to Save Our Delta Fisheries

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	Print Name	Signature	Address	Date
1	Steven J. Suhr	Steven Suhr	[redacted]	7-14-16
2	Robert E Moon	Robert Moon		818
3	Ronna Joseph	Ronna Joseph		818
4	Karen Suhr	Karen Suhr		7/15/16
5	Hudson Vitaich	Hudson Vitaich		7/16
6	Mike Pappa			26 7/16
7	Jennifer Vong			10 7/15/16
8	Koe Sartem			7/15/16
9	Kory Kohtz			7/15/16
10	Adelbert Lecman			7-15-16
11				
12	Steven Murrin			26
13	Frank Morones	Frank Morones		5822
14	Rick Tice			22
15				

Example Comment #7

CALIFORNIA FISH AND GAME COMMISSION
DECISION LIST FOR NON-REGULATORY ACTION THROUGH JUN 23, 2016
Revised 08-10-2016

FGC - California Fish and Game Commission **DFW** - California Department of Fish and Wildlife **WRC** - Wildlife Resources Committee **MRC** - Marine Resources Committee

Date Received	Name of Petitioner	Subject of Request	Short Description	Staff Recommendation	FGC Decision
5/12/2016	Harold Johnson	Bobcat trapping	Requests FGC reconsider ban on bobcat trapping.	*DENY; requires formal petition for regulatory change form available on FGC webpage* (www.fgc.ca.gov/public/information/petitionforregulatorychange.aspx).	RECEIPT: 6/22-23/2016 **ACTION: Scheduled 8/24-25/2016**
6/1/2016	Gene Carl	Permit to study Coho salmon	Requests a research permit to study Coho salmon to learn the limits and adaptability to future changes in habitat and environment.	*DENY; must seek permit through the existing DFW incidental take permit process, per Section 2080.1, Fish and Game Code.*	RECEIPT: 6/22-23/2016 **ACTION: Scheduled 8/24-25/2016**
6/22/2016	Joe Exline	Commissioner engagement	Comment to acknowledge Commissioner Williams' experience with houndsmen to inform his decision on the GPS collar issue for dogs and encourages similar engagement with sport and commerical fishing businesses.	*GRANT; will occur on an ongoing and case-by-base basis.*	RECEIPT: 6/22-23/2016 **ACTION: Scheduled 8/24-25/2016**
6/22/2016	Thomas O'Rourke Yurok Tribal Chairman	Commissioner Hostler-Carmesin conflict	(a) Request to investigate and address concerns regarding Commissioner Hostler-Carmesin's compliance with FGC Code of Conduct policy and apparent conflict of interest over matters concerning the Yurok Tribe. (b) Request to include Yurok Tribe in all discussions concerning co-management conducted by the Commission.	*(a) Send FGC response letter to Yurok Tribe.* *(b) GRANT; all tribes are welcome to join and participate in public meetings of FGC, including committee and tribal workgroup meetings. Meeting information is located at the back back of meeting agendas. Meeting agendas are available at least 10 days in advance on the FGC website.*	RECEIPT: 6/22-23/2016 **ACTION: Scheduled 8/24-25/2016**
6/22/2016	Reg Elgin Dry Creek Rancheria	Tribal Committee	Invites commissioners to participate in Tribal Committee meetings because there is a lot of work to get done.	*GRANT; on a case-by-case basis at the discretion of each Commissioner and in compliance with the Bagley-Keene Open Meeting Act.*	RECEIPT: 6/22-23/2016 **ACTION: Scheduled 8/24-25/2016**

RECEIVED
CALIFORNIA
FISH AND GAME
COMMISSION
2016 MAY 12 PM 2:0

Harold Johnson
[redacted]

MLS

California Fish and Game Commission
P.O. Box 944209
Sacramento, CA 94244-2090

Dear Sir,

I have been reading with some consternation about you Bobcat Trapping Ban. I am against banning activities such as these that have been put in place due to animal rights activists.

The Bobcat trapping ban may only affect a small portion of the California population, but those affected have lost their means of making a living.

As I understand it, bobcat trapping is only allowed in California with the use of box traps. This allows the trapper to release the animal or other animals caught in the trap. Although foothold traps are more affective and by no means any less humane than bobcat box traps, your state has outlawed these due to emotional issues brought forth by people who do not understand trapping. Regardless, the statewide banning of trapping of bobcats is honestly ridiculous and brought on by emotion, not science.

Almost the entire state of California is prime bobcat habitat. The number caught by hard working trappers is insignificant compared to the number found in you state. You are depriving your residents the opportunity for another outdoor activity. I have researched the reasons for you ban and find nothing of science significance that shows a ban will benefit bobcats. Apparently your commission has be infiltrated with people who do not understand wildlife issues. Your own fish and game department was against the ban, yet you allow emotion to rule the day.

I have trapped for many years and supplemented by income with trapping. Most of the animals I harvest are causing problems for landowners. I do this at no charge to the landowner and use the most humane methods available to dispatch animals. Here in Montana we have regulations that licensed trappers follow and we have ample populations of all furbearers. Yet we still trap. Why is it that California would ban trapping when in many areas bobcats are abundant?

As representatives of the people in California, you have an obligation to ALL people in California, and that includes trappers. Please consider removing the bobcat trap ban.

Sincerely,

Harold Johnson

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CALIFORNIA
FISH AND GAME
COMMISSION

2016 JUN -1 PM 3: 14

May 25, '16

Valerie Termini Dir.
Fish & Game Commission
1416 Ninth Street
Sacramento, Ca. 95814

Thank you for this opportunity to ask the commission for a research permit to study Coho salmon in our fish hatchery. The need to study the short life cycle of the Coho Salmon is to learn the limits and adaptability to future changes in the ever changing habitats and environment factors.

Respecting the Department Fish and Wildlife charge to protect the Coho Salmon, there seems to be confusion and a great disparity between the spirit of good faith of research and the interpretation of protection with the department's policies.

Our hatchery is only for research of adaptability in a artificial closed water recirculation system, with the tail waters are used in our Phormium nursery. We have accomplished multiple studies with rainbow trout including a artificial creek for a likeness for spawning for over 14 years.

I'm asking you for your consideration to issue me a permit to research Coho Salmon for the understanding of our future needs and potential augmentation in an artificial environment. Upon receiving a permit from the commission, we would like to extend in good faith the opportunity for a joint study with the DF&W for mutual benefits.

Thank you again for your consideration of our request.

Respectfully,

Gene Carl

Gene Carl

[redacted]

YUROK TRIBE

190 Klamath Boulevard • Post Office Box 1027 • Klamath, CA 95548

June 13, 2016

President Eric Sklar
California Fish and Game Commission
P.O. Box 944209
Sacramento, CA 94244-2090

RECEIVED AT

JUN 22 2016

COMMISSION MEETING
AGENDA ITEM 2
Thomas O'Rourke

Re: Tribal Committee Chair Jacque Hostler-Carmesin

Aiy-ye-kwee' President Sklar and Commissioners,

The purpose of this letter is to briefly summarize the Yurok Tribe's concerns about the California Fish and Game Commission's ("Commission") Tribal Committee Chair, Commissioner Jacque Hostler-Carmesin.

The Tribal Committee is a valuable forum for California tribes to have a platform and space to discuss critical issues. The ability to allow presentations and discussion on regulatory proposals with greater time and detail than what is possible at full Commission meetings is important to the Yurok Tribe. Trust in the Committee Chair by all California tribes is vital to the success of the Committee.

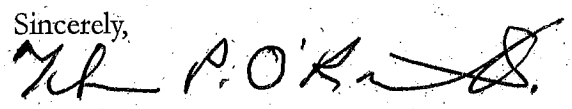
As you know, the Commission adopted a Code of Conduct Policy in March of 2013 which states, in part, that "a Commissioner shall conduct his or her affairs in an open, objective, and impartial manner, free of undue influence and the abuse of power and authority." The Yurok Tribe is of the opinion that the conduct of Commissioner Jacque Hostler-Carmesin is in conflict with this obligation. We respectfully request that the Commission address our concerns pursuant to relevant Code of Conduct grievance and investigation processes.

Commissioner Hostler-Carmesin is the current Chief Executive Officer of the Cher-Ae Heights Indian Community of the Trinidad Rancheria ("Trinidad Rancheria"). There have been numerous instances where the Yurok Tribal Council has questioned the appearance of a conflict of interest between Commissioner Hostler-Carmesin's role as the Commission's Tribal Committee Chair and her leadership at Trinidad Rancheria. Unfortunately, this conflict appears to be at the expense of Yurok Tribal interests and Yurok participation in key issues being considered by the Commission.

The Yurok Tribes desires a Tribal Committee Chair that is transparent, up-front, and unbiased in his or her leadership and decision-making. Yurok Tribal Council, unfortunately, has concerns about the current Committee Chair's ability to practice unbiased leadership given her current relationship with Trinidad Rancheria.

We appreciate your thoughtful review of our concerns. If you have any questions, please contact Self-Governance Director Javier Kinney at jkinney@yuroktribe.nsn.us or 707-482-1350.

Sincerely,



Thomas P. O'Rourke, Sr.
Chairman

Cc: Valerie Termini, Executive Director California Fish and Game Commission

A Status Review of Townsend's Big-Eared Bat (*Corynorhinus townsendii*) in California

Scott D. Osborn, Ph.D.

Wildlife Branch/Nongame Wildlife Program

August 25, 2016

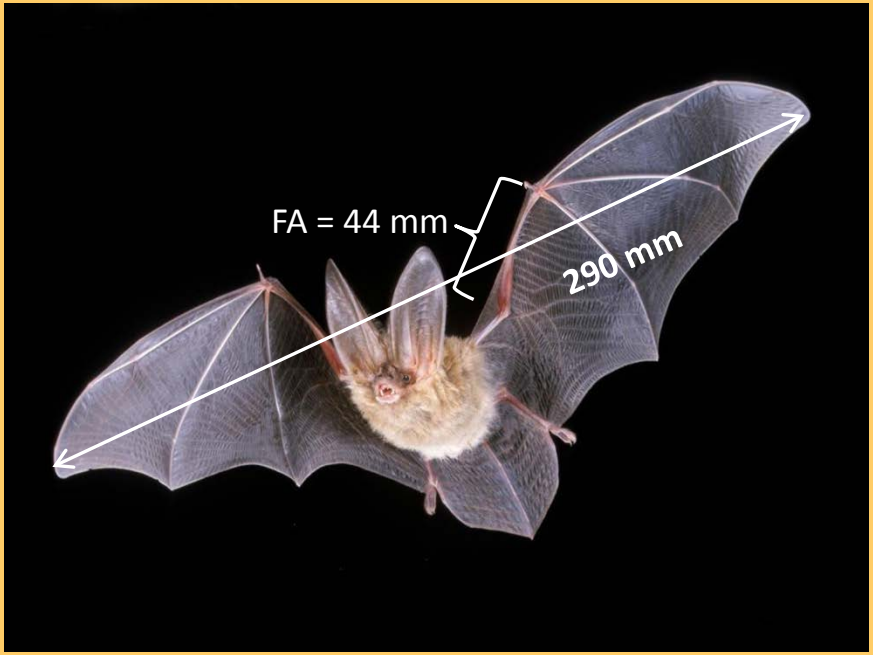
Photos: S. Osborn, L.S. Harris, Katrina Smith

Outline

- Taxonomy & Species Description
- Geographic Range
- Ecology
- Threats
- Status and Trends
- Conclusions
- Recommendations

Description

- Medium-sized ”micro” bat (10-12 g)
- Light brown dorsal fur; paler underparts
- Forearm 39-48 mm
- Ear 30-39 mm
- Two-pronged nose lump
- Broad, short wings



Photos: Merlin Tuttle, Bat Conservation International

Class Mammalia, Order Chiroptera, Family Vespertilionidae

Genus	Species	Subspecies	Common Name
Corynorhinus	*townsendii*		*Townsend's big-eared bat*

Class Mammalia, Order Chiroptera, Family Vespertilionidae

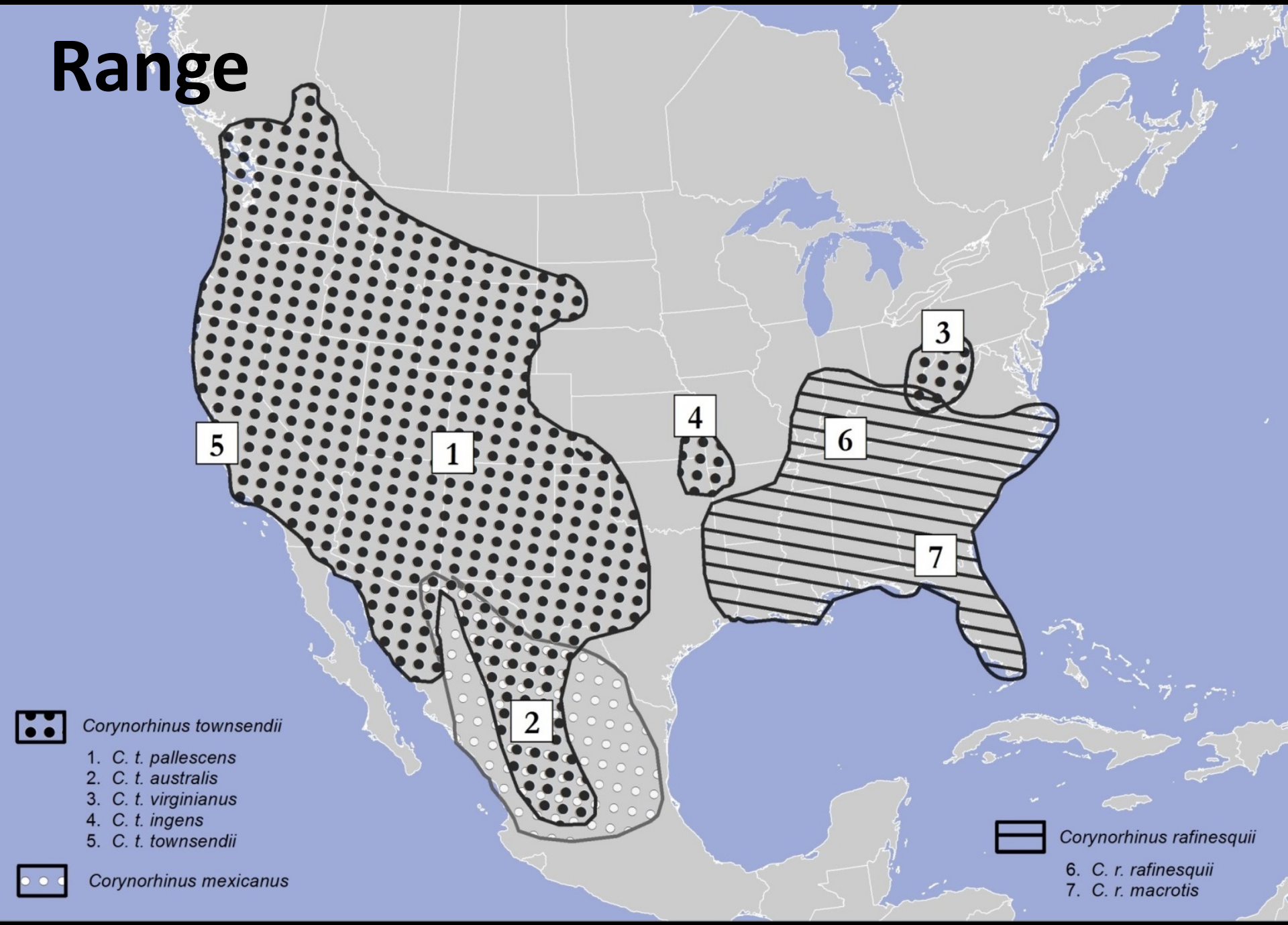
Genus	Species	Subspecies	Common Name
Corynorhinus	*townsendii*		*Townsend's big-eared bat*

Corynorhinus	*rafinesquii*		Rafinesque's big-eared bat
Corynorhinus	*mexicanus*		Mexican big-eared bat

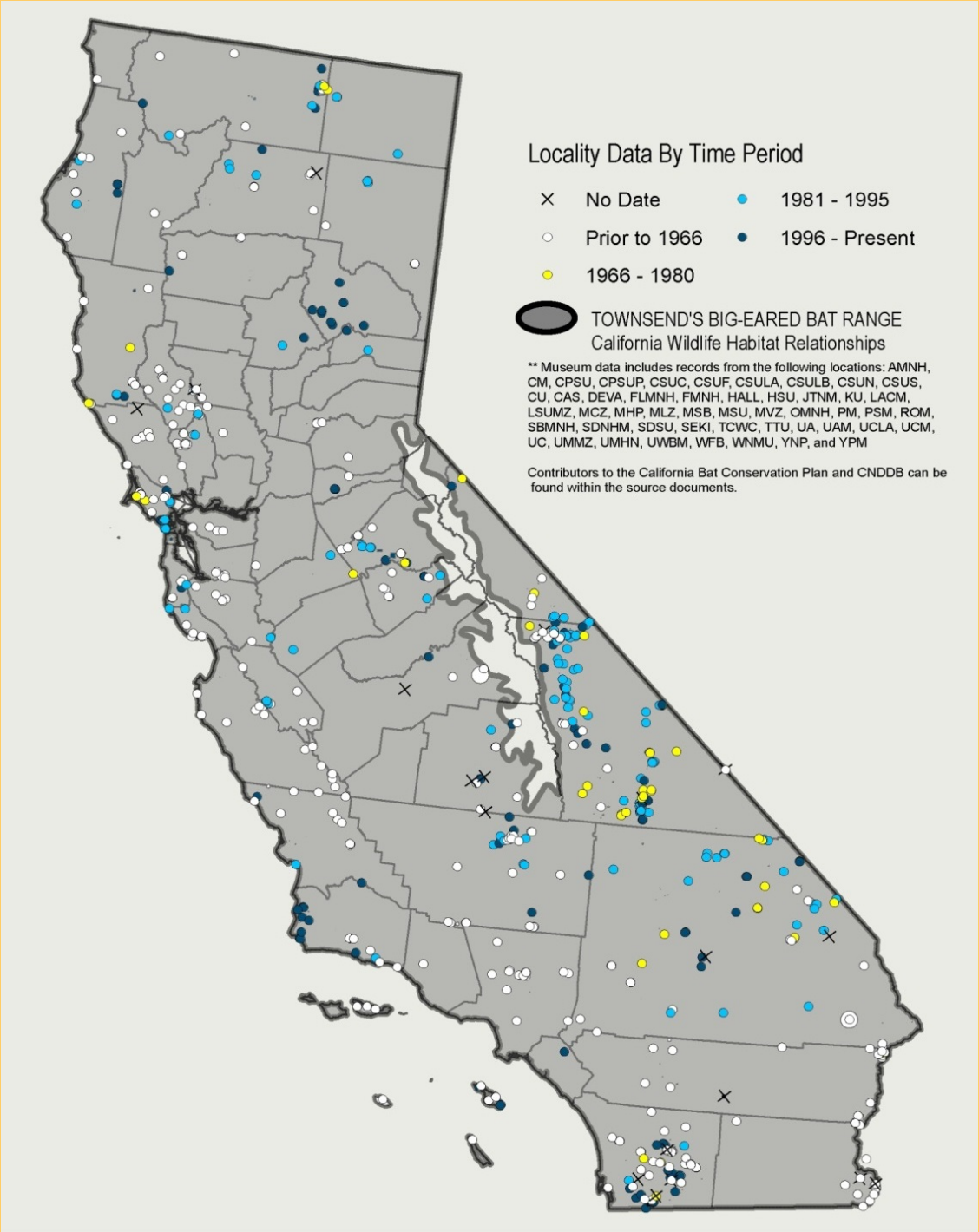
Class Mammalia, Order Chiroptera, Family Vespertilionidae

Genus	Species	Subspecies	Common Name
Corynorhinus	*townsendii*	*townsendii*	
		pallescens	
		ingens	Ozark big-eared bat
		virginianus	Virginia big-eared bat
		australis	
Corynorhinus	*rafinesquii*		Rafinesque's big-eared bat
Corynorhinus	*mexicanus*		Mexican big-eared bat

Range


1
2
3
4
5
6
7
Corynorhinus townsendii
1. C. t. pallescens
2. C. t. australis
3. C. t. virginianus
4. C. t. ingens
5. C. t. townsendii
Corynorhinus mexicanus
Corynorhinus rafinesquii
6. C. r. rafinesquii
7. C. r. macrotis

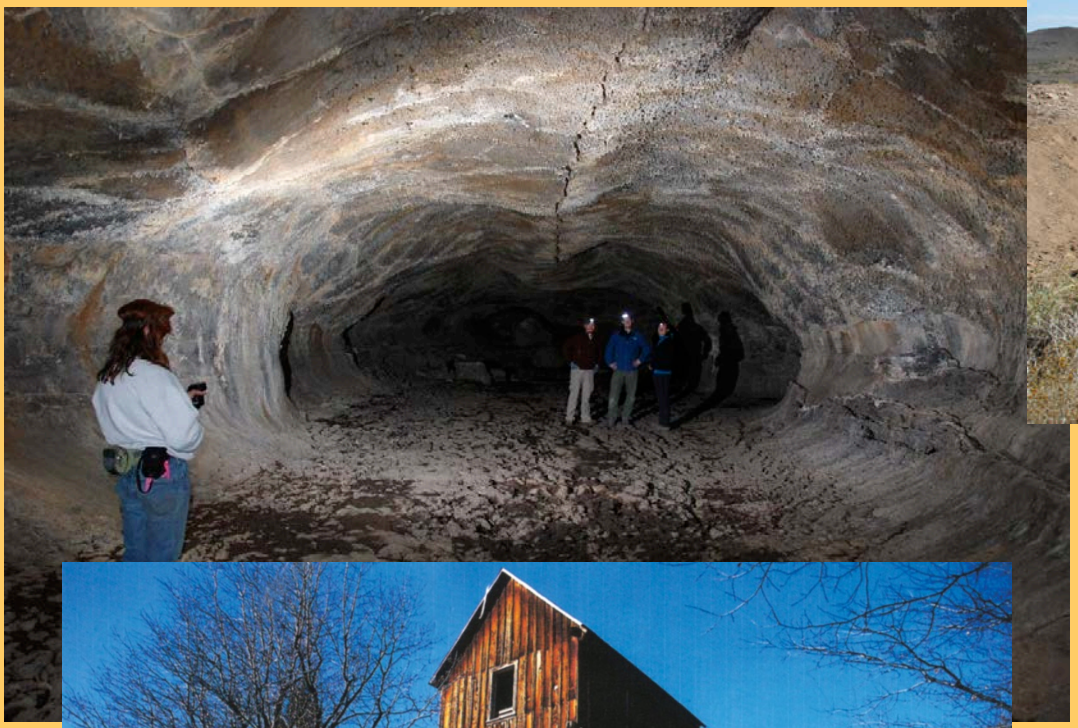
Calif. Range


Locality Data By Time Period
No Date
1981 - 1995
Prior to 1966
1996 - Present
1966 - 1980
TOWNSEND'S BIG-EARED BAT RANGE
California Wildlife Habitat Relationships
** Museum data includes records from the following locations: AMNH, CM, CPSU, CPSUP, CSUC, CSUF, CSULA, CSULB, CSUN, CSUS, CU, CAS, DEVA, FLMNH, FMNH, HALL, HSU, JTNM, KU, LACM, LSUMZ, MCZ, MHP, MLZ, MSB, MSU, MVZ, OMNH, PM, PSM, ROM, SBMNH, SDNHM, SDSU, SEKI, TCWC, TTU, UA, UAM, UCLA, UCM, UC, UMMZ, UMHN, UWBM, WFB, WNMU, YNP, and YPM
Contributors to the California Bat Conservation Plan and CNDDB can be found within the source documents.

Foraging Habitat

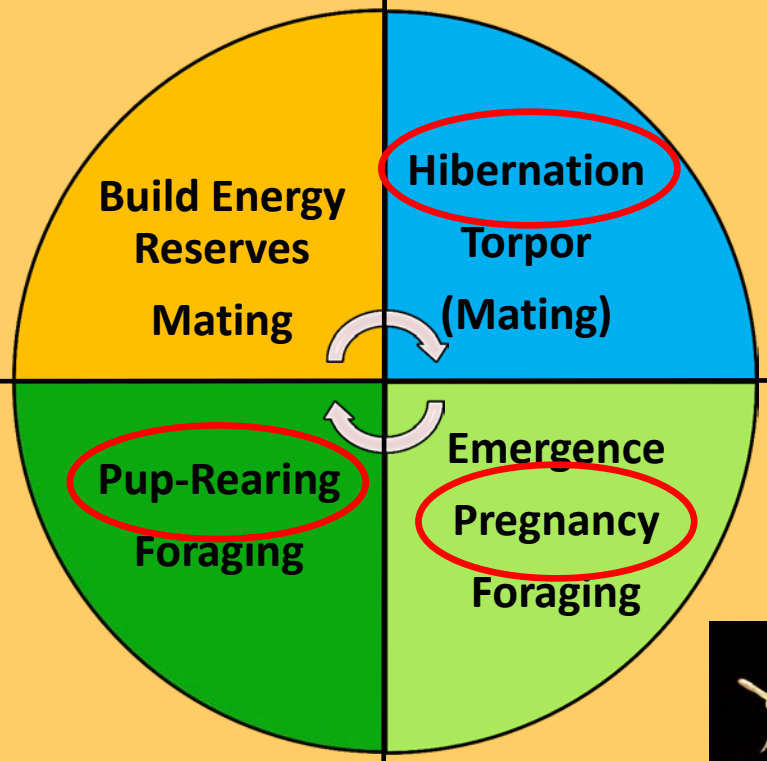
Photos: S. Osborn, NPS, W. Schlegel

Roosting Habitat



Photos: J. Chenger, S. Osborn, Sierra County Historical Society, BLM

COTO Annual Cycle



Photos: Aaron Corcoran, Katrina Smith, S. Osborn

Diet

Photos: Aaron Corcoran

Threats

- Habitat Loss/Degradation (Roost)
- Habitat Loss/Degradation (Foraging)
- Disease
- Mining
- Environmental Contaminants
- Climate Change (incl. Drought)
- Overexploitation
- Competition

Status & Trends

Summary of Pierson & Rainey (1998)

Photos: WBWG, TWS-WS, NPS

Status & Trends

Summary of Pierson & Rainey (1998)

Metric	Historical	Current (ca. 1990)
Number of adult females (18 colonies)	3,004	1,365
Number of maternity colonies	46	22 (43)
Average colony size	164	112

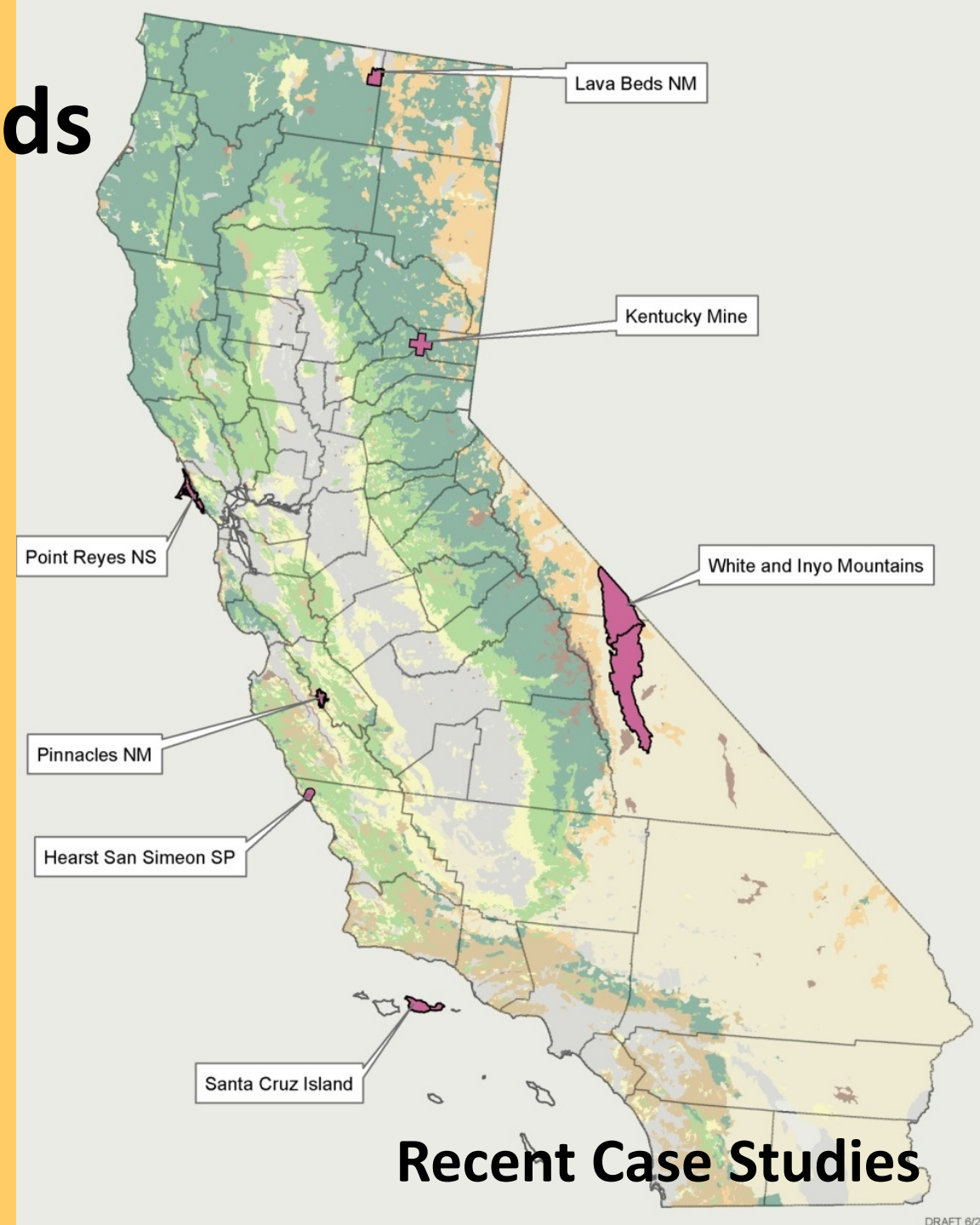
Status & Trends

Maternity Sites

- Randall House
- Kentucky Mine
- Lava Beds N.P.
- Pinnacles N.P.
- Hearst Castle
- Santa Cruz Island

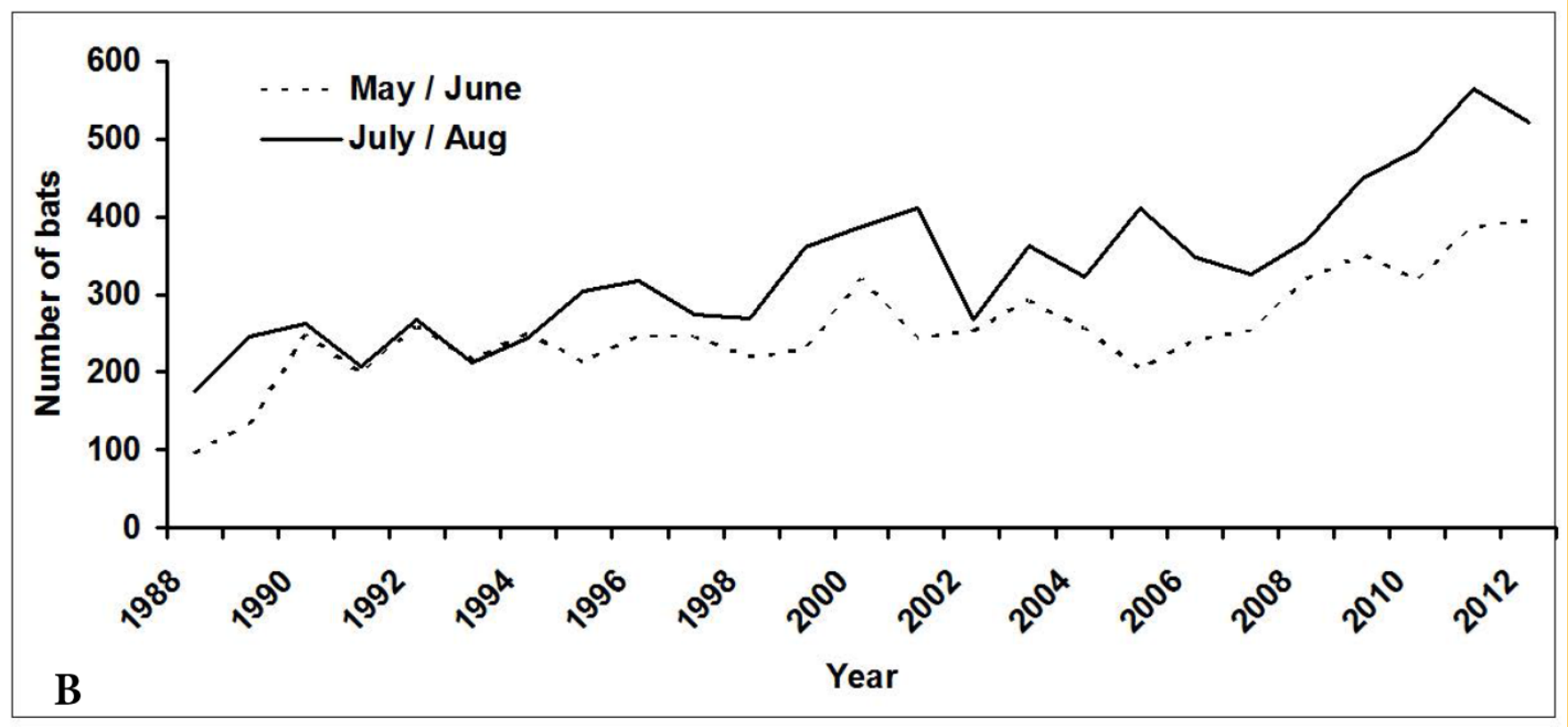
Hibernation Sites

- Lava Beds N.M.
- White-Inyo Mtns
- Pinnacles N.P.



Randall House,
Pt. Reyes Nat'l Seashore

Maternity Roost Exit Counts:

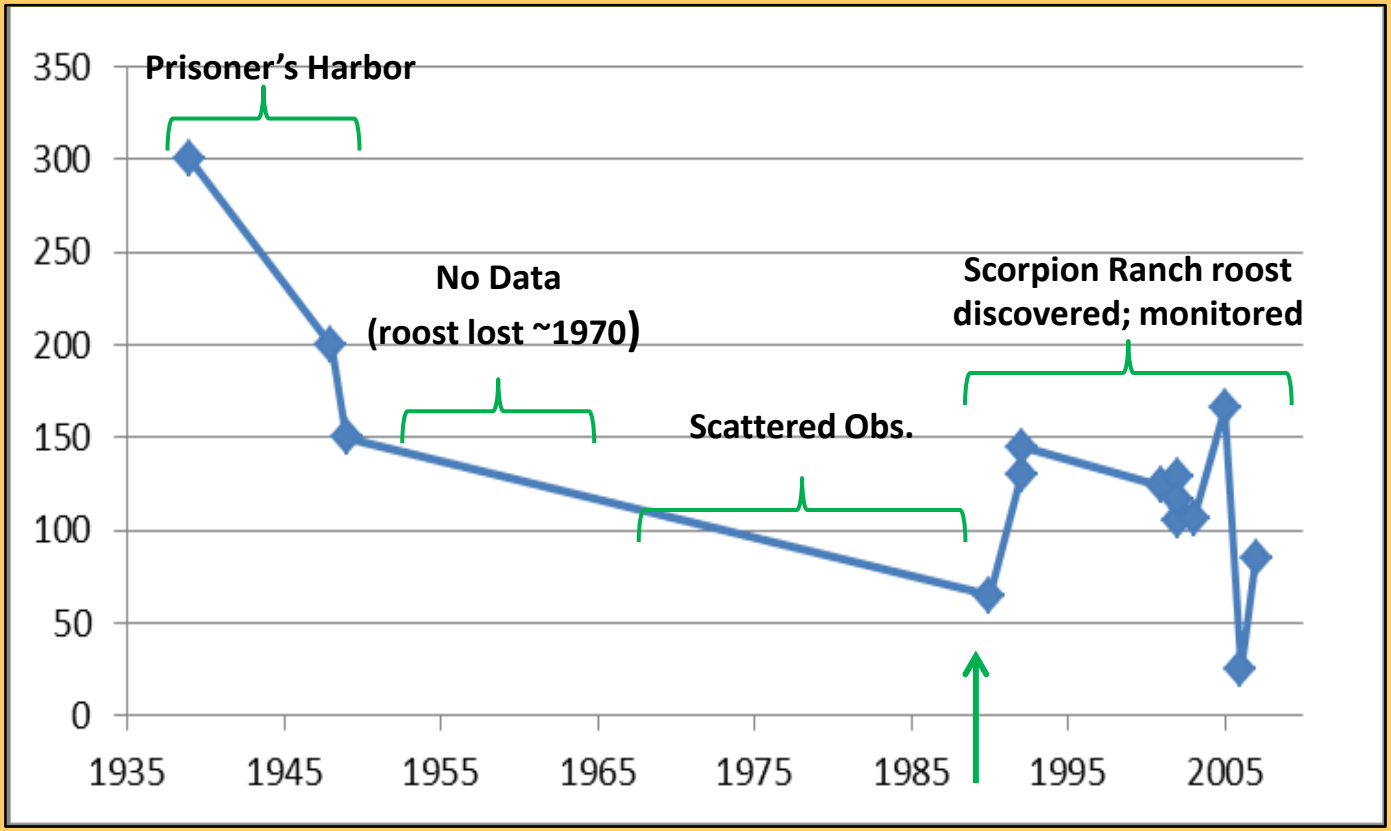


Fellers and Halstead 2015

Photo: Sonja Williams

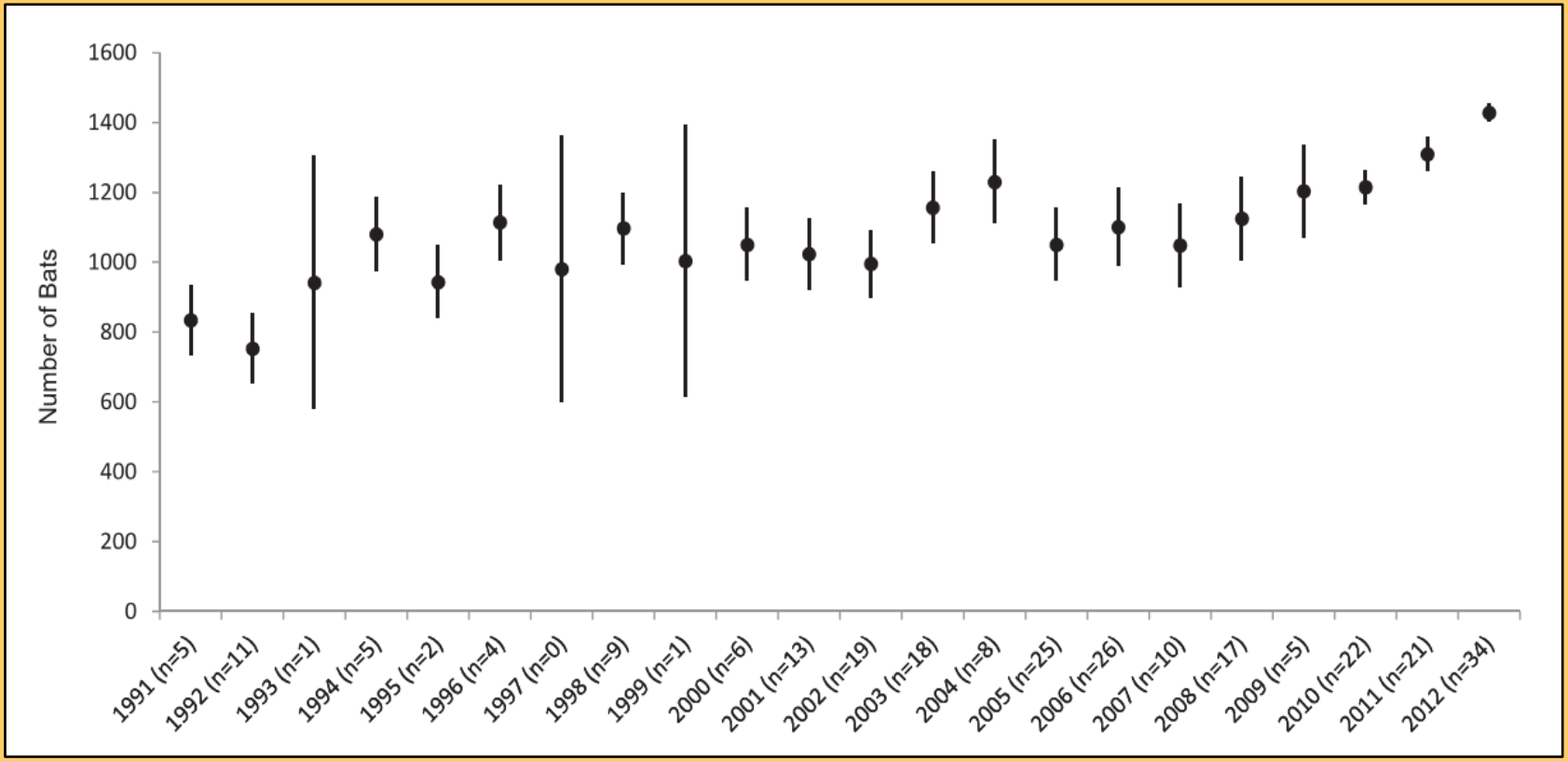
Santa Cruz Island, Channel Islands N.P.

Maternity Colony Counts:



Brown et al. 1994; Drost 2003, Brown and Berry 2007, NPS unpubl. data

Lava Beds N.M.



Weller et al. 2014

Photos: S. Osborn, J. Chenger, Katrina Smith

Case Study Summary

Hibernation	
Lava Beds N.M.	Statistically significant population increase over 22 years
White-Inyo Mountains	No statistical inference possible; many repeat visits had lower counts than initial visits 10-plus years earlier
Pinnacles N.P.	No inference possible
Maternity	
Randall House	Statistically significant population increase over 25 years
Kentucky Mine	Statistical tests not conducted; colony appears stable
Lava Beds N.M.	No inference possible
Pinnacles N.P.	Statistical tests not conducted, but colony appears to be stable or increasing
Hearst Castle	Statistical tests not conducted, but colony appears to be stable or increasing
Santa Cruz Island	No statistical tests conducted, but colony has decreased from historical size

Key Findings (Title 14 CCR 670.1)

1. Present or threatened modification or destruction of habitat
2. Overexploitation
3. Predation
4. Competition
5. Disease
6. Other natural occurrences or human-related activities

Recommendations

- The best available scientific information indicates to CDFW **the petitioned action is not warranted**.
- CDFW recommends to the Commission that Townsend's big-eared bat **not be added** to the list of Threatened and Endangered species under CESA.
- The Department presents several management recommendations in the Status Review report.

Questions?

August 10, 2016 Progress Reports on Crab Season, Domoic Acid and Disaster Declaration
Joint Committee on Fisheries and Aquaculture
Chairs: Senator Mike Mc Guire and Assemblyman Jim Wood
August 10, 2016 - 1:00 p.m. to 4:00 p.m.
State Capitol, Room 3191

Speaker: Jacque Hostler-Carmesin
Allotted Time: 5 minutes

Date: Wednesday, August 10, 2016

Time: 1:00 PM (you will start a little later)

Topic: Progress Reports on Crab Season, Domoic Acid and Federal Disaster Declaration

Format: 5 minute overview of FGC role

Background: There have been a total of 3 Joint Committee hearings since November 2015 on this issue held by Senator McGuire. The commercial fishery was closed in November 2015 due to elevated and persistent harmful algal bloom (HAB) levels detected in the crab.

Audience:
- Crab fishing industry (commercial and recreational)
- State agencies (Natural resource agency, Department of Fish and Wildlife, Fish and Game Commission staff)
- NGOs
- Legislative staffers

Draft Talking Points

- Good afternoon, my name is Commissioner Jacque Hostler-Carmesin and I am the Vice President of the California Fish and Game Commission (Commission).

- I want to brief you with the ongoing work of the Commission on this very important issue and our continued concern about the net result of these events to the fishery and communities along the coast that rely on fishing as a way of life.

- I'd like to make you aware of some of the challenges the Commission faced in implementing efficient and nimble regulations to address the need for fishery closure.

- During the recent fishery closures, the Commission 's current structure for emergency action proved to be a detriment to efficient and adaptive fisheries management
- Under the Commission's current authority, the only mechanism to rapidly close a fishery is by emergency action of the Commission for a period of 180 days (with the possibility for two additional 90 day extensions should unsafe conditions persist).

    - This approach is cumbersome and is not sensitive to the timing needs present in a public health emergency. By requiring a formal meeting and adoption process held by Commission to adopt the emergency regulatory changes, emergency regulations often take several days to implement.
    - Further, the office of administrative law (OAL) requires progress toward a long-term solution and is not favorable to a new repetitive emergency action every 90 days
- Thus, I appreciate the efforts of Senator McGuire to assist by developing a legislative option to provide a long-term nimble solution to help address this procedural challenge.
- Based on our recent experience with razor clam such a solution must covers all species and fisheries under FGC authority; in light of unanticipated conditions for other species, as we've seen with razor clam.
- The proposed SB 1287, will help address these challenges and streamline future response time if needed by providing a mechanism for immediate action by director of Fish and Wildlife.
    - First, it delegates authority to the Director to provide emergency closure and re-opening authority for human health concerns.
    - I also appreciate, the requirement to schedule a public discussion with the Commission to ensure clear communication between the Department of fish and wildlife and the Commission should emergency health issues arise and emergency closures become necessary.
    - This bill covers all species and fisheries under our authority; this anticipates potential extension of unanticipated conditions for other species, as we've seen with razor clam.

- It should also be noted that there was incredible coordination between the agencies involved in the HAB event.
    - Rapid action and coordination by each agency allowed for clear delineation of roles. The ongoing coordinated dissemination of clear and concise information led to common messaging designed to improve public understanding, help to ensure public safety, and ensure that closures and subsequent openings were biologically appropriate
    - Additionally, the Commission would like to specifically acknowledge the impacts that the emergency closures had to the fleet
    - While the season ultimately opened for commercial and recreational take, it was for a much shorter time – resulting in significant economic loss to the crab fishing communities
    - The Commission is actively engaged in discussion with fishing communities across the state to help identify needs, goals, and long-term solutions in light of changing ocean conditions
- It's also important to point out that the effects of elevated domoic acid have reached beyond the Dungeness crab fishery this year. In April, razor clams were found to have elevated domoic acid levels, which led to emergency action by the Commission to close the recreational fishery at all Humboldt and Del Norte county beaches based on OEHHA recommendations in consultation

with public health. As of July, levels in samples are still as high as 11 times the allowable level (July 2016 samples ranging from 85-230 ppm (acceptable level is 20 ppm)).

- It is not expected that the elevated domoic acid levels seen in the 2016 crab fishery will be an isolated event. That is why Commission staff has participated in the interagency HAB task force convened by OPC, to identify areas where new scientific information and guidance is needed for improved management of these fisheries.

- Managing fisheries in the face of changing ocean conditions is challenging, especially in the face of biological uncertainty. The Commission is looking forward to long term strategies, based on the best available science that can increase efficacy in managing future scenarios.

- Thank you for inviting me to speak today, and I welcome any questions.

Frequently Asked Questions:

Harmful Algal Blooms and California Fisheries

Developed in Response to the 2015-16 Domoic Acid Event

California Ocean Science Trust

AUGUST 2016

About this Document

GOAL : The goal of this document is to provide clarity for members of the fishing industry, consumers, non-governmental organizations, state agencies, and the Legislature on the California's current practices (through August 2016) in regards to harmful algal bloom (HAB) monitoring and management, and seafood toxin sampling and testing protocols. This document is intended to bring diverse audiences together around a common pool of information, and support more engaged conversations where everyone can move forward together.

Recent California fishery closures and health advisories during 2015-2016, resulting from elevated seafood toxin levels, have raised questions among California's coastal communities about the science supporting current biotoxin monitoring and fishery management practices. In response, the California Ocean Protection Council (OPC) and the Interagency Marine HAB Task Force[1] (HAB Task Force) have asked California Ocean Science Trust to develop a frequently asked questions (FAQ) document to address questions focused on:

I. HABs and seafood toxin monitoring efforts in California
II. Domoic acid and California fisheries
III. Human health and seafood safety concerns
IV. California's fishery and seafood toxin management

Questions were submitted to Ocean Science Trust by the HAB Task Force, along with input from the California Dungeness Crab Task Force (DCTF) Executive Committee, Commercial Fishermen of Santa Barbara, the office of California Senator Mike McGuire, and the Joint Committee on Fisheries and Aquaculture. Additionally, a public conference call was held on July 27, 2016 to further engage with the fishing industries involved and other interested parties. The majority of the questions included in this FAQ originated from these conversations, public comment, emails, and/or direct calls from stakeholders to agency or legislative staff. For the full list of questions submitted to Ocean Science Trust, visit here[2].

Ocean Science Trust compiled responses to the questions in this FAQ document based on existing scientific literature and consultation with representatives from the HAB Task Force, Ocean Protection Council Science Advisory Team "Harmful Algal Blooms and California Fisheries" working group (see below), and additional scientific experts (university researchers, and state and federal agency scientists). Additionally, this FAQ document prioritizes addressing questions that did not require additional research, due to the timeframe set by the California Legislature to begin addressing this issue.

This document is complementary to the work of an Ocean Protection Council Science Advisory Team (SAT) working group[3], convened by Ocean Science Trust to provide longer-term recommendations that can help California agencies and the Legislature prioritize future science-informed actions focused on better understanding and predicting fishery and human health impacts related to HABs.

An overview and more general scientific information about HABs in California can be found in a report created by leading academic experts in the field titled "A Primer on California Harmful Algal Blooms: Common questions and answers for stakeholders, decision-makers, coastal managers, and the education community," available here[4].

1 The HAB Task Force membership includes representatives from California Department of Public Health, California Fish and Game Commission, California Department of Fish and Wildlife, Ocean Protection Council, and the Office of Environmental Health Hazard Assessment.

2 http://www.oceansciencetrust.org/wp-content/uploads/2016/07/Full-List-of-Submitted-questions-HABs-and-fisheries-2016.pdf

3 For more about the SAT working group, visit here: http://www.oceansciencetrust.org/project/harmful-algal-blooms-and-california-fisheries/

4 McGaraghan et al., 2012: http://fisheries.legislature.ca.gov/content/august-10-2016-progress-reports-crab-season-domoic-acid-and-disaster-declaration

List of Acronyms

ASP – Amnesic Shellfish Poisoning
CDFW – California Department of Fish and Wildlife
CDPH – California Department of Public Health
CeNCOOS - Central and Northern Ocean Observing System
DCTF – Dungeness Crab Task Force
DSP – Diarrhetic Shellfish Poisoning
EMB – Environmental Management Branch of the California Department of Public Health
EPA – United States Environmental Protection Agency
FAQ – Frequently Asked Questions
FDA – United States Food and Drug Administration
FDB - Food and Drug Branch of the California Department of Public Health
FGC – Fish and Game Commission
HAB – harmful algal bloom
ISSC - Interstate Shellfish Sanitation Conference
MSA - Magnuson-Stevens Fishery and Conservation Management Act
NOAA – National Oceanic and Atmospheric Administration
OPC - California Ocean Protection Council
PSMFC – Pacific States Marine Fisheries Council
PSP – Paralytic Shellfish Poisoning
SAT - Ocean Protection Council Science Advisory Team
SOP - Standard Operating Procedures
Spp. - species
Task Force – California Interagency Marine Harmful Algal Bloom Task Force
WARNN-West – Wildlife Algal Toxins Research and Response Network for the West Coast

About Ocean Science Trust

Ocean Science Trust is an independent non-profit that brings together governments, scientists, and citizens to build trust and understanding in ocean and coastal science. We empower participation in the decisions that are shaping the future of our oceans. We were established by the California Ocean Resources Stewardship Act to support managers and policymakers with sound science. For more information, visit our website at www.oceansciencetrust.org.

About the Interagency Marine HAB Task Force

The Interagency HAB Task Force was established by the Ocean Protection Council in early 2016. Task Force members include Sonke Mastrup (California Department of Fish and Wildlife), Susan Ashcraft (Fish and Game Commission), Patrick Kennelly (Department of Public Health), Gregg Langlois (Department of Public Health, retired), Susan Klasing (Office of Environmental Health Hazard Assessment), Valerie Termini (Fish and Game Commission), and Jenn Phillips (Ocean Protection Council). During the winter of 2016-17, the Task Force will help guide the working group in developing a longer term management document about what information is needed and what investments are needed to help to better predict and plan for future events. The Task Force will also work together to review and update standard operating procedures (SOP) that will be utilized by the agencies responsible for oversight of public health and the fisheries.

About the Ocean Protection Council Science Advisory Team Working Group

The Harmful Algal Blooms and California Fisheries SAT working group was convened by Ocean Science Trust to develop scientific guidance and options for adding capacity to the California's existing HAB monitoring and sampling efforts, as well as advance our understanding and ability to predict HAB events and fishery impacts. Members include Raphael Kudela (UC Santa Cruz), William Cochlan (San Francisco State University), Dave Caron (University of Southern California), and Gregg Langlois (California Department of Public Health, retired).

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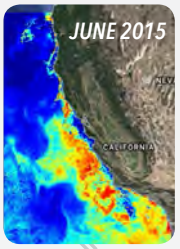
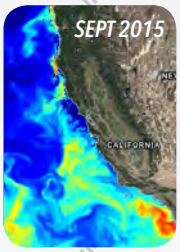
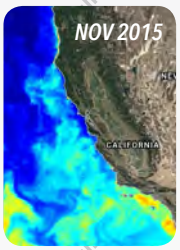
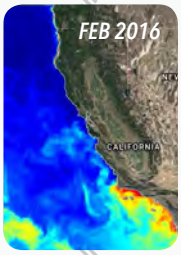
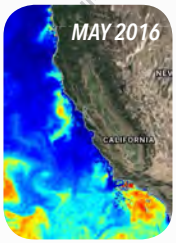
Timeline of Events: Domoic Acid and the California 2015-16 Fishing Season











Historical probability of particulate domoic acid (>500 nanograms/L)

Map data: CeNCOOS

2015

JUNE 1, 2015
CDPH advised consumers not to eat recreationally harvested mussels and clams, commercially or recreationally caught anchovy and sardines, or the internal organs of commercially or recreationally caught crab taken from Monterey and Santa Cruz counties due to elevated domoic acid levels.

JUNE 8, 2015
CDPH expanded the warning to include the internal organs (viscera) of scallops due to domoic acid.

JULY 3, 2015
CDPH expanded the warning to include Santa Barbara County.

AUGUST 26, 2015
CDPH advised consumers not to eat recreationally harvested bivalve shellfish (mussels and clams) from Humboldt or Del Norte counties due to elevated domoic acid.

SEPTEMBER 11, 2015
CDPH and CDFW began preseason Dungeness crab meat quality and toxin testing.

NOVEMBER 3, 2015
CDPH issued health advisory not to consume Dungeness and Rock crabs caught in waters between OR border and the southern Santa Barbara County line.

OEHHA and CDPH recommended delaying opening of Dungeness crab season and closing the rock crab fishery due to unsafe levels of domoic acid.

NOVEMBER 5, 2015
FGC held an emergency meeting and voted to delay the opening of the recreational Dungeness crab fishery.

NOVEMBER 6, 2015
Director of CDFW enacted an emergency rulemaking to delay the opener of the commercial Dungeness crab season and close commercial rock crab.

NOVEMBER 13, 2015
CDPH lifted advisory for bivalve shellfish (mussels and clams) and small finfish (anchovies and sardines) caught in the Santa Cruz, Monterey, or Santa Barbara County areas.

DECEMBER 9, 2015
CDPH lifted advisory for bivalve shellfish (except razor clams) from Humboldt and Del Norte Counties.

DECEMBER 31, 2015
CDPH lifted advisory for Dungeness and rock crabs caught along the coasts of Santa Barbara and San Luis Obispo counties. CDFW opens commercial and recreational rock crab, and recreational Dungeness crab in these regions.

2016

FEBRUARY 9, 2016
Governor Brown requested that the federal government declare a fishery resource disaster and commercial fishery failure under the Magnuson-Stevens Act in order to seek federal assistance.

FEBRUARY 11, 2016
CDPH lifted health advisory for Dungeness crabs caught in all areas south Point Reyes. CDFW and FGC opened recreational Dungeness crab fishing in areas south of Point Reyes.

MARCH 18, 2016
CDPH lifts health advisory for Dungeness crabs caught in areas south of the Sonoma/Mendocino County line. Recreational Dungeness crab fishery opens in this region, and CDFW provides commercial Dungeness crab fishermen seven days' notice of opening.

MARCH 26, 2016
Commercial Dungeness crab season opened south of the Sonoma/Mendocino County Line.

MARCH 28, 2016
CDPH lifted health advisory for rock crabs caught in state waters off the Channel Islands, with the exception of one area between Santa Rosa and Santa Cruz Islands. Recreational and commercial rock crab fisheries open in these regions.

APRIL 22, 2016
CDPH lifted Dungeness crab health advisory in Mendocino and portions of Humboldt Counties. Rock crab advisory lifted for Monterey County.

APRIL 27, 2016
FGC closed recreational razor clam fishery in Humboldt and Del Norte Counties.

MAY 2, 2016
Dungeness Crab health advisory lifted along Northern California Coast. California coast is open for recreational Dungeness crab, except one area within Humboldt county.

MAY 12, 2016
Commercial Dungeness crab fishery opened in Mendocino, portion of Humboldt and Del Norte counties.

MAY 19, 2016
Recreational Dungeness crab fishery opened statewide, Commercial fishermen given seven days' notice of opening.

MAY 26, 2016
Commercial Dungeness crab fishery opens statewide.

JUNE 3, 2016
Commercial and recreational rock crab fisheries open in remainder of Channel Islands.

JULY 6, 2016
CDPH lifted advisory for rock crab in portions of San Mateo County. Recreational and commercial rock crab fisheries open south of Pigeon Point.

Background

Harmful algal blooms (HABs) are extreme biological events that can result in negative impacts to fisheries, coastal ecosystems, economies, and public health via the production of natural toxins. These toxins can accumulate in meat and organs of shellfish and other seafood species and, when consumed by marine wildlife and humans, can result in various illnesses or death. It is generally accepted that HABs are increasing in frequency, intensity, and duration in all aquatic environments on a global scale. In California, the prevalence and intensity of HABs is a growing concern.

In 2011, a HAB event in coastal areas of Sonoma County led to the mass mortality of red abalone, urchins, sea stars, chitons, and crabs, and was the largest invertebrate die-off recorded for the region[5]. In the spring and summer of 2015, an unprecedented HAB of the marine algae *Pseudo-nitzschia* stretched from central California to the Alaska Peninsula, resulting in some of the highest concentrations of the toxin domoic acid ever observed in California. This particular event even exceeded domoic acid levels researchers had previous thought could occur in the natural environment. This most recent HAB was a consequence of a series of abnormal ocean changes in the Pacific Ocean, including a large mass of warm and nutrient-poor water, named "the blob," combined with warm water driven by El Niño.

As a result of this West Coast-wide HAB event, elevated levels of domoic acid were observed in major commercial and recreational California fisheries in 2015 and 2016, including Dungeness crab, rock crab, anchovies, mussels, and razor clams. This led to multiple fishery and aquaculture closures and health advisories during the 2015-2016 season, including California's commercial and recreational Dungeness crab and rock crab, and recreational razor clam fisheries. These closures resulted in extensive impacts and economic hardships on the commercial fishing and seafood industry, prompting Governor Brown to request[6] a fishery resource disaster and commercial fishery failure declaration under the Magnuson-Stevens Act on behalf of the commercial Dungeness crab and rock crab industries.

Given California's changing ocean conditions and increasing threats to coastal industries, communities, and economies, the State is interested in better understanding and predicting HAB events, as well as exploring opportunities to bolster its existing seafood toxin sampling and monitoring programs.

In this document, we focus on addressing frequently asked questions related to California's current practices for HAB monitoring, management, and seafood toxin sampling and testing protocols. In some sections, we address questions about California's HAB and shellfish monitoring efforts, broadly. In others, we focus more specifically on domoic acid and California's crab fisheries. Where possible, we attempt to distinguish between bivalve and crustacean shellfish. **Bivalve shellfish** (mussels, clams, oysters), are routinely monitored year round by the California Department of Public Health and have strict requirements for commercial shellfish growing areas in compliance with the National Shellfish Sanitation Program (NSSP)[7]. **Crustacean shellfish** (e.g., Dungeness and rock crab) and finfish (e.g., Pacific sardine, northern anchovy) are tested for toxins when there is an indicator present (see Box 1) and/or during routine monitoring, such as the preseason meat quality testing that takes place for Dungeness crab.

5 De Wit et al., 2014. Available at: http://www.nature.com/ncomms/2014/140416/ncomms4652/full/ncomms4652.html

6 Governor Brown Letter: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=116284

7 The National Shellfish Sanitation Program (NSSP) is the federal/state cooperative program recognized by the U. S. Food and Drug Administration (FDA) and the Interstate Shellfish Sanitation Conference (ISSC) for the sanitary control of shellfish produced and sold for human consumption. Participants in the NSSP include agencies from shellfish producing and non-producing States, FDA, EPA, NOAA, and the shellfish industry. For more information, visit here: http://www.fda.gov/Food/GuidanceRegulation/FederalStateFoodPrograms/ucm2006754.htm

Photo: NOAA

I. Harmful Algal Bloom and Biotoxin Monitoring Efforts in California

▪ *How are harmful algal blooms and associated biotoxins being monitored along California's coast?*

California has the longest-standing biotoxin monitoring program in the U.S., beginning in 1927 in response to a massive paralytic shellfish poisoning (PSP) episode. That event resulted in several deaths and over 100 illnesses that were associated with mussel consumption. In 1991, the California Department of Public Health (CDPH) began monitoring state fisheries for domoic acid after it was first detected in Monterey Bay.

CDPH has implemented a prevention program that has traditionally been comprised of the following basic elements:

1. a coastal bivalve shellfish monitoring program (see *CDPH Shellfish Monitoring Program* below) that serves to protect recreational harvesters and serves as an early warning for HABs that could be transported into the bays and estuaries used for commercial shellfish aquaculture;
2. a coastal phytoplankton monitoring program (see *CDPH Volunteer-based Phytoplankton Monitoring Program* below) for early detection of toxin producing species that could impact shellfish and other seafood resources. Early bloom detection, coupled with the ongoing bivalve shellfish monitoring, inform and direct the need for sampling other seafood species (e.g., crab, anchovy);
3. frequent monitoring of commercial bivalve shellfish growing areas;
4. an annual statewide quarantine on sport harvested mussels (from May 1 through October 31);
5. mandatory reporting of disease cases;
6. public information and education activities.

CDPH Shellfish Monitoring Program

Bivalve Shellfish

The shellfish monitoring component of the Marine Biotoxin Monitoring Program (Biotoxin Program) relies on participation of people from a wide variety of local, state, and federal agencies, Tribal biologists, educational organizations, researchers, and, increasingly, citizen volunteers. Program participants collect shellfish samples, primarily mussels, and ship them to the CDPH laboratory in Richmond, California where they are tested for the PSP toxins and domoic acid. Sampling frequency is often dependent on exceptionally low tides and calm seas, varying from once to twice per month. Approximately 1200 bivalve shellfish samples are collected annually by over 60 samplers at more than 100 sampling sites. Sites are selected based both on being representative of a coastal region's fishing sites (or embayments) and safety of access.

Commercial shellfish growers, who account for approximately two-thirds of the total number of samples, are required to submit shellfish samples at least weekly for toxin testing as a condition of their certification by CDPH. Some commercial bivalve shellfish companies operating in high-risk areas for domoic acid are required to conduct weekly field tests for this toxin in addition to shipping the sample to the CDPH laboratory. These qualitative tests (which only indicate presence/absence of domoic acid) provide the industry valuable information on the initial occurrence of toxin and can guide harvesting plans to ensure public health. This information also allows CDPH to prioritize samples that have tested positive in the field to be tested first when they arrive in the laboratory to confirm the positive test as well as ascertain levels of domoic acid in the samples.

It is also worth noting that commercial bivalve species fall under the protocol outlined in the FDA's National Shellfish Sanitation Program (NSSP). The NSSP only applies to commercial bivalve shellfish and requires each state to have a Biotoxin Contingency Plan that consists of the following:

- Initiate an emergency shellfish sampling and assay program.
- Close growing areas and embargo shellfish.
- Prevent harvesting of contaminated species.
- Provide for product recall.
- Disseminate information on the occurrences of toxic algal blooms and/or toxicity in shellfish meats to adjacent states, shellfish industry, and local health agencies.
- Coordinate control actions taken by authorities and federal agencies.

Crustacean Shellfish and Finfish

For most crustacean shellfish and finfish species, CDPH will initiate testing for HAB-induced toxins when there is an indicator that the toxin may be present or has entered the food chain (see Box 1 for indicators). Once CDPH learns of an indicator they consult with California Department of Fish and Wildlife (CDFW) to learn of any active commercial or recreational fisheries in the same geographical region where the indicator is present and determine whether or not sampling is needed.

Box 1. List of indicators that prompt CDPH to consider sampling seafood species (other than bivalves) for HAB-induced toxins in a given area.

- Increased toxin levels in CDPH bivalve sampling program, typically mussels
- Active toxin-producing bloom observed by CDPH, academic researchers or the public
- HAB species detected through CDPH phytoplankton monitoring
- Marine mammal strandings and bird die-off events, etc.
- Notifications from independent academic researchers who are conducting their own research and monitoring efforts

Typically, if there is an indictor present, CDPH will first check existing or new bivalve samples to see if the toxin has entered the food chain in an area where an indicator is observed. Bivalves are particularly good indicator species because they are efficient filter feeders, they are ubiquitous along the coast and easily accessible on low tides, and will often show presence of HAB-related toxins in their tissue before other non-bivalve species. If a toxin is present at high levels in the bivalves, CDPH will take necessary public health actions for the commercial and recreational bivalve fishery in question CDPH will also take into consideration whether additional indicators are also present while also consulting with CDFW to learn if there are other active fisheries in the area that could be impacted and initiating sampling for those species as necessary.

In addition to the above, for Dungeness crab, CDPH will work with CDFW during the pre-season meat quality testing to secure samples for toxin testing in advance of the season opener. If elevated toxin levels are observed, or if an active bloom on fishing grounds is present, then bi-weekly to weekly testing occurs until the bloom is no longer observed and/or toxin levels are no longer detected near the action level.

For rock crab, testing is implemented when a bloom is observed, if mussels test positive in the area, or other indicators signify testing is warranted (see Box 1). If the fishery is closed due to elevated toxin levels, sampling occurs weekly to bi-weekly.

CDPH Volunteer-based Phytoplankton Monitoring Program

CDPH initiated a volunteer-based phytoplankton monitoring program in 1991 to detect an initial increase of a toxin-producing species before shellfish and other seafood resources are impacted. This program draws on a wide range of participants as detailed for the shellfish sampling program. Phytoplankton monitoring participants are provided nets for collecting concentrated seawater samples, which are sent to the CDPH laboratory for examination under a microscope. This effort allows CDPH to focus additional attention on those coastal areas experiencing an increase in toxin-producing phytoplankton or an increase in toxins in shellfish. When phytoplankton levels are on the rise, additional samples are requested. Observations of high levels of toxin-producing phytoplankton are one of the indicators that can prompt CDPH to expand seafood sampling to other (non-bivalve) potentially impacted seafood species like crab and anchovy (see Box 1) in the area.

▪ *What harmful algal species and associated toxins are routinely monitored by the State and how?*

CDPH's phytoplankton monitoring program is focused primarily on the early detection of three toxin-producing species most prevalent in California and the West Coast (Figure 1, Table 1):

- *Alexandrium spp.*, a dinoflagellate responsible for the PSP toxins
- *Pseudo-nitzschia spp.*, a diatom that produces domoic acid, the toxin responsible for amnesic shellfish poisoning (ASP)
- *Dinophysis spp.*, a less common dinoflagellate species that produces toxins responsible for diarrhetic shellfish poisoning (DSP)

Other less common toxin-producing species are tracked via CDPH's phytoplankton monitoring efforts and, if warranted, CDPH will pursue shellfish testing. Common non-toxic species are also identified and tracked and can provide insight into other HAB events being investigated by researchers and other agency scientists. General trends in the relative abundance and geographic distribution of major phytoplankton groups (diatoms, dinoflagellates) can provide insight into the likelihood of a given toxin-producer being present. Summary data for toxin and phytoplankton monitoring is provided in monthly reports (see link in section *Where can HAB monitoring and active bloom information be found?* below).

HAB monitoring occurs in several ways in California, including a number of university researchers and the CDPH phytoplankton monitoring program. CDPH equips its program participants with a standard net (20 micrometer mesh size) for collecting concentrated seawater samples, which are sent to the CDPH laboratory. Samples are collected at varying frequencies, ranging from weekly to monthly. Approximately 1700 samples are collected each year by over 80 samplers at more than 150 sampling sites. Sites are selected based on safe access (e.g., piers) and being representative of a given region. Samples are examined microscopically and data collected on the presence of any known or suspected toxin-producer. Data is also collected on the percent composition of toxic and non-toxic genera.

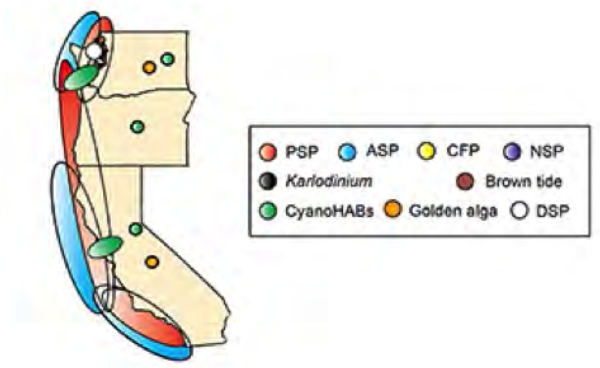
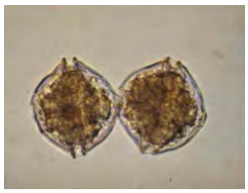
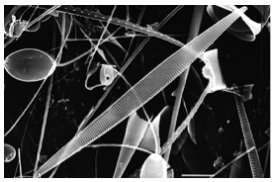
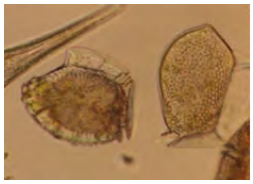


Figure 1. A generalized view of west coast states depicting the various HAB poisoning syndromes and other impacts that occur in specific areas. Note: all 50 states are impacted by cyanobacterial HABs, thus these areas are depicted using a single green and/or gold dot. Larger green areas denote widespread cyanoHAB problems. (Credit: modified from WHOI)

Table 1. Harmful algal species and their associated biotoxins routinely

Species	Biotoxin	Disease / Symptoms	Action Levels*
Alexandrium spp.  (WHOI / D. Anderson)	Saxitoxin and its derivatives	**Paralytic Shellfish poisoning (PSP)** Numbness and tingling of the lips, mouth, face, and neck; nausea; and vomiting. Severe cases result in paralysis of the muscles of the chest and abdomen possibly leading to death.	0.8 ppm (80µg/100g) saxitoxin equivalent
Pseudo-nitzschia spp.  (J. Rines)	Domoic acid	**Amnesic Shellfish Poisoning (ASP)** Nausea, vomiting, diarrhea, headache, dizziness, confusion, disorientation, short-term memory deficits, and motor weakness. Severe cases result in seizures, cardiac arrhythmia, respiratory distress, coma, and possibly death.	20 ppm domoic acid, except in the viscera of crustaceans, where 30 ppm is the action level**
Dinophysis spp.  (WHOI / D. Anderson)	Okadaic acid and its derivatives	**Diarrhetic Shellfish Poisoning (DSP)** Nausea vomiting, severe diarrhea, and abdominal cramps	0.2 ppm okadaic acid plus 35-methyl okadaic acid

*Current action levels in California, which are also recognized by all food safety authorities (for example, the U.S. Food and Drug Administration, the Canadian Food Inspection Agency, and the European Union). US FDA, 2011, available at http://www.fda.gov/downloads/Food/GuidanceRegulation/UCM251970.pdf

**While the FDA specifically lists 30 ppm action level for Dungeness crab viscera, California applies this to all harvested crustacean viscera.

- ***Are HAB events increasing in frequency? Are there links between climate change and HAB events?***

There is increasing recognition that the effects of HABs on public health, marine and freshwater ecosystems, economies, and human social structures are worsening[8]. It is generally accepted that HABs are increasing in frequency, intensity, and duration in all aquatic environments on a global scale[9]. Eutrophication (excessive nutrients that lead to dense algal growth and subsequent oxygen declines), climate change, ballast water dispersal, and improved monitoring are the most cited factors for the increased frequency of reported blooms.

Much is still unknown regarding the link between climate change and HAB events. Warmer sea surface temperatures are projected to broaden the seasonal period over which phytoplankton can grow, as well as expanding the ranges of warm water HAB species, potentially enhancing the risk of negative impacts and exposure to dangerous toxins. Scientists are still working to understand not only when HAB events occur, but what physiological characteristics of the phytoplankton and physical characteristics of the ocean cause them to start producing toxins. Changes in seawater carbon dioxide concentrations (ocean acidification) are also likely to influence phytoplankton species assemblages. More research is still needed in this area.

Scientists at the National Oceanic and Atmospheric Administration (NOAA) and the Wildlife Algal Toxins Research and Response Network for the West Coast (WARRN-West) are studying samples (2004 to present) from bowhead whales in the arctic to determine whether there is a link between climate factors and toxin levels, and whether there is a trend of increasing toxins over time[10].

- ***Can we predict future HAB events and impacts to fisheries?***

The short answer to this questions is that is it difficult to predict with certainty that a HAB will or will not occur in a specific year. However, scientists can make broad generalizations based on conditions that are favorable for blooms (see below). Scientists are refining models that can assist with forecasting when and where HAB events are likely to occur in California, and over what time frames. While there is no way to know for sure, it is unlikely to see another bloom to the scale of the 2015/16 event (magnitude, duration and geographical reach) again this year. Though scientists do expect unusual HAB events to occur with greater frequency.

Factors Contributing to *Pseudo-nitzschia* Blooms

Along the West Coast of California, Oregon and Washington, *Pseudo-nitzschia* blooms cause problems almost every year, related in part to upwelling of deep ocean water in these regions[11]. Upwelling brings waters with elevated nutrient levels to the top 300 meters of the ocean where light penetrates – ideal conditions for phytoplankton growth. There is no direct evidence to link land-based nutrient sources to *Pseudo-nitzschia* blooms on the CA coast[12]. This does not, however, preclude the possibility that the growth of these HAB species, their toxicity, and the frequency or duration of toxic events may be exacerbated by anthropogenic nutrient inputs since nitrogen sources traditionally associated with cultural eutrophication (e.g., ammonium and urea) have been shown to support equal or greater cellular growth rates and domoic acid production rates by many species of *Pseudo-nitzschia* in controlled laboratory studies[13] and have been suggested to sustain non-bloom concentrations of HAB species during upwelling-free periods[14].

For additional information on history, trends, causes, and impacts on *Pseudo-nitzschia* and other species, see here[15].

Predictive Modeling Efforts

Researchers at UC Santa Cruz, led by Dr. Raphael Kudela, have partnered with CeNCOOS to produce predictive "nowcasts" and forecasts of *Pseudo-nitzschia* blooms and domoic acid probabilities along the California coast. Nowcasts of HAB conditions are created through a combination of 1) sophisticated circulation models that predict the ocean physics, 2) satellite remote-sensing data of the ocean "color" and chlorophyll patterns, and 3) statistical models for predicting bloom and toxin likelihoods. These predictions are generated daily to provide a snapshot of where you might encounter a *Pseudo-nitzschia* bloom and/or domoic acid event. Predictions are also generated daily to provide a forecast of where you might encounter a *Pseudo-nitzschia* bloom and/or domoic acid event in the next one to three days. Data and additional information are available here: http://www.cencoos.org/data/models/habs.

8 Anderson et al. 2015, available at: http://oceandatacenter.ucsc.edu/home/Publications/2014/Anderson_Coastal&MarineHazards_2014.pdf
9 Moore et al. 2008, available at: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2586717/
10 Kathi Lefebvre, personal communication
11 Mos 2001, available at: http://ic.ucsc.edu/~kudela/OS130/Readings/DA_review.pdf
12 Anderson et al., 2005; Lewitus et al. 2012, available at: http://www.sciencedirect.com/science/article/pii/S1568988312001175
13 Auro and Cochlan, 2013, available at: http://onlinelibrary.wiley.com/doi/10.1111/jpy.12033/abstract
14 Cochlan et al., 2008, available at: http://www.sciencedirect.com/science/article/pii/S1568988308001005
15 Lewitus et al. 2012, available at: http://www.sciencedirect.com/science/article/pii/S1568988312001175

▪ *Where can HAB monitoring and active bloom information be found?*

CDPH Monthly Biotoxin Report

The CDPH Environmental Management Branch (EMB) publishes a monthly biotoxin report that is distributed via email and posted on its web page: http://www.cdph.ca.gov/healthinfo/environhealth/water/Pages/Shellfish.aspx

This site also contains a web map with selectable weekly layers of data showing the distribution and relative abundance of toxin-producing species: http://cdphdata.maps.arcgis.com/apps/MapTools/index.html?appid=42a78fba680c4c43970cfc5dfe878d8d

Current Quarantines and Health Advisories

A toll free number (1-800-553-4133) is maintained that contains up-to-date information on current quarantines and health advisories. Messages can be left for a call-back by program staff. The CDPH Food and Drug Branch (FDB) web page will contain ongoing monitoring results for Dungeness crab and other commercial species: http://www.cdph.ca.gov/HealthInfo/Pages/fdbDomoicAcidInfo.aspx

Advisories are also posted on the CDFW website here: https://www.wildlife.ca.gov/Fishing/Ocean/Health-Advisories

CalHABMAP

The California Harmful Algal Bloom Monitoring and Alert Program (CalHABMAP)[16] is a proactive HAB alert network that provides information on current algal blooms and facilitates information exchange among HAB researchers, managers and the general public throughout the State of California. CalHABMAP hosts a website where weekly algae and toxin data from eight California piers can be accessed. The eight sampling locations are:

- Santa Cruz Wharf
- Monterey Wharf
- Cal Poly Pier
- Goleta Pier
- Stearns Wharf
- Santa Monica Pier
- Newport Pier
- Scripps Pier

CeNCOOS

Central and Northern California Ocean Observing System (CeNCOOS) is a collaborative that enables sustained and coordinated measurements, model "nowcasts" and forecasts, and integrated products to inform decisions about our regional ocean. CeNCOOS helps support routine algae and toxin sampling at coastal locations throughout the region. Algae samples are currently being collected weekly at wharves in Santa Cruz and Monterey with the aid of CeNCOOS funds. Samples are also being collected at a Tiburon station in San Francisco Bay. Additionally, UC Santa Cruz frequently analyzes HAB toxins for government agencies (for informational purposes only), conservation groups, scientists, and others with the help of CeNCOOS support.

16 McGaraghan et al., 2012, available at: http://fisheries.legislature.ca.gov/sites/fisheries.legislature.ca.gov/files/u8/Primer%20on%20HAB%20westcoast.pdf

II. Domoic Acid and California Fisheries

▪ *What is the history of domoic acid toxicity in seafood in the U.S.?*

Domoic acid is a neurotoxin produced under certain conditions by the diatom *Pseudo-nitzschia* that can result in the illness called amnesic shellfish poisoning (ASP). It was identified as the toxin responsible for the first human domoic acid poisoning event, reported in 1987 in Prince Edward Island, Canada[17,18]. About 145 people became ill after eating blue mussels that had accumulated the toxin as a result of a *Pseudo-nitzschia* bloom present in the water. Nineteen people were hospitalized and 16 were treated in the Intensive Care Unit. Three people died (71, 82, and 84 years of age) while hospitalized and a fourth patient died of a heart attack three months later. Information from 10 of those people, ranging in age from 60 to 84, was used to estimate the levels of domoic acid that people consumed[19] (see question *What is the scientific rationale behind the action levels for domoic acid toxicity in seafood?* below for how this level was determined).

Pseudo-nitzschia is a phytoplankton species of global importance. It has been recorded in nearly every major marine and estuarine environment, and domoic acid has been found in the tissue or feces of organisms in multiple trophic levels in the oceans[20]. *Pseudo-nitzschia* has been present on the West Coast since at least the 1920s[21]. Domoic acid has been frequently observed in seafood around the U.S. (Figure 2), and events have occurred almost every year over the last decade in California (Figure 3).

Domoic acid enters the marine food chain by contaminating species such as mussels that filter their food out of the water[22] (Box 2). This water can contain both the algae and the toxin itself, which is released to the water column. The toxin accumulates in the digestive gland and certain other tissues of shellfish. For example, razor clams accumulate and retain the toxin in the edible portions (siphon, foot) as well as the viscera. ASP symptoms are characterized by gastrointestinal disorders (vomiting, diarrhea, abdominal pain), neurological problems (confusion, loss of short-term memory, disorientation, seizure, coma) and potentially death.

Box 2. Potential Vectors for Domoic Acid

Bivalves

razor clams, mussels, Pacific littleneck, geoduck, manila clams, oysters

Crustaceans

Dungeness, rock, and pelagic red king crab, spiny lobster, krill

Finfish

Pacific sardines, northern anchovies

Other invertebrates

market squid and other benthic invertebrates

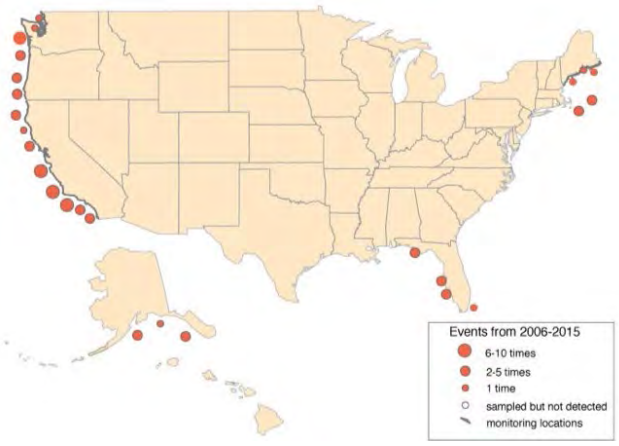


Figure 2. Presence of ASP toxins (i.e., domoic acid) in seafood in the U.S. from 2004-2015. (US National Office for Harmful Algal Blooms, Woods Hole Oceanographic Institution)

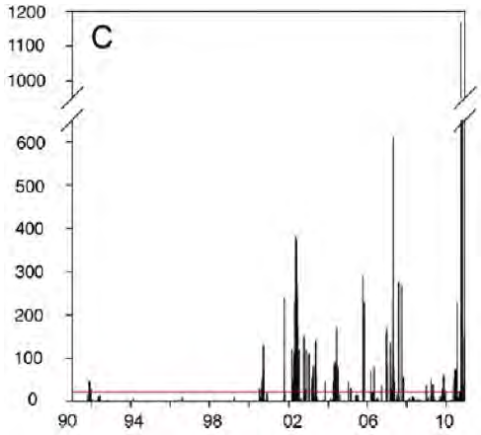


Figure 3. Historical time series of domoic acid toxins (ug/g shellfish meat) in California. The regulatory action level of 20 ug/g is shown in red. (CDPH Data. Figure taken from Lewitus et al. 2012)

17 Bates et al. 1989, available at: http://www.nrcresearchpress.com/doi/abs/10.1139/f89-156#.V5EtopOANBc
18 Perl et al. 1990, available at: http://www.nejm.org/doi/pdf/10.1056/NEJM199006213222504
19 Todd, 1993, available at: http://www.marearoja.cl/IMG/pdf/AMNESIC_SHELLFISH_POISON_REVIEW_BLOOM_CANADA_1987.pdf
20 Thessen, 2007, available at: http://bit.ly/23bVdLf
21 Lewitus et al. 2012, available at: http://www.sciencedirect.com/science/article/pii/S1568988312001175
22 Mos 2001, available at: http://ic.ucsc.edu/~kudela/OS130/Readings/DA_review.pdf

As a result of the 1987 acute toxicity episode, the Canadian government implemented a regulatory level of 20 mg DA/kg of meat (i.e., 20 ppm)[23] for all seafood. There have been no further documented human illness cases of ASP since 1987.

Although the regulatory level has been successful in preventing other human episodes of ASP, there are reports of domoic acid intoxication in marine animals, including sea lions, whales, sea otters and sea birds, as well as reports of coastal water contamination in many world regions[24]. A number of shellfish and finfish have been reported as potential vectors of the disease (Box 2), leading to widespread transfer through marine food webs and potentially to humans[25].

▪ *What are the current (2016) domoic acid action levels in California?*

Current action levels for domoic acid in seafood in California, which are also recognized by all food safety authorities (for example, the U.S. Food and Drug Administration[26], the Canadian Food Inspection Agency, and the European Union) are:

- ≥ 20 ppm in all seafood; except,
- ≥ 30 ppm in viscera (i.e., guts) of Dungeness crab

The U.S .Food and Drug Administration (FDA) sets policy for interstate and international commerce (i.e., transport and sale of seafood over state boundaries), which the states must follow as a minimum requirement. States can adopt more stringent standards and requirements, but cannot lower the action levels.

The FDA regulatory actions[27] to be considered by the states when the action levels are met are:

- closure of harvest areas found to produce crabs with such levels of the toxin; and/or
- evisceration of contaminated crabs.

▪ *What is the scientific rationale behind the action levels for domoic acid toxicity in seafood?*

The results of the first outbreak of amnesic shellfish poisoning that occurred in 1987 in Canada (see above) provided the best basis for the acute (short-term exposure) reference dose used to set the currently adopted domoic acid action levels in California[28,29] as mandated by the FDA.

During this outbreak, impacted individuals increased in the severity of signs and symptoms based on their dosage received (i.e., the amount of domoic acid a person consumed based on the levels in the mussels eaten), allowing experts to calculate a relationship between the amount of domoic acid ingested and the observed severity of symptoms[30]. The ***lowest observed adverse effect level*** (i.e., the lowest concentration of domoic acid ingested that caused symptoms of amnesic shellfish poisoning) was determined to be 1 mg/kg of body weight. This value was then divided by a precautionary "safety factor" of 10 to derive a precautionary ***reference dose*** of 0.1 mg/kg body weight. The Canadian authorities used the reference dose to establish the ***maximum residue limit*** (MRL) of 20 µg DA/g (20 ppm) shellfish (i.e., the threshold or guidance level) for domoic acid, the highest level that is tolerated in or on food for human consumption. The MRL was developed based on an average serving of shellfish (300 grams, approximately 0.7 pounds) for a person with a body weight of 60 kilograms (approximately 132 pounds). See Table 2 for a walk through of the action level calculation.

Health and Welfare Canada established 20 µg DA/g tissue (20 ppm) above which shellfish commercial operations should be closed. At present, this level has also been adopted by the U.S.[31], European Union, New Zealand, and Australia.

Action level adjustment for Dungeness crab viscera

In 1993, new data was presented in a memo[32,33] to the Health Hazard Evaluation Board (Board) at the U.S. Department of Health and Human Services suggested the tolerable level of domoic acid, applied to whole crab, was unnecessarily stringent. The Board agreed that a better estimate of consumption

23 Toyofuku 2006, available at: http://www.sciencedirect.com/science/article/pii/S0025326X06002797
24 Pulido 2008, available at: http://www.mdpi.com/1660-3397/6/2/180/htm
25 Lewitus et al. 2012, available at: http://www.sciencedirect.com/science/article/pii/S1568988312001175
26 US FDA, 2011. Available at: http://www.fda.gov/downloads/Food/GuidanceRegulation/UCM251970.pdf
27 Department of Health and Human Services. 1993a, available at: http://www.oceansciencetrust.org/wp-content/uploads/2016/07/DA_Crabs_93.pdf
28 Toyofuku, 2006, available at: http://dx.doi.org/10.1016/j.marpolbul.2006.07.007.
29 Pulido, 2008, available at: http://www.mdpi.com/1660-3397/6/2/180/htm
30 Todd, 1993, available at: http://www.marearoja.cl/IMG/pdf/AMNESIC_SHELLFISH_POISON_REVIEW_BLOOM_CANADA_1987.pdf
31 US FDA, 2011, available at: http://www.fda.gov/downloads/Food/GuidanceRegulation/UCM251970.pdf
32 Department of Health and Human Services. 1993a, available at: http://www.oceansciencetrust.org/wp-content/uploads/2016/07/DA_Crabs_93.pdf
33 Department of Health and Human Services. 1993b, available at: http://www.oceansciencetrust.org/wp-content/uploads/2016/07/DA_Crab.pdf

of Dungeness crab is to assume that one person consumes one whole crab in any one meal, which is (on average) equal to eating 300 grams of crabmeat, and 150 grams of crab viscera (in other words, a crab contains more meat than viscera). Therefore, since less viscera is consumed, a higher level of domoic acid is tolerated in the viscera. The FDA subsequently raised the action level for Dungeness crab viscera from 20 ppm to 30 ppm.

Table 2. Walking through the domoic acid action level calculation.

Value	Units	Toxicity Description	Supporting Date
1	mg domoic acid /kg tissue	**Lowest observed adverse effect level** (LOEL): this was the lowest dose amount that resulted in observable symptoms in one of 10 patients during the 1987 outbreak in Canada	Data from patients in the 1987 outbreak in Canada (Perl et al. 1990 ; Todd 1992; Toyofuku 2006)
0.1	mg domoic acid/kg tissue	**Acute reference dose:** the maximum acceptable oral dose of a toxic substance. "Acute" refers to a short term (single exposure) period or event. *Calculation: This was calculated by applying a precautionary safety factor of 10 to the LOEL above (i.e., 1mg/kg divided by 10). This level was then converted into an allowable level in shellfish tissue.*	
300	g	Average weight of shellfish consumed during the 1987 outbreak event	
60	kg	Average human body weight used to set the action level	
6	mg domoic acid	Acute dose for 60 kg person *Calculation: 0.1 mg/kg domoic acid * 60 kg body weight*	
20	mg domoic acid / kg shellfish tissue	Action level implemented in Canada and adopted internationally, including in California and the U.S. *Calculation: 6 mg acute dose divided by 300 g shellfish multiplied by 1000 (to convert to kg)*	

- ***What are the current criteria for opening and closing the Dungeness crab fishery based on the domoic acid action levels?***

Table 3. Dungeness crab season opening and closing criteria (as of August 2016).

	Seafood Testing Requirement
Season Opening Criteria	All crab collected during pre-season quality testing from each area (minimum of six), tested individually, have viscera levels of less than 30 ppm domoic acid. Each port has 2 or more sampling areas, depending on the geographical size of the fishing area it covers. Currently, three or more crab have to test above the limit to delay opening the fishery (see below)
Closing Criteria	3 or more crab viscera (of 6) from one area ≥30 ppm *or* 1 of 6 crabs with meat ≥ 20 ppm domoic acid. *Note: As of August 2016, the Tri-State Dungeness Crab Committee is updating the criteria related to closing so that closing and opening criteria are consistent.*
Re-opening Criteria	2 sets (6 crabs per set) collected one week apart, with all viscera samples testing below 30 ppm domoic acid

- ***Where can information be found on California's current domoic acid monitoring plans? What plan do other West Coast states adhere to?***

Dungeness Crab Monitoring Plan

CDPH adopted the Washington Department of Health's protocol "Strategy for Preventing Consumer Exposure to Domoic Acid from Dungeness Crab,"[34] with some variances in implementation (Table 4). The Washington Department of Health's protocol was reviewed and approved by the FDA and conforms to the U.S. Environmental Protection Agency (EPA) standards[35]. The Oregon Department of Agriculture (ODA) and CDPH have also adopted this protocol, although California samples more frequently then set forth in the Washington protocol.

The current protocol is under review by the West Coast states that are working with the Tri-State Dungeness Crab Committee[36] to make sure rational and justifiable standards are applied across the three states. The committee is composed of state agency, processor, and fishermen representatives from each state. The protocol will be posted on agency web sites when that process is completed.

Bivalve and Phytoplankton Monitoring Plans

CDPH maintains specific protocols for bivalve shellfish sampling and phytoplankton sampling procedures. Sampling plans for commercial bivalve shellfish aquaculture areas are contained in the management plans for each area.CDPH also has a biotoxin contingency plan for bivalve shellfish in compliance with the National Shellfish Sanitation Program guidelines. For more information on any of these documents contact EMB's biotoxin information line at 1-800-553-4133, or email redtide@cdph.ca.gov.

- ***Where are the domoic acid biotoxin monitoring sites in California?***

Commercial Bivalve Aquaculture/ Recreational bivalves

Commercial bivalve shellfish aquaculture sampling sites are based on active harvest locations. In some shellfish growing areas additional sentinel mussel stations may be established as early warning sites, typically near the entrance to the bays and estuaries used for shellfish production. Recreational bivalve shellfish sampling locations are representative of the region with respect to biotoxin exposure. Other factors include the ease of public access and safety of access to the intertidal zone, and of course the presence of significant shellfish resources.

CDPH monitors all five commercial bivalve shellfish aquaculture sites in the state year round, some with multiple sampling locations, and over 100 coastal sites.

Maps of bivalve shellfish and phytoplankton sampling locations can be found in the annual biotoxin reports located here: http://www.cdph.ca.gov/HealthInfo/environhealth/water/Pages/Shellfishreports.aspx

Commercial Finfish

When sampling is initiated because of an indicator(s) present (see Box 1), samples of commercial finfish, such as anchovy, will be obtained by CDPH FDB or CDFW when landed. Locations can vary as the fish population moves; CDFW block numbers are recorded for each catch sampled.

Dungeness and Rock Crab

When sampling is initiated because an indicator(s) is present (see Box 1), CDPH will monitor and test Dungeness and rock crab samples from up to 19 ports with multiple sampling locations: Mission Bay, Oceanside, Newport Beach, San Clemente, San Nicolas, LA/Long Beach, King Harbor, Ventura, Santa Barbara, Channel Islands, Avila, Morro Bay, Monterey, Half Moon Bay/SF, Bodega Bay, Fort Bragg, Eureka, Trinidad, Crescent City.

Dungeness and rock crab are also sampled in the same places and locations as the preseason crab quality testing (see section *What is the process for testing Dungeness and rock crab for domoic acid in advance of the season opener?*).

34 Washington State Department of Public Health, 2008, available at: http://www.ifrfish.org/wp-content/uploads/2016/02/Crab-DA-Monitoring-Plan-2008-2009.pdf

35 USEPA. 2000. Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories: Volume 1, Fish Sampling and Analysis, 3rd Ed. EPA 823-B-00-007

36 Under the Pacific States Marine Fisheries Commission Dungeness Crab Tri-state process, the three state Fish and Wildlife agencies consult on issues affecting the commercial Dungeness crab fishery.

Table 4. Dungeness crab domoic acid sampling strategy comparison between the three West Coast states. (Tri-State Dungeness Crab Committee, May 2016)

	WASHINGTON	OREGON	CALIFORNIA
DOMOIC ACID ACTION LEVEL / VISCERA	30 ppm	30 ppm	30 ppm
DOMOIC ACID ACTION LEVEL / MEAT	20 ppm	20 ppm	20 ppm
NUMBER OF CRAB PER SAMPLE	six legal size male crab	6-8 legal size male crab	six legal male crab preferred; sub-legals and females secondary
DEPTH STRATA	Best reflect current fishing activity; Shallow (5 - 15 fms) Deep (30-45 fms) or as directed by WDOH	5-10 fa, 15 fa, 30 fa, 45 fa or as directed by ODA	Best reflect current fishing activity; Shallow (15 fms), Mid (25-30 fms) Deep (45 fms)
CLOSURE CRITERIA FOR VISCERA	3 of 6 crab with viserca ≥ 30 ppm or 1 crab with viscera ≥ 80 ppm	3 of 6 crab with viserca ≥ 30 ppm or 1 crab with viscera ≥ 80 ppm (ODA currently trying to get FDA guidance)	3 of 6 crab with viserca ≥ 30 ppm
CLOSURE CRITERIA FOR MEAT	1 of 6 crab with meat ≥ 20 ppm	1 of 6 crab with meat ≥ 20 ppm	1 of 6 crab with meat ≥ 20 ppm
REOPENING CRITERIA	Reopening a zone requires two (2) consecutive sets of crab samples, not less than seven (7) days apart, with all crab in each sample, testing below 30 ppm in the viscera	Reopening a zone requires two (2) consecutive sets of crab samples, not less than seven (7) days apart, with all crab in each sample, testing below 30 ppm in the viscera, or 20 ppm in meat	Reopening a zone requires two (2) consecutive sets of crab samples, not less than seven (7) days apart, with all crab in each sample, testing below 30 ppm in the viscera
NORMAL SAMPLING FREQUENCY	Monthly or as directed by WDOH	Started coastwide monthly sampling in May 2016	During Pre-season quality testing or as directed by CDPH
TRIGGER FOR EXPANDING SAMPLING FREQUENCY	Increased domoic acid levels in razor clam samples as directed by WDOH	Increased domoic acid levels in razor clam samples as directed by ODA	Developing DA-producing HAB, increasing DA levels in mussels/seafood samples, as directed by CDPH
EXPANDED SAMPLING FREQUENCY	10 days to 2 weeks or as directed by WDOH	Bimonthly or as directed by ODA	1-2 weeks depending on DA concentration
GEOGRAPHIC SAMPLING AND CLOSURE ZONES	Five Zones; WA/OR Border to Pt. Chehalis; PT. Chehalis to Destruction Is.; Destruction Is. to US/Canada Border; Grays Harbor; Willapa Bay	Six Offshore Zones: Astoria, Garibaldi, Newport, Charleston, Port Orford and Brookings. Bays and Columbia River as directed by ODA	Up to 20 Port areas with multiple sampling locations (depending on area of the bloom): Mission Bay, Oceanside, Newport Beach, San Clemente, San Nicolas, LA/Long Beach, King Harbor, Ventura, Santa Barbara, Channel Islands, Avila, Morro Bay, Monterey, Half Moon Bay/SF, Bodega Bay, Fort Bragg, Eureka, Trinidad, Crescent City

The number of ports sampled during a given biotoxin event is based on the geographic extent of the bloom (Table 2)[37]. CDFW used the existing pre-season crab quality test sites as a baseline with input from CDPH and modified some of these areas, e.g. Mendocino County to San Mateo County to get more complete coverage. Each port has two or more sampling locations to ensure adequate representation of the areas where the respective species are typically fished. Additional areas may be sampled for other species (e.g., shrimp).

- ***How were the Dungeness crab sites selected?***

Dungeness crab sampling locations from Half Moon Bay northward were determined by CDFW, based on previous experience with the annual preseason sampling for meat quality and domoic acid levels. Sampling sites south of Half Moon Bay for Dungeness and rock crab were determined with input from the industry and based on the location of the crab resources and hence the greatest fishing activity. Sampling locations were selected to represent the nearshore fishery, as well as the fishery offshore around the northern Channel Island chain.

- ***How frequently are biotoxin sites sampled? What determines how frequently sampling occurs?***

Dungeness and Rock Crabs

Prior to season opening for Dungeness crabs, samples are collected for domoic acid toxin testing during the meat quality testing. Although not required, preseason meat quality testing has occurred in the southern region for informational purposes only. In addition, domoic acid levels have also been tested in this region during the same time period. If the season has opened, sampling can be initiated mid-season if a bloom is observed and/or other indicator(s) are present (see Box 1). If sampling indicates high levels of toxin are present in crab samples, bi-weekly to weekly testing occurs. Sampling frequency may be decreased or delayed if there is continued bloom activity in an area tied with recent crab samples testing well above the action level.

For rock crab, since the season is open year round, testing is only implemented when a bloom is observed and/or other indicator(s) are present (see Box 1). Depending upon the overlap in presence of the indicators with fishing grounds, monitoring may occur monthly under low toxicity conditions, with sampling increasing as toxin concentrations in rock crab tissue and viscera increase. Sampling occurs weekly or bi-weekly when a fishery closure is in place, based on the prevailing levels of domoic acid being found in the samples. Previous sampling efforts show that extremely high levels of domoic acid will not clear from the system of the crabs within a week. Therefore, when crabs are still testing high, bi-weekly sampling was considered appropriate. However, when sampled crabs within an area are nearing the action level, weekly sampling was considered appropriate. These sampling time frames are subject to weather conditions. As of July 2016, CDPH continues domoic acid testing for rock crab since the commercial and recreational rock crab fisheries remain closed north of Pigeon Point.

Due to previous sampling and testing efforts along the West Coast, along with independent research on the depuration ("clearing") rate of domoic acid in Dungeness crab[38], it is known that the toxin is not likely to clear from crab meat and viscera within a week or two if samples have been consistently testing well above the action level and there is still a toxic bloom present in the water. As samples start approaching the action level, more frequent testing will be conducted to ensure that the health advisories can be lifted as soon as it is safe to do so. Inclement weather and adverse ocean conditions can significantly delay sample collection. When the fishery was closed this year, sampling frequency was determined, in part, by weather and the ability of fishermen to go out and collect samples.

Razor Clams

Razor clams are a high-risk species since they appear to handle domoic acid differently than other bi-valves, some holding on to the toxin for over a year even in the absence of a bloom. Razor clam samples are requested by the CDPH Marine Biotoxin Monitoring Program from local CDFW biologists and program volunteers when routine coastal mussel and phytoplankton monitoring indicates the presence of a toxin or a potential toxic bloom developing. When a toxin is detected in razor clams, sampling is increased as tides and ocean conditions allow. The frequency of sample collection is based on the availability of adequate low tides. Twice per month is the greatest frequency and in some months the tides or inclement weather will not support any sampling. Due to the ability of razor clams to retain domoic acid for considerable periods of time (months to over a year), sampling frequency may be decreased until toxin concentrations decline closer to the action level.

37 Source: Tri-State Dungeness Crab Committee, May 2016

38 Lund et al., 1997, available at: http://www.ifrfish.org/wp-content/uploads/2015/11/Domoic-Acid-Update-and-Deputation-in-Dungeness-Crab.Wekellpdf.pdf

Additional species

Marine mammal strandings, mass seabird die-offs, or other environmental factors indicative of an offshore bloom may trigger extra sampling in designated areas, or sampling of a localized species, despite the lack of current biotoxin activity (See Box 1).

Opportunistic sampling of other species may be done for public health protection in consultation with CDFW, Tribal representatives, or local county health departments. CDPH works with CDFW to determine what species are being fished in an area, and then collect species at the dock for testing to ensure public health before that product makes it to the market for human consumption.

- ***How is spacing of sites considered?***

Bivalve Shellfish

Sampling locations representing recreational harvest areas for bivalve shellfish can vary from one to several sites per coastal county, depending on the number of suitable access points and available program participants. Commercial bivalve shellfish growing areas are sampled intensively, with each major growing area having several locations in close proximity sampled at least weekly.

Dungeness and rock crab

Dungeness crab sampling locations are based on those used by CDFW for pre-season assessment of quality and previous domoic acid sampling. Sites are representative of the fishery range, with multiple sites sampled per landing port. Sampling locations are also selected to be representative of different depths and distance from shore. Rock crab sampling locations are selected based on resource location and are representative of CDFW fishing blocks located nearshore and offshore around islands such as the Channel Islands, Catalina, etc.

- ***How are samples collected within a site (distance, including buffer zones)? Does sampling control for potential differences in domoic acid levels between male and female Dungeness crabs?***

Bivalves

Recreational bivalve shellfish samples are collected as low as possible in the intertidal zone while ensuring the safety of the collector. Sentinel mussel stations are preferably located subtidally to represent maximum exposure to toxin-producing phytoplankton. Commercial bivalve shellfish samples are representative of current harvest locations and can include multiple species (mussels, oysters, and clams).

Dungeness and rock crab

Crab samples are obtained along transect lines predetermined by CDFW. Samplers are required to stay within one mile of the transect coordinates. Three different depths are sampled along the transect. At each depth two samples are collected, for a total of six crabs. The priority is on the collection of legal-sized male crabs since take of only males are allowed in the commercial fishery. If inadequate numbers are available, then a sample may be supplemented with female and/or undersized crab to ensure an adequate sample size. There is no scientific information to suggest differences in toxicity between male and female Dungeness crabs.

- ***How is domoic acid detected in seafood samples? How are the samples processed during testing (i.e., are whole crabs homogenized in seawater or freshwater? Are viscera tested separately from crab tissue?)?***

CDPH uses the most accepted regulatory method for detecting domoic acid in seafood, which is a reversed-phase high performance liquid chromatographic (HPLC) method with ultraviolet (UV) detection[39]. This method is approved by AOAC International and FDA. The CDPH Food and Drug Laboratory has a reporting limit of 2.5 micrograms per gram of tissue (µg/g or parts per million [ppm]). There is also an AOAC International approved enzyme-linked immunosorbent assay (ELISA) for the detection of domoic acid in mussels, oysters and clams. This method has not been validated for crab tissue or other seafood species.

Crab viscera are analyzed separately from the meat. Samples are not diluted in either freshwater or seawater. Crabs are steamed so as not to be contaminated by the cooking medium, and each crab is individually wrapped in foil to avoid any cross-contamination during steaming. The homogenized tissue is mixed with a solvent (methanol) to extract any domoic acid that is present. This extract is then analyzed by the HPLC method mentioned above.

39 Dhoot et al., 1993, available at: http://www.cdph.ca.gov/pubsforms/Documents/fdbSSdaMeth.pdf

▪ *How long does it take to process crab samples once they have been received by CDPH?*

During pre-season testing samples are processed with sufficient time to recommend opening or closing of the fishery for Dungeness crab. Once the Dungeness crab or other fishery is closed or, for fisheries like rock crab that are open year round, the following process and timeline is typical:

1. **Sample request**
   (approximate time = 1 – 2 days, weather and availability of fishermen permitting)

   CDFW staff contact volunteer fishermen and request samples from the areas of interest. If the fishermen are not in port, it can take a day or two to connect with them to make the request. After contact, CDFW sets the sampling schedule and specifying sampling date window, location, and disposition of samples.

2. **Sample collection**
   (approximate time = 1 – 5 days, conditions permitting)

   Fishermen or CDFW staff collects samples as permitted by CDFW and as ocean conditions, scheduling, and mechanical issues allow. Sometimes fishermen freeze and retain samples overnight depending on when they return to shore (0-1 days). Samples are delivered directly to CDPH lab in Richmond, California or a local CDFW field office.

3. **Samples shipped and delivered to CDPH lab**
   (approximate time = 2 – 5 days, depending on day of the week samples are brought to CDFW offices for shipping)

   If samples are brought/delivered to a CDFW office, the samples are frozen and packaged and shipped within one business day depending upon the time received. If a sample was received on Friday, it is often not shipped until the following Monday to ensure viability of frozen sample(s) upon arrival (i.e., if shipped on a Friday, samples may sit in an office at CDPH and thaw out until they open Monday morning) (0-4 days, depending on time and day received). Once samples are shipped they are in the mail and received by CDPH the next day (1 day).

4. **Laboratory toxicity testing and results available**
   (approximate time = 2 – 4 days)

   Once CDPH receives the sample(s), they run laboratory tests for domoic acid, run quality assurance testing, and post the results online (2-3 days; max 4 days). The only time that CDPH does not turn specific samples around within 2-3 days is when certain blocks of samples were prioritized for testing over other samples, even if they had been received first. Samples are given priority for the following reasons:

   - Samples for areas that had a clean test the previous week and therefore a second set of clean crabs would result in opening the fishery in that area.
   - Samples for areas where crabs from the previous week were at or near the action level of 30 ppm for viscera and/or 20 ppm for meat.

   The rationale for prioritizing of certain blocks of samples is to test those for which an area might be opened (already had one week of clean samples) or for those which might have their first set of clean samples (previous samples had been near action level). By prioritizing these sample sets, CDPH ensure areas that can be opened are opened as quickly as possible while also prioritizing sample sets that could give fishermen an indication that they may be able to fish an area in the near term should the area test clean again the following week. Additionally, even if a sample set is delayed due to de-prioritization, it was still processed before the second set of samples, thus not delaying the opening of a clean area.

▪ *How are government agencies responding to the 2015/16 shellfishery closures in California (e.g., Dungeness and rock crab, razor clam)?*

CDPH has and continues to deliberate with counterparts in Oregon, Washington, and the FDA to discuss the recent unprecedented domoic acid event and potential modifications to future monitoring and regulatory efforts. Currently, this effort is taking the form of CDPH and CDFW participating in the Tri-State Dungeness Crab Committee work group meeting to discuss potential changes in sampling criteria and decision criteria, as well as to consider alternatives for managing impacted fisheries. The goal is for all three West Coast states to agree upon and utilize the same sampling and operating standards.

In addition, in early 2016, the Ocean Protection Council convened the HAB Task Force, composed the following members:

- **Sonke Mastrup**, California Department of Fish and Wildlife
- **Susan Ashcraft**, California Fish and Game Commission
- **Patrick Kennelly**, California Department of Public Health

- **Gregg Langlois**, California Department of Public Health (retired)
- **Susan Klasing**, Office of Environmental Health Hazard Assessment
- **Valerie Termini**, California Fish and Game Commission
- **Jenn Phillips**, California Ocean Protection Council

The HAB Task Force requested that Ocean Science Trust develop this FAQ document, as well as convene an Ocean Protection Council Science Advisory Team (SAT) working group[40] to provide scientific guidance on ways to the State's existing HAB and biotoxin monitoring in California. In addition, during the winter of 2016-17, the HAB Task Force will work together to review and update standard operating procedures (SOP) that will be utilized by the agencies responsible for oversight of public health and the fisheries.

40 More information on the SAT working group can be found here: http://www.oceansciencetrust.org/project/harmful-algal-blooms-and-california-fisheries/

III. Health and Seafood Safety Concerns

- ***After consumption of crab meat, is toxin accumulation additive if multiple crabs are eaten? In other words, if toxin levels are below the threshold of concern, but still >0 PPM, how many crabs or pounds of crab meat are safe to eat for an average adult, a child, or an elderly person?***

  Because the action level is based on limited data and does not estimate levels for sensitive populations such as the fetus and young children, the threshold between safety and non-safety is not precise enough to make detailed recommendations for specific populations. The original action level was based on a consumption of 250 - 300 grams (about 8 ounces) at which negative impacts were observed to human health. OEHHA recommends limiting consumption of seafood that tests positive for domoic acid, but at levels below the action level, to 8 ounces, and less than that for children. OEHHA also recommends that guts (viscera) not be consumed during a domoic acid event. Additionally, consumers can consider it best practice to not consume the viscera at any time since this is where the majority of the toxin is present in the crab.

- ***What are the long-term effects of low levels of domoic acid exposure?***

  It is not known whether repeated exposure over several days, months or years will make someone more susceptible to the toxic effects of domoic acid. Researchers have explored the effects of low-level domoic acid exposure in sea lions[41] and zebrafish[42,43]. This work suggests repetitive, low-level exposure could contribute to chronic health consequences. However, there are still significant gaps in knowledge of the health effects of chronic exposure.

  Researchers are working to better understand responses in humans. An ongoing study funded by the National Institute of Health is looking at domoic acid neurotoxicity in native Americans in the Pacific Northwest[44].

- ***Do some fished species accumulate domoic acid toxin more than others?***

  Research into this question is currently underway by researchers at Oregon Department of Fish and Wildlife, as well as California Sea Grant Extension program.

- ***What is known about angler exposure to domoic acid via consumption of contaminated fishes?***

  A study conducted by California Sea Grant measured domoic acid in 11 fish species targeted by Santa Cruz Wharf anglers in Monterey Bay, California, USA, and sur-veyed anglers regarding their fish consumption patterns[45]. In this geographically limited study, results suggested that anglers who consume their catch are exposed to asymptomatic domoic acid doses, and that exposure is a function of the species and parts consumed, as well as storage methods and domoic levels in the seawater when the fish are caught.

For additional questions on human health and consumer safety concerns, see California Sea Grant's FAQ report *Natural Biotoxins in California Crabs: Domoic Acid, Frequently Asked Questions on Human Health, Fishery Closures, and Biotoxins in Crabs*[46].

41 Goldstein et al., 2008: http://www.sciencedirect.com/science/article/pii/S1568988313000139#bib0065
42 Lefebvre et al., 2012: http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0036213
43 Hiolski et al., 2015, available at: http://www.ncbi.nlm.nih.gov/pubmed/25033243
44 More information on this work http://tools.niehs.nih.gov/portfolio/index.cfm/portfolio/grantDetail/grant_number/R01ES012459
45 Mazzillo et al., 2010, available at: http://www.int-res.com/articles/feature/b009p001.pdf
46 California Sea Grant's FAQ report https://caseagrant.ucsd.edu/sites/default/files/Biotoxins-SU16-FAQ-v2.pdf

Table 5. Overview of jurisdiction and roles of the various state bodies involved in California's fishery and seafood toxin management.

Agency / Body	Jurisdiction / Mission	Authority / Role
California Department of Public Health, Food and Drug Branch	Protect and improve the health of all California residents by assuring that food, drugs, medical devices and certain other consumer products are safe for public consumption and use	• Seafood monitoring • Sample commercial fisheries such as Dungeness crab, rock crab, and anchovies. • Communication with OEHHA toxicologists when dangerous levels of toxin are detected • Regulate human food supply (ensure products in marketplace are safe for human consumption) • Laboratory toxin testing
California Department of Public Health, Environmental Management Branch	Seeks to create a safer environment through advanced public health protection	• Manage the Marine Biotoxin Monitoring Program for bivalve shellfish • Bivalve shellfish biotoxin sampling and monitoring • Phytoplankton monitoring
California Department of Fish and Wildlife	Responsible for implementing regulations as set forth by the Fish and Game Commission and State Legislature	• Director has authority to open or close the commercial Dungeness crab fishery in the event of toxic substances upon recommendation of the public health agencies (CDPH and OEHHA) • Engage in preseason Dungeness crab testing
California Fish and Game Commission	Manage the recreational Dungeness crab fishery	• Authority to open or close the recreational Dungeness crab fishery in the event of toxic substances upon recommendation of the public health agencies
California State Legislature	Manage and regulate the commercial Dungeness crab fishery	• Authority to regulate the fishery including setting seasons, size limits, management boundaries, etc. • Establish limited entry and trap limit programs • Set permit fees and tax rates • Establish advisory bodies
Office of Environmental Health Hazard Assessment	Protect and enhance public health and the environment by scientific evaluation of risks posed by hazardous substances	• Advise CDPH on human health risk and then consult with CDPH Director, if necessary to advise CDFW and FGC to close or re-open an affected commercial or recreational fishery when action levels are exceeded or fall below action levels, respectively
Tri-state Dungeness Crab Committee, Pacific States Marine Fisheries Commission	Consult on issues affecting the commercial Dungeness crab fishery in California, Oregon and Washington	• Create opportunity for West Coast states to collaborate and coordinate on common sampling protocols and best practices

IV. California's Fishery and Seafood Toxin Management

- ***What agency leads California's seafood biotoxin monitoring and sampling programs, and how are these programs funded?***

As the shellfish control authority for California, CDPH manages the State's marine biotoxin monitoring program. CDPH is responsible for ongoing bivalve shellfish (e.g. mussels) and phytoplankton monitoring, and does a limited amount of environmental sampling for other seafood species (e.g., crab, lobster). These samples are largely volunteer-based and help inform the program of offshore events that may not be detected at nearshore sampling stations. When dangerous levels of toxin are detected in recreationally-harvested species, EMB will issue a health advisory for the affected species and region. If commercial bivalve shellfish aquaculture is impacted, CDPH EMB will implement a harvest closure until toxin concentrations decline to safe or undetectable levels. CDPH FDB is responsible for processing the samples of commercial fisheries species such as Dungeness crab, rock crab, and anchovies.

There are no dedicated funding sources for domoic acid monitoring in California. As events occur, limited support is provided by the redirection of General Funds from other programs to cover the necessary activities.

- ***What are the roles of the California government agencies and state bodies with regard to HAB response, monitoring, and fisheries management?***

See table 2 for an overview of the various state bodies involved in California's fishery and seafood toxin management.

Bivalve shellfish sampling for biotoxin testing is organized by CDPH EMB's Biotoxin Monitoring Program. Monitoring of other commercial seafood species is coordinated by both CDPH FDB and CDFW. The testing is done at CDPH laboratories in Richmond, California, the only NSSP-certified laboratory in California that can conduct biotoxin analysis for regulatory purposes relative to human health impacts.

When dangerous levels of toxin are detected in commercial seafood, CDPH FDB communicates with toxicologists in the Office of Environmental Health Hazard Assessment (OEHHA), who determine the risk to human health. The OEHHA Director consults with the CDPH Director before recommending to the CDFW and the Fish and Game Commission (FGC) to close the affected commercial or recreational fishery, respectively.

During the 2015-2016 domoic acid event, CDFW worked closely with CDPH and OEHHA to determine when and where fisheries could safely be sampled and reopened.

- ***How do HAB and fishery management measures in California, specifically for domoic acid and Dungeness crab, link to what is being done in Oregon and Washington?***

Regulatory issues that affect more than one state's fishery are negotiated through the Tri-State Dungeness Crab Committee coordinated by the Pacific States Marine Fisheries Commission (PSMFC). The Committee comprises one member from each state management agency, each with five industry advisors, and is chaired by the PSMFC. The committee signed an interstate Memorandum of Understanding (MOU, 1996) stating that all three state management agencies will develop consistent and complementary management actions for Dungeness crab.

The current crab monitoring plan "Strategy for Preventing Consumer Exposure to Domoic Acid from Dungeness Crab," developed by Washington State and implemented, with some variances in California and Oregon is under review by the West Coast states working with the Tri-State Dungeness Crab Committee to make sure rational and justifiable standards are applied in the three states.

- ***How does Dungeness crab management differ between the recreational and commercial sector, and what is the rationale for this difference?***

The commercial Dungeness crab fishery is managed by the State Legislature, while the recreational fishery is managed by the FGC. Unlike most of our other major commercial fisheries, the Legislature has not delegated its management authority to the FGC, in part because the industry has opposed it.

CDFW is responsible for enforcement of regulations for both fisheries. However, when it comes to public health, regulations state that the Director of CDFW has the authority to close a commercial fishery when CDPH issues a health advisory and the Director of OEHHA, in consultation with the Director of CDPH, recommends closure of a fishery to ensure public health. SB1287 has a provision to give the Director of CDFW more authority in the recreational fishery should an event like this occur again. As of July 2016, SB1287, is currently being considered in the State Legislature.

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) exempts the Dungeness crab fishery from the requirement of a federal fishery management plan (FMP). Instead, it authorizes the States of California, Oregon and Washington to adopt and enforce state laws and regulations governing Dungeness crab fishing and processing in the federal exclusive economic zone adjacent to each state. Under the MSA, California, Oregon and Washington have jurisdiction over their respective permit holders and permit conditions (such as gear and seasons), as well as control over conditions for making landings within a state.

- ***What do differences in Dungeness crab management between the commercial and recreational sectors mean for opening and closing of each sector? (i.e., Why did the commercial sector have to wait while the sport sector was opened?)***

While commercial Dungeness crab management is typically under the authority of the California State Legislature, the FGC Code section 7715[47] currently gives the Director of CDFW authority to open or close the commercial fishery in the event of toxic substances upon recommendation of the public health agencies. Otherwise, all regulatory authority lies with the California State Legislature. The FGC has regulatory authority over the recreational fishery and does not need directive from CDPH and/or OEHHA to close a fishery under their jurisdiction due to public health or other concerns.

During the 2015-16 Dungeness crab fishery closures, the commercial and recreational sectors had requested the CDFW allow approximately one week notice before opening the commercial fishery to allow commercial fishermen time to gear up, and to allow recreational fishermen time to fish before commercial crabbers dropped their gear. Current law requires the FGC to open the recreational fishery immediately upon being notified by the health agencies that a health risk no longer exists. Logistically, the FGC must also come together to meet in person in order to decide upon opening a fishery, which can also cause delays in the opening of the recreational fishery. Emergency regulations[48] also stipulated that fisheries open in an orderly fashion, and an effort was made to avoid opening the recreational fishery in a patchwork manner, with some contiguous counties open while others were not.

With regards to the commercial Dungeness crab fishery, the State initially consulted with some members of the commercial industry (via the DCTF, and later in the season through the DCTF public calls) at the start of the regular season in October 2015 when the first samples came back above the action level for domoic acid. At this time, some members of the industry stated that their desire was to open the fishery coast-wide, rather than in sections, with the caveat that they would reconsider this request if the domoic problem persisted for a long period[49]. When the problem did persist longer-term, with crabs testing above the domoic acid action level well into the 2015-16 crabbing season, it became evident that delaying season until the whole coast could be opened might result in no areas of the fishery being opened at all. Some members of the fishing industry began requesting that the State consider opening traditional management areas of the fishery rather than delaying until the whole coast could be opened. There was not consensus among fishermen in these regions as to which management option was preferred[50].

As sampling areas began having crabs decrease in toxin levels, nearing the action level, CDPH would inform CDFW. CDFW and CDPH worked collaboratively to identify enforceable boundaries for the area to be opened while ensuring their were sufficient buffer zones to account for crab mobility. If there were data gaps within that particular geographic area, CDPH and/or CDFW would request and process extra samples from an area not previously sampled to ensure no crabs were found with elevated levels of domoic acid. If the first data gap verification sample set was clean, CDPH did not require a second set.

In addition, the fair start statute (FGC Code Section 8279.1) that prevents permit holders who had fished in other states or locations in California from fishing for 30 days from the start of the delayed season opener, was applicable to the domoic acid fishery delay.

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47 Fish and Game Code section 7715. (a) If the Director of Environmental Health Hazard Assessment, in consultation with the State Director of Health Services, determines, based on thorough and adequate scientific evidence, that any species or subspecies of fish is likely to pose a human health risk from high levels of toxic substances, the Director of Fish and Game may order the closure of any waters or otherwise restrict the taking under a commercial fishing license in state waters of that species. Any such closure or restriction order shall be adopted by emergency regulation in accordance with Chapter 3.5 (commencing with Section 11340) of Part 1 of Division 3 of Title 2 of the Government Code. (b) Any closure or restriction pursuant to subdivision (a) shall become inoperative when the Director of Environmental Health Hazard Assessment, in consultation with the State Director of Health Services, determines that a health risk no longer exists. Upon making such a determination, the Director of Environmental Health Hazard Assessment shall notify the Director of Fish and Game and shall request that those waters be reopened for commercial fishing.

48 Emergency regulations for Dungeness and rock crab are posted here: https://www.wildlife.ca.gov/Conservation/Marine/Invertebrates/Crabs

49 Dungeness crab Task Force Executive Committee letter: http://www.opc.ca.gov/webmaster/_media_library/2009/04/DCTF_EC_FINAL_DAMemo_Nov2015.pdf

50 Letters from the fishing community:
http://www.opc.ca.gov/webmaster/ftp/project_pages/dctf/ec-meeting-15/DCTF-EC-DAMemo-FINAL-Feb2016.pdf
http://www.opc.ca.gov/webmaster/ftp/project_pages/dctf/ec-meeting-15/HMBSMA-CDFW-2-15-16.pdf
http://www.opc.ca.gov/webmaster/ftp/project_pages/dctf/ec-meeting-15/DomoicLetter-CCEurTrin-Feb2016.pdf
http://www.opc.ca.gov/webmaster/_media_library/2009/04/crab2016.pdf

- ***What is the process for testing Dungeness and rock crab for domoic acid in advance of the season opener? When will domoic acid testing for the 2016-17 season commence?***

In advance of season opener for Dungeness crab in 2016, CDFW, Washington Department of Fish and Wildlife, and Oregon Department of Fish Wildlife conduct a test fishery in the area from Point Arena California to the U.S. Canadian border for meat quality and yield to inform commercial Dungeness crab season opening date(s)[51]. During this time, six additional crab samples are also collected from each site and shipped to CDPH laboratories in Richmond, California for domoic acid testing. While quality testing is not required in the southern region of California, crabs are also taken from the area south of Point Arena for domoic acid testing and meat quality (for informational purposes only) during this same time period.

As of August 5, 2016, the date for commencement of pre-season crab testing has not been set. The criteria in Box 1 will help determine the exact time, with consultation with public health agencies and industry[52].

In California, preseason testing typically occurs in late October and November of each year. However, during the 2015-16 season, the preseason testing for domoic acid was initiated in September. This was a joint decision of the CDFW based on high domoic acid levels observed during the summer months, and the concerns voiced by some crab fishermen. CDPH agreed to process the samples and began designing a sampling plan in collaboration with CDFW.

The 2015-16 sampling was conducted coast-wide from Crescent City to Santa Barbara and the Northern Channel Islands (as opposed to Half Moon Bay and northward, which is the case in a typical year), and included domoic acid testing for both Dungeness and rock crab, in their respective fishery ranges, and testing continued on a near weekly basis through July (the end of the Dungeness crab season). As of July 2016, CDPH continues domoic acid testing for rock crab since the commercial and recreational rock crab fisheries remain closed north of Pigeon Point.

CDFW staff and leadership are currently determining an appropriate time to begin preseason testing for the 2016-17 season based on CDPH data. Preliminary observations from CDPH phytoplankton sampling (as of late June 2016) suggest that *Pseudo-nitzschia*, the species responsible for domoic acid production, may be present in high concentrations along portions of the California coast, though this does not always mean that domoic acid levels will be elevated in seafood. Contact Pete Kalvass, Senior Environmental Scientist Supervisor at California Department of Fish and Wildlife with additional questions about preseason testing (Peter.kalvass@wildlife.ca.gov).

There are challenges associated with preseason testing sampling for domoic acid. First, preseason testing relies largely on the efforts of commercial fishermen volunteers able and willing to collect samples at the various ports on their own vessels. These fishermen often incur the cost of sample collection (time, crew, and operational expenses), though in recent years the crabs collected during preseason quality testing have been allowed to be sold to pay for some of the expenses associated with crab quality testing only. In addition, there are chain-of-custody procedure requirements that may necessitate an on-board observer on sample collection vessels. In the future, if extensive sampling efforts are required (additional sites, samples, and species) as was the case in 2015, this method of sample collection may not be a long-term solution.

Because rock crab is open year round, toxin testing will begin when or if any of the indicators in Box 1 are present in the same region as rock crab fishing grounds, or during the preseason testing for Dungeness crab (which was the case in 2015), and on recommendation of CDPH.

- ***Why was a "two clean test" system required most of the time and a "one-test" system at other times? Describe CDFW's rationale for opening the District 10 line without the two consecutive clean tests required elsewhere.***

The standard requirement to re-open a closed Dungeness crab fishery due to elevated toxin levels in California is two consecutive clean tests: two sets (6 crabs per set) collected at a site one week apart, with all viscera samples testing below 30 ppm and meat testing below 20 ppm domoic acid. (Note: CDPH did not test both meat and viscera in most situations because once one of the crab viscera samples tested above 30 ppm, the levels in the meat did not make a difference. If samples were testing very high (>90 ppm) in the viscera, CDPH did test domoic acid levels in some of those meat samples.)

However, there were two instances (in Sonoma and Trinidad locations) where the health agencies, in consultation with CDFW, recommended opening an area to crab fishing without the "two clean test" system. There were several factors that went into the adaptive management decisions that led the health agencies to conclude that they could confidently assume that all crab in the area were below the federal domoic acid action levels in both meat and viscera and therefore safe for entering the marketplace.

51 The preseason crab testing protocol is available here: http://www.psmfc.org/crab/2013_FINAL_PreSeasonTestingProtocol.pdf

52 Pete Kalvass, Senior Environmental Scientist Supervisor, CDFW, personal communication

Both Sonoma and Trinidad locations had the same sampling history:

- One week of all six crabs tested well below the action levels,
- immediately followed by one week where five of the six crabs tested well below the action level, and one crab tested above the action level (but in the 30 ppm range) ;
- followed by one week where all crabs tested well below the action level again.
- Additionally, the two sampling locations immediately above and below these areas had also been testing well below the action levels for several weeks.

Because of this sample history, the health agencies determined that it would be safe to open the fishery in these areas without conducting and testing another round of samples. The health agencies would not have made this recommendation if any one crab had tested well above the action level or if any of the "clean" crabs in the sample had tested near the action level, rather than in the low 20s or below. Similarly, they would like have not made this recommendation if the areas immediately north and south had not also been testing consistently clean, thus assuring that crab moving in and out of the fished area were also safe for consumption.

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