State of California  
Department of Fish and Wildlife

Memorandum

Date: September 3rd, 2014

To: Sonke Mastrup  
Executive Director  
Fish and Game Commission

From: Charlton H. Bonham  
Director

Subject: Petition from the Center for Biological Diversity to list the Flat-tailed Horned Lizard as Endangered under the California Endangered Species Act

The Department of Fish and Wildlife (Department) prepared the attached petition evaluation report in response to a petition, dated June 9, 2014, received by the Fish and Game Commission (Commission) on June 10, 2014 (Petition) from the Center for Biological Diversity to list the Flat-tailed Horned Lizard (Phrynosoma mcallii) as an endangered species under the California Endangered Species Act (CESA). (See generally Fish and Game code §2073.5, subd. (a); Cal Code Regs., title 14, §670.1, subd. (d)(1).)

In accordance with CESA, the attached petition evaluation report delineates the categories of information required in a petition, evaluates the sufficiency of the information in the Petition, and incorporates additional relevant information that the Department possessed or received during the review period. Based upon the information contained in the Petition, the Department has determined that there is sufficient information to indicate that the petitioned action may be warranted. The Department recommends that the Petition be accepted.

If you have any questions or need additional information, please contact Dan Yparraguirre, Deputy Director of Wildlife and Fisheries Division at (916) 653-4673 or Dr. Eric Loft, Chief of Wildlife Branch at (916) 445-3555.

Attachment

et: Department of Fish and Wildlife

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REPORT TO THE FISH AND GAME COMMISSION

EVALUATION OF THE PETITION
FROM THE CENTER FOR BIOLOGICAL DIVERSITY
TO LIST THE FLAT-TAILED HORNED LIZARD (PHRYNOSOMA MCALLII)
AS ENDANGERED
UNDER THE CALIFORNIA ENDANGERED SPECIES ACT

Photo by Eric Hollenbeck

Prepared by
California Department of Fish and Wildlife

October 2014
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I. Executive Summary

The Center for Biological Diversity (CBD or Petitioner) submitted a petition (Petition) to the Fish and Game Commission (Commission) to list the flat-tailed horned lizard (FTHL) (*Phrynosoma mcallii*) as endangered pursuant to the California Endangered Species Act (CESA), Fish and Game Code Section 2050, et seq.

Pursuant to Fish and Game Code Section 2073.5 and Section 670.1 of Title 14 of the California Code of Regulations, the Department of Fish and Wildlife (Department) has prepared this evaluation report for the FTHL Petition (Petition Evaluation). The Petition Evaluation is an evaluation of the scientific information discussed and cited in the Petition in relation to other relevant and available scientific information possessed by the Department during the evaluation period. The Department’s recommendation as to whether to make FTHL a candidate for listing under CESA is based on an assessment of whether the scientific information in the Petition is sufficient under the criteria prescribed by CESA to consider listing FTHL as endangered.

In completing its Petition Evaluation, the Department has determined there is sufficient scientific information to indicate that the petitioned action may be warranted. Therefore, the Department recommends the Commission accept the Petition for further consideration under CESA.

After reviewing the Petition and other relevant information, the Department makes the following findings:

- **Population Trend.** The Petition contains sufficient information to conclude FTHL population levels have declined over time in some parts of the species’ range.

- **Range.** The Petition contains sufficient information to conclude the FTHL’s range has been reduced in some areas.

- **Distribution.** The Petition contains sufficient information to conclude the distribution of FTHLs has been reduced in some areas.

- **Abundance.** The Petition contains sufficient information to conclude FTHL abundance has been reduced in some areas.

- **Life History.** The Petition contains sufficient information to conclude some FTHL life history traits render it particularly vulnerable to natural and anthropogenic impacts.

- **Kind of Habitat Necessary for Survival.** The Petition contains sufficient information to conclude that FTHLs require specialized microhabitat features for survival.
• **Factors Affecting the Ability to Survive and Reproduce.** The Petition contains sufficient information to conclude that FTHLs are subject to a variety of threats that have the potential to adversely affect their ability to survive and reproduce.

• **Degree and Immediacy of Threat.** The Petition contains sufficient information to conclude the degree and immediacy of some threats have the potential to adversely affect their ability to survive and reproduce.

• **Impacts of Existing Management.** The Petition contains sufficient information to conclude that existing management efforts may not be successful in maintaining self-sustaining populations throughout the species’ California range.

• **Suggestions for Future Management.** The Petition contains sufficient information to conclude that additional management efforts may be necessary to maintain self-sustaining populations throughout the species’ California range.

II. Introduction

A. **Candidacy Evaluation**

CESA sets forth a two-step process for listing a species as endangered. First, the Commission determines whether a species is a candidate for listing by determining whether “the petition provides sufficient information to indicate that the petitioned action may be warranted.” (Fish & Game Code, § 2074.2, subd. (a)(2).) Within 10 days of receipt of a petition, the Commission must refer the petition to the Department for evaluation (Fish & Game Code, § 2073.) The Commission must also publish notice of receipt of the petition in the California Regulatory Notice Register. (Fish & Game Code, § 2073.3.) Within 90 days of receipt of the petition, the Department must evaluate the petition on its face and in relation to other relevant scientific information and submit to the Commission a written evaluation report with one of the following recommendations:

• Based upon the information contained in the petition, there is not sufficient information to indicate that the petitioned action may be warranted, and the petition should be rejected; or

• Based upon the information contained in the petition, there is sufficient information to indicate that the petitioned action may be warranted, and the petition should be accepted and considered.

(Fish & Game Code, § 2073.5, subd. (a)(1).)

If the petition is accepted for consideration, the second step requires the Commission to determine, after a year-long “scientific-based review of the subject species,” whether listing as endangered is or is not actually warranted. (Fish & Game Code, § 2075.5.)

In *Center for Biological Diversity v. California Fish and Game Commission* (2008) 166 Cal.App.4th 597, the California Court of Appeals addressed the parameters of the Commission’s discretion in its application of
the threshold candidacy test. The court began its discussion by describing the candidacy test previously set forth in *Natural Resources Defense Council v. California Fish and Game Commission* (1994) 28 Cal.App.4th 1104, 1114:

As we explained in *Natural Resources Defense Council* [citation], “the term ‘sufficient information’ in section 2074.2 means that amount of information, when considered with the Department’s written report and the comments received, that would lead a reasonable person to conclude the petitioned action may be warranted.” The phrase “may be warranted” “is appropriately characterized as a ‘substantial possibility that listing could occur.’” [citation] “Substantial possibility,” in turn, means something more than the one-sided “reasonable possibility” test for an environmental impact report but does not require that listing be more likely than not.

(*Center for Biological Diversity*, at pp. 609-10.) The court acknowledged that “the Commission is the finder of fact in the first instance in evaluating the information in the record.” (*Id.* at p. 611.) However, the court clarified:

[T]he standard, at this threshold in the listing process, requires only that a substantial possibility of listing could be found by an objective, reasonable person. The Commission is not free to choose between conflicting inferences on subordinate issues and thereafter rely upon those choices in assessing how a reasonable person would view the listing decision. Its decision turns not on rationally based doubt about listing, but on the absence of any substantial possibility that the species could be listed after the requisite review of the status of the species by the Department[.]

(*Ibid.*)

B. Petition History

The FTHL was the subject of a previous CESA listing petition. Dr. Wilbur Mayhew and Ms. Barbara Carlson of the University of California at Riverside petitioned the Commission to list FTHL as an endangered species under CESA on January 25, 1988. Consistent with the Department’s recommendation, the Commission designated the FTHL as a candidate species for CESA listing on May 13, 1988. After completing the status review, the Department recommended listing the species as threatened; however, on June 22, 1989, the Commission voted against the proposed listing.

The FTHL also has a listing history under the federal Endangered Species Act (ESA), more details of which can be found in the petition (p. 7-9). From the time the United States Fish and Wildlife Service (USFWS) initially proposed to list the FTHL as threatened under the ESA in 1993 (58 FR 62624), the listing decision has been the subject of numerous court cases. The primary issue in all of them was whether or not the USFWS sufficiently analyzed FTHL population viability across its entire range. After each court-ordered re-evaluation, the USFWS withdrew its proposed rule to list, most recently in 2011 (76 FR 14210).

On June 10, 2014, CBD submitted the Petition to the Commission to list FTHL as endangered under CESA. On June 12, 2014, the Commission referred the Petition to the Department for evaluation. The
Department requested of the Commission, and was granted, a 30-day extension to the 90-day Petition evaluation period. This Petition Evaluation report was submitted to the Commission on October 1, 2014.

The Department evaluated the sufficiency of the scientific information presented in the Petition, using information in the Petition as well as other relevant scientific information available at the time of review. Pursuant to Fish and Game Code section 2072.3 and Section 670.1(d)(1) of Title 14 of the California Code of Regulations, the Department evaluated whether the Petition includes sufficient scientific information regarding each of the following petition components:

- Population trend;
- Range;
- Distribution;
- Abundance;
- Life history;
- Kind of habitat necessary for survival;
- Factors affecting ability to survive and reproduce;
- Degree and immediacy of threat;
- Impacts of existing management;
- Suggestions for future management;
- Availability and sources of information; and
- A detailed distribution map.

C. Overview of Flat-tailed Horned Lizard Ecology

Flat-tailed horned lizards (Class Reptilia, Order Squamata) belong to the Family Phyrnosomatidae. The genus *Phrynosoma* consists of a unique group known commonly as horned lizards, which are characterized by an ant-rich diet, squat dorso-ventrally flattened bodies, cranial horns, body fringe, cryptic coloration, reluctance to run when approached, and a long active period.

The FTHL has the smallest range of any horned lizard in the United States and has among the smallest ranges of all horned lizards. The species is restricted to appropriate substrates in southeastern California, the extreme southwestern portion of Arizona, and the adjacent portions of northeastern Baja California Norte and northwestern Sonora, Mexico. Approximately one-quarter of the FTHL’s range is within California, where it is confined to lower elevations throughout much of the Salton Trough, in sections of eastern San Diego County, central Riverside County, and western and south-central Imperial County.

High quality FTHL habitat is typically characterized as areas of low relief with finely packed sandy soils that are covered with loose, fine aeolian sands. Favorable habitat is typically associated with the
creosote bush shrub community, especially a creosote-bursage assemblage. However, FTHLs can occupy a wide range of habitats and are frequently reported in areas without the aforementioned qualities.

Ants comprise 97% of the FTHL diet, higher than any other species of horned lizard. FTHLs primarily eat harvester ants but are known to eat smaller ants and other invertebrates opportunistically as well.

FTHLs have long active seasons, and some individuals may never hibernate. The species does not aestivate but will retreat into burrows when surface temperatures reach 50°C (122°F). They have relatively large home ranges and do not appear to be territorial.

FTHLs are generally capable of mating upon emergence, and females may make long distance movements out of their home range areas to nest. In years with high spring and summer precipitation, females may be capable of producing two separate clutches. FTHLs produce small clutches compared to other horned lizards.

Upon hatching, juveniles grow quickly. Under favorable conditions, hatchlings born in the first cohort are able to reach adult size prior to hibernation and can breed at the beginning of the next year’s active season, while hatchlings from the second cohort may not mature until the middle of the following summer. Growth rates slow under drought conditions.

The average FTHL lifespan is three years. The largest natural cause of FTHL mortality is predation; up to 40% of the population may be preyed upon in certain years. Predation is highest along roads, powerlines, and near urban and agricultural development. FTHLs are also susceptible to vehicle mortality.

III. Sufficiency of Scientific Information to Indicate the Petitioned Action May Be Warranted

A. Population Trend (p. 10-12)

1. Scientific Information in the Petition

The Petition states the FTHL is at serious risk of continuing population decline due to habitat destruction associated with human activities. The Petition also states that studies have failed to adequately estimate accurate population sizes and trends throughout the majority of the species’ range. This is due to the difficulty of estimating population trends using the available data because of low detectability and use of un-standardized, and in some cases, inappropriate survey methods over time.

The Petition provides estimates of historic losses due to agricultural and urban development of suitable FTHL habitat (p. 12-14), which are used as a proxy for past population declines. In addition, the Petition contains four examples of more contemporary declines in areas outside of the large-scale historical loss areas. These include (1) the Coachella Valley, in which Barrows and Allen (2010) provide personal observations that areas with occasional sightings of FTHL two decades ago have been reduced to zero; (2) East Mesa, in which Turner et al. (1980) reported that the northern portion, where many FTHLs had been collected in the 1960s, apparently no longer supported high densities of the species; (3) Algodones
Dunes, in which Altman et al. (1980) summarize Wilbur Mayhew’s personal observations of fewer FTHLs along a 7-mile stretch of Hwy 78 from the early to mid-1960s and into the early 1970s; and (4) Ocotillo Wells State Vehicular Recreation Area (OWSRA), in which Klauber (1939) described the FTHL as “relatively common,” but according to Eric Hollenbeck (pers. comm. in Petition) and FTHLICC (2009) too few FTHLs were captured in 2007 and 2008 to justify continuing surveys.

The Petition presents the results from two studies that found no significant trend in FTHL abundance from 1979-2001 (Wright 2002) and from 2007-2009 (Root 2010). While both found the populations relatively stable, they cautioned their interpretation. Wright (2002) warned that the insensitive methodology may have prevented detection of a real population change, and Root (2010) noted that data were over a short period of time and derived from high quality habitat, so the results could not be compared with historic abundances and should not be extrapolated rangewide.

2. Other Relevant Scientific Information

In addition to the sources cited in the Petition, the Department possesses two reports containing population trend data (Frary 2011, Leavitt 2013b). While these do not include analyses of long-term population trends, they add to the body of work that may prove useful in understanding FTHL relative abundance and population dynamics.

Frary (2011) estimated population growth rate from 2008 to 2010 for three of the FTHL Management Areas (MAs) in California (East Mesa, West Mesa, and Yuha Desert) and one in Arizona. In all cases, populations increased from year to year ($\lambda > 1$), but in most cases the confidence levels overlapped with 1, indicating the population growth was not statistically significant.

Leavitt (2013b) estimated population growth rate from the MAs and from OWSVRA Research Area (RA) between 2007 and 2013 (Table 1). He calculated an increase between 2008 and 2010 like Frary (2011) with a subsequent decline and an apparent rebound in 2013. Leavitt (2013b) explained that indications of a steady decline for the Borrego Badlands MA are likely due to irregular sampling at that location, suggesting that this trend is an artifact of a poor sampling regime. He concluded that based on the data available it would appear that populations of FTHLs are tracking similar cycles across their range and no major reductions in the extent of FTHL range were detected within the MAs or RA (Leavitt 2013b).

Leavitt (2013a) suggested that high variability in abundance over time appears to follow oscillations in winter precipitation; however, he warned that fitting a linear model to precipitation and FTHL abundance is too simplistic for the complex relationship between precipitation and reproductive output (e.g., food web interactions). This hypothesis is supported by Barrows and Allen (2009) who reported that FTHL abundance on stabilized sand fields in the Coachella Valley were associated with abundance of harvester ants, their primary prey, but counterintuitively there was a negative correlation between harvester ants and annual rainfall, likely due to proliferation of an invasive weed. They noted that FTHL experienced a 4-year decline over the period of their study (2002-2007) but were able to rebound with no management intervention.

Table 1. Population growth rates ($\lambda$) for Management (Research) Areas in California (Leavitt 2013b)

<table>
<thead>
<tr>
<th>Area</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Mesa</td>
<td>1.0</td>
<td>1.1</td>
<td>0.9</td>
<td>1.2</td>
<td>1.0</td>
</tr>
<tr>
<td>West Mesa</td>
<td>1.2</td>
<td>1.1</td>
<td>1.3</td>
<td>1.0</td>
<td>1.1</td>
</tr>
<tr>
<td>Yuha Desert</td>
<td>1.1</td>
<td>1.2</td>
<td>0.9</td>
<td>1.0</td>
<td>1.1</td>
</tr>
<tr>
<td>Borrego Badlands MA</td>
<td>0.8</td>
<td>0.9</td>
<td>1.0</td>
<td>0.8</td>
<td>0.9</td>
</tr>
<tr>
<td>OWSVRA RA</td>
<td>1.1</td>
<td>1.2</td>
<td>1.0</td>
<td>1.1</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>East Mesa(^1)</td>
<td>West Mesa(^1)</td>
<td>Yuha Desert(^1)</td>
<td>Borrego Badlands(^2)</td>
<td>Ocotillo Wells SVRA(^2)</td>
</tr>
<tr>
<td>----------------</td>
<td>------------------</td>
<td>------------------</td>
<td>---------------------</td>
<td>-------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>2007-2008</td>
<td>0.77</td>
<td>0.55</td>
<td>0.94</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2008-2009</td>
<td>1.91</td>
<td>2.73</td>
<td>1.38</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2009-2010</td>
<td>1.25</td>
<td>1.13</td>
<td>1.79</td>
<td>-</td>
<td>-</td>
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<tr>
<td>2010-2011</td>
<td>1.03</td>
<td>2.64</td>
<td>1.26</td>
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<tr>
<td>2011-2012</td>
<td>0.34</td>
<td>0.42</td>
<td>0.87</td>
<td>0.47</td>
<td>0.92</td>
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<tr>
<td>2012-2013</td>
<td>1.39</td>
<td>-</td>
<td>-</td>
<td>0.49</td>
<td>0.92</td>
</tr>
</tbody>
</table>

\(^1\) based on Huggins closed-capture abundance estimates; \(^2\) based on occupancy model estimates

3. Sufficiency of the Petition with regard to Population Trend

While the Department questions portions of the Petitioner’s assessment of FTHL Population Trend, the Department nonetheless concludes that the Petitioners have submitted sufficient information to demonstrate or create a reasonable inference that FTHLs have experienced historic declines and may continue to do so.

B. Range and Distribution (p. 12-20)

1. Scientific Information in the Petition

The Petition provides a description of the FTHL’s range and the uncertainty in what constituted historically suitable habitat (Figure 1a), the latter of which affects estimates of range, distribution, and abundance. The Petition also provides information on habitat loss and the species’ distribution throughout parts of its range.

The Petition provides the following information regarding the FTHL range. The FTHL has the smallest range of any horned lizard in the United States and has among the smallest ranges of all horned lizards (Leaché and McGuire 2006). The species is restricted to appropriate substrates in southeastern California, the extreme southwestern portion of Arizona, and the adjacent portions of northeastern Baja California Norte and northwestern Sonora, Mexico (Funk 1981). The majority of the current range (70.4%) is within Mexico, while 25.3% is within California and 4.3% is within Arizona (76 FR 14210). Within California, FTHLs are found throughout much of the Salton Trough, in sections of eastern San Diego County, central Riverside County, and western and south-central Imperial County. FTHLs are confined to lower elevations and are most frequently found below 230 m in elevation, although they have been reported up to 520 m above sea level (Turner et al. 1980).

The Petition cites Mulcahy et al. (2006), who describe the significant barriers to gene flow that have divided the current FTHL range into at least three phylogenetically distinct populations, two of which occupy portions of California (Figure 1b). The two California populations (Eastern and Western) are
separated from the Arizona (Southeastern) population by the Colorado River and are separated from each other by agricultural and urban development in the Imperial Valley (Mulcahy et al. 2006).

The Petition explains that because large-scale agricultural development began in the early 1900s, prior to any monitoring studies, it is difficult to determine which areas were historically occupied by FTHLs. The uncertainty regarding what represented the historic range of FTHL centers on use of the former Lake Cahuilla lakebed.

The Petition provides assessments of the FTHL’s historic range from the USFWS (76 FR 14210) and Hodges (1997), along with descriptions of how they likely represent underestimates and overestimates, respectively. In their most recent assessment, the USFWS concluded that historic habitat for the FTHL only includes (1) habitat outside the former Lake Cahuilla area and (2) habitat outside the areas historically subject to periodic flooding by the Colorado River (76 FR 14210). Hodges (1997) chose to include the former Lake Cahuilla lakebed as historic habitat, estimating California historically supported 890,000 ha of suitable habitat.

The Petition notes that the study by Hodges (1997) was undertaken without the benefit of genetic data, which suggest that the populations east and west of the agricultural development in the Imperial Valley were isolated centuries ago and that much of the area was not frequently suitable FTHL habitat even prior to human development (Mulcahy et al. 2006). The hydrological history of the region also supports the conclusion that portions of the Salton Trough did not historically support habitat suitable for FTHLs (see 76 FR 14210 for a detailed account of the geologic history). The Petition also notes that the excluded area in the USFWS assessment contains historic records and extant populations, and that while Mulcahy et al. (2006) suggested that genetic connectively across the Imperial Valley was limited, it did not preclude infrequent gene flow and movement of FTHLs across this area.

The Petition cites estimates of historic FTHL habitat loss by Hodges (1997) and Barrows et al. (2008), largely due to direct and indirect impacts from agricultural and urban development. Hodges (1997) estimated nearly 51, 58, and 8.6% of suitable FTHL habitat had been lost in Imperial, Riverside, and San Diego Counties, respectively by 1997. Barrows et al. (2008) reported that an estimated 83-92% of suitable habitat has been lost in the Coachella Valley.

In addition to the estimated loss of habitat in the Coachella Valley, the Petition cites a Coachella Valley Conservation Commission (2013a) report describing the recent reduction in FTHL distribution in the area. According to this report, as recently as the early 1980s, FTHLs had a broader distribution in the Coachella Valley, occurring on what is now the Whitewater Floodplain Preserve, on the southern flanks of Edom Hill, and at the eastern end of the Indio Hills, but currently the only remaining populations are on the Thousand Palms Preserve and further south within the Dos Palmas Preserve (CVCC 2013a).

The Petition states that while agricultural and urban development have not increased appreciably throughout the majority of the FTHL’s range, FTHL habitat has recently been lost to energy development projects and associated transmission lines, route proliferation, and other localized development projects as discussed below under the Factors Affecting Ability to Survive and Reproduce section (p. 39-76).
Figure 1. FTHL assessments of historic habitat. a) USFWS estimate of historic range excluding the 39-foot contour of the former Lake Cahuilla (blue line) (71 FR 36745); b) FTHL historic and current habitat based on historic FTHL sightings (yellow dots) and USFWS' estimate of historic and current range. It also denotes the three genetically distinct FTHL populations.
2. Other Relevant Scientific Information

The Petition describes one analysis (Root 2010) of FTHL occupancy surveys undertaken over the years (p. 26) but suggests the protocols used are not useful for estimating FTHL abundance or population trends; however, its utility in describing FTHL distribution is not discussed. Root (2010) analyzed single-year FTHL occupancy rates, which provided an estimate of FTHL distribution within these areas (Table 2). He found that across all survey efforts, single-season FTHL occupancy probability estimates generally were relatively high.

In addition to the analysis above, the Department possesses two other recent reports on FTHL distribution across the MAs and RA (only results from California are reported here). Frary (2011) analyzing the same data as Root (2010) but with the addition of two sites in 2010 and also found that results generally indicated high occupancy probability across all MAs (Table 2). Leavitt (2013b) calculated relatively high occupancy probabilities at OWSVRA RA but relatively low at Borrego Badlands MA, although he noted the latter results were likely an artifact of poor sampling regime.

Table 2. Occupancy Probability Estimates for Management (Research) Areas in California

<table>
<thead>
<tr>
<th>Year</th>
<th>East Mesa</th>
<th>West Mesa</th>
<th>Yuha Desert</th>
<th>Borrego Badlands</th>
<th>Ocotillo Wells SVRA</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>0.42</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2006</td>
<td>0.82</td>
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<td>0.81</td>
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</tr>
<tr>
<td>2008</td>
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<td>2012</td>
<td></td>
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<td>0.10</td>
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<td>0.78</td>
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</table>

1 2005-2009 data from Root (2010); 2010 data from Frary (2011); 2011-2013 data from Leavitt (2013b)

3. Sufficiency of the Petition with regard to Range and Distribution

While the Department questions some of the Petitioner’s assessment of Range and Distribution, the Department nonetheless concludes that Petitioners have submitted sufficient information to demonstrate or create a reasonable inference that FTHLs have experienced a reduction in range and distribution throughout a portion of its range in California and may continue to do so.
C. **Abundance** (p. 21-28)

1. **Scientific Information in the Petition**

The Petition states that reliable rangewide abundance or density estimates are lacking, citing the complications with low detection rates, survey methodology, and data analysis described under Population Trend. The Petition explains that while inferences can be made from the available data, they must be treated with caution, as all analyses for this species are associated with high levels of uncertainty and many large assumptions.

The Petition describes the difficulty in detecting FTHLs and summarizes early monitoring efforts aimed at estimating abundance, which took the form of detection rates as opposed to population sizes. The Petition explains how the Interagency Conservation Agreement (ICA) signatories recognized the need to establish standardized monitoring techniques capable of detecting regional population trends and describes the various revisions to the monitoring protocols in the Rangewide Management Strategy (RMS) that have taken place over the years. The Petition states that some of these protocols continue to use unreliable estimates of detection (e.g., scat) and tend to overestimate abundance because the surveys were conducted in higher quality habitat than exists throughout the species’ range.

The Petition describes one effort (Grant and Doherty 2007) as producing the most reliable estimates, although it cautions against extrapolating the results and suggests they are likely overestimates, particularly for Yuha Desert in 2004 and West Mesa (Table 3).

| Table 3. Abundance Estimates by Management Area (Grant and Doherty 2007) |
|---|---|---|---|---|
| Area (ha) | Abundance | Lower C.I. | Upper C.I. | Density |
| Yuha Desert 2002 | 24,362 | 25,514 | 12,761 | 38,790 | 1.05 |
| East Mesa 2003 | 46,660 | 42,619 | 19,619 | 67,639 | 0.91 |
| West Mesa 2003 | 55,077 | 10,849 | 3,213 | 23,486 | 0.20 |
| Yuha Desert 2004 | 24,362 | 73,017 | 4,837 | 163,635 | 3.00 |

The Petition also describes the plot-level abundance and density results reported by Root (2010) from the Demographic surveys undertaken on the MAs from 2007-2009. The 9-ha abundance estimates from the more conservative of two models used ranged from 6-46.5 adults and 0-142.8 juveniles, yielding 0.3-3.3 FTHL/ha density (Root 2010).

The Petition states that in spite of the caution by Root (2010) about extrapolating his results, the USFWS used the most conservative density estimate from his study to calculate estimates of FTHL abundance across their range. The USFWS wrote that even at the lowest estimated density of adult FTHL of 0.3 individuals per ha, there are likely more than 50,000 adult FTHL in the Western Population and 85,000 in the Eastern Population (76 FR 14210). It acknowledged that there were numerous assumptions in its
calculations that limited accuracy of the extrapolated population sizes; however, it indicated that even using the most conservative density value, these populations are of sufficient size such that any threats associated with small populations would be unlikely (76 FR 14210). The Petition states that it was inappropriate for the USFWS to extrapolate even the most conservative density estimate to areas outside of the demographic plots since they were located within the higher quality habitat of the MAs and are not representative of the habitat quality across the species’ entire range.

2. Other Relevant Scientific Information

In addition to the information contained in the Petition, the Department presents two other studies that estimated abundance (Hollenbeck 2004) and Leavitt (2013b). Hollenbeck (2004) estimated abundance in the 31,567 ha OWSVRA in 2003 as 19,222 FTHLs (95% C.I. = 18,870-26,752) and density as 0.61 FTHL/ha using the grand mean from individual plot-density estimates. He also calculated an overall estimate of abundance in Program MARK (Burnham and Anderson 2002) as 60,293 FTHLs (1.91 FTHL/ha), but the 95% C.I. included zero. Leavitt (2013b) found FTHL abundance was lower on all the demographic plots studied across its range in 2012 than in previous years, although it rebounded in East Mesa MA in 2013 (Table 1).

The Department also notes that Grant and Doherty (2007) stated that the point estimates generally indicated larger populations than they expected, and they mentioned that a population viability analysis on this species used initial population sizes of 5,000 and assumed a carrying capacity of 15,000 (Fisher and Rorabaugh 1999).

3. Sufficiency of the Petition with regard to Abundance

While the Department disagrees with portions of the Petitioner’s assessment of FTHL Abundance, the Department nonetheless concludes that the Petitioners have submitted sufficient information to demonstrate or create a reasonable inference that accurate rangewide estimates of FTHL abundance are lacking and that habitat loss, degradation, and fragmentation may be adversely impacting abundance over parts of its range.

D. Life History (p. 28-37)

1. Scientific Information in the Petition

The Petition provides the following description of FTHL life history, which includes information on identification, taxonomy, phylogeny, activity, movements, population sex and age structure, diet, reproduction, and mortality. The following information is provided by the Petitioners.

The genus *Phrynosoma* consists of a unique group of iguanid lizards known commonly as horned lizards, which are characterized by an ant-rich diet, squat dorso-ventrally flattened bodies, cranial horns, body fringe, cryptic coloration, reluctance to run when approached, and a long active period (Pianka and
Among *Phrynosomids*, the FTHL has multiple diagnostic traits including a distinctive dark dorsal stripe down its midline, long occipital horns, a dorso-ventrally flattened tail, and a prominent umbilical scar (Funk 1981, Muth and Fisher 1992, Young and Young 2000). Adult FTHLs range in size from 57-84 mm snout to vent length (SVL) and typically weigh between 12-22 g (Young 1999).

Phylogenetic relationships of *Phrynosomids* are not well understood (Leaché and McGuire 2006, Mulcahy et al. 2006). Mulcahy et al. (2006) used mtDNA to reveal two major clades east and west of the Colorado River. The western clade (i.e., the Eastern and Western populations and the Coachella Valley) is predominantly in California and shows signs of genetic differentiation among regions. The Eastern and Western populations are significantly differentiated and currently separated by urban and agricultural development, although gene flow was limited prior to this change in landscape (Mulcahy et al. 2006). While the Coachella Valley FTHLs are also separated from the rest of the Western population by urban and agricultural development, they are not significantly genetically differentiated from each other (Mulcahy et al. 2006).

FTHLs remain active an average of 277 days/year without any prolonged periods of inactivity or aestivation (Muth and Fisher 1992). Daily activity begins in the early morning and may cease around midday (Muth and Fisher 1992) but can apparently extend after dark (Norris 1949). When surface temperatures reach 50°C (122°F) most FTHLs will retreat into rodent or self-constructed burrows, although (Young and Young 2000) observed them at surface temperatures of 55°C (131°F). FTHLs move in short bursts of a few meters and may preferentially stop to rest on elevated areas with a clear vantage point, such as rocks or roads (Setser and Young 2000). They will often fully or partially bury themselves when sandy substrates are available (Young and Young 2000). FTHLs typically remain inactive, fully exposed on the surface at night, but they will partially bury themselves under sand for cover and thermoregulation on cool nights (Klauber 1939, Muth and Fisher 1992, Setser and Young 2000, Young and Young 2000). When approached by potential predators, the vast majority of FTHLs will crouch low and remain motionless until the perceived threat is gone, relying on their cryptic coloration to deter predation (Wone et al. 1994, Young and Young 2000).

Compared to their size, FTHLs have very large home range areas and do not appear to be territorial (Muth and Fisher 1992). Estimates of home range size and daily movement vary widely, potentially due to differences in location, sex, climatic conditions, and density dependence. A table of home range size estimates is provided in the Petition (p. 33).

Most FTHLs hibernate over winter, although some individuals are active throughout the entire winter and did not hibernate. Winter dormancy usually begins on average in mid-November but can range from October through December (Grant and Doherty 2009, Muth and Fisher 1992, Wone and Beauchamp 2003). Time of emergence is variable and can range from December to April, but averages in February (Mayhew 1965, Wone and Beauchamp 2003). Many individuals choose hibernation sites under or near vegetation (Grant and Doherty 2009).

FTHLs are generally capable of mating upon emergence (Howard 1974). In years with high spring and summer precipitation, females may be capable of producing two separate clutches of eggs (Howard 1974, Muth and Fisher 1992, Turner and Medica 1982). Several researchers report that the first clutch typically hatches in mid to late July, while offspring from the second clutch hatch from late August...
through October (Howard 1974, Muth and Fisher 1992, Turner and Medica 1982). In dry years, females appear to produce a single clutch that does not hatch until late August or September (Setser 2001, Young and Young 2000). It is possible that females do not lay multiple clutches, but rather different individuals lay at distinct times throughout the active period (Young and Young 2000).

Gravid females deposit their eggs in deep burrows over a period of two to four days (Young and Young 2000). Some gravid females will leave their home range, traveling as far as 1,647 m to deposit their eggs before returning to their original home range site (Setser 2001, Young and Young 2000). Nests are dug deep enough to ensure that the eggs are laid in moist soil and then filled, so they are not easily recognizable from the surface (Setser 2001). Eggs are incubated for approximately 52 days before hatching (Setser 2001). Compared to other horned lizards, FTHLs produce small clutches (averaging 4.7-5.4) and have the lowest productivity index, which is the combination of average clutch size and frequency (Howard 1974, Pianka and Parker 1975).

Upon hatching, juveniles are approximately 30 mm SVL and average 1.4 g (Young and Young 2000). Juveniles grow quickly, but growth rate appears to be dependent on when and where hatchlings were born, precipitation, and resource availability. Under favorable conditions, hatchlings born in the first cohort (around mid-July) are able to reach adult size prior to hibernation and thus are able to breed at the beginning of the next year’s active season, while hatchlings from the second cohort may not mature until the middle of the following summer (Muth and Fisher 1992, Young and Young 2000). Growth rates slow under drought conditions, and it may take two years before hatchlings reach maturity in dry years (Young and Young 2000).

The size class structure of the populations varies dependent on rainfall and whether there are multiple clutches, but in years in which there are two distinct cohorts, the population can shift from 88% adults in May to 79% juveniles by September (Muth and Fisher 1992).

Ants comprise 97% of the FTHL diet, higher than any other species of horned lizard (Pianka and Parker 1975). FTHLs primarily eat harvester ants but are known to eat smaller ants and other invertebrates opportunistically as well (Young and Young 2000). During a severe drought, Young and Young (2000) measured scat contents and found less than half the number of ants that were present in scat collected during wetter years, noting FTHLs lost weight during drought conditions. In drought years, annual vegetation is depressed, resulting in decreased seed abundance, which in turn negatively affects the harvester ants that feed primarily on seeds (Barrows and Allen 2009).

Most FTHLs live to three years in age, but individuals can live four or even six years (FTHLICC 2003, Young). Muth and Fisher (1992) estimated the mean annual survival rate at approximately 53%, noting the lowest survival rates occurred in spring and summer. During hibernation, survival is typically 100% (Grant and Doherty 2009, Muth and Fisher 1992). Juvenile survivorship is not clear, but the annual juvenile survival rate for desert horned lizards is significantly lower than adult survivorship (Pianka and Parker 1975).

The largest natural cause of mortality in FTHL is predation, as up to 40% of the population may be preyed upon in certain years (Young and Young 2000). They are an important prey item for loggerhead shrikes (Lanius ludovicianus), sidewinders (Crotalus cerastes), and round-tailed ground squirrels.
(*Spermophilus* tereticaudus). Since FTHLs spend much of their time on the surface, both during the day and at night, they are vulnerable to diurnal and nocturnal predators. Avian predation increases along roads, powerlines, and urban and agricultural development (Barrows et al. 2006, Young and Young 2000).

FTHL are also highly susceptible to vehicle mortality. FTHLs can be crushed by both on-road and off-road vehicles, although the latter is rarely documented. Even on infrequently traveled paved roads, vehicular morality rates can be as high as 19% (Young and Young 2000).

2. **Other Relevant Scientific Information**

The Department adds that Frary (2011) concluded that estimates of apparent survival, derived from the demographic surveys on the MAs, were generally low between 2008-2009 and 2009-2010, at the same time population growth rate estimates were increasing. Estimates from the California MAs ranged from 0.19-0.43.

3. **Sufficiency of the Petition with regard to Life History**

The Department concludes that the Petitioners have submitted sufficient information to demonstrate or create a reasonable inference that some FTHL life history traits render them particularly vulnerable to natural and anthropogenic threats.

E. **Kind of Habitat Necessary for Survival** (p. 38-39)

1. **Scientific Information in the Petition**

The Petition provides the following account of known FTHL habitat conditions and associations.

FTHL habitat is characterized by hot summers and generally mild winters. Annual rainfall is temporally and spatially variable across FTHL range but is typically low; the western part of FTHL range predominantly experiences winter rains, and the eastern portion generally receives summer rains (Johnson and Spicer 1985). FTHL habitat is subjected to frequent drought conditions (Johnson and Spicer 1985) and flash floods during periods of heavy rain (Turner and Medica 1982).

High quality FTHL habitat is typically characterized as areas of low relief with finely packed sandy soils that are covered, intermittently, with loose, fine aeolian sands (Rorabaugh et al. 1987, Turner et al. 1980, Young and Young 2000). Favorable habitat is typically associated with the creosote shrub community, especially a creosote bush (*Larrea tridentata*)-white bursage (*Ambrosia dumosa*) assemblage (Altman et al. 1980, Turner and Medica 1982, Young and Young 2000). Moderately compacted sand may be an important habitat feature in order to allow easy digging while still providing FTHLs with strong burrows able to withstand repeated use (Barrows and Allen 2009).
FTHLs can occupy a wide range of habitats and are frequently reported in areas without the aforementioned qualities. FTHLs have been found on sparsely vegetated gravel flats, barren clay soils, and mudhills characterized by concretions, small pebbles or gravel, and silt (Beauchamp et al. 1998, Turner et al. 1980, Wone 1992, Young and Young 2000). FTHLs are also documented on the stabilized sand fields and along the vegetated edges of active sand dunes (Barrows and Allen 2009, Turner et al. 1980, Young and Young 2000) and infrequently within active sand dunes (Barrows and Allen 2009, Johnson and Spicer 1985, Luckenbach and Bury 1983, Wright 2002). FTHLs have also been collected in rocky habitats in the lower slopes of the Superstition Mountains (Turner et al. 1980).

The Petition provides evidence that habitat correlates associated with FTHL abundance vary by study. In general, most researchers report a positive correlation between FTHL abundance and perennial plant density (Altman et al. 1980, Barrows and Allen 2009, Muth and Fisher 1992, Turner and Medica 1982), while one has noted a weak correlation between vegetation and FTHL abundance (Wright 2002), and still another has shown a negative correlation between FTHLs and thick vegetation (Beauchamp et al. 1998). Positive correlations have all been reported between FTHL and the abundance of sand (Hollenbeck 2004, Wright and Grant 2003), gravel hardpan and mud hills (Beauchamp et al. 1998, Wone 1992), and harvester ant nests (Barrows and Allen 2009, Rorabaugh et al. 1987, Turner and Medica 1982).

2. Other Relevant Scientific Information

The Department adds that Gardner (2005) found that among mudhill and wash plots within OWSVRA, sites with FTHL observations had, on average, a substrate with more sand and fewer pebbles as well as greater number of live shrubs. Gardner (2005) found no correlation between FTHL presence and harvester ant diversity when ants are widely available.

3. Sufficiency of the Petition with regard to Kind of Habitat Necessary for Survival

The Department concludes that the Petitioners have submitted sufficient information to demonstrate or create a reasonable inference that while FTHLs may occupy several different coarse-scale habitat types, they likely require particular microhabitat features.

F. Factors Affecting the Ability to Survive and Reproduce and Degree and Immediacy of Threat (p. 39-76)

1. Scientific Information in the Petition

The Petition provides descriptions of a variety of threats to the survival of FTHLs in California. These include direct and indirect impacts associated with agricultural, urban, and renewable energy development; on and off road vehicles; fragmentation, barriers, and edges; military training and border activities; nonnative plants; and climate change.
The Petition states that agricultural development has eliminated FTHL habitat in the Imperial and Coachella valleys and the Borrego Springs area. Predators such as loggerhead shrikes and round-tailed ground squirrels are attracted to agricultural lands and forage along the borders of these areas (Barrows et al. 2006, Young and Young 2005). Irrigation allows Argentine ants (*Linepithema humile*) to invade otherwise too arid regions, displacing native ant species (Pianka and Parker 1975, Suarez et al. 1998). The Petition recognizes that new agricultural development has slowed substantially due to reduced water deliveries from the Lower Colorado River, and some fields have been fallowed (76 FR 14210).

The Petition states that a majority of the urban development within the California portion of FTHL range has occurred to support agricultural expansion; however, urban development, independent of agriculture, also occurs in the Coachella Valley and Borrego Springs (FTHLICC 2003, 76 FR 14210). Indirect effects include off-road vehicle (ORV) use, route proliferation, spread of nonnative plants, trash accumulation, and increased predation (FTHLICC 2003). According to the Petition, future urban development in the Coachella Valley has been permitted through the Coachella Valley Multiple Species Habitat Conservation Plan (CVMSHCP), which authorizes development in approximately 50% of the modeled suitable FTHL habitat.

The Petition states that most land within the California portion of the FTHL range is owned by the State or various federal agencies, so extensive urban development is unlikely (76 FR 14210). Private land holdings are relatively small and discontinuous throughout the range (76 FR 14210), indicating development of private land is likely to have small, localized impacts. The Petition describes how the CVMSHCP provides conservation assurances for areas of modeled suitable FTHL habitat for the life of the plan, whether the species is present or not. The only "core habitat" that remains for the FTHL within the planning area is the existing Thousand Palms Conservation Area. While some land is authorized for development within Conservation Areas, most suitable FTHL habitat within Conservation Areas is not subject to take.

The Petition describes the following potential threats associated with renewable energy development. Renewable energy development has increased dramatically in recent years and can have a large physical and ecological footprint with potentially significant impacts on desert wildlife (Cameron et al. 2012; Lovich and Ennen 2011, 2013; Stoms et al. 2013). The Petition cites the Solar Programmatic Environmental Impact Statement (Solar PEIS) assessment that "Numerous wildlife species would be adversely affected by loss of habitat, disturbance, loss of food and prey species, loss of breeding areas, effects on movement and migration, introduction of new species, habitat fragmentation, and changes in water availability" (BLM and DOE 2012). Large-scale concentrating solar projects have the potential to alter the microhabitat of a region by increasing the albedo effect, which could influence local temperature and precipitation patterns through changes in wind speed and evapotranspiration, and depending on design, they may also have the ability to produce significant amounts of unused heat that could be carried downwind into adjacent wildlife habitat with the potential to create localized drought conditions (Lovich and Ennen 2011). Large and single-use renewable energy projects on public lands displace other multiple use activities, which can be expected to increase impacts from ORV use and
other uses in FTHL habitat. In addition to construction related mortality, new roads are often constructed to create access to renewable energy development sites, which increases the risk of direct morality of FTHLs by vehicles, and makes previously inaccessible areas available to ORVs. Gen-tie transmission lines may also increase avian predation by providing additional perching sites. All renewable energy projects also carry an increased risk of fire (Lovich and Ennen 2011). Persistent, loud noise and vibrations associated with wind farms may also negatively affect wildlife, including reptiles (Lovich and Ennen 2013).

The Petition states that the demand for renewable energy has increased significantly recently, especially in southern California (Cameron et al. 2012; Lovich and Ennen 2011, 2013). Federal and state initiatives to increase renewable energy development ensure development will continue. To meet greenhouse gas reduction goals, the California Energy Commission estimates 25,000 ha of land will need to be developed in California deserts (CEC 2012), and the Petition estimates that currently in the state of California, 7% of FTHL habitat will potentially be impacted by pending or approved projects. FTHL habitat ranked fairly high on the solar energy development compatibility index developed by Stoms et al. (2013), and the Petition indicates that FTHL habitat is at increased risk of development due to its proximity to established transmission infrastructure such as the Sunrise Powerlink.

The Petition states that there are currently seven pending and authorized solar projects covering 1,735 ha of land in California within the FTHL’s range. The Petition reports there are currently five pending and authorized wind projects covering nearly 3.4% of FTHL range in California, or approximately 13,500 ha, and there are also three authorized wind testing facilities covering 7,243 ha of United States Bureau of Land Management (BLM) land, most of which is in the FTHL range. Additionally, the Petition states that there are currently 28 geothermal leases in the FTHL range, 24 of which have been authorized, and project sites covering 13,200 ha of land and have the potential to adversely affect FTHLs.

The Petition states that Solar PEIS (BLM and DOE 2012) did not analyze impacts to FTHLs and designated a 2,314 ha developable solar zone for streamlined environmental permitting on FTHL habitat immediately north of the East Mesa MA. The Petition also states that the draft biological goals and objectives in the Desert Renewable Energy Conservation Plan (DRECP 2013), as proposed in May 20, 2013, fall well short of assuring conservation for the FTHL throughout their range within the plan boundaries; however, this plan is still in its formative stage.

The Petition described additional types of human development in the FTHL range, including mineral mines, the Warren H. Brock Reservoir, the All-American and Coachella irrigation canals, landfills and junkyards, transmission lines, and several major interstate and state highways, but it provided no information regarding the degree of future expansion.

b) Vehicle Impacts

The Petition describes how FTHLs are frequently found on and around paved roads and freeze in the presence of threats, including vehicles, which makes them particularly susceptible to road kills. Young and Young (2000) surveyed a stretch of lightly trafficked roadway, and 3% and 19% of FTHLs they observed were dead on the road over two years of study. Hodges (1997) found 23% of FTHL were dead
on a road, and Mayhew found 24% dead on a road (Turner et al. 1980). Beyond vehicular road kills, roads and their associated landscaping and transmission lines also have edge effects capable of impacting FTHLs in surrounding habitat and potentially limiting gene flow (Barrows et al. 2006, Lovich and Bainbridge 1999, Young and Young 2000).

The Petition states that most of the undeveloped land within the FTHL range in California is subject to either open or limited ORV use (see map on p. 54 of the Petition). While accounts of direct mortality are few, Muth and Fisher (1992) attributed 2 of 42 radio-telemetered FTHL deaths to ORVs. Additionally, it is possible FTHLs alter their behavior in response to ORV; Nicolai and Lovich (2000) found three male transmittered FTHLs showed reduced movement following an ORV race. The Petition states that while few studies have investigated the impacts of ORVs on FTHLs in a rigorous manner, many of the impacts of ORVs on desert landscapes are known to impact FTHLs, including loss of native vegetation, soil disturbance and compaction, nonnative plant introductions, and decreased harvest ant populations.

In terms of controlled experiments to investigate ORV impacts on FTHLs, the Petition presents the following studies. Grant and Doherty (2009) reported no instances of FTHLs being killed while in hibernation even when run over directly, but FTHLs chose burrows near shrubs more often in higher ORV use areas. McGrann et al. (2006) found higher densities of FTHLs on low ORV impact plots vs. high ORV impact plots (as defined by track coverage). The density of active ant mounds and FTHL body mass were greater on the low ORV impact plots (McGrann et al. 2006).

In terms of degree and immediacy of threat, the Petition cites Cordell (et al. 2008) as support that ORV recreation is one of the fastest growing outdoor activities and continues to increase in popularity. The Petition also states that ORV use has increased especially rapidly, citing an increase in visitation to SVRAs between 1985 and 2000 (Grant and Doherty 2009) and an increase in ORV registrations (OHMVRD 2011). OWSVRA received over 500,000 visitors in 2011 (CSPS 2012). The Petition reports that illegal ORV use off of designated routes has been documented (FTHLICC 2003, McGrann et al. 2006, Muth and Fisher 1992). ORV use has also increased along the U.S.-Mexican border. Evidence presented of significantly increased ORV tracks in the FTHL range is current up to 2002 (p. 66-67, FTHLICC 2003).

c) Fragmentation, Barrier, and Edge Impacts

The Petition states that habitat fragmentation due to dispersal barriers that isolates small populations poses a threat to the viability of the FTHL and that there are numerous barriers that fragment FTHL habitat, which result in metapopulations, increasing the risk of localized extirpations. These barriers include major roads, canals, railroads, and the U.S.-Mexican border, as well as minor roads, areas of heavy and frequent off-road vehicle use, renewable energy, and other forms of development.

The Petition presents a USFWS analysis of the potential for these barriers to create fragmented small populations at risk of extinction. The USFWS found that FTHL numbers were typically large enough that the degree of fragmentation created by these barriers would not result in reduced population viability for the vast majority of habitat blocks (76 FR 14210). The Petition considers this an invalid analysis because it used a density estimate derived on high quality habitat plots and only major barriers to movement were included.
The Petition recognizes that with the possible exception of canals and major interstate highways, most barriers within the FTHL range are likely semipermeable, allowing some level of gene flow (Barrows et al. 2006, 76 FR 14210). The Petition however, states that large contiguous blocks of semipermeable barriers like those between the Yuha Desert MA and West Mesa MA could act as permanent barriers separating populations and cutting off gene flow.

The Petition describes edge effects and their potential to fragment or diminish the value of FTHL habitat and cites two studies that estimated their distance (Barrows et al. 2006, Young and Young 2005). Barrows et al. (2006) reported FTHL detections were lower up to 150 m from edge of human development in the Coachella Valley, but this differed significantly by type (wide road with curbs adjacent to suburban development had greater effect than narrow curbless road adjacent to abandoned agricultural fields). They found that the pattern fit a road-mortality/avoidance hypothesis, but they also noted predation may be playing a role. Young and Young (2005) observed lower occupancy of plots near agricultural and urban edges up to 450 m.

d) Military Training Impacts

The Petition describes military lands and activities within the California FTHL range. The Naval Air Facility El Centro has two ranges: Range 2510 has 12,060 ha of land within the West Mesa MA, represents 22% of the MA, and all of the 3,440 ha Range 2512 is located within the East Mesa MA, covering 7% of the MA (FTHLICC 2003). Most training is aircraft related. On the ground activities include non-exploding bombing, ground-based training, target maintenance, target site clean-up, road travel and maintenance, mobile target activities, and target and run-in-line grading (FTHLICC 2003, 76 FR 14210). The Petition states that certain incendiary devices are capable of starting wildfires, although efforts are taken to reduce fire risk (FTHLICC 2003).

Within the two military ranges on California MAs, there are three areas used for inert bombing exercises, each with an impact radius of up to 460 m (FTHLICC 2003). The Petition quotes the USFWS’s position that "most military activities are confined to previously disturbed areas, so the amount of destruction or modification of FTHL habitat is limited" (76 FR 14210), but it disagrees with that determination.

e) Border Activity Impacts

The Petition describes how the FTHL range extends across the international U.S.-Mexican border within each of the three populations and the associated potential threats to those populations. In response to illegal immigration and narcotics smuggling, U.S. Customs and Border Patrol actively patrols the border, using off-road vehicles and surveillance cameras in addition to pedestrian and vehicle fences (Cohn 2007, FTHLICC 2003, Lasky et al. 2011). The Petition states that activities along the international border can adversely affect FTHLs through direct impacts from vehicle travel, fragmentation of the landscape, and indirect impacts from fences/barriers providing predator perching opportunities and trash which subsidizes predators.
f) Nonnative Plant Impacts

The Petition states that nonnative and invasive plant species have the capacity to alter desert landscapes and cause ecosystem shifts and trophic cascades that will negatively influence the FTHL. Nonnative annual grasses have invaded and subsequently altered the creosote bush scrub habitat throughout the southern Californian desert (Brown and Minnich 1986, Lovich and Bainbridge 1999, Rao and Allen 2010, Steers and Allen 2011). In years with heavy precipitation, invasive species rapidly proliferate (Barrows et al. 2009, Rao and Allen 2010) and may directly impact FTHLs. While these direct effects are likely short in duration, invasive annual grasses are known to heighten the extent, frequency, and severity of natural fire regimes throughout desert shrublands (Brown and Minnich 1986; Rao and Allen 2010; Steers and Allen 2010, 2011). Following a fire, there is often a shift in the species composition, and long-lived native species have struggled to recover, including species important to the FTHL such as creosote bush and white bursage (Steers and Allen 2011).

The Petition states that Sahara mustard (*Brassica tournefortii*) is an invasive annual plant that can pose a threat to the FTHL; the species is present throughout the entire range of the FTHL in California. Introduced in the Coachella Valley in 1927, during years of heavy rain, the species proliferates (Barrows et al. 2009). There have been three major 'explosions' of mustard growth since the 1970s, and the most recent explosion in 2005 has been specifically studied in relations to the FTHL (Barrow and Allen 2009, Barrows et al. 2009, CVCC 2013a,b). While Barrows et al. (2009) explain that native vegetation has been able to re-establish after spikes in mustard abundance, more recently Barrows states that Sahara mustard is altering aeolian sand habitats and is rapidly becoming the dominant annual plant during non-drought years (CVCC 2013a).

In 2005, when rainfall was over three times higher than normal, while the mustard thrived, harvester ant abundance, and concomitantly FTHL abundance, crashed (Barrows and Allen 2009). FTHL may be shifting habitat due to Sahara mustard; FTHL prefer stabilized sand dune habitats in the Coachella Valley (Barrows and Allen 2009); however, since 2005 and the mustard explosion, FTHL have been found more frequently on active sand dunes, where mustard growth is limited (CVCC 2013b). Furthermore, juveniles were 10% smaller on stabilized sand fields as compared to active dunes, potentially due to limited food resources in areas dominated by mustard (CVCC 2013b). Barrows explained that despite recent years with average to above average rainfall, FTHLs have responded much the same way they would have during drought conditions (CVCC 2013b).

g) Climate Change Impacts

The Petition states that climate models predict that southwestern North America will not only become warmer but also drier over the 21st century, trends that are expected to be accelerated in North American deserts (Seager et al. 2007). Over the last century, the Sonoran Desert has experienced increasing minimum temperatures, decreased frequency of freezing temperatures, and an overall increase in winter and spring temperatures (Weiss and Overpeck 2005). Recent trends indicate annual rainfall is becoming more variable, which has the potential to alter the biological responses, facilitate
the invasion of nonnative plants, and alter fire regimes (Abatzoglou and Kolden 2011). Numerous studies have indicated plant compositional changes related to climatic changes in the Sonoran Desert (Kimball et al. 2010, Munson et al. 2012, Weiss and Overpeck 2005) that could negatively impact FTHLs. The Petition states that as the climate warms, species are predicted to expand their ranges to seek refuge in cooler climes at higher latitudes or elevations (Lenoir et al. 2008, Parmesan 2006). Because the FTHL has specific habitat requirements and is limited to low elevations, its ability to shift its range may potentially be compromised. In addition, the Petition states that FTHLs may be unable to acclimate and adapt rapidly enough to cope with increasing temperatures. As daytime temperatures warm, FTHL may need to spend more time in burrows, which would leave less time to actively forage and seek mates and would effectively reduce successful reproduction potential. Temperature changes may also influence FTHL hibernation. As winter temperatures warm, FTHLs may emerge from hibernation sooner, which would place them at increased risk of ORV exposure. The Petition provides anecdotal accounts of FTHL emergence time being documented earlier in the year over the decades since Mayhew (1965) first studied them.

2. Other Relevant Scientific Information

The Department is aware of some additional information regarding factors affecting the FTHL’s ability to survive and reproduce.

With respect to the threat posed by Argentine ants, Barrows et al. (2006) report that Argentine and red fire ants (*Solenopsis invicta*) have invaded the Coachella Valley but not FTHL habitat, presumably due to a barrier created by hyper-arid conditions.

While not included in the Petition, the Department is also aware of a recent study by Goode and Parker (2013), who also calculated rates of road mortality in FTHL. In this study, FTHLs were the most common species found on the road, and 30% of observations were of dead individuals, a greater proportion than those cited in the Petition.

The Department is aware of another study undertaken to understand potential ORV impacts on FTHLs (Gardner 2005). Using occupancy data from paired plots in washes and mudhills approximately 300 m away, Gardner (2005) found that road proximity was not a negative influence on FTHL presence as would be reasonably hypothesized. This result was attributed to the positive association between FTHL occupancy and sand, and one of the roads was a sandy wash. Gardner (2005) also found that when sand was sufficient, shrub density was an important predictor of FTHL presence, supporting the notion that activities that reduce shrub cover can adversely impact FTHLs.

With respect to the degree and immediacy of ORV use, Cordell et al. (2008) reported that national ORV use peaked in 2002 and 2003 and declined after that, and the OHMVrd (2011) reported that the depth of California’s economic recession has resulted in decreased visitation to the SVRAs.
3. Sufficiency of the Petition with regard to Factors Affecting the Ability to Survive and Reproduce and Degree and Immediacy of Threat

While the Department disagrees with portions of the Petitioner’s assessment of the factors affecting the FTHL’s ability to survive and reproduce and their relative degree and immediacy of threat, the Department nonetheless concludes that the Petitioners have submitted sufficient information to demonstrate or create a reasonable inference that FTHLs are subject to numerous threats that have the potential to adversely affect their ability to maintain self-sustaining populations within California.

G. Impact of Existing Management Efforts (p. 76-83)

1. Information in the Petition

   a) Interagency Conservation Agreement/Rangewide Management Strategy

   The Petition states that the ICA is limited in its effectiveness because the provisions in the RMS are subject to the availability of funds and that the ICA is voluntary. The RMS is a joint effort of the BLM, the U.S. Bureau of Reclamation, the USFWS, the Department, California State Parks, and the Arizona Game and Fish Department, covering nearly 200,000 ha of public and private lands within the FTHL range in MAs, representing 36% of their habitat in California. In addition, the U.S. Marine Corps and the U.S. Navy are signatories to the ICA through the Sikes Act, and incorporated components of the RMS into their Integrated Natural Resources Management Plans. Because of this, the FTHL is afforded some protections at the Naval Air Facility in El Centro. The goal of the RMS is to maintain self-sustaining populations in perpetuity.

   The Petition states the RMS is inadequate to meet its goal to maintain the species because: (1) the RMS does not offer protection from ORV use inside and outside of the MAs; (2) the MAs do not cover a sufficient amount of habitat to protect the FTHL; (3) ORV tracks are not counted toward the 1% surface disturbance cap within the MAs; (4) mitigation and compensation requirements for surface disturbance are not adequate to deter large-scale energy projects; (5) habitat restoration being undertaken seems unlikely to be successful; (6) it does nothing to remedy habitat fragmentation from large-scale barriers; (7) law enforcement efforts are inadequate to eliminate illegal ORV; (8) there are still many more questions to be answered including effects of ORVs despite the creation of OWSVRA as a Research Area; (9) current monitoring methods are insufficient to accurately determine population density current monitoring methods are insufficient to accurately determine population density and trends; and (10) no FTHL habitat outside of the MAs are surveyed.

   b) California Desert Conservation Act (CDCA) Plan

   The Petition states that through the CDCA, BLM can designate Areas of Critical Environmental Concern (ACEC), which generally limit certain activities that result in major surface disturbance. There are
currently six ACECs within the FTHL range, three were designated to protect the FTHL: the Yuha Desert ACEC, East Mesa ACEC, and West Mesa ACEC. BLM integrated provisions of the RMS into the ACECs, which make them mandatory to follow; however, because the Petition finds the RMS is inadequate to protect FTHL, so is the CDCA.

c) Habitat Conservation Plan/Natural Community Conservation Plan

The Petition explains that there are currently two federal incidental take permits that include the FTHL as a covered species, but only the CVMSHCP is within California. While HCPs provide for conservation of species during the life of the plan, the Petition states they do not provide conservation assurances in perpetuity. In addition, the Petition states that because HCPs actually allow for “take” of species and habitat, they do not aid in species recovery, and continued take will only decrease populations further. The CVMSHCP was developed in coordination with the California Natural Community Conservation Planning Act.

The Petition describes the CVMSHCP’s FTHL goal to ensure the conservation of the species by maintaining long-term persistence of self-sustaining populations, as well as its methods for attempting to achieve that goal. They include maintaining the Thousand Palms population and creating two additional self-sustaining populations by protecting “core habitat” within the Thousand Palms Conservation Area and protecting potential habitat within several other conservation areas. The Petition states this goal may be unattainable because even in Thousand Palms, which has the largest population in the region, the relatively small geographic size, low population density, and isolation from the larger populations to the south, make FTHLs extremely vulnerable to extirpation in the Coachella Valley.

d) State Regulations

The collection of FTHLs without a permit is prohibited in California through Title 14 of the California Code of Regulations, Section 40. The Petition recognizes the FTHL is not significantly threatened by commercial exploitation or overutilization and states that while these regulations are important and should remain, they do not significantly reduce threats to the FTHL.

e) Federal and State Conservation Status

The Petition states that in 1980, the BLM designated the FTHL as a Sensitive Species in California and the species remains a sensitive species today. A Sensitive Species designation indicates that the BLM considers the FTHL to be at risk of population declines that could lead to extinction. BLM affords sensitive species with protections equivalent to those given to federal candidate species.

The Petition reports that the Department also lists the FTHL as a Species of Special Concern (SSC), a designation assigned when “declining population levels, limited ranges, and/or continuing threats have made them [the SSC] vulnerable to extinction” (CDFG 2011). The goal of a SSC designation is to draw attention to the status of the species and provides no specific protections.
2. Other Relevant Information

The Department is aware that the FTHL is a proposed covered species under the DRECP and the Imperial Valley Natural Community Conservation Plan/Habitat Conservation Plan, which should afford it protections from impacts associated with renewable energy and irrigation-related development and operations within the plan areas that overlap the FTHL’s range, but since the draft plans have not been finalized, their adequacy of protection for the species is unknown.

3. Sufficiency of the Petition with regard to Impacts of Existing Management Efforts

While the Department questions portions of the Petitioner’s assessment of the impacts of existing management efforts, the Department nonetheless concludes that the Petitioners have submitted sufficient information to demonstrate or create a reasonable inference that they may not be adequate to maintain self-sustaining populations in California.

H. Suggestions for Future Management (p. 83-89)

1. Information in the Petition

The Petition presents a reasonable list of recommended management actions. According to the Petition, this list is not intended to be exhaustive but provides important conservation measures considered necessary to protect the FTHL. Details on each recommendation can be found within the Petition.

- Utilize monitoring techniques capable of detecting population trends throughout FTHL range. Currently resources are being devoted to survey efforts that are unable to accurately determine population trends (see Abundance and Impact of Existing Management Efforts).
- Further limit off-road vehicle use within MAs.
- Explore using appropriate fencing to keep FTHLs off of roads and limit ORV trespass.
- Focus renewable energy development on lands that meet energy needs while conserving important FTHL habitat.
- Prohibit further development in the MAs.
- Expand current and establish new MAs in the area between West Mesa MA and Yuha Desert MA, the southern portion of Anza Borrego State Park that is within current FTHL range, and north of the East Mesa MA.
- Determine the population status of FTHL in the Dos Palmas Conservation Area in the Coachella Valley.
- Reduce edge effects by burying transmission lines and conducting routine maintenance of vegetation along habitat boundaries and roads.
- Conduct additional research to understand the effectiveness and most appropriate design of highway culverts in natural FTHL populations; based on this research, modify existing culverts and install new culverts to increase gene flow between occupied habitat areas.
- Modify the project evaluation protocol for mitigation and compensation described in the RMS.
- More aggressive actions should be taken to control nonnative plants and restore damaged ecosystems.
- Management efforts should continue to acquire private lands where possible, especially within the matrix of public lands.
- Coordinate conservation strategies with the Mexican government and eliminate pesticide spraying within FTHL range to protect food sources.
- Monitor Argentine and other invasive ant populations along FTHL habitat boundaries to prevent potential invasions.
- Limit use of off-road vehicles in border area where possible.
- Efforts should be taken to improve lizard translocation success while exploring alternative mitigation techniques capable of reducing mortality associated with development.
- Local Land Use Plan and OWSVRA Plan Updates need to include safeguards for FTHL habitat.
- FTHLICC needs to be expanded and/or better coordinate with Counties and CVMSHCP.
- Evaluate the stability and sustainability of the FTHL.

The Petition also states that numerous other rare sympatric species and communities would benefit from listing the FTHL as endangered and that impacts to some of these other species are avoidable with better management of FTHL habitat.

2. Other Relevant Information

Goode and Parker (2013) found that the current design of FTHL exclusion fencing is inadequate at keeping the species out of a construction area, so recommendations to install it as an impact minimization measure may not obtain the desired result.

3. Sufficiency of the Petition with regard to Suggestions for Future Management

The Department concludes that the Petitioners have submitted sufficient information to demonstrate or create a reasonable inference that additional management efforts may aid in maintaining self-sustaining populations of FTHLs in California.
I. Detailed Distribution Map

1. Information in the Petition
The Petition included a detailed distribution map (see Figure 1 in the Range and Distribution section).

2. Other Relevant Information
The Department prepared a current range map in California with historic and current point locations (Figure 2).

3. Sufficiency of the Petition with regard to a Detailed Distribution Map
The Department concludes the Petition contains a sufficient depiction of the FTHL’s distribution.

IV. Status of the Species
The rangewide status of the flat-tailed horned lizard is uncertain; however, through implementation of the Rangewide Management Strategy, approximately 36% of its range in California is managed for the species. Surface disturbance within these areas is limited to 1%, and compensation and mitigation measures are in place whenever habitat is disturbed within and outside of the Management Areas within the Interagency Conservation Agreement signatories’ jurisdiction. Population monitoring within these areas and the Ocotillo Wells SVRA Research Area indicates that the species has been relatively stable and generally widely distributed in recent years in spite of its boom and bust cycles. With the exception of the Coachella Valley, information on the species’ status outside these areas in California is lacking.

The flat-tailed horned lizard has lost habitat to direct and indirect impacts from agriculture and urban development, which have slowed substantially recently, but the increase in renewable energy development and its associated infrastructure throughout its range poses a potential threat to the species’ ability to maintain self-sustaining populations. Additional potential threats include off-road vehicle use, nonnative plants, and climate change.

Having reviewed and evaluated relevant information, including the material referenced in the Petition and other information in the Department’s possession, the Department believes there is sufficient scientific information available at this time to indicate that the petitioned action may be warranted. (See Fish & Game Code, § 2073.5, subd. (a)(2); Cal. Code Regs. tit. 14, § 670.1, subd. (d).)
Figure 2. Detailed distribution map for FLH created by Kristi Cripe, California Department of Fish and Wildlife.
V. Literature Cited


Frary, V. 2011. Flat-tailed horned lizard (Phyrnosoma mcallii) monitoring in southeastern California and southwestern Arizona: 2010 analysis update. Report prepared by Arizona Game and Fish Department, Phoenix, AZ.


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Young, K.V., and A.T. Young. 2005. Indirect Effects of Development on the Flat-tailed Horned Lizard. Report prepared for Arizona Game and Fish Department, Yuma, AZ.
