U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: *Elgaria panamintina*

COMMON NAME: Panamint alligator lizard

LEAD REGION: South Pacific Region, Region 8

DATE INFORMATION CURRENT AS OF: April 2019

STATUS/ACTION

__X__ Species assessment– determined either we do not have sufficient information on threats or the information on the threats does not support a proposal to list the species and, therefore, it was not elevated to Candidate status

___ Listed species petitioned for uplisting for which we have made a warranted-but-precluded finding for uplisting (this is part of the annual resubmitted petition finding)

___ Candidate that received funding for a proposed listing determination; assessment not updated

___ New candidate

___ Continuing candidate

___ Listing priority number change
Former LPN: ___
New LPN: ___

___ Candidate removal: Former LPN: ___
___ A – Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.
___U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.
___ F – Range is no longer a U.S. territory.
___ I – Insufficient information exists on taxonomy, or biological vulnerability and threats, to support listing.
___ M – Taxon mistakenly included in past notice of review.
___ N – Taxon does not meet the Act's definition of "species."
___ X – Taxon believed to be extinct.

Date when the species first became a Candidate (as currently defined):

Petition Information:
___ Non-petitioned
__X_ Petitioned; Date petition received: July 11, 2012
90-day substantial finding FR publication date: September 18, 2015
12-month warranted but precluded finding FR publication date:

FOR PETITIONED CANDIDATE SPECIES:
a. Is listing warranted (if yes, see summary of threats below)? No
b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? N/A
c. Why is listing precluded? N/A

PREVIOUS FEDERAL ACTIONS:
We identified the Panamint alligator lizard [under the scientific name *Elgaria panamintinus* (*sic*)] as a Category 2 candidate species in our September 18, 1985, Review of Vertebrate Wildlife (50 FR 37958). Category 2 candidates were defined as species for which we had information that proposed listing was possibly appropriate but conclusive data on biological vulnerability and threats were not available to support a proposed rule at the time. The Panamint alligator lizard remained a Category 2 candidate in subsequent annual candidate notices of review (CNOR) (54 FR 554, January 6, 1989; 56 FR 58804, November 21, 1991, entire (under the scientific name *E. panamintina* and thenceforth); and 59 FR 58982, November 15, 1994). In the February 28, 1996, CNOR (USFWS 1996a, entire), we discontinued the designation of Category 2 species as candidates (the practice of which was finalized in a separate final rule (61 FR 64481, December 5, 1996)); at that point, the Panamint alligator lizard was no longer a candidate species.

The Center for Biological Diversity (CBD) petitioned the U.S. Fish and Wildlife Service (Service) on July 11, 2012, to add 53 species of amphibians and reptiles, including the Panamint alligator lizard (*Elgaria panamintina*) to the List of Endangered and Threatened Wildlife, with critical habitat, under the authority of the Endangered Species Act (ESA, or the Act). The Service received the petition on July 11, 2012, and on September 18, 2015, we published a finding that the petition presented substantial scientific or commercial information indicating that the petitioned action may be warranted for the Panamint alligator lizard (80 FR 56423). This conclusion was based on information in the petition and available literature suggesting that there may be threats to the species from (1) present or threatened destruction, modification, or curtailment of the species' habitat or range from mining, off-road vehicle activity, grazing, and introduction of invasive plant species; and (2) overutilization (unauthorized collecting) for commercial uses (Service 2015, pp. 1-2). As part of that finding, we solicited information from governmental agencies, Native American Tribes, the scientific community, industry, and any other interested parties on various aspects of the species' biology; any potential threats to the species, including possible effects from climate change; any past and ongoing conservation measures; and any information that may help us designate critical habitat for the species, should we determine that listing the species is warranted and that designating critical habitat for the species is prudent and determinable.

For additional information, a complete discussion of topics discussed and summarized in this document for this species can be found in the Panamint alligator lizard Species Status Assessment Report (SSA) (Service 2019, entire).

ANIMAL/PLANT GROUP AND FAMILY: Reptile/Anguidae

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Mono and Inyo Counties, California/United States of America

CURRENT STATES/COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Mono and Inyo Counties, California/United States of America

LAND OWNERSHIP: The vast majority (98.7 percent) of the Panamint alligator lizard's range (CWHR 2014, entire) occurs on Federal land (Table 1) (see the Panamint alligator lizard SSA, Table 2 and Figure 10, Service 2019, pp. 15–30). Moreover, 64.7 percent is designated as Wilderness under the Wilderness Act of 1964 (16 U.S.C. 1131 *et seq.*) (see also the California Desert Protection Act of 1994 (Public Law 103-433), and the Omnibus Public Land Management Act of 2009 (Public Law 111-11)), and 5.8 percent is designated as Areas of Critical Environmental Concern (ACECs) (see the Panamint alligator lizard SSA, Table 3 and Figure 11, Service 2019, pp. 29–31) under the Federal Land Policy and Management Act (FLPMA) of 1976 and the California Desert Conservation Area Plan of 1980. State land is only 0.8 percent of the Panamint alligator lizard's range, nearly all of which, through a provision in the California Desert Protection Act of 1994, is anticipated to be exchanged with other Federal lands outside of the species' range (NPS 2002, p. 65; BLM 2016, Figure 1 therein and Appendix F therein). Thus, most of the State land within the species' range will eventually become Federal land. Private lands are 0.5 percent of the species' range, and local and tribal trust lands are each less than 0.1 percent of the species' range (Table 1).

Table 1. *Acres, hectares, and the percentage of the species' range by major land-owner (jurisdictional) categories within the range of the Panamint alligator lizard (PAL) (CWHR 2014).*

Owner	Acres	Hectares	Percentage of PAL
Federal Total	2,585,494.2	1,046,312.4	98.7%
State	19,745.7	7,990.8	0.8%
Local	1,783.9	721.9	<0.1%
Private	13,356.8	5,405.3	0.5%
TOTAL PAL RANGE	2,620,380.6	1,060,430.4	100.0%

LEAD REGION CONTACT Deborah Giglio, Pacific Southwest Region, 916–414–6481, Deborah_Giglio@fws.gov

LEAD FIELD OFFICE CONTACT Gjon Hazard, Carlsbad Fish and Wildlife Office, 760–431–9440 x287, Gjon_Hazard@fws.gov

BIOLOGICAL INFORMATION:
For additional information, a complete discussion of topics discussed and summarized in this

document for this species can be found in the Panamint alligator lizard SSA (Service 2019, entire).

Species Description

The Panamint alligator lizard (*Elgaria panamintina*) (Figure 1) is a secretive species known only from a remote region in eastern California. Growing to be about 6 inches (15 centimeters) long from snout to vent (Stebbins and McGinnis 2012, p. 330), they can have a tail that may extend up to twice that length (Banta *et al.* 1996, p. 629.1). Dorsally, they range in color from beige to brown and have 7 to 8 darker cross bands; ventrally, they are whitish with gray splotches (Mahrdt and Beaman 2009, p. 488)

Taxonomy

The Panamint alligator lizard is a member of the reptilian family Anguidae, which includes alligator lizards and legless lizards. First discovered in 1954, Stebbins (1958, entire) described *Gerrhonotus panamintinus* as a new species based on type specimens from the Panamint Mountains, Inyo County. Prior to and after Stebbins' publication, the taxonomy of alligator lizards and their close allies was unstable. Good (1985, pp. 70 and 76) reorganized the western North American *Gerrhonotus* species, recognizing them as members of the genus *Elgaria*. This included the Panamint alligator lizard, consequently changing the specific epithet of that taxon to *panamintina* to match the gender of the "new" genus. Since then, the nomenclature of *E. panamintina* has been stable in the literature (Clause *et al.* 2015, 6th page (unpaginated)) and is recognized by the Committee on Standard English and Scientific Names, a joint committee with representatives from major herpetological societies in North America (de Quieroz and Reeder 2012, p. 39). No subspecies have been described (Banta *et al.* 1996, p. 629.1).

While the species-level nomenclature of *Elgaria panamintina* has been constant for several decades, the taxonomic relationships among the alligator lizards continue to be a subject of research. As discussed in greater detail in the Panamint alligator lizard SSA (Service 2019, pp. 4-6), there is some uncertainty with the relationship of *E. panamintina* to other species in the genus, particularly the southern alligator lizard (*E. multicarinata*). Additionally, Toffelmier and Shaffer (2017, entire) provided preliminary results from a recent population-level genomics study on *E. panamintina* (see Panamint alligator lizard SSA, Appendix C, Service 2019). The results showed a higher level of genetic variation across the species range indicating a reduced level of genetic exchange and potentially having taxonomic implications. While the information available at the time the Panamint alligator lizard SSA was prepared provides no information as to the relationship of *E. panamintina* to any other *Elgaria* species, the results showed reduced genetic exchange across the species' range. Specifically, at the genetic level, *E. panamintina* is arranged across the landscape in multiple groupings where the amount of gene flow is, in most cases, much greater within a given group than the amount of gene flow is between the other groups (Toffelmier and Shaffer 2017, 6th page (unpaginated) and Figure 8 therein). In general, these groups fairly closely align with the mountain ranges where the species occurs. Moreover, these preliminary data suggest that the amount of genetic differentiation across the species' range is substantial; however, the available information from this study does not address the species' taxonomic status. More research is needed, but at this point, we are recognizing *Elgaria*

panamintina as a diagnosable taxon at the species level.

Habitat/Life History

Anecdotal evidence suggests the Panamint alligator lizard is most often detected in or near areas of riparian vegetation, nearly always with surface water (Stebbins 1958, p. 15; Phillips-Brandt-Reddick 1983, p. 89; Macey and Papenfuss 1991, p. 303; Mahrdt and Beaman 2009, p. 489; Clause 2013, 5th page (unpaginated); Parker and Brito 2013, p. 70; Thomson *et al.* 2016, p. 205). However, this may simply be due to sampling bias. No effective method exists for sampling this species in talus except for the expensive, labor intensive, and low yield method of pitfall trapping (Banta 1963, entire; Cunningham and Emmerich 2001, entire; Morafka *et al.* 2001, entire). Riparian areas contrast markedly with the conditions in the rest of the species' range (open desert and dry, rugged mountain slopes). Areas of riparian vegetation likely offer the greatest opportunities for food and hydration, often having microhabitat sites (refugia) suitable for sheltering and nesting (such as concentrations of large rocks or woody material). Although no data currently exists on Panamint alligator lizard densities in any habitat, this pattern suggests the species could achieve its highest density in riparian areas, implying that Panamint alligator lizard populations near riparian areas might be "subsidized" by the productivity (e.g., higher survival and reproduction of Panamint alligator lizard individuals) of those sites compared to dry sites (for example, see Sabo and Power 2002, entire). However, not all areas with riparian vegetation necessarily support populations of Panamint alligator lizards (for example, Clause 2015, 6th page (unpaginated); see also Cunningham and Emmerich 2001, Site Reports therein).

It also appears that areas of talus (separate from riparian areas) are important to the species (Banta 1963, p. 6, see also Figure 6 therein; Clause *et al.* 2015, 8th and 9th pages (unpaginated); Clause 2017 *in litt.*). Talus areas, with their abundant interstitial spaces between and under the jumbled rocks, provide abundant options for refugia and moisture (Cunningham and Emmerich 2001, p. 26; Clause *et al.* 2015, 9th page (unpaginated)). Many sites where Panamint alligator lizards were detected had riparian and talus together in close proximity (Giuliani 1977, p. 7; LaBerteaux and Garlinger 1998, p. 85; Cunningham and Emmerich 2001, pp. 6, 26, see also Appendix 4 therein; Morafka *et al.* 2001, 4th page (unpaginated); Clause 2015, 8th page (unpaginated); Clause 2017 *in litt.*). It is not clear whether or to what extent Panamint alligator lizards also occur in other (non-riparian, non-talus) areas, but the available information suggests that Panamint alligator lizards rarely if ever exclusively use these areas for long periods of time.

Thus, the Panamint alligator lizard occupies heterogeneous habitat areas. In this document, we often discuss the different ecological settings (such as riparian and talus) that the species uses. There is no information to suggest that there are differences in macrohabitat needs based on sex or age. Additionally, it is likely that there is some level of regular interchange of individuals (dispersal) between and among these ecological settings within a (canyon-scale) population.

Little is known about the life history of the Panamint alligator lizard. For insight, we look to other species, especially the closely related and better studied southern alligator lizard. Panamint alligator lizards depend on external heat sources to maintain body temperature, but we expect they, like other alligator lizard species, can be active at lower temperatures than other species of lizards in the region. We also expect Panamint alligator lizards seek shelter (refugia), such as

openings between and under rocks and in dense vegetation, to avoid environmental temperature extremes. Such refugia also help them avoid desiccation and predators. A subset of these refugia probably serves as more specialized nest sites and wintertime hibernacula.

Panamint alligator lizards are generalist predators, predominantly eating invertebrates, but may prey on small vertebrates as well. They use active-search and sit-and-wait methods of hunting. Prey availability likely varies dramatically seasonally and inter-annually; however, sites with more consistent water, like spring-fed riparian areas and deep talus areas, could be expected to be less susceptible to the vagaries of the region's precipitation. Although Panamint alligator lizards get moisture from their food, they probably also need to occasionally drink water (surface water, rain, or dew). Riparian areas and pockets of moisture deep in talus areas are likely sources of supplemental water.

Life Cycle

The basic life cycle of the Panamint alligator lizard is typical of most oviparous (egg-laying) lizards: eggs hatch to become non-breeding juveniles, which then grow and mature to become breeding adults. In general, mating occurs in the spring (May) (Banta and Leviton 1961, p. 205; Morafka *et al.* 2001, 7th page (unpaginated); Clause *et al.* 2015, 7th page (unpaginated)). Eggs are laid several weeks later, generally in the early summer. Juvenile Panamint alligator lizards probably do not become sexually mature adults until their second spring, roughly 18 months after hatching, which is the pattern observed in southern alligator lizards (Goldberg 1972, p. 272). Little is known about juvenile Panamint alligator lizard behavior. Additionally, the life span of the Panamint alligator lizard is not known, but the southern alligator lizard can live up to a decade or more (San Diego Zoo 2008, unpaginated).

Current and Historical Range/Distribution

The overall geographical extent of where the Panamint alligator lizard occurs is not well known, but it does appear to be geographically limited (Figure 1 and see the Panamint alligator lizard SSA, Figure 3, Service 2019, pp. 3–7). There is little to suggest that the species' historical range differs from its current range. It is known to occur in the White, Inyo, Nelson, Coso, Argus, and Panamint mountain ranges in Mono and Inyo Counties, in eastern California (Cunningham and Emmerich 2001, Appendix 4 therein (unpaginated); Mahrdt and Beaman 2009, p. 490; Clause *et al.* 2015, 3rd page (unpaginated)); however, the precise geographical limits of the species' range are unclear. Although seemingly suitable habitat occurs in Nevada, in the northern continuation of the White Mountains and elsewhere, no Panamint alligator lizards have been found in that State despite focused surveys (Banta 1965, p. 7; NDOW 2013, p. 141; Clause *et al.* 2015, 3rd page (unpaginated); NDOW 2017a *in litt.*; NDOW 2017b *in litt.*).

For the purposes of this document and the Panamint alligator lizard SSA, we are defining the range of the Panamint alligator lizard, given the available information, as the area depicted by the California Wildlife Habitat Relationships (CWHR) System (see Panamint alligator lizard SSA, Figure 4, Service 2019, p. 8).

In all, the overall range of the Panamint alligator lizard is comparatively geographically limited

and includes the above-listed mountain ranges, but more field surveys are needed to refine the boundaries of the species' current range. While acknowledging the limitations of the available data, there is little to suggest that the species' range is substantially larger than what is portrayed by most sources, nor do the available data suggest that the species' range has changed substantially over the past several hundred years.

Little is known about Panamint alligator lizard movements, although preliminary radio telemetry data showed that Panamint alligator lizards originally captured in riparian zones rarely strayed far from those riparian zones during the breeding season. We expect that some individuals disperse (immigrate, emigrate), which is suggested by a preliminary analysis of genetic data showing a low level of gene flow between neighboring (between-canyon) populations. These data also suggested that there is a high level of genetic structuring across the species' range. Five of the six mountain ranges were sampled, and there were marked differences across all of them. We assume the sixth mountain range, the Coso Mountains, follows this same pattern. Because of these observed differences, we often distinguish between *canyon-scale* populations, and *mountain-range-scale* populations in the Panamint alligator lizard SSA (Service 2019).

Population Estimates/Status

Similar to other alligator lizard species, the Panamint alligator lizard is secretive and difficult to detect; extensive survey effort is often needed to merely determine presence or absence (Cunningham and Emmerich 2001, p. 24; Clause 2015, 8th page (unpaginated)). Moreover, much of the Panamint alligator lizard's range is difficult to access and the level of research on this species has been modest at best (Clause *et al.* 2015, 7th page (unpaginated); Thomson *et al.* 2016, p. 205). As discussed in the Panamint alligator lizard SSA, the overall abundance of the endemic Panamint alligator lizard is unknown but appears to be relatively small because it likely occurs at low densities over a restricted range (Service 2019, pp. 7-17). While the lack of data makes it difficult to know for sure, there is no evidence to suggest that the species' overall abundance has declined substantially since historical times. A numerical decline in individuals could potentially become evident in the contraction of the species' range (Lawton 1994, p. 62; Rodda 2012, p. 283), but no information exists suggesting that the range of the species, albeit relatively small, has changed since historical times. While not all known Panamint alligator lizard locations have received repeated survey effort, many canyons where Panamint alligator lizards have been detected in the past have yielded positive results in subsequent searches; no (canyon-scale) populations are known to have suffered extirpation (Clause *et al.* 2015, 5th and 10th pages (unpaginated)). In fact, as detailed in the Panamint alligator lizard SSA, available evidence suggests that the Panamint alligator lizard's overall abundance is probably stable. For additional information, see the Panamint alligator lizard SSA (Service 2019, pp. 7–17).

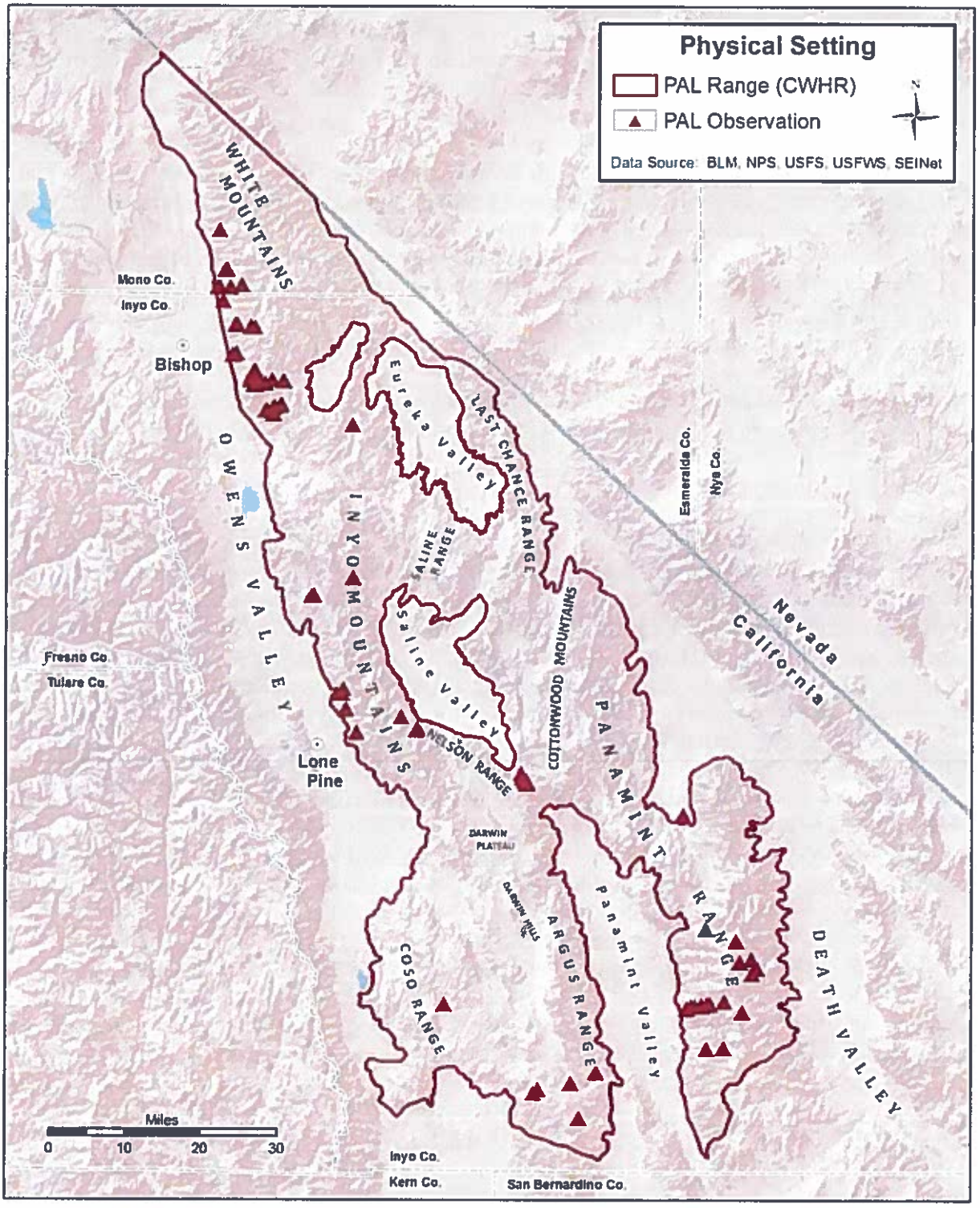

Figure 1. Range of the Panamint alligator lizard (PAL) in the context of its physical and geographical setting. The range is based on the California Wildlife Habitats Relationships System (CWHR). The depicted observation sites points are for general reference only; the precision and accuracy of the available detection site data are variable.

Table 2. Summary of Panamint alligator lizard mountain range-scale "populations," their detection history, and current status across the six mountain ranges in the species' geographical range. As used here, a population is loosely defined and does not necessarily indicate panmictic interbreeding; however, available information suggests that some amount of genetic exchange (interbreeding) occurs between and among canyons within at least some of the mountain ranges (see text). Not all detections are in canyons per se. The data quality for the detection history is quite variable; some sites have had good coverage with precise reporting through time, while others have had spotty coverage, imprecise reporting, or both. We have no rigorous data to establish "absence" (regardless of location); detection history is highly dependent on level of effort. We consider mountain-range-scale populations that have had detections since 2010 to be extant; populations without recent detections but for which there is little evidence to suggest population losses are presumed to be extant.

Mountain Range	Major Land Owners	Eco-region	Max. Elevation	Canyons with detections (in or near)	≤1969	1970s	1980s	1990s	2000s	2010s	Status	Comments
White	USFS	Great Basin	>14,000 ft (>4,300 m)	Piute Creek, Coldwater Canyon, Gunter Creek, Silver Canyon, Redding Canyon, Black Canyon, Marble Canyon, Westgard Pass	✓	✓	✓	✓	✓	✓	Extant	Multiple sites with multiple detections each. Long history of detections. Vouchers.
Inyo	USFS, BLM	Great Basin	>11,000 ft (>3,350 m)	Joshua Flats, Lead Canyon, Mazourka Canyon, Union Wash, French Spring, Long John Canyon, Craig Canyon, Daisy Canyon	✓	✓	✓	✓	✓	✓	Extant	Multiple sites, some with multiple detections each. Long history of detections. Vouchers.
Nelson	NPS	Mojave Desert	7,700 ft (2,350 m)	Grapevine Canyon	✓		✓		✓		Presumed Extant	One canyon with multiple detections before 1969, then single detections in the 1980s and 2000s. Vouchers.
Coso	Navy, BLM	Mojave Desert	8,160 ft (2,485 m)	Haiwee Spring				✓			Presumed Extant	One unvouchered visual detection at one site. No other detections in the Coso Range.
Argus	Navy, BLM	Mojave Desert	8,800 ft (2,680 m)	Mountain Springs Canyon, Water Canyon, Homewood Canyon			✓	✓	✓	✓	Extant	Several sites with 1 to 2 detections each. Moderate history of detections. Vouchers.
Panamint	NPS, BLM	Mojave Desert	>11,000 ft (>3,350 m)	Telephone Canyon, Wildrose Canyon, Hanaupah Canyon, Surprise Canyon, Pleasant Canyon	✓	✓	✓	✓	✓	✓	Extant	Multiple sites, some with multiple detections each. Long history of detections. Vouchers.

Summary of Biological Information

The Panamint alligator lizard (*Elgaria panamintina*) (Figure 1) is a secretive species known only from a remote region in eastern California. The Panamint alligator lizard is a member of the reptilian family Anguidae, which includes alligator lizards and legless lizards. First discovered in 1954, Stebbins (1958, entire) described *Gerrhonotus panamintinus* as a new species based on type specimens from the Panamint Mountains, Inyo County. While the species-level nomenclature of *Elgaria panamintina* has been constant for several decades, the taxonomic relationships among the alligator lizards continue to be a subject of research. More research is needed, but at this point, we are recognizing *Elgaria panamintina* as a diagnosable taxon at the species level. Anecdotal evidence suggests the Panamint alligator lizard is most often detected in or near areas of riparian vegetation, nearly always with surface water (Stebbins 1958, p. 15; Phillips-Brandt-Reddick 1983, p. 89; Macey and Papenfuss 1991, p. 303; Mahrdt and Beaman 2009, p. 489; Clause 2013, 5th page (unpaginated); Parker and Brito 2013, p. 70; Thomson *et al.* 2016, p. 205). It also appears that areas of talus (separate from riparian areas) are important to the species (Banta 1963, p. 6, see also Figure 6 therein; Clause *et al.* 2015, 8th and 9th pages (unpaginated); Clause 2017 *in litt.*). The basic life cycle of the Panamint alligator lizard is typical of most oviparous (egg-laying) lizards: eggs hatch to become non-breeding juveniles, which then grow and mature to become breeding adults. It is known to occur in the White, Inyo, Nelson, Coso, Argus, and Panamint mountain ranges in Mono and Inyo Counties, in eastern California (Cunningham and Emmerich 2001, Appendix 4 therein (unpaginated); Mahrdt and Beaman 2009, p. 490; Clause *et al.* 2015, 3rd page (unpaginated)); however, the precise geographical limits of the species' range are unclear. As discussed in the Panamint alligator lizard SSA, the overall abundance of the endemic Panamint alligator lizard is unknown but appears to be relatively small because it likely occurs at low densities over a restricted range (Service 2019, pp. 7-17). While the lack of data makes it difficult to know for sure, there is no evidence to suggest that the species' overall abundance has declined substantially since historical times.

THREATS

We define "threat" as any action or condition that is known to or is reasonably likely to negatively affect individuals of a species. This includes those actions or conditions that have a direct impact on individuals, as well as those that affect individuals through alteration of their habitat or required resources. The mere identification of "threats" is not sufficient to compel a finding that listing is warranted. Describing the negative effects of the action or condition (i.e., "threats") in light of the exposure, timing, and scale at the individual, population, and species levels provides a clear basis upon which to make our determination. In determining whether a species meets the definition of an "endangered species" or a "threatened species," we have considered the factors under section 4(a)(1) of the Act (Factor A – the present or threatened destruction, modification, or curtailment of its habitat or range; Factor B – overutilization for commercial, recreational, scientific, or educational purposes; Factor C – disease or predation; Factor D – the inadequacy of existing regulatory mechanisms; and Factor E – other natural or manmade factors affecting its continued existence) and assessed the cumulative effect that the threats identified within the factors—as ameliorated or exacerbated by any existing regulatory mechanisms or conservation efforts—will have on the species now and in the foreseeable future.

Potential threats which may adversely affect Panamint alligator lizard and its habitat include reduced surface water (Factor E), degraded riparian vegetation (Factor A), impacts to refugia (Factor A), crushing and other direct mortality (Factor E), collecting (Factor B), disease (Factor C), predation (Factor C), barriers to dispersal (Factor E), small population effects (Factor E), climate change (Factor A), the inadequacy of existing regulatory mechanisms (Factor D), and cumulative effects.

Below we present a summary of the information on threats potentially impacting Panamint alligator lizard and its habitat. For a detailed discussion of the potential threats to the species, please see the Panamint alligator lizard SSA (Service 2019, pp. 42–74).

Reduced Surface Water (Factor E)

Current

A reduction in surface water could be caused by development activities (roads and infrastructure, which is often associated with mining in this region) and existing water diversions. These include wildlife guzzlers (discussed in the Panamint alligator lizard SSA, Appendix A (Service 2019)), but they also include activities that provide water for human consumption and are typically associated with various development activities. As discussed in the Panamint alligator lizard SSA, Appendix A (Service 2019), mining-related development, especially evidence of past activities, is prevalent in the region; however, current, active mines within and near the Panamint alligator lizard's range are few in number and geographically limited to a few discrete sites. Likewise, there are very few paved or improved dirt roads, and even the unimproved roads are sparse on the landscape; while roads can have an impact on surface flow, not all of them substantially affect surface flow. As such, overall impact to surface water within the species' range is limited. Existing energy-related infrastructure within the range of the species consists of one existing geothermal facility and linear features (pipelines, powerlines) that cross the area. The geothermal facility is geographically discrete and small compared to the species' range, and linear features are few with limited overall impact. For additional information, please see the Panamint alligator lizard SSA (Service 2019, pp. 42-44 and Appendix A).

Future

We identified supplemental hydration as an important need for the Panamint alligator lizard. Although areas with surface water are important to the species, individual Panamint alligator lizards do not appear to solely depend on those areas for hydration. That is, in some areas where the species occurs, the only water an individual Panamint alligator lizard is likely to encounter is from precipitation or condensation even in the absence of identified potential threats or direct impact to water resources. Thus, a reduction in surface water would have only a limited impact on individual Panamint alligator lizards' needs for supplemental water now or in the future. Moreover, anthropogenic activities that may result in a reduction of surface water are few and geographically limited within the range of the Panamint alligator lizard. We expect future impacts from these activities will be limited because of the amount of designated wilderness and other regulatory mechanisms that limit impacts in the region, nearly all of which is under Federal management. Therefore, the identified potential threat of reduced surface water is likely to only

affect a few individual Panamint alligator lizards at scattered locations and is not a threat to the species now or in the future throughout all of the species' range. For additional information on effects from reduced surface water into the future, please see the Panamint alligator lizard SSA (Service 2019, p. 62 and Appendix A).

Degraded Riparian Vegetation (Factor A)

Current

Riparian vegetation can be impacted by several possible sources. These include mining activities, other development (i.e., anthropomorphic activities such as roads), and agriculture, which can result in destruction of riparian plants (see Panamint alligator lizard SSA, Figure 13, Service 2019, p. 43). Additionally, they may also affect a site's hydrology, resulting in a reduction in surface flow, which can subsequently affect the quality or quantity of riparian vegetation by causing riparian plants to die or to become stressed. Other sources include grazing and browsing by livestock (primarily domestic cattle and sheep, and feral horses and burros), which can eat and trample riparian plants and alter an area's hydrology. Off-road vehicle (ORV) activity can crush riparian plants. Flash floods can physically destroy or remove (wash away) riparian plants or result in avulsive changes in a stream's channel, leaving existing stands of vegetation dewatered. Invasive, nonnative plants, such as tamarisk (*Tamarix* spp.), can replace native plant species that are likely to be superior as habitat to support the Panamint alligator lizard.

Reviewed in detail in the Panamint alligator lizard SSA, Appendix A (Service 2019), and summarized below, the following possible sources are currently making limited contributions to the identified potential threat of degraded riparian vegetation:

- Mining activities and other development activities are often concentrated in the canyon bottoms and valley floors, where riparian vegetation also grows. Once more common throughout the range of the Panamint alligator lizard, mining activity is now rare and typically localized on the landscape within the species' range, affecting a small amount of the region's riparian vegetation. Thus, these possible sources of impact are making limited contributions to the identified potential threat of degraded riparian vegetation.
- Agriculture (unauthorized marijuana cultivation) in the region occurs exclusively in riparian areas, where associated activities result in destruction of native riparian plants and, more importantly, can result in diversion of water, which can affect native riparian vegetation downstream. However, current levels of unauthorized marijuana cultivation are limited and very localized. This activity is making a limited contribution to the identified potential threat of degraded riparian vegetation.
- Grazing and trampling by feral and domestic livestock can have substantial impacts on riparian areas in particular. Although formerly more common throughout the Panamint alligator lizard's range, ongoing agency review and management on Federal land has reduced the level of impact and, as a result, has improved the quality and quantity of riparian vegetation throughout the species' range, although the amount of impact from feral equines is higher in the southern mountain ranges (Coso, Argus, and Panamint). Thus, grazing by domestic and feral livestock is affecting riparian areas within the species' range, but it is doing so only in localized areas and is subject to management to

reduce impacts; as such, grazing is making a limited contribution to the identified potential threat of degraded riparian vegetation.

- Flash flooding is affecting riparian areas within the species' range, but it is doing so only very locally and infrequently with temporary impacts throughout the species' range; as such, it is making a limited contribution to the identified potential threat of degraded riparian vegetation.

We now assess the extent to which this potential threat is currently resulting in an impact on the Panamint alligator lizard. Degraded riparian vegetation can impact the Panamint alligator lizard's habitat needs of microclimate refugia, hydration, and prey base, and the species' demographic needs of suitable levels of fecundity, individual survival, and abundance (see Panamint alligator lizard SSA, Figure 13, Service 2019, p. 43). Areas of riparian vegetation provide thermal and hydrological refugia; however, Panamint alligator lizards also occur in areas of talus. As such, areas of riparian vegetation are important sources of microclimate refugia for breeding and sheltering, but the species is not solely restricted to riparian areas and can find refugia in areas without riparian vegetation. The subsidizing nature of riparian areas also makes them important sources of food and water for Panamint alligator lizards, but similarly, they find sufficient resources in non-riparian areas to live and survive. This is exemplified by the apparent lack of any extirpations of local (canyon-scale) populations even where riparian vegetation has been severely impacted in the past. Thus, areas of riparian vegetation are important but not relied upon exclusively to provide the Panamint alligator lizard with its habitat and demographic needs. In the Panamint alligator lizard SSA (Service 2019, pp. 44–46 and Appendix A), we evaluated the potential impacts to riparian vegetation from a series of possible threats, including mining activities, other types of development, and agriculture. While these activities are occurring, their impacts are geographically limited and discrete within the range of the Panamint alligator lizard. Moreover, given that riparian vegetation is not the sole source of the species' needs, and given that the current extent of impacts to riparian vegetation are geographically limited in scope, the current level of loss and degradation of riparian vegetation from the identified threats from these specific stressors is likely to affect only a small number of Panamint alligator lizards rangewide.

Future

In the future, we expect the evaluated impacts are likely to continue but at a small scale given the remoteness of the area and because of implementation and enforcement of the existing regulatory mechanisms on Federal land (including nearly two-thirds designated Wilderness) that will help avoid and minimize potential impacts. These threats are currently only making a limited contribution to the degradation of riparian vegetation in the region and will likely make only limited contributions to the level of threat in the future.

Also, in the future, there is a potential for climate change to affect the amount of water at the sites that support riparian vegetation within the range of the Panamint alligator lizard. It is not clear, however, how much riparian vegetation will be impacted or how long such impacts might take. Reduced overall precipitation, if that occurs in the future, could be expected to degrade the quality and quantity of riparian vegetation. However, although future climate change-related impacts on riparian vegetation may be less geographically discrete than other impacts, we do not expect the level of impact to be a significant threat to the Panamint alligator lizard because

Panamint alligator lizards also occur in areas of talus, which is abundant, and also Panamint alligator lizard populations can survive in riparian vegetation that was degraded by very severe droughts, at least over the short term. For additional information, please see the Climate Change Effects section, below, and the Panamint alligator lizard SSA (Service 2019b, pp. 62–64).

Impacts to Refugia (Factor A)

Current

Degradation of riparian vegetation can affect Panamint alligator lizard refugia and contribute to the identified threat of impacts to refugia. Additionally, mining, other development (i.e., anthropomorphic activities such as roads), ORV activity, and flash floods may contribute directly to this threat (see Panamint alligator lizard SSA, Figure 13, Service 2019, p. 43). As discussed in the Panamint alligator lizard SSA (Service 2019, p. 46 and Appendix A), only flash flooding is likely to make a substantive contribution to this threat, but it is doing so only very locally and infrequently, and this is limited to those refugia that occur within the flood zone. However, Panamint alligator lizard refugia are not geographically limited to the flood zone or to riparian areas; they may also occur in other areas and in talus, in particular. There are many areas of talus in the rugged, rocky mountains where this species primarily occurs. While refugia are important components of the species' habitat needs that, in turn, allow for important demographic needs, refugia are not limiting on the landscape and do not occur only in areas that may be affected by flash floods or by the degradation of riparian vegetation. As such, the potential sources that currently may result in impacts to refugia are of small magnitude rangewide and are likely to only affect a small number of Panamint alligator lizards.

Future

Refugia are important because they are places where individual Panamint alligator lizards may seek protection from predators and extreme environmental conditions (particularly temperature and related desiccating effects). A subset of available refugia also serve as nest sites and hibernacula. The anticipated increase in environmental temperatures in the future (circa 50 years) may make the availability of suitable refugia more important to individual lizards. Although we know little about the specific qualities of the species' established refugia, it is likely that the rocky environment where the Panamint alligator lizard occurs offers many options for refugia. Sites with riparian vegetation will offer additional refugia options. We expect that the (often boulder-strewn) sites where this species typically occurs will provide enough refugia for the Panamint alligator lizard to meet its life-history needs, including nesting and hibernation. As a result, we do not expect impacts to refugia to be a significant threat to the Panamint alligator lizard either now or in the future. For additional information on future impacts to refugia, please see the Panamint alligator lizard SSA (Service 2019, pp. 60-61).

Crushing and Other Direct Mortality (Factor E)

Current

Individual Panamint alligator lizards have the potential to be crushed or otherwise directly killed by mining activity, other development (anthropomorphic activities such as roads), drowning in water diversion structures, ORV activity, flash flooding, and on-road vehicle activity (see the

Panamint alligator lizard SSA, Figure 13, Service 2019, p. 43). These threats are addressed in more detail in the Panamint alligator lizard SSA (Service 2019, Appendix A and pp. 46-47 (on-road vehicle activity)). Of the threats discussed in the Panamint alligator lizard SSA, Appendix A, flash flooding made a limited contribution to this threat, and impacts associated with flash floods are very local and infrequent. The other threats in Appendix A were found to be inconsequential. As discussed in the Panamint alligator lizard SSA (Service 2019, pp. 46-47 and Appendix A), Panamint alligator lizards are also known to have been run over by vehicles (both on- and off-road), though such events are likely very rare, impacting only the occasional individual. As a result, we do not expect crushing and other direct mortality to currently be a significant threat to the Panamint alligator lizard. For additional information, please see the Panamint alligator lizard SSA (Service 2019, pp. 46-47).

Future

As discussed in the Panamint alligator lizard SSA (Service 2019, p. 64 and Appendix A), there is a potential for an increase in the frequency of flash floods, which could result in an increase in the number of Panamint alligator lizard deaths. However, this possible increase is not certain and the frequency of flash floods occurring in a particular canyon is rare. Additionally, crushing and other direct causes of mortality of Panamint alligator lizards in the future are expected to be geographically localized or temporally rare. As a result, we do not expect crushing and other direct mortality to be a significant threat to the Panamint alligator lizard either now or in the future.

Collecting (Factor B)

Current

As discussed in the Panamint alligator lizard SSA (Service 2019, pp. 47-48), collecting for commercial, recreational, scientific, or educational purposes has been suggested in the literature as a possible impact to the Panamint alligator lizard (Mahrdt and Beaman 2002, p. 3; Mahrdt and Beaman 2009, p. 491, Yasuda 2015, p. 49). While Yasuda (2015, p. 49) notes that some unauthorized collecting has occurred, it is not clear how frequently it happens. Clause *et al.* (2015, 14th–16th pages (unpaginated)) report finding little in the way of large-scale collecting infrastructure (cover boards, pitfall traps) during recent fieldwork, although such items have been noted in the past (Morafka *et al.* 2001, 4th page (unpaginated)). Clause *et al.* (2015, 15th page (unpaginated)) also failed to find any Panamint alligator lizards for sale from on-line sources, suggesting a limited market. Thus, if unauthorized collecting is occurring, it does not appear to be frequent at the current time. Moreover, Panamint alligator lizards continue to be comparatively easily found at the most readily accessible and widely known site, which is where the effects of over-collection (if it were occurring) would presumably be the most noticeable (Clause *et al.* 2015, 15th page (unpaginated)). Thus, only a small number of Panamint alligator lizards, at most, are being affected by unauthorized collecting, and those impacts are localized.

Future

We concluded that current levels of collecting, regardless of purpose, are affecting a small number of Panamint alligator lizards at only a few locations. As discussed in the Panamint alligator lizard SSA (Service 2019, p. 64), because of existing regulatory mechanisms currently

being implemented by the State and by Federal landowners, we expect future legal collecting to occur at sustainable levels. While it is difficult to predict future unauthorized activities, the available information suggests that past unauthorized collecting activities were limited. There is nothing at this point to suggest that the levels of unauthorized collection will substantially increase in the future. Thus, we do not expect future collecting activities, for whatever reason, will be substantially larger than current levels. We found no information indicating that collecting has led to the loss of populations or a significant reduction in the numbers of individuals for this species. Therefore, we do not expect that collecting to be a significant threat to the Panamint alligator lizard, nor is it likely to become a concern in the future.

Disease (Factor C)

Current

As discussed in the Panamint alligator lizard SSA (Service 2019, p. 48), some level of disease is undoubtedly natural in the Panamint alligator lizard; however, no ailments or afflictions have been found to have a population-level effect on the species (Morafka *et al.* 2001, 4th page (unpaginated); Clause *et al.* 2015, 16th page (unpaginated); Yasuda 2015, p. 19). Therefore, the current impacts of disease are likely affecting only a few Panamint alligator lizards and it is not a current threat to the species.

Future

As discussed in the Panamint alligator lizard SSA (Service 2019, p. 65), some diseases have been known to have significant impacts on other reptile species (Gibbons *et al.* 2000, pp. 657–658; Lorch *et al.* 2015, entire), and climate change might possibly increase the risk of a pathogen becoming a significant problem (Wake 2007, entire; Bickford *et al.* 2010, p. 1050). However, there is little to suggest that future impacts from disease are likely to occur. Therefore, we do not expect disease to be a significant threat to the Panamint alligator lizard in the future.

Predation (Factor C)

Current

Panamint alligator lizards are subject to some level of natural predation by a variety of animals. Additionally, some level of cannibalism also probably occurs in Panamint alligator lizard populations. While there are no quantified data for the Panamint alligator lizard, there is no information suggesting that the level of predation on Panamint alligator lizards has changed significantly over time, nor does predation appear to have caused any reduction in Panamint alligator lizard populations (Morafka *et al.* 2001, 4th page (unpaginated); Clause *et al.* 2015, 16th page (unpaginated)). Therefore, the current level of predation does not appear to be substantially above natural levels. For additional information, please see the Panamint alligator lizard SSA (Service 2019, p. 48).

Future

It is possible the level of predation could increase in the future. If the amount of human activity were to increase in the region, the number of subsidized predators (such as common ravens and coyotes) could also increase. However, due to the high amount of Federal ownership and

extremely low level of private ownership within the Panamint alligator lizard's range, it is unlikely that the amount of human habitation will increase over the next 40 years or more. Therefore, there is little to suggest that predation pressure in the future will exceed the level the Panamint alligator lizard is already facing. As a result, we do not expect predation to be a significant threat to the Panamint alligator lizard either now or in the future. For additional information on effects from future predation, please see the Panamint alligator lizard SSA (Service 2019, p. 65).

Barriers to Dispersal (Factor E)

Current

Dispersal is important to the Panamint alligator lizard at the individual, population, and species levels. Something that prevents dispersal-related movement would be a barrier. Barriers may be physical (like a wall) or conditional (such as adverse environmental conditions). Panamint alligator lizards are typically faced with few natural physical barriers that would have a population-level effect (although a given individual at a particular site might face an insurmountable physical barrier that may limit its ability to disperse). As noted in the Panamint alligator lizard SSA, Appendix A (Service 2019), and above, we do not consider roads and vehicular traffic to be physical barriers. Under current conditions, there is little to suggest that conditional barriers occur for long enough periods of time to prevent dispersal-related movement; that is, seasonal conditions (typically during spring and autumn) are, on average, of adequate duration and quality for dispersal. This is exemplified by populations persisting in areas that have been subject to severe disturbance (such as historical mining, flash floods). Therefore, under current conditions, the identified potential threat of barriers to dispersal is not a threat to the Panamint alligator lizard. For additional information, please see the Panamint alligator lizard SSA (Service 2019, pp. 48-49).

Future

Under current conditions, we concluded that any potential barriers are unlikely to be a threat to the Panamint alligator lizard. As discussed in the Panamint alligator lizard SSA (Service 2019, p. 65), there is little to suggest that in the future conditions will be such that the identified potential threat of barriers to dispersal will be of sufficient magnitude to substantially affect the species. As a result, we do not expect barriers to dispersal to be a significant threat to the Panamint alligator lizard either now or in the future.

Small Population Effects (Factor E)

Current

Panamint alligator lizards are not evenly distributed across the landscape. Preliminary results from a recent genomic study indicate that the Panamint alligator lizard occurs as a number of genetically distinguishable groups (Toffelmier and Shaffer 2017, entire). We have no data on the number of Panamint alligator lizards in any of these groups at this time, but it seems unlikely that the effective population size of any of the interbreeding populations is in the thousands (Service 2019, pp. 49-51).

The pattern of distribution of the Panamint alligator lizard has suggested to many authors that the species may be susceptible to the deleterious effects of small population size. However, the available information, although limited and not without uncertainties, suggests that there is some natural gene flow, at least between neighboring canyon-scale populations within a mountain range, although it occurs rarely and appears to decrease with distance. The available information also suggests that there is virtually no gene flow between mountain-range-scale populations, seemingly a natural condition. The available information further suggests that the effective population sizes are probably smaller than what is considered to be sufficient to maintain evolutionary potential over the long term. Panamint alligator lizard populations could be affected by random deleterious effects associated with small population size. However, there is little to suggest that these populations are suffering from those effects or have suffered from them over the approximately 60 years since the species was discovered. For additional information, please see the Panamint alligator lizard SSA (Service 2019, pp. 49-51).

Future

In the future, it is likely that these populations will continue to remain small and will continue to be more susceptible to the random intrinsic forces and factors that may negatively affect small populations. However, because these forces and factors are primarily the result of random events, it is not clear whether or to what extent they will manifest themselves on the Panamint alligator lizard in the future. As a result, we do not have information to suggest or support that small population effects are currently a significant threat to the Panamint alligator lizard or likely to be one in the future. For additional information on effects of small population size into the future, please see the Panamint alligator lizard SSA (Service 2019, pp. 65-66).

Climate Change Effects (Factor A)

Current

As discussed in the Panamint alligator lizard SSA (Service 2019, pp. 51-52), there is some evidence to suggest that the region's temperatures have increased over the past several decades; for example, Gonzalez (2016, entire), although short on details, reported a statistically significant increase of 1.3 ± 0.5 °C/100 yr. (2.3 ± 0.9 °F/100 yr.) for Death Valley National Park for the period 1950–2010. As discussed in detail in the Climate Change Effects section under the Future Conditions and Status section of the Panamint alligator lizard SSA, other authors have also noted similar temperature increases in the greater Mojave Desert region over the 20th century (Service 2019, pp. 55–62). Although these increases may potentially have occurred as a result of global climate change, the cause and effect relationship for this observed increase is not yet clear. There is little information to suggest that these noted temperature increases or any other climate change effects are currently having a substantial impact on the Panamint alligator lizard or its habitat. We expect any effects associated with global climate change, should they occur, would manifest themselves more fully in the future. Thus, we do not address potential effects associated with global climate change in this section, but in the Future section, below.

Future

We discuss in detail in the Panamint alligator lizard SSA (Service 2019, pp. 55–62) the anticipated effects to the species and its habitat that may result from projected changes in the

global climate. We anticipate that global climate change may potentially contribute to or exacerbate existing potential threats. Some of the potential impacts are discussed in the threat discussions of the preceding sections. Additionally, effects associated with climate change may serve as stressors affecting the habitat requirements of the species, including the need to have suitable microclimate refugia and nest sites, the need to have a sufficient prey base, and the need to have periods of moderate environmental conditions. The anticipated increase in environmental temperatures may make the availability of suitable refugia more important in the future; however, we expect that the often boulder-strewn sites where the Panamint alligator lizard typically occurs will provide enough refugia for the species to meet its life-history needs, including nesting and hibernation.

Anticipated changes in future environmental conditions will likely have some effect on insect abundance and timing (Kingsolver *et al.* 2011, entire), but it is not clear the extent to which this will occur in the Panamint alligator lizard's range. Given that the environmental conditions that drive prey availability are naturally variable in the region, alterations due to climate change would likely need to be pronounced to have a long-term population-level effect on the Panamint alligator lizard; we do not expect that level of change in the next 50 years or so. Moreover, the Panamint alligator lizard's behavioral flexibility suggests that its ability to hunt will not be dramatically affected by increasing environmental temperatures. Therefore, we do not expect future climate change to be a substantial threat to Panamint alligator lizard's ability to forage.

The anticipated increase in environmental temperatures due to effects associated with climate change has the potential to affect the timing and duration of periods of moderate environmental conditions (primarily temperature), which are important for Panamint alligator lizard survival and dispersal. It is likely that seasonal temperature regimes will shift temporally, and probably include an upward elevational shift. Over most of the Panamint alligator lizard's range, the species occurs on the low-to-mid elevation portions of mountain ranges. As such, the species has the potential to shift upwards as the moderate environmental conditions shift, although it is difficult to quantify such shifts from the available information. However, despite the uncertainties, the Panamint alligator lizard appears to have life history and geographical options that may allow it to cope with changing environmental conditions, especially in the higher elevation mountain ranges. As such, we do not expect the species' survival and dispersal abilities will be substantially affected by future climate change. For additional discussion of threats related to the effects of climate change, see the Panamint alligator lizard SSA (Service 2019, pp. 55-62).

The Inadequacy of Existing Regulatory Mechanisms (Factor D)

We consider relevant Federal, State, and tribal laws and regulations when evaluating the status of the species. Only existing ordinances, regulations, laws, etc., that have a direct connection to a threat are applicable. In the Panamint alligator lizard SSA, we identified the regulatory mechanisms (i.e., Wilderness Act, National Environmental Policy Act, Federal Land Policy and Management Act of 1976, Organic Act of 1916, National Forest Management Act and others) that have been implemented and assist in alleviating the identified threats (Service 2019, Appendix B). We did not identify any data suggesting that any of these regulatory mechanisms

are inadequate, or that they are being inadequately implemented with respect to the Panamint alligator lizard's conservation status. As a result, we do not consider the existing regulatory mechanisms to be inadequate. See the Panamint alligator lizard SSA for a complete discussion of threats and regulatory mechanisms ((Evaluated Threats) Service 2019, pp. 42-74) and ((Existing Regulatory Mechanisms and Conservation Measures) Service 2019, Appendix B).

Cumulative Effects

Many of the sources and threats are closely allied and have the potential to work in combination. In particular, mining, other development, water diversions, and agriculture can all impact the amount or availability of surface (or near-surface) water, which can in turn affect riparian vegetation. Although the Panamint alligator lizard is known to occur in talus areas, water and the riparian vegetation it supports are also important habitat resources for the Panamint alligator lizard. Although the non-climate change related threats could work together in combination, there is little to suggest that anything more than a few individuals are currently being affected by reduced availability of surface water. As discussed in the individual sections above, it is possible that a reduction in precipitation and an increase in temperatures, as anticipated under future climate change, could work in combination with the other threats. While there is uncertainty in future climate change-related effects, none of the impacts, even when combined, are anticipated to have a substantial impact on the Panamint alligator lizard or its habitat in the next half-century or so. For additional information, see the Panamint alligator lizard SSA (Service 2019, pp. 42–74).

Uncertainties

There is much that we do not know about the Panamint alligator lizard because the region where it occurs is rugged and remote, with very little of its range easily accessible. This inaccessibility (1) has limited the level of scientific inquiry on the species, and (2) has limited the amount of up-to-date on-the-ground information on potential activities or threats impacting the species throughout its range. On the other hand, this inaccessibility also has limited the quantity and magnitude of anthropogenic threats in the region. We know a good deal more about the management environment within the species' range. About 98.7 percent of the range is federally owned (Table 1). All of the Federal landowners have existing guidance documents, which are derived from or implement existing regulatory mechanisms (see the Panamint alligator lizard SSA, Appendix B (Service 2019)). These guidance documents include measures that directly or indirectly benefit the Panamint alligator lizard or its habitat through avoidance, minimization, or other conservation measures.

Summary of Current Condition and Threats

The Panamint alligator lizard first became known to science in the 1950s. The species is known to be distributed across six desert mountain ranges in Mono and Inyo Counties, in eastern California: the White, Inyo, Nelson, Coso, Argus, and Panamint Ranges. The species' range spans two major ecoregions: the White and Inyo mountain ranges are in the Great Basin (in the north); the remaining mountain ranges are in the Mojave Desert (in the south). The White, Inyo,

and Panamint Ranges achieve high elevations (more than 11,000 feet (3,350 meters)), while the Nelson, Coso, and Argus ranges attain more modest heights (about 7,700 to 8,800 feet (2,350 to 2,680 meters)).

The species occurs nearly entirely on Federal lands; moreover, 64.7 percent of its range is designated as Wilderness (see the Panamint alligator lizard SSA, Table 3, Service 2019, p. 29). Some of the potential threats identified above (see also the Panamint alligator lizard SSA, Figure 13, Service 2019, p. 43) used to affect the species at a higher magnitude or had a greater likelihood of occurring in the past; however, the identified threats (i.e., reduced surface water, degraded riparian vegetation, impacts to refugia, crushing and other direct mortality, collecting, disease, predation, barriers to dispersal, small population effects and climate change) are currently only affecting small numbers of individuals, are highly localized in their effects, or both. The effects of the potential sources and threats under current conditions have little effect on the species' habitat and demographic needs (see the Panamint alligator lizard SSA, Figure 14, Service 2019, p. 54).

Data on the species' population size are insufficient to indicate any population trend. None of the Panamint alligator lizard populations (mountain-range-scale or canyon-scale) are known to have suffered extirpation, although we have no recent data for two mountain-range-scale populations, and we presume them to be extant (see Panamint alligator lizard SSA, Table 2, Service 2019, p. 29). The current information indicates that the species uses a wider variety of habitats than once thought; that is, Panamint alligator lizards are not solely restricted to the region's few, isolated riparian areas. Genetic data suggest there is low-level gene flow between neighboring (canyon-scale) populations, indicating that a small amount of dispersal (immigration, emigration) is successfully occurring between nearby populations.

Summary of Future Condition and Threats

Similar to current conditions, future conditions for the Panamint alligator lizard will continue to hinge upon the remoteness of the area and the existing regulatory mechanisms governing or implemented by the various Federal agencies that own and manage nearly all of the species' range. While there could be some changes in this regulatory environment in the future, we expect them to be minor with respect to the future physical environment within the region. In all, as discussed in greater detail in the Panamint alligator lizard SSA, we expect future impacts from non-climate-change-related sources and threats such as mining, livestock grazing, ORV activity, collecting, disease, predation and off road vehicles and barriers to dispersal (see the Panamint alligator lizard SSA Figure 14, Service 2019, p. 54), to be geographically limited or to impact only a few Panamint alligator lizard individuals. The other non-climate-change-related sources and threats are related to water and its influence on the species' habitat, including other development activities, water diversions, and agriculture (unauthorized cannabis cultivation) influencing reduced surface water and degraded riparian vegetation (see the Panamint alligator lizard SSA Figure 14, Service 2019, p. 54). These have the potential to affect larger areas of Panamint alligator lizard habitat over time, especially when down-stream effects are considered, but the species is not restricted to areas of riparian vegetation; as such, the effects are not expected to be substantial at the species-level.

In the future, climate change has the potential to exacerbate many of the other possible threats to the species. The expected increase in temperatures and the uncertain status of future precipitation may contribute to changes to the amount and timing of surface and groundwater availability, including flash floods. These, in turn, have the potential to result in the loss or degradation of riparian vegetation, but it will likely take decades before the effects are manifested and Panamint alligator lizards are flexible and malleable to harsh conditions. While climate change impacts could occur over time, the severity or likelihood of these potential future impacts is not expected to adversely affect the overall viability of the species. We examine the possibilities in detail in the Panamint alligator lizard SSA (Service 2019, pp. 42–74).

CONSERVATION MEASURES PLANNED OR IMPLEMENTED

We are not aware of any species-specific plans or conservation measures for the Panamint alligator lizard. Most of the Panamint alligator lizard range is remote with little in the way of human settlement and no areas of significant urbanization. The vast majority (98.7 percent) of the Panamint alligator lizard range occurs on Federal Land. Federal landowners have existing guidance documents that are derived from or implement existing regulatory mechanisms. These guidance documents include measures that indirectly benefit the Panamint alligator lizard or its habitat through impact avoidance, minimization, or other conservation measures. The Panamint alligator lizard SSA, Appendix B (Service 2019), discusses the existing regulatory mechanisms that currently manage and protect Federal and State lands.

Due to management actions on Federal lands and existing regulatory mechanisms, some threats associated with habitat loss (i.e., mining, ORV, crushing and other direct mortality, grazing, reduced surface water and development) currently acting on the Panamint alligator lizard and its habitat are reduced compared to the past and do not have a population- or species-level impact either singly or in combination, either now or into the future. For additional information on existing regulatory mechanisms, please see Appendix B of the Panamint alligator lizard SSA (Service 2019).

RESILIENCY, REDUNDANCY, AND REPRESENTATION

As discussed in more detail in the Panamint alligator lizard SSA (Service 2019, pp. vii–viii), we use the principles of resiliency, redundancy, and representation (the 3R's) as a lens to evaluate current and future effects to the Panamint alligator lizard. Resiliency describes the ability of a species to withstand stochastic disturbance. Resiliency is positively related to population size and growth rate, and may be influenced by connectivity among populations. Generally speaking, populations need abundant individuals within habitat patches of adequate area and quality to maintain survival and reproduction in spite of disturbance. Redundancy describes the ability of a species to withstand catastrophic events. It is about spreading risk among multiple populations to minimize the potential loss of the species from catastrophic events. Redundancy is characterized by having multiple, resilient populations distributed within the species' ecological settings and across the species' range. It can be measured by population number, resiliency, spatial extent, and degree of connectivity. Representation describes the ability of a species to adapt to changing

environmental conditions overtime. It is characterized by the breadth of genetic and environmental diversity within and among populations. Measures may include the number of varied niches occupied, the gene diversity, and heterozygosity of alleles per locus. For additional information related to the following discussions, please see the Panamint alligator lizard SSA (Service 2019, pp. vii-viii, 68-74).

Resiliency

While the quality of the available site-specific detection data is inconsistent and largely anecdotal or derived from non-systematic surveys, the lack of any known extirpations suggests the Panamint alligator lizard is currently resilient, even at the smaller canyon scale. They have continued to survive on the landscape and appear to be adaptable to naturally changing conditions. The Panamint alligator lizard currently occurs and survives in areas that get very cold in the winter and very hot in the summer, far outside the limits of its preferred body temperature range. The Panamint alligator lizard survives these temperature extremes through its behavior. For example, it uses microhabitat refugia to avoid extreme conditions, it hibernates in the winter, and it is known to shift its daily behavior patterns (such as, switching between diurnal and nocturnal activity in response to changes in temperature). Thus, resiliency in the Panamint alligator lizard does not appear to have decreased since the species was discovered a half-century ago.

In the future, anticipated changes in the climate may result in less snow (due to increasing temperatures) and more variability in precipitation in general. We expect this could, over time, reduce the amount of groundwater, but it is unclear how long that will take or how much groundwater levels may decline. A reduction in groundwater, in turn, could reduce the quantity or quality of riparian vegetation, and thereby reduce the quality of this habitat for Panamint alligator lizards living there. Thus, through this pathway, climate change may affect Panamint alligator lizard productivity in riparian areas, reducing the area's value as (1) habitat for producing potential source populations and (2) potential macrohabitat refugia. This could lower the resiliency of the various Panamint alligator lizard populations affected.

While we anticipate the effects of climate change to occur throughout the range of the species, we expect the hydrology that supports Panamint alligator lizard habitat in riparian vegetation could be less affected in the higher elevation mountain ranges. This is because higher elevation mountains would be expected to capture more precipitation from passing storms. Moreover, climate change could be expected to have greater effects in the lower elevation mountains. This is because there appears to be fewer Panamint alligator lizard canyon-scale populations in the lower elevation mountains, and broadly speaking, most of them appear to be smaller in numerical size when compared to the canyon-scale populations in the higher elevation mountain ranges. While the level of survey effort is not consistent throughout the species' range, this pattern suggests that there are a greater number of resilient canyon-scale populations in the higher elevation mountains, and the populations in the lower elevation mountains are starting from a lower resiliency baseline.

Additionally, the canyon-scale populations in the higher elevation mountains have the potential

to maintain resiliency by shifting their distribution upward as temperatures increase. While the anticipated future climate-related impacts to riparian vegetation could affect the Panamint alligator lizards living in riparian areas, Panamint alligator lizards also occur in talus areas. It is less clear what impacts climate change could have on Panamint alligator lizards living in those areas. Panamint alligator lizards could continue to use those areas as well, regardless of the mountain range's peak elevation. If climate change disproportionately affects the Panamint alligator lizard populations in the lower elevation mountains, then the species could potentially move upwards in elevation, although the timing of this is uncertain. Nevertheless, despite these potential future changes in climate, we expect there will continue to be multiple resilient canyon-scale populations spanning the north-south range of the species.

Redundancy

At the species level, redundancy in the Panamint alligator lizard is illustrated by four of the six mountain ranges having more than one canyon-scale population. Although the number of interbreeding populations in a given mountain range is unclear, genetic data indicates that there is some connectivity (albeit low-level) between neighboring canyon-scale populations and confirming that individuals can and do disperse over areas greater than just within a given canyon. Two mountain ranges are known to have only one canyon-scale population each, although this may emphasize the species' secretive nature more than its actual distribution. The species' secrecy might also mean that there are more populations than are currently known. If that should be the case, the species' level of redundancy would be higher than is currently known. In any case, as noted above, no Panamint alligator lizard populations have been extirpated since the 1950s when the species was discovered, and there is no information to suggest that it suffered substantial losses prior to that. This suggests that the species' levels of redundancy have not decreased over the past half-century or so. Additionally, as discussed in the Resiliency section above, we expect there will continue to be multiple resilient canyon-scale populations in the future, despite the potential effects of climate change. This would provide continued species-level redundancy, albeit possibly at a lower level than today.

Representation

As discussed in detail in the Panamint alligator lizard SSA (Service 2019, pp. vii-viii), the representation of the Panamint alligator lizard is portrayed by its genetic variation across six mountain ranges that exhibit a north-south environmental gradient from the Great Basin ecoregion in the north to the Mojave Desert ecoregion in the south. Like in redundancy, the lack of past extirpations suggests that the species' levels of representation has not decreased over the past half-century. Also as previously noted, in the future we expect Panamint alligator lizard populations will continue to occur across most of the species' geographical range, including across the north-south environmental gradient that transitions from the Great Basin to the Mojave Desert. Similarly, we expect there will continue to be species-level representation, but like redundancy, also possibly at a lower level than today. While the possible losses of some of the canyon-scale populations could result in a loss of representation, some level of representation will be maintained over most of the species' range.

3Rs Summary

In sum, there are few current threats to the species. While there could be some impacts to the species through time, the effects of which could be especially apparent in the lower elevation mountains, we expect there will continue to be multiple resilient canyon-scale populations, providing continued but reduced redundancy. We also expect that Panamint alligator lizard populations will continue to occur across most of the species' geographical range, including across the north-south environmental gradient that transitions from the Great Basin to the Mojave Desert. While possible losses of some of the canyon-scale populations could result in a loss of representation, some level of representation will be maintained over most of the species' range. Therefore, we conclude the species is viable and will continue to be viable in the future. For additional information, see the Panamint alligator lizard SSA (Service 2019, pp. vii–viii).

FINDING OR DETERMINATION

Determination of Species Status

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species meets the definition of "endangered species" or "threatened species." The Act defines an "endangered species" as a species that is "in danger of extinction throughout all or a significant portion of its range," and a "threatened species" as a species that is "likely to become an endangered species within the foreseeable future, throughout all or a significant portion of its range." The Act requires that we determine whether a species meets the definition of "endangered species" or "threatened species" because of any of the following factors:

(A) The present or threatened destruction, modification, or curtailment of its habitat or range;
(B) Overutilization for commercial, recreational, scientific, or educational purposes;
(C) Disease or predation;
(D) The inadequacy of existing regulatory mechanisms; and
(E) Other natural or manmade factors affecting its continued existence.

Determination of Status Throughout All of Its Range

We have carefully assessed the best scientific and commercial information available regarding the past, present, and future threats to the Panamint alligator lizard. Potential threats which may affect the Panamint alligator lizard or its habitat include reduced surface water (Factor E), degraded riparian vegetation (Factor A), impacts to refugia (Factor A), crushing and other direct mortality (Factor E), collecting (Factor B), disease (Factor C), predation (Factor C), barriers to dispersal (Factor E), small population effects (Factor E), climate change (Factor A), the inadequacy of existing regulatory mechanisms (Factor D) and cumulative effects. As described in the Panamint alligator lizard SSA (Service 2108, pp. 68–74), we also examined three possible scenarios to give an idea of the breadth of possible future outcomes for the viability of the Panamint alligator lizard. For these scenarios, we chose a forecast timeframe of 50 years because that is long enough to capture the temporal range of the available climate model projections;

however, beyond that timeframe, the level of uncertainty becomes high, making predictions of the future less dependable. In addition, we expect that a timeframe of 50 years in the future will encompass similar variability for the species and its environment as 50 years in the past.

Regarding cumulative effects, there are potential threats that may act together in combination to affect the Panamint alligator lizard at certain sites. The vast majority of the species' range is also under Federal control and threats affecting the Panamint alligator lizard have been reduced and are anticipated to continue to be reduced by existing management practices by the Federal land management agencies. These actions are anticipated to provide indirect benefits to Panamint alligator lizard by maintaining the quality of habitats used by the species. We conclude that the magnitude of effects to the Panamint alligator lizard is low overall for current threats, and low to potentially moderate for future climate change threats.

All threats are acting on the Panamint alligator lizard currently and into the future are on the individual animal level except for climate change, which may affect the lower elevation mountain ranges (Coso, Argus and Nelson) at the individual or potentially the population levels in the future. However, climate change is not likely to adversely affect the overall viability of the Panamint alligator lizard due to the Panamint alligator lizard's behavioral flexibility and its ability to survive and meet its resource needs in an already extreme environment (temperature and water availability). Ongoing Federal land management actions and existing regulatory mechanisms, which include at least 98.7 percent of the Panamint alligator lizard's range, will continue to ameliorate threats and protect the Panamint alligator lizard and its habitat now and into the foreseeable future. The overall redundancy of the Panamint alligator lizard will be protected from future climate change due to the populations being distributed over six mountain ranges, which improves the ability of the Panamint alligator lizard to withstand small-scale threats, as well as catastrophic events. Having populations located at different sites in six mountain ranges gives the Panamint alligator lizard some level of redundancy and representation which can help it to adapt to changing environmental conditions into the future associated with climate change. Over time, the Panamint alligator lizard could potentially be adversely affected in one or more of the lower elevation mountain ranges because the environmental effects of increased temperatures and reduced or changed precipitation patterns are most likely to have a greater impact in these areas. The Panamint alligator lizards in the three high elevation mountain ranges are less likely to be affected by future climate change and are expected to remain viable (i.e., continue to retain resiliency, representation and redundancy). The high and low elevation mountain ranges span the north-south ecological gradient throughout the species' range (Service, 2019, pp. 42-74). Based on our review of the best available scientific and commercial information pertaining to the five factors, we find that the threats acting on the species and its habitat, either singly or in combination, are not of sufficient imminence, intensity, or magnitude to indicate that the Panamint alligator lizard is in danger of extinction (an endangered species) throughout all of its range, or likely to become endangered within the foreseeable future (a threatened species) throughout all of its range. This finding is based on our conclusion, after taking into consideration those efforts to protect the species, that the Panamint alligator lizard is viable and will continue to be viable in the future.

Because we determined that the Panamint alligator lizard is not in danger of extinction or likely

to become so in the foreseeable future throughout all of its range, we will consider whether the Panamint alligator lizard is in danger of extinction now or likely to become so in the foreseeable future throughout a significant portion of its range.

Determination of Status Throughout a Significant Portion of Its Range (SPR)

Under the Act and our implementing regulations, a species may warrant listing if it is in danger of extinction or likely to become so in the foreseeable future throughout all or a significant portion of its range. Having determined that the Panamint alligator lizard is not in danger of extinction now or likely to become so in the foreseeable future throughout all of its range, we now consider whether it may be in danger of extinction or likely to become so in the foreseeable future in an SPR. The range of a species can theoretically be divided into portions in an infinite number of ways, so we first screen the potential portions of the species' range to determine if there are any portions that warrant further consideration. To do this we look for portions of the species' range for which there is substantial information indicating that: (1) the portion may be significant, and (2) the species may be in danger of extinction or likely to become so in the foreseeable future in that portion. No portion would warrant further consideration if, for that portion, either one of these initial elements is not present. Therefore, if we determine that either of the initial elements is not present for a particular portion of the species' range, then the species does not warrant listing because of its status in that portion of its range.

We emphasize that the presence of both of the initial elements is not equivalent to a determination that the species should be listed—rather, it is a determination that a portion warrants further consideration. If we identify any portions that meet both of the initial elements, we conduct a more thorough analysis to determine whether the portion does indeed meet both of the SPR standards: (1) the portion is significant and (2) the species is in danger of extinction or likely to become so in the foreseeable future in that portion. Confirmation that a geographic area does indeed meet one of these standards (either the portion is significant or the species is endangered or threatened in that portion of its range) does not create a presumption, prejudgment, or other determination as to whether the species is endangered or threatened in a significant portion of its range. Rather, we must then undertake a more detailed analysis of the other standard to make that determination. If the portion does indeed meet both SPR standards, then the species is endangered or threatened in that significant portion of its range.

At both stages in this process—the stage of screening potential portions to identify any portions that warrant further consideration and the stage of undertaking the more-detailed analysis of any portions that do warrant further consideration—it might be more efficient for us to address first the "significance" question or the "status" question. Our selection of which question to address first for a particular portion depends on the biology of the species, its range, and the threats it faces. Regardless of which question we address first, if we reach a negative answer with respect to the first question that we address, we do not need to evaluate the second question for that portion of the species' range.

In the first stage of the process described above, the stage of screening potential portions to identify any portions for which both of the initial elements are present, we ask whether there is

substantial information indicating that a species may be in danger of extinction or likely to become so in the foreseeable future in any portion of its range that may be significant. The Service's most-recent definition of "significant" has been invalidated by the courts (for example, *Desert Survivors v. Dep't of the Interior*, No. 16-cv-01165-JCS (N.D. Cal. Aug. 24, 2018)). Therefore, we screen for the first prong (identifying portions that may be significant) by looking for portions of the species' range that could be significant under any reasonable definition of "significant." To do this, we look for any portions that may be biologically important in terms of the resiliency, redundancy, or representation of the species. To screen for the second prong (identifying portions where the Panamint alligator lizard may be in danger of extinction or likely to become so in the foreseeable future), we consider whether the threats are geographically concentrated in any portion of the species' range at a biologically meaningful scale. If a species is not in danger of extinction or likely to become so in the foreseeable future throughout all of its range and the threats to the species are essentially uniform throughout its range, then the species would not have a greater level of imperilment in any portion of its range than it does throughout all of its range and therefore no portions would qualify as an SPR.

After reviewing the biology of the species and potential threats, we have identified a portion for which both initial elements may be present (i.e., the species may be in danger of extinction or likely to become so in the foreseeable future, and the portion may be significant).

Screening Analysis

For Panamint alligator lizard, we chose to evaluate the status screening question first (i.e., identifying portions where the Panamint alligator lizard may be in danger of extinction or likely to become so in the foreseeable future). We first considered whether any of the identified threats are geographically concentrated in a portion of the Panamint alligator's range. We found that the threat of climate change effects may have a disproportionate impact on the species in the three lower elevation mountain ranges, compared to the populations in the higher elevation mountain ranges.

As discussed in detail in the Panamint alligator SSA, we noted that the future effects associated with climate change may have a disproportionate impact on the Panamint alligator lizard in the lower elevation mountain ranges (Service 2019, pp. 42–74). Over time, the Panamint alligator lizard could potentially be adversely affected in one or more of the lower elevation mountain ranges because the environmental effects of increased temperatures and reduced or changed precipitation patterns are most likely to have a greater impact in these areas. The lower elevation mountains are at greater risk of increased temperatures and evaporation, and because the lower mountains do not capture as much precipitation, they are also more susceptible to drought conditions. This could adversely affect riparian vegetation in those mountains because they are predominantly spring-fed. There are fewer Panamint alligator lizard occurrences and seemingly, smaller populations detected in the lower elevation mountain ranges. Thus, there is information indicating that threats hypothetically could have a greater impact in the lower elevation mountain ranges (the Coso, Argus, and Nelson Mountains), suggesting that the species may be in danger of extinction there in the future, depending on the type and severity of the climate change impacts.

We next turn to a detailed analysis of whether the species is in danger of extinction or likely to become so in the foreseeable future in this portion and, if so, whether the portion meets the definition of "significant" described above.

Analysis of Status

We determine the status of the species in a portion of its range the same way we determine the status of a species throughout all of its range. In order to examine the species status, we will consider whether threats are reasonably likely to affect the species in that portion to such an extent that the species is in danger of extinction or likely to become so in the foreseeable future in that portion. We can accomplish this by considering the level of effects of the threats on the species that are concentrated in that portion.

Based on the best available scientific information, we do not think that climate change is reasonably likely to affect the Panamint alligator lizard in the lower elevation mountain ranges to such an extent that the species is in danger of extinction or likely to become so in the foreseeable future (50 years) in the lower elevation mountain ranges for the following reasons: 1) the habitat alterations due to climate change would likely need to be pronounced to have a long-term population-level effect on the Panamint alligator lizard in the lower elevation mountain ranges, and based on climate change forecast projections we do not expect that level of change in the next 50 years; 2) the Panamint alligator lizard is also not entirely dependent on riparian habitat and can occur in talus habitat (which is abundant in the lower elevation mountain ranges); 3) the Panamint alligator lizard has demonstrated that it can survive extreme environmental conditions; and 4) the Panamint alligator lizard appears to have life-history and geographical options that allow it to cope with changing environmental conditions through its behavioral flexibility. Therefore, we expect that it will continue to survive and respond to climate change through changes in its behavior. Based on climate change models, trends and projections, we expect the Panamint alligator lizard would continue to occur in the lower level mountain ranges 50 years into the foreseeable future. Therefore, the best scientific and commercial information available indicates that the species is not in danger of extinction or likely to become so in the foreseeable future in that portion. As a result, we did not need to determine whether the portion is significant.

Determination of Status

Our review of the best available scientific and commercial information regarding the past, present, and future threats to Panamint alligator lizard indicates that the Panamint alligator lizard is not in danger of extinction nor likely to become endangered within the foreseeable future throughout all or a significant portion of its range. Therefore, we find that listing the Panamint alligator lizard as an endangered or threatened species under the Act is not warranted at this time.

COORDINATION WITH STATES

In preparing this finding, we coordinated with the California Department of Fish and Wildlife (CDFW) and the Nevada Department of Wildlife (NDOW) through our initial letter to partners

and during peer and partner review of the Panamint alligator lizard Species Status Assessment. Both CDFW and NDOW commented on our Panamint alligator lizard Species Status Assessment and we incorporated this information into our analysis.

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APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve: _____ 4/26/19

Regional Director, Fish and Wildlife Service — Date

Concur: _____ 9-16-19

Principal Deputy Director, U.S. Fish and Wildlife Service,
Exercising the Authority of the Director, U.S. Fish and Wildlife Service — Date

Do not concur: _____

Principal Deputy Director, U.S. Fish and Wildlife Service,
Exercising the Authority of the Director, U.S. Fish and Wildlife Service — Date

Director's Remarks:

U.S. Fish and Wildlife Service Species Assessment
For Panamint Alligator Lizard (*Elgaria panamintina*)

Date of annual review: April 2019
Conducted by: Gjon Hazard, Carlsbad Fish and Wildlife Office, Region 8
Deborah Giglio, Pacific Southwest Regional Office, Region 8