5-YEAR REVIEW

Alameda Whipsnake (*Masticophis lateralis euryxanthus*)

GENERAL INFORMATION:

Species: Alameda Whipsnake (*Masticophis lateralis euryxanthus*)
Date listed: December 5, 1997
FR citation(s): 62 FR 64306
Classification: Threatened

State Listing:
The Alameda whipsnake was listed as threatened by the State of California in 1971.

BACKGROUND:

Most recent status review:
U.S. Fish and Wildlife Service. 2011. Alameda Whipsnake (*Masticophis lateralis euryxanthus*). 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office, Sacramento, California. 34 pp. [CLICK HERE TO VIEW DOCUMENT].

FR Notice citation announcing this status review:
U.S. Fish and Wildlife Service. 2019. Endangered and Threatened Wildlife and Plants: Initiation of 5-Year Status Reviews of 58 Species in California, Nevada, and the Klamath Basin of Oregon. Federal Register 84:36116-36118. [CLICK HERE TO VIEW DOCUMENT].

ASSESSMENT:

Information acquired since the last status review:
This 5-year review was conducted by the U.S. Fish and Wildlife Service's (Service) Sacramento Field Office. Data for this review were solicited from interested parties through a Federal Register notice announcing this review on July 26, 2019; however, we did not receive any information for this subspecies from the public in response to the notice. We also contacted subspecies experts, performed a literature search, reviewed information from our own files, including a review of Alameda whipsnake 10(a)(1)(A) recovery permit annual reports, and obtained data from an occurrence search of the California Natural Diversity Database (CNDDB) maintained by the California Department of Fish and Wildlife.

The Alameda whipsnake is a slender, fast-moving, diurnal snake with a broad head, large eyes, and slim neck; characteristics typical of snake species that prey on lizards. This subspecies is commonly associated with small to large patches of chaparral or coastal scrub vegetation, interspersed with other native vegetation types throughout Contra Costa County, most of Alameda County, and portions of northern Santa Clara and western San Joaquin counties. Chaparral and coastal scrub vegetation serve as the center of home ranges and provide for concealment from predators as well as foraging opportunities. However, there have been verified

observations of Alameda whipsnakes up to 6.4 kilometers (4 miles) from coastal scrub and chaparral habitat.

Since the last 5-year status review several papers have been published on the Alameda whipsnake, observations on morphology and phenology have been noted, and new observations have been documented. Publications since the last review include: a) genetic studies to determine the structure of whipsnake populations throughout the East Bay and to examine the phylogenetic history of the New World racers and whipsnakes (*Coluber* and *Masticophis*), b) several pesticide effect determinations completed by the Environmental Protection Agency (EPA), c) the subspecies' use of atypical habitats, and d) the subspecies' response to vegetation treatments.

Genetic Studies

Richmond *et al.* (2016) used microsatellite and mitochondrial DNA sequence data to determine the genetic structure of Alameda whipsnake populations across its range, how population expansion occurred in the past throughout the East Bay, and to determine the degree of distinctiveness between the Alameda and chaparral whipsnake. Sampling occurred in 12 locations from five of the six Alameda whipsnake recovery units, nine of which were within the range of the Alameda whipsnake, two within the intergrade zone (i.e., area where the Alameda and chaparral whipsnake ranges overlap), and one location within the range of the chaparral whipsnake.

The data suggested the subspecies expanded north-to-south in a ring formation along two axes, one along the east side of the San Ramon Valley from northern Contra Costa County into the Los Vaqueros watershed and the other along the west side of the valley from Contra Costa County into the Berkeley Hills and then eastward into the Diablo Range. The terminal portions of the ring are associated with the south end of Unit 4 and the northeastern end of Unit 5 (critical habitat Unit 5A; see Appendix A, Figures 1 and 2). In addition, although urbanization within the Livermore Valley currently limits Alameda whipsnake use and/or colonization of this area, historically it is likely a lack of suitable habitat on the Livermore Valley floor that ultimately excluded the subspecies from this area (Richmond *et al.* 2016).

Three different migration models were developed to determine historical population connectivity, and an incomplete stepping-stone model without ring closure at Units 4 and 5 was favored. The incomplete stepping-stone model that assumed different rates of multidirectional gene flow was more likely over a model that allowed fixed rate gene flow. Gene flow out of the terminal ends of the ring (south end of Unit 4 and the northeastern end of Unit 5) has occurred at a greater rate than into those areas, possibly because the habitat and climate in these areas are less favorable than areas closer to the San Francisco Bay. Although these genetic studies revealed genetic diversity was reduced in the southeastern portion of Unit 5 (critical habitat Unit 5A), there was no evidence that the individuals sampled within any unit are inbred (Richmond *et al.* 2016).

Currently, there is little admixture between recovery units, except for the western part of Unit 5 (Del Valle and Ohlone Regional Wilderness) and the southwestern portion of Unit 1 (Tilden Regional Park and Claremont Canyon). The individuals from the western portion of Unit 5 showed substantial admixture with samples from Unit 3 and the eastern portion of Unit 5 (critical

habitat Unit 5A), and individuals from the southwestern portion of Unit 1 had a greater degree of common ancestry with individuals from Unit 3 than individuals from other portions of Unit 1 (Richmond *et al.* 2016) (see Appendix A, Figures 1 and 2).

Another genetic study, completed by Myers *et al.* (2017), used multi-locus data in a coalescent framework to examine the phylogenetic history of the New World racers and whipsnakes (*Coluber* and *Masticophis*). The two genera have been considered two exclusive clades based primarily on morphological characters and mostly single-locus analyses. Nuclear and mitochondrial DNA analysis suggest *Masticophis* is monophyletic with *Coluber*, but not with strong support. The authors felt the low support found for monophyly is due to "a recent, rapid radiation of species" and suggested that further genomic studies be completed before the two are united under the single genus *Coluber* (Myers *et al.* 2017). It should be noted that the Richmond *et al.* (2016) publication described above refers to the Alameda whipsnake as *Coluber lateralis euryxanthus*.

Habitat Use

Trails

With the goal of better informing management considerations, Miller and Alvarez (2016) reviewed over 365 reported observations of the Alameda whipsnake to better understand aspects of the subspecies' behavior. Their primary focus was subspecies observations within developed areas, especially along roads or trails. They found that individual whipsnakes were using trails and roadways for basking or sunning, which can put them at an increased risk of mortality. Of the observations reviewed, 13 of them included a dead snake killed by anthropogenic means. Four of the individuals were documented as roadkill, which the authors assumed meant they were ran over by a motor vehicle, one was documented as killed by a mountain bike, and the other eight were documented as dead along a roadway. Although the cause of mortality was not noted for the eight documented as dead along the roadway, the authors assume they were roadkill. Because habitats that are bisected by trails or roadways may increase snake use of these areas, there is also an increased probability that a negative anthropogenic interaction could take place (i.e., being run over by a bike or car, increased risk of collection and predation, etc.). Therefore, the authors conclude that although the subspecies is known to persist in areas that have been bisected, future roadways or trails should be limited or restricted in areas that are known to support Alameda whipsnakes (Miller and Alvarez 2016).

Atypical Habitat

The Alameda whipsnake has also been observed in habitats that may have been considered atypical in the past, but are now thought to be used more frequently. Herpetological surveys utilizing both trapping and visual methods were conducted in 2017, 2018, and 2019 at the National Park Service's John Muir National Historic Site in Martinez, California. Although the John Muir National Historic Site is comprised of three different parcels, the Mt. Wanda parcel was the primary area targeted for the survey effort. This parcel occurs adjacent to designated critical habitat (Unit 1) and within recovery Unit 1 for the Alameda whipsnake (The Wildlife Project 2019; Alvarez and Villalba 2020) (see Appendix A, Figures 1 and 2).

Alameda whipsnakes were found in three areas of Mt. Wanda and within one of those areas individuals were found in a habitat type considered atypical for the subspecies. During the course

of the surveys, a total of 26 individual Alameda whipsnakes were captured, with 8 recaptures (total of 34 captures). Nineteen of these captures were in coastal scrub habitats; however, ten of the captures, three of which were recaptures, where in a remnant olive orchard. The authors suggest there is a subpopulation at the Mt. Wanda site that is utilizing the small patches of scrub habitat, surrounding oak woodlands, non-native grasslands, and unexpectedly, the remnant olive orchard that is surrounded by dense oak woodland and non-native grassland. The patches of scrub habitat found at the Mt. Wanda site were much smaller than the suggested home range of a single snake, but at least 11 individuals were observed within a scrub patch. This may indicate the subspecies is utilizing other habitat types besides scrub regularly (Alvarez and Villalba 2020).

It is possible the Alameda whipsnake is utilizing the remnant olive orchard since the olive plants are similar to native scrub in that they are brushy, have a short stature with low overhanging branches, a canopy that is not completely closed, and a clear understory. If that is the case, the structure of the habitat may be more important to the Alameda whipsnake than the actual vegetation type (Alvarez and Villalba 2020; Alvarez *et al.* in prep). In addition, the subspecies did not appear to move between the olive orchard and the scrub patches on Mt. Wanda, likely because the non-native grassland that separated the two areas was so overgrown that it would be difficult for the subspecies to navigate (The Wildlife Project 2019; Alvarez and Villalba 2020).

Fuels Management Research

In order to reduce the wildfire risk in areas of urban interface within the East Bay, the East Bay Regional Parks District (District) is implementing their Wildfire Hazard Reduction Resource Management Plan. Implementation of the plan includes vegetation treatments in areas within the range of the subspecies and within designated critical habitat. The District began a multi-year occupancy study in 2016 to evaluate the subspecies' response to the various fuel-load-reducing vegetation treatments. The survey protocol requires pre-treatment baseline trapping surveys, which were conducted in 2016, and two post-treatment surveys, one which was completed in 2019 and another that is scheduled for 2021. During the survey efforts, vegetation, topographic, and weather data were recorded at each survey trapline location. Trap-line locations were consistent between the pre-treatment and 2019 efforts. During the pre-treatment surveys, a subset of captured Alameda whipsnakes were implanted with radio transmitters to assess habitat use over a 6 month to 1 year interval. Vegetation data associated with the telemetered snakes was obtained from GIS and observation. No individuals were tagged during the 2019 effort (Stoelting *et al.* 2019).

A total of 22 and 28 individual Alameda whipsnakes were captured in 2016 and 2019, respectively. Based on the telemetry data from the three tagged Alameda whipsnakes, there was a selection against oak-bay woodland habitat and selection for developed areas; however, areas identified as developed were small areas that were previously graded and contain gravel substrate or paved platforms (often for utilities) and were not highly urbanized. The telemetry data also showed more selection for a southeastern aspect, although there was not an aspect the subspecies avoided. There was a positive association between vegetation treatment and occupancy during the 2019 effort that was not seen during the 2016 pre-treatment effort. Also unlike 2016, one individual in 2019 moved between a control and treatment trapline. Sites that were occupied during the 2016 effort were more likely to be occupied during the 2019 effort than

not occupied and none of the individuals captured during the 2016 effort were re-captured during the 2019 effort (Stoelting *et al.* 2019).

Observations to note over the course of this study include the capture of a small female in late May 2019. The small size of this individual suggests it was either a late-hatchling from 2018 or a very-early hatchling from 2019. Data from 2016 data suggests the subspecies does not avoid areas with eucalyptus or conifer forest and disturbance does not necessarily preclude individuals utilizing an area. In 2016, a female that was previously using the area returned to the area after being treated using hand power tools. In addition, because some of the treatment areas that received routine treatments in the past (prior to the study) were subsequently occupied by Alameda whipsnakes, it appears that relatively recent treatment activities do not deter the subspecies from utilizing the area, and in fact, may attract them. The number of individuals captured in both survey years suggest the area is supporting a breeding population of Alameda whipsnakes. The study is scheduled to continue with a final trapping effort in 2021 (Stoelting *et al.* 2019).

Morphology

Personal observations by species experts have suggested the Alameda whipsnake shares some physical characteristics with other arboreal snakes found throughout the world, including: a long prehensile tail, a long slender body that is able to become rigid to help facilitate bridging gaps between branches, and a large head that can be used to pull itself up into trees and shrubs (Murphy *in litt.* 2019). These observations suggest the subspecies is more arboreal than previously thought and additional studies should be conducted to determine how often the subspecies is utilizing trees and large shrubs for activities other than basking.

Surveys and Other Observations

Surveys for the Alameda whipsnake have continued to occur throughout the subspecies' range since the last 5-year review (CNDDB 2020) (see Appendix A, Table 1). Individuals have been observed within the Coyote Hills Regional Park and a survey effort was conducted during the 2019 season to determine if a viable population occurs within this area. This is the first observation of the subspecies to the west of Interstate 880 and appears to be isolated from the other known populations due to the presence of the major highway (Lim *in litt.* 2019) (see Appendix A, Figures 1 and 2).

Phenotypic Variation

Whipsnakes captured in the Alameda watershed during a 2012 survey effort for a Calaveras Reservoir study were either intergrades or more closely related to chaparral whipsnakes (Swaim *in litt.* 2019). Although Alameda and chaparral whipsnakes are currently distinguished from each other using eight phenotypic characteristics, the whipsnakes captured during this survey effort exhibited a mix of characteristics that are attributed to both subspecies. Just one of the captured individuals had four of the eight characteristics attributed to the Alameda whipsnake and none had more than four of the eight characteristics; however, all of them had at least one of the eight Alameda whipsnake characteristics. A manuscript aligning the Richmond *et al.* (2016) genetics findings with a quantitative analysis of the color characters used to distinguish the Alameda whipsnake from the chaparral whipsnake is expected to be submitted for publication (Swaim *in litt.* 2019).

Threats

Pesticide Effects

The EPA's Environmental Fate and Effects Division completed several pesticide effect determinations that assessed the direct and indirect effects of chemical use on the Alameda whipsnake, and how the use of these chemicals modify Alameda whipsnake critical habitat (Housenger *et al.* 2012; Odenkirhcen *et al.* 2010; Hartless *et al.* 2011; Sternberg *et al.* 2011). The pesticides analyzed included the anticoagulant rodenticides bromadiolone, brodifacoum, and chlorophacinone (Sternberg *et al.* 2011; Housenger *et al.* 2012; Hartless *et al.* 2011), and aluminum and magnesium phosphides, which are used as fumigants (Odenkirhcen *et al.* 2010). The assessments determined that all three anticoagulants directly affect the Alameda whipsnake through secondary exposure via prey consumption. Because the Alameda whipsnake targets live prey, it is unlikely to ingest the rodenticide directly; however, prey items that do ingest the poison may not die until several days after ingestion, and Alameda whipsnakes may consume poisoned prey (Sternberg *et al*. 2011; Housenger *et al*. 2012; Hartless *et al.* 2011). The assessments also showed the use of all three anticoagulant rodenticides can result in indirect effects to survival, growth, and reproduction from a reduction in prey and availability of small mammal burrows (Sternberg *et al.* 2011; Housenger *et al.* 2012; Hartless *et al.* 2011).

Aluminum and magnesium phosphides are fumigants that are used outdoors to control burrowing mammals. The assessment found that the use of these fumigants can have both direct and indirect effects to the Alameda whipsnake. If any individual whipsnakes were within a burrow that was treated with the fumigant, they would be killed. Indirect effects due to the use of aluminum and magnesium phosphides include a reduction in prey base, reduction in burrowing mammals, and elimination of burrow habitat when burrows are sealed off during treatment (Odenkirhcen *et al.* 2010). The use of the chemicals analyzed are primarily concentrated in areas with urban development. Therefore, the Alameda whipsnake is at an increased risk of exposure to these chemicals in developed areas (Housenger *et al.* 2012; Odenkirhcen *et al.* 2010; Hartless *et al.* 2011; Sternberg *et al.* 2011).

Snake Fungal Disease

In late 2019, the emerging Snake Fungal Disease (SFD) was confirmed in a California kingsnake (*Lampropeltis californiae*) in Plymouth, Amador County (CDFW 2019). The fungus that causes SFD was also detected on a southern watersnake (*Nerodia fasciata*) found deceased in Folsom, Sacramento County. Cases of the disease range from mild to life-threatening, and affected snakes are often emaciated (CDFW 2019). During trapping efforts at Sibley Volcanic Preserve and Wildcat Canyon Regional Park (within the range of the Alameda whipsnake), two California kingsnakes and a Pacific ringsnake had noticeable apparent scale infections (Stoelting *et al.* 2019). Scale clips from one of the California kingsnakes and the Pacific ringneck were tested for the causative agent of SFD and both tested negative (Stoelting *et al.* 2019). Although it is unknown if or how SFD may affect the Alameda whipsnake, the emerging threat of this disease is of great concern. The California Department of Fish and Wildlife plans increased surveillance and implementation of precautions to minimize risk of anthropogenic spread.

Habitat Loss

Habitat loss and fragmentation due to urban development and the installation of associated infrastructure (i.e., roads, trails, etc.) continues to be a threat to the Alameda whipsnake

throughout its range. However, development projects that are subject to Section 7 consultation or result in the issuance of an incidental take permit under the federal Endangered Species Act (Act) typically include habitat compensation, which can reduce the severity of overall habitat loss typically associated with these projects. Habitat compensation can occur via a variety of mechanisms, including the purchase of credits at approved conservation banks, through permittee responsible mitigation, and through the development of Habitat Conservation Plans (HCPs).

Conservation

Conservation Banks

A mitigation bank or conservation bank (bank) is a property or suite of properties (i.e., umbrella bank, phased bank, etc.), providing habitat or other conservation values that are conserved and managed in perpetuity, and provides ecological functions and services for specified listed species or resources. Mitigation and conservation banks function to offset adverse impacts that occurred elsewhere; therefore, the Service approves a specified number of credits that the bank owner may sell to developers or other project proponents for use as compensation to offset adverse impacts their projects will likely have on listed species. The money from the initial investment and bank credit sales is then used to permanently protect and manage the land for those species and resources. More information about conservation banks within the Sacramento Fish and Wildlife Office's Service area can be found at: https://www.fws.gov/sacramento/es/Conservation-Banking/Banks/In-Area/.

There are currently two active conservation banks and two inactive/sold out conservation banks for the Alameda whipsnake. Active conservation banks include the 640 acre Ohlone West Conservation Bank in Alameda County and the 430 acre Oursan Ridge Conservation Bank in Contra Costa County. The 640 acre Ohlone Preserve Conservation Bank in Alameda County is currently sold out of credits and the 654 acre Pleasanton Ridge Conservation Bank, also in Alameda County, is currently inactive. There are currently no proposed or pending conservation banks for the Alameda whipsnake.

Permittee Responsible Mitigation

Permittee-responsible mitigation, also sometimes referred to as turn-key mitigation, includes activities or projects undertaken by a permittee (or authorized agent) to provide compensatory mitigation to offset impacts from a single project. The permittee retains full responsibility for this mitigation. Ideally, permittee-responsible mitigation projects are established in advance of the project-related impacts they are offsetting; however, this typically does not occur due to multiple factors.

Habitat compensation through permittee responsible mitigation for the Alameda whipsnake has occurred throughout the subspecies' range for a number of projects. The primary agencies implementing permittee-responsible mitigation for the Alameda whipsnake include East Bay Regional Park District, East Bay Municipal Utility District, California Department of Transportation, City of Livermore, and Alameda and Contra Costa counties.

Habitat Conservation Plans
Habitat Conservation Plans (HCPs) are planning documents required as part of an application for an incidental take permit. They describe the anticipated effects of the proposed taking; how those impacts will be minimized, or mitigated; and how the HCP is to be funded. HCPs can apply to both listed and non-listed species, including those that are candidates or have been proposed for listing. Regional HCPs develop large-scale conservation strategies within a specific region that are designed to conserve functional ecological systems and the covered species that depend on them. Such HCPs aim to avoid a fragmented conservation landscape by working with local land use authorities and a designated implementing entity to conserve, enhance, and manage a preserve system. Project-level HCPs are designed to fully offset the impacts associated with the permitted activity by contributing to a larger conservation design.

Being included as a covered species under an HCP can result in habitat being set aside and managed for the species as mitigation for impacts associated with covered activities, such as planned urban development, within the HCP permit area. In addition to mitigation, avoidance, minimization, and other conservation measures (e.g. monitoring, seasonal work windows, habitat management, etc.) are implemented. HCPs can also utilize banks, in-lieu fee programs, or other mechanisms to preserve habitat in perpetuity and contribute to a regional conservation strategy.

There are currently three HCPs that include the Alameda whipsnake as a covered species: Pacific Gas & Electric Bay Area Operations and Maintenance HCP, permit issued in 2017; East Contra Costa County HCP/Natural Community Conservation Plan, permit issued in 2007; and the East Bay Municipal Utility District HCP, permit issued in 2008. More information about the HCPs that include the Alameda whipsnake as a covered species can be found at: https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=C04A.

Recovery Permits
Recovery permits, also referred to as 10(a)(1)(A) permits, allow scientists to take listed species as a means to ultimately contribute to the recovery of the listed species. The data acquired from some actions covered under recovery permits (e.g., occurrence, abundance, distribution, etc.) allow the Service to make informed decisions for the species that will enhance their survival and recovery. Recovery permits can be issued for activities that directly aid the recovery of a species, such as captive breeding, reintroductions, habitat restoration, removal or reduction of threats, and educational programs. The Service's recovery permitting program aids in the conservation of listed species by ensuring permittees have adequate field experience and qualifications for conducting activities with the target listed species and, for most species, ensures that permittees are following standardized protocols while surveying. The recovery permitting application process ensures that scientific proposals are crafted using the recommended actions laid out in the Recovery Plan for the target species. There is currently no protocol survey guidance for the Alameda whipsnake; however, there are minimum qualifications to obtain a recovery permit for the subspecies. Minimum qualifications can be found at: https://www.fws.gov/sacramento/es/Permits/.

Research and surveys performed by permittees has resulted in a number of reports and peer-reviewed publications about the species, and has contributed to our knowledge of Alameda whipsnake genetics, habitat use, morphology, phenology and occurrence. Survey efforts by

permitted biologists since the last 5-year review are summarized in Table 1 (see Appendix A). The most recent occurrence data from CNDDB and submitted permittee reports are shown in Figures 1 and 2 (see Appendix A). Many of these studies have contributed to our understanding of the current status of the subspecies, and a summary of these studies are incorporated in the information above.

Recovery Criteria
As described in our 2011 5-year review, a draft recovery plan for the Alameda whipsnake was issued in November 2002 ((Draft Recovery Plan for Chaparral and Scrub Community Species East of San Francisco Bay, California; Service 2002) but was never finalized.

Conclusion:

After reviewing the best available scientific information, we conclude that the Alameda whipsnake remains a threatened species. The evaluation of threats affecting the species under the factors in 4(a)(1) of the Act and analysis of the status of the species in our 2011 5-Year Review remains an accurate reflection of the species current status.

RECOMMENDATIONS FOR FUTURE ACTIONS:

1. Promote the eradication of *Eucalyptus globules*, *Pinus radiata*, *Cupressus macrocarpa*, *Genista monspessulana*, and other non-native invasive species in the San Francisco East Bay.

2. Focus land protection efforts on undeveloped parcels in the wildland urban interface to reduce urban sprawl into chaparral and coastal scrub vegetation and to reduce the need for fuel reduction treatments within Alameda whipsnake habitat.

3. Continue research on the Alameda whipsnake's response to various vegetation treatments.

4. Recent observations suggest the subspecies is utilizing habitats that are considered atypical and using patches of typical scrub habitat that appears too small to support the subspecies. Additional studies should be conducted to determine how often the subspecies is utilizing these atypical habitats and how these habitats provide for the subspecies' requirements (i.e., feeding, breeding, basking, etc.).

5. Recent observations suggest the subspecies is more arboreal than previously thought. Additional studies should be conducted to determine how often the subspecies is utilizing trees and large shrubs for activities other than basking.

Field Supervisor, Sacramento Fish and Wildlife Office

MICHAEL FRIS Digitally signed by MICHAEL FRIS Date: 2020.07.08 14:20:41 -07'00'

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In Litteris

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Appendix A

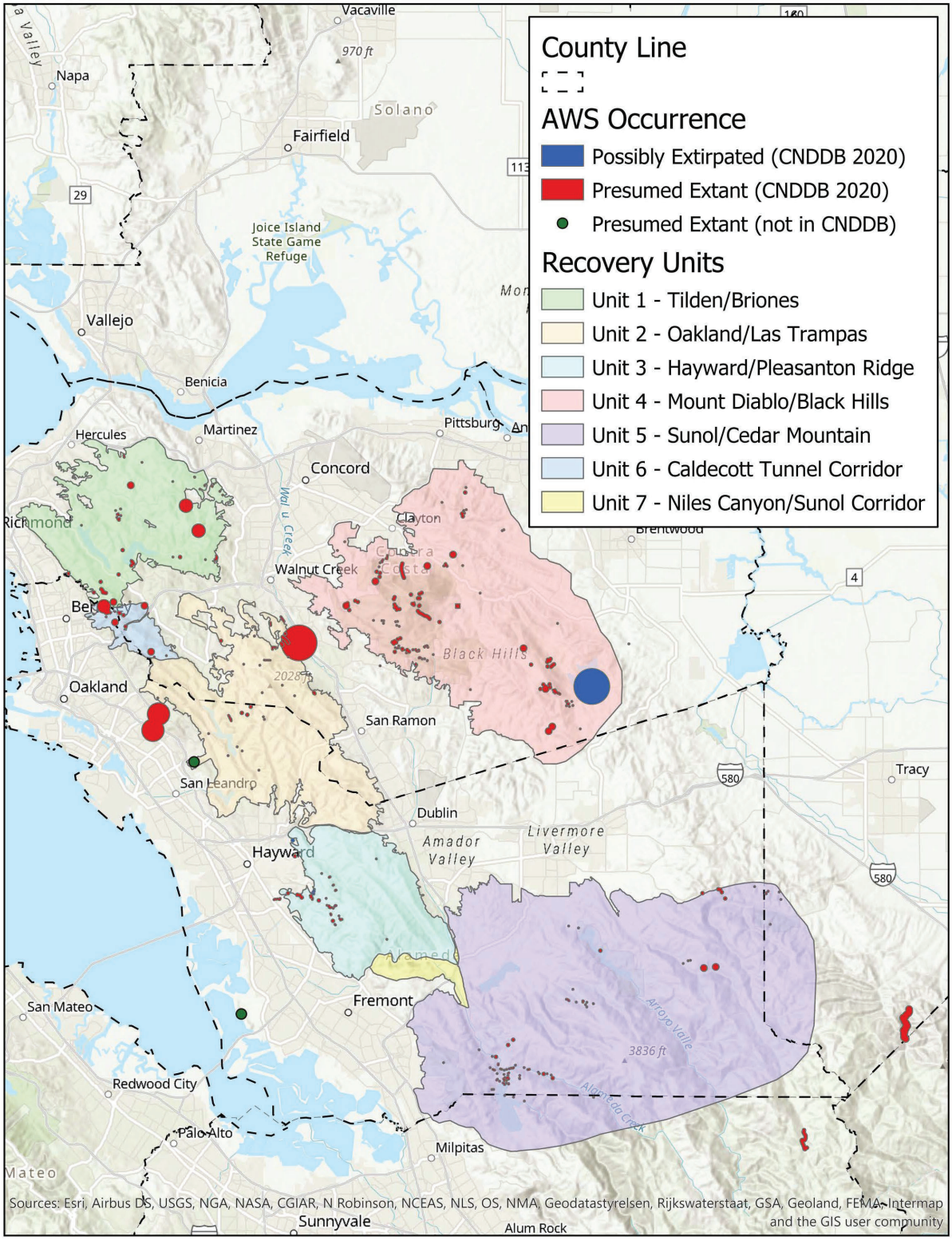

Figure 1. Alameda whipsnake occurrence data and recovery units

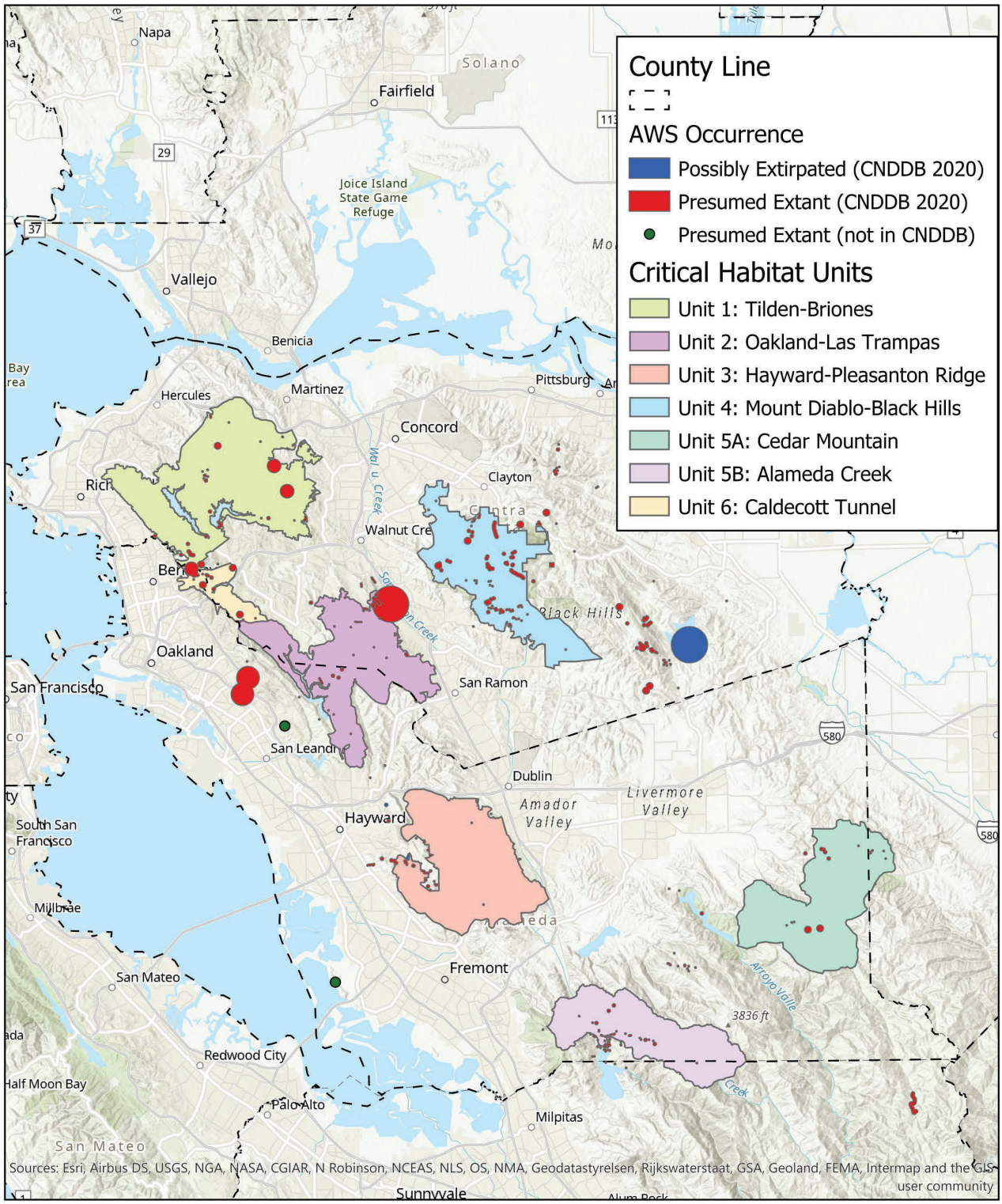

Figure 2. Alameda whipsnake occurrence data and designated critical habitat units

Table 1. Summary of Alameda whipsnake (AWS) survey efforts since the last 5-year review

Year	Area Surveyed	Population	AWS present	# of AWS	Notes, purpose of survey
2010	Redwood Regional Park, Alameda Co.	Oakland-Las Trampas	No	N/A	Preconstruction surveys
2010	Knowland Park, Oakland	Oakland-Las Trampas	Yes	1 male (captured 3 times)	Development, grassland, scrub, chamise chaparral, and coast-live oak woodland. Habitat loss to succession. Purpose of project is to expand the zoo.
2010	Wilder Ranch, Orinda	Tilden-Briones	No		
2010	Oursan Ridge, Contra Costa Co.	Tilden-Briones	Yes	4	Conservation property for EBMUD.
2011	Las Trampas Regional Wilderness	Oakland-Las Trampas	No	N/A	Preconstruction surveys
2011	Calaveras Dam, Sunol	Sunol-Cedar Mountain	Yes	Relocated 1 individual	
2011	Alameda Watershed	Sunol-Cedar Mountain	No	N/A	Limited trapping conducted
2012	Little John Cove	Tilden-Briones	Yes	4; 2 male (1 recaptured 4 times)	Scrub, woodland, grassland
2012	Bollinger Canyon, Contra Costa Co.	Oakland-Las Trampas	No	N/A	Preconstruction surveys
2012	Calaveras Dam, Sunol	Sunol-Cedar Mountain	Yes	Relocated 2 individuals	Submitted to CNDDB
2012	Alameda Watershed, Calaveras Reservoir	Sunol-Cedar Mountain	Yes	10; 8 adults and 2 juveniles	Scrub grassland; individuals exhibited a mixture of Alameda and chaparral whipsnake phenotypic characteristics
2012	Alameda Co., North of Sunol	Sunol-Cedar Mountain	Yes	12 (3 males recaptured); 6 adults and 6 juveniles; Sex ratio=.71:1	Potential compensation site. Annual grassland, with a mosaic of oak and riparian woodland, oak savannah, and north coastal scrub. Shrub canopy consists of CA sagebrush, open canopy. Contains rocky outcrops. Land use: grazing
2013	Siesta Valley	Tilden-Briones	Yes	5; 1 male and 4 females	Scrub, woodland, grassland
2013	Southeastern Alameda Co.	Sunol-Cedar Mountain	Yes	29 (28 had phenotypic characteristics more similar to the chaparral whipsnake)	Obtain genetic samples from individuals within the intergrade zone. Chaparral
2013	Calaveras Dam, Sunol	Sunol-Cedar Mountain	Yes	Relocated 2 individuals	

Year	Area Surveyed	Population	AWS present	# of AWS	Notes, purpose of survey
2014	Siesta Valley	Tilden-Briones	Yes	1 female	Scrub, woodland, grassland
2014	Calaveras Dam, Sunol	Sunol-Cedar Mountain	Yes	Relocated 2 individuals	
2014	Wilder Development, Orinda	Tilden-Briones	No	N/A	
2015	Former Oak Knoll Naval Hospital, Oakland	Oakland-Las Trampas	No	N/A	Residential housing surrounded by native grassland and oak woodland. Riparian corridor bisects the site. Sampled in 1996 and 2006, both negative. Purpose of study is for recovery
2015	Sobrante Ridge	Tilden-Briones	Yes	21; 2 females (both recaptured once); 1 juvenile mortality	Scrub, woodland, grassland
2015	Calaveras Dam, Sunol	Sunol-Cedar Mountain	Yes	Multiple individuals relocated	
2015	Scow Canyon, San Pablo Watershed, Orinda	Tilden-Briones	No; seen in "reference area" nearby	3 (2 females recaptured)	Survey conservation area that has been enhanced. Scrub.
2016	San Pablo Ridge	Tilden-Briones	No	N/A	Scrub, woodland, grassland
2016	Tilden Regional Park, Claremont Canyon Regional Preserve, and Sibley Volcanic Regional Preserve	Tilden-Briones (Tilden); Caldecott Tunnel (Claremont and Sibley)	Yes	22 (6 recaptures). All at Tilden	Mostly Baccharis shrub, woodland, grassland
2016	Alameda Creek Diversion Dam, Sunol	Sunol-Cedar Mountain	Yes	9 individuals observed	
2017	Pinole Ridge	Tilden-Briones	No	N/A	Scrub, oak woodland, grassland
2017	Ohlone West Conservation Bank, Alameda Co.	Sunol-Cedar Mountain	Yes	8; 1 adult female, 1 juvenile male, and 6 adult males	Coast sage scrub and chaparral
2017	Tilden	Tilden-Briones	Yes	1 adult (radio tracked individual from last year)	
2017	Private Property, Alameda Co.	Sunol-Cedar Mountain	Yes	3; 2 adults, 1 male young-of-year (2 recaptures)	Annual grassland, mixed oak woodland, small scrub patches; individuals exhibited a mixture of Alameda and chaparral whipsnake phenotypic characteristics

Year	Area Surveyed	Population	AWS present	# of AWS	Notes, purpose of survey
2018	Mt. Wanda - John Muir National Historic Site, Martinez	Tilden-Briones	Yes	22 (7 recaptures); All captures were adults or sub-adults	Survey of NPS land. Site dominated by coastal oak woodland and non-native grasslands. Small portions of the site contain trails, parking areas, residential structures, coastal scrub habitat, and a remnant olive orchard. Individuals found in coastal scrub and olive orchard.
2018	Dinosaur Ridge	Oakland-Las Trampas	Yes	11; 8 adult males, 1 juvenile male, and 2 adult females; 2 incidental observations	
2018	Pleasanton Ridge Conservation Bank	Hayward-Pleasanton Ridge	Yes	2; 1 juvenile female (recaptured 2 other times) and 1 adult male	Coyote brush, California sagebrush, grassland. Low number of captures likely due to low spring temperatures
2018	Ohlone West Conservation Bank, Alameda Co.	Sunol-Cedar Mountain	Yes	3; 1 adult female (recaptured once) and 2 adult males	Mixed oak woodland, scrub, annual grassland, rocky outcrops present. Low number of captures likely due to the low spring temperatures
2019	Mt. Wanda - John Muir National Historic Site, Martinez	Tilden-Briones	Yes	4; 3 adults and 1 juvenile	Survey of NPS land. Site dominated by coastal oak woodland and non-native grasslands. Small portions of the site contain trails, parking areas, residential structures, coastal scrub habitat, and a remnant olive orchard.
2019	Coyote Hills Regional Park, Fremont	N/A - Closest to Hayward-Pleasanton Ridge	Yes		Three observations made by a local naturalist. There are no other AWS records in CNDDB west of Interstate 880. Photos were submitted and confirmed. Coverboards were placed in the spring and early summer, but there were no additional observations.
2019	Ohlone Regional Wilderness	Sunol-Cedar Mountain	Yes	5; 3 adult males (1 was recaptured once), 1 juvenile male, and 1 juvenile female	Oak savannah, scrub, grassland, oak woodland
2019	Tilden Regional Park, Claremont Canyon Regional Preserve, and Sibley Volcanic Regional Preserve	Tilden-Briones (Tilden); Caldecott Tunnel (Claremont and Sibley)	Yes	28 (3 at Claremont, all others at Tilden); 2 adult males and 1 adult female at Claremont; 15 adult males, 4 juvenile males, 1 adult female, and 5 juvenile females at Tilden	Shrubland, grassland, woodland