

STATE OF CALIFORNIA
NATURAL RESOURCES AGENCY
DEPARTMENT OF FISH AND WILDLIFE

REPORT TO THE FISH AND GAME COMMISSION

**A STATUS REVIEW OF THE
SAN BERNARDINO KANGAROO RAT
(*Dipodomys merriami parvus*) IN CALIFORNIA**



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Cover photo by Thea Wang, San Diego Zoo Wildlife Alliance. Used with permission.

EXECUTIVE SUMMARY

This status review report is based upon the best scientific information available to the California Department of Fish and Wildlife (Department) on the San Bernardino kangaroo rat (*Dipodomys merriami parvus*) and serves as the basis for the Department's recommendation to the California Fish and Game Commission (Commission) on whether to list the species as threatened or endangered under the California Endangered Species Act (CESA; Fish & G. Code, § 2050 et seq.).

The Endangered Habitats League petitioned the Commission to list the San Bernardino kangaroo rat as endangered on March 15, 2019. At its scheduled meeting on August 7, 2019, the Commission considered the Petition and, based on the Department's evaluation and recommendation and other comments and information received, found that sufficient information existed to indicate the petitioned action may be warranted and accepted the Petition for consideration. Upon publication of the Commission's findings, the San Bernardino kangaroo rat was designated a candidate species on August 23, 2019.

The San Bernardino kangaroo rat was listed as Endangered under the federal Endangered Species Act (ESA) in 1998. In addition to its status as a CESA candidate species, the Department designated the San Bernardino kangaroo rat as a California Species of Special Concern, an administrative designation intended to focus attention on animals at conservation risk, stimulate research on poorly known species, and achieve conservation and recovery of these animals before they meet criteria for listing as threatened or endangered under CESA.

The San Bernardino kangaroo rat is a subspecies of Merriam's kangaroo rat (*Dipodomys merriami*), one of the smallest kangaroo rats in North America. The fur on its back, sides, and head is yellowish-brown. It has white fur on its belly and legs. Its tail is long, with a tuft of longer fur at its end. There are four toes on each hind foot. The San Bernardino kangaroo rat's geographic range is confined to the lowlands of the San Bernardino Valley and surrounding areas. Its distribution is now restricted to a small subset of its historical range and occurs in three disjunct areas within the Lytle Creek/Cajon Wash, Santa Ana River wash, and San Jacinto River.

San Bernardino kangaroo rats occur in relatively open scrub habitats within their range. Earlier successional stages of Riversidean Alluvial Fan Sage Scrub are favored over denser, more mature stages. Prior to widespread development in the region, disturbance of vegetation through periodic flood events maintained habitat suitability. Habitat connections between disturbed and undisturbed areas allowed recolonization of disturbed areas after floods.

San Bernardino kangaroo rats are nocturnal and take cover during the day in underground burrows. They are active year-round and forage primarily on seeds, but also sometimes

consume shrub foliage and insects, especially during reproductive periods. Reproduction coincides with food availability and may occur in any month but is most common from spring through autumn. Population size fluctuates widely, dependent on annual seed production, which in turn is dependent on seasonal precipitation. Average lifespan is 3 to 4 years.

There is no current population estimate for the San Bernardino kangaroo rat; however, it is certain the number of kangaroo rats has diminished significantly since increased development in its geographic range began in the late 19th century. Estimates of the loss of suitable or occupied habitat include 90% loss from the 1880s to 1998 and an additional 30% loss of remaining habitat from 1998 to 2018. Evidence from live-trapping studies suggests densities of San Bernardino kangaroo rats in occupied habitats are often below the densities reported before the species was listed under the ESA.

The primary threats to the continued existence of the San Bernardino kangaroo rat are loss, degradation, and fragmentation of habitat, as well as the associated effects of small population size and impaired population genetic characteristics. Loss and fragmentation of habitat reduce the total number of kangaroo rats that can be supported and inhibit the movement of kangaroo rats within the range, impeding genetic exchange between habitat patches. Limited habitat connectivity between stream channels and upland refugia increases flood-related mortality and impairs recolonization of instream areas. Isolation of the existing populations in the Lytle Creek/Cajon Wash, Santa Ana River, and San Jacinto River areas due to habitat fragmentation makes it more likely that the species will be extirpated within an area without the possibility of recolonization.

Habitat within the fragmented occupied patches is degraded by edge and other effects, including human recreation, light pollution, surface mining, nonnative plant invasion, and nonnative predators. Further, flood control projects have limited disturbance events within stream channels resulting in habitat degradation.

Small population size and genetic effects are the greatest proximate threats to the San Bernardino kangaroo rat. Based on comprehensive genetics studies by the San Diego Zoo Wildlife Alliance (SDZWA), it is certain that the three isolated populations have reduced genetic diversity, are experiencing inbreeding effects, and have low effective population sizes, all of which indicate impaired genetic conditions for the San Bernardino kangaroo rat populations.

Climate change projections suggest the future climate in the range of the San Bernardino kangaroo rat will be warmer, with more frequent extreme heat waves, which may affect nighttime activity of the species. More frequent occurrence of long-term droughts is expected to impact seed production over multiple year periods, thus impacting reproduction over multiple generations. Such impacts would result in smaller population size. Projected more

extreme rainfall events would conversely increase the likelihood of mortality within stream channel habitat.

Other threats, such as from disease and environmental toxins and introduced species may also impact San Bernardino kangaroo rat populations. These effects may combine or act synergistically with other threats.

Given the loss of most of the historically available habitat for the San Bernardino kangaroo rat, and the consequent risks to its continued existence due to small population size and impaired genetic condition, the Department considers all currently occupied San Bernardino kangaroo habitat as essential for the species in California. Additionally, suitable but apparently unoccupied habitat near the currently occupied habitat is also considered essential for the conservation of the species. Further, other areas within the historical range that are not currently suitable habitat, but near or adjacent to currently suitable or occupied habitat and have the potential to be restored to suitability within the near term should also be considered essential.

The Department offers several management recommendations based on review of documents prepared by the U.S. Fish and Wildlife Service and the SDZWA. These recommendations are listed in full in the report. They include development of a Recovery Plan for the species; conservation and restoration of habitat throughout the species' range; management to restore connections between occupied sites and between upland and instream sites; use of conservation translocation to improve population genetic characteristics; develop and implement a range-wide survey and monitoring program; conduct research on a variety of conservation questions, including disease and environmental contaminant issues; and the use of education and enforcement to better protect San Bernardino kangaroo rat habitat.

In consideration of the scientific information contained in this status review report, the Department has determined that listing the San Bernardino kangaroo rat under CESA as endangered is warranted.

REGULATORY SETTING

Federal Endangered Species Act

In 1998, the U.S. Fish and Wildlife Service (Service) emergency listed the San Bernardino kangaroo rat (*Dipodomys merriami parvus*) as endangered under the federal Endangered Species Act (ESA) (USFWS 1998). The Service designated critical habitat for the species in 2002 and revised the critical habitat designation in 2008 (USFWS 2002, USFWS 2008). In 2009 the Service published its 5-year status review for the species and based on ongoing threats and lack of recovery, recommended no change in the listing status of the San Bernardino kangaroo rat (USFWS 2009). In April 2020, the Service published its second 5-year status review for the species and concluded the species remained endangered (USFWS 2020).

Petition Evaluation Process

On March 15, 2019, the Commission received Endangered Habitats League's petition to list the San Bernardino kangaroo rat as endangered under CESA (EHL 2019). Commission staff transmitted the petition to the Department pursuant to Fish and Game Code section 2073 on March 22, 2019, and published a formal notice of receipt of the petition on April 12, 2019 (Cal. Reg. Notice Register 2019, No. 15-Z, p. 575). A petition to list or delist a species under CESA must include "information regarding the population trend, range, distribution, abundance, and life history of a species, the factors affecting the ability of the population to survive and reproduce, the degree and immediacy of the threat, the impact of existing management efforts, suggestions for future management, and the availability and sources of information. The petition shall also include information regarding the kind of habitat necessary for species survival, a detailed distribution map, and any other factors that the petitioner deems relevant" (Fish & G. Code, § 2072.3).

On May 30, 2019, the Department provided the Commission with its petition evaluation report (CDFW 2019) to assist the Commission in making a determination as to whether the petitioned action may be warranted based on the sufficiency of scientific information (Fish & G. Code, §§ 2073.5 & 2074.2; Cal. Code Regs., tit. 14, § 670.1, subds. (d) & (e)). Focusing on the information available to the Department relating to each of the relevant categories, the Department recommended to the Commission that the petition be accepted.

At its scheduled public meeting on August 7, 2019, in Sacramento, California, the Commission considered the petition, the Department's petition evaluation and recommendation, and comments received. The Commission found sufficient information existed to indicate the petitioned action may be warranted and accepted the petition for consideration. Upon publication of the Commission's notice of its findings, the San Bernardino kangaroo rat was

designated a candidate species on August 23, 2019 (Cal. Reg. Notice Register 2019, No. 34-Z, p. 1182).

Status Review Overview

The Commission's decision to accept the petition, thus designating the San Bernardino kangaroo rat as a candidate species, triggered the Department's process for conducting a status review to inform the Commission's decision on whether listing the species is warranted (Fish & G. Code, § 2074.6). At its scheduled public teleconference on June 25, 2020, the Commission granted the Department a six-month extension to complete the status review and facilitate external peer review.

This status review report is not intended to be an exhaustive review of all published scientific literature relevant to the San Bernardino kangaroo rat; rather, it is intended to summarize the key points from the best scientific information available relevant to the status of the species. This final report, based upon the best scientific information available to the Department, is informed by independent peer review of a draft report by scientists with expertise relevant to the San Bernardino kangaroo rat. This review is intended to provide the Commission with the most current information on the San Bernardino kangaroo rat and to serve as the basis for the Department's recommendation to the Commission on whether the petitioned action is warranted. The status review report also identifies habitat that may be essential to continued existence of the species and provides management recommendations for recovery of the species (Fish & G. Code, § 2074.6). Receipt of this report is to be placed on the agenda for the next available meeting of the Commission after delivery. At that time, the report will be made available to the public for a 30-day public comment period prior to the Commission taking any action on the petition.

BIOLOGY AND ECOLOGY

Species Description and Taxonomy

The San Bernardino Merriam's kangaroo rat (more commonly known as and referred to herein as the San Bernardino kangaroo rat) is in the Family Heteromyidae, a lineage of small New World rodents that includes pocket mice, kangaroo mice, and kangaroo rats. There are 20 recognized species of kangaroo rats (ASM Mammal Diversity Database 2021), which are distributed widely in the arid and mesic open habitats of western North America, including northern Mexico. They are notable for their bipedal locomotion, ability to subsist in dry habitats without drinking water, and external fur-lined cheek pouches used to carry seeds from foraging areas to cache locations. Kangaroo rats have relatively large heads, large hind feet, and long tufted tails, which help provide balance and agility while hopping.

Merriam's kangaroo rat (*Dipodomys merriami*), one of the smallest kangaroo rat species, is distributed in the Great Basin, Mojave, Sonoran (including Colorado), and Chihuahuan deserts from western and southern Nevada, southern California, southwestern Utah, southern and western Arizona, southern New Mexico, southwestern Texas, and much of northern Mexico, including Baja California (Hall 1981).

The San Bernardino kangaroo rat is one of 19 subspecies of *D. merriami* and one of three subspecies occurring in southern California (Hall 1981, Wilson and Reeder 2005), along with *D. m. merriami* (the most widely distributed subspecies of Merriam's kangaroo rat) and *D. m. collinus* (the Earthquake or Aiguanga kangaroo rat, occurring south through eastern San Diego and western Imperial counties, into northern Mexico, Lidicker 1960). The San Bernardino kangaroo rat is endemic to California. It is smaller and darker than the other southern California subspecies. Its geographic range is disjunct from the other *D. merriami* subspecies (Lidicker 1960), which likely led to divergence in form and genetics from the other subspecies. According to Lidicker (1960), the San Bernardino kangaroo rat is sufficiently different from the other subspecies to possibly warrant full species designation.

The fur on its back, sides, and head is faintly yellow, with an over-wash of dusky brown (Lidicker 1960) and with white fur on its belly and legs. The tail has dark brown stripes running along the dorsal and ventral surface, with whitish fur on the sides of the tail. The tail has a tuft of longer fur at its end. There are four toes on each hind foot, which distinguishes it from other similar sized kangaroo rats within its range, which have five toes on the hind feet.

The online VertNet Portal (VertNet 2020) contains standard measurements of 48 San Bernardino kangaroo rat adults (15 females, 33 males) collected for academic museums between 1894 and 2002, with most of the specimens collected in the 1930s. Based on the reported measurements, males may tend to be slightly larger on average than females; however, they are otherwise similar in size, as statistical tests for differences in total length, tail length, hind foot length, ear length, and body mass only showed a significant difference between the sexes for total length (CDFW unpublished analysis). Male total length averaged 234.1 mm (9.22 in.), while females averaged 224.1 mm (8.82 in.). Table 1 lists average standard measurement values for both sexes combined.

Table 1. Morphometric measurements of San Bernardino kangaroo rat specimens as reported in the VertNet portal database.

| Measure | Mean | Minimum | Maximum | Std. Dev. | N |
|-----------------------|-------|---------|---------|-----------|----|
| Total length (mm) | 231.0 | 181.0 | 279.4 | 13.3 | 48 |
| Tail length (mm) | 134.5 | 105.0 | 171.4 | 11.3 | 48 |
| Hind foot length (mm) | 35.4 | 30.0 | 41.3 | 1.6 | 48 |
| Ear length (mm) | 11.4 | 8.0 | 13.0 | 1.9 | 5 |
| Body mass (g) | 23.5 | 15.5 | 30.0 | 7.4 | 3 |

Field guides (Ingles 1965, Jameson and Peeters 2004, Reid 2006) report Merriam’s kangaroo rat (all subspecies combined) body size greater than those recorded in the VertNet Portal data set for the San Bernardino kangaroo rat, which reinforces the fact that the San Bernardino kangaroo rat is a relatively small subspecies of *D. merriami*.

Life History

Because there is relatively little life history information available based on San Bernardino kangaroo rat studies, much of the following is summarized from other Merriam’s kangaroo rat subspecies studies. Although the San Bernardino subspecies is unique in many respects, studies from other subspecies provide the best available information to describe its attributes because the other subspecies are the nearest-related taxa to the San Bernardino kangaroo rat.

San Bernardino kangaroo rats appear to time reproduction to coincide with high food-availability (USFWS 2009) and reproduction may occur almost any month of the year, depending on food availability. Females can have more than one litter per year, with litter sizes ranging from two to five young (Kenagy and Bartholomew 1985, USFWS 2009). McKernan (1997) reported the reproductive condition of 247 adult San Bernardino kangaroo rat captures during live-trapping studies from 1988 through 1990 in the Santa Ana River and Cajon Wash. McKernan observed adult males in reproductive (scrotal) condition from January through August, with the greatest proportion reproductive in July. He observed adult females in reproductive condition (pregnant or lactating) from January through late November, with the greatest proportion observed in late June. McKernan (1997) reported that in four years of live-trapping studies (1989-1992) in the Santa Ana River, population density peaked each year in August, corresponding with the annual peak in juvenile numbers.

Females care for the young and may shift the young between day burrows, possibly to minimize parasite infestations or to avoid attracting predators (Behrends et al. 1986).

Average lifespan for Merriam's kangaroo rat is between 3 and 4 years (Brown and Zeng 1989). Fluctuations in kangaroo rat populations between years can be great. Price and Endo (1989) reported densities of Stephens' kangaroo rat (*Dipodomys stephensi*) as varying by factors of 3 to 10 (300% to 1000%) between years. Similarly, combined capture rates of three species of kangaroo rats (*D. spectabilis*, *D. ordii*, and *D. merriami*) at a long-term study site in southeastern Arizona fluctuated more than 20% over a 13-year period (Heske et al. 1994). The numbers of Merriam's kangaroo rats alone fluctuated by about 500% at the same study site (Zeng and Brown, 1987, Brown and Heske 1990). Reproduction in kangaroo rats is directly related to seed production and availability, which in turn is affected by annual precipitation. Kangaroo rats, like other Heteromyids, have relatively small litter sizes for rodents. They favor survival strategies such as food storage in dispersed caches (scatter-hoarding) and predator avoidance over reproduction during unfavorable drought periods; populations rebound during years with sufficient rain and seed production (Brown and Harney 1993).

San Bernardino kangaroo rats are active at night and retreat to their underground burrows during the day. They remain active throughout the year and rely on scattered seed caches when forage is scarce. They use burrows for cover, seed storage, mating, and for rearing young. It is unknown whether San Bernardino kangaroo rats routinely share their burrows with other individuals (K. Romich, California Department of Fish and Wildlife, personal communication).

Merriam's kangaroo rat is generally solitary but appears to be more social than other kangaroo rat species (Randall 1989). Females tend to occupy home ranges that do not overlap with other females' home ranges, while males usually exhibit home range overlap with females and other males, at least during the breeding season (O'Farrell 1980). Individuals may maintain stable home ranges over several seasons but may shift their activity within the home range (Behrends et al. 1986, Zeng and Brown 1987). Such long-term occupancy appears to allow individuals to establish stable relationships with neighbors, and females have been shown to mate with neighbor males (Randall 1989). During observations of paired encounters between neighbors and nonneighbor individuals, Randall (1989) observed that in most encounters Merriam's kangaroo rats mutually tolerated each other rather than exhibiting aggression. Females appeared to recognize neighbors and engaged in nonagonistic contact with neighbor males and females, whereas males attempted to contact both neighbors and nonneighbors, with interactions with males more likely to be agonistic. Randall (1989) concluded the males' behavior could be important for mating success, whereas females' recognition of neighbors may be important for spacing of home ranges and mating.

Burrow systems are clustered in an area (USFWS 2009). In a radio-telemetry study of another Merriam's kangaroo rat subspecies, home range sizes of males and females were similar, at about 0.32 ha (0.8 ac.) (Behrends et al. 1986). In another study of Merriam's kangaroo rat in

southeastern Arizona, Perri and Randall (1999) found average home range area for males to be 0.17 ha (0.41 ac.) and for females to be 0.07 ha (0.17 ac.).

In a live-trapping and radio-telemetry study of movements by Merriam's kangaroo rat in southeastern Arizona, Jones (1989) reported nightly movements of up to 146 m (479 ft.) by males and 123 m (403.5 ft.) by females. Behrends and others (1986) observed occasional long-distance movements of 100 m (330 ft.) or more. Based on recaptures at live traps, Jones (1989) reported total lifetime dispersal distances from their natal burrows between 0 and 265 m (869.4 ft.) in males and between 0 and 158 m (518.4 ft.) in females. Jones concluded that dispersal in Merriam's kangaroo rat consists of successive, relatively short, forays into areas adjacent to familiar areas. This behavior would both minimize the risks associated with predation, competition, and foraging in unfamiliar areas, as well as decreasing the overall rates of dispersal and colonization in suitable habitats by individuals. Braden (2001, cited in USFWS 2019a) reported male San Bernardino kangaroo rats are known to move much greater distances (300 to 400 m (984.3 to 1312.3 ft.)) during the breeding season, presumably to mate with reproductive females.

Range and Distribution

The San Bernardino kangaroo rat is endemic to California, historically ranging along alluvial fan habitats in floodplain terraces of the northern San Bernardino Valley and at the northern bases of the San Jacinto Mountains (Lidicker 1960, McKernan 1997). The current distribution of the San Bernardino kangaroo rat is limited to three disjunct geographic areas: Lytle Creek/Cajon Wash, Santa Ana River, and San Jacinto River/Bautista Creek (USFWS 1998). Additional details on the historical and current distribution of the San Bernardino kangaroo rat are provided below.

Historical Range and Distribution

Prior to the late 19th century, the San Bernardino kangaroo rat's geographic range encompassed the broad alluvial floodplains and upland areas that then existed in lowland areas in what is now western Riverside County, southwestern San Bernardino County, and a small part of eastern Los Angeles County (Figure 1). The geographic range existed as two major areas connected by a corridor of lowland habitat. One major area occurred in the north around the confluence of Lytle Creek and the Santa Ana River and the other area existed along the San Jacinto River in the south (Figure 1). The large northern area of the historical distribution included the areas south of the San Bernardino and eastern San Gabriel mountains, west of the San Jacinto Mountains, and north and east of the Chino Hills. The smaller portion of the historical range included the Meniffee Valley northeast of the Santa Margarita Mountains, north of the Tualota Hills, Rawson and Domenigoni mountains, and the Santa Rosa Hills, southeast of the rugged hills around Steele Peak, and west of the confluence area of the San Jacinto River

and Bautista Creek (Figure 1). The linkage between the two major historical range areas includes the area at the base of The Badlands and low-lying areas of the Kalmia Hills (USFWS 2019a).

Based on air photos, capture records and other historical accounts, McKernan (1997) estimated the historical geographic range of the San Bernardino kangaroo rat to encompass about 11,300 ha (28,000 ac.). In its analysis for the federal ESA listing of the species, the Service estimated a larger area as the historical range, which included the lower portion of the Cajon Pass (see USFWS 1998b). The northern extent of the range was likely the Cajon Pass in San Bernardino County, and the southernmost extent was in Menifee in Riverside County (Figure 1).

Recent and historical occurrence records of the San Bernardino kangaroo rat are shown in Figure 2. Although relatively few in number, historical records are distributed widely throughout the lowlands in the geographic range. Recent records are known only from three small, isolated areas in the Lytle Creek/Cajon Wash, Santa Ana River, and San Jacinto River areas.

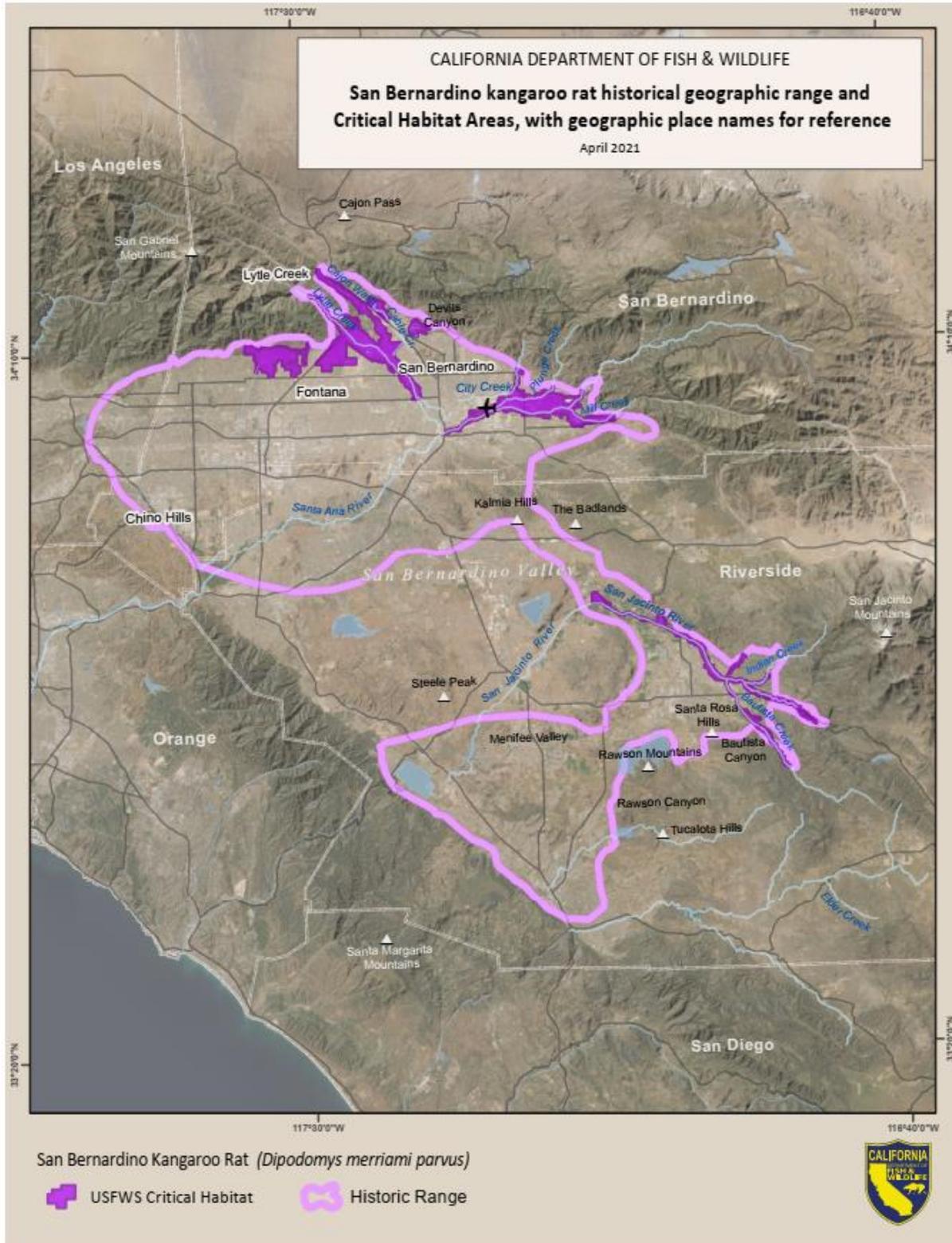


Figure 1. San Bernardino kangaroo rat historical geographic range and Critical Habitat Areas, with geographic place names for reference.

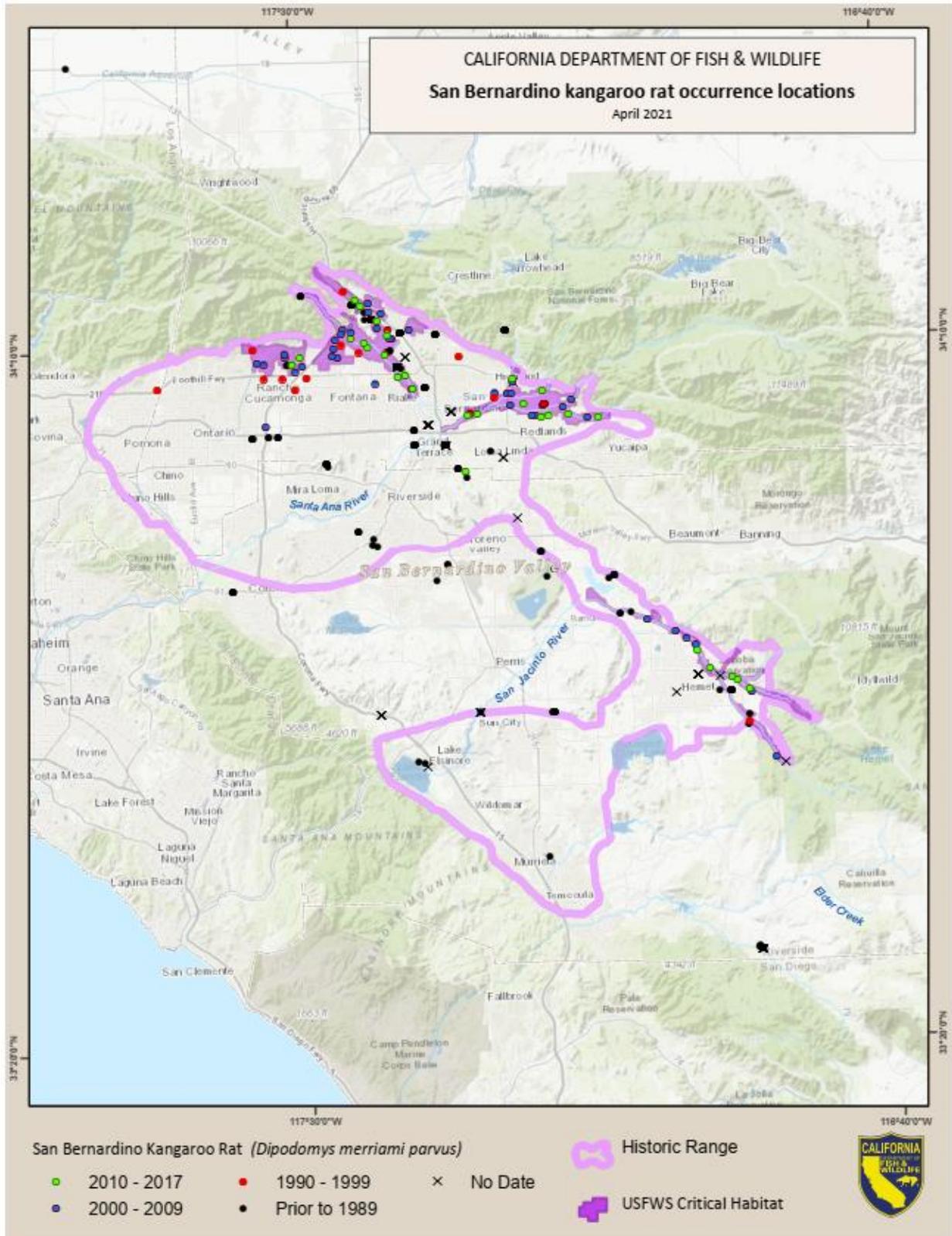


Figure 2. San Bernardino kangaroo rat occurrence locations by date of observation.

Current Distribution

The Service's analyses during the ESA listing process resulted in an initial estimate of approximately 1,300 ha (3,250 ac.) for the current geographic range at that time – considered to be the area of suitable habitat that had some degree of occupancy by the species (USFWS 1998a). The estimate was later revised up for the final listing rule and was considered to encompass about 3,900 ha (9,800 ac., USFWS 1998b). This total occurred in three separate areas, corresponding to the three extant populations: 1,545 ha (3,861 ac.) in the Santa Ana River; 2,065 ha (5,161 ac.) in Lytle Creek/Cajon Wash; and 310 ha (775 ac.) in the San Jacinto River (USFWS 1998b, p. 51005).

The following paragraphs, delimited by quotation marks, are excerpted from the USFWS' draft San Bernardino kangaroo rat Species Status Assessment (USFWS draft 2019a) and describe the distribution of the species within the three population areas. The Department has reviewed this summary of available scientific information and concurs with its description and conclusions.

Santa Ana River (San Bernardino County)

“The largest remaining population [in terms of area] of San Bernardino kangaroo rat appears to reside in and around the Santa Ana River. San Bernardino kangaroo rats are known to occur within the upper Santa Ana River wash from approximately 5.6 km (3.5 mi.) above the confluence of Mill Creek and the Santa Ana River to approximately 0.8 km (0.5 mi.) downstream from the western edge of the San Bernardino Airport in the City of San Bernardino. They occupy habitat within a mosaic of undisturbed habitat and developed areas and may use less suitable habitats such as the margins of water spreading grounds (groundwater recharge), airports, and aggregate mining operations, and fallow citrus groves (USFWS 2009, p. 6). They are most abundant in the wash area where Mill, Plunge, and Elder Creeks flow into the Santa Ana River. City Creek, which is just downstream of the wash area, is also occupied, as are the Mill Creek spreading basins on the historical flood plain south of Mill Creek.

“Throughout the Santa Ana River population, roughly 310.4 ha (767 ac.) are conserved to the benefit of San Bernardino kangaroo rat. The Santa Ana River population has the most intact and connected modeled upland habitat (although only 4.5% is currently conserved), helping to make it the most resilient remaining population.”

Lytle and Cajon Creeks (San Bernardino County)

“Lytle and Cajon Creeks appear to contain the second largest population [area] of San Bernardino kangaroo rat, after the Santa Ana River population (USFWS 1997). The Lytle-Cajon population is found in a roughly Y-shaped distribution

along Lytle and Cajon Creeks, from just north of the I-15 Bridge crossing in Cajon Creek to approximately 14.5 km (9 mi.) downstream and from above the I-15 Bridge crossing in Lytle Creek downstream approximately 12.9 km (8 mi.) into the City of San Bernardino, where it becomes a concrete-lined channel.

“Most San Bernardino kangaroo rat populations associated with tributaries to Lytle or Cajon Creeks appear to be extirpated. Just east of the main Lytle-Cajon population is a now disjunct area called Cable Creek. San Bernardino kangaroo rat were trapped in this area in 2004; however, multiple trapping efforts since then have produced negative results. This population was historically connected to Cajon Creek, but the Cable Creek area is now hydrologically and physically isolated from Cajon Creek by development and infrastructure.

“To the southeast of Cable Creek, within the Devil’s Canyon area (Subunit 2B), Riversidean Alluvial Fan Sage Scrub (RAFSS) habitat surrounds a series of percolation basins. This habitat is what remains of the Cajon Creek alluvial fan. San Bernardino kangaroo rat were historically trapped here, but they have not been found in this area since listing. We expect that this small and isolated population has been extirpated.

“To the south and west of Lytle Creek is a large triangular-shaped area in north Fontana west of Riverside and Sierra Avenues that historically contained San Bernardino kangaroo rat and was part of the Lytle Creek alluvial floodplain. The habitat here has become senescent with time and lack of hydrological flows. This area has not had a positive trapping result for San Bernardino kangaroo rat since 2002, despite numerous trapping efforts since then (2003, 2004, 2005, 2007, 2008, 2010, 2011, and 2016).

“The 555.6 ha (1,373 ac.) Cajon Creek Conservation Area, which includes a 273.2 ha (675 ac.) conservation bank, was set aside by Vulcan Materials, Inc. in the Cajon Creek wash¹. Trapping for San Bernardino kangaroo rat occurred through the Cajon Creek Habitat Conservation Management Area in November 2017 (S. Montgomery, [SJM Consulting] personal communication [to USFWS]). These data showed a general trend of San Bernardino kangaroo rats occurring in higher density in the late pioneer and intermediate RAFSS consistent with our

¹ This single inventory of the conservation area consisted of 28 small mammal trapping grids covering approximately 10.4 ha (25.60 ac.) (1.9%) of the of the conservation area. The study captured 131 San Bernardino kangaroo rats at 26 of the 28 grids (93% grid occupancy) with 6.2% trap success (K. Romich, California Department of Fish and Wildlife, personal communication).

understanding of distribution relative to habitat characteristics. San Bernardino kangaroo rat were also captured, albeit in low numbers, in mature RAFSS and buckwheat scrub, where suitable soils occur. San Bernardino kangaroo rat co-occurred with *Dipodomys simulans* kangaroo rats in most grids in the Cajon Creek Conservation Area, with *Dipodomys simulans* kangaroo rats outnumbering San Bernardino kangaroo rat in mature RAFSS.”

San Jacinto River (Riverside County)

“The smallest remaining population [based on area] of San Bernardino kangaroo rat is on the San Jacinto River and its tributary, Bautista Creek. San Bernardino kangaroo rat are primarily confined to the upper reaches of the San Jacinto River as animals downstream have been extirpated by agriculture, residential development, and flood control activities. The population has contracted from 24 km (15 mi.) in length historically to a record of approximately 17.7 km (11 mi.) in 2005 to about 9.7 km (6 mi.) in length along the San Jacinto River currently. The extant distribution appears to be from just upstream of the confluence of Indian Creek to approximately 1.6 km (1 mi.) north of the Main Street Bridge (WRCRCA 2016). The distribution of the San Jacinto population is bisected by an abandoned surface mine that is 12.2 to 18.3 m (40 to 60 ft.) deep and poses a substantial barrier to San Bernardino kangaroo rat movement.

“The most recent trapping effort found 182.5 ha (451 ac.) were occupied out of a total of 569.8 ha (1,408 ac.) of suitable habitat (WRCRCA 2016, p. 10), putting this population at approximately 32% occupancy. The largest concentration of San Bernardino kangaroo rats within this population is between the San Jacinto River-Bautista Creek confluence and the Main Street Bridge (USFWS 2011). The San Jacinto population is the only known remaining population within Riverside County.

“The last capture record for San Bernardino kangaroo rat in Bautista Creek was in 2002 when one animal was caught. Minimal trapping has occurred in the Bautista Creek population since then; however, a trapping effort in 2015 produced negative results (WRCRCA 2016). This population’s status is currently unknown; however, it is isolated from the San Jacinto River population by more than 6.4 km (4 mi.) of development, agricultural operations, and 6.4 km (4 mi.) of concrete-lined channel.”

Population Structure and Genetics

The work of Shier and her colleagues (documented in a pre-publication report to USFWS as Shier et al. 2018, and in a peer-reviewed scientific journal publication as Hendricks et al. 2020) provides a comprehensive examination of the current population genetics of the San Bernardino kangaroo rat. This body of work informs several recommendations presented in Hendricks et al. (2020) to improve the species' conservation status from a population genetics perspective (see Management Recommendations section of this report). Unless otherwise noted, all references to San Bernardino genetics in the following section are from the peer-reviewed version of the report in *Conservation Genetics* (Hendricks et al. 2020).

Shier and her colleagues conducted the range-wide genetics study using tissue samples collected from 169 San Bernardino kangaroo rats collected in 2015 and 2017 at 17 sites throughout the three populations. Genetic information was extracted from 51 individuals at five sites in the Lytle/Cajon Creek populations, 57 individuals from three sites in Santa Ana River, and 61 individuals from four sites in San Jacinto River. The researchers used nucleotide sequencing of both mitochondrial DNA (mtDNA) and nuclear DNA to assess different aspects of the subspecies' population genetics. Mitochondria are passed only from mothers to their offspring – there is no paternal contribution -- and mtDNA does not recombine during meiosis, as does nuclear DNA. Thus, in general, mtDNA is conservative over time and therefore is useful for understanding the phylogeny (evolutionary history) of a species. Nuclear DNA changes more rapidly in successive generations than mtDNA and is useful for understanding population structure and family lineages.

Population geneticists have developed several metrics and statistical tests to describe different attributes of species and populations. The following is the Department's summary of the Hendricks et al. (2020) report's results and conclusions.

Mitochondrial DNA Analyses

From the 169 sampled individuals, the researchers found 14 mtDNA haplotypes, or unique maternal lineages. All but one of these haplotypes was confined to one of the three populations areas; one haplotype occurred in both the Lytle/Cajon Creek and Santa Ana River population. This is one of several results indicating little gene flow occurs between populations. Both the Lytle/Cajon Creek population and the Santa Ana River population had five unique haplotypes, plus one shared haplotype resulting from a translocation of 377 individuals in 2015. The San Jacinto River population had three haplotypes, all unique to the population. Haplotype diversity (H_D), a measure of diversity that accounts for both the number of haplotypes and the number of individuals in a population sample, was highest in the Lytle/Cajon Creek population ($H_D = 0.798$), somewhat lower in the Santa Ana River population (0.659), and quite low at the San Jacinto River population (0.126).

Overall diversity of nucleotide sequences (polymorphisms) in the mtDNA samples was low. Tajima's D, a population genetic test statistic, indicates whether DNA in a population is evolving randomly or is under selection, and whether the population size is expanding or contracting. Tajima's D was not statistically significant at the population level; however, for the Hemet sample site within the San Jacinto River population, Tajima's D had a significantly negative value, suggesting a population expansion after a previous contraction. Within the Santa Ana River population's Redlands site, Tajima's D was significantly positive, suggesting a recent population contraction. No other sample site had a significant result in this test.

Statistical methods to infer the likely sequence of evolution from one haplotype to another (statistical parsimony networks, phylogenetic trees based on Bayesian inference and maximum likelihood) can be used to determine the most likely ancestral versus derived haplotypes (see Figure 2 of Hendricks et al. 2020). These methods indicate there is one geographically clustered group of closely related haplotypes in the Lytle/Cajon Creek population (which includes the haplotype shared with the Santa Ana River population). Otherwise, there is no geographic clustering within the haplotype network or phylogenetic tree, which suggests the divergence in haplotype lineages occurred prior to isolation of the three populations.

Nuclear DNA Analyses

Genetic diversity indexes for species, populations, and sample sites. Table 2 lists a variety of population genetic diversity values estimated at both the sample site and population level by Shier et al. (2018). Genetic diversity in a population can be described using several parameters, including allelic richness (AR), private allelic richness (PAR), and observed heterozygosity (H_O). AR refers to the number of different versions of a gene (alleles) there are, averaged across all the genes for all individuals. Higher numbers of alleles provide greater evolutionary potential – in other words, natural selection may operate with more versions of genes in the population. PAR is similar, except it assesses the number of alleles that are unique within a site or population. H_O is the proportion of loci (genes or genetic markers) within a site or population that are heterozygous (that is, have two different alleles rather than two copies of the same allele). Values for all three parameters were lower for the San Jacinto River population than for the other two populations (Table 2), which is consistent with the relatively low mtDNA diversity seen for the San Jacinto population).

Genetic differentiation between populations (pairwise F_{ST}). The San Jacinto River population showed high genetic differentiation from both the Lytle/Cajon Creek population ($F_{ST} = 0.213$) and the Santa Ana River population ($F_{ST} = 0.189$). The Lytle/Cajon Creek and Santa Ana River populations had relatively low differentiation from each other ($F_{ST} = 0.098$).

Population inbreeding coefficient (FIS). This metric compares the observed heterozygosity value with the expected heterozygosity (H_E), a theoretical value for a sampled population that assumes random breeding and no selective pressure. Population inbreeding coefficients for the three populations range from 0.042 in Lytle/Cajon Creek to 0.072 in San Jacinto River, which are considered “low but significant,” suggesting that inbreeding is likely occurring (Shier et al. 2018).

Individual inbreeding coefficient (F) is a metric that quantifies the probability that an individual will inherit two identical alleles from a common ancestor. Individual inbreeding coefficients show that roughly a quarter of individuals sampled in each population had elevated F, providing further support that inbreeding is an issue for the species (Supplementary Table S4 in Hendricks et al. 2020).

Effective population size for populations and sample sites (N_e). The effective population size of a population represents the number of breeding individuals in recent generations (D. Shier, San Diego Zoo Wildlife Alliance, personal communication). Where genetic diversity is high and most adults have a good probability of breeding, then N_e approaches the actual number of breeding females in the population. However, where only a few individuals breed or breeding individuals are genetically similar, then N_e can be much lower than the actual number of adult females. Low effective population sizes are detrimental to populations both by limiting the

genetic variation available to cope with selection pressures, and by increasing the chances of genetic drift, which is the further loss of allelic richness through small population size. The N_e estimate for the Lytle/Cajon Creek population was 85.8 (95% confidence interval 67.7 to 114.2), for Santa Ana River was 30.4 (26.2-35.7), and for San Jacinto River was only 14.7 (10.9-19.6) (Table 2). Individual sites with adequate sample sizes yielded N_e point estimates between 2 and 130, with most sites between 2 and 30 (Table 2). These N_e values for the populations are extremely low and are another indication that the species suffers from lack of genetic diversity and has limited capacity to respond to stressors such as disease and changes in physical and biotic environment.

Gene flow between and genetic clustering of sample sites and populations. The study included a modeling effort to determine theoretical exchange of individuals between the three populations and between sample sites. The model's results suggest the overwhelming percentage (98-99%) of individuals per generation originate from within their own population, not from other populations. Within sample sites, the percentage of individuals per generation originating onsite ranged from 68% to 89%. The models suggest there is essentially no migration between the populations and limited migration between sites. The gene flow results are consistent with cluster analyses that indicate overall similarity in genotypes is greatest within the populations. Each individual's genetic characteristics matched others' characteristics within the same population, and each population's individuals were distinctly different from those of other populations (see Hendricks et al. 2020).

Table 2. Genetic indices for the San Bernardino kangaroo rat, as summarized in Table 3 of Shier et al. (2018) and Supplementary Table S4 of Hendricks et al. (2020). Summary statistics from microsatellite data (nuclear DNA): sample size (N), allelic richness (AR; level of genetic diversity), private allelic richness (PAR; level of diversity and isolation), observed heterozygosity (H_o ; a metric of individual diversity), expected heterozygosity (H_E ; individual diversity expected from population-level allele frequencies), weighted inbreeding coefficients (F_{IS} ; estimated from the difference in observed vs. expected heterozygosity), and effective population size (N_e , estimated from linkage disequilibrium; the size of an ideal theoretical population that would have the same degree of loss of genetic diversity as we see in the San Bernardino kangaroo rat) with 95% CI. Allelic richness and private allelic richness estimates are rarefied. Negative N_e values and CI that extend to infinity indicate the number of samples from these locations is too small to calculate a reliable estimate.

| POPULATION/SITE | N | AR | PAR | H_o | H_E | F_{IS} | N_e (95% CI) |
|--------------------------|-----------|--------------|-------------|--------------|--------------|---------------|--------------------------|
| LYTLE/CAJON CREEK | 51 | 10.86 | 2.57 | 0.776 | 0.802 | 0.042* | 85.8 (67.7-114.2) |
| Hwy210 | 3 | 3.64 | 0 | 0.762 | 0.623 | -0.133 | -2.9 (-3.3-inf.) |
| Glen Helen | 7 | 5.5 | 0.07 | 0.847 | 0.716 | -0.107 | -164.5 (44.3-inf.) |
| Institution | 1 | 1.86 | 0.07 | 0.857 | 0.429 | -- | -0.3 (-0.3-inf.) |
| Lytle Creek Cons. Bank | 19 | 7.07 | 0 | 0.756 | 0.736 | 0.0004 | 34.8 (25.7-51.2) |
| Cajon Creek Cons. Bank | 21 | 9.5 | 0.43 | 0.769 | 0.809 | 0.062* | 130.5 (76-400.7) |
| SAN JACINTO RIVER | 61 | 5.57 | 0.57 | 0.577 | 0.616 | 0.072* | 14.7 (10.9-19.6) |
| North of Lake Park Dr. | 5 | 2.64 | 0 | 0.486 | 0.449 | 0.029 | 2.1 (1.4-5.9) |
| South of Lake Park Dr. | 22 | 3.93 | 0 | 0.519 | 0.536 | 0.049 | 31.1 (17.3-84.1) |
| Hemet | 19 | 3.79 | 0.14 | 0.538 | 0.548 | 0.045 | 11 (7.3-17.2) |
| Valle Vista | 15 | 4.5 | 0.21 | 0.743 | 0.644 | -0.119* | 39.4 (19.5-235.7) |
| SANTA ANA RIVER | 57 | 9.29 | 1.21 | 0.744 | 0.783 | 0.058* | 30.4 (26.2-35.7) |
| Redlands (Diversified) | 22 | 5.64 | 0.14 | 0.731 | 0.696 | -0.026 | 9.1 (7.3-11.5) |
| Mountain View | 15 | 6.14 | 0.14 | 0.724 | 0.686 | -0.0204 | 13.9 (10.8-18.3) |
| SBV & Cone Camp | 20 | 8.07 | 0.71 | 0.775 | 0.766 | 0.014 | 60.9 (42.6-101.7) |

*Significance $p \leq 0.05$

In summary, the genetics work on the San Bernardino kangaroo rat by Shier and her colleagues indicates:

- the three remaining populations are highly fragmented,
- there has been no recent natural gene flow between the three populations,
- genetic diversity is low throughout the species,
- separation of the populations was recent, likely coinciding with increased development within the species' geographic range since the late 19th century, and
- the species' continued existence is at risk due to loss of genetic diversity and isolation of populations.

Habitat Associations and Use

The San Bernardino kangaroo rat inhabits alluvial floodplains and adjacent upland habitats. Like other Merriam's kangaroo rats, the San Bernardino kangaroo rat prefers open habitats with low shrub canopy cover and rarely occurs in dense vegetation (McKernan 1997). It prefers sandy loam substrates, which are characteristic of alluvial fans and floodplains, where it is easy to dig shallow burrows and cache food supplies (USFWS 1998). The Scalebroom Scrub (*Lepidospartum squamatum*) Shrubland Alliance (Sawyer et al. 2009), RAFSS, may exist in low shrub densities on loose sandy soils preferred by the San Bernardino kangaroo rat (USFWS 1998). According to the draft Species Status Assessment report for the San Bernardino kangaroo rat (USFWS 2019a), "RAFSS is a relatively uncommon desert-influenced plant community in southern California that develops on alluvial fans and floodplains subjected to scouring and deposition."

The Service's Critical Habitat designation notice and other sources describe San Bernardino kangaroo rat habitat characteristics as including "sandy or gravelly soils and substrates, generally supporting open-structured alluvial fan scrub vegetation, in floodplains with active fluvial processes and nearby upland and/or less frequently inundated terraces" (USFWS 2002).

One study conducted over several years in the Woolly Star Preserve area of the Santa Ana River system provides detailed information on San Bernardino kangaroo rat habitat associations in that area (USFWS 2010). The study included trapping in both active channel and floodplain-terrace habitats from 2006 through 2009, followed by a comprehensive data collection effort in 2011. Small mammal trapping grids encompassing 28 m² (300 ft²) were randomly placed within various habitat types. These small grids (n=360) were trapped, and the results analyzed to determine San Bernardino kangaroo rat detection probability and to explore the relationships between kangaroo rat occupancy and habitat metrics. Large (99 m², 1065 ft²) mark recapture grids (n = 6) were permanently established within highly suitable San Bernardino kangaroo rat habitat to estimate abundance, as well as to summarize and assess differences in measured habitat characteristics.

USFWS (2010) found San Bernardino kangaroo rat occupancy had a negative exponential relationship with percent cover of annual grass and a negative linear relationship with percent cover of large substrate (e.g., boulder and cobble). Occupancy had a positive linear relationship with scalebroom presence. Weaker models also suggested kangaroo rat occupancy was related to percent cover of shrubs (positive); yerba santa (*Eriodictyon californicum*) (negative); annual forb (positive); and herbaceous perennials (positive). Percent annual forb cover, and local presence of yerba santa or cryptogamic crust, seemed only marginally associated with San Bernardino kangaroo rat occupancy. Although these habitat variables may indeed contribute either directly or indirectly to local San Bernardino kangaroo rat occupancy probabilities (Reynolds 1958, Bradley and Mauer 1971), their individual effects likely were correlated with

the better supported annual grass, boulder and cobble, and scalebroom variables. Although the best-supported baseline habitat-covariate model was relatively parsimonious, with only three habitat parameters, it provided reasonable predictions of local (grid-level) San Bernardino kangaroo rat occupancy within floodplain-terrace habitats. Overall, the results indicate that San Bernardino kangaroo rat occupied areas with average shrub percent cover of 25%, with scalebroom scrub cover approximately 5%. Annual grass percent cover was typically below 35%. Other constraints included having lower percentage of boulders and cobble, combined for less than 10% of the substrate cover, and average depth of looser soil between 7.9 and 9.9 in. (USFWS 2010).

Other literature highlights the importance of active hydrologic conditions (with periodic flood events within the floodplain) to sort soils, disturb maturing vegetation, and maintain the relatively open vegetation preferred by the kangaroo rat (McKernan 1997, Smith et al. 1980). Based on a species distribution modeling at the landscape level using occurrence data from 2002 to 2018, (Shier et al. 2019, Chock et al. 2020), the presence of San Bernardino kangaroo rat is most strongly associated with alluvial scrub cover and fluvial soils. Microhabitat modeling that identified habitat features associated with San Bernardino kangaroo rat abundance at a fine scale indicated that there were higher numbers of individuals at sites with <20% shrub cover, <30% annual grass cover, and ≥50% open (bare) ground, which includes sand and gravel exposure of ≥25% of the area. The microhabitat model suggests low cover of woody debris (6% – 13%) is also important. Factors negatively affecting San Bernardino kangaroo rat abundance include presence of fine soils, organic duff and soil content, and larger soil particles such as cobble and boulders (Shier et al. 2019, Chock et al. 2020). All these habitat features are directly affected by high flood events that promote the favorable factors and diminish the negative factors. The most robust San Bernardino kangaroo rat populations occur in areas receiving occasional disturbance-event floods. However, some occupied areas have not recently experienced such flooding (Shier et al. 2019, Chock et al. 2020).

Natural stream channels on alluvial fans are shallow and braided, with sediment ranging from fine silt to boulder size. Sediment originates in the mountain headwaters, where erosion and debris flows contribute to its transport downstream. Once it is deposited in the alluvial fan area, floods and other high-water events rework the sediment through scour, transport, and deposition. Over time, a channel may develop, where coarse sediments (cobble and boulder) predominate in the most active part of the channel and finer sediments (pebble, sand, and silt) are more common farther away from the active channel. It is common for active channels to shift during flood events, as higher velocity flows work to erode point bars and slower velocity areas receive sediment by deposition. During flood events, water and sediment may overtop the banks of the stream and deposit fine sediment in the upland area.

These processes also affect vegetation in the channel and upland areas. In the absence of disturbance from flood, the shrubs grow larger and cover more ground, and grasses and forbs fill in the spaces between shrubs. Where high velocity water erodes the channel, plants are removed along with the soil. Heavy deposition of soils in an area can bury (or partially bury) plants, and either set back their growth or kill them. Parts of the stream channel that are less frequently worked by high water tend to have relatively mature vegetation, while more active parts of the channel may have early successional scrub or no vegetation at all.

Between flood events, San Bernardino kangaroo rats inhabit and use the array of available vegetation and soils on the alluvium in different ways. They appear to mostly avoid coarse sediments, such as areas of cobble and boulders, as they are difficult to traverse and offer few food resources. Open areas of early successional scrub are easy for kangaroo rats to move through and offer little cover for terrestrial predators (though aerial predators, such as owls, are more of a danger in open habitats). Open areas may also have relatively abundant seeds in the loose soils, which are easily gathered by the kangaroo rats. In areas with older vegetation and greater plant cover, movement and predator avoidance are more difficult for kangaroo rats, though there may be a more abundant seed bank. Older vegetation areas may also offer better opportunities for burrow construction, as the soils are firmer and bolstered by the roots of shrubs. Upland areas are also habitable, but like mature areas within the stream channel, are less optimal for meeting all the San Bernardino kangaroo rat's life history needs. San Bernardino kangaroo rats also face competition from the Dulzura kangaroo rat, which favors the more upland habitats in the species' range.

During periods in which successive years of adequate precipitation yield good seed production, San Bernardino kangaroo rat numbers will increase due to relatively high reproduction. Where a natural array of early- to late-successional scrub vegetation is available, the local San Bernardino kangaroo rat population will expand over the generations and inhabit much of the area in and around stream channel areas – with higher densities in the high-quality habitat areas and with lower densities in lower quality areas. High water and flood events, while rejuvenating habitat, likely drown many kangaroo rats living in active channel areas. The areas are then repopulated by the dispersing offspring that survived the flood in the upland areas and less active parts of the stream channel.

Maintenance of San Bernardino kangaroo rat habitat quality thus requires both adequate and natural stream flows to ensure ongoing sediment transport, with occasional flood events, as well as natural connections between upland and other refugium habitat areas and the more actively worked parts of the channel (USFWS 2002). Naturally functioning alluvial systems, which produce the full array of scrub successional stages in a well-connected mosaic, are necessary to sustain San Bernardino kangaroo rat populations (USFWS 2002 and USFWS 2009).

Diet

Like other subspecies of Merriam's kangaroo rat, the San Bernardino kangaroo rat is granivorous, meaning they primarily forage for seeds, which are generally high in calories. Kangaroo rats have inflated auditory bullae resulting in a restricted jaw gape, therefore the seeds used by kangaroo rats tend to be small. The seeds primarily come from grasses and forbs and are generally less than 3 mm (0.12 in.) in length and with a mass less than 25 mg (0.0009 oz., Reichman and Price 1993). Heteromyids use two methods to harvest seeds: 1) directly collecting the seeds from plants and 2) collecting seeds from soil surfaces (Reichman and Price 1993). An advantage to having a diet primarily of seeds is that it allows animals to store the food items for long periods of time without spoiling, which is an important adaptation for xeric environments where seed production is sporadic and unreliable. Kangaroo rats store seeds in caches located in their burrow systems or on the soil surface. Burrow caches, called "larder hoards," are usually larger than surface caches, called "scatter hoards," which are placed in shallow pits distributed around on the soil surface (Jenkins et al. 1995).

Merriam's kangaroo rat is generally known for its ability to live indefinitely without drinking water while subsisting primarily on dry seeds (USFWS 1998). Seeds serve as an important source of water as the preformed water within seeds is absorbed by the kangaroo rats. Seeds stored underground also adsorb water from water vapor in the burrow air, which increases the water content ingested with the seeds. Water is also produced through oxidation of the starch and lipid molecules in the seeds when they are digested (Schmidt-Nielsen 1979). They are morphologically adapted for desert life with external, fur-lined cheek pouches which allow for water loss minimization during the transfer of seeds (Schmidt-Nielsen 1979). The fur-lined cheek pouches also allow for heteromyids to process and eat seeds in their burrows rather than in a potentially dangerous above-ground environment. Heteromyids rarely eat seeds while foraging and often do not husk seeds before storing them in their cheek pouches (Reichman and Price 1993).

The San Bernardino kangaroo rat also eats herbaceous vegetation and insects in the spring during the reproductive season. When available, insects may comprise up to half of the diet (USFWS 1998); insects are important in the diet during periods of growth and reproduction due to their high protein content (Reichman and Price 1993). Food availability has been cited as a factor affecting kangaroo rat reproduction success. Females increase ingestion of foods with higher water content during lactation (USFWS 2009). Foraging is influenced by many factors, including the threat of predation. When seeking and processing food, San Bernardino kangaroo rats must balance energetic gain with the threat of predators (Shier et al. 2020).

Competition

Kangaroo rats compete with other rodent species for food and cover resources. There is a large body of ecological literature on the structuring of heteromyid rodent communities, including the role of interspecific competition (see Brown and Harney 1993). The most intensive competition occurs between individuals with similar resource use habits, which for a San Bernardino kangaroo rat is other San Bernardino kangaroo rats. Setting aside this intraspecific competition, the most important competitors of San Bernardino kangaroo rats are probably other heteromyid species that occur within its geographic range. These include the Dulzura kangaroo rat which until the 1990s, was considered a subspecies of the Pacific kangaroo rat, *Dipodomys agilis*), and three species of pocket mice: the California pocket mouse (*Chaetodipus californicus*), San Diego pocket mouse (*Chaetodipus fallax*), and the little pocket mouse (*Perognathus longimembris*). Of these, the Dulzura kangaroo rat is most similar in form and ecological characteristics to the San Bernardino kangaroo rat. However, its body mass (range 55 to 70 g (1.9 to 2.5 oz., Best 1999) is roughly twice that of the San Bernardino kangaroo rat. The pocket mice range in body mass from less than half to about nine-tenths the body size of the San Bernardino kangaroo rat. Kangaroo rats are bipedal and prefer open, flatter habitats, while pocket mice are quadrupedal and may occur in more rugged areas with dense vegetation. Pocket mice are also capable of using torpor to reduce energy expenditures during cold periods, a physiological adaptation that kangaroo rats do not have. Throughout its wide geographic range, Merriam's kangaroo rat occurs as the smallest-bodied kangaroo rat within the granivorous rodent species assemblage and may co-occur with one or more pocket mouse or murid rodent species, such as the cactus mouse (*Peromyscus eremicus*), all smaller than Merriam's kangaroo rat (Brown and Harney 1993), and woodrats (genus *Neotoma*), which are primarily folivorous and much larger bodied than *D. merriami*.

Differences in body size, locomotory mode, and energetic strategy all provide a means of reducing direct competition for resources by these similar species and has allowed stable and rich assemblages of heteromyid and murid rodents to occur in the American Southwest. Limited food resources and interspecific competition may play a role in regulating the density of rodent populations and determining the organization of rodent communities - with an increase in a seed source resulting in an increased density of the largest granivorous rodent species and decreased densities of the two next-to-largest species; and reciprocal shifts in the densities of congeneric species (Brown and Munger 1985). Thus, competition can be an important driving factor in the evolution and ecology of desert rodent communities.

Predation

Little is known about specific predators of San Bernardino kangaroo rat, but native predators probably include owls, gray fox (*Urocyon cinereoargenteus*), coyote (*Canis latrans*), bobcat

(*Lynx rufus*), ringtail (*Bassariscus astutus*), striped skunks (*Mephitis mephitis*), long-tailed weasel (*Mustela frenata*), badger (*Taxidea taxus*), and snakes (USFWS 2002).

It is estimated that free-ranging domestic cats (*Felis catus*) kill 6.3-22.3 billion mammals annually (Loss et al. 2013). Cats are opportunistic hunters and can occur in high densities in many areas, posing a potential predator threat to San Bernardino kangaroo rat where they overlap (Trouwborst et al. 2020).

STATUS AND TRENDS IN CALIFORNIA

Administrative Status

Endangered Species Act

The San Bernardino kangaroo rat is listed as endangered under the ESA by the Service. The species was listed under an emergency rule in 1998 (USFWS 1998). In 2009 the Service published its 5-year status review for the species and based on ongoing threats and lack of recovery, recommended no change in the listing status of the San Bernardino kangaroo rat (USFWS 2009). In April 2020, the Service published its second 5-year status review for the species and concluded the species remains endangered (USFWS 2020).

California Species of Special Concern

The San Bernardino kangaroo rat was designated a Species of Special Concern by the Department in 1992. Species of Special Concern (SSC) is a Department administrative designation that does not confer any special legal protection. It is intended to alert biologists, land managers, and others to a species' declining status and to encourage additional management considerations for these species to ensure population viability and to preclude the need for listing. SSCs are defined as species, subspecies, or distinct populations of an animal native to California that currently satisfies one or more of the following (not necessarily mutually exclusive) criteria: extirpated from the State or, in the case of birds, in its primary seasonal or breeding role; listed under the federal Endangered Species Act (but not CESA) as threatened or endangered; meets the State definition of threatened or endangered but has not been formally listed; is experiencing, or formerly experienced, serious (nonscyclical) population declines or range retractions (that have not been reversed) that, if continued or resumed, could qualify it for State threatened or endangered status; has naturally small populations exhibiting high susceptibility to risk from any factor(s), that if realized, could lead to declines that would qualify it for State threatened or endangered status (Comrack et al. 2008). As an SSC, the San Bernardino kangaroo rat is also considered a "Species of Greatest Conservation Need" in the 2015 update of California's State Wildlife Action Plan by definition (CDFW 2015).

During the Department's Mammal Species of Special Concern update project in 2010, the project's independent Technical Advisory Committee evaluated the conservation status of all of

California's native mammal species and subspecies, including those taxa already listed under the federal or state Endangered Species Acts (CDFW unpublished information). The Committee based its evaluation on several criteria, including population trend, geographic range trend, population size, range size, and degree of threat, among other factors. The San Bernardino kangaroo rat received a score of 86.8 out of a possible 105 total points, where higher scores indicate greater conservation concern. Only two other mammal species received higher scores. These are the wolverine (*Gulo gulo*), which is effectively extirpated from California, and the Fresno kangaroo rat (*Dipodomys nitratooides exilis*), which is both state and federally listed as endangered. More than 20 mammal taxa already listed under either or both CESA and the ESA received lower scores than the San Bernardino kangaroo rat (CDFW unpublished information).

California Endangered Species Act

The San Bernardino kangaroo rat is currently a Candidate for listing as Threatened or Endangered under CESA (Fish & G. Code, § 2050 *et seq.*). During candidacy, the species receives the protections afforded by CESA as if it were listed, including the general prohibition on “take” (“to hunt, pursue, catch, capture, or kill” or to attempt to engage in these activities, Fish & G. Code, § 86). Incidental take authorization, as well as authorization for take for scientific, educational, or management purposes, may be authorized for candidate species under the Fish and Game Code. Candidacy will end once findings are published related to the Commission's listing decision.

Trends in Distribution and Abundance

Distribution Trend

The amount of suitable and occupied habitat for the San Bernardino kangaroo rat has decreased dramatically since development increased significantly within the species' geographic range over a hundred years ago. One estimate of the size of the species' historical geographic range is nearly 135,000 ha (roughly 333,333 ac., USFWS 1998). As previously described, most of the available habitat in the historical range has been converted through agricultural development, followed by residential and commercial development. Suitability has been much reduced through water diversions and flood control projects, and some suitable habitat has been isolated as small fragments separated by unsuitable habitat areas. McKernan (1997) estimated that the great majority of habitat within the subspecies' historical range was no longer suitable for the kangaroo rat by the 1930. Occupied habitat now occurs in three areas, each of which is a collection of sites where San Bernardino kangaroo rats persist.

Since 1997, several authors have estimated the geographic range area, suitable habitat area, or occupied habitat area for the San Bernardino kangaroo rat at various points in time. These estimates are summarized in Table 3. Methods have varied in these studies, but the two conclusions that emerge are 1) from the time before increased settlement of the area began in

the 1880s until 1998, 90% or more of the habitat for the species was converted to non-suitable or non-occupied condition; and 2) suitable, occupied habitat has continued to be lost since its listing under the ESA. White, Braden, and Brylski (reported in the Petition, EHL 2019), assessed the amount of suitable habitat in both 1998 and 2018. According to this study, roughly 4,400 ha (11,000 ac.), or about 30% of remaining suitable habitat, was lost over the 20 years since ESA listing.

Table 3. Estimates of the geographic range area, suitable habitat area, and area of occupancy of the San Bernardino kangaroo rat from the historical period to 2018.

| Area Description | Year | Hectares | Acres | % of 1880s area | % of Petition 1998 Estimate | Reference and Notes |
|--|------|----------|---------|-----------------|-----------------------------|---|
| Historical geographic range | 1880 | 130,587 | 326,467 | 100% | | USFWS 1998; Final Rule to List. USFWS unpublished GIS analysis; equals area of suitability based on suitable soils and historical collections of the subspecies; not all this historical range would have been occupied; USFWS used 2.5:1 conversion for ac/ha conversion rather than 2.471:1. |
| Geographic range, early 20 th century | 1930 | 11,326 | 28,000 | 9% | | McKernan 1997. Summed from McKernan (1997) Figure 15 "Estimated acreage of historic suitable habitat for SBKR" [later designated by USFWS as applying to the "1930s"] |
| Known occupied habitat | 1996 | 1,313 | 3,247 | 1% | | McKernan 1997. Summed from McKernan (1997) Figure 16 "Approximate acreage of known occupied SBKR habitat, 1996" |
| Likely suitable occupied habitat | 1997 | 3,919 | 9,797 | 3% | | USFWS 1998; Final Rule to List. USFWS unpublished GIS analysis -- based on Braden and McKernan's assessment that SBKR occupy a wider range of soil and vegetation types than previously thought, added additional blocks of native vegetation, while subtracting overmature scrub and degraded habitat areas. |
| Suitable habitat | 1998 | 14,749 | 36,464 | 11% | 100% | Petition 2019. Based on current and 1998 air photos, survey reports, etc. |
| Likely occupied area within Critical Habitat | 1998 | 13,155 | 32,480 | 10% | 89% | USFWS 2002; Final Critical Habitat Rule. Revised analysis based on additional information on habitat usage and occupancy since the time of listing led to conclusion that the area occupied in 1997 was significantly underestimated; |

| Area Description | Year | Hectares | Acres | % of 1880s area | % of Petition 1998 Estimate | Reference and Notes |
|-------------------------------|------|----------|--------|-----------------|-----------------------------|--|
| | | | | | | unclear how much suitable occupied habitat existed outside CH areas |
| Occupied suitable habitat | 2008 | 4,328 | 10,696 | 3% | 29% | USFWS 2008; Final Revised Critical Habitat Rule. Cited in USFWS 2009 as USFWS 2008b, p. 91936; "...the current range of the species encompasses at least 10,696 acres (4,328 hectares). While these acres do not encompass all habitat occupied by or suitable for the SBKR, we believe that they do represent much of the remaining occupied habitat (USFWS 2008b, p. 61936)." ² |
| Suitable habitat | 2018 | 10,382 | 25,668 | 8% | 70% | EHL 2019. Based on current and 1998 air photos, survey reports, etc. |
| Estimated functioning habitat | 2018 | 6,593 | 16,300 | 5% | 45% | USFWS 2018; RO briefing paper. Number taken from Petition's Table 1 |

² The Department could not find these habitat areas depicted on the referenced page or elsewhere in USFWS 2008b.

Population Trend

There is no survey or census-type information that quantitatively addresses population trend in the San Bernardino kangaroo rat across its geographic range. Despite the relatively restricted current range of the species, funding for range-wide monitoring has not been available on an ongoing basis. However, some live-trapping studies have estimated the abundance or density of San Bernardino kangaroo rats at specific sites over a period, notably including McKernan (1997) for the period 1987 to 1996. Consistent with findings for other kangaroo rats (Brown and Harney 1993, Germano and Saslaw 2017), McKernan (1997) found large fluctuations in San Bernardino kangaroo rat density at his six trapping sites, in both seasonal and annual time scales, as well as large differences between sites based on habitat quality.

Many live-trapping studies have been conducted to assess the presence or absence of San Bernardino kangaroo rats at proposed development sites as part of the environmental review process. Although important for determining whether a proposed project is likely to result in “take” of the species during implementation, these studies do not contribute much information to our understanding of population trend because they do not generally determine population size or density at the trapping site. Further complicating the assessment of population trend are the fluctuations in kangaroo rat density that cannot be attributed to identifiable factors, such as habitat structure or quality, preceding weather patterns, food availability, and reproduction. For example, Braden and McKernan (2000, cited in USFWS 2002) estimated San Bernardino kangaroo rat densities varied between 2 and 26 individuals per hectare (5 – 64 per acre) over a 15-month study period. While some of the variation could be attributed to typical seasonal variation, the ten-fold difference in the 2000 study is much greater than that observed by McKernan (1997) at other study sites, where seasonal fluctuations in density were on the order of two-fold. As summarized by the Service (USFWS 2002):

(1) a low population density observed in an area at one point in time does not mean the area is occupied at the same low density any other month, season, or year; (2) a low population density is not an indicator of low habitat quality or low overall value of the land for the conservation of the species; (3) an abundance of San Bernardino kangaroo rats can decrease rapidly; and (4) one or more factors (e.g., food availability, fecundity, disease, predation, genetics, environment) are strongly influencing the species’ population dynamics in one or more areas.

All these factors lead to an over-arching conclusion that monitoring population trends of the San Bernardino kangaroo rat through typical mark-recapture methods is both difficult and labor-intensive.

Indirect evidence indicates the population size of the San Bernardino kangaroo rat has declined substantially since the 1880s, based on the loss of habitat. As described above (Distribution

Trend), there has been a substantial and ongoing loss of suitable habitat for the species since increased settlement of the area began in the late 1880s, as well as since the ESA listing (Table 3). Assuming no change in the average density of kangaroo rats, there would be roughly one-tenth as many individuals now as occurred in the 1880s. Based on the analysis of Braden, White, and Brylski (reported in the Petition), there would have been about a 30% decline between 1998, when the species was ESA listed, and 2018 (Table 3).

It is also quite likely that there are, on average, fewer San Bernardino kangaroo rats per unit area now than previously, due to habitat fragmentation and degradation (including degradation that has occurred through loss of hydrologic disturbance processes that maintain open habitats). Small, isolated habitat patches with degraded habitat are more likely to experience local extirpations without the opportunity for recolonization, as likely occurred at the Etiwanda Fan Critical Habitat Unit (USFWS 2002). This is also seen in the efforts reported by Hendricks et al. (2020) to collect genetic samples from the species across its range. Trapping for this study focused on sites previously reported to harbor medium- to high population densities or which appeared to have high quality habitat; however, several of the sites yielded no captures of the species and most of the rest had low capture success (see Table 4, excerpted and modified from supplementary table S2 of Hendricks et al. 2020). Trap success (the count of captures per 100 trap-nights), ranged from 0 to 10.4 captures/100 trap-nights in the 12 trapping sites listed in Table 4, with two-thirds of the sites at one capture per 100 trap-nights or less, and only three sites with trap success greater than 7 captures per 100 trap-nights. For sites with no other kangaroo rat species present, these are quite low capture rates (see Frye 1983). Although anecdotal, this evidence is consistent with the conclusion that San Bernardino kangaroo rats now exist at lower densities across their occupied range than in the past due to habitat fragmentation and degradation.

Table 4. Trap success data for San Bernardino kangaroo rat at several sites sampled by Hendricks et al. 2020 (Table S2). Populations are LCC = Lytle/Cajon Creek, SAR = Santa Ana River, SJR = San Jacinto River, ETFAN = Etiwanda Fan. Traps Nights is the product of the number of live traps set at a site and the number of nights trapped. Number Samples is the approximate number of SBKR captured. Trap Success is Number Samples divided by Trap Nights, or the number of unique individuals captured per 100 Trap Nights.

| Population | Site | Month | Year | Trap Nights | Number Samples | Trap Success |
|------------|---------------------------------------|-----------|------|-------------|----------------|--------------|
| LCC | Lytle Creek Conservation Bank | Nov | 2017 | 250 | 19 | 7.6% |
| LCC | Institution | Feb/April | 2017 | 402 | 1 | 0.2% |
| LCC | Cemex | Aug | 2018 | 510 | 0 | 0.0% |
| LCC | Glen Helen | Feb/April | 2017 | 732 | 7 | 1.0% |
| SAR | Mtn View | Apr | 2017 | 144 | 15 | 10.4% |
| SAR | Woolly Star Preserve Area (Cone Camp) | Sep | 2016 | 150 | 11 | 7.3% |
| SAR | San Bernardino Valley | Aug-Oct | 2016 | 2352 | 9 | 0.4% |
| SJR | Valle Vista | July | 2015 | 500 | 15 | 3.0% |
| SJR | Hemet | May | 2017 | 804 | 1 | 0.1% |
| SJR | Valle Vista | July | 2015 | 975 | 0 | 0.0% |
| ETFAN | Wilson | Jun | 2017 | 504 | 0 | 0.0% |
| ETFAN | Edison | Jun | 2018 | 800 | 0 | 0.0% |

Based on the forgoing, it is very likely that the population trend of the San Bernardino kangaroo rat has been substantially negative, both from the late 19th century and since the ESA listing in the late 1990s.

FACTORS AFFECTING ABILITY TO SURVIVE AND REPRODUCE (THREATS)

The Department has identified the following factors as potential threats to the continued existence of the San Bernardino kangaroo rat in California: habitat loss, degradation, and fragmentation; small population size and associated population genetic factors; water management systems; disease, pathogens, and parasites; introduced species; other ecological factors; and climate change. Each of these topics is addressed below.

Several anthropogenically-driven conservation issues that may influence the degree and severity of potential threats are folded into these overarching factors. These issues include urbanization, agricultural development, surface mining, edge effects, light pollution, nonnative predators, recreation, and road effects.

Loss of Habitat

The San Bernardino kangaroo rat is threatened by both the loss of habitat that has occurred over the past 100-plus years, as well as planned and possible future habitat loss. As described above and presented in Table 3, about 95% of the species' functional habitat area has been lost since the late 19th century, with 6,593 ha (16,300 ac.) functioning habitat remaining as of 2018. This loss of habitat greatly reduces the number of San Bernardino kangaroo rats that can be supported. Small populations are at greater risk of extinction than large populations (see Small Population Size, below).

Since federal ESA listing, the total area of San Bernardino kangaroo rat habitat has continued to decline through permitted take (such as Habitat Conservation Plans) of kangaroo rats and their habitat. As described above, approximately 30% of the suitable habitat available at the time of ESA listing in 1998 has been converted to non-habitat. Of the habitat available in 1998, only 45% remains functional, with the full suite of hydrological and other ecological processes contributing to ongoing habitat suitability (Table 3).

Degradation and Fragmentation of Habitat

Coincident with the loss in total area of habitat, other attributes of habitat quality are also usually impacted. For the San Bernardino kangaroo rat, development and conversion of native habitat began at the end of the 19th century with increased settlement and agricultural development and accelerated through the 20th century with widespread residential and commercial development and continues today. As these activities continued, suitable habitat was separated by roads, highways, and extensive areas converted to human use. In time, the current pattern of much reduced and highly fragmented native habitats emerged.

Degradation of habitat quality occurs when its structural or biotic characteristics are changed and are no longer as suitable for the needs of a species. For the San Bernardino kangaroo rat, one common impact to habitat quality is the development of dense, mature stages of its RAFSS habitat, which may occur over a period of a decade or two if not disturbed by flood events. Other habitat degradation effects include the introduction of invasive nonnative plant species and the effects of domestic predators (cats, dogs) on native rodents.

Nighttime light levels are greatly affected by human development, with illumination from fixed sources (street and parking area lights, building illumination, construction project lighting, mining operations) and moving sources (both road and air traffic). Artificial lighting at night affects nocturnal wildlife in a variety of ways, including altering nighttime behavioral patterns, influencing their phenology and physiology, and disrupting movement, migration, and navigation (Rich et al. 2020). Wang and Shier (2017) examined foraging behavior of free-living San Bernardino kangaroo rats in the Santa Ana Wash under a variety of natural and artificial light conditions. They found that foraging activity was reduced near the artificial lights. A more recent experiment (Shier et al. 2020) on the effects of artificial light on the endangered Stephens' kangaroo rat (*Dipodomys stephensi*), which occurs in grasslands of southern California, found that two types of artificial light (floodlamp illumination and bug lamps) both had significant negative impact on the foraging activity of free-ranging kangaroo rats compared to natural nighttime light levels, though the effect was more pronounced during new moon conditions than during a full moon. The authors considered several explanations for the reduced foraging activity in the illuminated trials, including overly bright conditions for the nocturnal-adapted eyes of the kangaroo rats and risk-averse behavior when illumination makes the kangaroo rats more visible to predators (an effect previously demonstrated for natural illumination by the moon).

Large surface mines for sand and gravel are found in the Santa Ana River wash area from above the Boulder Avenue-Orange Street crossing, downstream to the Alabama Street crossing, and in Lytle Creek just above its confluence with Cajon Creek, and below the creek confluence just north of the 210 freeway. Based on analysis of aerial imagery and data available from the California Department of Conservation mines online (CDOC 2021), the area of ground disturbance for the surface mines in the stream channels and nearby terraces encompass 446 ha (1,101 ac.) in the Lytle/Cajon Creek system and 562 ha (1,388 ac.) in the Santa Ana River wash area (CDFW unpublished data). An additional 162 ha (401 ac.) of expanded sand and gravel mining is proposed in the Santa Ana River Wash Plan (see Habitat Conservation Plans, below). Although kangaroo rats may disperse through some of the areas subject to surface mining, the lack of vegetation and frequent re-working of the substrate make these areas unsuitable for long-term occupancy by the San Bernardino kangaroo rat.

Make-shift homeless campsites have been steadily increasing throughout many southern California river systems. Human trespassing can expose San Bernardino kangaroo rats to a higher risk of burrow collapsing, night-time activity disturbances, vegetation fires, and predation from domestic pets. Within the Santa Ana River, numerous homeless activities have been reported, recorded with remote cameras, or witnessed within areas of high-density San Bernardino kangaroo rat occupancy (K. Romich, California Department of Fish and Wildlife, personal communication).

Off-highway vehicle (OHV) and non-motorized bicycle use occurs in many of the drainages within the geographic range of the San Bernardino kangaroo rat. Although not explicitly studied in the region, studies of OHV effects in other systems (for example, see Bury et al. 1977) found OHV use degrades habitat quality by collapsing rodent burrows, damaging vegetation, and compacting soils. Bury et al. (1977) also discussed the potential of noise from OHV use to disrupt establishment and defense of territories by wildlife species. Furthermore, OHV noise can impair hearing and disrupt physiological or behavioral characteristics of kangaroo rats (Lovich and Bainbridge 1999).

Although not quantified, visual inspection of aerial imagery (such as Google Earth) reveals OHV trail networks throughout most of the remaining San Bernardino kangaroo habitat patches. OHV use is a difficult to manage and persistent threat in the densely populated areas of California. In San Bernardino kangaroo rat habitat, OHV use may result in compaction of soils, burrow collapse, loss of native vegetation, and introduction and facilitation of the growth of nonnative vegetation. Regional management plans (such as the Wash Plan, discussed under Habitat Conservation Plans, below) include measures to control access to habitat areas, including signage, fencing, and patrols.

Edge effects occur in habitat near a transition to another vegetation type and generally are considered in terms of the negative effects of non-habitat reaching into otherwise suitable habitat. One study program examining old-growth Douglas-fir (*Pseudotsuga menziesii*) forest edges in the Pacific Northwest found that the physical characteristics (temperature, relative humidity, light levels) and the response in terms of tree growth and mortality extended several tens of meters to more than 120 m (394 ft.) (Chen et al. 1990, Chen et al. 1992). In the sage scrub habitat of the San Bernardino kangaroo rat, the depth of edge effects likely extends a much smaller distance into intact habitat. However, given the relatively small area and often linear configuration of suitable habitat patches, edge effects within San Bernardino kangaroo habitat may add to the effects of habitat loss and degradation. In particular, the negative impacts of artificial light at night, noise, the establishment of noxious weeds and nonnative grasses, competition with disturbance-adapted competitors like the California ground squirrel (*Otospermophilus beecheyi*), and the intrusion of nonnative predators such as domestic cats,

human foot traffic, OHVs, and non-motorized bicycles all have a greater impact in areas near the edges of otherwise suitable habitat and have the effect of further reducing the capacity of habitat patches to support the kangaroo rat.

Small Population Size

Small, isolated populations are inherently vulnerable to extinction due to loss of genetic variability; inbreeding depression and genetic drift; reduced genetic capacity to respond to changes in the environment; as well as through demographic stochasticity (changes in age and sex ratios resulting in reduced breeding opportunities) due to random variation in birth and death rates (Primack 1993, Reed and Frankham 2003). In wildlife populations, genetic diversity has been shown to be strongly correlated with high survival and reproduction rates, as well as decreased extinction risk (Hedrick and Kalinowski 2000, Reed and Frankham 2003). The smaller the population size, the more likely other threats will drive it to extinction (Primack 2010).

There is no current estimate of actual population size of the San Bernardino kangaroo rat; however, if kangaroo rats occupy all the roughly 4,300 ha (10,635 ac.) estimated by the Service in 2008 to be occupied by the species at that time, and assuming densities of between 0.4 and 12 individuals per ha (1 – 30 per ac., McKernan 1997), then between 1,720 and 52,000 individuals may exist in total. At the lower end of this wide range, the estimate is below the population size experts believe to be required to ensure long-term viability of a species (Traill et al. 2007, Traill et al. 2010, Flather et al. 2011). It is likely that during extended drought San Bernardino kangaroo rat densities would tend toward the low end of the range; thus, if drought becomes more common in southern California, then the species would occur at low population sizes more frequently. See the section on Climate Change for more discussion of the effect of drought on populations.

Given the total population is subdivided into three smaller populations, and even within populations some occupied sites are isolated from other sites, the effect of small population size is exacerbated for the species. The loss of genetic diversity inherent to small, isolated populations can be expected to increase their risk of extinction because small and inbred populations have reduced ability to adapt to changing environments due to diminished pools of potentially adaptive heritable phenotypes (Frankham 2005). Populations of at least several hundred reproductive individuals are believed to be required to ensure the long-term viability of vertebrate species, with several thousand individuals being the goal (Primack 1993). Observations of wild populations indicate that it is possible for small populations to persist, at least in the short term, in the face of genetic challenges; however, these observations do not indicate that small populations in general will ultimately recover (Harding et al. 2016).

Reproduction and survival rates vary among individuals and between years in wildlife populations. This is the intrinsic variation that leads to demographic stochasticity, and while this tends to average out in large populations, it has a much greater proportional effect on the rate of growth or decline in small populations. Once a population size drops, the next generation is more susceptible to demographic stochasticity. And, at extremely small population size, unequal numbers of males and females may result in fewer mating opportunities and a decline in reproduction (Primack 1993). The small population sizes of San Bernardino kangaroo rat, in each of the three populations, as well as at isolated sites within the populations, are all vulnerable to these effects, especially given the kangaroo rat's naturally large variation in reproduction across years. For example, a severe multi-year drought could lead to drastically reduced population size or extirpation at isolated habitat patches.

Unpredictable changes in the natural environment and biological communities can cause the size of small populations to vary dramatically where larger, more widely distributed populations would remain more stable because these changes normally occur only in localized areas within the entire population's geographic range (Primack 1993). For example, unpredictable changes in the abundance of a species' forage, impacts of its predators, climate, vegetation community, or disease and parasite exposure can cause the size of a small, isolated population to fluctuate wildly, and possibly lead to extinction (Primack 1993). Additionally, natural disasters such as droughts, fires, and severe storms can lead to dramatic population changes if the population is small and localized such that the disaster impacts all or most of the individuals. Although the probability of such events is generally low in any given year, over the course of generations the probability becomes much greater (Primack 1993). Ecological modeling studies have demonstrated that the influence of random environmental stochasticity has a greater influence on extinction probability than demographic stochasticity (Primack 1993). Environmental and genetic effects may interact synergistically to seriously threaten small populations. As populations get smaller, they become more vulnerable to demographic variation, environmental variations, genetic drift, and inbreeding depression. Each of these effects can amplify the impact of the other effects, further reducing population size and accelerating the species towards extinction in what has been termed an extinction vortex (Primack 1993).

Small populations, and populations that have experienced periods of low population numbers in the past, lose genetic diversity and may suffer the effects of inbreeding depression - the concentration of deleterious alleles (maladaptive genes) in the population from the mating of closely related individuals resulting in offspring with reduced fitness (Frankham 2005, Harding et al. 2016). Closely related to inbreeding depression is genetic drift, the random change in allele frequencies within a population over time, which may lead to the accumulation and fixation of detrimental alleles in the population due to a limited breeding pool (Hedrick and Kalinowski 2000). In large populations maladaptive genes do not accumulate in the population

due to random mate pairings and the elimination of less fit offspring through natural selection. However, in small, isolated populations natural selection can have less of an effect on the population genotype than genetic drift. When this happens, deleterious genes can become fixed in the population's genotype resulting in decreased fitness in all individuals, and potentially negative population growth (Hedrick and Kalinowski 2000, Frankham 2005).

The influence of inbreeding depression on fitness-related traits appears variable across populations, heritable traits, and environments (Hedrick and Kalinowski 2000). Inbreeding depression affects nearly every well studied wildlife species and contributes to extinction risk in most wild populations of naturally outbreeding species (Frankham 2005). Based on the work of Shier and others, it is clear that inbreeding is occurring in populations of the San Bernardino kangaroo rat and that significant genetic diversity has been lost from the species (Hendricks et al. 2020).

The loss of genetic diversity and the accumulation of deleterious genes can largely be mitigated by the exchange of breeding individuals between populations (Primack 1993). Computer simulations have suggested that as few as 1 or 2 immigrants per generation in a population of about 100 individuals can greatly reduce the impact of genetic drift; with 4 to 10 immigrants per generation, the effects of genetic drift may be negligible (Primack 2010). Consequently, habitat fragmentation can seriously increase the risk that genetic diversity will be lost in isolated populations and, conversely, habitat connectivity between populations can substantially mitigate this risk.

While the genetic risks associated with small populations may significantly increase a population's risk of extinction, it is important to note that a small population size alone is not necessarily predictive of reduced population viability. Implementation of a well-planned conservation strategy can substantially mitigate risks associated with small populations. A comprehensive plan for long term viability should include the principles of representation, resiliency, and redundancy (Shaffer and Stein 2000, Wolf et al. 2015). These principles require recovered species be present in multiple large populations across the entire spectrum of habitats used by the species and these populations must also be resilient to environmental changes, identified threats, and genetic threats (Wolf et al. 2015). The San Bernardino kangaroo rat population, currently existing in low numbers in isolated patches of suitable habitat, is highly exposed to the environmental and genetic risks inherent to small populations.

The SDZWA team conducted a preliminary population viability analysis of the Lytle/Cajon Creek population (Chock et al. 2019) using demographic data for the San Bernardino kangaroo rat and closely related species. Their models used a range of values, from conservative to optimistic, for each demographic parameter and considered possible trajectories for the population assuming no additional loss of habitat as well accounting for habitat loss and loss of individuals due to a

residential development project currently in the environmental review process. The preliminary results suggest a high probability of extinction of the Lytle/Cajon Creek population within 100 years even in the absence of further development (Chock et al. 2019). Of the 500 simulations run using existing conditions (no additional development), 71.4% declined to extinction within 100 years. When the loss of habitat and individual kangaroo rats were included in the model, 76.4% of the 500 simulations went to extinction. The authors caution the probability of extinction may be higher than suggested by the models due to likely overestimates of carrying capacity of the modeled area. The results indicate that, unless population trends are reversed, the Lytle/Cajon Creek population is likely to become extinct in the next 100 years, and that with further development in the area the probability of extinction increases.

Population Genetics Factors

The range-wide assessment of San Bernardino kangaroo rat population genetics conducted by the SDZWA team (Shier et al. 2018, Hendricks et al. 2020) confirmed: 1) small effective population sizes and low levels of genetic diversity within each of the three remaining populations, 2) little or no gene flow between sites and populations, 3) high genetic structure between populations corresponding to geography across the range and 4) the genetic partitioning between the three populations arose recently, since the time of increased settlement of the region.

All three San Bernardino kangaroo rat populations exhibit low effective population sizes, with effective population size (N_e) values of 30.4 for the Santa Ana River population, 85.8 for the Lytle/Cajon Creek population, and 14.7 for the San Jacinto River population. The three populations have low genetic diversity and there is no evidence of recent natural gene flow between them. The San Jacinto River population is the most genetically distinct of the three populations, consistent with its greater geographic distance and longer period of isolation from the other two populations. The San Jacinto population also has the least genetic diversity among the three populations.

The genetic evidence indicates the three extant populations became isolated in the relatively recent past, consistent with the timing of increased settlement and development within the historical range of the kangaroo rat. The three populations can be distinguished from each other by their genetic characteristics. Each population is also structured by site, with individuals within a site more like each other than to individuals from other sites. This structuring suggests that limited or no gene flow occurs between sites within the three populations.

The SDZWA team summarized the conservation implications of their population genetics work on the kangaroo rat as follows:

“Minimum viable population (MVP) thresholds for assessing the extinction risk of threatened species are set in part by the 50/500 rule, a guiding principle in conservation for assessing minimum viable effective population size (N_e). Franklin (1980)... Franklin et al. (2014) proposed that a minimum $N_e > 50$ is necessary to prevent short-term inbreeding depression, and to prevent long-term loss of genetic diversity, $N_e > 500$ is necessary, though these “rules of thumb” are debated (Frankham et al. 2014; Franklin et al. 2014). It is argued that long-term $N_e > 500$ can be maintained at the metapopulation level, and local N_e can be smaller if there is gene flow (Jamieson and Allendorf 2012).

“However, our data indicate that all three [San Bernardino kangaroo rat] populations show extensive population structure, and there was no evidence of recent gene flow except what was documented from human mediated translocation between the Santa Ana River and Lytle/Cajon Creek populations in 2015. This suggests that that species-wide N_e may not be sufficient to maintain genetic diversity over the long term and N_e should reflect updated values of 100/1000 to maintain adaptive potential (Frankham et al. 2014).

“In general, successful translocation may help mitigate effects of habitat fragmentation, restore some level of historical gene flow, and increase levels of genetic diversity by actively relocating animals between isolated clusters.

“The [genetic] processes [within and between] fragmented populations are complex (Young and Clarke 2000) and can lead to detrimental effects as a result of a reduced gene flow between populations. Gene flow is an imperative aspect of the evolutionary processes of fragmented populations because successful genetic exchange can increase heterozygosity and increase allelic richness (Chapman et al. 2009; Caballero and Garcia-Dorado 2013; Frankham 2015). Without genetic influx, small populations are especially subject to genetic drift, inbreeding, reduced genetic diversity including potentially adaptive variants, and increased extinction risk (Frankham 2005). These threats are more extreme for regionally endemic species, since localized destruction and degradation are more threatening to these species than to species with a larger geographic distribution (Bibby et al. 1992; Purvis et al. 2000)...

“A process of local extirpation and recolonization is natural for this species and requires upland refugia to be available during flood events and a population of sufficient size to persist through the flood event to allow for persistence...

“Contractions without the possibility of subsequent expansion due to habitat loss has resulted in declining population sizes of [San Bernardino kangaroo rat] and other alluvial fan obligates (Hanes et al. 1989). Fragmentation can reduce

gene flow and lead to a decrease in population size through a cascade of genetic consequences, such as inbreeding and increased genetic drift.”

Water Management

Water management projects discussed here include the construction and operation of dams and other flood control structures, operation of hydropower facilities, armoring of banks and man-made infrastructure, and ground water recharge. Such projects alter the hydrology (rates and timing of water flow and sediment transport) in stream channels occupied by the San Bernardino kangaroo rat, which in turn affects erosion of stream beds and banks and influences the structure and composition of vegetative communities. Stormwater management also affects surface flows, erosion, and sediment transport within the upland alluvial areas outside of stream channels, as well as delivery of stormwater runoff to stream channels. Erosion control devices such as armored channels not only affect the hydrology of the system, but also impact the movement of wildlife between the channel and upland areas.

In the unaltered hydrologic systems in which the San Bernardino kangaroo rat occurred prior to modern water management practices, there was no impediment to water flow from the headwaters of the Santa Ana and San Jacinto river systems down through tributary creeks and streams, into the mainstem rivers, and out to the mouth of the Santa Ana River in the Pacific Ocean. Flows in many stream reaches were ephemeral, increasing during the winter rainy season and diminishing or disappearing during the summer dry season. In the absence of channel armoring, the high-energy flows of winter runoff resulted in a dynamic channel system, where water would alternate through a wide, ever-changing, and braided network within the larger stream channel. Shallow, braided stream channels naturally integrated into the surrounding upland areas. Groundwater recharge occurred throughout the hydrologic basin during periods of adequate local precipitation and streamflow.

The unaltered hydrologic system provided highly suitable habitat conditions for the San Bernardino kangaroo rat. The low gradient valley lowland areas in which the species occurs captured alluvium eroded from the mountainous headwater reaches of river tributaries. The sand and gravel-dominated alluvium formed soils suitable for the kangaroo rat. Uncontrolled flows allowed for a variety of runoff intensities over the course of a season, between years, and across the basin. In areas where intense flows occurred, there was erosion of substrate and vegetation, which reset the succession of the sage scrub habitat. At any given time, a patchwork of pioneer through early, mid, and late successional scrub habitat would be continuously available throughout the network of connected stream reaches. Population densities of the kangaroo rat were (and are) highest in the relatively open, early successional scrub stages, but dispersal and lower density populations occurred in all stages. Populations

were spread among both the wide, braided stream channels and the upland areas to which they connected.

Management of water in streams within the geographic range of the San Bernardino kangaroo rat includes: the use of impounding structures like the Seven Oaks Dam, which meter the release of water to minimize the risk of downstream flooding; armoring of stream banks and manmade structures like bridges to reduce erosion of banks and stream channels that support infrastructure; modification of streambeds to promote ground water recharge, and the operation of hydroelectric power facilities to generate electricity. Indirect effects of other activities on stream hydrology include altered stormwater runoff patterns due to changes in soil surface permeability from urbanization and delivery of stormwater to receiving stream channels. Each of these management actions diminishes the quality of habitat for the San Bernardino kangaroo rat and are discussed in the following section.

Seven Oaks Dam, completed in 2000 (San Bernardino Co. 2021), is an earth and rock fill dam located on the Santa Ana River in upper Santa Ana Canyon about a mile upstream from the mouth of the canyon. Its purpose is to reduce the risk of damaging floods and to retain sediment from entering the downstream channel, as well as to generate electricity. The reservoir gross capacity is 17,960 hectare-meters (145,600 acre-feet), with a flood control capacity of 14,012 hectare-meters (113,600 acre-feet). Sediment storage capacity over 100 years is estimated to be 3,947 hectare-meters (32,000 acre-feet).

Seven Oaks Dam directly affects the stream channel and nearby upland habitat of the San Bernardino kangaroo rat in the Santa Ana River drainage. Prior to its construction, it was recognized the new dam would impede flood-level flows from the mountainous headwaters of the Santa Ana River. Such floods, especially when combined with flows from other tributary streams, resulted in transport and sorting of sediment in the stream channel, including deposition of relatively uniform sand substrates favored by the San Bernardino kangaroo rat. Flood flows also disturbed or removed vegetation and reworked or realigned the active channel. Such effects improve the post-flood habitat conditions for the kangaroo rat, but where floodwaters inundate occupied habitat patches, kangaroo rats may be drowned or displaced from their home territories.

As part of the approval process for the Seven Oaks Dam, 308 ha (760 ac.) of conservation land downstream of the Seven Oaks Dam was acquired as the Woolly Star Preserve Area (WSPA), located mostly on the southern margin of the Santa Ana River wash area. The Service's Biological Opinion (BO) for the dam also required an adaptive management plan (or Multispecies Habitat Management Plan, MSHMP) for dam operations that would include high-flow releases to maintain some of the natural flood effects of the stream system (ICF 2019a). However, in the nearly two decades since the dam became operational, there have only been

three events in which releases have reached 142 cubic meters per second (m^3/s) (5,000 cubic feet per second (cfs)), a level that, if combined with other tributary flood-level flows, could achieve flow rates necessary to provide the flood disturbance the system requires (ICF 2019a). These high-flow releases were conducted as tests of the release gate mechanism, rather than habitat management releases and were not timed to coincide with high-flows in tributary streams and so likely had no impact on downstream habitat (ICF 2019a). In fact, it appears the approved water control manual (WCM) for the dam is in direct conflict with the MSHMP, in that the WCM requires dam releases to be limited to $1.42 \text{ m}^3/\text{s}$ (50 cfs) or less during conditions in which system hydrographs are rising. In other words, during periods in which flooding flows could be initiated, the Seven Oaks Dam release gates are required to be nearly shut. This prevents any flooding flows of the dammed portion of the system from contributing to habitat maintenance (ICF 2019a).

Studies have been underway to determine if there are changes to dam operations that could be made, possibly in conjunction with construction of instream water control structures, to direct some high flows to habitat areas most likely to benefit from disturbance, while balancing the needs of public safety and infrastructure (ICF 2019a, 2019b). While there appears to be some prospect for improving habitat conditions in some areas, the situation is complicated by hydrologic effects of other structures and activities within the wash area, including revetments and other protective structures on bridges, channels, and ongoing surface mining activity.

Prado Dam is also located on the Santa Ana River 56 km (35 mi.) downstream of Seven Oaks Dam on the western edge of the historical range of the San Bernardino kangaroo rat, about 3.2 km (2 mi.) west of the city of Corona. Built by the U.S. Army Corps of Engineers (ACOE) in 1941, its primary purpose is also flood control. Although the footprint of the dam and associated retention basin and other structures is on land within the historical range of the kangaroo rat, the species has likely been extirpated from the area for many years. Operation of the Prado Dam affects the stream channel outside the range of the species and therefore is not considered a factor in the conservation and recovery of the San Bernardino kangaroo rat.

Other water impoundments in the geographic range include Lake Mathews, Perris Reservoir, and Mystic Lake. Operation of these reservoirs could, in theory, affect kangaroo rat habitat quality in the reaches downstream from their dams, but because they are in areas where there is no habitat remaining for the species, in practice there is no conservation impact on the species.

Many of the stream channels within the geographic range of the San Bernardino kangaroo rat have been armored to reduce streambank erosion, channel meandering, or to reduce the potential for overtopping of banks during floods. According to the Upper Santa Ana River Habitat Conservation Plan (HCP) (ICF 2020b), which includes the watersheds encompassing the

Lytle and Cajon Creek and Santa Ana River populations, the only low gradient stream channels without channel confinement structures are in the portions of Lytle, Cajon, Plunge, and Mill creeks, and the portion of the Santa Ana River below Greenspot Road to its confluence with Plunge Creek (see Fig 3-9 in ICF 2020b). Except for the lower Santa Ana River below Lake Evans, which is classified as low gradient meandering (and which is outside the current range of the kangaroo rat), all other stream channels within the San Bernardino kangaroo rat historical and current range within the HCP area are classified as either confined to a concrete conveyance channel, channelized and braided, or straight channelized streams. Streams within the San Jacinto-Bautista Creek system are likewise highly channelized, with several miles of concrete-lined channel on Bautista Creek above its confluence with the San Jacinto River.

As quantified in the Upper Santa Ana River HCP (see Table 3-5 of the HCP), there are 694 km (431 mi.) of stream channels within the plan area. Of these, concrete conveyance channels comprise 40% of the total channel length within the plan area, straight channelized reaches comprise 4%, low gradient meandering channels comprise 17%, and braided channels comprise only 15% of the total channel length within the HCP area (ICF 2020b). Although considered necessary to protect human development from damaging floods, the extensive restructuring of stream beds and banks in the historical range of the kangaroo rat has made most of the streambeds uninhabitable or prone to highly erosive flows that prevent growth of normal stream vegetation communities. The concrete structures also prevent movement of kangaroo rats between the upland and channel habitats (where they remain), preventing dispersal and connectivity between habitats, as well as opportunities for recolonization of stream channels after floods impact local populations.

Groundwater recharge facilities are another water management structure established at several locations within the Santa Ana and San Jacinto river systems, and several more are planned for future implementation under the Wash Plan and Upper Santa Ana River HCP (ICF 2020a, 2020b). The facilities are important for increasing stream water percolation into the groundwater basin to reduce the rate of groundwater depletion from pumping that increasingly occurs throughout the area as the human population in the region grows. Recharge basins may be configured as graded areas within stream channels to present a series of low cross-channel ridges and basins that slow water flow and allow more water to percolate into the streambed than would occur without the impediments to flow. The ridge and basin system requires regular grading to maintain its structure, generally preventing the development of scrub vegetation and habitat for the San Bernardino kangaroo rat. Recharge facilities may also be configured as water diversions from the stream channel onto adjacent upland spreading areas. Based on review of proposed recharge projects listed in the Upper Santa Ana River HCP (ICF 2020b, pp. 2-18 to 2-51) recharge basin project footprints vary from a few ha to >24.3 ha (60 ac.) each. New recharge areas encompassing 61 ha (150 ac.) are proposed in the Wash Plan (ICF 2020a). Where

such areas are currently functioning habitat, the area would be lost for occupancy by San Bernardino kangaroo rats. The reduction in stream flows also affects sediment transport to and in kangaroo rat occupied stream reaches.

Flood management in southern California is needed to protect communities from frequent and extreme flood events. Given the San Bernardino kangaroo rat exists and relies on active floodplain processes, flood control practices from the Riverside County Flood Control and Water Conservation District and San Bernardino County Flood Control District have either removed or fragmented much of the habitat throughout the species' range.

Hydroelectric power is produced by electrical generators turned by turbines powered by the flow of water falling down an enclosed pipe placed on a slope. Within the drainages still occupied by the San Bernardino kangaroo rat, there are three hydropower projects licensed by the Federal Energy Regulatory Commission (FERC). All three projects were licensed in 2003 and their licenses will expire in 2033 (FERC 2021).

The following descriptions of FERC-licensed projects are based on visual inspection of project structures in aerial images (Google Earth, accessed February 2021). FERC project P-1932 is located on Lytle Creek and consists of five in- or near stream structures, starting at an intake about 7.2 km (4.5 mi.) upstream from the I-15 bridge over the creek, two powerhouses, and an afterbay located adjacent to the Cemex sand and gravel mine about 11.9 km (7.4 mi.) downstream of the intake. Project P-1934 is located on Mill Creek and consists of an intake about 8.9 km (5.5 mi.) upstream from the Mill Creek-Santa Ana River confluence. The diverted water flows about a quarter mile to the powerhouse, bypassing the stream channel. Project P-1933 is located on the upper Santa Ana and its mountain tributary Bear Creek. The lowest set of turbines in the project is located at the Seven Oaks Dam, so operation of the dam for flood control and the powerhouse for electricity generation are linked. For all projects, instream water diversions at the intake reduces the natural instream flow, which may impact habitat functioning in the intervening stretch. Where instream structures such as intakes, diversion dams, and berms or weirs exist, the footprint of the structures and regular maintenance may impact habitat quality.

Disease, Pathogens, and Parasites

Disease is not currently known to be a conservation concern for the San Bernardino kangaroo rat, nor was it a threat addressed during the initial listing of the species (USFWS 2019a). Little is known about disease and health issues as they affect abundance and distribution of heteromyid rodents, including Merriam's kangaroo rat (Brown and Harney 1993). A variety of disease pathogens have been found in heteromyids, including viruses, bacteria, fungi, and protozoa (Whitaker et al. 1993). Both internal and external parasites have been found in kangaroo rats;

these include fleas, ticks, lice, mites, chiggers, nematodes, tapeworms, and whipworms (Hedeen 1953, Bienek and Grundmann 1973, Carter et al. 1985, Thomas et al. 1990, Whitaker et al. 1993).

In August 2020, SDZWA biologists attempted to trap San Bernardino kangaroo rats at a Bureau of Land Management (BLM)-owned site in the Santa Ana River drainage to use as founders for a planned translocation study. During this trapping they documented several individuals with fur loss. Seven of the 21 captured kangaroo rats had moderate to severe fur loss on the dorsum (back surface) of the head and neck.

The site is approximately 1 mile northeast of the Redlands Shooting Range, which has hosted sport shooters since the mid-1960s. Lead bullets were freely shot into the Santa Ana River where the San Bernardino kangaroo rats occur until 2013, when a range curtain was installed. Due to contamination, lead continues to actively be mined and removed from the site, which may also be contaminated with polycyclic hydrocarbons.

Based on the observed fur loss and known contamination of the site, the USFWS authorized a team from the SDZWA to investigate the cause of the fur loss (Hammond et al. 2021). The team captured seven individuals and collected a variety of samples for testing, including skin biopsies, scrapes, tape lifts, blood, hair, feces, as well as whole-body x-rays. Histological examination showed low-level dermatitis in most individuals. All hair samples were negative for fungal DNA, though a dermatophytic fungus (*Trichophyton* sp., a common group of soil fungi, some of which cause fungal infections of human skin such as ringworm and athlete's foot) was grown in culture from one individual's fur sample. All the other samples were negative for fungus, bacteria, ectoparasites, and endoparasites. The whole-body x-rays indicated one or more pinpoint opaque items in five of the seven individuals, but the nature of the material (whether sand or metal) could not be determined. All individuals had measurable levels of lead in their blood, and one individual had a low level of mercury. The lead levels were relatively low (< 0.03 parts per million, PPM) for all but one individual, which had a level roughly 10x higher (0.31 PPM). A variety of other metals were found in some or all individuals' blood. These include selenium, zinc, copper, iron, cobalt, and molybdenum (Hammond et al. 2021). Additional testing for heavy metals in the hair samples showed generally higher concentration of heavy metals than in blood (D. Shier, SDZWA, personal communication). This may be because hair reflects cumulative metal exposure over longer periods of time in comparison to blood, which represents a single point in time. In both blood and hair testing all sampled individuals had some lead in their system, with one individual exhibiting much higher concentrations of lead in both hair and blood samples. Subsequent trapping of San Bernardino kangaroo rats from the site in March of 2021 showed limited evidence of fur loss or skin irritation, but individuals exhibited severe fur loss and skin irritation and crusting again in September of 2021,

suggesting the issue may be cyclic. A larger study using fur clippings from control sites is underway to establish a "normal" range for heavy metals in Merriam's kangaroo rat (D. Shier, personal communication).

In recent years, two other listed rodents in California, the giant kangaroo rat (*Dipodomys ingens*) and Amargosa vole (*Microtus californicus scirpensis*) have been found to host ectoparasites that cause fur loss and other skin and connective tissue damage. Other kangaroo rat species in the San Joaquin Valley have also exhibited fur loss due to unknown causes (E. Tennant, California Department of Fish and Wildlife, personal communication). These conditions may interact with other stressors to contribute to the conservation risk of these species.

Introduced Species

As mentioned above, nonnative predators (domestic cats and dogs) may represent a threat to the San Bernardino kangaroo rat, especially given the highly fragmented distribution of suitable habitat and its juxtaposition with housing developments. Cats especially may exert a negative impact on nocturnal rodent populations when given free access to roam at night. The actual effect of nonnative predators is unknown. Nonnative competitors, such as old-world rats and mice, may compete to some degree with kangaroo rats, but most of these species are highly commensal with humans and stay relatively close to settled areas.

Plants, such as nonnative grasses and other weeds, may impact the habitat quality of the native sage scrub vegetation. Nonnative (annual) grasses are invasive throughout Southern California and thrive in areas of disturbance, such as along the edges of habitat blocks and along roads and trails within such blocks. San Bernardino kangaroo rats have not been detected in otherwise suitable habitat patches containing nonnative grasses (Shier et al. 2019), likely because the dense cover of annual grasslands interferes with the species' preferred locomotory and foraging modes. Although not analyzed for this report, modeling studies in other areas suggest that annual grasslands may replace other xeric scrub habitat types in much of California in the future due to climate change effects (e.g., Lenihan et al. 2003).

Other Ecological Factors (Diet, Predation, Competition)

As mentioned above under Diet, the diet of reproductive female kangaroo rats in spring may include a large proportion of insects, which is an important source of protein that helps ensure successful reproduction. Studies showing insect community decline at sites around the world (e.g., Moller 2019, Powney et al. 2019, Baranov et al. 2020) suggest a global phenomenon for which a simple explanation has not been ascertained. Although there is no current evidence for insect decline in the range of the San Bernardino kangaroo rat, if such a decline occurs it could add to other stressors on the species.

Predation is not generally considered a risk to kangaroo rat populations because they have evolved a variety of behavioral, physiological, and anatomical adaptations to reduce the risk of predation. However, in the highly fragmented and altered habitat conditions of the San Bernardino kangaroo rat, it is possible that predation may play a larger than typical role in controlling populations. Habitat fragmentation associated with urban development is likely to increase interactions of San Bernardino kangaroo rats with potential predators such as opossum (*Didelphis virginiana*) and striped skunks (USFWS 2002). Predation has also been shown to be influenced by artificial lighting at night as it makes small prey species, such as San Bernardino kangaroo rat, more visible and therefore more vulnerable (Shier et al. 2020). Similarly, moonlight also affects predation risk of nocturnal rodents, which generally decrease their foraging activity during bright moon phases (see meta-analysis of moonlight effects on nocturnal mammals by Prugh and Golden 2014). Young individuals dispersing from their natal territories may be especially at risk. Additionally, as previously noted, male Merriam's kangaroo rats increase their daily movements during the breeding season, which likely also increases predation risk.

Competition is not generally considered a threat to the continued existence of the San Bernardino kangaroo rat. However, in the highly fragmented and altered alluvial fan vegetation in which it now occurs, San Bernardino kangaroo rats may be at a disadvantage compared to other rodents. For example, the Dulzura kangaroo rat favors sage scrub vegetation that is more mature than that favored by the San Bernardino kangaroo rat (USFWS 2019a). Locally occurring pocket mice species may also favor mature scrub vegetation, and thus compete with the San Bernardino kangaroo rat. Moreover, the smallest pocket mice species may be able to persist in smaller isolated patches of native vegetation than the San Bernardino kangaroo rat because they can occur at higher densities than the kangaroo rat. A diurnal rodent, the California ground squirrel (*Otospermophilus beecheyi*) can occur where soils and vegetation have been disturbed by human activity, possibly to the competitive disadvantage of rodents less tolerant of such disturbance. Nonnative rodents, such as house mice (*Mus musculus*) and black and Norway rats (*Rattus rattus*, *Rattus norvegicus*) may also pose a competitive threat where they occur. However, because these nonnative species usually occur in habitats developed for human occupation, they likely do not compete directly with the San Bernardino kangaroo rat where natural habitat quality is good.

The Department considers competition for food and cover resources with other native or introduced species a potential threat to the San Bernardino kangaroo rat, especially when combined with the effects of habitat loss and fragmentation. At this time, we are not aware of evidence to support this supposition, but recommend that research into the effects of competition, especially with other rodent species favored by habitat degradation.

Climate Change

Global warming is expected to increase future temperatures and precipitation in the geographic range of the San Bernardino kangaroo rat, which in turn may affect habitat quality and behavior. It may also increase the frequency and/or intensity of flooding within stream channels, which could lead to larger mortality events during floods. Where habitat connections have been lost between stream channel habitat and upland refugia habitat, populations of San Bernardino kangaroo rats are further threatened by lack of recolonization after floods.

Increased frequency of extreme heat events and nighttime heat waves may occur in the future. Semi-fossorial nocturnal rodents avoid the most extreme daytime temperatures in their underground burrows. Both evaporative water loss and energy expenditures increase for mammals at ambient temperatures above certain limits. For Merriam's kangaroo rat, water loss increases dramatically at ambient temperatures above 35°C (95 °F)(Tracy and Walsberg 2001). The upper end of the thermoneutral zone has been estimated at 34°C (93°F)(Banta 2003). Excessive heat loads from nighttime air temperatures above these limits may pose a threat to the San Bernardino kangaroo rat, either by reducing the number of hours during the night with temperatures suitable for above ground activity, or by imposing physiological stress on active individuals in the form of heat and water imbalances. The threat of extreme heat cannot currently be predicted, but it can be expected to add to the other known threats to the species.

Likewise, the impact of the ongoing pattern of severe multi-year droughts in southwestern North America has not been quantified for the San Bernardino kangaroo rat. However, severe drought over a period of years would be certain to impact the species, primarily through loss of seed production, which has been demonstrated in desert ecosystems (e.g., Pol et al. 2010, Price and Joyner 1997). Multiple years of reduced forage would result in little or no reproduction in the kangaroo rat, which would result in reduced population size.

Projected changes in the climate within the current San Bernardino kangaroo rat range were obtained from Cal-Adapt.org (Cal-Adapt 2021) which offers tools for visualizing projected changes in future climate. The following projections for 2070 to 2099, which include projections of average air temperature, average annual precipitation, and frequency of extreme precipitation events, indicate annual average maximum temperatures are projected to increase (Table 5). In a moderate emissions scenario (RCP³ 4.5) where greenhouse gas emissions peak around 2040 and then decline, the annual average maximum temperature is projected to increase by 3.3 °C (6 °F) or more. In the high emissions scenario (RCP 8.5) where greenhouse

³ RCP is a Resource Concentration Pathway and values represent different greenhouse gas concentrations.

gas emissions continue to rise strongly through 2050 and plateau around 2100, the annual average maximum temperature is projected to increase by 4.7 °C (8.4 °F) or more.

Table 5. Average annual maximum temperature (°C) for the three San Bernardino kangaroo rat population areas observed in the historical period and projected into the future (2070-2099) for a moderate (RCP 4.5) and high (RCP 8.5) greenhouse gas emissions scenario. The historical period is defined as 1960-1990.

| Population Area | Historical average observed temperature (°C) | RCP 4.5 Projection (°C) | RCP 8.5 Projection (°C) | Change with RCP 4.5 Projection (°C) | Change with RCP 8.5 Projection (°C) |
|-------------------------------|---|--------------------------------|--------------------------------|--|--|
| Lytle and Cajon Creeks | 23.5 | 26.9 | 28.2 | +3.4 | +4.7 |
| Santa Ana River | 25.6 | 29.1 | 30.6 | +3.6 | +5.0 |
| San Jacinto River | 27.4 | 30.7 | 32.3 | +3.3 | +4.9 |

Average annual precipitation is also projected to increase. The Santa Ana River and San Jacinto areas are projected to experience less change, but the Lytle/Cajon Creek area, which already receives the greatest amount of annual rainfall, is projected to experience an annual increase of precipitation of 6.6 cm (2.6 in.) in the moderate RCP 4.5 scenario and 12.2 cm (4.8 in.) with the high emission RCP 8.5 scenario (Table 6). Likewise, all three areas are projected to experience an increase in the annual number of extreme precipitation events, defined as 2-day precipitation events that surpass the lowest annual precipitation accumulation in the historical record (1960 to 1990). In both emission scenarios, all locations are predicted to have at least one more extreme precipitation event per year than they did historically (Table 7). With RCP 8.5, the Lytle/Cajon Creek area is projected to go from three extreme precipitation events that occurred per year on average historically, to five extreme precipitation events per year.

Table 6. Average annual precipitation (cm) for the three San Bernardino kangaroo rat population areas observed in the historical period and projected into the future (2070-2099) for a moderate (RCP 4.5) and high (RCP 8.5) greenhouse gas emissions scenario. The historical period is defined as 1960-1990.

| Population Area | Historical average annual precipitation (cm) | RCP 4.5 Projection (cm) | RCP 8.5 Projection (cm) | Change with RCP 4.5 Projection (cm) | Change with RCP 8.5 Projection (cm) |
|------------------------|--|-------------------------|-------------------------|-------------------------------------|-------------------------------------|
| Lytle and Cajon Creeks | 47.5 | 54.1 | 59.7 | +6.6 | +12.2 |
| Santa Ana River | 35.3 | 35.6 | 39.1 | +0.3 | +3.8 |
| San Jacinto River | 29.5 | 31.8 | 33.0 | +2.3 | +3.6 |

Table 7. Historical and projected annual frequency of extreme precipitation events in the three San Bernardino kangaroo rat population areas.

| Population Area | Extreme threshold (cm) | Historical # of Extreme events | RCP 4.5 Projection of extreme events | RCP 8.5 Projection of extreme events |
|------------------------|------------------------|--------------------------------|--------------------------------------|--------------------------------------|
| Lytle and Cajon Creeks | 4.9 | 3 | 4 | 5 |
| Santa Ana River | 2.3 | 3 | 4 | 4 |
| San Jacinto River | 2.2 | 2 | 3 | 3 |

ESSENTIAL HABITAT (FGC § 2074.6)

The Department considers all currently occupied San Bernardino kangaroo habitat as essential for the continued existence of the species in California. Additionally, suitable but apparently unoccupied habitat near the currently occupied habitat (within the areas delineated as Critical Habitat by the Service, USFWS 2008) is also considered essential for the conservation of the species. Further, other areas within the historical range that are not currently suitable habitat, but which are near or adjacent to currently suitable or occupied habitat and could be restored to suitability within the near term, should also be considered essential. This determination is based on the large reduction in available habitat for the species, its fragmented and degraded nature, and the low population numbers supported by the small amount of remaining habitat for the species.

As described in the Range and Distribution, Loss of Habitat, and Degradation and Fragmentation of Habitat sections, above, the loss of most of the species' habitat over the past 100-plus years, combined with the low genetic diversity and effective population size for the species has resulted in a precarious conservation status for the species. The amount of currently remaining suitable habitat is insufficient to adequately support the population sizes and connectivity needed for the species to persist, and any additional loss of occupied habitat creates significant additional risk for extirpation of the remaining populations. Further, the low population size (or effective population size as estimated by the genetics studies of the species) is far below the thresholds for stable long-term persistence cited above. Therefore, the Department deems it essential for the continued existence of the species to restore and preserve additional habitat areas not currently supporting the kangaroo rat.

Characteristics of essential habitat for the San Bernardino kangaroo rat are described in detail in the Habitat Associations and Use section, above. These characteristics include relatively open areas of alluvial scrub vegetation occurring in early- to mid-successional seral stage with sandy loam soils. Low abundance of cobbles and boulders, woody debris, and cover by nonnative grasses and forbs are important factors in habitat suitability. Populations of San Bernardino kangaroo rats depend on periodic disturbance of alluvial and stream channel vegetation through flood events and also require connectivity between population centers and between channel habitat and refugium habitat upslope from the channels.

EXISTING MANAGEMENT

Land Ownership within the Geographic Range of the San Bernardino Kangaroo Rat

The historical geographic range of the San Bernardino kangaroo rat encompassed the counties and cities listed in Table 8. The species has been extirpated from most of its range and most of these jurisdictions no longer have habitat for the species or, where habitat remains, it is in small and fragmented patches. The current geographic range, as approximated by the USFWS Critical Habitat (USFWS 2008) for the species, encompasses just a few cities and unincorporated areas in San Bernardino and Riverside counties. The cities include Fontana, Highland, Rancho Cucamonga, Redlands, Rialto, San Bernardino, Yucaipa, and San Jacinto (Table 8).

Table 8. City and county jurisdictions within the historical geographic range of the San Bernardino kangaroo rat. Cities and unincorporated areas within the counties encompassed by the current range (as approximated by the USFWS-designated Critical Habitat Areas) are indicated by italics and asterisks.

| San Bernardino County | Riverside County | Los Angeles County |
|--------------------------------|------------------------------|---------------------------|
| Chino | Banning | Claremont |
| Chino Hills | Beaumont | La Verne |
| Colton | Calimesa | Pomona |
| <i>Fontana*</i> | Canyon Lake | Unincorporated areas |
| Grand Terrace | Corona | |
| Hesperia | Eastvale | |
| <i>Highland*</i> | Hemet | |
| Loma Linda | Jurupa Valley | |
| Montclair | Lake Elsinore | |
| Ontario | Menifee | |
| <i>Rancho Cucamonga*</i> | Moreno Valley | |
| <i>Redlands*</i> | Murrieta | |
| <i>Rialto*</i> | Norco | |
| <i>City of San Bernardino*</i> | Perris | |
| Upland | Riverside | |
| <i>Yucaipa*</i> | <i>San Jacinto*</i> | |
| <i>Unincorporated areas*</i> | Temecula | |
| | Wildomar | |
| | <i>Unincorporated areas*</i> | |

Based on CDFW’s analyses, more than 90% of the land in the San Bernardino kangaroo rat’s current geographic range, as approximated by the USFWS Critical Habitat designation, is privately owned. Federal and State agencies (BLM, US Forest Service, and CDFW) together own about 4% of the current range. Cities, the County of San Bernardino, the San Bernardino Flood Control District, and the Western Riverside County Regional Conservation Authority make up the remainder of the area (CDFW unpublished GIS analysis).

State and Federal Laws

The laws and regulations governing land use within the San Bernardino kangaroo rat’s geographic range vary by ownership. Several state and federal environmental laws apply to activities undertaken in California that may provide some level of protection for San Bernardino kangaroo rats and their habitat. The following is not an exhaustive list.

National Environmental Policy Act and California Environmental Quality Act

Most federal land management actions must undergo National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. § 4321, et seq.) analysis. NEPA requires federal agencies to document,

consider alternatives, and disclose to the public the impacts of major federal actions and decisions that may significantly impact the environment. As a federally listed Endangered species, impacts to San Bernardino kangaroo rats are considered during NEPA analysis and a Biological Opinion for such projects must be issued by the Service.

The California Environmental Quality Act (CEQA) is like NEPA; it requires state and local agencies to identify, analyze, and consider alternatives, and to publicly disclose environmental impacts from projects over which they have discretionary authority (Pub. Resources Code § 21000 et seq.). CEQA differs substantially from NEPA in requiring mitigation for significant adverse effects to a less than significant level unless overriding considerations are documented. CEQA requires an agency find projects to have a significant effect on the environment if they have the potential to substantially reduce the habitat, decrease the number, or restrict the range of any rare, threatened, or endangered species (Cal. Code Regs., tit. 14, §§ 15065(a)(1), 15380.). CEQA establishes a duty for public agencies to avoid or minimize such significant effects where feasible (Cal. Code regs., tit. 14, § 15021). Impacts to San Bernardino kangaroo rats, as an SSC, should be identified, evaluated, disclosed, and mitigated or justified under the Biological Resources section of an environmental document prepared pursuant to CEQA. However, a lead agency is not required to make a mandatory finding of significance conclusion unless it determines on a project-specific basis that the species meets the CEQA criteria for rare, threatened, or endangered.

Clean Water Act and Porter-Cologne Water Quality Control Act

The Clean Water Act originated in 1948 as the Federal Water Pollution Control Act of 1948. It was amended in 1972 and became known as the Clean Water Act (CWA). The purpose of the CWA was to establish regulations for the discharge of pollutants into waters of the United States and establish quality standards for surface waters. Section 404 of the CWA forbids the discharge of dredged or fill material into waters and wetlands without a permit from the ACOE. The CWA also requires an alternatives analysis, and the ACOE is directed to issue their permit for the least environmentally damaging practicable alternative. The definition of waters of the United States has changed substantially over time based on Supreme Court decisions and agency rule changes.

The State of California established the Porter-Cologne Water Quality Act in 1969 and like the CWA, it establishes water quality standards and regulates discharge of pollutants into state waters, but it also administers water rights, which regulate water diversions and extractions. The State Water Resources Control Board (SWRCB) and nine Regional Water Boards share responsibility for implementation and enforcement of Porter-Cologne as well as the CWA's National Pollutant Discharge Elimination System permitting. Proposed water management projects in the geographic range of the San Bernardino kangaroo rat should be evaluated under

the CWA and Porter-Cologne Act to consider the impacts of the proposed activities to the species.

Lake and Streambed Alteration Agreements

Fish and Game Code Section 1602 requires entities to notify the Department of activities that “divert or obstruct the natural flow of, or substantially change or use any material from the bed, channel, or bank of any river, stream, or lake, or deposit or dispose of debris, waste, or other material containing crumbled, flaked, or ground pavement where it may pass into any river, stream, or lake.” If the activity may substantially adversely affect an existing fish and wildlife resource, the Department may enter into a lake or streambed alteration agreement with the entity that includes reasonable measures necessary to protect the resource (Fish & G. Code, §1602, subd. (a)(4)(B)). A lake or streambed alteration agreement does not authorize take of species listed as candidates, threatened, or endangered under CESA (see Protection Afforded by Listing for CESA compliance requirements).

Federal Power Act

The Federal Power Act and its major amendments are implemented and enforced by FERC and require licenses for dams operated to generate hydropower. One of the major amendments of the Federal Power Act required that these licenses “shall include conditions for the protection, mitigation and enhancement of fish and wildlife including related spawning grounds and habitat” (ECPA 1986). Hydropower licenses granted by FERC are usually valid for 30 to 50 years. If a licensee wants to renew its license, it must file a Notice of Intent and a pre-application document five years before the license expires to provide time for public scoping, any new studies necessary to analyze project impacts and alternatives, and preparation of environmental documents. The applicant must officially apply for the new license at least two years before the current license expires.

As a federal agency, FERC must comply with federal environmental laws prior to issuing a new license or relicensing an existing hydropower project, which includes NEPA and ESA. As a result of environmental compliance or settlement agreements formed during the relicensing process, some operations have been modified and habitat restored to protect fish and wildlife.

Surface Mining and Reclamation Act (SMARA)

Reclamation of mined areas in the State of California is required under the Surface Mining and Reclamation Act (SMARA). The County of San Bernardino also requires that mining companies submit a reclamation plan for County approval. The primary purpose of these ordinances is to provide for erosion-control measures and to restore slopes to a moderate slope. However, reclamation may not resolve the problem of maintaining or mitigating for the loss of species or ecosystem functions in a biologically meaningful way because of change in soil composition,

topography, and altered hydrology. The feasibility of re-creating alluvial fan sage scrub habitat that would support the San Bernardino kangaroo rat has not yet been determined.

Patterns and Practices in the Environmental Review of Individual Projects

Proposed projects with the potential to impact the San Bernardino kangaroo rat must undergo review in the NEPA and CEQA processes. Prior to the designation of the kangaroo rat as a candidate for listing under CESA, the primary review process was NEPA and required consultation with the Service. The Service may grant incidental take authorization under either ESA Section 7 (for projects carried out, funded, or permitted by federal agencies) or ESA Section 10 (for non-federal projects, including private landowner projects and local jurisdiction projects). As discussed in the Petition, 45 projects with Service incidental take authorization for the San Bernardino kangaroo rat were reviewed, including 40 biological opinions for federal projects (Section 7) and five HCPs (Section 10). As summarized in the Petition, mitigation for impacts to San Bernardino kangaroo rats of these projects consisted of one or more of three strategies: relocation of kangaroo rats from project impact areas to other sites; habitat restoration; and/or purchase of mitigation credits from mitigation banks, primarily in the Lytle Creek and Cajon Wash mitigation banks.

The effectiveness of these three strategies in conserving or recovering the San Bernardino kangaroo rat is uncertain. Relocation has been the most common requirement in the 40 Section 7 projects, but its effectiveness has not been consistently monitored. HCPs and biological opinions commonly include habitat restoration. However, persistent occupancy by the kangaroo rat has not been confirmed in any restored habitat areas. Monitoring of restoration project success has also not been typically required. As a result, the ultimate outcome of these strategies does not inform subsequent project requirements.

Purchase of mitigation credits has resulted in protection of some habitat in mitigation banks. However, while the purchase of mitigation habitat results in its protection, it does not actually make up for the loss of the impacted habitat, which means there is a net loss of habitat available for the kangaroo rat. Given the limited amount of habitat available to the species, despite the long-term protection of some habitat in mitigation banks, the overall net loss of habitat resulting from this strategy has made the conservation status of the species more precarious. Also, the two primary mitigation banks currently available are both in the Lytle Creek-Cajon Wash population area and only encompass 600 ha (1,482 ac.). Additionally, the banks do not provide insurance against stochastic events (such as disease) that may impact the Lytle/Cajon Wash population.

Administrative and Regional Plans

FERC Licenses

As mentioned above in the Water Management section, three active FERC licenses have been issued in the current geographic range of the San Bernardino kangaroo rat. All three licenses were issued in 2003 and will expire in 2033. The licenses cover operation of hydropower facilities in the Lytle Creek, Bear Creek-Santa Ana River, and Mill Creek drainages.

South Coast Resource Management Plan (RMP)

Through the South Coast Resource Management Plan (RMP), the BLM designated an Area of Critical Environmental Concern (ACEC) in the Santa Ana River in 1994. The ACEC is composed of three parcels of land that total approximately 304 ha (760 ac.) for the purpose of protecting and enhancing the habitat of federally listed plant species occurring in the area, such as the Santa Ana River woolly star (*Eriastrum densifolium* subsp. *sanctorum*) and the San Bernardino kangaroo rat, while providing for the administration of existing valid rights (BLM 1994, p. 145). Although the establishment of the ACEC is important in regard to conservation of sensitive habitats and species in this area, the administration of valid, pre-existing rights may conflict with conservation intentions in this area. Existing rights include a withdrawal of Federal lands in this area for water conservation through an act of Congress.

The entire ACEC is included in this withdrawn land and may be available for water conservation measures such as the construction of groundwater recharge basins, subject to compliance with the ESA. As part of the South Coast RMP and the Santa Ana River Wash HCP some areas that are currently considered ACEC will become privately owned and other areas currently in private ownership will become public lands and designated as ACEC (see Habitat Conservation Plans, below).

Habitat Conservation Plans and Natural Community Conservation Plans

Western Riverside Multi-Species Habitat Conservation Plan (and NCCP)

The Western Riverside County Multiple Species Habitat Conservation Plan and Natural Communities Conservation Plan (WRC MSHCP/NCCP) was permitted in 2004 with a term of 75 years. It addresses 146 listed and at-risk species' habitat needs and preservation of native vegetation communities within the 509,000 ha (1,260,000 ac.) plan area in western Riverside County. Signatories to the WRC MSHCP/NCCP include the California Department of Fish and Game (now the California Department of Fish and Wildlife), the Service, Western Riverside County Regional Conservation Authority (WRCRCA), the County of Riverside, cities within MSHCP/NCCP area, county flood control and water conservation districts, county regional parks, the local waste management district and county transportation district, and the California Department of Parks and Recreation and California Department of Transportation.

The WRC MSHCP/NCCP area encompasses all the currently occupied San Bernardino kangaroo rat habitat in Riverside County. The HCP/NCCP is intended to promote land use flexibility through the establishment of a regional preserve system. The HCP/NCCP sets aside 202,343 ha (500,000 ac.) for habitat and species, including 61,917 ha (153,000 ac.) of private land.

In its findings document for issuance of the project incidental take permit (CDFG 2004), the Department noted that occurrences of the San Bernardino kangaroo rat in the San Jacinto River, Bautista Creek, Reche Canyon, and the northern portion of the Jurupa Mountains are within the HCP area. The HCP acknowledges implementation would result in the loss of 722.4 ha (1,785 ac.) of habitat for the San Bernardino kangaroo rat. The HCP's objectives to mitigate impacts to San Bernardino kangaroo rat are: 1) include within the Plan area 1,797 ha (4,440 ac.) of San Bernardino kangaroo rat habitat as protected area, 2) conduct surveys as part of the project review process for public and private projects, 3) within the 1,797 ha (4,440 ac.) of occupied and potential habitat, ensure that 75% is occupied and 20% supports a medium or higher population density, and 4) project managers will maintain or restore ecological processes within the historic floodplains for the species.

As reported in the most recent annual report for the WRC MSHCP/NCCP (WRCRCA 2018) in which surveys for the San Bernardino kangaroo rat were reported, focused surveys conducted between 2004 and 2017 for the San Bernardino kangaroo rat indicate that neither of the objectives of 75% occupancy of the 1,797 ha (4,400 ac.) of preserve areas or 20% occupancy at medium or high density has been met during implementation of the plan.

Upper Santa Ana River Wash Habitat Conservation Plan (Wash Plan HCP)

The Upper Santa Ana River Wash Habitat Conservation Plan (Wash Plan HCP) has been in development for several years and a final draft of the proposed plan was issued in May 2020 (ICF 2020a). The Wash Plan was permitted by the U.S. Fish and Wildlife Service in July 2020 but has not yet been issued an incidental take permit by the Department, nor has an application for Streambed Alteration Agreement been submitted to the Department (K. Romich, California Department of Fish and Wildlife, personal communication). The lead project proponent is the San Bernardino Valley Water Conservation District, but several other entities participated in Wash Plan HCP development to obtain coverage for their planned projects, including the cities of Redlands and Highland, two water districts, the San Bernardino County Flood Control District, and two sand and gravel mining companies (Cemex, Inc. and Robertson's Ready Mix). Projects covered by the Wash Plan would include flood control, water conservation (ground water recharge), surface mining, and a variety of city projects, among others. The Wash Plan HCP is currently in review by the Department; if approved as currently proposed, the Department would issue incidental take authorization for the San Bernardino kangaroo rat, as well as several other species that are either listed under the ESA or CESA currently or may be

listed in the future. The Department is currently reviewing the incidental take application and modeling to refine impacts and ensure full mitigation is achieved.

The Wash Plan HCP area encompasses approximately 1,983 ha (4,900 ac.) along 9.7 km (6 mi.) of the Santa Ana River channel starting at Greenspot Road in the city of Highland, about 1.6 km (1 mi.) downstream of the Seven Oaks Dam and ending at Alabama Street in the city of Redlands. Major tributaries flow into the Santa Ana River in the HCP area, including Mill Creek from the southeast, Plunge Creek from the northeast, and City Creek along the northwestern edge of the HCP area. The broad, braided multi-channel wash of the Santa Ana River spans about a mile and half in width for much of the HCP area. The Wash Plan HCP area covers most of the Santa Ana River unit of the San Bernardino kangaroo rat's Critical Habitat designated by the Service.

The Wash Plan HCP proposes several conservation activities to benefit the covered species in exchange for incidental take authorization for covered activities that result in habitat loss and with some potential for direct take of covered animals, including the San Bernardino kangaroo rat. Impacts associated with ongoing and expanded surface mining would occur in an area around existing aggregate mining facilities in the western portion of the HCP area. Water conservation activities would occur at existing and expanded groundwater recharge facilities on the eastern end of the HCP area. Impacts from other activities would be smaller in scale and scattered throughout and along the periphery of the HCP area and include construction of new flood control structures, road and trail construction, agricultural activities at an existing small citrus orchard, and habitat restoration and maintenance.

Habitat conservation activities proposed to benefit the San Bernardino kangaroo rat and other covered species include setting aside certain areas from future impacts as Conserved Lands, managing other areas of lower habitat quality to improve their conservation value, and avoiding or minimizing impacts to covered species during covered activities. Management for covered species would include efforts to control invasive plant species, vegetation thinning, revegetation with native plant species, and species and habitat monitoring. Managed lands would also benefit from signage, fencing, and other access control measures to reduce impacts of trespass, vandalism, and dumping.

Table 9 (excerpted from the Wash Plan's Table ES-4) summarizes the areas of impact and conservation proposed by the HCP to San Bernardino kangaroo rat habitat in the HCP area. The HCP categorizes impacts as either permanent, where covered activities will result in permanent loss of habitat suitability, or temporary, where there is an expectation that habitat value may be restored after the activity. Impacts are considered temporary for activities such as well and underground pipeline construction, operation of groundwater recharge spreading basins, construction of access roads, and use of stockpile, processing, and staging areas.

Table 9. Summary of Wash Plan effects on San Bernardino Kangaroo Rat habitat.

| Habitat Quality | Permanent Impacts (ha) | Temporary Impacts (ha) | Impact Total (ha) | Conserved Lands (ha) | Managed Lands (ha) | HCP Preserve Total (ha) |
|-------------------------|-------------------------------|-------------------------------|--------------------------|-----------------------------|---------------------------|--------------------------------|
| High Suitability | 9.1 | 0.8 | 9.8 | 49.1 | 69.0 | 118.1 |
| Medium Suitability | 27.4 | 0.6 | 28.0 | 49.4 | 42.7 | 92.1 |
| Low Suitability | 48.6 | 1.9 | 50.5 | 77.6 | 51.0 | 128.6 |
| Very Low Suitability | 145.3 | 22.5 | 167.8 | 130.1 | 96.2 | 226.3 |
| Ecological Process Area | 0.6 | 18.4 | 19.0 | 74.1 | 17.4 | 91.5 |
| Totals | 231.0 | 44.2 | 275.2 | 380.3 | 276.3 | 656.6 |

According to the Wash Plan, approximately 231 ha (571 ac.) of suitable San Bernardino kangaroo rat habitat would be lost from the Wash Plan area, mostly in the expanded aggregate mining area that would encompass much of the western half of the HCP area, but also in the expanded recharge area in the northeastern portion of the HCP. Another 44 ha (109 ac.) would be temporarily impacted, mostly along the northwestern margin of the HCP area. Approximately 380 ha (940 ac.) would be set aside as conserved lands and another 276 ha (683 ac.) would be managed to improve habitat quality for the San Bernardino kangaroo rat and other covered species. These would add to the area already conserved in the Santa Ana Woolly Star Preserve and would include lands currently owned by the Conservation District and the Flood Control District.

In summary, in exchange for setting aside and managing approximately 656 ha (1,622 ac.) for the benefit of the San Bernardino kangaroo rat, the Plan proposes impacts to 275 ha (680 ac.) of suitable kangaroo rat habitat (including 231 ha (571 ac.) of permanent loss of habitat).

Table 10 (excerpted from the HCP’s Table ES-5) summarizes the impacts and conservation to the sage scrub vegetation community (including both RAFSS and Riversidean Sage Scrub (RSS)). The area values of sage scrub impacts and conservation are similar to the San Bernardino kangaroo rat acreages shown in Table 10 due to the close association of the kangaroo rat with this vegetation community. For the sage scrub community, there would be 256.4 ha (633 ac.) of permanent or temporary impacts during implementation of the Wash Plan, and 619 ha (1530 ac.) of conserved or managed sage scrub community.

Table 10. Summary of Wash Plan effects on Riversidean Alluvial Fan Sage Scrub (RAFSS) and Riversidean Sage Scrub (RSS) Vegetation area (ha).

| Vegetation | Permanent Impact (ha) | Temporary Impact (ha) | Impact Total (ha) | Conserved Lands (ha) | Managed Lands (ha) | HCP Preserve Total (ha) |
|-------------------------------------|------------------------------|------------------------------|--------------------------|-----------------------------|---------------------------|--------------------------------|
| RAFSS – Pioneer | 0.6 | 14.8 | 15.3 | 83.7 | 14.5 | 98.3 |
| RAFSS – Intermediate | 64.3 | 7.2 | 71.5 | 123.6 | 95.8 | 219.5 |
| RAFSS – Intermediate / Mature | 104.8 | 4.2 | 109.0 | 67.9 | 128.1 | 196.0 |
| RAFSS – Mature | 47.2 | 3.2 | 50.3 | 70.9 | 23.2 | 94.1 |
| RAFSS – Mature/ Nonnative grassland | 4.0 | 3.0 | 7.0 | 11.3 | 0.0 | 11.3 |
| RSS | 3.2 | 0.0 | 3.2 | 0.0 | 0.0 | 0.0 |
| <i>Sage Scrub Total</i> | <i>223.9</i> | <i>32.5</i> | <i>256.4</i> | <i>357.5</i> | <i>261.6</i> | <i>619.1</i> |

Upper Santa Ana River Habitat Conservation Plan/Program (HCP)

The Upper Santa Ana River Habitat Conservation Plan (USAR HCP) encompasses a large planning and permit area of 349,230 ha (862,966 ac.) in San Bernardino and Riverside counties within the watersheds of the upper Santa Ana River and tributary drainages. A stakeholder review draft (ICF 2020b) was released in October 2020. The HCP seeks incidental take coverage over the proposed 50-year permit period for 20 listed or at-risk species, including fish, amphibians, the southwestern pond turtle (*Actinemys marmorata pallida*), riparian associated birds, and small mammals, including the San Bernardino kangaroo rat. Eleven public agencies involved in water management, led by the San Bernardino Valley Municipal Water District, would gain incidental take authorization if the plan is permitted. Covered activities are broadly categorized as water reuse (water treatment), groundwater recharge, wells and water conveyance, solar energy development, routine operations and maintenance, and habitat enhancement, management, and monitoring.

Impacts to the San Bernardino kangaroo rat would occur due to loss of habitat through ground disturbance, as well as direct mortality of some individual kangaroo rats. The USAR HCP

estimates that approximately 201 ha. (496 ac.) of kangaroo rat habitat would be permanently impacted during implementation, as well as temporary impacts on an additional 22.3 ha (55 ac.). The USAR HCP Preserve System would include habitat areas of various quality for the kangaroo rat totaling 361.8 (894 ac.). Similar to the Wash Plan HCP, the Department has reviewed the incidental take application and will continue to work with the permittee partners to refine the impact assessment and ensure full mitigation for the San Bernardino kangaroo rat is achieved.

Covered activities and conservation actions related to the San Bernardino kangaroo rat would affect the Lytle/Cajon Creek and Santa Ana River populations (the San Jacinto River population lies entirely outside the HCP area).

During implementation of covered activities, a variety of measures intended to avoid and minimize the potential for direct take of the kangaroo rat would be implemented. These include habitat assessments prior to project implementation, surveys to determine presence of the species, fencing of project areas to preclude entry of kangaroo rats into impact areas, salvage of soils from permanent impact areas for use in restoration projects, and daytime work only to minimize nighttime disturbance of kangaroo rat behaviors.

The goals of the HCP are to 1) conserve the covered species and their habitats and to contribute to their recovery; 2) sustain ecological processes that maintain ecosystem function for the covered species; 3) maintain and improve habitat connectivity in an HCP Preserve System and adjacent protected habitat areas; and 4) manage the Preserve System lands to maintain or improve conditions for the covered species. Specific objectives and actions outlined in the plan that would benefit the San Bernardino kangaroo rat include:

- Conserving and managing 362 ha (894 ac.) of modeled habitat within the Preserve System.
- Restoration of 89 ha (220 ac.) in two groundwater recharge basins within the Preserve System, managing nonnative grass to improve kangaroo rat habitat quality, identify areas within the Preserve System where sediment replenishment would improve habitat quality and to conduct such replenishment, conduct surveys for the kangaroo rat in the Preserve System, and to restore suitable habitat in two new groundwater recharge basins.
- Contribute to genetic health of the species by working with the wildlife agencies and others to study and identify conservation actions that would enhance gene flow and genetic diversity within the Preserve System.

Other Approved Habitat Conservation Plans

The Service lists four other HCPs with coverage for the San Bernardino kangaroo rat on [its species profile webpage](#). These four HCPs are small in area of impact and relied primarily on purchase of conservation bank credits to offset the loss of habitat for the species. A brief description of each HCP follows.

Walton Homes Habitat Conservation Plan. The Walton Homes HCP was permitted to Walton Homes LLC in 2007 with a term of five years. The proposed development was 17.2 ha (42.5 ac.) of residential and light industrial development in the City of Redlands. To mitigate for the 1.3 ha (3.1 ac.) of the project site that was occupied by San Bernardino kangaroo rat, 3.6 ha (9 ac.) of conservation credits were purchased from the Cajon Creek Conservation Bank.

Regency Centers Habitat Conservation Plan. The Regency Centers Habitat Conservation Plan was permitted to Regency Centers in 2008 with a term of three years. The proposed development was 3.4 ha (8.4 ac.) of commercial development in the City of Highland. To mitigate for the 1.8 ha (4.5 ac.) of the project site that was occupied by San Bernardino kangaroo rat, 5.3 ha (13 ac.) of conservation credits were purchased from the Cajon Creek Conservation Bank.

Lytle Creek Turnout Low-Effect Habitat Conservation Plan. The Lytle Creek Turnout Low-Effect HCP (formerly the West Valley Water District HCP) was permitted in 2009 for a duration of two years and was extended by one year. The total area covered was 0.9 ha (2.16 ac.) in the City of Rialto. It was developed for utility infrastructure.

City of Highland Roadways Project Habitat Conservation Plan. The City of Highland Roadways Project HCP was permitted in 2001 for a duration of five years. The total area covered was 4.1 ha (10.2 ac.).

SUMMARY OF LISTING FACTORS

CESA's implementing regulations identify key factors relevant to the Department's analyses and the Commission's decision on whether to list a species as threatened or endangered. A species will be listed as endangered or threatened if the Commission determines that the species' continued existence is in serious danger or is threatened by any one or any combination of the following factors: (1) present or threatened modification or destruction of its habitat; (2) overexploitation; (3) predation; (4) competition; (5) disease; or (6) other natural occurrences or human-related activities (Cal. Code Regs., tit. 14, § 670.1, subd. (i)).

This section provides summaries of information from the foregoing sections of this status review, arranged under each of the factors to be considered by the Commission in determining whether listing is warranted.

Present or Threatened Modification or Destruction of Habitat

Loss of habitat is the primary threat to the continued existence of the San Bernardino kangaroo rat and directly influences other major threats, including small population size and the loss of genetic diversity. Between 92% and 95% of habitat within the species' historical geographic range has been permanently lost since development of the region significantly increased beginning in the 1880s. Between about a third and half of the habitat remaining at the time of ESA listing has since been lost. Current development projects and HCPs in review contemplate additional losses of habitat within the USFWS' critical habitat boundaries. Remaining habitat occurs in three disjunct areas with no connectivity between them and sometimes limited connectivity within them, and therefore isolated populations are confined to small areas of suitable habitat.

Degradation or modification of habitat has occurred throughout the currently occupied range of the species. Loss of natural fluvial processes, especially in the Santa Ana River due to the Seven Oaks Dam but to some degree in all three population areas, due to channelization and water recharge projects has reduced the natural balance between flood events that reset the successional process in the kangaroo rat's sage scrub habitat and recolonization of such areas from refugium habitat in upland terraces. Other degradation of habitat has resulted from OHV and other recreational uses, surface mining, artificial lighting, edge effects, and other factors.

Overexploitation

As a nongame mammal (defined in Fish and Game Code § 4150), the San Bernardino kangaroo rat is not harvested or collected for commercial or personal use. Collection of the species has occurred in California on a limited basis for bona fide scientific and educational purposes. Scientific collection is regulated according to Fish and Game Code (§§ 1002 *et seq.*), which is administered by the Department. Given the species' precarious conservation status, scientific collection is limited to live-trapping studies that generally require immediate release at the site of capture after measurement and assessment of sex, reproductive status, and tissue sampling.

The Department does not consider overexploitation to be a significant threat to the continued existence of the San Bernardino kangaroo rat in California.

Predation

The Department does not consider predation on its own to be a significant threat to the continued existence of the San Bernardino kangaroo rat in California. However, it is possible that predation, especially from nonnative species, may exacerbate threats from habitat loss and degradation, small population size and lack of genetic diversity, and connectivity.

Competition

The Department does not consider competition on its own to be a significant threat to the continued existence of the San Bernardino kangaroo rat in California. However, it is possible that competition, especially from nonnative species, may add to the threats of loss of habitat, degradation of habitat, small population size, and lack of genetic diversity and connectivity to further imperil the species.

Disease

The Department has no concrete information regarding the threat of disease to the San Bernardino kangaroo rat; however, the lack of genetic diversity in the species may make it susceptible to impacts from disease.

Other Natural Events or Human-Related Activities

Small Population Size

Although the current population size of the San Bernardino kangaroo rat is unknown, given the low availability of habitat and the generally low population densities recently reported for the species, the total population probably consists of a few thousand individuals. The small population is subdivided into three completely disjunct populations and occupied sites within the populations may be relatively isolated from each other and consist of dozens or hundreds of individuals. Populations of this size are inherently vulnerable to threats including inbreeding depression, demographic stochasticity, environmental stochasticity, and loss of genetic diversity. These effects can result in decreased reproductive output, inability to adapt to changing environmental conditions, concentration of maladaptive genetic traits, and other deleterious effects. Small, isolated populations are also at greater risk of extinction due to catastrophic events such as disease outbreak or extreme floods. Small population effects almost certainly impact the San Bernardino kangaroo rat.

Genetics Factors

Our current understanding of the population genetics indicates the conservation status of the species is imperiled by genetic factors associated with its small and isolated populations, lack of genetic diversity, and inbreeding depression. Any of these factors would be of concern but acting in concert they suggest the species may be on the brink of population collapse and is in dire need of conservation and recovery actions to prevent irretrievable loss of genetic diversity within the species, to reverse inevitable declines in numbers of individuals, and to prevent further loss of occupancy within suitable habitat.

Climate Change

Past and ongoing changes to the climate in the San Bernardino kangaroo rat's geographic range include rising temperatures and projected increases in total and extreme precipitation; these may result in further negative impacts to habitat quality for the species. If the projected changes occur, it is likely that nighttime behaviors could be compromised, with warmer temperatures making energy and water balance more difficult for the small-bodied heteromyid. More extreme precipitation events, combined with the existing highly channelized condition of many of the streams in which the kangaroo rat occurs, may lead to excessive and repeated scouring of some of these areas, preventing the re-establishment of early successional sage scrub habitat. Although the degree to which these changes will threaten the San Bernardino kangaroo rat in the foreseeable future is unknown, as an isolated subspecies confined by mountain ranges to the north, east and south, and intensive human development to the west, there is no opportunity for this species to shift its geographic range in the face of climate change impacts.

PROTECTION AFFORDED BY LISTING

It is the policy of the State to conserve, protect, restore, and enhance any endangered or threatened species and its habitat (Fish & G. Code, § 2052). The conservation, protection, and enhancement of listed species and their habitat is of statewide concern (Fish & G. Code, § 2051(c)). If listed, unauthorized take of San Bernardino kangaroo rat would be prohibited under state law. CESA defines "take" as hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill (Fish & G. Code, § 86). Any person violating the take prohibition would be punishable under state law. The Fish and Game Code provides the Department with related authority to authorize "take" of species listed as threatened or endangered under certain circumstances (see, e.g., Fish & G. Code, §§ 2081, 2081.1, 2086, & 2835).

If San Bernardino kangaroo rat is listed under CESA, take resulting from activities authorized through incidental take permits must be minimized and fully mitigated according to state standards (Fish & G. Code, § 2081, subd. (b)). These standards typically include protection of land in perpetuity with an easement, development and implementation of a species-specific adaptive management plan, and funding through an endowment to pay for long-term monitoring and maintenance to ensure the mitigation land meets performance criteria. Obtaining an incidental take permit is voluntary. The Department cannot force compliance; however, any person violating the take prohibition may be criminally and civilly liable under state law. Research that takes San Bernardino kangaroo rat, such as trapping to determine population size or better understand the species or factors affecting its survival, would be regulated by issuance of permits or memorandums of understanding under Fish and Game Code Section 2081(a).

Additional protection of San Bernardino kangaroo rat following listing would be expected to occur through state and local agency environmental review under CEQA. CEQA requires affected public agencies to analyze and disclose project-related environmental effects, including potentially significant impacts on rare, threatened, and endangered species. In common practice, potential impacts to listed species are examined more closely in CEQA documents than potential impacts to unlisted species. Where significant impacts are identified under CEQA, the Department would recommend that project-specific avoidance, minimization, and mitigation measures to benefit the species be incorporated into proposed projects. State listing, in this respect, and consultation with the Department during state and local agency environmental review under CEQA, would therefore be expected to benefit the San Bernardino kangaroo rat in terms of reducing impacts from individual projects to a greater degree than has been occurring absent listing.

CESA listing may prompt increased interagency coordination specific to San Bernardino kangaroo rat conservation and protection. Listing would also increase the likelihood that state and federal land and resource management agencies will allocate additional funds toward protection and recovery actions.

LISTING RECOMMENDATION

CESA directs the Department to prepare this report regarding the status of the San Bernardino kangaroo rat in California based upon the best scientific information available (Fish & G. Code, § 2074.6). CESA also directs the Department based on its analysis to indicate in the status report whether the petitioned action (i.e., listing as endangered) is warranted (Fish & G. Code, § 2074.6; Cal. Code Regs., tit. 14, § 670.1, subd. (f)).

Under CESA, an endangered species is defined as “a native species or subspecies...which is in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes, including loss of habitat, change in habitat, overexploitation, predation, competition, or disease” (Fish & G. Code, § 2062). A threatened species is defined as “a native species or subspecies...that, although not presently threatened with extinction, is likely to become an endangered species in the foreseeable future in the absence of the special protection and management efforts required by [CESA]” (Fish and G. Code, § 2067).

The Department includes and makes its recommendation in its status report as submitted to the Commission in an advisory capacity based on the best available science. In consideration of the scientific information contained herein, the Department has determined that listing the San Bernardino kangaroo rat under CESA as endangered is warranted.

MANAGEMENT RECOMMENDATIONS

The Department has evaluated existing management recommendations and available literature applicable to the management and conservation of the San Bernardino kangaroo rat to arrive at the following recommendations. These recommendations, which represent the best available scientific information, were largely derived from recommendations developed by the Service for its draft Recovery Implementation Strategy for the San Bernardino kangaroo rat (USFWS 2019b), the SDZWA's research on San Bernardino kangaroo rat population genetic structure (Shier et al. 2018), as well as additional recommendations formulated by the Department.

- 1) **Develop and implement a conservation strategy and recovery plan for the San Bernardino kangaroo rat.** Such a plan would likely include many of the actions listed below.
- 2) **Use outreach, education, and other methods to limit recreational threats and improve public awareness and support.** Off road activities and other recreational activities are putting additional stress onto the San Bernardino kangaroo rat and its habitat. Limiting impacts from recreational activities while also improving outreach and public awareness will help improve human interactions and reduce impacts to San Bernardino kangaroo rat.
 - a) Locate areas that are vulnerable to or are currently being impacted by off-road activity and take steps to deter future impacts, including fencing, patrolling, and other access control measures.
 - b) Increase communication between San Bernardino County Flood Control District, Caltrans, and other necessary parties to prevent future roadwork impacts into occupied and critical habitats. Post maps of occupied and critical habitats in Caltrans and San Bernardino County Flood Control District workstations.
- 3) **Conserve and restore occupied habitat throughout the range of the species.** Conserving suitable habitat and restoring previously suitable habitat is required for recovery of the species. This includes both in-stream habitat and refuge habitat in upland areas, plus connections between these types of habitat. Much of the remaining suitable San Bernardino kangaroo rat habitat is pressured or impacted by development or surface mining. Therefore, it is important to focus efforts to conserve and/or restore remaining suitable habitat that are adjacent to occupied areas. In the absence of natural processes (flooding), the early successional habitat requirements for San Bernardino kangaroo rat can transition into unsuitable habitat that requires manmade restoration to reset to the suitable early successional habitat type.
 - a) Prioritize the protection and acquisition of recently flooded alluvial fan sage scrub habitat (pioneer or intermediate phases) and functional habitat over mature habitat.

- b) Map all potential suitable upland refugium habitat
 - c) Prioritize the protection and acquisition of suitable upland refugium habitat that maintains connectivity to lowland habitat.
 - d) Protect suitable habitat to support the long-term viability of all three populations.
 - e) Identify and manage potential risks associated with global climate change.
 - i) Monitor habitat variables (temperature, drought periods, and fluvial processes) and responses to changes in environmental conditions that may be attributed to global climate change (fecundity, range shift, reduction/shift in available diet).
 - ii) Consider impacts from altered alluvial processes including sediment transport, habitat creation, altered upland refugium habitat, erosion, and altered flood cycles during reestablishment planning. Adaptively manage any threats that manifest as a result of global climate change, such as decreased or altered water flows, changed precipitation patterns, or increased temperatures.
- 4) **Restore and protect other potentially suitable habitat including upland refugium habitat throughout the range of the species.**
- a) Create a standardized approach to habitat mitigation efforts.
 - b) Restoration of mature habitat needs to be tested and monitored for success.
 - c) Determine if habitat management/manipulation techniques can reliably and demonstrably improve San Bernardino kangaroo rat habitat at prior mining sites.
 - d) Identify and create practical methods to mimic the natural sediment flushing associated with the fluvial processes in alluvial fan sage scrub.
 - e) Restore hydrological processes in current or potential San Bernardino kangaroo rat habitat to a more natural condition.
 - f) Evaluate whether reduction of annual grasses using herbicides, mowing, grazing, or other methods is an effective management tool for promoting occupancy or population trends.
- 5) **Use management tools to improve connectivity and maintain/restore small populations.**
Due to the highly fragmented and pressured habitat San Bernardino kangaroo rat lives in, the remaining populations require a variety of management techniques to increase connectivity and/or restore and maintain existing populations to increase resiliency and

retain representation. This may also include a conservation agreement to prioritize management efforts in each of the three populations.

- a) Select target sites for actions that enhance or expand San Bernardino kangaroo rat habitat.
 - b) Increase connectivity within populations, including between upland terrace habitat and low floodplain or channel habitat.
 - c) Use conservation translocation as a tool to augment populations and increase genetic diversity to ameliorate potential inbreeding impacts.
- 6) **Use reestablishment and augmentation as tools to increase abundance and expand the distribution of the San Bernardino kangaroo rat.** Small, isolated populations inhabiting fragmented and stochastic prone (flooding) habitat are not sustainable. If necessary, conservation translocation or captive rearing could be used for augmentation and/or reintroduction, allowing managers to raise the viability of San Bernardino kangaroo rat.
- a) Determine metrics for evaluating effectiveness of translocations.
 - b) Develop a conservation translocation protocol for wild-reared individuals. Protocols will include site preparation, standardized husbandry/holding instructions, standardized post-release monitoring and reporting procedures and requirements, and adaptive management framework.
 - c) Implement a conservation translocation program to identify possible translocation sites that incorporate management of the species' population genetics.
 - d) Conduct post release success assessment by monitoring translocated individuals for at least three years to help determine the conditions needed for success and whether use of translocation is an appropriate recovery tool for the species.
 - e) Reestablish the San Bernardino kangaroo rat in suitable habitat at appropriate areas. Evaluate areas connected or near to occupied areas first. Then look at other suitable habitat, including Cable Creek, Bautista Creek, and Etiwanda Fan.
 - f) Undertake habitat manipulations near or adjacent to occupied habitat to expand available habitat and increase population numbers.
 - g) Undertake habitat manipulations at sites targeted as host sites for reintroduction efforts.

- h) Based on genetic data of San Bernardino kangaroo rat in each population, develop a genetic management plan to help conserve the genetic diversity of San Bernardino kangaroo rat in each population when conducting reestablishment or augmentation (manage the captive animals to match the genetic diversity of the wild).
 - i) Develop and implement a captive breeding program for the San Bernardino kangaroo rat for release to augment or reestablish populations where necessary throughout the range.
 - j) Reestablish or augment populations using captive-bred or translocated individuals. Captive-bred or translocated individuals should be used to:
 - i) Investigate gaps in San Bernardino kangaroo rat's life history that will be applicable to refine recovery methods and objectives.
 - ii) Augment existing populations to prevent extinction and increase abundance or genetic diversity.
 - iii) Reestablish historically occupied areas to create connectivity between populations and reestablish metapopulation dynamics.
- 7) **Conduct research to inform management actions where appropriate throughout the range of the species.** There are numerous gaps in our understanding of San Bernardino kangaroo rat biology and ecology. Additional information will help inform management decisions throughout the range of the species. Research is needed to determine population sizes, densities, and trends throughout the species' range, further explore the species' population genetics and its effects on small population size and fragmentation, determine impacts from climate change, create optimal upland refugium habitat conditions, and identify how to best minimize impacts caused by recreation.
- a) Estimate baseline overall population sizes, trends, and densities by completing annual standardized surveys.
 - b) Research dispersal range and permeability to barriers including common barriers between upland terraces and channels.
 - c) Assess factors affecting use of habitat corridors and connections between sites; use such information to help improve movement of San Bernardino kangaroo rats between occupied sites.

- d) Monitor outbreeding depression of recently translocated individuals from Santa Ana River to Lytle and Cajon Creeks by determining successful breeding and reproductive fitness of subsequent generations.
 - e) Use data from monitoring and research to develop a Population Viability Analysis (PVA) for each population. A PVA would help inform the implementation of other recovery actions and the assessment of recovery criteria. Include PVA with augmentation and without augmentation or removal of animals for translocation.
 - f) Undertake surveys to determine if unknown populations exist within suitable habitat.
 - g) Assess the degree of impact to San Bernardino kangaroo rats of anthropogenic noise and artificial light at night.
 - h) Research the impacts of predators, including nonnative predators, on San Bernardino kangaroo rat populations.
 - i) Determine if competition is occurring when food resources are scarce or after relocation to occupied habitat.
 - j) Conduct population surveys within the Cajon Creek Conservation Bank.
 - k) Conduct more genetic sampling to capture additional genetic information and better estimate effective population size at each of the three populations, especially in previously unsampled sites and sites with apparent high population density.
 - l) Identify habitat conditions (vegetation and soil data) within conservation areas and within Critical Habitat.
- 8) Create and implement a protocol for range wide surveys and monitoring.**
- a) The protocol should allow for comparison of the relative status of the species within and between populations and would help in the development of a PVA.
 - b) Create a range wide comprehensive management plan that would unify all San Bernardino kangaroo rat management techniques, including translocation techniques.
- 9) Additional sampling and study of fur loss of San Bernardino kangaroo rat at BLM site in the Santa Ana River wash, or other sites where fur loss is observed, should occur to determine its cause and possible management actions.**

ECONOMIC CONSIDERATIONS

The Department is charged in an advisory capacity in the present context to provide a written report and a related recommendation to the Commission based on the best scientific information available regarding the status of San Bernardino kangaroo rat in California. The Department is not required to prepare an analysis of economic impacts (See Fish & G. Code, § 2074.6; Cal. Code Regs., tit. 14, § 670.1, subd. (f)).

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APPENDIX A - List of Acronyms, Initialisms, and Abbreviations

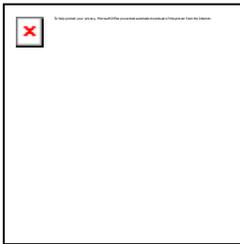
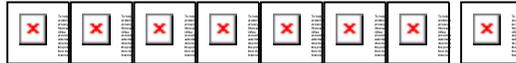
| Acronym | Meaning |
|----------------|---|
| ACEC | Area of Critical Environmental Concern |
| ACOE | Army Corp of Engineers |
| AR | Allelic richness |
| BO | Biological Opinion |
| CDFW | California Department of Fish and Wildlife |
| CESA | California Endangered Species Act |
| CEQA | California Environmental Quality Act |
| cfs | Cubic feet per second |
| Commission | Fish and Game Commission |
| CWA | Clean Water Act |
| Department | Department of Fish and Wildlife |
| ESA | Federal Endangered Species Act |
| FERC | Federal Energy Regulatory Commission |
| FIS | Individual inbreeding coefficient |
| HCP | Habitat Conservation Plans |
| HE | Expected heterozygosity |
| HO | Observed heterozygosity |
| ICF | An international consulting firm founded as the Inner City Fund in 1969 |
| MSHMP | Multispecies Habitat Management Plan (for the Seven Oaks Dam) |
| mtDNA | mitochondrial DNA |
| MVP | Minimum viable population |
| NCCP | Natural Communities Conservation Plan |
| NEPA | National Environmental Policy Act |
| OHV | Off-Highway Vehicle |
| pairwise FST | Genetic differentiation between populations |
| PAR | Private allelic richness |
| PVA | Population Viability Analysis |
| RAFSS | Riversidean Alluvial Fan Sage Scrub |
| RCP 4.5 | A moderate emission scenario used in climate change projections |
| RCP 8.5 | A high emission scenario used in climate change projections |
| RMP | South Coast Resource Management Plan |
| RSS | Riversidean Sage Scrub |
| SBKR | San Bernardino kangaroo rat |
| SCE | Southern California Edison |
| SDZWA | San Diego Zoo Wildlife Alliance |
| Service | U.S. Fish and Wildlife Service |

| Acronym | Meaning |
|----------------|---|
| SMARA | Surface Mining and Reclamation Act |
| SOD | Seven Oaks Dam |
| SSC | Species of Special Concern |
| SWRCB | State Water Resources Control Board |
| USAR HCP | The Upper Santa Ana River Habitat Conservation Plan |
| USFWS | U.S. Fish and Wildlife Service |
| Wash Plan HCP | Upper Santa Ana River Wash Habitat Conservation Plan |
| WCM | Water Control Manual (for the Seven Oaks Dam) |
| WRCRCA | Western Riverside County Regional Conservation Authority |
| WRC MSHCP | Western Riverside County Multiple Species Habitat Conservation Plan |
| WSPA | Woolly Star Preserve Area |

APPENDIX B – Public Notification

@Wildlife

From: California Fish and Game Commission <fgc@fgc.ca.gov>
Sent: Wednesday, August 28, 2019 9:04 AM
To: [REDACTED]
Subject: Notification of CDFW Status Review for San Bernardino Kangaroo Rat



www.fgc.ca.gov

California Fish and Game Commission

The following message is being sent on behalf of the California Department of Fish and Wildlife (CDFW).

Dear fish and wildlife stakeholder,

The California Department of Fish and Wildlife (CDFW) has initiated a status review for the San Bernardino kangaroo rat (*Dipodomys merriami parvus*) pursuant to Fish and Game Code Section 2074.6. CDFW is providing this notice pursuant to Fish and Game Code Section 2074.4 to solicit data and comments on the petitioned action from interested and affected parties.

For more information on the method and deadline for submittal of data and comments, please see the CDFW notice letter that can be accessed at <http://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=174231&inline>.

Know someone else who would be interested in our organization?

SHARE THIS EMAIL

Not yet signed up to receive our informative emails?

SIGN UP

California Fish and Game Commission,
Mailing address: P.O. Box 944209, Sacramento, CA 94244-2090,
Physical address: 1416 Ninth Street, Suite 1320, Sacramento, CA 95814

[SafeUnsubscribe™](#) scott.osborn@wildlife.ca.gov

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ry tributary creek, located at an abandoned quarry, referred to as the Upper Quarry in project documents, located on Stanford University property in the Matadero Creek watershed in Santa Clara County, California.

On December 14, 2018, the San Francisco Bay Regional Water Quality Control Board (Regional Water Board) received a Notice of Intent (NOI) to comply with the terms of, and obtain coverage under, the General 401 Water Quality Certification Order for Small Habitat Restoration Projects (General 401 Order) and received supplemental application materials through May 9, 2019 for the Upper Quarry Habitat Improvement Project for California Red-Legged Frogs. The Regional Water Board determined that the Project, as described in the NOI, was categorically exempt from California Environmental Quality Act (CEQA) review (section 15333 — Small Habitat Restoration Projects) and met the eligibility requirements for coverage under the General 401 Order. The Regional Water Board issued a Notice of Applicability (CIWQS Place ID No. 854450 (BKW), CIWQS Reg. Meas. ID No. 427807) for coverage under the General 401 Order on August 1, 2019.

Stanford University is requesting a determination that the project and associated documents are complete pursuant to Fish and Game Code section 1653 subdivision (d). If CDFW determines the project is complete, the District will not be required to obtain an incidental take permit under Fish and Game Code section 2081 subdivision (b) or a Lake or Streambed Alteration Agreement under Fish and Game Code section 1605 for the proposed project.

In accordance with Fish and Game Code section 1653 subdivision (e), if CDFW determines during the review, based on substantial evidence, that the request is not complete, Stanford University will have the opportunity to submit under Fish and Game Code section 1652.

FISH AND GAME COMMISSION

NOTICE OF FINDINGS

San Bernardino Kangaroo Rat
(*Dipodomys merriami parvus*)

NOTICE IS HEREBY GIVEN that, pursuant to the provisions of Section 2074.2 of the Fish and Game Code, the California Fish and Game Commission (Commission), at its August 7, 2019 meeting in Sacramento, California, accepted for consideration the petition submitted to list San Bernardino kangaroo rat (*Dipodomys merriami parvus*) as endangered under the California Endangered Species Act.

Pursuant to subdivision (e)(2) of Section 2074.2 of the Fish and Game Code, the Commission determined that the amount of information contained in the petition, when considered in light of the California Department of Fish and Wildlife’s (Department) written evaluation report, the comments received, and the remainder of the administrative record, would lead a reasonable person to conclude there is a substantial possibility the requested listing could occur.

Based on that finding and the acceptance of the petition, the Commission is also providing notice that the San Bernardino kangaroo rat is a candidate species as defined by Section 2068 of the Fish and Game Code.

Within one year of the date of publication of this notice of findings, the Department shall submit a written report, pursuant to Section 2074.6 of the Fish and Game Code, indicating whether the petitioned action is warranted. Copies of the petition, as well as minutes of the August 7, 2019 Commission meeting, are on file and available for public review from Melissa Miller-Henson, Acting Executive Director, Commission, 1416 Ninth Street, Suite 1320, Sacramento, California 95814, phone (916) 653-4899.

Written comments or data related to the petitioned action should be directed to the California Department of Fish and Wildlife, P.O. Box 944209, Sacramento, CA 94244-2090, Attn: Scott Osborn, or email wildlifemgt@wildlife.ca.gov (include “SBKR” in subject line). Submission of information via email is preferred.

DISAPPROVAL DECISION

DEPARTMENT OF PUBLIC HEALTH

State of California
Office of Administrative Law

In re:
Department of Public Health

Regulatory Action:

Title 17, California Code of Regulations

Adopt sections: 30315.05, 30315.20, 30315.22, 30315.23, 30315.33, 30315.50, 30315.52, 30316.30, 30317.10, 30317.20, 30318.11

Amend sections: 30315.10, 30315.34, 30315.36, 30315.60, 30316, 30316.10, 30316.20, 30316.60, 30316.61, 30318.10, 30319, 30320.90



State of California – Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
Wildlife Branch
1812 Ninth Street
Sacramento, CA 95811
www.wildlife.ca.gov

GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director



August 28, 2019

**SUBJECT: NOTIFICATION OF STATUS REVIEW FOR SAN BERNARDINO
KANGAROO RAT**

To whom it may concern:

The California Department of Fish and Wildlife (Department) has initiated a status review for the San Bernardino kangaroo rat (*Dipodomys merriami parvus*) pursuant to Fish and Game Code section 2074.6 and is providing this notice pursuant to Fish and Game Code section 2074.4 to solicit data and comments on the petitioned action from interested and affected parties.

The Department has initiated this status review following the Fish and Game Commission's (Commission) decision to accept for consideration the petition to list the species under the California Endangered Species Act (CESA) at its August 7, 2019 meeting. Having provided public notice (Cal. Reg. Notice Reg. 2019, No. 34-Z, p. 1182; Fish & Game Code, § 2074.2), the San Bernardino kangaroo rat is now a candidate species under CESA.

The Department has 12 months to review the petition, evaluate the available information, and report back to the Commission whether the petitioned action is warranted. (Fish & G. Code, § 2074.6.) The Department's recommendation must be based on the best scientific information available to the Department (Fish & Game Code, § 2074.6.).

Anyone with data or comments on this species' ecology, genetics, life history, distribution, abundance, habitat, the degree and immediacy of threats to reproduction or survival, adequacy of existing management, and recommendations for management of the species, is hereby requested to provide such data or comments to:

California Department of Fish and Wildlife
Attn: Scott Osborn
1812 9th Street
Sacramento, California 95811
wildlifemgt@wildlife.ca.gov

Please submit two hard copies if submitting by surface mail. If submitting by email, please include "SBKR" in the subject heading.

Responses and information received by **September 27, 2019**, will be evaluated for incorporation in the Department's final report to the Commission. The Department's written report will indicate, based on the best scientific information available, whether the Department concludes that the petitioned action is warranted or not warranted. Receipt of the report will be placed on the agenda for the next available meeting of the Commission after delivery. The report will be made available to the public at that time. Following receipt of the Department's report, the Commission will allow a 30-day public comment period prior to taking any action on the Department's recommendation.

As candidate species, the San Bernardino kangaroo rat receives the same legal protection afforded to an endangered or threatened species under the California Endangered Species Act (Fish & G. Code, § 2085). Research on the species requires appropriate permits issued pursuant to Fish and Game Code Section 2081(a). Detection information on the San Bernardino kangaroo rat should be sent to the California Natural Diversity Data Base at <https://www.wildlife.ca.gov/Data/CNDDDB/Submitting-Data>.

Interested researchers or anyone with questions may contact Scott Osborn at the email or address above, or at 916-324-3564.



California Department of
Fish and Wildlife

CDFW News

≡ MENU



CDFW Seeks Information Related to San Bernardino Kangaroo Rat

September 4, 2019

The California Department of Fish and Wildlife (CDFW) is seeking information relevant to a proposal to list the San Bernardino kangaroo rat (*Dipodomys merriami parvus*) as an endangered species under the California Endangered Species Act.

In March 2019, the Endangered Habitats League submitted a petition to the California Fish and Game Commission to formally list the San Bernardino kangaroo rat as endangered under the California Endangered Species Act. The listing petition and CDFW's petition evaluation described a variety of threats to the survival of the species in California. These include direct and indirect impacts associated with habitat loss, habitat fragmentation, habitat degradation, small and fragmented subpopulations, loss of ecological processes maintaining habitat suitability, low genetic diversity and climate change. CDFW recommended and the Commission voted to advance the species to candidacy on Aug. 7, 2019. The Commission published findings of this decision on Aug. 23, 2019, triggering a 12-month period during which CDFW will conduct a status review to inform the Commission's decision on whether to list the species.

As part of the status review process, CDFW is soliciting information from the public regarding the San Bernardino kangaroo rat's ecology, genetics, life history, distribution, abundance, habitat, the degree and immediacy of threats to reproduction or survival, adequacy of existing management and recommendations for management of the species. Comments, data and other information can be submitted in writing to:

California Department of Fish and Wildlife

Attn: Scott Osborn

1812 Ninth St.

Sacramento, CA 95811

Comments may also be submitted by email to wildlifemgt@wildlife.ca.gov. If submitting comments by email, please include "SBKR" in the subject heading.

All comments received by Sept. 27, 2019 will be evaluated prior to submittal of the CDFW status review report to the Commission. Receipt of the report will be placed on the agenda for the next available meeting of the Commission after delivery and the report will be

made available to the public at that time. Following the receipt of the CDFW report, the Commission will allow a 30-day public comment period prior to taking any action on CDFW's recommendation.

The listing petition and CDFW's petition evaluation for the kangaroo rat is available at

<https://fgc.ca.gov/cesa#sbkr>.

###

Media Contacts:

Scott Osborn, CDFW Wildlife Branch, (916) 324-3564

Kirsten Macintyre, CDFW Communications, (916) 322-8988

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Tagged California Endangered Species Act, California Fish and Game Commission, nongame species, public comments, San Bernardino kangaroo rat

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State of California – Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
Wildlife Branch
1812 Ninth Street
Sacramento, CA 95811
www.wildlife.ca.gov

GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director



September 19, 2019

Honorable Patricia Garcia-Plotkin, Director
Agua Caliente Band of Cahuilla Indians
5401 Dinah Shore Drive
Palm Springs, CA, 92264

Dear Honorable Tribal Representative:

NOTIFICATION OF STATUS REVIEW FOR THE SAN BERNARDINO KANGAROO RAT

The California Department of Fish and Wildlife (Department) has initiated a status review for the San Bernardino kangaroo rat (*Dipodomys merriami parvus*) pursuant to Fish and Game Code section 2074.6. The Department is providing this notice pursuant to Fish and Game Code section 2074.4 to solicit data and comments on the petitioned action from interested and affected Tribes.

The Department initiated the status review following the Fish and Game Commission's (Commission) decision to accept for consideration the petition to list the San Bernardino kangaroo rat under the California Endangered Species Act (CESA) at its August 7, 2019, meeting. Having provided public notice (Cal. Reg. Notice Reg. 2019, No. 34-Z, pg. 1182; Fish & Game Code, § 2074.2), the San Bernardino kangaroo rat is now a candidate species under CESA. As a candidate species, the species receives the same legal protection afforded to an endangered or threatened species (Fish & Game Code, § 2085).

The Department has 12 months to review the petition, evaluate the available information, and report back to the Commission whether the petitioned action is warranted (Fish & Game Code, § 2074.6). The Department's recommendation must be based on the best scientific information available. The Department welcomes your Tribe to provide any data or comments on the species' ecology, genetics, life history, distribution, abundance, habitat, the degree and immediacy of threats to its reproduction or survival, the adequacy of existing management, and recommendations for management of the species.

Please provide such data or comments to "Attn: Scott Osborn" at the address in the letterhead or by email to: wildlifemgt@wildlife.ca.gov. If submitting by email, please include "SBKR" in the subject heading. Please submit detection information to the California Natural Diversity Database at: <https://www.wildlife.ca.gov/Data/CNDDDB/Submitting-Data>.

Patricia Garcia-Plotkin, Director
Agua Caliente Band of Cahuilla Indians
September 19, 2019
Page 2

The Department respectfully requests your responses and information before **October 22, 2019** to allow sufficient time to evaluate the information for possible incorporation in the Department's final status review report to the Commission. The written report will indicate, based on the best scientific information available, whether the Department concludes the petitioned action is warranted or not warranted. The Commission will place receipt of the report on the agenda for the next available Commission meeting after delivery. The report will be made available to the public at that meeting. Following receipt of the Department's report, the Commission will allow a 30-day public comment period prior to taking any action on the Department's recommendation.

The Department welcomes direct communication and consultation to discuss the status review for the San Bernardino kangaroo rat and to identify any impacts to Tribal interests or cultural resources. The Department is committed to open communication with your Tribe under its Tribal Communication and Consultation Policy, which is available through the Department's Tribal Affairs webpage at <https://www.wildlife.ca.gov/General-Counsel/Tribal-Affairs>.

If you would like more information on the status review, please contact Scott Osborn, Senior Environmental Scientist (Specialist) at wildlifemgt@wildlife.ca.gov or at the address above. To request formal government-to-government consultation pursuant to the Department's Tribal Communication and Consultation Policy, please respond in writing to Tribal Liaison Nathan Voegeli by email tribal.liaison@wildlife.ca.gov or by mail to Department of Fish and Wildlife, 1416 9th Street, Suite 1341, Sacramento, CA 95814. Please designate and provide contact information for the appropriate Tribal lead person.

We look forward to your response and input on the status review.

Sincerely,



Kari Lewis, Chief
Wildlife Branch

ec: California Department of Fish and Wildlife
Stafford Lehr, Deputy Director, [REDACTED]
Nathan Voegeli, Tribal Liaison, Tribal.Liaison@wildlife.ca.gov
Erin Chappell, Environmental Program Manager, [REDACTED]
Scott Osborn, Senior Environmental Scientist, [REDACTED]



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GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director



September 19, 2019

Honorable Jeff Grubbe, Chairperson
Agua Caliente Band of Cahuilla Indians
5401 Dinah Shore Drive
Palm Springs, CA, 92264

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Jeff Grubbe, Chairperson
Agua Caliente Band of Cahuilla Indians
September 19, 2019
Page 2

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Sincerely,



Kari Lewis, Chief
Wildlife Branch

ec: California Department of Fish and Wildlife
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Scott Osborn, Senior Environmental Scientist, [REDACTED]



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GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director



September 19, 2019

Honorable Amanda Vance, Chairperson
Augustine Band of Cahuilla Mission Indians
P.O. Box 846
Coachella, CA, 92236

Dear Honorable Tribal Representative:

NOTIFICATION OF STATUS REVIEW FOR THE SAN BERNARDINO KANGAROO RAT

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Amanda Vance, Chairperson
Augustine Band of Cahuilla Mission Indians
September 19, 2019
Page 2

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We look forward to your response and input on the status review.

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Kari Lewis, Chief
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Stafford Lehr, Deputy Director, [REDACTED]
Nathan Voegeli, Tribal Liaison, Tribal.Liaison@wildlife.ca.gov
Erin Chappell, Environmental Program Manager, [REDACTED]
Scott Osborn, Senior Environmental Scientist, [REDACTED]



State of California – Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
Wildlife Branch
1812 Ninth Street
Sacramento, CA 95811
www.wildlife.ca.gov

GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director



September 19, 2019

Honorable Doug Welmas, Chairperson
Cabazon Band of Mission Indians
84-245 Indio Springs Parkway
Indio, CA, 92203

Dear Honorable Tribal Representative:

NOTIFICATION OF STATUS REVIEW FOR THE SAN BERNARDINO KANGAROO RAT

The California Department of Fish and Wildlife (Department) has initiated a status review for the San Bernardino kangaroo rat (*Dipodomys merriami parvus*) pursuant to Fish and Game Code section 2074.6. The Department is providing this notice pursuant to Fish and Game Code section 2074.4 to solicit data and comments on the petitioned action from interested and affected Tribes.

The Department initiated the status review following the Fish and Game Commission's (Commission) decision to accept for consideration the petition to list the San Bernardino kangaroo rat under the California Endangered Species Act (CESA) at its August 7, 2019, meeting. Having provided public notice (Cal. Reg. Notice Reg. 2019, No. 34-Z, pg. 1182; Fish & Game Code, § 2074.2), the San Bernardino kangaroo rat is now a candidate species under CESA. As a candidate species, the species receives the same legal protection afforded to an endangered or threatened species (Fish & Game Code, § 2085).

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Doug Welmas, Chairperson
Cabazon Band of Mission Indians
September 19, 2019
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We look forward to your response and input on the status review.

Sincerely,



Kari Lewis, Chief
Wildlife Branch

ec: California Department of Fish and Wildlife
Stafford Lehr, Deputy Director, [REDACTED]
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GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director



September 19, 2019

Honorable Daniel Salgado, Chairperson
Cahuilla Band of Indians
52701 U.S. Highway 371
Anza, CA, 92539

Dear Honorable Tribal Representative:

NOTIFICATION OF STATUS REVIEW FOR THE SAN BERNARDINO KANGAROO RAT

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Daniel Salgado, Chairperson
Cahuilla Band of Indians
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Wildlife Branch

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GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director



September 19, 2019

Honorable Fred Nelson, Chairperson
La Jolla Band of Luiseno Indians
22000 Highway 76
Pauma Valley, CA, 92061

Dear Honorable Tribal Representative:

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Fred Nelson, Chairperson
La Jolla Band of Luiseno Indians
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Wildlife Branch

ec: California Department of Fish and Wildlife
Stafford Lehr, Deputy Director, [REDACTED]
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GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director



September 19, 2019

Honorable Paul Macarro, Cultural Resources Coordinator
Pechanga Band of Luiseno Indians
P.O. Box 1477
Temecula, CA, 92593

Dear Honorable Tribal Representative:

NOTIFICATION OF STATUS REVIEW FOR THE SAN BERNARDINO KANGAROO RAT

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Paul Macarro, Cultural Resources Coordinator
Pechanga Band of Luiseno Indians
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Kari Lewis, Chief
Wildlife Branch

ec: California Department of Fish and Wildlife
Stafford Lehr, Deputy Director, [REDACTED]
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GAVIN NEWSOM, Governor
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Pechanga Band of Luiseno Indians
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GAVIN NEWSOM, Governor
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September 19, 2019

Honorable Joseph Hamilton, Chairperson
Ramona Band of Cahuilla
P.O. Box 391670
Anza, CA, 92539

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Joseph Hamilton, Chairperson
Ramona Band of Cahuilla
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GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director



September 19, 2019

Honorable John Gomez, Environmental Coordinator
Ramona Band of Cahuilla
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GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director



September 19, 2019

Honorable Jim McPherson, Tribal Historic Preservation Officer
Rincon Band of Luiseno Indians
One Government Center Lane
Valley Center, CA, 92082

Dear Honorable Tribal Representative:

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Jim McPherson, Tribal Historic Preservation Officer
Rincon Band of Luiseno Indians
September 19, 2019
Page 2

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We look forward to your response and input on the status review.

Sincerely,



Kari Lewis, Chief
Wildlife Branch

ec: California Department of Fish and Wildlife
Stafford Lehr, Deputy Director, [REDACTED]
Nathan Voegeli, Tribal Liaison, Tribal.Liaison@wildlife.ca.gov
Erin Chappell, Environmental Program Manager, [REDACTED]
Scott Osborn, Senior Environmental Scientist, [REDACTED]



State of California – Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
Wildlife Branch
1812 Ninth Street
Sacramento, CA 95811
www.wildlife.ca.gov

GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director



September 19, 2019

Honorable Steven Estrada, Chairperson
Santa Rosa Band of Cahuilla Indians
P.O. Box 391820
Anza, CA, 92539

Dear Honorable Tribal Representative:

NOTIFICATION OF STATUS REVIEW FOR THE SAN BERNARDINO KANGAROO RAT

The California Department of Fish and Wildlife (Department) has initiated a status review for the San Bernardino kangaroo rat (*Dipodomys merriami parvus*) pursuant to Fish and Game Code section 2074.6. The Department is providing this notice pursuant to Fish and Game Code section 2074.4 to solicit data and comments on the petitioned action from interested and affected Tribes.

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Steven Estrada, Chairperson
Santa Rosa Band of Cahuilla Indians
September 19, 2019
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Kari Lewis, Chief
Wildlife Branch

ec: California Department of Fish and Wildlife
Stafford Lehr, Deputy Director, [REDACTED]
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GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director



September 19, 2019

Honorable Mercedes Estrada
Santa Rosa Band of Cahuilla Indians
P.O. Box 391820
Anza, CA, 92539

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Mercedes Estrada
Santa Rosa Band of Cahuilla Indians
September 19, 2019
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Kari Lewis, Chief
Wildlife Branch

ec: California Department of Fish and Wildlife
Stafford Lehr, Deputy Director, [REDACTED]
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GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director



September 19, 2019

Honorable Mark Cochrane, Co-Chairperson
Serrano Nation of Mission Indians
P. O. Box 343
Patton, CA, 92369

Dear Honorable Tribal Representative:

NOTIFICATION OF STATUS REVIEW FOR THE SAN BERNARDINO KANGAROO RAT

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Mark Cochrane, Co-Chairperson
Serrano Nation of Mission Indians
September 19, 2019
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Kari Lewis, Chief
Wildlife Branch

ec: California Department of Fish and Wildlife
Stafford Lehr, Deputy Director, [REDACTED]
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GAVIN NEWSOM, Governor
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September 19, 2019

Honorable Wayne Walker, Co-Chairperson
Serrano Nation of Mission Indians
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Patton, CA, 92369

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Wayne Walker, Co-Chairperson
Serrano Nation of Mission Indians
September 19, 2019
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Kari Lewis, Chief
Wildlife Branch

ec: California Department of Fish and Wildlife
Stafford Lehr, Deputy Director, [REDACTED]
Nathan Voegeli, Tribal Liaison, Tribal.Liaison@wildlife.ca.gov
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State of California – Natural Resources Agency
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Wildlife Branch
1812 Ninth Street
Sacramento, CA 95811
www.wildlife.ca.gov

GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director



September 19, 2019

Honorable Joseph Ontiveros, Cultural Resource Department
Soboba Band of Luiseno Indians
P.O. BOX 487
San Jacinto, CA, 92581

Dear Honorable Tribal Representative:

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Joseph Ontiveros, Cultural Resource Department
Soboba Band of Luiseno Indians
September 19, 2019
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State of California – Natural Resources Agency
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Wildlife Branch
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Sacramento, CA 95811
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GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director



September 19, 2019

Honorable Shane Chapparosa, Chairperson
Los Coyotes Band of Cahuilla and Cupeño Indians
P.O. Box 189
Warner Springs, CA, 92086-0189

Dear Honorable Tribal Representative:

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Shane Chapparosa, Chairperson
Los Coyotes Band of Cahuilla and Cupeño Indians
September 19, 2019
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Sacramento, CA 95811
www.wildlife.ca.gov

GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director



September 19, 2019

Honorable Robert Martin, Chairperson
Morongo Band of Mission Indians
12700 Pumarra Road
Banning, CA, 92220

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Robert Martin, Chairperson
Morongo Band of Mission Indians
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We look forward to your response and input on the status review.

Sincerely,



Kari Lewis, Chief
Wildlife Branch

ec: California Department of Fish and Wildlife
Stafford Lehr, Deputy Director, [REDACTED]
Nathan Voegeli, Tribal Liaison, Tribal.Liaison@wildlife.ca.gov
Erin Chappell, Environmental Program Manager, [REDACTED]
Scott Osborn, Senior Environmental Scientist, [REDACTED]



State of California – Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
Wildlife Branch
1812 Ninth Street
Sacramento, CA 95811
www.wildlife.ca.gov

GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director



September 19, 2019

Honorable Denisa Torres, Cultural Resources Manager
Morongo Band of Mission Indians
12700 Pumarra Road
Banning, CA, 92220

Dear Honorable Tribal Representative:

NOTIFICATION OF STATUS REVIEW FOR THE SAN BERNARDINO KANGAROO RAT

The California Department of Fish and Wildlife (Department) has initiated a status review for the San Bernardino kangaroo rat (*Dipodomys merriami parvus*) pursuant to Fish and Game Code section 2074.6. The Department is providing this notice pursuant to Fish and Game Code section 2074.4 to solicit data and comments on the petitioned action from interested and affected Tribes.

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Denisa Torres, Cultural Resources Manager
Morongo Band of Mission Indians
September 19, 2019
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Wildlife Branch

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Stafford Lehr, Deputy Director, [REDACTED]
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GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director



September 19, 2019

Honorable Shasta Gaughen, Tribal Historic Preservation Officer
Pala Band of Mission Indians
PMB 50, 35008 Pala Temecula Rd.
Pala, CA, 92059

Dear Honorable Tribal Representative:

NOTIFICATION OF STATUS REVIEW FOR THE SAN BERNARDINO KANGAROO RAT

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Shasta Gaughen, Tribal Historic Preservation Officer
Pala Band of Mission Indians
September 19, 2019
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Wildlife Branch

ec: California Department of Fish and Wildlife
Stafford Lehr, Deputy Director, [REDACTED]
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GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director



September 19, 2019

Honorable Temet Aguilar, Chairperson
Pauma Band of Luiseno Indians
P.O. Box 369
Pauma Valley, CA, 92061

Dear Honorable Tribal Representative:

NOTIFICATION OF STATUS REVIEW FOR THE SAN BERNARDINO KANGAROO RAT

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Temet Aguilar, Chairperson
Pauma Band of Luiseno Indians
September 19, 2019
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Kari Lewis, Chief
Wildlife Branch

ec: California Department of Fish and Wildlife
Stafford Lehr, Deputy Director, [REDACTED]
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GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director



September 19, 2019

Honorable Bo Mazzetti, Chairperson
Rincon Band of Luiseno Indians
One Government Center Lane
Valley Center, CA, 92082

Dear Honorable Tribal Representative:

NOTIFICATION OF STATUS REVIEW FOR THE SAN BERNARDINO KANGAROO RAT

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Bo Mazzetti, Chairperson
Rincon Band of Luiseno Indians
September 19, 2019
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Wildlife Branch

ec: California Department of Fish and Wildlife
Stafford Lehr, Deputy Director, [REDACTED]
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Wildlife Branch
1812 Ninth Street
Sacramento, CA 95811
www.wildlife.ca.gov

GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director



September 19, 2019

Honorable Donna Yocum, Chairperson
San Fernando Band of Mission Indians
P.O. Box 221838
Newhall, CA, 91322

Dear Honorable Tribal Representative:

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Donna Yocum, Chairperson
San Fernando Band of Mission Indians
September 19, 2019
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ec: California Department of Fish and Wildlife
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State of California – Natural Resources Agency
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Wildlife Branch
1812 Ninth Street
Sacramento, CA 95811
www.wildlife.ca.gov

GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director



September 19, 2019

Honorable San Luis Rey, Tribal Council
San Luis Rey Band of Mission Indians
1889 Sunset Drive
Vista, CA, 92081

Dear Honorable Tribal Representative:

NOTIFICATION OF STATUS REVIEW FOR THE SAN BERNARDINO KANGAROO RAT

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San Luis Rey, Tribal Council
San Luis Rey Band of Mission Indians
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ec: California Department of Fish and Wildlife
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State of California – Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
Wildlife Branch
1812 Ninth Street
Sacramento, CA 95811
www.wildlife.ca.gov

GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director



September 19, 2019

Honorable Lee Clauss, Director of Cultural Resources
San Manuel Band of Mission Indians
26569 Community Center Drive
Highland, CA, 92346

Dear Honorable Tribal Representative:

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Lee Clauss, Director of Cultural Resources
San Manuel Band of Mission Indians
September 19, 2019
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GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director



September 19, 2019

Honorable Scott Cozart, Chairperson
Soboba Band of Luiseno Indians
P. O. Box 487
San Jacinto, CA, 92583

Dear Honorable Tribal Representative:

NOTIFICATION OF STATUS REVIEW FOR THE SAN BERNARDINO KANGAROO RAT

The California Department of Fish and Wildlife (Department) has initiated a status review for the San Bernardino kangaroo rat (*Dipodomys merriami parvus*) pursuant to Fish and Game Code section 2074.6. The Department is providing this notice pursuant to Fish and Game Code section 2074.4 to solicit data and comments on the petitioned action from interested and affected Tribes.

The Department initiated the status review following the Fish and Game Commission's (Commission) decision to accept for consideration the petition to list the San Bernardino kangaroo rat under the California Endangered Species Act (CESA) at its August 7, 2019, meeting. Having provided public notice (Cal. Reg. Notice Reg. 2019, No. 34-Z, pg. 1182; Fish & Game Code, § 2074.2), the San Bernardino kangaroo rat is now a candidate species under CESA. As a candidate species, the species receives the same legal protection afforded to an endangered or threatened species (Fish & Game Code, § 2085).

The Department has 12 months to review the petition, evaluate the available information, and report back to the Commission whether the petitioned action is warranted (Fish & Game Code, § 2074.6). The Department's recommendation must be based on the best scientific information available. The Department welcomes your Tribe to provide any data or comments on the species' ecology, genetics, life history, distribution, abundance, habitat, the degree and immediacy of threats to its reproduction or survival, the adequacy of existing management, and recommendations for management of the species.

Please provide such data or comments to "Attn: Scott Osborn" at the address in the letterhead or by email to: wildlifemgt@wildlife.ca.gov. If submitting by email, please include "SBKR" in the subject heading. Please submit detection information to the California Natural Diversity Database at: <https://www.wildlife.ca.gov/Data/CNDDB/Submitting-Data>.

Scott Cozart, Chairperson
Soboba Band of Luiseno Indians
September 19, 2019
Page 2

The Department respectfully requests your responses and information before **October 22, 2019** to allow sufficient time to evaluate the information for possible incorporation in the Department's final status review report to the Commission. The written report will indicate, based on the best scientific information available, whether the Department concludes the petitioned action is warranted or not warranted. The Commission will place receipt of the report on the agenda for the next available Commission meeting after delivery. The report will be made available to the public at that meeting. Following receipt of the Department's report, the Commission will allow a 30-day public comment period prior to taking any action on the Department's recommendation.

The Department welcomes direct communication and consultation to discuss the status review for the San Bernardino kangaroo rat and to identify any impacts to Tribal interests or cultural resources. The Department is committed to open communication with your Tribe under its Tribal Communication and Consultation Policy, which is available through the Department's Tribal Affairs webpage at <https://www.wildlife.ca.gov/General-Counsel/Tribal-Affairs>.

If you would like more information on the status review, please contact Scott Osborn, Senior Environmental Scientist (Specialist) at wildlifemgt@wildlife.ca.gov or at the address above. To request formal government-to-government consultation pursuant to the Department's Tribal Communication and Consultation Policy, please respond in writing to Tribal Liaison Nathan Voegeli by email tribal.liaison@wildlife.ca.gov or by mail to Department of Fish and Wildlife, 1416 9th Street, Suite 1341, Sacramento, CA 95814. Please designate and provide contact information for the appropriate Tribal lead person.

We look forward to your response and input on the status review.

Sincerely,



Kari Lewis, Chief
Wildlife Branch

ec: California Department of Fish and Wildlife
Stafford Lehr, Deputy Director, [REDACTED]
Nathan Voegeli, Tribal Liaison, Tribal.Liaison@wildlife.ca.gov
Erin Chappell, Environmental Program Manager, [REDACTED]
Scott Osborn, Senior Environmental Scientist, [REDACTED]



State of California – Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
Wildlife Branch
1812 Ninth Street
Sacramento, CA 95811
www.wildlife.ca.gov

GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director



September 19, 2019

Honorable Michael Mirelez, Cultural Resource Coordinator
Torres-Martinez Desert Cahuilla Indians
P.O. Box 1160
Thermal, CA, 92274

Dear Honorable Tribal Representative:

NOTIFICATION OF STATUS REVIEW FOR THE SAN BERNARDINO KANGAROO RAT

The California Department of Fish and Wildlife (Department) has initiated a status review for the San Bernardino kangaroo rat (*Dipodomys merriami parvus*) pursuant to Fish and Game Code section 2074.6. The Department is providing this notice pursuant to Fish and Game Code section 2074.4 to solicit data and comments on the petitioned action from interested and affected Tribes.

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The Department has 12 months to review the petition, evaluate the available information, and report back to the Commission whether the petitioned action is warranted (Fish & Game Code, § 2074.6). The Department's recommendation must be based on the best scientific information available. The Department welcomes your Tribe to provide any data or comments on the species' ecology, genetics, life history, distribution, abundance, habitat, the degree and immediacy of threats to its reproduction or survival, the adequacy of existing management, and recommendations for management of the species.

Please provide such data or comments to "Attn: Scott Osborn" at the address in the letterhead or by email to: wildlifemgt@wildlife.ca.gov. If submitting by email, please include "SBKR" in the subject heading. Please submit detection information to the California Natural Diversity Database at: <https://www.wildlife.ca.gov/Data/CNDDDB/Submitting-Data>.

Michael Mirelez, Cultural Resource Coordinator
Torres-Martinez Desert Cahuilla Indians
September 19, 2019
Page 2

The Department respectfully requests your responses and information before **October 22, 2019** to allow sufficient time to evaluate the information for possible incorporation in the Department's final status review report to the Commission. The written report will indicate, based on the best scientific information available, whether the Department concludes the petitioned action is warranted or not warranted. The Commission will place receipt of the report on the agenda for the next available Commission meeting after delivery. The report will be made available to the public at that meeting. Following receipt of the Department's report, the Commission will allow a 30-day public comment period prior to taking any action on the Department's recommendation.

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We look forward to your response and input on the status review.

Sincerely,



Kari Lewis, Chief
Wildlife Branch

ec: California Department of Fish and Wildlife
Stafford Lehr, Deputy Director, [REDACTED]
Nathan Voegeli, Tribal Liaison, Tribal.Liaison@wildlife.ca.gov
Erin Chappell, Environmental Program Manager, [REDACTED]
Scott Osborn, Senior Environmental Scientist, [REDACTED]



State of California - Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
Inland Deserts Region
3602 Inland Empire Blvd., Suite C-220
Ontario, CA 91764
www.wildlife.ca.gov

GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director



July 30, 2019

RE: TAKE OF SAN BERNARDINO KANGAROO RAT DURING CESA CANDIDACY PERIOD

Dear Project Manager,

You are receiving this letter as a courtesy because California Department of Fish and Wildlife (CDFW) records indicate you have been issued a lake or streambed alteration agreement that includes protective measures for San Bernardino Kangaroo Rat (*Dipodomys merriami parvus*) or CDFW has coordinated with you on a project expected to impact San Bernardino Kangaroo Rat.

As you may be aware, the Endangered Habitats League submitted a petition (Petition) to the Fish and Game Commission (Commission) to list the San Bernardino Kangaroo Rat as endangered pursuant to the California Endangered Species Act (CESA), Fish and Game Code Section 2050 et seq. CDFW completed its petition evaluation and determined there is sufficient scientific information to indicate that the petitioned action may be warranted. CDFW recommended the Commission accept the Petition for further consideration under CESA.

On June 12, 2019, the Commission received CDFW's evaluation report. At its August 7, 2019, meeting, the Commission may take action on whether to accept the petition for consideration and designate the San Bernardino Kangaroo Rat as a candidate species pursuant to Fish and Game Code Section 2074.2. If the Commission accepts the Petition for consideration and San Bernardino Kangaroo Rat is designated as a candidate species, CDFW will initiate a one-year status review of the species. CDFW will prepare a status review report for San Bernardino Kangaroo Rat to inform the Commission's decision on whether listing is warranted.

During the candidacy period, no person shall import into California, export out of California, or take, possess, purchase, or sell within California, San Bernardino Kangaroo Rat and any part of product thereof, or attempt any of those acts, except as authorized pursuant to CESA. Under Fish and Game Code Section 86, "take" means to hunt, pursue, catch, capture, or kill, or to attempt to hunt, pursue, catch, capture, or kill.

This letter is to notify you that, should the Commission approve candidacy, then upon publication of the Commission's acceptance of the petition for consideration and designation of the San Bernardino Kangaroo Rat as a candidate species, take of San Bernardino Kangaroo Rat will be prohibited unless you have authorization pursuant to CESA.

CDFW recognizes there may be circumstances where take of the species during candidacy may be unavoidable for already permitted projects. CESA provides a mechanism to do this in appropriate circumstances. Pursuant to Section 2081, subdivision (b), of the Fish and Game Code, CDFW may issue an incidental take permit (ITP) authorizing the take of a candidate

Take of San Bernardino Kangaroo Rat During CESA Candidacy Period

Page 2 of 2

species when it is incidental to an otherwise lawful activity, the impacts of the take are minimized and fully mitigated, the applicant ensures there is adequate funding to implement any required measures, and take is not likely to jeopardize the continued existence of the species.

Should you desire to apply for an incidental take permit pursuant to Fish and Game Code Section 2081, subdivision (b), to take San Bernardino Kangaroo Rat during its candidacy period, please submit an application to CDFW describing the activities for which you seek coverage. To avoid disruption in work schedules, an application for a Section 2081(b) incidental take permit authorizing the take of San Bernardino Kangaroo Rat may be filed prior to the Commission's decision whether to accept the petition for consideration. CDFW will review all complete incidental take permit applications, however CDFW has discretion in incidental take permitting and submittal of a complete application does not guarantee that the application will be accepted and a permit issued. Additional information on incidental take permits and the ITP application process is available on CDFW's website:
<https://www.wildlife.ca.gov/Conservation/CESA/Incidental-Take-Permits>.

Incidental take permits must comply with the requirements of California Code of Regulations, Title 14, sections 783.0 – 783.8. An incidental take permit issued pursuant to Section 2081, subdivision (b), will provide take coverage only to those individuals and entities expressly listed in the permit and will not generally apply to partners, collaborators, contractors, and affiliates. In addition, take coverage pursuant to Section 2081, subdivision (b), does not typically extend to "movement out of harm's way." Biological monitors who are only complying with the minimization and mitigation terms of an incidental take permit or other similar CDFW-issued authorization to take San Bernardino Kangaroo Rats must receive authorization to handle San Bernardino Kangaroo Rats for the purpose of relocating them.

CDFW appreciates your cooperation with this process. If you have any questions or need any additional information related to incidental take permits, please contact Ms. Kim Romich at kimberly.romich@wildlife.ca.gov and (909) 980-3818 for projects in San Bernardino County or Ms. Joanna Gibson at joanna.gibson@wildlife.ca.gov and (909) 987-7449 for projects in Riverside County. If you would like more information from CDFW about the San Bernardino kangaroo rat CESA listing process or status review, or to be placed on a list to receive future updates about the listing process from CDFW, please contact Scott Osborn at 916-324-3564 or Scott.Osborn@wildlife.ca.gov. If you would like to be placed on a list to receive information about the San Bernardino kangaroo rat listing process from the Fish and Game Commission, please call 916-653-4899 or email fgc@fgc.ca.gov.

Sincerely,



Scott Wilson
Environmental Program Manager

APPENDIX C - Public and Tribal Comments

Note: The attached comments were received during the public solicitation for information period plus one week. The reports and papers provided are not included due to their size but are available upon request.



Department of Public Works

- Flood Control
- Operations
- Solid Waste Management
- Surveyor
- Transportation

Kevin Blakeslee, P.E.
Director

September 26, 2019

California Department of Fish and Wildlife
Attn: Scott Osborn
1812 9th Street
Sacramento, CA 92203

RE: THE COUNTY OF SAN BERNARDINO'S COMMENTS ON SAN BERNARDINO KANGAROO RAT (SBKR) IN RESPONSE TO CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE'S NOTIFICATION FOR REVIEW OF SPECIES STATUS

Dear Mr. Osborn:

We received your letter dated August 28, 2019, requesting comments/information related to SBKR species' ecology, genetics, life history, distribution, abundance, habitat, the degree and immediacy of threats to reproduction or survival, adequacy of existing management, and recommendations for management of the species." The County of San Bernardino (County) has the following comments:

1. SBKR is currently being managed by the U.S. Department of Fish and Wildlife (USFWS). With the proposed State listing, the County is concerned that mitigation requirements between CDFW and USFWS will be inconsistent and stacked, so that an undue burden is placed on County taxpayers for improving or maintaining infrastructure vital to flood and fire protection of residents, with little or no benefit to the species. Mr. Dan Silver of the Endangered Habitats League stated at the Commission meeting and in the Petition that the Federal listing has "failed as a regulatory mechanism". The County disagrees. Both County and USFWS staff have collaborated over the years on a variety of projects to successfully mitigate for SBKR impacts through the implementation of onsite avoidance and minimization measures designed to reduce impacts, and through providing compensatory mitigation.
2. The Petitioner has not provided sufficient scientific information to justify its findings. There is no comprehensive population trend data for the species so the Petitioner is relying on habitat analysis, discrete SBKR survey data, summarized 2018 USFWS data, unpublished data that has not undergone peer review, contains 10 to 20-year-old reports, and unsubstantiated assumptions. None of the original technical reports containing the data is attached to the Petition forcing the County to rely upon summaries that cannot be substantiated. Further, the Petitioner discusses unique genetic structures of isolated SBKR populations without providing any supporting documentation as an attachment to the Petition.

BOARD OF SUPERVISORS

ROBERT A. LOVINGOOD
First District

JANICE RUTHERFORD
Second District

DAWN ROWE
Third District

CURT HAGMAN
Chairman, Fourth District

JOSIE GONZALES
Vice Chair, Fifth District

Gary McBride
Chief Executive Officer

3. The Petitioner erroneously cites flood control operations several times as a cause for poor SBKR persistence without sufficient evidence to support such findings. As an example, on page 3 of the Petition, it states “probability of (SBKR) persistence is poor in the upper reaches of City Creek and in Mill Creek as a result of flood control operations”. It should be noted that the San Bernardino County Flood Control District (District) maintains very little of Mill Creek, about 8% of the streambed, and maintenance is dependent on rainfall and need; therefore, the implication that maintenance is having an adverse impact to SBKR in Mill Creek is not substantiated. This District minimal maintenance pattern observed at Mill Creek is repeated among multiple District facilities including, but not limited to, Plunge Creek and City Creek. Additionally, on page 37 the Petition states that “Outside of Lytle Creek-Cajon Wash, all SBKR habitat is downstream of flood control structures that have eliminated historical flooding regimes.” This is untrue, Mill Creek, Plunge Creek, and City Creek also have no upstream flood control structures and facilitate scour downstream to SBKR occupied habitats.
4. On page 27 the Petition notes several times that Climate Change is likely to exacerbate the adverse effects to SBKR, and climate models are cited showing evidence of an increase in annual rainfall. In the discussion of future management of SBKR, the Petition identifies restoration of hydrologic processes including modifying streambed elevations with sediment or constructing channels to create overflow banks within Mill Creek and larger tributaries. This illuminates the larger concern of competing public interests; that of species protection and fire/flood protection. Climate change could potentially result in the need for more flood protection than is currently provided. Additionally, the County is concerned that modifying streambed elevations with sediment or constructing channels to create overflow banks within Mill Creek and larger tributaries, as suggested, would conflict with the U.S. Army Corps of Engineers and Regional Water Quality Control Board standards and guidelines.
5. The Petition in places requires clarification. On page 7 of the Petition there is no specific map describing the boundaries of the units in Tables 1 and 2. Table 1 is not clear to the reader and lacks defined limits to species occupation. For example, the City Creek unit is described as being extirpated as of 2018, however City Creek is occupied by SBKR within many reaches.
6. The County of San Bernardino is concerned that CDFW may not have met its statutory requirements pursuant to Fish and Game Code §2073.3 (b) and §2078 for the candidate listing of the species. On July 31, 2019, the County of San Bernardino submitted a letter to President Sklar requesting that the public comment period be re-opened due to lack of sufficient notice of the petition. According to §2073.3, once the notice is published in the California Regulatory Notice Register, the commission shall “notify interested persons pursuant to Section 2078 by mail, of the notices prepared pursuant to subdivision (a), the department shall notify the petitioner regarding its content”. The County did not receive notification until a few weeks prior to the August 7-8, 2019 Commission hearing to determine if listing may be warranted. Further, receipt of the County’s letter was neither acknowledged as part of the August 2019 Agenda or included in the Meeting Binder for the CA Fish and Game Commission. No response to the County’s letter was provided by the Commission or staff.

S. Osborn, CA Dept. Fish and Wildlife
County Response to CDFW Species Status
September 27, 2019
Page 3 of 3

Thank you for the opportunity to comment on the status review currently being conducted by CDFW for SBKR. If you have any questions regarding this letter, please contact Michael Perry, at (909) 387-1864.

Sincerely,



DAVID R. DOUBLET, P.E.
Deputy Director – Flood Control

DRD:MP:sr



RIVERSIDE COUNTY FLOOD CONTROL
AND WATER CONSERVATION DISTRICT

September 26, 2019

EMAILED TO: wildlifemgt@wildlife.ca.gov

California Department of Fish and Wildlife
1812 9th Street
Sacramento, CA 95811

Attention: Scott Osborn

Ladies and Gentlemen:

Re: Comments on Status Review for
San Bernardino Kangaroo Rat

This letter is written in response to the California Department of Fish and Wildlife (Department) status review of the San Bernardino Kangaroo Rat (*Dipodomys merriami parvus*). The status review was initiated following the Fish and Game Commission's decision to accept for consideration the petition to list the San Bernardino Kangaroo Rat (SBKR) under the California Endangered Species Act (CESA) at its August 7, 2019 meeting.

The following are the Riverside County Flood Control and Water Conservation District's (District) comments and concerns regarding status of the species and petition to list the species under CESA:

The Federal Endangered Species Act protects the SBKR and listing under CESA is unnecessary.

The U.S. Fish and Wildlife Service (Service) originally listed SBKR as an endangered species under the Federal Endangered Species Act (FESA) in 1998. The Service provided additional protection for the SBKR with the designation of critical habitat. The SBKR's status as an endangered species was considered during the planning, development and approval of the Western Riverside County Multiple Species Habitat Conservation Plan (WRC-MSHCP). Conservation lands have been established subsequent to the FESA listing and final WRC-MSHCP approval that protect SBKR habitat. Thus, listing the species under CESA is unnecessary and would lead to costly new regulatory requirements for State and local agencies, without providing any more benefit to SBKR.

The SBKR is adequately conserved within the WRC-MSHCP and Should Not be Listed under CESA.

The District has existing and/or proposed drainage facilities whose construction, and/or operation and maintenance would be negatively impacted if the species were listed under CESA due to the additional time and resources needed to obtain CESA permits. The timely maintenance of existing drainage facilities and construction of new facilities is critical to protecting the public from flood hazards. The SBKR suitable habitat and conservation areas established in Riverside and San Bernardino Counties after the species was federally listed should also be considered during the status review. Thus, listing the species under CESA would provide little benefit, but would add costs and increase public risks by delaying flood control operations and maintenance. Consequently, for the reasons explained herein, the District believes that the species is currently protected and does not need to be listed under CESA.

The SBKR is listed as one of the species to be protected by the requirements of the WRC-MSHCP. As described in Table 9-2 Species Conservation Summary, the WRC-MSHCP includes a number of species-specific regional objectives to ensure long-term conservation of this species. The District is a WRC-MSHCP Permittee subject to the applicable WRC-MSHCP provisions including the requirement to contribute mitigation funding to help accomplish the regional conservation objectives. The District also has a long history of working with the Department in regard to developing avoidance and minimization measures for flood control activities. Compliance with the WRC-MSHCP by the District and other Permittees ensures that the species will be conserved on a regional basis as intended when the Department and Service authorized the final WRC-MSHCP.

September 26, 2019

Furthermore, Section 15.2 of the WRC-MSHCP Implementing Agreement executed by the Department recognizes the Department's Natural Community Conservation Planning (NCCP) status of the WRC-MSHCP. It states the following:

"CDFG has found, following opportunity for public comment, that the MSHCP and this Agreement: 1) adequately provide for the conservation and management of the Covered Species Adequately Conserved and their habitat within the MSHCP; and 2) satisfy all legal requirements under the NCCP Act necessary for CDFG to issue an NCCP Authorization for such species. CDFG has found that the MSHCP meets the requirements of the NCCP Act for an NCCP Plan, and has approved the MSHCP as an NCCP Plan. CDFG has found further that the MSHCP and this Agreement adequately provide for the mitigation of potential "significant effects on the environment" (as defined in California Public Resources Code section 21068) which may result to Covered Species and their habitat from the Covered Activities in the Plan."

Also, please see the final paragraph in Section 15.3 of the WRC-MSHCP Implementing Agreement stating the following:

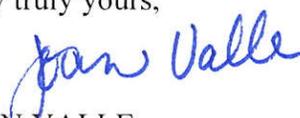
"Based on the best available current scientific and commercial data, CDFG has found that the MSHCP, as implemented by this Agreement will complement other applicable conservation planning and regulatory programs and efforts addressing wildlife within the region and minimizes and mitigates the potential significant adverse impacts of the Covered Activities on the Covered Species."

If a new species is listed under CESA in Riverside County that is already covered by the WRC-MSHCP, we request that the Department ensure that the review of projects consistent with the WRC-MSHCP are expedited and completed within short time frames. We also request that the Department include clear guidance indicating that written documentation of WRC-MSHCP consistency from a Permittee will allow the Department to either make a "no effect" determination or proceed to consult informally and in a streamlined manner with the Permittee. Lastly, additional mitigation beyond that required by the WRC-MSHCP should not be necessary.

Conclusion

Thank you for the opportunity to respond to the status review for the SBKR. Please continue to send the District any notifications regarding this matter to my attention. If you need further information or clarification regarding the above issues, please feel free to contact Randy Sheppard at 951.955.1306 or me at 951.955.8856.

Very truly yours,



JOAN VALLE
Chief of Regulatory Division

- c: Regional Conservation Authority
Attn: Charles Landry, Executive Director
City of San Jacinto
Attn: Travis Randel, Community Development and Planning Director
- cc: County Counsel
Attn: Leila Moshref-Danesh, Deputy County Counsel
RCFC&WCD
Attn: Jason Uhley, General Manager-Chief Engineer

September 27, 2019

Via: Email: wildlifemgt@wildlife.ca.gov / U.S. Postal Service

California Department of Fish and Wildlife
Attn. Scott Osborn
1812 9th Street
Sacramento, California 95811

SUBJECT: California Department of Fish and Wildlife Notification of Status Review for San Bernardino Kangaroo Rat ("SBKR") - Public Comments

The petition to list the San Bernardino Kangaroo Rat (SBKR) as a candidate for the State endangered species list under the California Endangered Species Act (CESA) asserts that the Trump administration's politicization of federal environmental agencies threatened the rat's survival. "State listing is a necessary backstop to the disregard of law and science by federal government agencies under the current administration" said the petitioner Endangered Habitat League (Los Angeles Times, August 31, 2019 - *State steps in for rat species as U.S. weakens protections*). While this criticism of our current federal government misdeeds is certainly valid, we must not ignore state government misfeasance/malfeasance in the management of our endangered wildlife.

Attachment "A" presents the State Auditor report "*California Department of Fish and Wildlife - It Is Not Fulfilling Its Responsibilities Under the California Environmental Quality Act [CEQA] - June 2019.*" The Auditor Report, which includes the CDFW response to the audit, is presented in its entirety herein for inclusion in the California Fish and Game Commission Administrative Record for the SBKR determination. The Auditor Report should be reviewed with the realization CDFW is one of four designated "trustee" agencies under CEQA and most importantly recognize the fish and wildlife resources of California are held in trust for the people of the state by and through the department [CDFW] (Fish and Game Code § 711.7).

The Audit Report recognizes CDFW is the highest state authority overseeing California's fish and wildlife resources and that CDFW input on CEQA documents, such as environmental impact reports (EIR's) is **critical** for endangered wildlife such as the subject SBKR. The audit notes in recent years CDFW has reviewed less than half of the CEQA documents it received. CDFW frequently does not respond to consultation requests and rarely provides comments on draft CEQA documents. In **2018** CDFW provided formal comments on just **8 percent** of draft documents it received. Because CDFW lacks policies for prioritizing and reviewing CEQA documents, CDFW cannot ensure that its staff are consistently reviewing projects with potentially significant impacts on the environment such as the reduction in number and range of the candidate species SBKR.

Another troubling revelation in the Auditor Report is that CDFW has not ensured that it spends the filing fee paid by project applicants and public agencies subject to CEQA exclusively on its CEQA work activities. Although state law (Fish and Game Code § 711.4) restricts the use of the filing fee revenue [currently \$ 3,271.00 for the CDFW review of a Draft EIR] to fund only activities related to its CEQA responsibilities, the CDFW keeps the revenue in a shared account with revenues for other functions, and it does not track the CEQA revenue and expenditures separately from the other functions. The Audit determined that from fiscal years 2012-13 through 2016-17 CDFW spent \$5.7 million in CEQA filing fee revenue to subsidize non-CEQA programs. The propriety and adequacy of the above CEQA management practices by CDFW are clearly a relevant consideration in the subject SBKR listing action.

It must also be recognized SBKR is one of 146 plants and animals covered under the Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP). SBKR is therefore now subject to an "incidental take" permit pursuant to the State Natural Communities Planning Act issued by CDFW. The defacto exemption of the CEQA review of projects by CDFW along the San Jacinto River floodplain continues to allow agencies such as Eastern Municipal Water District (EMWD) to destroy the little SBKR habitat remaining.

We appreciate the opportunity to comment on yet another species destined for a CESA listing. We believe absent substantial reform of the above faulty CDFW implementation of CEQA this listing will largely be another empty CESA promise emblematic of a failed SBKR conservation effort.



Tom Paulek, Conservation Chair.
Friends of the Northern San Jacinto Valley.



Susan Nash,
FNSJV, president

Attachment "A" : California State Auditor Report, June 2019, California Department of Fish and Wildlife, REPORT 2018-119

O'NEIL LLP

ATTORNEYS AT LAW

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WILLIAM L. TWOMEY

DENNIS D. O'NEIL
(1938-2017)

DEAN DUNN-RANKIN
SANDRA A. GALLE
WILLIAM E. HALLE
ANDREW K. HARTZELL
JOHN D. HUDSON
JAY F. PALCHIKOFF

September 27, 2019

Via email: wildlifemgt@wildlife.ca.gov
California Department of Fish and Wildlife
Attn: Scott Osborn
1812 9th Street
Sacramento, CA 95811

Re: SBKR – Data, Information and Comments for Use by Department in Status Review of the San Bernardino kangaroo rat (*Dipodomys merriami parvus*) in Connection with the Consideration for Listing under the California Endangered Species Act

Ladies and Gentlemen:

This firm represents Lytle Development Company (“LDC”). On behalf of LDC, we are submitting the following data, information and comments for the Department’s use in its consideration of whether to list the San Bernardino kangaroo rat (“SBKR”) under the California Endangered Species Act (“CESA”). This information is being provided in response to the Department’s August 28, 2019 written request for such information from interested and affected parties.

Lytle Development Company has been assisting with conservation and recovery efforts for the San Bernardino kangaroo rat for more than 20 years. Over that period of time it has gained extensive knowledge concerning the SBKR’s biological needs, habitat requirements and preferences, distribution in its historic range, distribution in Cajon and Lytle Creeks, habitat restoration techniques to best restore, enhance and create habitat for the SBKR, and a variety of other pertinent information relative to the species. Lytle Development Company is almost certainly the single most knowledgeable entity regarding the status, distribution, and habitat use of the SBKR within the entire portion of Lytle Creek above (i.e., upstream) of the confluence of Lytle and Cajon creeks (the “Lytle-Cajon Confluence”). LDC has conducted numerous SBKR surveys in the Lytle Creek area utilizing highly-qualified SBKR biologists, and has mapped the distribution and studied the occupation of the Lytle Creek area by the SBKR.

Lytle Development Company was also the developer of the Lytle Creek North project and is the developer of the Lytle Creek Ranch project, two projects which are discussed extensively in the EHL Petition submitted to the CDFW urging the listing of the SBKR under CESA (the “EHL Petition” or “Petition”).

Given all of the above, LDC possesses the best, most detailed, and most accurate information regarding the distribution of the SBKR in Lytle Creek, the quality and distribution of its habitat in Lytle Creek, the hydrology and geomorphology of Lytle Creek, the existing and expected hydrologic conditions impacting SBKR habitat in and adjacent to Lytle Creek, and the conservation measures employed by the Lytle Creek North project and those conservation measures proposed by the Lytle Creek Ranch project for the conservation and recovery benefit of the SBKR.

As such, the Department should give considerable weight, attention and credibility to the information provided by LDC in its submissions to the Department pertaining to the consideration to list the SBKR under CESA.

Lytle Creek Ranch Mixed-Use Development Project - Summary of Impacts and Benefits to the San Bernardino Kangaroo Rat

The Petition greatly distorts the pertinent biological facts concerning the Lytle Creek Ranch project’s expected impacts on the SBKR. More details are provided further below in this letter, but a summary of the project’s expected impacts and benefits to the SBKR are briefly described here.

- The project is located at the uppermost limit of the species’ range within Lytle Creek. Development of the project site will not interrupt connectivity between populations or subpopulations of the species.
- The project will permanently remove 87.9 acres of SBKR occupied habitat.
- That the project will remove only 87.9 acres of occupied habitat has been thoroughly established by multiple, extensive and comprehensive habitat surveying and live trapping programs, including three consecutive years of surveying and live trapping to determine the full extent of habitat occupation within the proposed development footprint by a widely-recognized biologist with SBKR expertise. The limits of SBKR occupation within the project development footprint were further confirmed by additional and subsequent FWS-directed surveying in 2014; roughly 24 additional transects were trapped for 5 days using approximately 480 traps, with no (0) SBKR captures.
- Of those 87.9 acres, 51 acres are now permanently disconnected from exposure to fluvial processes, and therefore the necessary vegetation in those 51 acres is

senescing and will become completely unsuitable for the species within the coming decades.

- Vegetation within other areas of the project development footprint unoccupied by the SBKR has senesced to the degree that it does not provide suitable habitat for the SBKR. Similar vegetation senescence has been documented within the Etiwanda Fan, areas west of the project site in Fontana, and elsewhere, and is acknowledged to be a condition rendering areas unsuitable for the SBKR.
- Most of the 87.9 acres -- including all of the 51 acres currently senescing to unsuitable habitat -- contain barriers to SBKR movement to the primary habitat for the species, which is located in Lytle Creek Wash. The occupied habitat within the development footprint is separated from the wash by steep, rocky escarpments essentially non-passable by SBKR. Moreover, in most areas the occupied habitat within the proposed development footprint is also separated from the wash habitat by unsuitable habitat for the SBKR which reduces the likelihood of movement by SBKR from the occupied habitat within the development footprint to the edge of the cliff separating the higher elevation development area from the wash (where the primary SBKR habitat is located).
- In exchange for the loss of these 87.9 acres (51 acres (60%) or more of which are on a natural path to becoming completely unsuitable for the SBKR), the project will protect, preserve, monitor and manage in perpetuity a 727-acre area containing the primary habitat for the San Bernardino kangaroo rat in Lytle Creek Wash and immediately surrounding upland refugia habitat areas, following a Habitat Monitoring and Management Plan (“HMMP”) developed with and approved by the U.S. Fish & Wildlife Service.
- The project will provide funding to ensure that all of the monitoring, management and preservation activities will be conducted in perpetuity, and will engage a conservation area manager to oversee the conservation and recovery program for the SBKR in this area and protect the area in perpetuity.
- The project will enhance and restore 91 acres of upland habitat with high connectivity to primary SBKR habitat in Lytle Creek which can serve as additional, new, occupied refugia habitat for the SBKR; thereby enhancing the species’ ability to re-populate primary habitat areas in Lytle and Cajon Creeks after major, episodic flooding events (such as a 100-year flood event).
- The project will fund and implement an adaptive management plan to enable additional measures to be implemented within the 727-acre SBKR conservation area to further ensure the continued conservation of the SBKR within Lytle Creek Wash and promote recovery efforts for that species within Lytle and Cajon creeks and elsewhere within its historic range.

- With the establishment of the Lytle Creek Ranch SBKR Conservation Area, approximately 2,900 acres of biologically connected lands will be protected (and largely managed) for the benefit of the SBKR in Lytle and Cajon creeks.
- With the project's implementation of the SBKR HMMP, the prospects for the SBKR's long-term persistence within Lytle Creek Wash and the Lytle-Cajon creek area will be significantly increased compared with its current existing condition in Lytle Creek. Similarly, the conservation and recovery of the SBKR will be substantially improved through implementation of the project, as compared with the alternative of the project site (including the proposed 727-acre conservation area and the proposed area of development) remaining in its current state of benign neglect.

In sum, to mitigate for the relatively small amount of occupied acreage removed (most of which has no or very limited long-term benefit for the SBKR), the U.S. Fish & Wildlife Service and Lytle Development Company have developed a robust and comprehensive conservation program for the species to be implemented within a substantially-sized and biologically integrated portion of Lytle Creek wash which will provide substantial and long-term benefits to the species' conservation and recovery over the currently existing conditions.

Lytle Creek North (Residential Development) Project

This project has already been developed, and the project's revetment described in the Department's petition evaluation report dated May 30, 2019 ("Department Report") was completed in 2004. (See Department Report, pg. 15). Although the Biological Opinion for that project included a statement that the USFWS believed 296 acres of the 677-acre project site had the potential to support SBKR prior to site development, in fact the full trap-out of the proposed development footprint area prior to project construction revealed that **only 10.5 acres of habitat were actually occupied by the SBKR** (less than 2% of the 677-acre project site) and only 6 SBKR were found to be occupying that 10.5-acre area.

To offset the loss of 10.5 acres of occupied SBKR habitat, the Lytle Creek North project actually **established and set aside a 212.7-acre SBKR conservation area** (not just a 160-acre conservation area as suggested by the Petition). Those 212.7 acres of habitat were located in the primary and most suitable SBKR habitat in the vicinity of the project site, an area containing a hydrologically-dynamic area of RAFSS habitat (containing suitable soils and benefitted by exposure to active fluvial processes) which will continue to be biologically refreshed for the RAFSS habitat cycle (of pioneer-RAFSS, to intermediate RAFSS, to mature-RAFSS, back to pioneer-RAFSS) to maintain a healthy RAFSS habitat occupiable by the SBKR on a permanent basis.

Furthermore, the Petition fails to recognize that the SBKR Conservation Area's 212.7 acres are required to be protected and managed in perpetuity with sufficient funding provided for that purpose.

The Petition also fails to acknowledge that the project restored and enhanced 40 acres of those 212.7 acres for the benefit of the SBKR, thereby creating an additional 40 acres as suitable and occupied upland refugia habitat for the SBKR in the immediate area of the project site. Those 40 acres of refugia habitat were either not then functioning as such (describes 24 of those 40 acres) or were in a degraded vegetated state with only low levels of SBKR occupying the area (describes 16 of those 40 acres). The Lytle Creek North project, just on this basis alone, created a net functional **increase in that amount of occupied SBKR habitat of roughly 400 percent.**

Contrary to the misleading information in the Petition, that 40-acre restored upland habitat **has met the success criteria established for it under the USFWS Biological Opinion** (“BO”). Populations of the SBKR on that 40-acre area have been found to be in excess of the target level set by the BO in multiple years (such as in 2004, 2017 and 2018) as demonstrated in reports filed with the USFWS and included in this letter.

In fact, contrary to the Petition’s claims, the restoration program for that 40-acre area has been very successful; not only have the vegetation standards in the BO been surpassed on a repeated and consistent basis, the number of SBKR on that 40-acre area has increased as a result of the restoration from an initial baseline number of 13 individuals to a level of 84 individuals (in 2004), 126 individuals (in 2017) and 281 individuals (in 2018). These increases in the number of SBKR occupying the restored/enhanced 40-acre area are all significant increases over the initial baseline number of 13 individuals, and the results have surpassed the success criterion established by the USFWS for this area. Furthermore, the vegetation has been maintained in an open canopy and structure condition suitable for SBKR use and occupation, which was also a requirement of the BO.¹

The Petition (and Department Report) is likewise incorrect in its claim that this 40-acre refugia area will be “likely inundated” and significantly eroded in larger flood events in the future. The Petition and DFW Report cite three documents in support of this erroneous claim. The first, “USFWS 2017,” simply does not provide an analysis of this issue. The second, “Chang 2016”, is a draft report which was not designed to evaluate this issue, and does not substantiate the Petition’s claims. The third, “Cbec 2018,” constitutes an analysis with many flaws and shortcomings—flaws and shortcomings which lead to: (1) erroneous conclusions regarding the potential for future flooding of the large central island in Lytle Creek (roughly 120 acres in size) which these 40 acres constitute a portion of, and (2) erroneous conclusions regarding the degree of expected erosion of this large central island area in Lytle Creek over

¹ Also, contrary to representations in the Petition, monitoring of the 40-acre restored habitat has occurred yearly since the inception of the conservation program in 2003. Thus it is not the case, as claimed in the Petition, that no mitigation or conservation programs exist for the SBKR which regularly monitor the habitat conditions for the SBKR in those areas. The SBKR HMMP for the proposed Lytle Creek Ranch project (discussed further below) also implements regulator monitoring of the habitat conditions in the proposed 727-acre SBKR Conservation Area and requires management measures be implemented and adopted as appropriate based on that monitoring.

time. See, PACE Technical Memorandum re: CBEC Lytle Creek Sediment Transport Modeling, June 21, 2019 (attached). The Petition and DFW report also fail to recognize and account for the extensive hydrological and geomorphological information and analysis provided and conducted by Pacific Advanced Civil Engineering (“PACE”) in numerous reports and technical memoranda which addressed these two topics and which demonstrate that: (1) the large central island in Lytle Creek is not reasonably likely to become inundated so as to adversely affect SBKR occupying that refugia area, and (2) the large central island is expected to remain relatively intact and of the same size over time as its current size (roughly 120 acres). See various PACE memoranda, reports and letters enclosed with this letter.

The Petition also mischaracterizes the size of the island portion of the refugia habitat within the Lytle Creek North project’s 212.7-acre SBKR conservation area. The island portion of refugia habitat is 40 acres in size, not “56.8 acres,” and this 40-acre area is part of a larger central island within Lytle Creek consisting of approximately 120 acres (but only 40 acres of which are located in the Lytle Creek North SBKR Conservation Area). The Biological Opinion did note the presence of other “upland” or refugia habitat areas within the 212-acre conservation area.

The Petition then continues by mischaracterizing the results of the 2005 flood events and the unusual circumstances surrounding those events associated with a County work project which was then underway upstream of the Lytle Creek North SBKR Conservation Area when the 2005 flood events occurred. In fact, the 2005 flooding events caused only a total of 3.8 acres of erosion on the 40-acre refugia area, and this acreage was subsequently restored back to suitable SBKR refugia habitat by Lytle Development Company in 2007-2009. In the course of that erosion repair work, LDC also placed protective rock gabions at certain locations associated with the 40-acre refugia area to decrease the potential for any future erosion of the large central island in Lytle Creek Wash. See, PACE Technical Memorandum re: CBEC Lytle Creek Sediment Transport Modeling, June 21, 2019. Moreover, the cbec 2018 study referenced by Petitioner is significantly flawed in many aspects of its analysis, has not been thoroughly reviewed by other independent experts, and does not represent the best available information.

In contrast to the information in cbec 2018, the best available information on those topics is, in fact, provided by the multiple studies and analyses conducted by PACE over a number of years, and attached hereto, which together demonstrate that the large central island within Lytle Creek (roughly 120 acres in size) is not expected to receive detrimental flood waters overtopping it, nor experience erosion of any significant magnitude.² PACE’s work has been reviewed by the

² As noted elsewhere, the Chang 2016 partial draft report cited by the Petition was not designed to evaluate the erosion potential for, or the possibility of water getting onto, the large central island in Lytle Creek. The petitioners (EHL) made similar claims to the City of Rialto on this topic in 2017 and 2018, citing Chang 2016, and the City rejected those claims in 2018, recognizing that the Chang report did not substantiate these claims. A California court in 2018 found Petitioner’s claim on this issue equally unpersuasive.

USFWS, ACOE and DFW over multiple years, including the period of 2006-2009 and 2012-2019, and confirmed as accurate and reliable consistently.³

In sum, the Petition substantially mischaracterizes the Lytle Creek North project and its effects on the SBKR. That project had a net positive effect on the SBKR and its conservation and recovery. While 10.5 acres of disconnected (to the primary habitat in Lytle Creek) upland habitat occupied by 6 SBKR individuals were removed for development, 212.7 acres of prime habitat for the SBKR were conserved and protected in perpetuity with a management program required to ensure that active and appropriate long-term management of those 212.7 acres would continue in perpetuity. Within those 212.7 acres of conserved and managed habitat are 40 acres of upland refugia habitat associated with a larger central island within Lytle Creek, which 40-acre area was restored and enhanced by the project to be occupied, suitable refugia habitat for the SBKR and where the numbers of individual SBKR on those 40 acres increased from 13 individuals to more than 260 individuals as the result of a habitat restoration program funded and conducted by the Project. The active management and protection of 212.7 acres of primary habitat for the SBKR can be expected to provide a net benefit to the SBKR's conservation compared with the simple benign neglect of having done nothing to benefit the SBKR on the Lytle Creek North project site (a site which contained only 10.5 acres of occupied SBKR habitat).

Lytle Creek Ranch (Mixed Use) Development Project

Lytle Development Company, as the applicant for a Section 404 Clean Water Act permit from the U.S. Army Corps of Engineers ("ACOE") and the real-party-in-interest associated with the federal Endangered Species Act Section 7 consultation being conducted by the U.S. Fish & Wildlife Service ("USFWS"), has the first-hand and most accurate knowledge of the biological facts and Project-related facts related to impacts to the SBKR and SBKR habitat associated with the Project.

The Petition, in describing this project, is incorrect about: (1) the amount of SBKR occupied habitat to be lost as a result of the Project; (2) the amount of occupied SBKR habitat to be preserved and managed in perpetuity by the Project; (3) the amount of SBKR habitat to be created and restored by the Project; (4) the amount of the SBKR conservation area to be protected and managed by the Project; and (5) the extensive habitat and species management benefits to the SBKR Conservation Area created by the Project.⁴

³ The cbec information has not been subjected to any comparable degree of scrutiny, and there has been limited opportunity or time for any organizations to do so.

⁴ Whether the Petition is obtaining information from some sort of earlier draft version of the Project, some draft or outdated document, or simply doesn't understand the actual facts is not clear; what is clear is that the Petition's information regarding the Lytle Creek Ranch project (and Lytle Creek North project) is fundamentally incorrect and inaccurate in a large variety of material respects.

The Petition's description of the Lytle Creek Ranch project on pages 29-30 of the Petition is incorrect on almost every salient fact relative to the Project's impact on – and conservation and recovery measures for – the SBKR.

In fact, the Project proposes to permanently remove only 87.9 acres of habitat occupied by the SBKR.⁵ Moreover, 51 of those 87.9 acres (60%) are in two areas which are no longer subject to active fluvial processes of Lytle Creek, and the vegetation in those 51 acres is in the process of senescing to the condition where it will be completely unusable for SBKR, much like has already occurred in most areas of the Etiwanda Fan and the area west of the Project site in Fontana. Already these 51 acres have been cut off from active fluvial processes for roughly 50 years and 70 years, respectively.⁶ Those 51 acres are also significantly disconnected to the primary SBKR habitat in Lytle Creek so as to virtually eliminate the ability of the individuals in those 51 acres to reach the primary habitat in Lytle Creek.

Almost all of the planned development area for the Project on the south side of Lytle Creek is on land which cannot provide long-term refugia habitat for the SBKR due to its lack of fluvial process exposure, unsuitable habitat trending to an even more inhospitable condition, and barriers for movement by SBKR in Lytle Creek up into the much more elevated area separated by both steep rock escarpments and unsuitable habitat at the top of the bank.⁷

The Lytle Creek Ranch Project's Proposed SBKR Conservation Area

The Project is proposing to manage, preserve and protect -- all in perpetuity -- a 727-acre area within Lytle Creek containing the primary and most suitable habitat for the SBKR in the stretch of Lytle Creek near the project site. **Within that 727-acre SBKR Conservation Area, the Project will also restore, enhance and create 91 acres of upland refugia habitat for the SBKR with high connectivity to the primary SBKR habitat in Lytle Creek.** Those restored 91 acres will offset the 87.9 acres of habitat lost as a result of the project development.⁸ In all,

⁵ Approximately 40.8 acres in the Neighborhood 2 area of the Project and 47.1 acres in the Neighborhood 3 area of the Project. The Project also would directly affect approximately 8.1 acres of SBKR occupied habitat on a temporary basis, in connection with the construction of the Project's revetments. Those 8.1 acres temporarily affected would be able to function as SBKR habitat after Project construction.

⁶ The 51 acres are found within two separated areas of the Project site, which areas have been permanently cut off from future fluvial processes for differing periods of time.

⁷ The Project's permanent effects to SBKR occupied habitat on-site have decreased by approximately 49.5 acres (or roughly 36%) (137.4 acres reduced to 87.9 acres) from the amount associated with the initial project design proposed to the ACOE and USFWS at the start of the ESA Section 7 consultation. This reduction again demonstrates that the federal Endangered Species Act and its Section 7 consultation process does – contrary to Petitioner's assertion – operate to provide adequate protections to the species.

⁸ It should be remembered in this context that 51 of the 87.9 acres to be lost from project development are already in the process of naturally converting to unsuitable habitat for the SBKR because the vegetation is now senescing to a condition uninhabitable by the SBKR. The recognition of this fact should help the Department understand the substantial net benefit to the SBKR of the implementation of the Lytle Creek Ranch.

the 727-acre SBKR Conservation Area will have more than 200 acres of refugia habitat within it, and will be adjacent to other areas of existing refugia habitat in several different locations, including the Lytle Creek North SBKR project's Conservation Area, the Wildlands Conservation Bank in Lytle Creek, the San Bernardino County Sheriff's Woolly-Star conservation area and the Cajon Creek Conservation Bank's conservation area. The Project's 727-acre SBKR conservation area will be consistently monitored and biologically managed in perpetuity to promote optimal conditions for the SBKR within the conservation area. The Project will provide an adaptive management program to benefit the SBKR as well, and the Project contains numerous measures, with funding for them, to promote the recovery of the SBKR.

The Project's 727-acre SBKR Conservation Area contains all of the attributes of high fitness habitat for the SBKR as described in the literature: (1) pioneer and intermediate stages of RAFSS habitat which are subject to dynamic hydrological processes, (2) limited non-native grass cover, (3) surface soils suitable for burrowing, and (4) adjacency to, and ready access to and from, suitable/usable upland habitats. Slide #10 from LDC's August 2017 presentation to the ACOE and USFWS demonstrates how well and thoroughly the high fitness habitat areas for the SBKR within the Project boundaries are captured by the boundaries of the 555-acre on-site portion of the Project's SBKR Conservation Area. (A copy of that slide is attached to this letter.) Slide #58 from that same presentation depicts the expected long-term conditions within LDC's proposed 727-acre SBKR Conservation Area with the conservation measures of the Project implemented. (A copy of that slide is attached to this letter.)

Substantial increased amounts of Intermediate RAFSS habitat and later stage Pioneer RAFSS habitat are expected within the LCRSP SBKR Conservation Area and the immediately adjacent Lytle Creek North SBKR Conservation Area. Additionally, these two conservation areas, combined, are expected to contain more than 130 acres of connected, managed refugia habitat and to contain another roughly 100 acres of connected upland refugia habitat areas located throughout the length of the Conservation Area, from the Lytle Creek Ranch Project's Neighborhood 4 area downstream to the lower end of the Project's Neighborhood 2 area. See Slides #19 and #20 from LDC's March 2018 presentation to the ACOE and USFWS; also see the "Additional Hydrology Information" section of the 2018 Biological Assessment Update (included with this letter) for an explanation of the updated flood frequency rating curve and its relationship to areas within the Project's proposed Conservation Area expected to be above the 100-year event. (A copy of those slides are attached to this letter.)

Additionally, habitat conditions for the SBKR are expected to improve within the linear area of the off-site portion of the Conservation Area (located between the Neighborhood 2 and 3 portions of the Conservation Area) which will further enhance SBKR movement and connectivity between and among SBKR located within the Neighborhood 2 area of the Conservation Area and the Neighborhoods 3 and 4 areas of the Conservation Area. This improvement in SBKR habitat conditions (with perpetual management of those areas) will significantly benefit the conservation of the SBKR and promote the recovery of the species.

The Project would permanently preserve approximately 323.6 acres of SBKR occupied habitat within the on-site portion of the Lytle Creek Ranch project's SBKR Conservation Area in its Neighborhood 2 and Neighborhood 3 areas. The calculation for the amount of occupied acreage in the Project's Neighborhood 3 area is based on the expectation that the Project's proposed on-site refugia enhancement/restoration in Neighborhood 3 will be occupied by the SBKR once restored/enhanced. This is a reasonable expectation, given the Lytle Development Company's success in creating occupied and used SBKR habitat in similar areas as part of the Lytle Creek North development project. The amount of SBKR occupied habitat within the 172 acres of the adjacent off-site portion of the Lytle Creek Ranch SBKR Conservation Area has not been mapped, however, biologists with Environmental Science Associates (formerly, PCR Services Corporation) believe that based on vegetation types, soils, physical location, and hydrologic conditions on these lands, together with the active habitat management and restoration program which would be followed pursuant to the Lytle Creek Ranch project's SBKR Habitat Maintenance and Monitoring Plan ("SBKR HMMP"), the majority of those 172 will contain SBKR occupied habitat over the long-term.

Additionally, the location of the Project's proposed SBKR Conservation Area adjacent to a number of other SBKR-oriented conservation lands will further act to promote the recovery of the SBKR in the Lytle/Cajon creek system. The Project's 727-acre SBKR conservation area is immediately adjacent to the 216.8-acre Lytle Creek North Conservation Area, the approximately 180-acre Lytle Creek Conservation Bank (containing approximately 90 acres serving as SBKR refugia habitat), the roughly 128-acre San Bernardino County Sheriff's woolly-star preserve, San Bernardino County Flood Control District lands targeted for SBKR conservation (see the Glenn Helen Specific Plan on file with the County of San Bernardino), and the roughly 1,100-acre Vulcan Materials Conservation Lands and Bank in Cajon Creek. Those lands are shown on Slide #42 of LDC's March 2018 presentation to the ACOE and USFWS. (A copy of that slide is attached to this letter.) With the establishment of the Lytle Creek Ranch SBKR Conservation Area, approximately 2,900 acres of biologically connected lands will be protected (and largely managed) for the benefit of the SBKR in Lytle and Cajon creeks.

Another improvement the Project will make to the quality and function of the SBKR habitat within the 727-acre SBKR Conservation Area involves the creation/ restoration/ enhancement of 91 acres of this area to habitat suitable for SBKR refugia. Fifty-six (56) of those acres are in the center of the large central island (roughly 120 acres in size in total) within the proposed Conservation Area, and have a high degree of connectivity for SBKR movement between the upland refugia areas and the primary SBKR habitat within the Conservation Area. The other 35 acres are located on the north bank of Lytle Creek, just northwest of the Project's Neighborhood 2 area, and are connected both to the primary SBKR habitat in the Neighborhood 2 portion of the SBKR Conservation Area and connected to the San Bernardino County Sheriff's woolly-star preserve (approximately 130 acres in size). Currently, most of those 91 acres are too densely vegetated with chamise chaparral, mature RAFSS, or non-native annual grassland to be able to support SBKR. The Project, through its proposed SBKR HMMP, will create/ restore/ enhance those 91 acres as SBKR refugia habitat and will monitor and manage the habitat

conditions and SBKR populations on these areas in perpetuity to ensure that these 91 acres remain functional to serve as usable SBKR refugia habitat.

Accordingly, these 91 acres of new refugia habitat will be much better connected (in terms of SBKR mobility and access) to the primary SBKR habitat within the proposed Conservation Area, as compared with the refugia habitat which the Project proposes to remove in Neighborhood 2 (roughly 40 acres) and Neighborhood 3 (roughly 11 acres). Those combined 51 acres (in Neighborhoods 2 and 3) have very limited connectivity for SBKR to move into the primary habitat in Lytle Creek, because of steep escarpments along much of the area's length separating the terrace habitat from the wash, significant patches of vegetation generally understood to preclude SBKR movement between much of those areas and the primary habitat in the wash, and the existence of a man-made groin (one of the Riverside Avenue Groins) between portions of that area and the primary SBKR habitat in the wash. The presence of those three conditions largely isolates the 51 acres of refugia habitat within the Project's development footprint from the primary SBKR habitat in the wash. Slide #26 from the LDC's March 2018 presentation to the ACOE and USFWS illustrates the height and steepness of the escarpment in the majority of locations (but not all) between the 51 acres to be removed by the Project and the primary habitat in the wash. (A copy of that slide is attached to this letter.)

The 91 acres provided by the Project will also be monitored and managed in perpetuity to ensure that they function continuously as SBKR habitat; whereas the 51 acres to be removed by the Project have no monitoring or management associated with them and are located in areas hydrologically disconnected from Lytle Creek, such that over time, those 51 acres will cease being able to support SBKR occupation and use. The Petition attempts to discount the value of 56 acres of the proposed refugia habitat to be newly restored and enhanced, by incorrectly speculating that the large central island within Lytle Creek (wherein those 56 acres will be located) are not likely to persist as SBKR refugia habitat over time. It incorrectly makes this claim and attempts to support it by citation to a draft 2016 Chang report on another topic and a self-commissioned cbec 2018 report which has substantial shortcomings in terms of its analyses. This issue of the Petition's incorrect assertions and predictions about future hydrology in Lytle Creek is discussed in greater detail above, in the discussion of the Lytle Creek North project. The Department is referred to that section of this letter for more discussion of this issue.

However, it is worth noting that a substantial series of hydrologic studies between 2001 and 2010 and between 2012 and 2018, including a variety focused on water depth, velocity and stream power, and comparing pre-project and post-project expected hydraulics within Lytle Creek (adjacent to and downstream of the proposed Project), have been conducted by PACE at the request of the ACOE and USFWS and presented to those agencies. Many of those studies analyzed the effects of the Project on habitat conditions for the SBKR within the Project's proposed SBKR Conservation Area and areas in Lytle Creek and Cajon Creek downstream of the Project site. Many considered a range of flow events (from 2-year events to the 100-year flow event). Habitat components and physical attributes analyzed included, but were not limited to: changes in the amount of available refugia habitat for the SBKR, changes in the amount of RAFSS habitat, the amount and distribution of active channel, pioneer RAFSS, and intermediate

RAFSS, and the overall amount, distribution, and connectivity of high-fitness SBKR habitat and refugia habitat pre- and post-Project. Multiple analyses with a bearing on expected long-term hydrologic conditions in Lytle Creek were conducted. The extensive information and in-depth analyses conducted by PACE are far more reliable and credible than the recent, self-serving analysis produced by the Petitioners through the cbec 2018 report. The PACE analyses demonstrate that it is reasonable to expect that the habitat conditions within the Lytle Creek Ranch conservation area will remain suitable for the SBKR over the long term and that the large central island within Lytle Creek will continue to provide substantial functioning and occupied refugia habitat for the SBKR (after Project implementation) over the long-term.

The proposed Project is expected to improve the quality of the SBKR habitat within the 172-acre off-site portion of the proposed SBKR Conservation Area. Revisions to the Project's design since 2013 – as a result of the implementation of Section 7 of the federal Endangered Species Act – include the use of a wrap-around revetment (i.e., a tie-back revetment) at the “downstream end” of the Project's Neighborhood 3 area adjacent to Lytle Creek and at the “upstream end” of the Project's Neighborhood 2 area adjacent to Lytle Creek wash. Use of the wrap around revetments will remove the need to repair the damaged portion of the CEMEX Mining U.S.A. south pit levee (damaged and breached in the storms of 2005). This modification to the Project will enable habitat conditions for the SBKR to improve in that portion of Lytle Creek located between the Project's SBKR Conservation Area in Neighborhood 3 and Neighborhood 2 (and between the CEMEX north and south mining pits), thereby increasing opportunities for SBKR “live in” habitat and SBKR movement, connectivity and genetic exchange between areas of the proposed SBKR Conservation Area upstream of the CEMEX mining property and downstream of the CEMEX property in Lytle Creek. And with the Project's two wrap around revetments, those improved habitat conditions for the SBKR are expected to exist more frequently and for longer durations, compared with the Project's original design.⁹

The Project's SBKR Conservation Area and conservation elements (including, but not limited to the SBKR HMMP and its adaptive management plan component), in combination, provide a net improvement to the functioning of the SBKR's habitat in Lytle and Cajon Creeks. Among other things, the Project will: (1) improve habitat quality in the 172-acre off-site portion of the SBKR Conservation Area and improve connectivity between the Neighborhood 2 and Neighborhood 3 habitat areas in Lytle Creek wash; (2) control weeds, grasses and improve habitat quality and connectivity within Lytle Creek; (3) Monitor the 727-acre Conservation Area and provide management and adaptive management to be able to respond to changes in grasses and SBKR population levels of concern; (4) provide an erosion adaptive management plan to provide added security for the long-term persistence of restored/enhanced SBKR refugia habitat on the large, central island (roughly 120 acres) in Lytle Creek; (5) provide opportunities through

⁹ Again, this change to the Project's design, development footprint, and impact on the SBKR was the result of the Section 7 consultation process under the federal Endangered Species Act. This change in the project, with its substantial benefits to the conservation and recovery of the SBKR, again demonstrates that the federal Endangered Species Act and its Section 7 consultation process does – contrary to Petitioner's assertion – operate to provide adequate protections to the species.

the SBKR HMMP adaptive management plan component to transfer sediments/substrate beneficial to the SBKR to areas within the SBKR Conservation Area to promote SBKR conservation and recovery; (6) provide opportunities through the SBKR HMMP adaptive management plan component for captive breeding and/or translocation programs for the SBKR, should such activities be found to benefit the recovery of the SBKR; (7) prevent various potential adverse activities from occurring within a 727-acre area of primary SBKR habitat in the Lytle Creek area such as future mining, water percolation pond construction, etc.; (8) patrol the 727-acre SBKR Conservation Area and thereby improve and maintain habitat quality and reduce impacts to the SBKR; (9) enhance and restore SBKR habitat, and manage the same; (10) increase occupied and usable SBKR refugia habitat by 91 acres within the SBKR Conservation Area; (11) provide, manage, and maintain refugia areas which are well-connected for SBKR access to the primary SBKR habitat in the Lytle Creek area; (12) improve habitat quality for the SBKR within Lytle Creek within the northern side of the large central island; (13) provide and ensure the continued fluvial activity within Lytle Creek to ensure the long-term ecological processes necessary to maintain the quality and suitability of the habitat for SBKR in perpetuity; (14) provide SBKR habitat expansion areas in the northwestern portion of the Project's SBKR Conservation Area; and (15) provide and protect a SBKR conservation area large in size and connected to more than 2,300 acres of other protected SBKR habitat conservation properties.

The Lytle Creek Ranch Project, if implemented, would provide a net increase in the value of the SBKR habitat in Lytle and Cajon Creeks for the SBKR's conservation and recovery. The Project's proposed SBKR Conservation Area contains most all of the high fitness habitat for the SBKR (i.e., pioneer and intermediate phase RAFSS habitat which is connected hydrologically to Lytle Creek) within the Project site. The Project's SBKR Conservation Area will permanently preserve and actively manage some 93% of the hydrologically connected pioneer and intermediate RAFSS habitat within the Project site; only roughly 7% would be lost as a result of Project development. Of the RAFSS habitat removed by the Project, the large majority of that habitat is already hydrologically disconnected from Lytle Creek, and thus even without the Project it will continue to senesce and convert to habitat unsuitable to support – or otherwise remain as unsuitable for – the SBKR.

The Project would create/restore/enhance some 91 acres of SBKR refugia habitat which is much better connected to the primary SBKR habitat within the Conservation Area than is the 51 acres of refugia habitat which would be removed by the Project. Moreover, the Project would monitor and manage the habitat and SBKR populations in those 91 acres to ensure that they remain functional for the SBKR in perpetuity. Furthermore, the Project would monitor habitat conditions and the SBKR population throughout a protected 727-acre SBKR Conservation Area and provide adaptive management to respond to any adverse conditions which might develop relating to the SBKR or its habitat in this area in perpetuity.

The Project's SBKR HMMP will control weeds and non-native grasses within the 727-acre Conservation Area, thereby improving the quality of the habitat of these acres for the SBKR. These 727-acres will thus persist as available habitat to the SBKR in perpetuity. In contrast, without the Project, SBKR habitat conditions within the project's development footprint

will only continue to deteriorate and then disappear over time and habitat conditions in the primary habitat within Lytle Creek could suffer from lack of management to maximize the area's fitness for the SBKR. The Project would also provide and protect an area of some roughly 173 acres in and adjacent to Lytle Creek above (i.e., upstream of) the Interstate 15 which are expected to be connected hydrologically to fluvial activity from Lytle Creek over the long term and which could become more suitable for SBKR occupation over time, given the effects of climate change and other biological factors and events. Active monitoring of these area by the Project and its adaptive management program will enable this portion of the SBKR Conservation Area to maximally benefit the SBKR and its recovery over time.

Furthermore, protecting this 727-acre area via one or more conservation easements and active patrolling via the Conservation Area manager will prevent unauthorized disturbances to the SBKR and its habitat and will prevent activities such as future mining from being conducted on these lands, providing further long-term protection to the SBKR. Placement of the conservation easement(s) over this land will also help to ensure that the lands associated with the Conservation Area (and other SBKR conservation areas and habitats adjacent to, or downstream of, of the Project site) will continue to experience appropriate fluvial activity over the long term. The Project's proposed SBKR Conservation Area also is connected to another 90 acres of refugia habitat for the SBKR being preserved and managed by the roughly 182-acre Lytle Creek Conservation Bank (approved by the Service for the benefit of the SBKR), located adjacent to the downstream end of the Lytle Creek Ranch Project's Neighborhood 2 area at the Lytle/Cajon creek confluence. (See Exhibit 7 of the 2018 Biological Assessment Update included with this letter.) This protected and managed refugia habitat also would be expected to provide a founder population of SBKR able to repopulate the Lytle Creek Ranch's SBKR Conservation Area after an episodic flood event.

Moreover, the Lytle Creek Ranch Project's proposed SBKR Conservation Area is adjacent to four (4) other existing conservation areas in Lytle and Cajon Creeks, which together with the Project's Conservation Area, would provide a combined, interconnected area of roughly 2,900 acres in Lytle and Cajon creeks which would secure the long-term persistence of the SBKR in the Lytle/Cajon Creek area (Unit #2 of federally-designated SBKR critical habitat). Slide #42 of LDC's March 2018 presentation to the ACOE and USFWS illustrates the connectivity with the other four conservation areas (and a fifth expected area, namely the San Bernardino County Flood Control District's expected mitigation area, which is another roughly 533 acres in size).

The Project's proposed SBKR HMMP will ensure that the 727-acre SBKR Conservation Area is adequately managed for the SBKR in perpetuity, including the control (and maintenance) of vegetation conditions which will be optimal for maintaining the persistence of the SBKR within the Lytle Creek Wash area. As Dr. Michael J. O'Farrell notes in his September 2018 letter (included with this letter), the open shrub land / forb land habitat which will be maintained will produce large quantities of seed food source for the SBKR, and these seeds will persist in the soil for years, acting as a food reserve for the SBKR.

Dr. O'Farrell also affirms in his September 2018 letter that the Project's proposed SBKR Conservation Area, coupled with the proposed SBKR HMMP, is expected to promote the recovery of the SBKR. His reasoning for that conclusion is provided in the letter included with this document. Dr. O'Farrell also explains why he believes that the Project, by including within it the establishment of the SBKR Conservation Area and the implementation (and funding) of the SBKR HMMP, will not diminish the functioning of the USFWS's designated Critical Habitat Unit #2 for the SBKR (Lytle-Cajon Creeks) and will not adversely modify that designated critical habitat.

In total, the Project's Proposed SBKR Conservation Area, along with its SBKR HMMP (including its adaptive management plan component) incorporated as part of the Project, will provide a net improvement to the functioning of the SBKR habitat in Lytle and Cajon Creeks to provide for the essential needs of the SBKR and promote the conservation and recovery of the species by increasing the functions and values of the habitat within a 727-acre area to satisfy essential requirements of the SBKR. With the implementation of the Project, the prospects for the SBKR's long-term continued existence with Lytle Creek is increased compared with its current condition in Lytle Creek. The Lytle Creek Ranch project is an example of how existing laws such as the federal ESA already operate to secure and outcome whereby the conservation and recovery of the SBKR is increased through development project approval as the result of such project's being able to provide proactive conservation protection, management and recovery measures for the species, in contrast with the "benign neglect" of the species which results from merely allowing existing conditions to continue. The Lytle Creek Ranch project is an example of how listing of the SBKR under the CESA is **not** necessary to ensure adequate conservation of the species.

CEMEX Aggregate Mining Project Levee Repair in Lytle Creek

Lytle Development Company also has substantial knowledge concerning the levee repair project being pursued by CEMEX Materials U.S.A. ("CEMEX"), which property and project is located adjacent to LDC's Lytle Creek Ranch project.

The history associated with this CEMEX proposed project provides evidence directly undermining the Petition's assertion that CESA listing of the SBKR is necessary to assure the adequate conservation of the species. In fact, the existing protections afforded the SBKR under the federal Endangered Species Act, federal Clean Water Act, CEQA and the State Streambed Alteration Agreement statute have been the reason that this repair project has not been able to proceed for the past ten (10) years. The CEMEX project proposal and design continues to undergo various modifications to minimize any adverse impacts to the SBKR. The combination of these existing SBKR protections have allowed the California Department of Fish & Wildlife and U.S. Fish & Wildlife Service to refuse to issue the necessary resource agency permits they administer to enable some version of the project to move forward until CEMEX has modified its project to the point where the impacts to SBKR, if any, are acceptable to these two agencies.

In short, the history of this CEMEX project is a clear example that the existing protections given to the SBKR by the federal Endangered Species Act, along with other existing protections under CEQA, NEPA and Section 1600 of the Fish & Game Code, are sufficient to promote the conservation of the species.

Letters Submitted from Other Interested Parties

We are aware of at least two letters submitted by other interested organizations identifying flaws in the information provided in the Petition. We ask that the Department carefully review the information in those two letters when developing its written report under Fish & Game Code Section 2074.6. Those two letters are: (1) a letter from Briscoe, Ivester & Bazel, dated May 30, 2019, and (2) a letter from the California Chamber of Commerce (and a collection of other organizations), dated June 7, 2019. We have enclosed copies of those letters for your convenience as well.

Other Inaccuracies and Errors in the EHL Petition or Department Report

Other errors and inaccuracies contained in the Listing Petition and/or Department Report include, but are not limited to, information concerning the following pertinent topics, as explained below. We request that the Department review this information and ensure that the report developed by the Department pursuant to Section 2074.6 does not use and does not perpetuate the incorrect information and analyses discussed below.

Distribution

The information regarding Lytle Creek in the Petition is in error. Information provided by LDC, above, illustrates that the Petition fundamentally misunderstands the data and information concerning the SBKR distribution in Lytle Creek.

In addition, the Petition mischaracterizes and overstates the extent of trapping done in Lytle Creek, as well as Cajon Creek, by Shier *et al.* 2018 (EHL Petition at pg. 10). For example, Shier *et al.* 2018 did not conduct any SBKR surveys in Lytle Creek upstream of the Wildlands Conservation Bank; thus, that study conducted no trapping on the Lytle Creek Ranch portion of Lytle Creek, nor on the CEMEX property north of the Wildlands Conservation Bank, nor on the Lytle Creek North SBKR Conservation Area. Those three areas combined represent roughly 1,000 acres of SBKR habitat in Lytle Creek which were not sampled at all. In fact, the Shier study explains that it was trapping simply for the purpose of capturing about 20 SBKR in Cajon Creek and 20 SBKR in Lytle Creek for hair samples for genetic testing.

Distribution Reduction

McKernan 1997 appears not to have based his estimate of the historical reduction of SBKR habitat on a sufficiently rigorous analysis. Furthermore, their estimate that the actual habitat occupied by the SBKR has been reduced by 95% over time has never been independently

analyzed or verified nor adequately examined by others. Having reviewed the procedure as described in McKernan 1997, we believe that it is highly likely to be overstated. We explain further below.

Population Trend

As the Department Report acknowledges, the Petition acknowledges that it lacks population trend data for the SBKR and that such information has not been collected. (Department Report, pg. 8). Therefore, the Petition relies upon information on population density and habitat availability to suggest a population decline. The problem with this analytical approach and reasoning is that there is insufficient data on SBKR population density to establish a population decline.

The estimate that less than 5% of the SBKR's historical habitat remains, cited in the Department Report, the Petition, and the USFWS's 2009 species status review, are each blindly based on an assertion found in McKernan 1997 which, itself, has never been adequately or sufficiently demonstrated – neither by McKernan, nor by any credible independent scientist or researcher. Thus, the CDFW, in considering the listing of the SBKR, should not base that decision on an assumption that 95% or more of the historical habitat of the SBKR has been lost -- since the only original source of this estimate is McKernan 1997 and that non-peer reviewed, non-published paper submitted to the USFWS does not provide sufficiently detailed data to reach this 95% loss estimate. The insufficiency of the research conducted by McKernan 1997 to estimate the “historic loss” of SBKR habitat should not be overlooked or “swept under the rug” by CDFW in its 12-month review analysis, especially since the Petition admits that “the understanding of trends in abundance is poor” for this species and therefore “the dramatic loss ... of the species' habitat ... is the best descriptor of SBKR's status and need for California Endangered Species Act (CESA) protection.”

Looking at McKernan's methodology in his unpublished 1997 report to the Service, it appears that he significantly overestimated the original amount of actual habitat that would be expected to have been occupied by the SBKR. Consequently, the percentage loss of actual, occupied SBKR habitat over time has likely been exaggerated – both by McKernan 1997 and by other writers subsequent to McKernan 1997, none of whom have conducted an independent analysis of this claim.

Similarly, the Petition has not demonstrated that the relevant naturally-functioning floodplains in existence in 1998 (at the time of the species' federal Endangered Species Act listing) have substantially declined. Once again, the failure by the Petition to substantiate this claim, undermines the Petition's claim that CESA listing is necessary to halt a further decline in the species' distribution in California.

The Department's Report also fails to define the “historical period” it -- or the Petition -- has used to judge the “decline” of the SBKR populations. In the absence of defining this period and substantiating that it is the relevant period within which to evaluate whether a listing under

CESA is warranted, the Department has not adequately established a decline [large enough to warrant listing].

Additionally, at time of federal listing in 1998 it is unlikely that there were significant numbers, or a significant-sized population, of SBKR within any area outside the three main population areas of Lytle and Cajon Creeks, the Santa Ana River, and the San Jacinto River and Baptista Creek areas. The Petition has not accounted for this reality. Furthermore, there has been no established significant decline in the SBKR population size within the Lytle-Cajon Creeks population or the Santa Ana River population.

Abundance

McKernan, in his 1997 report to the USFWS (McKernan 1997), did not conduct his trapping efforts in a manner (or using a methodology) able to determine SBKR abundance in the various habitats and locations he sampled in the 1990's.

Brian Root's 2010 paper (cited in the Petition) focused on just certain areas of SBKR habitat or potential habitat within the Santa Ana River, and this data does not allow for extrapolation to other population areas such as Lytle-Cajon Creek or the San Jacinto River/Bautista Creek area. (See Department Report at pages 12-13).

As for the information concerning SBKR genetics and the implications for the continued existence of the species (see Department Report at pg. 14), very little is known about SBKR genetics or actual SBKR population sizes or effective population sizes. Both the Petition and the Department Report read far more into Shier *et al.* 2018 and its study than is warranted, given the nature and limited extent of the work associated with Shier's non-peer reviewed report submitted to the USFWS.

The Department needs to gather much more information on the actual SBKR population sizes and effective population sizes of the three main SBKR populations before reaching any conclusions as to whether any of these three populations are truly threatened from a genetics standpoint in the extirpation based on lack of genetics fitness in the short or long term.

Effects of Climate Change

Neither the Petition nor the Department's Report have sufficiently established facts, reasoning, and analysis to substantiate the "conclusion" in the Department's Report that future climate change "would likely ... amplify many of the above-described factors" in a way that would increase adverse impacts on the SBKR and its habitat. In fact, as a desert-climate - adapted species which is also adapted to living in a flashy floodplain environment, the SBKR may not experience climate change in a detrimental manner, in contrast with other species which have different biological needs and life histories. For example, the Petition claims that climate change may reduce shrub cover; however low levels of shrub cover are preferred by SBKR and increase the suitability of an area for SBKR. (See Petition at pgs. 28-29.) Nor has the Petition

provided any information to establish that a +/- 2 to 4 inch change in the amount of annual rainfall would be detrimental, as opposed to neutral or beneficial to this species, which is adapted to arid environments with flashy fluvial processes. If the Department's listing decision is going to cite climate change as a justification for listing the SBKR under CESA, it will have to discover and present sufficient facts and analysis to support a position that climate change is likely to be materially adverse to the continued existence of the SBKR. Neither the Petition nor the Department's Report provides the facts and analytical reasoning for such a conclusion.

Unreliable and Unusable "Information" and "Data" in the EHL Petition

The Department's listing decision should not be based -- to any degree -- upon incomplete, draft, anonymous, partial, or unauthorized documents, excerpts, and pages which the Petitioner submitted to the Department as part of the Petition. Much of the material in the EHL Petition consists of fragments of documents, pages or materials either in draft form, by unattributed "authors," or specifically marked as "Not for Distribution" -- or which consist of a combination of these individual shortcomings and warning signs. No such "information" can or should be considered sufficiently "reliable" information to enable the Department to consider it in the present evaluation for listing under CESA.

For example, page 10 of the Department's Report cites data on SBKR functioning habitat as of 2018 and cites its source for this information as "USFWS 2018" in at least five (5) instances and regarding five different areas of SBKR habitat. [Department Report, Table 1] However, the source DFW cites for this information is "USFWS 2018 Lytle Creek conservation briefing," which refers to fragments from a draft document obtained by EHL but which is not a final or published document issued by USFWS. As it is not a complete or final document produced or released by USFWS for any kind of public use, it cannot constitute information upon which to evaluate whether listing of the SBKR is warranted under the CESA.

Furthermore, the Petitioner does not provide any data on remaining suitable SBKR habitat acreage as of 2018 which can be used credibly or validly in the listing decision, inasmuch as the "2018 USFWS cited documents" are not documents suitable for use by the public or government agencies. This data flaw calls in question even further the "conclusions" regarding the loss of potential and functioning SBKR habitat (and SBKR federally-designated critical habitat) found in the Department's Report at pages 10-11.

The Petition and the Department Report also attempt to utilize this "unusable information" (i.e., "USFWS 2018") to conclude that the SBKR's distribution within the three main geographic areas where the species is found (i.e., Lytle-Cajon, Santa Ana River, and San Jacinto River) has contracted meaningfully since 1998. Once again, the Department's evaluation for listing under CESA will not be able to use the "information" in the various pages claimed to have an origin from USFWS submitted by Petitioner related to "USFWS 2018."

The Petition bases far too many of its claims and assertions on draft documents and unattributed pages from unknown authors and unreliable data. The Department's 12-month

evaluation cannot rely on any of this “information” from the source cited as “USFWS 2018” in the Petition, and any attempt to do so by the Department would undermine the integrity of the CESA listing process.

Degree and Immediacy of Threat and the Impact of Existing Management Efforts

The existing information does not establish that threats to the long-term survival of the SBKR will likely worsen in the future.

As mentioned elsewhere, the Department should independently and carefully examine the original raw data and analysis underlying the conclusions in McKernan 1997 about the actual likely percentage reduction in SBKR historical, occupied (or likely occupied) habitat. A thorough and independent review by the Department is critical, since the original estimate in McKernan 1997 is based on a rather crude and simplistic measurement approach which likely overstates the actual percentage loss of the historical habitat occupied by the species. The species has certain rather narrow habitat requirements in terms of soil substrate, vegetation type, vegetation density, elevation, fluvial action connectivity, etc., and it appears that McKernan’s 1997 methodology significantly overestimated the actual acreage likely occupied by the SBKR over the last 100 to 200 years. The USFWS’s listing “rule” (“USFWS 1998”) basically just took McKernan’s estimate as a “given,” without conducting a careful, independent analysis of the likely historical loss of occupied habitat and the likely amount of SBKR occupied habitat in the early 1900’s and early 1800’s.

The Department, in its status review, should also reexamine the lack of a foundation for the Petition’s claim that the three main populations of the SBKR are “small” in size. None of those three main populations have been sufficiently surveyed to provide a solidly-reliable estimate of their true population sizes, nor whether those population numbers are really “small” in terms of the sustainability of the three main SBKR populations in those locales.

Furthermore, the Department’s status review should more carefully examine the limitations of what Shier *et al.* 2018 can actually tell us about the genetics of the remaining SBKR populations and the actual genetic threats -- if any -- to the species. The existing genetic information on the SBKR is insufficient to reach the negative conclusions suggested by the Department’s Report evaluating the Petition to list the species. Shier *et al.* 2018 is really just the first study of SBKR genetics, it is limited in scope and limited in the questions it was actually designed to answer. The Department’s status review should be careful to not interpret Shier *et al.* 2018 to be establishing more “facts” on these topics than the study and its data and findings can support.

The Petition states, without adequate support, that the current SBKR habitat in Lytle Creek is “subject to high stream velocity and scouring events relative to historical conditions ...” (Petition at pg. 27). Nor has the Petition substantiated how it knows that any velocity or scour changes from “historic conditions” have increased in a manner materially detrimental to the SBKR. The Petition’s statement on this issue is mere, unsubstantiated speculation. It also

ignores the various analysis conducted by PACE (hydrologists and engineers) and PCR Services Corporation (biological consultants) which indicate that substantial amounts of RAFSS habitat continue to exist in Lytle Creek and that a large sediment source is expected to always remain upstream in the watershed feeding Lytle Creek so as to ensure that sandy soils will continue to persist in Lytle Creek to provide SBKR habitat over time. See PACE memoranda, reports and letters enclosed with this letter and PCR Services memoranda enclosed with this letter.

The EHL Petition contains incorrect information on existing management efforts for the SBKR and, in so doing, the Petition suggests that existing management efforts for the species require CESA listing of the SBKR to somehow increase proactive conservation measures for the species. This belief is incorrect and is based on faulty information and reasoning. The Petition does not present adequate information to demonstrate that a CESA listing will improve the long-term conservation potential for the SBKR.

The existing protections for the SBKR under the federal Endangered Species Act, the federal Clean Water Act, the California Environmental Quality Act, the National Environmental Policy Act, and the California Fish & Game Code §1600 *et seq.* are, collectively, sufficient to ensure the conservation of the SBKR and promote its recovery. It is disingenuous for the Petition to claim, without adequate supporting evidence, that the existing local, State and federal legal and regulatory protections are insufficient to protect the SBKR, such that listing under CESA is required to make a difference in the conservation and recovery of this species.

The Department's Report to the Commission (as well as the Petition itself) contains some very incorrect, erroneous and misleading information on the effects and potential effects of various development projects on the SBKR. The Department's listing analysis should be based on the correct information regarding these projects and their effects on the SBKR. Two of the projects which are significantly incorrectly described and analyzed in the Petition are Lytle Development Company projects, so we can speak with authority and first-hand knowledge in regards to the true facts, and can correct many of the more erroneous and egregious "statements" and "information" about these projects contained in the Petition (and contained in the Department Report).

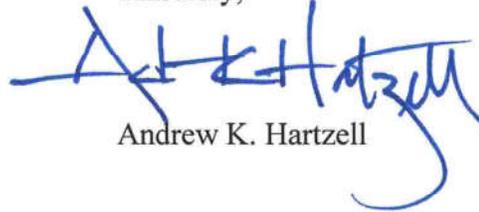
Since we are aware of how extensively the EHL Petition erred in providing "facts" and information about the two Lytle Development Company projects, we strongly encourage the Department to conduct an independent and thorough review of the pertinent facts regarding all the other projects to be evaluated in the Department's status review (and those which were described in the Petition). As we have been able to demonstrate that the Petition described so many of the pertinent facts about the Lytle Creek North and Lytle Creek Ranch projects incorrectly, the credibility of the entire Petition is severely undermined, and the Department should not assume that any other "facts" about any other existing or proposed projects discussed in the Petition are correct.

Conclusion

On behalf of Lytle Development Company, we appreciate the opportunity to present this information, data and these comments to the Department. We strongly encourage the Department to review all of this information carefully and to better scrutinize various shortcomings in the information in the Petition and the Department Report identified in this letter, in order to prepare a more accurate analysis and written report to the Commission under Cal. Fish & Game Code §2074.6 and reach a proper decision regarding whether the San Bernardino Kangaroo Rat should be listed under CESA.

Should you have any questions regarding the above or the enclosed information, please contact the undersigned at (949) 798-0714 or through the direct email address listed above.

Sincerely,

A handwritten signature in blue ink, appearing to read "A. K. Hartzell", with a large, stylized flourish extending from the end of the signature.

Andrew K. Hartzell

AKH/ln

cc: The Honorable Charlton H. Bonham (via email without enclosures)

Enclosures:

O'Farrell, Michael, J., Ph.D. Memo to Michael Story, Development Services Department, City of Rialto, 2010

O'Farrell, Michael, J., Ph.D. Memo to Michael Story, Development Services Department, City of Rialto, July 25, 2010

O'Farrell Biological Consulting, Restoration and Enhancement of Habitat for the SBKR Conservation Area, Lytle Creek North Master Planned Community, Final Annual Report for 2004, dated January 2005

O'Farrell Biological Consulting, letter to Carlsbad U.S. Fish and Wildlife Service, Comments on Proposed Revision of San Bernardino Kangaroo Rat Critical Habitat, August 15, 2007

O'Farrell Biological Consulting, Lytle Creek Ranch SBKR Trapping Report for years 2005, 2006 and 2007, dated November 12, 2007

O'Farrell Biological Consulting, Lytle Creek Ranch Update Additional Trapping, dated October 22, 2014

PACE Technical Memorandum re: PACE response to Comments on Lytle Creek Ranch Specific Plan Draft EIR, dated May 5, 2010

PACE letter to City of Rialto re: Lytle Creek Ranch Specific Plan Response to Comments - Letters from EHL (6/18/10), Chang (6/18/10), Vulcan (6/16/10) and BBC (6/22/10) regarding Environmental Impact Report for Project, dated June 30, 2010

PACE letter to Matrix Environmental re: Lytle Creek Ranch Specific Plan Project - Hydraulic Effects of Proposed Development Revetment on Floodplain, RAFSS Habitat Impacts, dated July 24, 2012

PACE Technical Memorandum re: Lytle Creek Ranch Specific Plan - Additional Floodplain Hydraulic/Fluvial Analyses for Revetment Impact Assessments and Information in Response to Comments on Corps Public Notice Concerning Permit Application, dated May 9, 2014

PACE Technical Memorandum re: Scientific Assessment of CDFW “Areas of Interest” (Active Intermittent Streams vs. Relict Features) Within Lytle Creek Ranch Specific Plan Development Area - Neighborhood 2, dated January 2017

PACE Technical Memorandum re: Lytle Creek - Updated Lytle Creek Stream Gauge Frequency Analysis, dated July 26, 2018

PACE Technical Memorandum re: CBEC Lytle Creek Sediment Transport Modeling of Potential Impacts to the SBKR Habitat (CBEC Memo dated November 29, 2018), dated June 21, 2019

PCR Technical Memorandum re: Lytle Creek Ranch Specific Plan - Additional Information and Analysis to Inform the Review of the Project by State and Federal Regulatory Agencies, dated May 7, 2014

PCR Memorandum re: Lytle Creek Ranch Specific Plan - Floodplain Areas Affected by Overflow, dated August 19, 2014

ESA Memorandum re: Estimation of SBKR population number in 2017 within the 40-acre enhanced and restored SBKR refugia area within the SBKR Conservation Area for the Lytle Creek North Master Planned Community project, San Bernardino County, California, dated September 7, 2017

ESA Memorandum re: Estimation of SBKR population density in 2017 within a 40-acre portion of Lytle Creek Wash, Lytle Creek North Master Planned Community project, San Bernardino County, California, dated September 12, 2017

ESA Biological Assessment Update (2018), for the Lytle Creek Ranch Project, selected sections and exhibits

ESA Memorandum re: Estimation of SBKR population number in 2018 within the 40-acre enhanced and restored SBKR refugia area within the SBKR Conservation Area for the Lytle Creek North Master Planned Community project, San Bernardino County, California, dated September 12, 2018

Lytle Development Company, August 11, 2017 presentation to USACOE and USFWS: Slide 10 & Slide 58

Lytle Development Company, March 29, 2018 presentation to USACOE and USFWS: Slide 19, 20, 26 and 42

Briscoe, Ivester & Bazel, LLP, letter to California Fish & Game Commission , regarding petition to list San Bernardino kangaroo rat, dated May 30, 2019

California Chamber of Commerce, et al., letter to California Fish & Game Commission , regarding petition to list San Bernardino kangaroo rat, dated June 7, 2019

 @Wildlife

From: 
Sent: Wednesday, September 4, 2019 6:04 PM
To: Wildlife Management
Subject: Kangaroo Rat

Hello!

Just read the latest CFW News email chain and saw your looking for public commit on the Kangaroo Rat-- had no idea it might be endangered.

Just wanted to let you know I saw one a few days ago at night by my camp sight just below Mono Lake a couple miles East of the 395. Just south of the 120.

Maybe a different subspecies but felt like I should drop the information down.

best,

--



From: [REDACTED]
Sent: Thursday, September 5, 2019 3:30 PM
To: Wildlife Management
Subject: Kangaroo rat is a threat to other wildlife

The kangaroo rat is vibrant, has healthy numbers in populations and is predominant across the whole Mojave desert and can carry diseases to other animals. The rat invades campgrounds, and human habitats, leaving disease carrying feces everywhere.

This rat is not afraid of humans and can be hand fed at camp fires most anywhere in the Mojave desert during an evening chat at the fire.

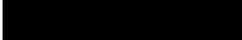
His intrusion into the San Bernardino valley habitats, brings much needed nourishment to owls and birds of prey that can enjoy his tender tasty body and feed to their young hatchlings. There are in survival text books, some great Kangaroo rat recipes I am told.

The Kangaroo rat has no esthetic value , but to be an irritant to human habitat and to progress in creating more affordable housing. The Kangaroo rat is a fine form of staple for coyotes, snakes, bobcat, fox and domestic felines. The only danger for the rat is to be alive. In and across the Mojave desert, the kangaroo rat is more than plentiful, he owns the desert floor in huge numbers and yet is protected to a point, he will be even more greater in numbers and push into more human habitats and already is becoming a nuisance in the San Bernardino Valley foothills.

Thank you for probably ignoring this comment from experience, I realize you want PC support.

[REDACTED]

@Wildlife

From: 
Sent: Thursday, September 5, 2019 3:28 PM
To: Wildlife Management
Subject: SBKR - question about kangaroo rat

Hello Scott Osborn, California Dept. of Fish and Wildlife --

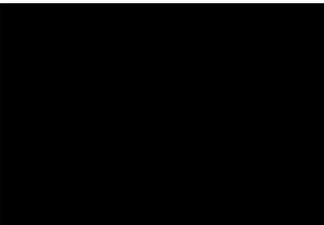
I see that a notice has been sent to the Kern County Board of Supervisors regarding the endangered status of the San Bernardino kangaroo rat. I looked it up and the habitat of the rat does not seem to be in east or west Kern County. I would like to refer to the notice in my section in The Loop Newspaper if the rat is found in Kern County.

If it is indigenous to Kern County, then:

Would you send me a high-resolution image of the rat?

Why is it a candidate for listing? What is making it disappear? What are the characteristics of the rat?

Thank you.



APPENDIX D - External Peer Review Solicitation Letters



State of California – Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
Wildlife Branch
P.O. Box 944209
Sacramento, CA 94244-2090
www.wildlife.ca.gov

GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director



September 3, 2021

Dr. Patrick A. Kelly
Endangered Species Recovery Program
California State University, Stanislaus
One University Circle
Turlock, CA 95382

SUBJECT: PEER REVIEW OF THE DEPARTMENT OF FISH AND WILDLIFE'S
REPORT ON THE STATUS OF THE SAN BERNARDINO KANGAROO RAT
(*DIPODOMYS MERRIAMII PARVUS*)

Dear Dr. Kelly:

Thank you for agreeing to serve as a scientific peer reviewer for the Department of Fish and Wildlife's (Department) Draft Status Review of the San Bernardino kangaroo rat (*Dipodomys merriami parvus*, hereafter SBKR). A copy of this report, dated September 2, 2021, is enclosed for your use in the review. The Department seeks your expert analysis and input regarding the scientific validity of the report, and its assessment and conclusions regarding the status of SBKR in California based on the best scientific information currently available. The Department is interested in and respectfully requests that you focus your peer review effort on the body of relevant scientific information and the Department's related assessment of the required population and life history elements prescribed in the California Endangered Species Act (CESA). **The Department would appreciate receiving your peer review input on or before October 4, 2021.**

The Department seeks your scientific peer review as part of formal proceedings pending before the California Fish and Game Commission (Commission) under CESA. As you may know, the Commission is a constitutionally established entity distinct from the Department, exercising exclusive statutory authority under CESA to list species as endangered or threatened (Fish & G. Code, § 2070). The Department serves in an advisory capacity during CESA listing proceedings, charged by the Fish and Game Code to evaluate the status of the species based on the best scientific information available to the Department and make recommendations to the Commission, including if CESA listing is warranted (Fish & G. Code, § 2074.6).

Conserving California's Wildlife Since 1870

Dr. Patrick Kelly
Endangered Species Recovery Program
CSU Stanislaus
September 3, 2021
Page 2

The Commission first received the petition to list SBKR under CESA in March 2019. On August 23, 2019, the Commission published findings regarding its acceptance and formally designating SBKR as a candidate for listing as threatened or endangered under CESA. As a candidate species, SBKR currently receives the same protections under CESA as threatened and endangered species. Formal acceptance of the petition triggered the Department's initiation of this status review, which will inform the Commission's decision on whether listing the species is warranted.

The draft report forwarded to you today reflects the Department's effort to identify and analyze the best scientific information available regarding the status of SBKR in California. The Department's preliminary recommendation on whether CESA listing is warranted for the species may be found in the draft report. We underscore, however, that scientific peer review plays a critical role in the Department's analysis and effort to develop and finalize its recommendation to the Commission as required by the Fish and Game Code. Our analysis and expected recommendation to the Commission may change or be modified following your input. For your reference, under CESA an endangered species is defined as "a native species or subspecies...which is in serious danger of becoming extinct throughout all, or a significant portion of its range due to one of more causes, including loss of habitat, change in habitat, overexploitation, predation, competition, or disease" (Fish and G. Code, § 2062). A threatened species is defined as "a native species or subspecies...that, although not presently threatened with extinction, is likely to become an endangered species in the foreseeable future in the absence of the special protection and management efforts required by [CESA]" (Fish and G. Code § 2067).

We ask you to focus your peer review on the best scientific information available regarding the status of SBKR in California. Your peer review of the science and analysis regarding the population status and the threat categories prescribed in CESA's implementing regulations are particularly important (Cal. Code Regs., tit. 14, § 670.1(i)(1)(A); i.e., present or threatened modification or destruction of the species' habitat, overexploitation, predation, competition, disease, or other natural occurrences or human-related activities), as well as your opinion on whether the body of information and reasonable conclusions drawn from the information indicate that SBKR is at serious risk of becoming extinct throughout all or a significant portion of its range in California

Dr. Patrick Kelly
Endangered Species Recovery Program
CSU Stanislaus
September 3, 2021
Page 3

(i.e. the species is endangered), or whether the species is likely to become so in the foreseeable future in the absence of CESA protection (i.e. threatened).

Please note that currently, the Department releases this report solely to you as part of the peer review process, it is not yet public. However, your review will be appended to the final report which will be released to the public upon receipt by the Commission. We ask that you please keep the Department's report and your review of it confidential until the final report is received by the Commission.

For ease of review and for accessibility by the public, the Department would prefer to receive your comments in list form by report page and line number. Please submit your comments electronically to Dr. Scott Osborn via email at [REDACTED]. For questions, Dr. Osborn can be reached via email or by phone at (707) 499-0566. If there is anything the Department can do to facilitate your review, please let us know.

Following receipt and consideration of peer review comments, the Department will prepare and submit its final status review report and related recommendation to the Commission. After at least a 30-day public review period, the Commission will consider the petition, the Department's status review, related recommendations including peer review comments, and public testimony during a regularly scheduled Commission meeting prior to making their decision.

Thank you again for your contribution to the status review effort and the important input it contributes to the CESA listing process.

Sincerely,

DocuSigned by:

7543E85CBE88445...

Scott Gardner, Chief
Wildlife Branch
Wildlife and Fisheries Division

Enclosure

cc: Department of Fish and Wildlife

Dr. Patrick Kelly
Endangered Species Recovery Program
CSU Stanislaus
September 3, 2021
Page 4

Garry Kelley, Acting Deputy Director
Wildlife and Fisheries Division

[REDACTED]

Erin Chappell
Wildlife Diversity Program Manager
Wildlife Branch

[REDACTED]

Daniel Applebee
Conservation and Recovery Unit Supervisor
Wildlife Branch

[REDACTED]

Scott Osborn
Senior Environmental Scientist (Specialist)
Wildlife Branch

[REDACTED]



State of California – Natural Resources Agency
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GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director



September 3, 2021

Dr. Douglas A. Kelt
Department of Wildlife, Fish, and Conservation Biology
University of California, Davis
One Shields Avenue
Davis, CA 95616

SUBJECT: PEER REVIEW OF THE DEPARTMENT OF FISH AND WILDLIFE'S
REPORT ON THE STATUS OF THE SAN BERNARDINO KANGAROO RAT
(*DIPODOMYS MERRIAMII PARVUS*)

Dear Dr. Kelt:

Thank you for agreeing to serve as a scientific peer reviewer for the Department of Fish and Wildlife's (Department) Draft Status Review of the San Bernardino kangaroo rat (*Dipodomys merriami parvus*, hereafter SBKR). A copy of this report, dated September 2, 2021, is enclosed for your use in the review. The Department seeks your expert analysis and input regarding the scientific validity of the report, and its assessment and conclusions regarding the status of SBKR in California based on the best scientific information currently available. The Department is interested in and respectfully requests that you focus your peer review effort on the body of relevant scientific information and the Department's related assessment of the required population and life history elements prescribed in the California Endangered Species Act (CESA). **The Department would appreciate receiving your peer review input on or before October 4, 2021.**

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Conserving California's Wildlife Since 1870

Dr. Douglas A. Kelt
Department of Wildlife, Fish, and Conservation Biology
University of California, Davis
September 2, 2021
Page 2

The Commission first received the petition to list SBKR under CESA in March 2019. On August 23, 2019, the Commission published findings regarding its acceptance and formally designating SBKR as a candidate for listing as threatened or endangered under CESA. As a candidate species, SBKR currently receives the same protections under CESA as threatened and endangered species. Formal acceptance of the petition triggered the Department's initiation of this status review, which will inform the Commission's decision on whether listing the species is warranted.

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Dr. Douglas A. Kelt
Department of Wildlife, Fish, and Conservation Biology
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Thank you again for your contribution to the status review effort and the important input it contributes to the CESA listing process.

Sincerely,

DocuSigned by:

7543E85CBE88445...

Scott Gardner, Chief
Wildlife Branch
Wildlife and Fisheries Division

Enclosure

ec: Department of Fish and Wildlife

Dr. Douglas A. Kelt
Department of Wildlife, Fish, and Conservation Biology
University of California, Davis
September 2, 2021
Page 4

Garry Kelley, Acting Deputy Director
Wildlife and Fisheries Division

[REDACTED]

Erin Chappell
Wildlife Diversity Program Manager
Wildlife Branch

[REDACTED]

Daniel Applebee
Conservation and Recovery Unit Supervisor
Wildlife Branch

[REDACTED]

Scott Osborn
Senior Environmental Scientist (Specialist)
Wildlife Branch

[REDACTED]



State of California – Natural Resources Agency
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P.O. Box 944209
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GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director



September 3, 2021

Dr. Debra M. Shier
San Diego Zoo Institute for Conservation Research
2929 Zoo Dr.
San Diego, CA 92112

SUBJECT: PEER REVIEW OF THE DEPARTMENT OF FISH AND WILDLIFE'S
REPORT ON THE STATUS OF THE SAN BERNARDINO KANGAROO RAT
(*DIPODOMYS MERRIAMI PARVUS*)

Dear Dr. Shier:

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Dr. Debra M. Shier
San Diego Zoo Institute for Conservation Research
September 3, 2021
Page 2

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Dr. Debra M. Shier
San Diego Zoo Institute for Conservation Research
September 3, 2021
Page 3

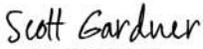
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Thank you again for your contribution to the status review effort and the important input it contributes to the CESA listing process.

Sincerely,

DocuSigned by:

7543E85CBE88445...

Scott Gardner, Chief
Wildlife Branch
Wildlife and Fisheries Division

Enclosure

ec: Department of Fish and Wildlife

Garry Kelley, Acting Deputy Director
Wildlife and Fisheries Division
[REDACTED]

Dr. Debra M. Shier
San Diego Zoo Institute for Conservation Research
September 3, 2021
Page 4

Erin Chappell
Wildlife Diversity Program Manager
Wildlife Branch
[REDACTED]

Daniel Applebee
Conservation and Recovery Unit Supervisor
Wildlife Branch
[REDACTED]

Scott Osborn
Senior Environmental Scientist (Specialist)
Wildlife Branch
[REDACTED]

APPENDIX E - External Peer Review Comments

Review of: “A status review of the San Bernardino kangaroo rat (*Dipodomys merriami parvus*) in California.”

By: Douglas A. Kelt, PhD, Professor of Wildlife Ecology, University of California Davis.

I am submitting my comments in two parts. Here I provide summary comments on the status review as a whole. Separately, I will provide line-specific comments in list form, as requested. I divide these line-specific comments into two parts – those that have no bearing on the science of this report (e.g., editorial issues such as typographical errors), and those that pertain to matters of science or interpretation.

While I have no personal experience with the San Bernardino kangaroo rat (SBKR) and so may not know important nuances of this taxon’s ecology, the status review for the SBKR appears to provide a clear and compelling synthesis of the biology of, and conservation challenges faced by, this taxon. I have no doubt that the proposal to list this as endangered is warranted. To do otherwise would be to ignore a history of demographic and habitat declines and a contemporary environment that comprises clear and present danger to the survival of this entity.

Unfortunately, the current status of this taxon appears woefully in peril. Key threats are the standard perils of the day, and include loss, degradation, and fragmentation of habitat; resulting small population size, aggravated further by isolation of subpopulations; limited genetic variation, aggravated by isolation of subpopulations; various water management projects and needs, including water diversion, damming, impoundment, recharge, flood management, and production of electricity; sundry biotic influences, separated here as (a) disease, pathogens, and parasites, and (b) introduced species such as domestic cats and dogs, non-native rats and mice, and invasive plants that alter habitat structure and desirability; and climate change. While these are the same threats, by and large, impacting wild species in many parts of the globe, the limited and fragmented geographic range of SBKR makes these much more tractable than they often might be. Hence, it is not difficult to envision management efforts to reduce or eliminate many of these threats, but the economic and social impacts of these may make them challenging.

It is disconcerting that no past efforts appear to have been successful in staunching the loss and degradation of habitat needed by this species. On pp. 52-53 of this report, the author(s) outline three conservation strategies that have been employed (relocation, habitat restoration, mitigation credits) and seemingly optimistically note that (p. 52:34-35) “The effectiveness of these three strategies in conserving or recovering the San Bernardino kangaroo rat is uncertain.” Indeed, relocation (p. 53:1) “has not been consistently monitored”, monitoring of the success of restoration (p. 53:4) “has also not been typically required”, and mitigation (p. 53:7-8) “does not actually make up for the loss of the impacted habitat, which means there is a net loss of habitat”. In short, nothing we have done to date has halted the seemingly inexorable decline of this taxon, which now numbers in the low thousands, leaving it highly susceptible to stochastic influences, ranging from demographic (random loss of subpopulations) to environmental (floods, drought, climate change).

Given these impacts, CDFW argues that “essential habitat” for SBKR should include (1) all currently occupied land, (2) “suitable but apparently unoccupied habitat near the currently occupied habitat” (p. 47:11-12), and (3) “areas within the historical range that are not currently suitable habitat, but which are near or adjacent to currently suitable or occupied habitat and could be restored to suitability within

the near term” (p. 47:14-16). These conclusions are “based on the large reduction in available habitat for the species, its fragmented and degraded nature, and the low population numbers supported by the small amount of remaining habitat” (p. 47:17, p. 48:1), and appear incontrovertible to this reviewer.

Accepting the proposed listing, the status review outlines nine explicit management recommendations, most of which include numerous specific actions. Seven of the nine are drawn from the USFWS Recovery Implementation Strategy (draft of 15 November 2019). Two additional recommendations are provided by CDFW (#1, a conservation strategy and recovery plan; and #8, concerning fur loss), and the remaining 7 are re-ordered here. USFWS presented their 7 recommendations as “Priority 1” or “Priority 2”, leading me to wonder if CDFW has re-ordered these to imply a descending order of prioritization. If so, this might be stated explicitly. For that matter, if CDFW considers any of these to fall above v. below a threshold of particular note (as did USFWS), this also might warrant comment. In any case, these recommendations clearly target actions intended to stabilize (sub)populations of this species; promote connectivity between existing subpopulations; consider augmentation (translocation, re-establishment, captive breeding) to increase abundance as well as distribution; conserve, restore, and protect key habitat; clarify key management needs and support research to inform these; develop protocols for range-wide surveying; better understand causes underlying fur loss in some individuals; and promote outreach and education to garner public support and reduce anthropogenic threats, including ORVs and other recreational activities. All data available for SBKR indicate that each point listed is both necessary and appropriate to better understand the management/conservation needs of this species.

In summary, this status survey provides biological background to support an argument that SBKR is at risk of imminent extinction; it provides background to establish key threats and key management needs to alter the current negative trajectory for this taxon; and it provides explicit management recommendations that address known threats and that likely provide the only means of reversing historic losses to habitat and demographic security for this taxon.

In closing, it seems to be worth noting that SBKR is the most distinctive of all subspecies of Merriam’s kangaroo rat, is fully allopatric from other subspecies, and may warrant recognition as a distinct species; this is noted by William Lidicker in his monograph on variation in Merriam’s kangaroo rat (p. 4, lines 11-13), but I hope this also will be noted in the executive summary. I do find it surprising that such a statement was published 60 years ago, but to date it appears that nobody has “taken the bait” to assess this question. If SBKR has diverged sufficient to be recognized as a distinct species, then the potential loss in evolutionary diversity would be that much more serious.

I hope that these comments and those in the spreadsheet are helpful to CDFW as they complete this status review.

Douglas A. Kelt Comments on Draft SBKR Status Review Report

| Order | Editorial v. Scientific (mostly) | Page | Line | Comment | Suggested edit, if any |
|-------|----------------------------------|------|----------------|---|--|
| 1 | Editorial | 4 | 1 | Extra period. | Remove period after scientific name in parentheses. |
| 2 | Editorial | 4 | 5 | Burt & Grosseheider has been revised by Fiona Reid (2006). | This book has been revised by Fiona Reid (2006). Alternatively, cite Hall's monographic 2-volume Mammals of North America (also dated - 1981 - but the most recent solid treatise continent-wide). |
| 3 | Editorial | 5 | 3 | Jameson & Peeters was updated in 2004. | Jameson, E. W., Jr., & H. J. Peeters. 2004. Mammals of California, revised ed. University of California Press, Berkeley, CA. |
| 4 | Editorial | 7 | 11 | Typo: "souths" should be "south". | Correct typo. |
| 5 | Editorial | 9 | 14 and onwards | Are these quoted directly from USFWS draft 2019a? If so, consider quotation marks for clarity. | Insert quotation marks if appropriate. |
| 6 | Editorial | 13 | 1 | Typo: "nucleotides sequences" should be "nucleotide sequences". | Delete "s". |
| 7 | Editorial | 22 | 18 | Should "southwest" be capitalized? | I think of the American Southwest as a geographical entity, hence a proper noun; capitalize unless CDFW sees this otherwise. |
| 8 | Editorial | 32 | 22 | Parentheses are not closed. | Insert closing parenthesis. |
| 9 | Editorial | 32 | 23 | Should this read "Department of Conservation mines online"? | Insert "online" if needed. |
| 10 | Editorial | 32 | 23 | Since this citation is in the Lit Cit as "California Department of Conservation", this parenthetical citation is not very useful; as noted separately, this would be more useful to readers if the Lit Cit is given as "DOC (California Department of Conservation). 2021." Also, should this be CDOC rather than DOC? doing so would make this parallel to CDFW, for example. Finally, is the word "mines" intended here? I believe this refers to CDOC's "Mines Online" site but the latter word is not presented here. | I recommend using "DOC" (or CDOC) at the start of the Lit Cit citation, and alphabetizing accordingly; alternatively, simply remove the parenthetical here. Either approach would make this more readily tracked by readers. |
| 11 | Editorial | 35 | 22 | Where you write "effects can work in concert with each other to seriously threaten small populations", consider the more brief "effects may interact synergistically to seriously threaten small populations"? Semantics - both make the same point. | Wordsmithing suggestion. |
| 12 | Editorial | 37 | 18 onwards | Is this a direct quote from the SD Zoo team? If so, quotation marks would make this more transparent. | Insert quotation marks if appropriate. |
| 13 | Editorial | 39 | 29 | It took me a while to find "San Bernardino Co. 2021" in the Lit Cit, as this is given there as "County of San Bernardino (San Bernardino Co.). 2021". I recommend that all Lit Cit be presented and alphabetized by the names given in text. | Standardize Lit Cit such that items are presented - and alphabetized - by the terms used in the text of the document. |
| 14 | Editorial | 45 | 24 | Typo: "Pol eta al." should read "Pol et al." | Correct typo. |
| 15 | Editorial | 52 | 29 - 33 | Specifically, line 31: should the comma in "other sites, habitat" be a semicolon to be consistent with sentence structure? | Change comma to semicolon? |
| 16 | Editorial | 69 | 2 | Scientific name is not in italics. | Italics needed. |
| 17 | Editorial | 69 | 4 (et seq) | Journal issue numbers are provided inconsistently; of course, these are not needed if journal issues are numbered sequentially (as most scientific journals are). | Standardize presentation of issue number across journals. |
| 18 | Editorial | 69 | 19 - 21 | Bureau of Land Management (BLM) is alphabetized by the parenthetical BLM rather than by "Bureau . . ." which puts this out of alphabetical order. | The parenthetical is not helpful here; however, this is cited in text as "BLM 1994" (p. 52, line 9) and so would seem best presented in the Lit Cit as "BLM (Bureau of Land Management). 1994". Indeed, I recommend this more reader-friendly approach to all such abbreviations (DOC, CDFW, USFWS, WRCRA, etc.) |
| 19 | Editorial | 70 | 1 - 3 | As noted in text, Burt & Grosseheider has been updated; current edition is by Fiona Reid. | Consider citing Reid (2006). |
| 20 | Editorial | 70 | 11 | Is there a reason why this is just "DOC" rather than "CDOC"? | I would suggest "CDOC" for consistency with "CDFW" and other acronyms. |
| 21 | Editorial | 71 | 17 | Title incorrect. | Change "metanalysis" to "meta-analysis" as in original. |
| 22 | Editorial | 71 | 23 | Typo: "Experimental" should be "Experimental". | Correct typo. |

Douglas A. Kelt Comments on Draft SBKR Status Review Report

| Order | Editorial v. Scientific (mostly) | Page | Line | Comment | Suggested edit, if any |
|-------|----------------------------------|------|---------|--|--|
| 23 | Editorial | 72 | 18 - 21 | As noted in text, "ICF" is never defined; more importantly, these citations do not provide sufficient information to find these (online or otherwise). I did track these down and have two suggestions. | I would recommend adding a URL and a date you accessed this. Hence, for example: "ICF. 2019. High-Flow Study of Seven Oaks Dam: Phase 1 Final Report. March 2019. San Diego, California. Available at https://www.sbrmwd.com/reports/-/folder-1103 (accessed 10 Sept. 2021)." |
| 24 | Editorial | 73 | 15 | Type: "Parallel" should be "Parallel". | Correct typo. |
| 25 | Editorial | 73 | 20 | Type: "Monte desert" should be "Monte Desert". | Correct typo. |
| 26 | Editorial | 74 | 16 - 17 | Note that Sawyer et al. 2009 is a second edition. Also, this information is on pp. 573-575 of this book - worth noting here? | Revise citation to indicate second edition. |
| 27 | Editorial | 74 | 26 | Type: Remove comma in "kangaroo rat, (<i>Dipodomys</i> . . ." | Remove comma. |
| 28 | Editorial | 76 | 6 | Type: "VertNet" not "VerNet" (this is correct elsewhere throughout the document). | Correct typo. |
| 29 | Scientific | 3 | 28 | There are 20 species of <i>Dipodomys</i> , per ASM Mammal Diversity Database (https://www.mammaldiversity.org/index.html) | Change to 20 species, cite ASM MDD, which has assumed the role of Wilson and Reeder as the best current database on mammal diversity. Alternatively, D. J. Hafner's chapter on Heteromyidae in the Handbook of the Mammals of the World (vol. 6) also lists 20 species. |
| 30 | Scientific | 4 | 2 | You list 5 desert regions, but the Colorado Desert is generally regarded as a region OF the Sonoran Desert. This is somewhat semantic, so a matter of choice. | Consider removing Colorado from this list, OR simply insert in parentheses after Sonoran, e.g., "Sonoran (Incl. Colorado) . . ." |
| 31 | Scientific | 4 | 10 | When you note that <i>parvus</i> is disjunct, consider citing Lidicker's monograph, as this is the only place I know of with a map (Fig. 16, p. 164) that actually indicates that this is geographically separate from other subspecies. | Consider inserting citation to Lidicker (1960) after "disjunct from other <i>D. merriami</i> subspecies". |
| 32 | Scientific | 4 | 15 | McKernan 1997 is not generally available; in any case, wouldn't one of the taxonomic treatises for this serve better? | Consider citing Lidicker's UCPC (67(2)) or Grinnell's "Geographical study of the kangaroo rats of California" (UCPZ 24) for physical descriptions of SBKR. |
| 33 | Scientific | 5 | 3 | Ingles' "Mammals of the Pacific States" is the other general treatment for the region. Although dated at this point, it provides quite a bit of natural history information that is not available in Jameson & Peeters or in Hall. | Consider adding Ingles's "Mammals of the Pacific States" in this list of field guides here? The citation is: Ingles, L. G. (1965). Mammals of the Pacific States: California, Oregon, and Washington. Stanford University Press, Stanford, California. |
| 34 | Scientific | 6 | 2 | SKR and SBKR are very different species, making the former a poor comparison. Three other papers come to mind: Brown & Heske 1990 (Oikos 59:290-302; https://doi.org/10.2307/3545139) present temporal dynamics for three species of dipos through 11 years. Heske, Brown, & Mistry 1994 (Ecology 75:438-444; https://doi.org/10.2307/1939547) add a couple of years but combining three k-rat species. Germano & Saslaw (2017, JM 98(6):1615-1626; https://doi.org/10.1093/jmammal/gyx140) demonstrate temporal fluctuation for three species of k-rat in the southern Central Valley. | Consider replacing (or supplementing) Price & Endo citation with citation to Germano for CA populations (3 species), also Brown & Heske, possibly Heske et al., for NM populations of <i>D. merriami</i> . |
| 35 | Scientific | 6 | 12 | Most k-rats are pretty asocial, however. A somewhat dated reference is T. Jones' chapter (Social systems of heteromyid rodents) in the ASM Heteromyidae volume. Also, Vasquez & Álvarez-Castañeda (2011, Mammalian Biology 76(5):577-582) show that <i>D. merriami insularis</i> rarely share burrows. Shier & Randall (2004, JM 85(5):1002-1008) note that sociality in k-rats may be inversely related to body size. If so, then SBKR (on the small end of the k-rat body size spectrum) might be more social as well. However, social does not necessarily equate with burrow sharing, which tends to be uncommon (Stephen's k-rat may be an exception; Brock and Kelt 2004, JM 85(1):51-57, DOI: 10.1644/1545-1542(2004)085<0051:casoss>2.0.co;2). | Consider citing some of the authors listed, possibly supplement current verbiage. |
| 36 | Scientific | 6 | 35 | Would Lidicker's (1960) monograph on <i>D. merriami</i> (UCPZ 67(2)) be better than McKernan 1997 as a reference for the historic distribution of SBKR? | Consider replacing citation to McKernan 1997 with one to Lidicker 1960 (note that I have not seen McKernan). |

Douglas A. Kelt Comments on Draft SBKR Status Review Report

| Order | Editorial v. Scientific (mostly) | Page | Line | Comment | Suggested edit, if any |
|-------|----------------------------------|------|---------|--|--|
| 37 | Scientific | 12 | 5 & 6 | Circular logic? Hendricks et al. "also inform several recommendations presented in Hendricks et al.?"? Do you mean merely to note that Hendricks et al. provide several recommendations to improve the conservation status of this species? As stated, it appears that Shier et al. (subsequently published in Hendricks et al.) examined pop genetics of SBKR; they also inform several recommendations presented in Hendricks et al. | Rewrite? |
| 38 | Scientific | 12 | 16 | The reason that mtDNA is more conservative than nDNA is that it is maternally inherited so does not recombine regularly, as do nuclear genomes. On the other hand, mtDNA has a higher mutation rate than nDNA, as I understand. Note that Hendricks (p. 821, middle of left column) highlight that mtDNA is less variable within subpopulations, yet MORE variable at the species level. In any case, you refer to maternal lineages below (line 25), making me wonder if you should introduce this here solely maternally inherited; hence, less recombination during meiosis (in females only) | Clarify maternal inheritance, if only in preparation for subsequent mention of this. |
| 39 | Scientific | 20 | 4 - 26 | These two paragraphs provide useful information on how SBKR uses different parts of their habitat between flood events. There are no citations, however; is there literature to cite in support of these observations? | Cite literature if available. |
| 40 | Scientific | 21 | 6 - 8 | Merriam's k-rats also larder-ward, which is very important to their long-term survival in arid times. Jenkins et al. (cited here) does discuss larder-hoarding in addition to scatter-hoarding. There has been very interesting work on the pilferage of scatter hoards (which tend to be quite shallow) by pocket mice (e.g., Lisa Leaver at a site near Palm Desert). | The mention of scatter-hoarding but lack of any reference to larder-hearding merely risks leaving readers questioning whether the authors of this report know that k-rats employ both. Hence, SOME mention might be useful. It terms of their impact on dispersal (and plant establishment) and potential for pilferage by pocket mice, scatter-hoards likely are more important. Possible verbiage: "Kangaroo rats store seeds in caches which may be located in their burrow systems (these are larger caches, termed larders) or in shallow pits on the surface of the soil (smaller and scattered about; hence "scatter hoards"; e.g., Jenkins et al. 1995)." Then onwards with "Heteromyids use two methods . . .". |
| 41 | Scientific | 21 | 11 - 20 | One additional point that might warrant attention is that seeds cached under ground can adsorb moisture, further benefiting the water balance of this species. | |
| 42 | Scientific | 21 | 15 | Vander Wall 1993 is not the best citation for the point made here. Schmidt Nielsen's (1964) little book "Desert Animals" discusses this, as do all animal physiology text books. | Consider citing Schmidt-Nielsen, K. 1964. Desert animals: physiological problems of heat and water. Clarendon Press, Oxford. |
| 43 | Scientific | 21 | 15 | This is a trivial comment: the "external" cheek pouches of a k-rat are external only in relation to the oral cavity (as such, distinct from the internal cheek pouches of chipmunks and others). Vander Wall (1993), as cited here, makes the very good point that fur-lining reduces water loss. The KEY benefit of these, of course, is that it allows rapid collection of seeds while on the surface, and efficient transport to burrows for storage (and moisture adsorption). | No change needed. |
| 44 | Scientific | 21 | 27 - 28 | This sentence ("When seeking and processing food . . .") was one of very few that struck me as sufficiently self-evident and valid for all animal species, that I don't know that this actually contributes much to the discussion. | |
| 45 | Scientific | 21 | 30 | Why limit this to semi-fossorial rodents? | Probably no change needed. |

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| 46 | Scientific | 21 | 32 | The debate over the role of competition (most notably, versus that of predation) raged for some time. I believe that some of the final salvos in this were in two papers by Brown and colleagues: Brown, Fox, & Kelt 2000 (Am Nat 156(3):314-321; https://doi.org/10.1086/303385) and Brown, Kelt, & Fox (Am Nat 160(6):L815-818; https://doi.org/10.1086/343882). | Probably no change needed; the cited reference is widely known, but it was fairly early in a charged "discussion" on the application of "metadata" to understanding assembly and the nature of competition among arid-zone rodents in North America. |
| 47 | Scientific | 22 | 11 - 15 | Merriam's k-rat also co-occur with woodrats (<i>Neotoma</i>), which are much larger; however, the diet of the latter is largely folivorous and hence not competitive with k-rats. I point this out primarily because as written this could be interpreted to indicate that MKR occurs ONLY with the taxa listed. | Add brief (almost fleeting) reference to <i>Neotoma</i> to provide more comprehensive context for the competitive environment. |
| 48 | Scientific | 22 | 37 | I presume that "these species" refers solely to <i>Rattus</i> and <i>Mus</i> ? Consider making this more explicit, as it could also be referring to <i>Otospermophilus</i> from the sentence preceding the <i>Rattus</i> / <i>Mus</i> comment. | |
| 49 | Scientific | 22 | 29 - 30 | Are you implying that pocket mice here are competitively dominant to SBKR? They certainly will steal from scatter hoards (as demonstrated by Lisa Leaver in So Cal, others elsewhere), but typically are behaviorally subordinate; however, I don't know how this would play out at these sites and with this subspecies. | |
| 50 | Scientific | 22 | 33 - 35 | This seems to imply that Cal gnd squirrels would be limited to areas "disturbed by human activity." Is that known to be the case here? Can CGS not impact SBKR in sites that are not disturbed by human activity? | |
| 51 | Scientific | 23 | 3 - 6 | Here you note that competition (for food, cover) is "elimited from further consideration due to a lack of evidence that competition alone, absent the effects of habitat loss and fragmentation, may pose a threat . . ." (my emphasis). But this seems to discount the very real possibility that competition <u>in combination with</u> other factors such as habitat loss and fragmentation, may be quite important to local survival. Since we know that habitat loss and fragmentation are two of the dominant threats to this species, if this leads to a shift in assemblage composition (e.g., more Cal. ground squirrels or worse, more <i>Rattus</i> , perhaps change in plant species lead to different food resources, reduced successional change perhaps favoring <i>Dulzura</i> k-rat) then is there evidence that synergistic effects may occur. In short, I worry about putting competition aside merely because in the absence of other factors it has not been shown to be a threat. | Perhaps leave competition in as a potential threat in the face of other stressors on this ecosystem, and perhaps call for further research to quantify the extent of potential synergies. |
| 52 | Scientific | 23 | 19 | There is a large literature showing how k-rats (and pocket mice) are lunar-phobic, and how nocturnal lighting influences foraging decisions. Oodles of papers by Burt Kotler and friends; a recent synthesis by Laura Prugh summarizes nicely (i. Animal Ecol 83:504-514; http://dx.doi.org/10.1111/1365-2656.12148). I also note below (p. 32, line 9) that some recent work has targeted <i>D. merriami</i> explicitly; the cited paper (Shier et al. 2020) was on the much larger <i>D. stephensi</i>). | Consider integrating citations that address lunarphobia in <i>D. merriami</i> (e.g., three cited in comments for p. 32, line 9). |
| 53 | Scientific | 32 | 9 | As noted above, much work has been conducted on the effect of nocturnal lighting on Merriam's k-rat. See recent papers by Lisa Leaver (Behav Ecol. 15(5):729-734, DOI:10.1093/behcol/ahr070; Behav. Proc. 64(1):71-75, DOI 10.1016/S0376-6357(03)00108-6) and Bill Longland (Am Midl Nat 132(1):182-90, DOI: 10.2307/2426203). Leaver studied near Palm Desert; Longland in Nevada. | Integrate additional citations if you wish. |
| 54 | Scientific | 32 | 12 - 13 | You write: "compared to natural nighttime light levels" - the impact of this would differ greatly under a full vs. new moon. Do you know what lunar phase was used in this study? | |

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| 55 | Scientific | 33 | 6 | Shier et al. 2012 (Biol. Conserv. 150:53-58; DOI: 10.1016/j.biocon.2012.03.007) also studied the effect of traffic noise on SKR. | |
| 56 | Scientific | 34 | 13 - 19 | And given the inherent variability of this system in terms of rainfall, which drives food production, it seems safe to assume that in drought years the population size will drop to the lower end of these projections, if not lower. That is, low density overall, and reduced occurrence at more marginal sites. Long-term management needs to plan for the possibility of multiple years of such conditions. | I wonder if emphasizing here, and moreso in the section on Climate Change, that climate change is predicted to lead to extended drought conditions here, such that managers should assume poor conditions in most years. We cannot manage SBKR on the rosy expectations that water managers employed in the early years of Colorado River water allocations! |
| 57 | Scientific | 34 | 20 - 21 | I presume there is no evidence that "better" sites might occasionally be linked by metapopulation dynamics? I am sure that the three main sites are not, but I do hope for some such connection among subsites. | |
| 58 | Scientific | 34 | 27 | I believe this is stating that "the goal" of managers should be to have several thousand individuals? I would consider this a basement target rather than a goal. Moreover, as noted just above, this needs to be a goal during extended "bad" times such as long droughts. Otherwise, brilliant planning during good times will be "rewarded" with extirpation or extinction during bad times. | |
| 59 | Scientific | 34 | 32 | Since you defined demographic stochasticity in the first paragraph of this section, you probably could say here, instead, that "This is the intrinsic variation that leads to demographic stochasticity, and while this tends to average out in large populations, it has a much greater proportional effect on the rate of growth or decline in small populations..." (or some such thing). | See "Comment" cell. |
| 60 | Scientific | 35 | 2 - 3 | Unequal numbers of males and females also affects Ne. Worth noting? | |
| 61 | Scientific | 35 | 31 - 32 | As I think of it, the accumulation and fixation of detrimental alleles is one possible consequence or result of genetic drift, but is not genetic drift itself. Frankham et al. (2002; <i>Introduction to conservation genetics</i> , p. 537) define g.d. as "Changes in the genetic composition of a population due to random sampling in small populations. Results in loss of genetic diversity, random changes in allele frequencies, and diversification among replicate populations." | Consider restating as "... genetic drift, the random change in allele frequencies within a population over time, which may lead to the accumulation..." |
| 62 | Scientific | 36 | 13 | This "high elevation" summary misses some key nuance of this issue, however. This comes from a 1987 publication that presents computer simulations. Primack provides a nice illustration of this, but note that with only one immigrant per generation, the simulated population from about 55 generations onwards remains below 90% of original heterozygosity. With 2 immigrants/generation this stabilizes at about 90%, and with 5 immigrants/generation we still end up (at 100 simulated generations) with a ca. 5% loss. Primack notes (6 th ed, p. 254) that "if even 1 or 2 immigrants arrive each generation in an isolated population of about 100 individuals, the impact of genetic drift will be greatly reduced." Four to 10 immigrants/generation leads to "negligible" impacts (again, based on simulation). | I would revise the text to add nuance. Perhaps "Computer simulations have suggested that as few as 1-2 immigrants per generation in a population of about 100 individuals can greatly reduce the impact of genetic drift; with 4 to 10 immigrants per generation, the effects of genetic drift may be negligible (Lacy et al. 1987; Primack xxx)." Note that Primack is now in it's 6th edition. Lacy is: Lacy, R. C. 1987. Loss of genetic diversity from managed populations: interacting effects of drift, mutation, immigration, selection, and population subdivision. <i>Conservation Biology</i> 1(2):143-158. You may wish to cite Primack only, which is fine with me. |
| 63 | Scientific | 36 | 14 | When you state that "habitat fragmentation can seriously increase the genetic risks..." I think you mean that this risks the loss of genetic diversity. I wonder if stating this more explicitly might make this more clear? | Wordsmithing suggestion. |

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| 64 | Scientific | 36 | 18 - 19 | I think that you intend to note that small population size alone is not necessarily predictive of <u>reduced</u> viability. Every population has some viability, be that low or high; clearly, small N likely reduces viability, but no set "size" by itself is predictive, per se. Smaller is more likely to be associated with lower viability; of course, you follow this by noting (rightly) that this can be mitigated by good planning. | Would inserting "reduced" clarify your intent? |
| 65 | Scientific | 37 | 9 - 11 | The fact that these populations were connected is a given. What the genetic evidence indicates is that their subsequent isolation is relatively recent. | Restate along the lines of: "The genetic evidence indicates the three extant subpopulations became isolated in the relatively recent past . . ." |
| 66 | Scientific | 38 | 1 | Fragmented populations are not processes. Do you (or did the SD Zoo team) mean to refer to the processes that result in fragmented populations? | Wordsmithing may be warranted. |
| 67 | Scientific | 39 | 7 & 10 | Use of terms such as "optimal" and "ideal" assume that we actually know what this species would select given a broad range of available habitats. We certainly know where they occur, but whether this is optimal or ideal is somewhat inferential. | Wordsmithing; consider "highly suitable" or other alternate phraseology? |
| 68 | Scientific | 44 | 19 - 21 | This sentence ("In the case of . . .) reads as alarmist and seems to extend beyond any available data. What "is possible" could be any of a suite of things. If you leave this in, consider restructuring along the lines of "At the extreme, the loss of genetic diversity in SBKR might limit the capacity of some remnant populations to resist certain pathogens or toxins." | |
| 69 | Scientific | 53 | 7 - 8 | This text, and the preceding paragraph, seem to indicate that three of three strategies to help this species lack any mandatory follow-up, and all three appear to have resulted in a loss to the range or to habitat quality for this taxon. Is the unfortunate message that efforts to date have not been pursued with diligence, or that statutory requirements are insufficient? (or both?) | |
| 70 | Scientific | 63 | 1 | If "the Department expects" various efforts, does this equate to "mandates" or to any legal consequences? | If there are consequences to ignoring CDFW in this, perhaps state this more clearly. If not, perhaps note that as well? |
| 71 | Scientific | 63 | 28 | Of the 9 Mgmt Recommendations provided, 7 are taken verbatim from the USFWS in their Recovery Implementation Strategy (Draft), but presented here in a different order. To this, CDFW has added #1 (develop a conservation strategy and recovery plan) and #8 (investigate fur loss at Santa Ana River wash and elsewhere if observed). I note that all 5 USFWS "Priority 1" items are at the beginning of the CDFW listing, and their 2 "Priority 2" items are near the end of the CDFW listing. This leads me to ask if CDFW has presented their 9 recommendations in any priority order (if so, you might state this in the opening para to this section). Such a priority ranking seems logical. If so, do you envision these in a linear descending hierarchy, or are there any thresholds that warrant notice, as in the two-tier prioritization presented in the Draft RIS? | See "Comment" cell. |
| 72 | Scientific | 73 | 12 - 14 | McKernan 1997 does not seem to be available online. | If possible, please indicate where this might be available to interested public (e.g. URL). |
| 73 | Scientific | 73 | 30 - 31 | Why cite both Primack 1993 (here) and 2010 (top of subsequent page)? Does the latter not cover materials for which you reference the former? Note that the latest (6th) edition was published in 2014. | |

[REDACTED]@Wildlife

From: Debra Shier <[REDACTED]>
Sent: Monday, October 4, 2021 6:02 PM
To: Osborn, Scott@Wildlife
Cc: [REDACTED]
Subject: RE: External Review for San Bernardino kangaroo rat CESA Status Review report
Attachments: Chock et al habitat suitability SBKR.pdf; SBKR 2019 comprehensive annual report final.docx; Hendricks 2020 supplementary tables 10592_2020_1289_MOESM1_ESM.xlsx; SBKR Status Review_External Review Comments dms.xlsx

WARNING: This message is from an external source. Verify the sender and exercise caution when clicking links or opening attachments.

Dear Scott,

Thank you for the opportunity to review your SBKR CESA status review report. It is extremely comprehensive and well written. I have attached here a list of comments and suggested edits as requested as well as a few reports and papers that you may not have had available to you that I reference in my comments.

Please let me know if you have any questions.

All my best,
Debra

Debra M. Shier, Ph.D.
Brown Endowed Associate Director of Recovery Ecology
Co-lead Southwest Hub
Conservation Science and Wildlife Health



P.O. Box 120551
San Diego, CA 92112-0551

[REDACTED]

From: Osborn, Scott@Wildlife <[REDACTED]>
Sent: Friday, September 3, 2021 12:09 PM
To: Debra Shier <[REDACTED]>
Cc: [REDACTED]
Subject: External Review for San Bernardino kangaroo rat CESA Status Review report

Dear Debra,

The Department's San Bernardino Kangaroo Rat Status Review report is now ready for external expert review. I am hopeful that you can still fit this request into your schedule, despite getting it to you later than we planned. We are requesting your comments back on or before October 4, 2021. The document has 60+ pages of text and a few simple figures and tables. It is written for an educated layperson at the college undergraduate level.

In addition to the draft report itself, I've attached a letter from our Branch Chief requesting your help with this project. The letter includes additional background, including the importance of the external review step in the CESA listing process.

We ask that you use the attached spreadsheet to record your comments and any suggested changes in a page-line list. Please do NOT use Track Changes to make comments or edits. Because your comments will become part of the public record, documenting your comments in list form will help ensure accessibility for all members of the public.

If you have any questions or concerns about this request or the process, please don't hesitate to contact me. Thanks again for your willingness to help with this important task!

Scott

=====
Scott D. Osborn, Ph.D., CWB® CDFW Wildlife Diversity Program

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Help Endangered Species at Tax Time**



| Page | Line | Comment | Suggested edit, if any |
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| 2 | 15 | outside agencies know the Department as California Department of Fish and Wildlife | add "California" in front of Department of Fish and Wildlife |
| 4 | 1 | remove . after <i>Dipodomys merriami</i> | |
| 4 | 7 | would be helpful to add common names | |
| 5 | 18-19 | Researchers and regional agency staff refer to the 3 remaining populations as populations Lytle Cajon Creek (LCC), Santa Ana River (SAR) and San Jacinto River (SJR). I wouldn't say that the Cajon Wash was a separate population from LCC as it wasn't likely isolated. Since this is the first mention of populations, you may want to define them here or since range and distribution come in the next section, just say Santa Ana River and Cajon Wash and remove the word population here. | |
| 6 | 14 | Nothing is discussed with regard to <i>D. merriami</i> sociality but this would provide more context to how the species use space. MKR is generally solitary, but appear to be more social than other kangaroo rat species. And, while males and females have similar home range sizes in the Behrends study, home range overlap varies by sex. Like other small mammals, MKR females tend to maintain exclusive territories that do not overlap with other females, while males tend to exhibit some degree of home range overlap with neighbor females and other males, especially during the breeding season (O'Farrell 1980, Behrends 1986a,b). MKR has been shown to maintain stable home ranges over several seasons though they may shift centers of activity within familiar areas (Behrends et al. 1986a; Zeng and Brown 1987). This long-term occupancy appears to allow MKR to establish stable relationships with neighbors and females have been shown to mate with neighboring males (Randall 1987, 1989). During observations from the field and in paired encounters, MKR tolerated neighbors and rarely exhibited repeated aggressive encounters (Randall 1989). However, they rarely approach the core of neighboring conspecific territories (Behrends et al. 1986) and unfamiliar MKR exhibit mutual avoidance (Randall 1989). | |
| 8 | 12 | <i>D. merriami</i> generally do not defend their home ranges sufficiently to be considered highly territorial, and more often cache seeds in scattered pockets that were moved frequently (Leaver and Daly 2001, Price et al. 2000). Observations of aggressive interactions suggest that MKR may maintain territories around their day burrow and core activity areas. Consequently, individuals may behave aggressively around burrows, but be relatively tolerant of conspecifics in less densely used parts of the home range. | |
| 9 | 15 | you use the term "subpopulation" to refer to the LCC, SAR, and SIR, but USFWS and researchers use the term "population", if this is intentional, you may want to indicate how you are defining population and subpopulation. If you decide to change it to population, it will require a global replace throughout the doc. In our 2020 paper, we refer to LCC/SAR and SIR as populations and use the terms "site" and "subpopulations" interchangeably | The population with the largest distribution of San Bernardino kangaroo rats... Or The largest [distribution] remaining population... |
| 9 | 34 | The size designation appears to be driven by the species distribution in the area not the abundance. I understand that this is an excerpt from the USFWS draft Species Status Assessment. But, it is not accurate because we don't have abundance estimates. This is relevant b/c the effective population size indicate a smaller number of reproductive individuals in SAR compared to LCC | Lytle and Cajon Creeks appear to contain the population with the second largest distribution of the ... or if you don't want to change the USFWS language, "Lytle and Cajon Creeks appear to contain the second largest [distribution] population of the ..." |
| 10 | 9 | same issue as on line 15. Lytle and Cajon Creeks appear to contain the second largest population as measured by distribution not abundance | |
| 13 | 15 | In the case of the San Jacinto population, the distribution is the smallest and the Ne is the smallest, so it may be ok to leave this one as is. | "which suggests the divergence in haplotype lineages occurred prior to isolation..." |
| 15 | 7,8 | This is correct. But, it remains possible that individual mutations in haplotypes could have arisen after population isolation thus it's best to use the term haplotype lineage or major lineages here. | Higher number mean, increased evolutionary potential, or in other words, there are more versions of the various genes on which natural selection to work in a population. |
| 15 | lines 20-25 | a little awkward | Revise title for FIS to say: Population inbreeding coefficient (FIS) and revise the text to read: "This metric compares the observed heterozygosity value with the expected heterozygosity (HE), a theoretical value for a sampled population that assumes random breeding and no selective pressure. Population inbreeding coefficients for the three subpopulations range from 0.042 in Lytle/Cajon Creek to 0.072 in San Jacinto River, which are considered "low but significant," suggesting that inbreeding is likely occurring (Shier et al. 2018). |
| 15 | add text after lines 25 | In our 2018 report, we estimated inbreeding due to nonrandom mating using FIS, which is the deficiency of heterozygotes observed relative to the level expected with random mating. This is shown in Table 3. In Hendricks et al 2020, we dug deeper into inbreeding and estimated inbreeding at the individual level (F) to calculate the probability that an individual will inherit two identical alleles from a common ancestor at a locus. They are complementary measures of inbreeding and both provide support for inbreeding in SBKR. In fact, based on individual inbreeding coefficients, our results indicate that roughly a quarter of individuals sampled in each population had elevated F. | Individual inbreeding coefficient (F) is a metric that quantifies the probability that an individual will inherit two identical alleles from a common ancestor. Individual inbreeding coefficients show that roughly a quarter of individuals sampled in each population had elevated F, providing further support that inbreeding is an issue for the species. |

| Page | Line | Comment | Suggested edit, if any |
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| 15 | lines 26-29 | while effective population size can be defined this way when estimated, with demographic information or pedigree, because we used linkage disequilibrium to estimate N_e , a simpler definition that doesn't include number of breeding females is more accurate | The effective population size of a population represents the number of breeders in recent generations. |
| 15 | Line 30 | b/c N_e is estimated using linkage disequilibrium, this should be changed from actual number of adult females to "breeding adults" | |
| 16 | 4 | awk | ..."has limited capacity to respond to stressors such as ..." |
| 17 | 1 | Table 2 is also in the supplementary material (online only) of the Hendricks ms. Supplementary Table S4. You could add a cite to both Shier, 2018 and Hendricks 2020. I will share the online info with you via email. | |
| 19 | Lines 10-22 | This paragraph is based on our 2019 report, but similar to the genetics data, we published this work in 2020 under Chock et al 2020. I will send it to you. I would revise this paragraph as suggested. | Other literature highlights the importance of active hydrologic conditions (with periodic flood events within the floodplain) to sort soils, disturb maturing vegetation, and maintain the relatively open vegetation preferred by the kangaroo rat (McKernan 1997, Smith et al. 1980). Based on a species distribution modeling at the landscape level using occurrence data from 2002 to 2018, (Shier et al. 2019, Chock et al 2020), the presence of San Bernardino kangaroo rat is most strongly associated with alluvial scrub cover and fluvial soils. Microhabitat modeling that identified habitat features associated with San Bernardino kangaroo rat abundance at a fine scale indicated that there were higher numbers of individuals at site with approximately <20% shrub cover, <30% annual grass cover, and >50% open (bare) ground, which includes sand and gravel exposure of >25% of the area. The microhabitat model suggests low cover of woody debris (6% – 13%) is also important. Factors negatively affecting San Bernardino kangaroo rat abundance include presence of fine soils, organic duff and soil content, and larger soil particles such as cobble and boulders (Shier et al. 2018; Chock et al 2020). All these habitat features are directly affected by high flood events that promote the favorable factors and diminish the negative factors. The most robust San Bernardino kangaroo rat populations occur in areas receiving occasional disturbance-event floods. However, some occupied areas have not experienced such flooding recently (Shier et al. 2018; Chock et al 2020). |
| 21 | 3 | no mass included | |
| 21 | lines 2-4 | kangaroo rats also each shrub seeds but may shift to shrubs when forb and grass seeds are less profitable in the late summer/fall/winter; see Meserve 1976, Food relationships of a rodent fauna in a California coastal sage scrub community | |
| 21 | lines 8-10 | could cite Price and Joyner 1997 What resources are available to desert granivores seed rain or soil seed bank | |
| 21 | lines 24-26 | D. merriami females ingest more succulent vegetation during lactation likely to compensate for high water needs (Soholt, 1977). | Females increase ingestion of foods with high water content, such as succulent vegetation, during lactation (Soholt, 1977; USFWS, 2009) |
| 29 | Lines 1-7 | Table 4 from Shier et al 2018 was included as an online only supplementary table (S2) in Hendricks et al 2020 | |
| 32 | 10 | southern California | lower case S on southern |
| 32 | 32 | the text currently reads: Bernardino kangaroo as opposed to San Bernardino kangaroo rat | |
| 33 | 3,4,5 | True for range-wide. We are in the process of developing a range-wide monitoring plan which I will send to you. And, we have conducted a preliminary PVA for LCC that is in our 2019 annual report which I will also provide. | |

| Page | Line | Comment | Suggested edit, if any |
|------|----------------------------------|--|---|
| 33 | Section on Small populations | This is very well written. I would add that we (San Diego Zoo Wildlife Alliance) conducted a preliminary population viability analysis for the Lytle Cajon Creek population. In 2019 we assembled demographic data for SBKR and closely related species and undertook an effort to model population viability in the Lytle-Cajon Creek population without any additional development and with a hypothetical development scenario based on estimates of habitat reduction and direct impacts put forth in the first draft of the Biological Opinion. These models utilize a range of values, from conservative to optimistic, for each demographic parameter. Since exact values for each population are not known, we encompassed the range of biologically plausible possibilities. Our results are preliminary but strongly suggest a high probability of extinction within 100 years even in the absence of further development (Chock et al. 2019). Of the 500 simulations we ran using existing conditions (no additional development), 71.4% went to extinction within 100 years. When we modeled additional development as a reduction in carrying capacity (loss of habitat) and reduced initial population size (direct mortality from construction and/or mortality from translocation), 76.4% of the 500 simulations went to extinction. Our estimates of carrying capacity are likely artificially high (we used estimates of low, moderate, and high suitability acreage throughout the population and density estimates calculated by McKernan (1997), both of which likely overestimate the true ability of habitat to support SBKR across the range), and with reduced carrying capacity the probability of extinction would be higher than our analysis suggests. Our results indicate that unless population trends are reversed, this population is likely to become extinct in the next 100 years, and that with further development in the Lytle-Cajon Creek the probability of extinction increases. I will share the report. | |
| 34 | lines 13-19 | there are estimates of acreage of low, medium and high suitability and using these categories could provide a more realistic density range. Given the Ne across the 3 populations, the upper range listed here is extremely unlikely | |
| 36 | 30 | San Diego Zoo new name as of March 2021; San Diego Zoo Wildlife Alliance. Global replace necessary | |
| 43 | 21 | SDZWA biologists | In August 2020, biologists from San Diego Zoo Wildlife Alliance attempted to trap SBKR at BLM owned site in the SAR drainage to use as founders for a planned translocation study. During this trapping, they documented... |
| 44 | lines 10-11 | we now have data back on fur which shows substantially higher levels of heavy metals than the blood. | Additional testing for heavy metals in the hair samples showed generally higher concentration of heavy metals than in blood (Shier, personal communications). This may be because hair reflects cumulative metal exposure over longer periods of time in comparison to blood, which represents a single point in time. In both blood and hair testing all sampled individuals had some lead in their system, with one individual exhibiting much higher concentrations of lead in both hair and blood samples. Subsequent trapping of SBKR from the site in March of 2021 showed limited evidence of fur loss or skin irritation, but individuals exhibited severe fur loss and skin irritation and crusting again in September of 2021 suggesting that the issue may be cyclic, and a larger study utilizing fur clippings from control sites is underway to establish a "normal" range for heavy metals in Merriam's kangaroo rat (Shier, personal communications). |
| 46 | Table 5 | First column cuts off the n of the word subpopulation | |
| 56 | Table 10 | Second and Third columns need spacing fixed | |
| 57 | Table 11 | Columns need spacing fixed | |
| 60 | 6 | not sure if you intended to say subpopulations or populations or sites here | |
| 60 | Subheading Small population size | It seems relevant here to add the results of the PVA within the LCC populations with and without development. | |
| 63 | 34 | San Diego Zoo Wildlife Alliance | |
| 63 | Lines 16-17 | Agreed, but I would say that b/c we have so little habitat remaining, this should be revised to include refugia habitat that maintains connectivity to lowland habitat or for which connectivity can be restored. | |
| 64 | Lines 7-8 | Another method that may improve habitat for SBKR is the addition of soil. This could be used in concert with herbicide. | |
| 65 | 19, 24, 27, 31 | I would make a distinction here between conservation translocation and mitigation translocation because mitigation translocations are driven by development and common for SBKR and to date, none have shown long-term success | c) Use conservation translocation as a tool to augment ... |
| 66 | 30 | I would add population trends to this statement | |
| 67 | 7 | extra space after c) | |
| 67 | | I would add that it would be prudent to determine the extent to which anthropogenic impacts such as noise and light impact SBKR occupancy and persistence, and we need to better understand how to create habitat corridors that SBKR will use in order to improve habitat connectivity and gene flow | |

Comments on September 1, 2021, draft Status Review report for the San Bernardino kangaroo rat by Patrick A. Kelly, Ph.D., Professor of Vertebrate Ecology/Conservation Biology, Endangered Species Recovery Program, California State University, Stanislaus

Substantive excerpts of email to Scott Osborn and Daniel Applebee, October 14, 2021

Hi Dan and Scott,

...

Re. the SBKR report, I would like to congratulate the authors on an overall excellent review of the situation. The report is very comprehensive, but it is also very well written and documented, and it is compelling. There are many items that stood out to me in this report, but having worked on SKR in Riverside in the early 1990's, I'll just reference one here:

“As reported in the most recent annual report for the WRC MSHCP/NCCP (WRCRCA 2018), focused surveys conducted between 2004 and 2017 for the San Bernardino kangaroo rat indicate that neither of the objectives of 75% occupancy of the 1,797 ha (4,400 ac.) of preserve areas or 20% occupancy at medium or high density has been met during implementation of the plan.”

That's pretty striking.

One issue I question is the ranking of outreach/education under Management Recommendations (pp 63-68). Notice that it is the very last item:

- 9) **“Use outreach, education, and other methods to limit recreational threats and improve public awareness and support.** Off road activities and other recreational activities are putting additional stress onto the San Bernardino kangaroo rat and its habitat. Limiting impacts from recreational activities while also improving outreach and public awareness will help improve human interactions and reduce impacts to San Bernardino kangaroo rat.”

It even follows:

- 8) **Additional sampling and study of fur loss of San Bernardino kangaroo rat at BLM site in the Santa Ana River wash, or other sites where fur loss is observed, should occur to determine its cause and possible management actions.**

Why?

We all know how challenging conservation is for so many of our species, but SBKR (which could potentially be more than a subspecies) is in a worse predicament than many other listed or listable small mammals. Its habitat is not only highly fragmented and degraded, but its mostly in private ownership and its listing, which I support 100%, affects many local jurisdictions. A direct acknowledgment of this situation by emphasizing outreach and education (from the very beginning of any recovery initiative) under Management Recommendations could be a positive step. I suggest revising outreach/education and making it No. 1 in the management recommendations list, and then follow with the other 8 items as listed.

And here are a few minor issues I noticed:

FIGURE 2 (p. 14) is not cited until p. 48. I'm presuming that's an oversight. I would have expected it to be cited on pp. 9-11.

TABLE 4 (p. 30)—This is an interesting table, but I found the Trap Success column confusing. It might need more explanation in the caption; or, provide footnotes for some of the table entries (for that column). Worst case scenario, hopefully not needed, is to recalc. some of those values.

Very minor quibble about some text on p. 40: "As part of the approval process for the Seven Oaks Dam, 308 ha (760 ac.) of conservation land downstream of the Seven Oaks Dam were acquired as the Woolly Star Preserve Area (WSPA), located mostly on the southern margin of the Santa Ana River wash area." I think the subject of this sentence (WSPA area) is singular, so change "were" to "was." When reporting units of something (e.g., 50 ml of water), the subject is treated as singular even if the units are plural.

RCP (Representative Concentration Pathway? Pp. 45-47) should be defined/explained, perhaps in a footnote.

I hope these comments are helpful and not seen in any way as critical of the overall report. I really think it is an outstanding review of the situation.

Very best wishes,

Pat

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