3. Summary Profile of the SKR

This chapter summarizes information regarding the biology, life history, habitat requirements, and distribution of the SKR based on a literature review and research reports included in Volume II. It is intended to provide a brief, non-technical overview of key information concerning the species and studies conducted in support of this HCP. Readers seeking detailed technical information concerning characteristics of the SKR and its habitat should refer to the reports in Volume II.

A. Information Sources

As discussed in Chapter , presentation of biological data concerning the status and distribution of SKR is a required component of the RCHCA's application for a federal incidental take permit and a California Endangered Species Permit. The format and level of detail for biological data are not specified in federal or State law but the intended use is clear; these data are the basis for weighing the value of the resources to be conserved by a HCP against the resources to be lost. Data collection and analysis conducted for this HCP are focused primarily on issues specifically related to the design and management of permanent reserves for the SKR in western Riverside County. This focus is significant since planning reserves in the context of ongoing urban development obviously differs from planning for the management of resources in wilderness areas. However, regardless of the setting, conservation planning begins with identifying the characteristics of the species in question. The biological data on which this HCP is based are derived from SKR field studies, research, and site-specific surveys conducted in the plan area, supplemented by existing literature concerning the SKR. Studies commissioned by the RCHCA during the Short-Term HCP implementation process, and related studies sponsored by MWD, are summarized in Table 11. Detailed reports concerning SKR biological research projects sponsored by the RCHCA are presented in Volume II.

B. SKR Biology and Life History

As noted. Volume II presents detailed biological information concerning SKR characteristics. Following are discussions of specific aspects of SKR, including:

1. Physical characteristics;
2. Genetics;
3. Burrows and dust bathing;
4. Food sources and habits;
5. Home range and dispersal distances;
6. Reproduction and survivorship, and;
7. Population dynamics and viability.

1. Physical Characteristics

The SKR is a small nocturnal mammal related to the squirrel family of rodents; it is one of several species of burrowing, grain-eating kangaroo rats found in arid regions of North America. The SKR has a large head, external cheek pouches, elongated rear legs, relatively small front legs, and a crested tail with a lateral white band (Figure 17). Its overfur is a dusky cinnamon-buff color, with pure white underneath. The average adult weighs 2.3 ounces and, including a tail approximately 1.5 times longer than its body, is approximately 12 inches in length. The species' common name of "kangaroo" rat reflects the fact that it moves about by hopping on its elongated rear legs.

In size and appearance, the SKR is nearly identical to the Pacific kangaroo rat (PKR) which lives in the same general area, competes with the SKR for food, but is not a federally or State listed species. The habitat requirements of the two species are different albeit overlapping, and the two are genetically different and therefore do not interbreed. In areas suitable for both species it is difficult to specifically differentiate habitat occupied by SKR and PKR and determine relative densities of each species.

Additionally, their similarity in appearance makes specific identification of these species problematical for all but experienced field and research biologists. These problems prompted the RCHCA to commission Drs. Price, Kelly, and Goldingay of the University of California at Riverside to develop an easily followed protocol for distinguishing the two species (see Report No. 7 in Volume II).

2. Genetics

In terms of genetic characteristics, SKR in western Riverside County show a high degree of similarity and low degree of variability. This finding is derived from the genetic variability study conducted by McClenaghan and Truesdale of San Diego State University, in which blood samples taken from SKR at nine locations within seven SKR Study Areas were analyzed (see Report No. 10 in Volume II). Results of the analysis have several implications for reserve design and management. To a large extent, the high degree of genetic similarity obviates the need to design a preserve network which ensures the protection of unique gene pools. This also suggests that SKR could move or be moved to a new location without posing genetic risks to the resident SKR population in that area.

3. Burrows and Dust Bathing

Typical of this family of species, SKR construct burrows which may contain a number of underground chambers and food caches. In areas with loose sandy soil a SKR will excavate its burrow entirely on its own, creating a space 9 to 17 inches deep and well over 6 feet long. In areas with firm soils, SKR are known to convert pocket gopher and ground squirrel burrows into their own. In either locations, food caches often are established around as well as within the burrow. In part, these burrowing needs and habits dictate where the species will be found. As documented by several studies, SKR typically inhabit well drained gravelly soils and avoid areas high in clay content and difficult to excavate (see Reports No. 1 and 3 in Volume II). The burrows also reflect the species' nocturnal and essentially solitary nature, serving as sleeping quarters and nesting sites where SKR spend most of their time. Burrowing is not the only use or need that SKR have for specific types of soils. This species also requires patches of fine-grained soil for dust bathing. Such bathing is necessary to keep its fur clean, and also leaves characteristic tracks and markings around its habitat (see Report No. 1 in Volume II).

4. Food Sources and Habits

SKR forage for a few hours at night, collecting primarily seeds and sometimes fresh vegetation or insects, which they stuff in their cheek pouches and bring back to their burrows. They collect their food primarily by using their forelimbs to sift through soil intermixed with seeds and are extremely adept at detecting and harvesting such areas. As with most species of kangaroo rats, they are able to metabolize water from seeds and so do not require a water source. Most foraging occurs in open areas within a given radius of the burrow (see 5. Home Range and Dispersal Distances below).
The seasonal nature of the SKR's food source and its foraging technique reveal several key points about this species' needs. For example, since seed availability varies with the season, SKR either must be able to find food in different areas within a limited radius of their burrows or relocate to a new area when vegetation cycles shift. In addition, the ability of SKR to forage depends in part on the combined occurrence of the plants that produce seeds, enough space for the seeds to collect in the soil and for SKR to have access to them, and soils suitable for SKR burrows. The fact that their food sources and habits associate SKR with habitat having large patches of bare ground and few shrubs also makes SKR relatively easy prey for other species.

5. Home Range and Dispersal Distance

Consistent with its food sources and habitats, SKR home ranges (i.e., the area used by a SKR within the radius of its burrow) vary by season. As with many mammals, the ranges also vary by sex. Studies conducted in the HCP area by Ors. Kelly and Price for example, indicate that male SKR maintain an average home range of approximately 1,830 square yards; average female SKR home ranges were about 1,200 square yards or smaller, depending on whether the SKR was nursing a litter (see Report No. 4 in Volume II). Drs. Price and Kelly also studied average SKR dispersal distances (i.e., the distances moved by individuals over a lifetime) and found adult SKR to be highly sedentary, maintaining an average home range center within approximately 33 yards of the location where they were first observed (see Report No. 5 in Volume II). Even the dispersal of juveniles from nest sites appeared to be relatively restricted, with the majority shifting less than 55 yards away from their natal burrow. Maximum dispersal distances for individuals ranged from 186 to 383 yards, with most dispersals under 200 yards. Of course significant exceptions were observed, with some SKR dispersing over 435 yards and one moving over 1,100 yards. Although infrequent, such long-distance movements are significant for conservation since they facilitate flow among subpopulations and allow re-establishment of extinct subpopulations. The average dispersal distances also are significant in their suggestion that habitat patches separated by approximately 100 yards are likely to be connected on a regular basis by dispersing SKR, and patches separated by 500 yards or more are likely to remain isolated.

6. Reproduction and Survivorship

Among species like SKR, the ability of a population to reproduce and sustain itself is largely a function of food availability (see Reports No. 1, 3, and 11 in Volume II). In the case of this species, reproductive success appears to be highly correlated with the timing and abundance of winter rainfall. Breeding typically occurs from January to September and may extend into November if environmental conditions are particularly good. Conversely, under poor conditions SKR may forgo reproduction altogether. In general, however, reproduction begins in late spring and peaks in April and May.

The age of sexual maturity for SKR is not known, but in some years female SKR born early in the season may mature quickly enough to produce their first litter by the end of the summer. Female SKR can remain capable of reproducing as long as food sources are adequate and can produce multiple litters (potentially as many as five) under especially good conditions. Average life expectancy for SKR ranges between 4.5 and 6.6 months, with some individuals persisting for as long as 19 months. Survivorship tends to be high once animals have reached adulthood and established residency. These aspects of the species are significant to conservation planning since they indicate the degree to which the size and management of reserves must anticipate and accommodate fluctuations in the size, extent, and densities of the resident SKR population.

7. Population Dynamics and Viability

In order to better understand SKR population dynamics (i.e., changes in density, reproduction, recruitment, and survival) in the HCP area and to employ that knowledge in reserve design, three research projects were sponsored by the RCHCA. These include two studies in the field and one involving the development of a state-of-the-art computer model.

For the purpose of collecting SKR population dynamics data and determining whether those dynamics vary geographically, McClenaghan and Taylor monitored SKR populations at three locations in the Short-Term HCP Study Areas: Lake Mathews, Motte Rimrock Reserve, and the San Jacinto Wildlife Area. Live-trapping began in the fall of 1989 and was conducted monthly through February 1991. Over that 18 month period 308 SKR were captured, marked, and released;

these included 125 at Lake Mathews, 96 at Motte, and 87 at San Jacinto (see Report No. 11 in Volume II).

Two major findings emerged from the study. The first is that SKR display a suite of traits similar to other species in the same family. These include flexible reproductive seasons, high adult survival, small litter size, and slow growth and development of the young. These characteristics make the SKR well-suited to its arid and semi-arid environment, where fluctuations in physical factors and food resources are typically unpredictable. The second point is that differences in population dynamics observed in the three different geographic locations were very small. The primary difference was that the population observed at Lake Mathews displayed the greatest density. Otherwise, the three SKR Study Area populations showed similar patterns in population density, initiation and cessation of breeding, recruitment of new individuals into the population, and seasonal survival rates.

These results were confirmed and extended by a second study conducted by Drs. Price and Kelly, who collected basic SKR demographic information over the period of March 1990 to August 1991. Live trapping was conducted at two permanent study plots in Motte Rimrock Reserve and San Jacinto Wildlife Area (see Report No. 3 in Volume II). Data collected during the study revealed that a critical source of variation in SKR population dynamics is the timing of rainfall, which appears to determine the length of the breeding season. Temporal variations in habitat carrying capacities were thought to parallel changes in rainfall patterns.

Both the McClenaghan/Taylor and Price/Kelly reports emphasize the preliminary nature of their findings, staling that two years of information is not adequate to demonstrate how changes in environmental conditions, SKR population densities, and SKR vital statistics are linked. Long-term research of the type contemplated by Drs. Price and Kelly is deemed important by the RCHCA and will be sponsored within the core reserves as needed during implementation of this HCP.

The third SKR population dynamics project was undertaken by Dr. Michael Gilpin of the University of California at San Diego, who developed a computer model employing SKR research data to project whether SKR populations in a given area would persist over time. In order to create this model RECON provided Dr. Gilpin with the GIS data base for SKR habitat distribution in the Study Areas identified in the Short-Term HCP. Areas of SKR occupied habitat were identified within each Study Area, and those were divided into 300 x 300 meter cells. Only lands with occupied SKR habitat were translated into cells; no assumptions were made about the occurrence or availability of suitable but unoccupied habitat. Each cell was assigned a SKR carrying capacity based on current information concerning SKR population densities in that area. Dr. Gilpin then designed the model to simulate two types of fluctuations: 1) changes in SKR populations based on population change rates for other kangaroo rat and small rodent species, and; 2) changes in environmental conditions based on a formula derived from yearly rainfall patterns in western Riverside County over the past 60 years (see Report No. 12 in Volume II). Variables and the habitat data base used in the model were adjusted following initial runs based upon comments received from the SKR Ad Hoc HCP Biological Working Group. Subsequent to the completion of these adjustments the USFWS made its computer capabilities available to run the revised model (see Report No. 13 in Volume II and relevant material in Chapter 5. SKR Conservation and Mitigation Measures).

The Gilpin model predicts the long-term viability of SKR populations in user defined areas by simulating conditions over a 200 year period, applying the variables to each cell, and calculating annual changes in SKR densities in each cell. If the carrying capacity of habitat in a cell is exceeded in a year, a portion of the SKR population is dispersed to adjoining cells. Habitat separated by more than one empty cell is assumed to be beyond dispersal distances unless a bridging corridor can be established. Conversely, if the population drops too low, SKR in the cell are extirpated. At the end of the 200 year run, or at any point in the run, the model estimates the amount and density of SKR occupied habitat in the defined areas, together with a population index which facilitates comparison of population persistence in different areas. Numerous runs of the model are completed, and mean persistence times and population indices are then calculated.

Results of the initial model runs as applied to the Short-Term HCP Study Areas predicted wide variations in SKR population persistence over time even if all occupied habitat in the Study Areas is preserved. Subsequent runs of the adjusted Gilpin model exhibited generally consistent results, suggesting that SKR conservation may depend as much on the implementation of an adaptive habitat management strategy as upon the size and configuration of permanent reserves (see Chapter 5. SKR Conservation and Mitigation Measures).

C. Habitat Characteristics

Perhaps the most obvious components of reserve design are the characteristics and distribution of the habitat used by SKR. Key considerations include vegetation, soils, topography, and elevation (see Reports No. 1, 2, 6, and 8 in Volume II). These factors are reviewed below.

1. Vegetation and Soils

The vegetation most commonly associated with SKR includes two native shrubs (coastal sagebrush and California buckwheat) and the non-native herb filaree. The two shrubs usually are indicator species of coastal sage scrub habitat, such as that used by the PKR and California gnatcatcher; they also are characteristic of areas where transitions from one plant type to another are occurring.

Within the HCP area SKR are typically found in such transition areas, including grasslands that border coastal sage scrub, transition areas where sage scrub and grasslands are intermixed, areas of sparse sage scrub, and areas where native habitat has been removed or disturbed by agriculture and other uses. What each of these areas has in common is sparse, perennial vegetation covering less than 50% of the ground.

Another common feature is the suitability of soils for SKR burrows and food sources. SKR have been found on 36 types of well-drained soils, and over 125 soils are thought to be potentially suitable for the species. Potentially suitable soils include those types capable of supporting annual grasses mixed with forbs and shrub species. Additionally, soils must exhibit compaction characteristics suitable for the establishment of burrows.

Soils not considered suitable for SKR include: heavily alkaline or clay soils, generally in floodplains; highly rocky soils; shallow soils less than 50 centimeters deep; soils in areas exceeding 25% slope, and; soils above approximately 3,000 feet in elevation.

2. Topography and Elevation

As the list of unsuitable soil types suggests, SKR inhabit land forms that are relatively level or gently sloping. This species has been observed on slopes of 0 to 50% but seem to prefer areas of 7 to 10% slope. On steeper slopes and in shrublands, SKR typically is replaced by PKR.

In terms of elevation, most SKR are found below 600 meters. However, some have been observed in areas as high as 1,100 meters.

D. Rangewide and Local Distribution

The geographic range of SKR includes the Anza, Perris, and San Jacinto Valleys and other areas of western Riverside and northwestern San Diego Counties. The current estimated range of the SKR is depicted in Figure 18. This geographic range is estimated to encompass approximately 287,000 hectares (708,641 acres), which is unusually small for rodents in genera! and kangaroo rats in particular. For example, Merriam's kangaroo rat, which is the smallest kangaroo rat in the United States, has a range covering portions of six states. The vast majority of the SKR's range occurs in western Riverside County, with the only other significant populations found at Camp Pendleton, the adjacent Fallbrook Naval Weapons Station, and sites around Lake Henshaw in northern San Diego County.

Newly discovered SKR populations in the Anza Valley and the Corona/Norco area demonstrate that the precise distribution of this species is not presently known. Since those territories lie outside of this HCP area, comprehensive surveys for SKR have not been conducted. Outside of the HCP area the only SKR distribution data available at present are derived from site-specific surveys of individual properties generally conducted in conjunction with proposed development projects.

1. Rangewide Occurrence

Concurrent with the 1988 federal listing of SKR as an endangered species, O'Farrell and Uptain conducted a study to provide an overview of SKR distribution throughout its estimated range in western Riverside County. At the time of the study 79 populations of SKR had been identified, and the amount of habitat occupied by these populations was estimated at less than 40,000 acres.

Based on estimates prepared for this HCP, and in consultation with USFWS and CDFG, the current amount of occupied SKR habitat in the species' range is estimated at 48,550 acres. This includes approximately 34,450 acres in Riverside County and 14,100 in San Diego County (Table 12 and Figure 19). In San Bernardino County the species is now assumed to be extirpated.

With respect to these SKR distribution estimates it must be emphasized that implementation of the Short-Term HCP has greatly increased the total amount and level of detail of the information available concerning SKR occupied habitat in western Riverside County. Although the entire plan area has not been re-mapped specifically for SKR since the O'Farrell and Uptain effort, RCHCA funded studies and site specific surveys have provided updated information on all major areas of SKR occupied habitat in the HCP region. In San Diego County and elsewhere in Riverside County, site specific studies have been completed but studies and mapping comparable to the RCHCA's regional effort has not occurred.

2. Occurrence in the Plan Area

Within the plan area known patches of SKR occupied habitat generally are concentrated in the core reserves proposed for establishment in Chapter 5. SKR Conservation and Mitigation Measures. The largest blocks of habitat occur south of Lake Mathews, within Sycamore Canyon Park, in the Lake Perris State Recreation Area, and in the Shipley Reserve portion of the Lake Skinner-Domenigoni Valley core reserve.

Within the plan area approximately 23,650 acres or approximately 79% of existing SKR occupied habitat occurs on unincorporated lands within the HCP area (Table 13). The City of Riverside contains the next largest amount, with approximately 3,400 acres; the other seven RCHCA cities combined contain about 2,950 acres.

With the exception of the Santa Rosa Plateau, all existing wildlife preserves in the HCP area contain areas of SKR occupied habitat. The SKR core reserves proposed in this HCP encompass approximately 12,460 acres or 42% of the SKR occupied habitat in the HCP area. Upon expansion of the reserves through federal land exchanges, approximately 15,000 acres or 50% of SKR occupied habitat in the HCP area will be conserved within the core reserves.

Distribution of SKR habitat within the core reserves defined in this HCP is discussed in Chapter 5. SKR Conservation and Mitigation Measures, together with an analysis of the long-term viability of SKR habitat in the plan area.

E. Decline Factors

The principal SKR populations remaining within the species' current range are patchily distributed and largely isolated from one another. This circumstance is one of the primary factors cited by USFWS in its listing of the species as endangered in 1988, and also was apparent in 1971 when SKR was listed as threatened under the California ESA.

1. Habitat Loss and Fragmentation

Although SKR occupied habitat is patchily distributed by nature, the current isolation of populations is largely the result of urban development which has produced irreversible changes to the pattern of natural habitat within the species' range. Recreation and agricultural land uses also have contributed to the habitat loss and fragmentation but generally do not produce the same types of permanent impacts as those caused by urban development.

2. Predation

Predators of SKR are similar to those of other rodents; these include owls, snakes, fox, coyotes, and cats, both feral and domestic. Barn owls and long-eared owls, for example, are both known to include SKR in their diets. Studies of desert rodents further suggest that predator avoidance may be an important component in SKR selection of foraging habitat and the size of its home range. Here too, however, urban development magnifies the potential effects of predation on SKR populations in a way that changes it from part of the natural ecosystem to a factor contributing to the species' decline. This results from the fact that urban development simultaneously increases: 1) the presence of known SKR predators, especially domestic cats; 2) ambient noise levels which may impair the SKR's ability to avoid predators, and; 3) nighttime illumination that potentially makes SKR an even easier prey.

3. Other Factors

Other factors that reduce habitat suitability or increase SKR vulnerability include grazing practices that either compact the soil or replace native vegetation with grasses not suitable for SKR, off-road vehicle activities that destroy foraging habitat, crush burrows, and compact soil, and rodent control programs that poison SKR.

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