Colorado River cotton rat, *Sigmodon arizonae plenus Paul W. Collins*

Description: A medium-sized (276-346 mm) rat-like rodent with rough, coarse fur; hispid blackish-brown dorsum; silvery or whitish venter with base of hairs blackish; scaly, sparsely haired tail (usually 110 mm or longer) which is shorter than the head and body length; large ears (19-24 mm) which are hidden by hair; and relatively large hindfeet (usually 32 mm or longer) (Clark 1972, Blood 1981, Hoffmeister 1986). No single character consistently separates *S. arizonae* from *S. hispidus*. However, distinguishing them is based on a suite of characters: *S. arizonae* can be distinguished by its larger overall size, hindfeet which are 32 mm or longer, broad presphenoid, round occipital shield, sharp anterior spine on the infraorbital plate, and nasal bones with straight lateral borders (Severinghaus and Hoffmeister 1978, Hoffmeister 1986, Blood 1990). In his original description of *plenus*, Goldman (1928) separated this taxon from *eremicus* because of its large size, pallid coloration, more massive skull, and broader rostrum.

Taxonomic Remarks: The Colorado River cotton rat is closely related to *Sigmodon arizonae*, based on genetic (Zimmerman 1970, Blood 1990) and morphologic data (Severinghaus and Hoffmeister 1978, Hoffmeister 1986, Blood 1990).

Goldman (1928) first described *plenus* as a subspecies of *Sigmodon hispidus*. Based on a difference in chromosome number and structure, Zimmerman (1970) synonymized *S. h. plenus* and *S. arizonae*, but left the status of *S. hispidus eremicus* in question. Zimmerman (1970) reported a chromosome number of 22 and a fundamental number of 38 for *S. arizonae*, and 24 chromosomes and a fundamental number of 38 for *S. a. plenus* from Parker, Yuma County, Arizona. This contrasts with *S. hispidus* which has 52 chromosomes and a fundamental number of 52 (Zimmerman 1970). Blood (1990) confirmed that *Sigmodon* populations along the Colorado River in California north of the Palo Verde Mountains had a karyotype of 24 and were morphologically most similar to *S. arizonae*. He also reported that cotton rats from along the Colorado River in Imperial County, California had a karyotype of 52 and were morphologically most similar to *S. hispidus* (Blood 1990).

Distribution: *S. a. plenus* is found in California and Arizona in moist riverside habitats along the Colorado River floodplain north of the Palo Verde Mountains, from Palo Verde Valley to the vicinity of Parker, Arizona (Hoffmeister 1986, Blood 1990, Blood in review). Populations that occurred historically in southern Nevada are now considered to be extinct (Hall 1946, Bradley 1966). Specimen records, along with recent surveys in California, confirm that the distribution of this taxon is patchy (Blood 1990).

Life History: This discussion is based on the hispid cotton rat (*Sigmodon hispidus*) (Cameron and Spencer 1981), a close relative of the Colorado River cotton rat, which is poorly studied. Cotton rats are active year-round, both nocturnally and diurnally. Cotton rats are vegetarians that feed primarily on grass stems, leaves, roots, and seeds but occasionally also eat insects, and animal flesh, and make well-defined runways through dense herbaceous growth. They are also capable swimmers.

The Arizona cotton rat probably has a relatively high reproductive potential. They breed year-round; young have been observed during the spring (February-April) and fall (August-October) (Hoffmeister 1986). Females are sexually active at 30-50 days of age and produce more than one litter annually. Litter sizes range from 1-15 young per litter with most litters averaging 5-7. Based on embryo counts, Hoffmeister (1986) recorded litters in *S. arizonae* ranging from 5-12 per litter. Schwartz and Schwartz (1959) recorded population peaks every 2 to 5 years in hispid cotton rats. Maximum densities in hispid cotton rats tend to occur in the fall (range from 14 to 69/ha) and

minimum densities occur in the winter or summer (range from 0.5 to 25/ha) (Zeiner et al. 1990). Colorado River cotton rat populations occasionally reach relatively high densities (Hoffmeister 1986). Males tend to have larger home ranges (0.35 to 0.39 ha) than females (0.22 ha).

Habitat: There is little literature on the habitat of *S. a. plenus*. Until 1970, *Sigmodon* populations along the Colorado River north of the Palo Verde Mountains were thought to represent a single species (whereas now they are known to comprise *a. plenus* and *h. eremicus*). Consequently, information contained in the early literature about habitat associations of cotton rats along the Colorado River pertains to both *S. a. plenus* and *S. h. eremicus*. Grinnell (1914) reported that cotton rats in California were associated with the willow-cottonwood plant association along the lower Colorado River. Grinnell (1933) reported that *S. h. eremicus* "inhabits tracts of sedge, rushes, or cane close to edges of permanent streams or sloughs." According to Clark (1972), *S. h. eremicus* in California were generally associated with drainage ditches, canals and seeps vegetated with plants such as arrowweed, saltgrass, common reed, screwbean, cattails, sedges, tamarisk, heliotrope and annual grasses.

Colorado River cotton rats probably frequent some of the same mesic habitats as S. h. eremicus. According to Goldman (1928), *plenus* was apparently restricted to "isolated sections of alluvial bottom along the Colorado River." The climate in areas adjacent to the river is too hot and arid to support cotton rats except in the immediate vicinity of the river flood plain (Williams 1986). Hall (1946) collected S. a. plenus from a small marsh in southern Nevada along the Colorado River supporting cattails (Typha sp.) and Bermuda grass (Cynodon sp.) and ringed by mesquite (Prosopis glandulosa). Near Parker, Arizona, Zimmerman (1970) captured plenus in stands of common reed (Phragmites communis). North of Blythe, Blood (1981) captured plenus in marginal habitat of a single row of salt cedar (Tamarix ramosissima) and an adjacent field of sagebrush (Artemsia sp.). Along the Arizona side of the Colorado River, Hoffmeister (1986) collected *plenus* in irrigated agricultural fields and along an irrigation canal. Elsewhere in Arizona, S. arizonae has been found in a variety of habitats, ranging from mesquite and tumbleweed (Salsola tragus) arid scrubs, to mesic areas such as along canals and banks of small streams vegetated with weeds and brush (Hoffmeister 1986). Based on the limited data presently available, Colorado River cotton rats are probably confined to isolated mesic habitats such as desert riparian, grassland, and fresh emergent wetlands in alluvial bottom lands along the Colorado River, and avoid surrounding true desert habitats (Goldman 1928, Hoffmeister 1986, Zeiner et al. 1990, Blood in review). Occasionally, they inhabit irrigated croplands and herbaceous borders along canals and irrigation ditches in the immediate vicinity of the Colorado River.

Status: Class II. Extensive alteration and destruction of wetland and riparian habitats along the lower Colorado River during the past 100 years (Ohmart et al. 1988) has adversely affected this taxon. A review of museum specimen records (n=162) indicates that *S. a. plenus* occurred historically along the Colorado River at eleven sites in California, five sites on the Arizona, and one site in Nevada. Attempts to trap cotton rats in 1979 along the California side of the Colorado River between Blythe to Earp resulted in the capture of *plenus* at a site 33 mi (53.1 km) north of Blythe near the town of Earp (Blood 1981). Bradley (1966) caught no cotton rats along the Colorado River in Nevada, where the species occurred historically (Hall 1946). Based on the absence of habitat, Bradley (1966) argued that the wetland vegetation at this marsh reverted to drier desert vegetation as a result of the elimination of annual flooding along the Colorado River due to channelization of the river, and hydrological changes as a result of dams and the filling of Lake Powell.

The principal reason for the decline of Colorado River cotton rats in California has been the destruction, fragmentation, and degradation of seasonally flooded riparian and wetland communities

along the floodplain of the lower Colorado River. Much of this resulted from the construction of dams and canals which diverted water for urban and agricultural uses and which controlled annual flooding along the lower Colorado River. Some sites were flooded when lakes filled behind newly constructed dams, while other sites reverted to unsuitable dry desert habitats when annual flooding along the river flood plain was eliminated. Following the construction of dams and levees along the river, extensive areas of seasonally flooded riverside habitats were converted to irrigated agriculture. Urban and recreational developments have also eliminated habitat that probably once supported this taxon. Other threats to the continued survival of this taxon include use of rodenticide treated baits within its historic range, and continued loss of remaining areas of riverside habitat to urban, recreational and agricultural developments. It is unknown at this time whether extensive recreational uses of the lower Colorado River are having any adverse affects on this taxon.

Management Recommendations: The first priority for this taxon should be to gather current, reliable data on its distribution, population status, habitat needs, and extent of remaining suitable habitat. Live-trapping surveys at historical localities and potential habitat elsewhere within its range are needed to evaluate its current status in California. The southern distributional limits of this taxon along the Colorado River also needs to be investigated to clarify its distributional limits and to see whether there is any overlap with *S. h. eremicus* populations. Since there is no basic life history information for this taxon, detailed studies are needed to gather specific information on habitat requirements, reproductive biology, demographics, dispersal capabilities, food habits, and factors that are threatening extant populations. Basic life history data are needed before effective management recommendations can be developed for this taxon. The feasibility of securing native habitat along the Colorado River found to support extant populations of this taxon should be investigated.

