

Dipodomys elephantinus. By Troy L. Best

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Dipodomys elephantinus (Grinnell, 1919)

Elephant-eared Kangaroo Rat

Perodipus elephantinus Grinnell, 1919:43. Type locality 1 mi N Cook P.O., 1,300 ft, Bear Valley, San Benito Co., California.

Dipodomys elephantinus Grinnell, 1921:96. First use of current name combination.

CONTEXT AND CONTENT. Order Rodentia, Family Heteromyidae, Subfamily Dipodomysinae. *Dipodomys elephantinus* is monotypic.

DIAGNOSIS. A large-sized, large-eared, long-tailed kangaroo rat of a moderately dark tone of color (Fig. 1); skull (Fig. 2) with large mastoid and auditory bullae, narrow supraoccipital and interparietal, and weakly angled maxillary arch; incisors heavy; five toes on hindfoot (Grinnell, 1919). The tail is heavily tufted and crested and is 1.55 times the length of head and body (Grinnell, 1922). Color of upperparts near cinnamon buff; ear mostly brownish; dark ventral stripe on distal half of tail narrower than lateral white stripes; length of ear averaging more than 16.7 mm (Hall, 1981).

Grinnell (1922) indicated that in all adult *D. elephantinus* the nasals flare at their distal ends, so that a notable constriction appears in the rostrum anterior to the point where the premaxillaries turn downward to envelop the incisors. He reported that flaring nasals alone distinguished *D. elephantinus* from all other species of *Dipodomys*. He also noted that the greatest width of the rostrum near the end in *D. elephantinus* is among the largest for the genus. I found more than 10 specimens of *D. venustus* in the University of California Museum of Vertebrate Zoology to have flared nasals. Thus, greatest width of the rostrum and flaring nasals may not reliably differentiate *D. elephantinus* from *D. venustus*.

From *D. heermanni*, *D. elephantinus* differs in much larger size, much larger ear, darker general coloration, heavier dentition, much larger mastoid and auditory bullae, less strongly angled maxillary arch, heavier malar bar, and much heavier rostrum (Grinnell, 1919). Grinnell (1922) noted that *D. elephantinus* was larger than any other species of kangaroo rat in California except *D. ingens* and *D. deserti*. Ear length of *D. elephantinus* exceeds that of all

other species; only *D. agilis* and *D. venustus* approach it. In tone and pattern of coloration, *D. elephantinus* is distinctly paler and less heavily marked than *D. venustus*; thus *D. elephantinus* closely approaches *D. agilis*, except that the cheek is whiter (less buffy)

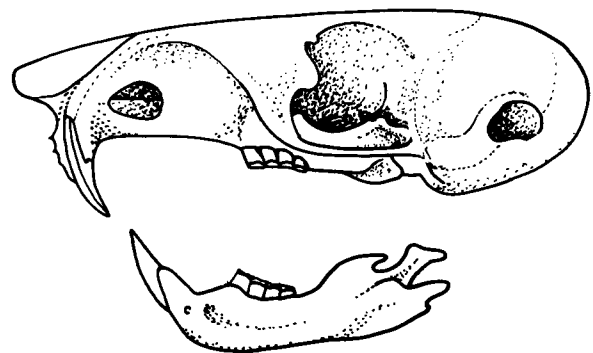
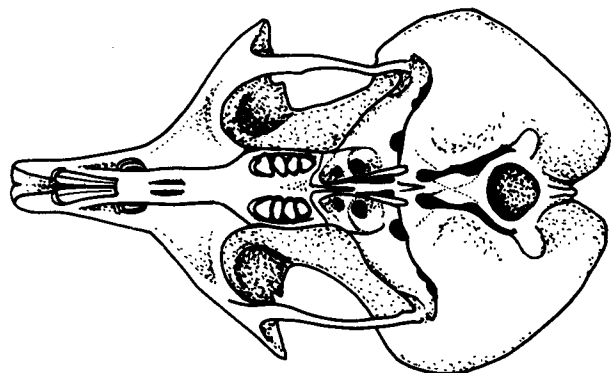
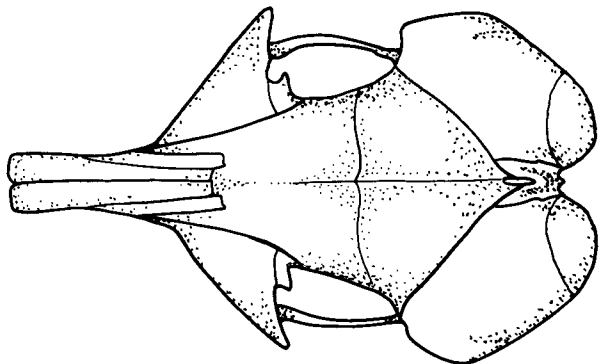


FIG. 1. A female *Dipodomys elephantinus* collected 1 mi N Pinnacles, San Benito Co., California, by T. L. Best, H. H. Thomas, and C. Lydeard in June 1984.

FIG. 2. Dorsal, ventral, and lateral views of cranium and lateral view of mandible of *Dipodomys elephantinus*.

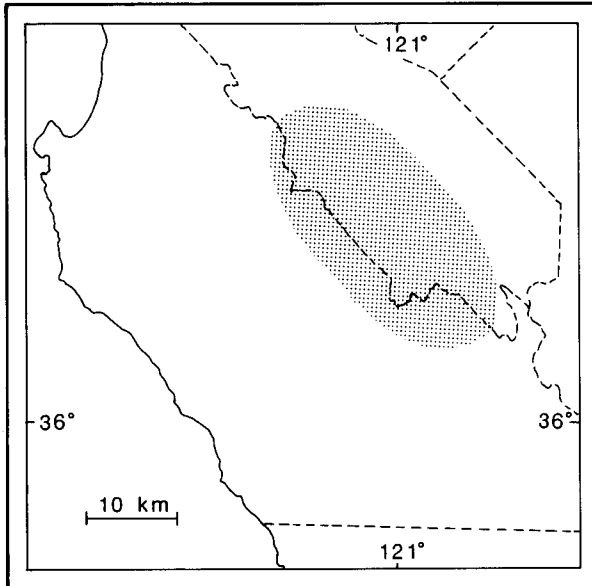


FIG. 3. Geographic distribution of *Dipodomys elephantinus*. The entire range is in San Benito and Monterey counties, California.

and there is much more white between the ear and the eye. A notable feature is the presence of numerous rather long (2 to 2.5 mm) white hairs on the inner surface of the pinna of *D. elephantinus*. These are present but fewer in *D. venustus*. The ventral dark tail stripe is narrower than in *D. venustus*, and the terminal tuft and crest is grayer basally. Half-grown *D. elephantinus* are distinguishable externally from *D. venustus* of corresponding age by much grayer rather than dusky-hued ear, and by less slaty black on the face. In general shape of skull, and narrow spread and weak angulation of maxillary arches, *D. elephantinus* is allied with *D. agilis*. However, there are sharp distinctions in other respects— heavy incisors, large bullae, appressed supraoccipital and interparietal, and broad, long rostrum, with nasals flared distally.

GENERAL CHARACTERS. Young *D. elephantinus* do not show the extreme cranial characters of adults; the bullae are relatively smaller, the supraoccipital and interparietal broader, and the rostrum weaker and not swollen at the end; young are grayer than adults, especially on the back (Grinnell, 1922).

Means and ranges (in parentheses) of measurements (in mm) of 10 adult specimens (five males and five females) selected by Grinnell (1922) are: total length, 324 (305 to 336); length of tail, 197 (183 to 210); length of hindfoot, 46.8 (44 to 50); length of ear (from crown), 17.4 (16 to 18); greatest length of skull, 43.0 (41.7 to 43.9); breadth of skull across bullae, 26.3 (25.5 to 26.8); spread of maxillary arches, 23.0 (22.1 to 23.7); greatest length of nasals, 15.7 (14.9 to 16.4); greatest width of rostrum near end, 4.9 (4.7 to 5.3); width of maxillary arch at middle, 5.2 (4.8 to 5.8). Mean weight (g) of the 10 specimens was: 85.2 (79.4 to 90.7). Ear length from notch for 38 males and 32 females was 19.2 (15 to 23) and 19.5 (12 to 23), respectively.

DISTRIBUTION. The known geographic distribution of *D. elephantinus* (Fig. 3) includes the southern part of the Gabilan Range, from the vicinity of the Pinnacles to near Hernandez, in San Benito and Monterey counties, California. The distribution is at an elevation of about 390 m (Grinnell, 1922). No fossils of *D. elephantinus* are known.

FORM AND FUNCTION. Except for the external and cranial features mentioned, little has been published on form or physiology of *D. elephantinus*. Grinnell (1922) presented illustrations of the ear, bones of the hindfoot, and cranium. Hall (1981) depicted the cranium as viewed from three angles. Beer (1965) examined the interparietal bone of two specimens and found them to be the same.

The baculum (Fig. 4) was figured and statistically analyzed by Best and Schnell (1974); the one specimen they examined grouped

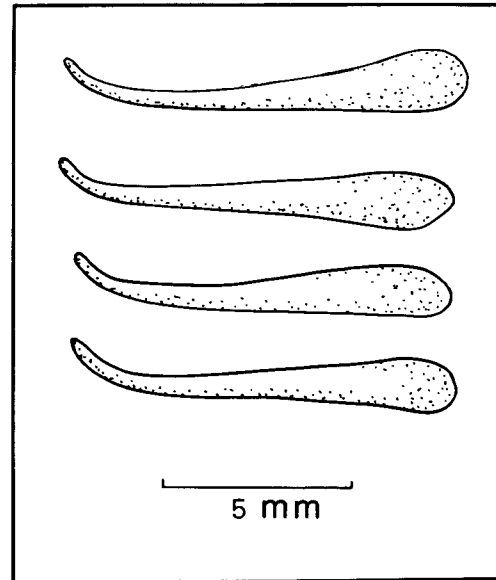


FIG. 4. Lateral views of representative bacula of *Dipodomys elephantinus* from San Benito Co., California.

with *D. microps*, *D. venustus*, *D. agilis*, *D. peninsularis*, and *D. compactus*. Average and range of bacular measurements (in mm) for eight specimens are: length, 11.4 (11.2 to 11.6); width of base, 2.7 (2.4 to 2.9); height of base, 2.5 (2.2 to 2.7).

ECOLOGY. Nothing has been published regarding the ontogeny and reproduction of *D. elephantinus*. However, among 74 specimens at the University of California Museum of Vertebrate Zoology, 26 were classified as subadults according to the cranial criteria of Best and Schnell (1974). Ten of 19 animals collected in June were subadults, 14 of 49 in July, 3 of 5 in August, and 0 of 1 in December; thus young are born at least during the spring and summer months.

Elephant-eared kangaroo rats occur on chaparral-covered slopes in the Upper Sonoran life zone (Grinnell, 1922). The habitat occupied by some of the specimens examined by Schnell et al. (1978) is depicted in Fig. 5. I have captured this species only under dense vegetation. *D. elephantinus* occurs in sympatry with *D. heermanni*, which usually occupies the more open habitat.

The International Union for Conservation of Nature and Natural Resources (1978) listed *D. elephantinus* as a rare species, and stated that "its habitat is at risk from increasing human use of the area where it is found and the continued outbreaks of brush fires." In 1984, this species was not captured on the same hillsides where M. L. Kennedy and T. L. Best found them in 1973. These areas had been burned after their visit; however, several individuals were captured in 1984 on hillsides that had not been burned for at least 11 years.

Because *D. elephantinus* may be conspecific with *D. venustus*, it is of interest to note Hawbecker's (1940) ecologic study of *D. venustus*. However, the habitat occupied by *D. elephantinus* is different from the relatively open habitat described for *D. venustus*, that is, *D. elephantinus* is found only in dense chaparral. Perhaps this is related to habitat segregation brought about by the sympatric occurrence of *D. heermanni* with *D. elephantinus*; no other species of kangaroo rats coexist with *D. venustus* in Hawbecker's study area.

Unsporulated oocysts of *Eimeria* sp. were found in 2 of 15 animals examined by Hill and Best (1985). Furman and Loomis (1984) reported the tick, *Ixodes jellisoni*, on *D. elephantinus*.

GENETICS. Stock (1974) described the karyotype of *D. elephantinus* (Fig. 6) as having a diploid number of 60 chromosomes and a fundamental number of 116. There are 3 pairs of metacentric, 21 pairs of submetacentric, and 5 pairs of subtelocentric chromosomes in the autosomal complement. The X-chromosome is submetacentric and the Y is telocentric. The nonpreferen-



FIG. 5. Habitat of *Dipodomys elephantinus*, 1 mi N Pinnacles, San Benito Co., California. *D. heermanni* usually occupies the more open habitat, and *D. elephantinus* occurs only under the dense canopy.

tially-stained karyotype appears identical to that of *D. venustus*. Hatch et al. (1976) examined the distribution of DNA buoyant fractions for *D. elephantinus*. No other genetic data are available.

REMARKS. Grinnell (1921, 1922) placed *D. elephantinus* in the *agilis* group because of characteristics of its ears, tail, and coloration. Although Setzer (1949) did not examine *D. elephantinus* as thoroughly as the other species he studied, he placed it in the *heermanni* group with the other members of the *agilis* group of Grinnell (1921, 1922). Setzer's (1949) decision was based upon external morphology and the configuration of the cranium. Subsequently, *D. elephantinus* consistently has been placed in the *heermanni* group (Lidicker, 1960; Stock, 1974).

By use of bacular characters, Best and Schnell (1974) compared *D. elephantinus* to 19 other species of kangaroo rats and found them to cluster with *D. microps*, *D. venustus*, *D. agilis*, *D. peninsularis*, and *D. compactus*. Schnell et al. (1978) examined 41 morphologic measurements, including 4 standard external characters, 16 from the skull and mandible, and 21 from the post-cranial skeleton. Their analyses compared *D. elephantinus* to 23 other species of kangaroo rats by various multivariate statistical procedures. *D. elephantinus* was most similar to *D. venustus* in distance and correlation phenograms for both sexes.

Grinnell (1922) pointed out that in some morphologic respects *D. venustus* approaches *D. elephantinus*, suggesting that the latter was just one of a series of recently evolved races. He thought that the two taxa might intergrade to the north along the Gabilan Range. However, he also pointed out that the flaring nasals of *D. elephantinus* separated it from *D. venustus* and all other *Dipodomys*. Hawbecker (1940) indicated that *D. venustus* from Santa Cruz Co., California, represented a possible intergradation with *D. elephantinus*. Analyses of karyotypic (Stock, 1974), bacular (Best and Schnell, 1974), and other morphologic features (Schnell et al., 1978) indicate a close relationship (possibly conspecific) between *D. elephantinus* and *D. venustus*.

Dipodomys is from the Greek words *di* (two), *podos* (foot), and *myos* (mouse) (Jaeger, 1955), which refer to its enlarged hindfeet and bipedal mode of locomotion. The specific name *elephantinus* was selected by Grinnell (1919) because of the large ear, its shape, and manner of folding. The common name, elephant-eared kangaroo rat, also was assigned by Grinnell (1919) and has been used consistently in studies referring to this species (for example, Grinnell, 1919, 1922; Hawbecker, 1940). However, Hall (1981), Hall and Kelson (1959), and Jones et al. (1982) used "big-eared kangaroo rat" as the common name. Because "elephant-eared kangaroo rat" is used by those who have worked with *D. elephantinus* and because it was assigned with the original description of the species, I considered it to be the most appropriate common name.

Y. Ramsey prepared Figs. 2 and 4, and H. T. Haagenstad



FIG. 6. Representative karyotype of a male *Dipodomys elephantinus* from Pinnacles National Monument, San Benito Co., California (from Hsu and Benirschke, 1975).

and R. M. Sullivan prepared Figs. 3 and 6, respectively. M. A. Mares, University of Oklahoma Stovall Museum of Science and History, loaned several specimens, and J. L. Patton and W. Z. Lidicker, Jr., University of California Museum of Vertebrate Zoology, allowed me to examine specimens in their care. J. A. Lackey, M. L. Kennedy, D. J. Hafner, J. K. Jones, Jr., and H. W. Setzer critically reviewed the manuscript.

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