

Dipodomys nelsoni. By Troy L. Best

Published 27 December 1988 by The American Society of Mammalogists

Dipodomys nelsoni Merriam, 1907

Nelson's Kangaroo Rat

Dipodomys nelsoni Merriam, 1907:75. Type locality "La Ventura, Coahuila, Mexico."

CONTEXT AND CONTENT. Order Rodentia, Family Heteromyidae, Subfamily Dipodomysinae. The species is monotypic (Hall, 1981).

DIAGNOSIS. *Dipodomys nelsoni* (Fig. 1) and the closely related species *D. spectabilis* are mostly allopatric. However, they are known to occur within 1.6 km of each other at several places in southern Chihuahua (Anderson, 1972). *D. spectabilis* is the only large species of *Dipodomys* with which *D. nelsoni* may be sympatric or is likely to be confused. All other species of *Dipodomys* that occur sympatrically, or that approach the range of *D. nelsoni*, can be distinguished by their smaller size.

Dipodomys nelsoni (Fig. 2) is similar to *D. spectabilis* in general form and massiveness of skull, but smaller. Mastoids nearly as large (relatively larger) as *D. spectabilis*; zygomata not so squarely or broadly spreading outward as in *D. spectabilis*; maxillary arch moderate, with well-developed angle (often "hooked"); color paler, grizzled buffy, most intense on flanks and rump, with vinaceous tinge; white tip of tail shorter (20 mm—Merriam, 1907) than in *D. spectabilis*, but never absent (Nader, 1978); distal one-half of upper surface of tail black and tufted, lateral white stripes reaching about two-thirds length of tail (Merriam, 1907). Statistical analyses of morphologic data clearly separate the smaller *D. nelsoni* from *D. spectabilis* (Anderson, 1972; Matson, 1980). Weight of adults (females not pregnant) demonstrate further the difference in size between these two kangaroo rats; average and extreme weights of six *D. spectabilis* from Chihuahua are 124.9 g (115 to 132) and 18 *D. nelsoni* from Chihuahua are 86.5 g (78 to 102; Baker, 1956).

In Chihuahua, mean measurements (in mm) of *D. nelsoni*, *D. s. spectabilis*, and *D. s. zygomaticus*, respectively, are: total length, 308.1, 335.8, 335.6; length of tail, 180.1, 195.4, 193.7; length of hind foot, 46.8, 52.4, 51.4; length of ear, 14.9, 16.1, 16.4; and weight (in g), 84.7, 119.7, 116.5 (Anderson, 1972). There is no reason to suppose that intergradation between *D. nelsoni* and *D. spectabilis* takes place (Anderson, 1972; Baker, 1956). However, Hall (1981) pointed out that additional specimens from places where the two taxa meet are needed for study to determine the taxonomic status of *D. nelsoni*.

GENERAL CHARACTERS. Nelson's kangaroo rat (Fig. 1) is among the largest of the genus (Best, 1988). Head relatively large, eyes large, and neck short; tail longer than head and body; hind feet relatively large (Anderson, 1972); maxillary arch relatively heavy and not flared; auditory bullae relatively large; supraoccipital and interparietal usually small; external opening of auditory meatus usually oval; incisors narrow (Nader, 1978).

Fur soft, pale brownish above and on thigh patches separated from dorsal brown by a white stripe; venter white; tail with lateral white stripes, darker dorsally and ventrally on most of tail, terminally well haired; tail white at tip and black subterminally (Anderson, 1972); tuft of hairs at base of tail ventrally grayish black; dorsal and ventral tail stripes dusky; subterminal band of tail dusky to black and sometimes tufted (Nader, 1978). Overall, color is pale ochraceous-buff to grizzled buff, purest on sides, thinly mixed with black-tipped hairs on dorsum, especially over top of head, back, and rump; facial markings dusky; anterior ear fold dusky; large spot behind ankle blackish; plantar stripes pale brown to dark brown (Nader, 1978).

Mean measurements (in mm) of 112 adult males and 87 adult females, respectively, from throughout the range of the species are: total length, 318.9, 311.8; length of body, 128.3, 127.1; length

of tail, 190.6, 184.7; length of hind foot, 66.6, 62.0; length of ear, 23.1, 20.9; basal length of cranium, 24.6, 24.4; greatest length of cranium, 42.6, 42.1; maxillary arch spread, 23.1, 22.8; interorbital width, 11.9, 11.7; nasal length, 15.1, 15.0; intermaxillary width, 7.7, 7.6; length of alveolar toothrow, 5.8, 5.8; maxillary arch width, 5.2, 5.1; basioccipital length, 6.3, 6.2; greatest depth of cranium, 14.5, 14.4; greatest width of cranium, 27.2, 27.0; nasal width, 4.1, 4.0 (Best, 1988); weight, 92.8 g, 84.4 g. Males of *D. nelsoni* are significantly larger than females in several characters including total length, length of tail, greatest length of cranium, basioccipital length, greatest width of cranium, nasal width (Best, 1988), and weight.

DISTRIBUTION. Nelson's kangaroo rat occurs in Chihuahuan Desert shrub vegetation from eastern Chihuahua and northeastern Durango eastward to southeastern Coahuila, southwestern Nuevo León, and the northern parts of San Luis Potosí and Zacatecas (Fig. 3). In Coahuila, passage to the northeast is barred by the Sierra del Carmen-Sierra Madre Oriental Axis, but not to the southeast by the southern Coahuila filter-barrier (Baker, 1956). No fossils are known.

FORM AND FUNCTION. The baculum (Fig. 4) is among the largest of the genus and most closely resembles that of *D. spectabilis*. Bacula average (in mm) 15.0 long, 2.0 wide at the base, and 2.1 high at the base (Best and Schnell, 1974). The interparietal bone (Beer, 1965) usually is composed of one bone (92.3% of 26 specimens examined), but may be composed of two bones (3.8%) or not present (3.8%).

ONTOGENY AND REPRODUCTION. A female taken in Zacatecas on 22 July contained two embryos (Matson and Baker, 1986). In Durango, one female contained two embryos on 17 July, but three females (taken 27 and 28 January) and four (taken 1 to 4 July) showed no evidence of breeding (Baker and Greer, 1962). On 4 and 5 July in Coahuila, three adult females had no embryos, one had two embryos 8 mm long, and one had two embryos 17 mm long. Testes lengths of five adult males captured at the same time averaged 10.8 mm (range, 10 to 12).



FIG. 1. *Dipodomys nelsoni* from 7.2 km W General Cepeda, Coahuila (photograph by T. L. Best, E. Hovey-Smith, E. C. Inness, and K. D. Shull, July 1986).

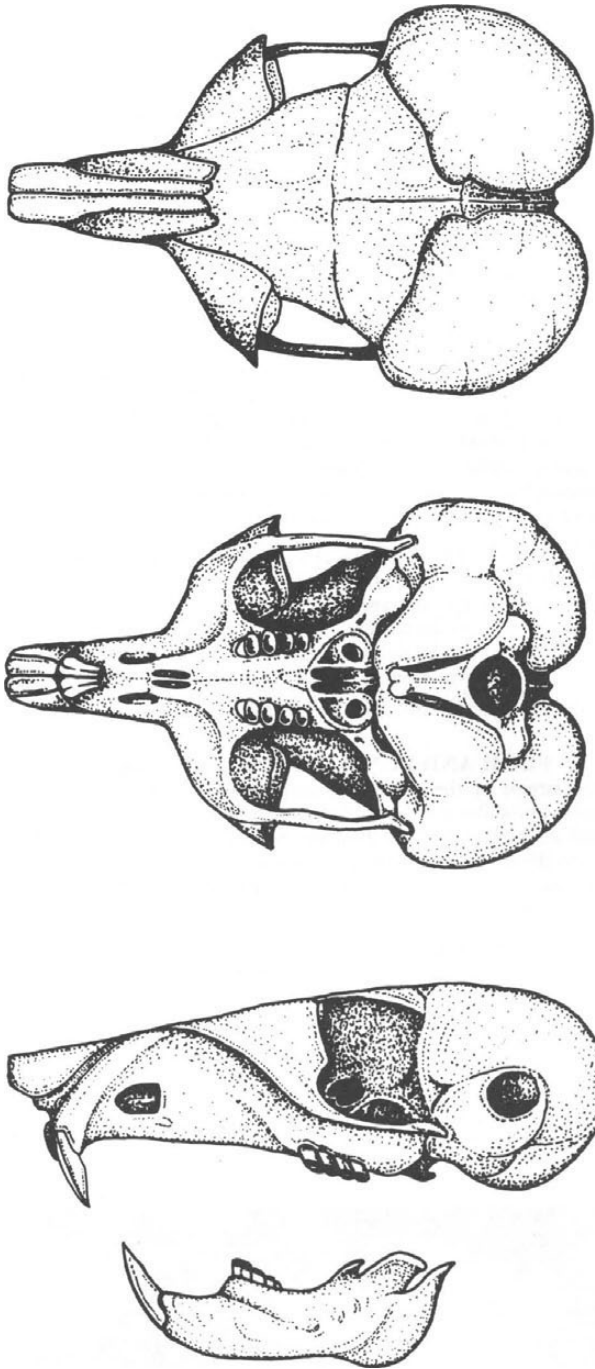


FIG. 2. Dorsal, ventral, and lateral views of cranium and lateral view of mandible of *Dipodomys nelsoni* (male, greatest length of cranium is 43.8 mm; Museum of Southwestern Biology 58179).

Among 299 *D. nelsoni* examined for a morphologic study (Best, 1988), 83 subadult and 11 juvenile specimens were found (based upon the ageing criteria of Best and Schnell, 1974). By month from January to December, they were distributed as follows: 3 subadults, 0 juveniles; 3, 2; 2, 0; 3, 2; 18, 2; 11, 0; 9, 2; 8, 0; 7, 2; 1, 0; 15, 1; 3, 0. This indicates that young may be born every month, but most reproduction seems to occur from April to September and in November.

ECOLOGY. *Dipodomys nelsoni* occurs in the Chihuahua-Zacatecas Biotic Province of México, which is characterized as an arid interior-desert region consisting mainly of rolling plains, increasing gradually from 300 to 900 m in altitude in the north to about 1,500 m in the south and west. Here grassland plains are interrupted by short ranges of desert mountains and areas overgrown with

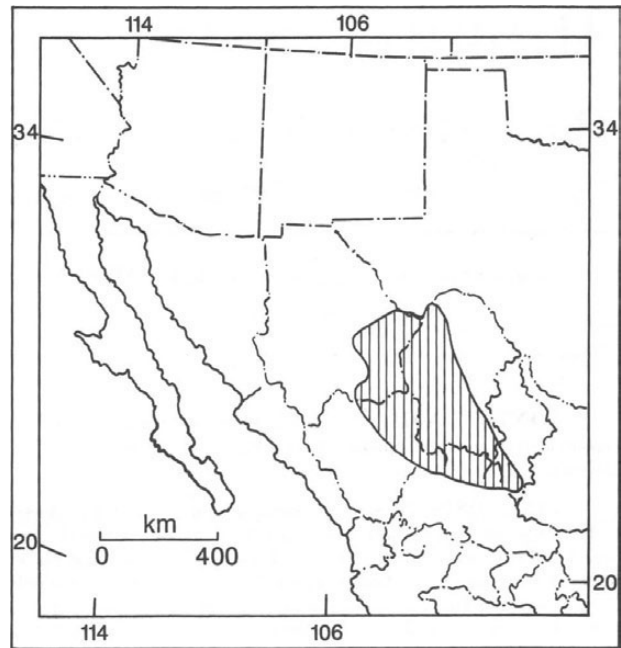


FIG. 3. Distribution of *Dipodomys nelsoni* in México (Hall, 1981).

Prosopis juliflora, *Acacia*, *Fouquieria splendens*, *Larrea tridentata*, *Yucca*, *Agave*, and cacti, including *Myrtillocactus geometrizans* (Goldman and Moore, 1946).

Scattered dome-shaped burrows with peripheral entrances typical of Nelson's kangaroo rat are conspicuous on desert flats (Fig. 5; Matson and Baker, 1986). These broad, low mounds usually possess several entrances. Sometimes openings of burrows are conspicuous in banks of shallow ditches along roadways (Baker and Greer, 1962). Like *D. spectabilis*, *D. nelsoni* constructs mounds, as large as 2.7 m in diameter and 0.6 m high. Some mounds have as many as six entrances and are honeycombed with tunnels (Baker, 1956).

In Chihuahua, burrows have been reported to penetrate the hard subsurface layer of rock. Here it was impossible to dislodge animals from burrows by means of a shovel because holes through the hard subsurface layer of rock enabled the kangaroo rats to remain out of the collector's reach (Hall, 1981).

In Coahuila, some inhabited mounds were surrounded by bare ground for a radius of up to 23 m; evidently these kangaroo rats

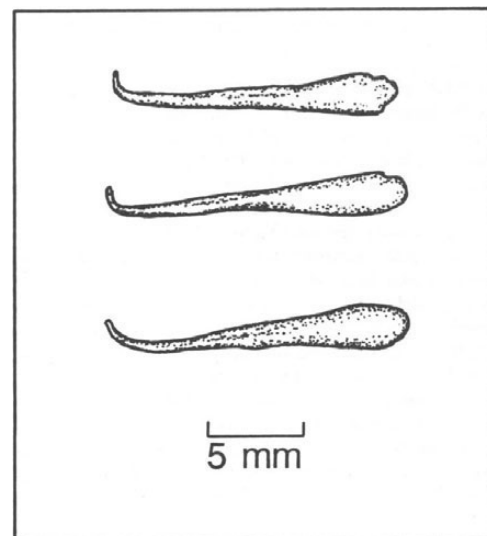


FIG. 4. Lateral views of representative bacula of *Dipodomys nelsoni* from Coahuila.



FIG. 5. A mound constructed by *Dipodomys nelsoni* 5.4 km W General Cepeda, Coahuila.

have to forage for plant foods over a considerable area under such circumstances. One mound examined in June 1952 was constructed in sandy soil about 50 km N Saltillo. Tunnels in the mound were roofed over by thin (<2.5 cm in some places), crusty coverings, that caved-in when stepped on or probed with a shovel. Excavation of the burrow produced a hole 1.2 m across and 0.9 m deep. Four lateral burrows were found leading away from the mound into more substantial soil. No signs of either food, nests, or fecal materials were found in the mound (Baker, 1956).

Near General Cepeda, Coahuila, burrows of *D. nelsoni* were found in hard-packed sandy-loam soils in an area dominated by scattered *Larrea*, *Acacia*, and Cactaceae. Mounds constructed by *D. nelsoni* in dirt piles along the highway between General Cepeda and Parras, Coahuila, were much closer together than those in the adjacent *Larrea* desert. In addition to possibly more favorable soil conditions along the roadway, the larger concentrations of mounds there may be related to the distribution of windblown seeds that serve as a source of food (Best et al., 1988).

When compared to mounds constructed by *Dipodomys spectabilis cratodon* and *D. s. zygomaticus* in northern México, those of *D. nelsoni* (Fig. 5) had the largest means for height of mound (50.3 cm, $SD = 19.8$, range, 20 to 84), total number of openings (13.5, $SD = 3.1$, range, 8 to 20), and numbers of active (10.8, $SD = 3.7$, range, 4 to 17) and inactive (2.7, $SD = 2.5$, range, 0 to 7) openings, and the smallest means for diameter of active (7.6 cm, $SD = 1.1$, range, 5.5 to 9.4) and inactive (4.8 cm, $SD = 0.9$, range, 3.5 to 7.3) openings. Mean diameter of mounds was 366.6 cm ($SD = 81.4$, range, 220 to 525) and the mean distance to the nearest mound was 15.6 m ($SD = 7.7$, range, 5 to 33). Statistically significant differences from the two subspecies of *D. spectabilis* were shown by *D. nelsoni* for its largest means for total number of openings and number of active openings, and its smallest mean for average diameter of inactive openings. Multivariate analyses consistently indicated that *D. nelsoni* was distinct from the two populations of *D. spectabilis* (Best et al., 1988).

Nelson's kangaroo rat was not abundant at any location in Coahuila sampled by Baker (1956). Usually no more than two rats were obtained at any one mound, and in good habitat less than four inhabited mounds were found within normal cruising range of collectors from any one campsite. Only two mounds were found in the vicinity of camps made from Boquillas southward for 48 km. Unoccupied mounds seemingly cave in quickly. When a mound was purposely stepped on to cave in one tunnel, the damage was repaired the next morning.

In San Luis Potosí, tracks and burrows of *D. nelsoni* were observed, but the animals refused to eat the bait on the traps. Because the nights were brightly moonlit, kangaroo rats were extremely difficult to shoot. Only after much hunting were two individuals secured (Dalquest, 1953). Baited snap traps caught few *D. nelsoni* in Chihuahua, though their burrows were easily located. Here the best means of obtaining specimens from the area having holes in the rocky substratum might be to use a spotlight and shot pistol at night, when the rats are above ground (Hall, 1981). Rats cared little for trap baits containing chewed rolled oats in Coahuila. Perhaps, most catches resulted because the rats sprung the traps accidentally when they passed over those that had been set crosswise in their

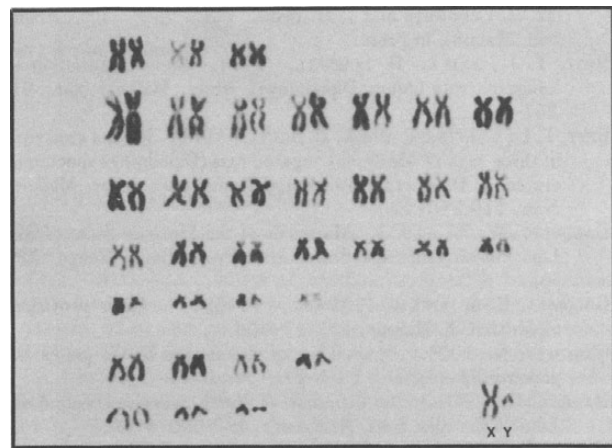


FIG. 6. Karyotype of *Dipodomys nelsoni* from near Matehuala, San Luis Potosí (from Hsu and Benirschke, 1975).

runways at entrances to burrows. Single-spring steel traps (size 0) set in burrow openings either with oats sprinkled on the pan or unbaited were as successful as wood-based rat traps in catching these animals. Hunting at night with flashlights was not successful (Baker, 1956).

The only parasite reported from *D. nelsoni* is the trombiculid mite *Hyponeocula arenicola* (Tanigoshi and Loomis, 1974).

GENETICS. Like *D. spectabilis*, *D. nelsoni* has a diploid chromosomal number of 72 (Fig. 6), but differs from the former in chromosomal configuration. *D. nelsoni* has four metacentric chromosomes (*D. spectabilis* has none), 21 submetacentric chromosomes (*D. spectabilis* has up to 12), seven subtelocentric chromosomes (*D. spectabilis* has none), and three acrocentric chromosomes (*D. spectabilis* has 23 to 35). The Y chromosome is submetacentric and the X chromosome is acrocentric, similar to those in *D. spectabilis*. *D. nelsoni* has a fundamental number of 134, which is greater than that of *D. spectabilis* (range, 70 to 94). The subspecies of *D. spectabilis* differ from each other in the same way that they differ from *D. nelsoni*, but to a lesser degree (Stock, 1974). Similarity of satellite DNA has been used in phylogenetic comparisons of *D. nelsoni* to other species of *Dipodomys* (Hatch and Mazrimas, 1977).

REMARKS. *Dipodomys nelsoni* most closely resembles *D. spectabilis* (Best and Schnell, 1974; Grinnell, 1921; Lidicker, 1960; Schnell et al., 1978; Setzer, 1949). *D. nelsoni* apparently was derived from *D. spectabilis* and retains many of the morphologic characteristics of that species, including a diploid chromosomal count of 72 (Stock, 1974). *D. nelsoni* has been regarded as a subspecies of *D. spectabilis* (Nader, 1965, 1978), and some intermediates have been reported (Baker and Greer, 1962; Hall, 1981; Nader, 1978; Petersen, 1976), but analyses of morphologic data separate the two (Anderson, 1972; Best, 1988; Matson, 1980).

Dipodomys is from the Greek words *di* (two), *podos* (foot), and *myos* (mouse), which refer to its enlarged hind feet and bipedal mode of locomotion. Merriam (1907) no doubt selected *nelsoni* to honor E. W. Nelson, who, with E. A. Goldman obtained the type specimen.

H. T. Haagenstad and B. Dennis prepared the figures. C. Jones, J. O. Matson, T. E. Garrison, M. L. Kennedy, and C. Inness reviewed the manuscript.

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