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FAMILY SCIURIDAE

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INTRODUCTION

The squirrel family, Sciuridae, consists of about 260 species of terrestrial, semiarboreal, and arboreal rodents. It is nearly cosmopolitan in distribution, being absent only from Australasia and oceanic islands. In North America, nearly every terrestrial ecosystem from the lowland tropics to the high Arctic has at least one squirrel species. There are seven genera and 34 native species of Sciuridae in Mexico (Castro-Campillo and Ramírez, 1992), and six genera, 19 species, and 33 subspecies are documented as occurring in northwestern Mexico, as defined in this book.

Several genera of Sciuridae (*e.g.*, *Spermophilus*, *Tamias*) are more diverse north of Mexico. Nevertheless, northwestern Mexico has a relatively high diversity of sciurids because of adjacent desert and montane habitats. Nine of the species are found in desert shrublands or grasslands, and 10 species (plus one introduced and four hypothetical species) are found in pine or pine-oak forests in the Sierra Madre Occidental, Sierra Juárez, Sierra San Pedro Martir, or the tropical forests of Nayarit and Sinaloa, with the highest sciurid diversity in Mexico in the Sierra Madre Occidental (Ocaña Oñate, 1989). Some of the 19 species are common and widespread, and six are game animals (SEMARNAP, 1997), whereas nine others are of conservation concern (NOM-095-ECOL-1994).

The family Sciuridae is defined by the following set of characteristics. The infraorbital canal is reduced with no part of the masseter muscle passing through it. Instead, the masseter medialis extends onto the anterior face of the infraorbital plate, and the cheek pouches are internal rather than external. The skull has well-developed postorbital processes, four or five cheek teeth, and a dental formula of 1/1 0/0 1-2/1 3/3 = 20 or 22. The hind legs are less than twice length of forelegs, and the tibia and fibula are not fused. The hind feet have five digits, whereas the front feet have four. The tail is completely covered with hairs (Hall, 1981; Nowak, 1991). Fossils date from the Oligocene (McLaughlin, 1984).

Except for flying squirrels, squirrels are conspicuous animals that are active during the day, and are thus familiar to the general public. However, they are not as well known scientifically as one might suppose, and many gaps remain in our knowedge. We have reviewed here the squirrel taxa in northwestern Mexico, and hope this review will stimulate further research on these interesting animals.

METHODS

In the species accounts, the genera of Sciuridae are arranged in alphabetical order, as are the species within each genus. For each species, we have included information on the taxonomy, distribution, natural history, conservation status, distributional records, and have suggested some directions for further research. In addition to the standard literature review, we have included original observations and comments on several species. The data on type specimens is from original descriptions, literature, and type lists (Lyon and Osgood, 1909; Wilson, 1991; Lawrence, 1993).

Measurements are useful for confirming identifications, and, when there was a choice, we attempted to use the measurements most appropriate for northwestern Mexico. The many studies consulted used different sets of measurements and different statistics (range only, or mean and standard deviation only, etc.), making a standardized table or set of measurements impractical.

The distributional records utilized some literature references, but were taken principally from computer printouts of specimens in 23 museums in the United States and Mexico. Time and resources have not permitted us to visit these museums to verify the records against the specimens themselves, and the lists of localities will certainly contain some errors. We further caution that we have not had an opportunity to verify the identification of the specimens. The identification of subspecies near the limits of their ranges should be regarded with particular suspicion. We know of no way to detect and resolve the all the errors without additional field work and visiting the museums. Also, some collections of sciurids have not been included, so the records listed are incomplete. Nevertheless, the specimen records do show patterns of distribution and collecting effort much better than existing maps (*e. g.*, Hall, 1981) and it seems valuable to include them. We have cited the records, quoting them exactly and editing only the most obvious errors. For example, readers will find "Puerto Peñasco," "Punto Peñasco," and "Punta Peñasco"--and all probably refer to Puerto Peñasco, Sonora.

Specimen records from the following collections have been included: Albertson College (ACMNH); American Museum of Natural History (AMNH); California Academy of Sciences (CAS); California State Polytechnic University (CSPUP); California State University-Los Angeles (CSULA); California State University-Long Beach (CSULB); California State University-Northridge (CSUN); Carnegie Museum of Natural History (CM); Field Museum of Natural History (FMNH); Museum of Comparative Zoology, Harvard University (MCZ); Instituto Politecnico Nacional (ENCB); Michigan State University (MSU); Museum of Southwestern Biology, University of New Mexico (MSB); National Museum of Natural History (USNM); Nevada State Museum (NSM); Moore Laboratory of Zoology, Occidental College (MLZ); Oklahoma State University (OSU); San Diego Natural History Museum (SDNHM); Texas Cooperative Wildlife Collection, Texas A & M University (TCWC); Universidad Autónoma Metropolitana-Iztapalpa (UAM-I); Instituto de Biología, Universidad Nacional Autónoma de México (IB UNAM); Museum of Vertebrate Zoology, University of California-Berkeley (MVZ); Universidad Autónoma de Baja California (UABC); University of California-Los Angeles (UCLA); University of Colorado (UCM); University of Florida, Florida State Museum (FSM); University of Kansas (KU); Burke Museum, University of Washington (UW-WSM).

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Although we occasionally disagreed with their conclusions, the excellent works of Howell (1938) and Hoffmeister (1986) were indispensible in preparing this chapter, and we highly recommend them to any serious student of Mexican Sciuridae.

Ammospermophilus Merriam

1892. *Ammospermophilus* Merriam, Proc. Biol. Soc. Wash., 7:27.

Type species. *Tamias leucurus* Merriam, 1889 [=*Ammospermophilus leucurus* (Merriam, 1889)].

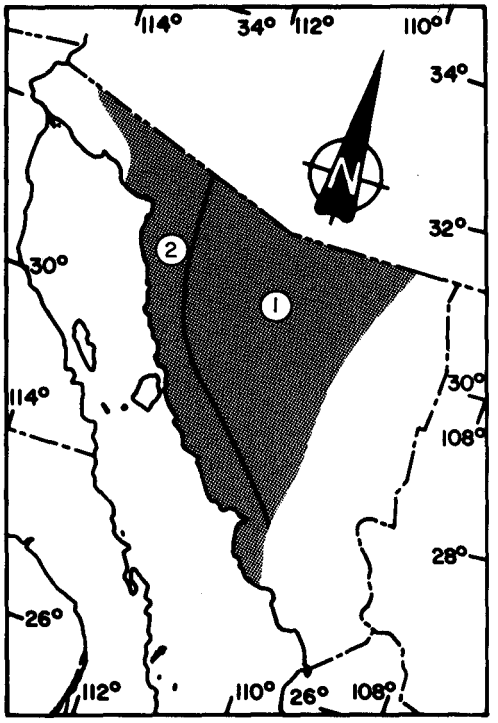
Diagnosis. The claviobrachialis muscle is absent (present in all other terrestrial squirrels; Bryant, 1945). The baculum is unique: the spoon joins the shaft at a 90° angle, is longer than the shaft and wider than long, and small spines occur all around the rim (Howell, 1938; Bryant, 1945; Burt, 1960). There is a small masseteric tubercle directly below the narrow, oval, medially-inclined infraorbital foramen. The cranium is nearly rectangular in dorsal outline, the dorsal surface flatter, and the sides of the cranium more vertical than in other ground squirrels. The brachydont cheek teeth have metalophs on M1 and M2 that do not join the protocone, and the protolophid is absent on P4 (Bryant, 1945).

Remarks. The antelope ground squirrels (genus *Ammospermophilus*) are easily distinguished in the field from other ground squirrels by their white lateral stripes and their habit of holding the tail up over the back when they run. The mantled ground squirrels, *Spermophilus* (subgenus *Callospermophilus*) also have white lateral stripes, but these are bordered by black stripes, the ear is much larger, the tail much thinner, the lateral line extends much higher, and they typically live in coniferous forest habitats. We know of no habitat overlap between *Ammospermophilus* and the mantled ground squirrels. *Ammospermophilus* do not hibernate and remain active all year, whereas mantled ground squirrels are classic hibernators. Chipmunks (*Tamias*) also have lateral stripes, but are easily distinguished by stripes on the face, a long, thin tail, and generally smaller size.

Ammospermophilus is closely related to *Spermophilus*, but there has been disagreement on the closeness of the relationship. Merriam (1892) erected *Ammospermophilus* as a subgenus of *Spermophilus*, but did not define it. Mearns (1907) raised *Ammospermophilus* to a genus and provided defining characteristics. Howell (1938) later reduced *Ammospermophilus* to a subgenus, but Bryant (1945) again elevated it to generic status, and this judgement has been followed to the present. Sciurid phylogenies disagree on the distance between *Ammospermophilus* and *Spermophilus* (Bryant, 1945; Black, 1972; Hafner, 1984).

There are five species of *Ammospermophilus*, three of which have allopatric distributions in northwestern Mexico. All live in semiarid habitats. All are known in Mexico by the common name "Juancito".

Ammospermophilus harrisii (Audubon and Bachman)



Geographic range of *Ammospermophilus harrisii*:
1. *A. h. harrisii* 2. *A. h.. saxicola*

Range. *A. harrisii* occurs in desert areas east of the Colorado River. In Arizona, it extends north and east to the Mogollon Rim and extreme southwestern New Mexico. In Sonora, it occurs from the Pacific coast on the west to the limits of the Sonoran Biogeographic Province in the east, except for the Pinacate desert.

Description. *A. harrisii* has a medium to short tail and small ears. The dorsal winter pelage is mouse gray, variegated with white, and the head, shoulders, thighs, and legs are cinnamon buff to fawn. The dorsal summer pelage is cinnamon buff, and shorter and harsher in texture. There is a white lateral stripe from the shoulders to the rump. The tail is mixed black and white above and below. The skull has long, inflated auditory bullae and the dental formula is 1/1 0/0 2/1 3/3 = 22. There is no sexual dimorphism (Howell, 1938; Hoffmeister, 1986; Best *et al.*, 1990b).

Measurements. The highest and lowest means of nine populations of *A. harrisii* (with total range of measurements in mm for all nine populations in parentheses, n=77 adults) were: total length, 229.0-245.8 (216-267); tail length, 70.9-84.6 (67-92); hind foot length, 37.2-41.6 (35-46); ear length, 11.5-13.9 (10-16); greatest length of skull, 39.2-41.0 (37.6-42.4); zygomatic breadth, 22.7-23.7 (22.0-24.1); length of nasals, 11.5-12.8 (10.2-13.6); interorbital breadth 9.0-9.8 (8.5-10.4); postorbital constriction, 13.1-14.8 (12.2-14.9); cranial breadth, 18.8-19.7 (18.1-20.5); palatilar length, 17.4-18.2 (16.6-19.1); maxillary toothrow, 7.0-7.3 (6.5-7.8); and bulla length, 10.2-10.9 (9.8-11.4) (Hoffmeister, 1986). Hoffmeister (1986) found no significant secondary sexual dimorphism in two external and five cranial measurements.

Remarks. The underside of the tail is dark gray (mixed black and white hairs) in *A. harrisii*, whereas *A. leucurus* and *A. insularis* have white undertails. The tail averages longer (67-94 vs. 50-87 mm), the dorsal pelage is darker, and the auditory bullae are slightly larger than in *A. leucurus* (Best *et al.*, 1990b).

The Colorado River separates the ranges of *A. harrisii* and *A. leucurus*, and may act as a barrier or filter. However, *A. leucurus* occurs on both sides of the Colorado River north of the Grand Canyon, where *A. harrisii* is absent. No fossils of *A. harrisii* are known (Best *et al.*, 1990b).

Ammospermophilus harrisii is associated primarily with the Sonoran Biogeographic Province (Brown, 1994), although it enters the Chihuahuan Biogeographic Province in southeastern Arizona and extreme western New Mexico. *A. harrisii* inhabits a variety of desert habitats, but usually has

a spotty distribution (Dice and Blossom, 1937). In some areas it is associated with rocky soils in canyons or hills, but elsewhere lives on sandy plains, river bottoms, or valleys (Best *et al.*, 1990b). They live as scattered individuals and are never abundant; population densities ranged from 0.08 to 0.36 individuals/ha (Best *et al.*, 1990b). They are frequently sympatric with *Spermophilus tereticaudus*, but in Arizona *A. harrisii* is found in rockier areas with denser vegetation than the latter (Neal, 1964; Hoffmeister, 1986; Best *et al.*, 1990b). The diet consists of mesquite beans, yucca seeds, cactus fruit and seeds, and green vegetation (Hoffmeister, 1986).

There are two molts, one in May or June and another in October. Winter pelage is longer and softer (Howell, 1938; Hoffmeister, 1986). They are apparently able to live without free water. The breeding season is from December to February, and young are born from February to April. There is one litter of 5-10 ($\bar{x}$ = 7.3) young per year (Neal, 1965).

They sometimes climb cholla cacti, but how they do this without damaging their feet is not clear. They are diurnal and are frequently active in the heat of the day, like other *Ammospermophilus* (Best *et al.*, 1990b).

Ammospermophilus harrisii is listed as a game animal in the Calendario Cinegético (SEMARNAP, 1997). In Sonora, the hunting season for squirrels is from 31 October to 22 March, and *A. harrisii* is included in the daily limit of three squirrels, with six in possession.

There are two subspecies; both occur in northwestern Mexico:

Ammospermophilus harrisii harrisii (Audubon and Bachman)

1854. *Spermophilus harrisii* Audubon and Bachman, Viviparous Quadrupeds of North America, 3:267.

1907. *Ammospermophilus harrisii*, Mearns, Mammals of the Mexican boundary of the United States, 303.

Type locality. "...on the Mexican boundary line, from the Santa Cruz Valley westward as far as the Sonoyta..." (as restricted by Mearns, 1896:444).

Range. *A. h. harrisii* occurs in the Arizona and Sonora uplands.

Recorded localities. *SONORA*: Agua Dulce (Hall, 1981); Agua Prieta, 32 km SE (Hall, 1981); Hermosillo (USNM 1, Hall, 1981); Magdalena, 1000' above town (USNM 1); Magdalena, 2 mi W La Mision (MVZ 1); Ortiz (USNM 1, Hall, 1981); Poso de Luis (USNM 1); Santa Ana, 33.4 mi S Puerto Gonzalitos (MVZ 1).

Ammospermophilus harrisii SONORA: Bamori, 15.6 mi SW (MVZ 1); Crater Elegante, 0.5 mi S (MVZ 4); Estero Tasiota, 5 mi NE (MVZ 1); San Javier, 2 mi E Cerro Colorado (MVZ 5); Sasabe, 22 mi SE (MSU 1); Sasabe, 26 mi S (AMNH 1); Sierra del Pinacate, Tinajas de los Papagos (MVZ 1); Sonoyta, 18 mi W (CSULB 1); Sonoyta, 140 [!] km S (CSULB 1); Sonoyta, 8 mi S sobre la carretera a Puerto Peñasco (CSULB 1); Tajitos, 1 mi W (CSULB 1).

Description. *A. h. harrisii* is larger and darker, with a shorter tail (80 vs. 95 mm) than the lighter *A. h. saxicola* (Mearns, 1907).

Measurements. The measurements ($\bar{x} \pm$ SD, range) of five male and six female adult *A. h. harrisii* from near the Graham Mountains and Bowie in southeastern Arizona were: total length, 235.0 ± 12.8 (221-267); tail length, 78.1 ± 5.1 (70-89); hind foot length, 40.8 ± 1.5 (38-43); ear length, 13.9 ± 1.3 (12-16); greatest length of skull, 40.43 ± 0.79 (39.1-41.9); zygomatic breadth, 22.83 ± 0.67 (22.2-24.0); length of nasals, 12.14 ± 0.61 (11.5-13.2); interorbital breadth, 9.48 ± 0.43 (8.8-10.2); postorbital constriction, 14.27 ± 0.40 (13.6-14.9); cranial breadth, 19.32 ± 0.50 (18.3-20.0); palatilar length, 18.23 ± 0.51 (17.4-18.8); maxillary toothrow, 7.19 ± 0.35 (6.5-7.6); and auditory bulla length, 10.85 ± 0.24 (10.5-11.4) (Hoffmeister, 1986) .

Remarks. See comments under *A. h. saxicola.*

Ammospermophilus harrisii saxicola (Mearns)

1896. *Spermophilus harrisi saxicolus* Mearns, Proc. U.S. Nat. Mus., 18:444.

1907. *Ammospermophilus harrisii saxicola*, Mearns, Bull. U.S. Nat. Mus., 56:viii, 306.

Type locality. "Tinajas Altas, Gila Mountains, Yuma County, Arizona."

Range. This subspecies occurs in the Colorado Desert closer to the Gulf of California than *A. h. harrisii.*

Recorded localities. *SONORA*: Bahía Kino (SDNHM 7, Hall, 1981); Bahía Kino, 0.5 mi N (CSULB 3); Bahía Kino, 4 mi N (by road) (USNM 1); Kino, 2.5 mi WNW (KU 1); Kino, 8 mi E (KU 2); Mexican boundary, Granite Mountains W of Tule Wells (USNM 2); Mexican boundary, Colorado Desert, Tinajas Mountains (USNM 1); Nuevo Kino, 6 km W of Kino, 3 msnm (KU 6); Nuevo Kino, 1 mi N, 50 msnm (KU 1); Pozo Escalante, 7 mi ENE (KU 1); Puerto Kino (MVZ 1, FSM 1); Puerto Kino, 6.8 mi N, Mina Los Afanes (MVZ 4); Puerto Libertad (SDNHM 6; Hall, 1981); Puerto Libertad, 4 mi NW, 50 ft. (KU 1); Puerto Libertad, 4 mi WNW (KU 2); Puerto Libertad, 45 mi NE (Hall, 1981); Puerto de Lobos, 7 mi NE (MVZ 1); Punta Arenas, 1 mi E (MVZ 1); Punta Arenas, 3.7 mi W, tierra firme de la Isla Tiburón (MVZ 1); Punta Peñasca, 3 mi N, Bahia Cholla (MVZ 1); Punta Peñasco (SDNHM 1); Puerto Peñasco, 27 mi N (MSB 1); Puerto Peñasco, 27 mi NW (MSB 1); Puerto Peñasco, 3.9 mi NE (MSB 1); Punta Peñasco, 1 mi E (CSUN 2); Punta Peñascosa (SDNHM 2); Punto Chueco, 14.8 mi N (USNM 2); Punta Chueca, 9 km N, 2 km E (MSB 2); San Carlos, 4 mi NW (MSB 2); San Carlos, 8 mi NNW (MSB 1).

Description. *A. h. saxicola* is a small, palid, desert form with a longer tail (95 vs. 80 mm) than the darker *A. h. harrisii* Mearns (1907).

Measurements. The means ± standard deviations (ranges in parentheses) of nine males, six females, and two adults of unrecorded sex of *A. h. saxicola* from Tinajas Altas and Tule Wells, Yuma Co., Arizona were as follows: total length, 232.1 ± 9.1 (216-245); tail length, 84.6 ± 5.8 (72-92) ;hind foot length, 39.2 ± 1.0 (37-41); greatest length of skull, 39.32 ± 0.59 (38.3-40.4); zygomatic breadth, 22.78 ± 0.61 (21.6-23.6); length of nasals, 11.45 ± 0.57 (10.7-13.1); interorbital breadth, 9.03 ± 0.43 (8.5-10.1); postorbital constriction, 13.42 ± 0.42 (12.7-14.3); cranial breadth, 18.80 ± 0.34 (18.3-19.4); palatilar length, 17.50 ± 0.58 (16.6-18.5); maxillary toothrow, 7.33 ± 0.19 (7.1-7.8); and auditory bulla length, 10.22 ± 0.26 (9.8-10.9) (Hoffmeister, 1986).

Remarks. *A. h. kinoensis* Huey from Bahía Kino, Sonora was considered a synonym of *A. h. saxicola* by Howell (1938). However, there is considerable geographic variation in pelage coloration and cranial measurements in this species (Hoffmeister, 1986), and the geographic variation and subspecific taxonomy of *A. harrisii* needs further study. The eumelanin content of the pelage is higher in more mesic regions (Best *et al.*, 1990b), resulting in darker coloration. *A. h. saxicolus* is supposedly slightly paler than *A. h. harrisii.* However, tint-photometer readings did not show a significant difference between the two (Dice and Blossom, 1937). Hoffmeister (1986) failed to find consistent size, tail, or color differences between specimens of the two subspecies, although he did find extensive geographic variation. He synonymized *A. h. saxicola* with *A. h. harrisii*, making the species monotypic. However, Best *et al.* (1990b) did not follow this judgement. We think Hoffmeister (1986) was probably correct to synonomize *A. h. saxicola* with *A. h. harrisii*, but this needs to be confirmed with a more complete study of the extensive geographic variation in *A. harrisii.*

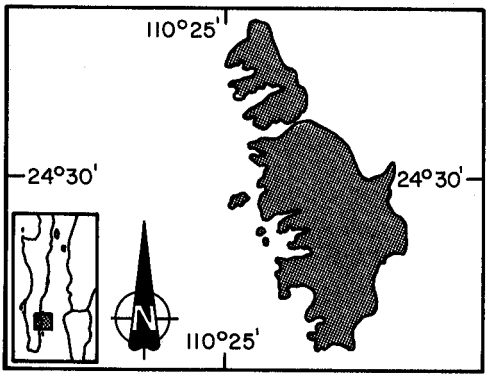
Ammospermophilus insularis Nelson and Goldman

1909. *Ammospermophilus leucurus insularis* Nelson and Goldman, Proc. Biol. Soc. Washington, 22:24.
1959. *Ammospermophilus insularis*, Hall and Kelson,Mammals of North America, 1959:334.

Type locality. "Espíritu Santo Island, Lower California [Baja California Sur], Mexico."

Range. The Espíritu Santo Island antelope squirrel is confined to Espíritu Santo Island, Gulf of California, Baja California Sur.

Recorded localities. *BAJA CALIFORNIA SUR*: Isla Espíritu Santo (CAS 2, MVZ 3, SDNHM 2, UCLA 8, AMNH 5, USNM 14); Isla Espíritu Santo, W side (MSB 8); Isla Espíritu Santo, San Gabriel (MVZ 1); Isla Partida, Bahía Cardonal (SDNHM 1).



Geographic range of *Ammospermophilus insularis*.

Description. *A. insularis* is a medium-sized rodent, with medium to short tail and small ears. Dorsal winter pelage is light cinnamon brown variegated with grayish-white, whereas the summer pelage is shorter and harsher in texture and lighter in color. The nose, head, shoulders, and legs are shades of cinnamon brown or dull fawn, and the underparts are buffy white. There is a creamy-white lateral stripe from the shoulders to the rump. The tail is mixed black and buffy white above and buffy white below bordered with black and tipped with buffy white. The rostrum is broad and the frontal area has been described as "heavy." The P3 is missing in about half of the specimens, so the dental formula is 1/1 0/0 2-1/1 3/3 = 20-22. They are not known to be sexually dimorphic (Nelson and Goldman, 1909; Howell, 1938; Best *et al.*, 1990a).

Measurements. Means and ranges (in mm) of external measurements of seven adults were: total length, 229 (210-240); tail length, 78 (71-83); hind foot length, 38.3 (36-40); ear length, 9.1 (8-11). Cranial measurements of five adults were: greatest length of skull, 41.8 (40.3-42.4); zygomatic breadth, 24.2 (23.9-24.7); length of nasals, 13.6 (12.3-14.3); interorbital breadth, 10.1 (9.8-10.6); postorbital constriction, 13.8 (13.4-14.0); cranial breadth, 8.9 (18.7-19.0); palatilar length, 18.4 (18-19); maxillary toothrow, 6.5 (6.4-6.7) (Howell, 1938).

Remarks. *Ammospermophilus insularis* is monotypic. It is similar to *A. leucurus extimus* on the nearby mainland of Baja California, but is larger and slightly darker on the flanks and hind legs. The skull is larger in nearly all measurements than *A. leucurus extimus*, except for the maxillary toothrow length. This may be because P3 is missing in many specimens of *A. insularis* (Howell, 1938).

Espíritu Santo Island is separated from the mainland of Baja California by the shallow San Lorenzo Channel, which is 6 km wide and about 10 m deep. The island is 16 km long and 7 km wide, and mountainous with the highest point being about 600 m above sea level (Nelson, 1922). The most recent connection between Espíritu Santo and the mainland occurred about 7000 years ago (Wilcox, 1978, cited in Mascarello and Bolles, 1980). Espíritu Santo is connected with Isla Partida at low tide. Best *et al.* (1990a, citing Hafner, 1981) state that *Ammospermophilus insularis* does not occur on Isla Partida, but there is a specimen record from Isla Partida in the San Diego Natural History Museum (see Recorded Localities above).

Since *A. insularis* has been isolated on Espíritu Santo Island for approximately 7000 years, it would presumably be most closely related, and possibly not even specifically distinct from the antelope ground squirrel on the adjacent mainland, *A. leucurus extimus*. However, the karyotype of *A. insularis* (2n=32) is more similar to that of *A. harrisii* than to *A. leucurus* (Mascarello and Bolles, 1980). No fossils of *A. insularis* are known (Best *et al.*, 1990a).

There is no fresh water on Espíritu Santo Island. The habitat is arid-tropical desert with large cacti similar to that on the adjacent mainland (Best *et al.*, 1990a). There is no detailed information on the ecology of *A. insularis*.

Little is known about the physiology or reproduction of *A. insularis*. There are spring and fall pelage molts, and winter pelage is softer and longer than spring pelage (Best *et al.*, 1990a). The alarm call is a trill similar to other *Ammospermophilus* (Best *et al.*, 1990a).

Ammospermophilus insularis is listed as threatened (amenazada) (Ceballos and Rodriguez, 1993; NOM-095-ECOL 1994), presumably due to its restricted distribution. A taxonomic study to determine if *A. insularis* is distinct at the species level from mainland *A. leucurus* would be useful.

Ammospermophilus leucurus (Merriam)

Range. *Ammospermophilus leucurus* occurs from southeastern Oregon, southwestern Idaho, Utah, Colorado, south into the part of Arizona north of the Grand Canyon of the Colorado River and west of the Colorado River in California, and then south throughout most of the Baja California peninsula (Hall, 1981).

Description. *A. leucurus* is a medium-sized rodent, with medium to short tail, and short, rounded ears. The dorsal pelage is grayish, brown, or cinnamon variegated with grayish-white in winter, and shorter and harsher in texture, and lighter in color in summer. The nose, head, shoulders, and legs are shades of cinnamon brown or dull fawn, and the underparts are creamy white. There is a creamy-white lateral stripe from the shoulders to the rump, and the tail is mixed black and buffy white above and buffy white below bordered with black and tipped with buffy white. The skull has a flattened braincase and long, inflated bullae. The dental formula is 1/1 0/0 2/1 3/3 = 22. Males are slightly larger than females (Howell, 1938; Hoffmeister, 1986; Belk and Smith, 1991). *Ammospermophilus harrisii* has a gray undertail and *A. insularis* has larger cranial measurements. The latter frequently lacks P3.

Measurements. The ranges of external and cranial measurements of both sexes of all subspecies of adult *A. leucurus* were: total length, 194-239; tail length, 54-77; hind foot length, 37-41; ear length, 7-10; greatest length of skull, 37.0-41.8; zygomatic breadth, 21.3-24.2; length of nasals, 10.7-13.7; interorbital breadth, 8.6-10.4; postorbital constriction, 13.1-15.2; cranial breadth, 17.8-19.5; palatilar length, 16.8-19.0; maxillary toothrow, 6.1-7.7 (Howell, 1938).

Remarks. *Ammospermophilus fossilis* has been described from Clarendonian (late Miocene/early Pliocene deposits in California. Pliocene fossils of the genus are known from Washington, Oregon, Idaho, and the cape region of Baja California. *A. leucurus* is known from Texas and Utah in late Pleistocene, and from Arizona, Nevada, and California during the Holocene (Belk and Smith, 1991). The diploid number of chromosomes is 32 in all *Ammospermophilus* (Belk and Smith, 1991).

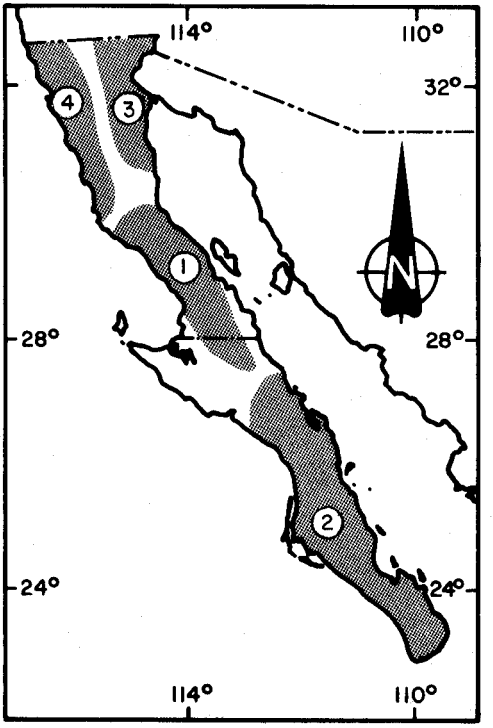
A. leucurus occurs in a variety of semiarid habitats; it appears to be a generalist with regard to shrub species and soil types (Belk and Smith, 1991). Population densities are low (0.06-0.35

individuals/ha) relative to other desert rodents, but the larger body size (*ca.* 110 g) makes them significant in terms of biomass in many communities where they occur (Belk and Smith, 1991).

They feed on green vegetation, seeds, insects, and vertebrates, in that order. They have been known to capture and eat smaller rodents. Food selection seems to be related to moisture content of the food available in order to maintain water balance (Belk and Smith, 1991).

Predators include birds of prey, coyotes (*Canis latrans*), foxes (*Vulpes*), badgers (*Taxidea taxus*) and snakes. Parasites included seven protozoan species, four cestodes, one acanthocephalan, seven nematodes, 23 fleas, 4 ticks, and two Diptera larvae (Belk and Smith, 1991).

In California, the breeding season occurs in March. Both males and females first reproduce at one year of age, and normally 100% of adults are reproductively active. Gestation is 30-35 days and litter size ranges from 5-14, but is adjusted according to annual productivity. The young are altricial, and are weaned after about two months. Growth is relatively slow, possibly due to the low productivity of an arid environment or perhaps the fact that they do not hibernate (Belk and Smith, 1991).



Geographic range of *Ammospermophilus leucurus*:
1. *A. l. canfieldae* 2. *A. l. extimus*
3. *A. l. leucurus* 4. *A. l. peninsulae*

They can discriminate blue and some yellows, but not red and green. They have a number of behavioral and physiological adaptations to reduce water loss, yet remain active during the day in arid environments. They have efficient kidneys, can withstand dehydration of 20-25%, can drink saline water (up to 1.4X sea water), but cannot live indefinitely without free water. Normal active body temperature is 38° C, but it fluctuates with ambient temperature, and they can survive temperatures as high as 43.6° C without harm. They do not tolerate cold temperatures well, do not store body fat, and do not hibernate. They can become torpid in an extreme situation, but are unable to arouse unless the ambient temperature exceeds 20° C (Belk and Smith, 1991).

In summer, they are most active in mid-morning and late afternoon to avoid extreme mid-day temperatures. Peak activity is between 10-32° C. They run rapidly across open areas and then forage in the shade. When the body temperature reaches a maximum, they return to their burrows and dissipate the heat load by putting their bellies against the cooler ground. Above ground activity and below ground cooling cycles take about 15-20 minutes. They frequently forage in shrubs, which increases convective heat loss. In winter, activity is unimodal (Belk and Smith, 1991).

Home ranges are about 6 (3-8) ha. Radio collared individuals traveled an average of 1 km/day. They utilize multiple burrows throughout the home range, and frequently take over abandoned

kangaroo rat (*Dipodomys* spp.) burrows. They make small seed caches in the burrows (Belk and Smith, 1991). They form stable, linear dominance hierarchies rather than holding territories. Alarm calls are pure toned, high pitched, long trills similar to those of *A. harrisii*. High pitched trills are associated with open habitats in *Ammospermophilus* (Belk and Smith, 1991).

The species is widespread in many parts of the peninsula (EY, personal observations), and appears unaffected by roads and campgrounds (Belk and Smith, 1991). Interestingly, the Calendario Cinegético (SEMARNAP, 1997) includes *A. harrisii* but not *A. leucurus*.

The limits of the subspecies in Baja California need to be more clearly defined. There are nine subspecies; four occur in northwestern Mexico:

Ammospermophilus leucurus leucurus (Merriam)

1889. *Tamias leucurus* Merriam, N. Amer. Fauna, 2:20.

1907. *Ammospermophilus leucurus*, Mearns, Bull. U.S. Nat. Mus., 56:vii, 299.

Type locality. San Gorgonio Pass, Riverside County, California.

Range. *A. l. leucurus* occurs from southeastern Oregon and Utah south to the San Felipe desert in northeastern Baja California (Hall, 1981).

Recorded localities. *BAJA CALIFORNIA*: Alaska, 1 mi W, La Rumerosa (MVZ 1); Alaska, 3 mi W, La Rumerosa (MVZ 1); Laguna Salada, Cañon los Muertos, Gaskills Tank (SDNHM 4); Laguna Salada, lado oeste, 15 mi S, Cañon Las Palmas (MVZ 6); Parral (FMNH 2; Hall, 1981); Paso San Matias, cima (SDNHM 1); Punta San Felipe (MVZ 3); San Felipe (MVZ 7, SDNHM 5, CSULB 2, FMNH 6, Hall, 1981); San Felipe Bay (USNM 1); San Felipe, 1 mi S (CSULB 1); San Felipe, 11 mi N, 4 mi W (MSB 4); San Felipe, 22 mi SE (CSULB 1); San Pedro Martir Mounvalle at E Base, 1000 ft. (USNM 1); San Pedro Martir Mountain Base, Esperanza Canyon, 1600 ft. (USNM 1); San Pedro Martir Mountain Base, Windy Canyon, 3600 ft. (USNM 2).

Ammospermophilus leucurus ssp? [Not located or uncertain locality due to redundancy of geographic names]: Arroyo San Jose, 1.9 mi W (SDNHM 1); Bahía San Francisco (AMNH 1); Boca de la Sierra (CSULB 1); Buena Vista (MVZ 3); Cañon San Juan de Dios (SDNHM 1); El Mayor, 13 mi N (MVZ 2); Jesus Maria, 10 mi S (SDNHM 1); Las Palomas (SDNHM 1); Los Burros (MVZ 1); Manantial de San Martin (FMNH 4); San Jose (MVZ 1); San Jorge (SDNHM 1); Sangre de Cristo (SDNHM 8); Sierra Santa Marta (USNM 1); Trinidad (FMNH 1); Triunfo (MVZ 10).

Description. In summer, the dorsal pelage is vinaceous buff with pinkish cinnamon legs, buffy white feet, white eye ring and lateral stripes, and white underparts. In winter, the dorsal hairs have white tips and a subterminal fuscous band, resulting in drab gray coloration. The tail is mixed black and white above and clear, creamy white below, bordered with a black subterminal band.

Measurements. The means and ranges of external measurements (in mm) of five male and five female adult *A. l. leucurus* from the type locality were: total length, 216.3 (211-223); tail length, 67.5 (63-71); hind foot length, 38.3 (37-40); ear length, 9 (8.5-10). Cranial measurements of eight male and three female adults were: greatest length of skull, 38.8 (37.2-40.0); zygomatic breadth, 22.6 (21.7-23.5); length of nasals, 11.4 (10.7-12.0); interorbital breadth, 9.7 (8.8-10.4); postorbital constriction, 13.9 (13.1-14.9); cranial breadth, 18.4 (17.8-19.3); palatilar length, 17.6 (16.8-18.5); maxillary toothrow, 6.7 (6.1-7.0)(Howell, 1938).

Remarks. The range of this subspecies is an enormous 1500 km from north to south, from Oregon to northern Baja California.

Ammospermophilus leucurus canfieldae Huey

1929. *Ammospermophilus leucurus canfieldae* Huey, Trans. San Diego Soc. Nat. Hist., 5:243.

Type locality. "Punta Prieta, Lower California [=Baja California], Mexico, lat. 28° 56' north, long. 114° 12' west."

Range. This subspecies occurs in the Central Desert from Cataviña to the San Ignacio area.

Recorded localities. *BAJA CALIFORNIA*: Aguaje de San Esteban (USNM 1; Hall, 1981); Arrastres de Arriola, 4 mi N (CSULB 1); Las Arrastras, 5 mi SW (CSULB 1); Bahía Los Angeles (USNM 1); Bahía de los Angeles, 7 mi S, Los Flores (SDNHM 1); Bahía de los Angeles, 7 km x carr. W (MVZ 1); Bahía San Francisquito, 7 mi W (SDNHM 4); Bahía San Luis Gonzaga, 8 mi S (CSULB 1); Bahía Santa Teresa (UCLA 1); Los Angeles, 2 mi S, Desierto (MVZ 1); Campo Los Angeles (SDNHM 2); Calamahue, 950 ft. (USNM 3; Hall, 1981); Calamahue, mouth of Calamahue Arroyo, 10 ft. (USNM 1); Campo Los Angeles (Hall, 1981); Cataviña (MVZ 2); Cataviña, 7 mi S (SDNHM 1); El Barril, Golfo de California (SDNHM 3); El Rosario, 2 mi N (CSULB 2); Jaraguay, 58 mi SE San Fernando, 1800 ft. (USNM 2; Hall, 1981); Mesquital (SDNHM 2); Mezquital, 9 mi NW (CSULB 1); Mezquital, 23 mi NE (CSULB 1); Mesquital, 10 mi SE (MVZ 16); Mision San Fernando (SDNHM 1); Mision de San Borjas (SDNHM 1, MSB 8); Mision de San Borja, 10 mi W (MSB 1); Mision Santa Gertrudis (SDNHM 2); Punta Prieta (MVZ 3, SDNHM 2; Hall, 1981); Punta Prieta, 14 mi N, Mina Desengaño (SDNHM 1); Rancho Santa Catarina (MSB 1); Rosarito, 4 mi NE (MSB 1); El Rosarito, 5 mi N (MVZ 1); San Agustine (MSB 6); San Andres (SDNHM 1); San Francisquito Bay, 7 mi W (MSB 4); San Ignacio (MVZ 8, USNM 6); San Ignacio, 11 mi N, Desierto (MVZ 1); San Ignacio, 10 mi E (MSB 7); Santa Catarina Landing (MSB 4); Santo Domingo (USNM 2; Hall, 1981); San Andrés (Hall, 1981); Sierra San Borjas, Mina San Juan (SDNHM 4); Yubay, 30 mi SE Calamahue (USNM 1; Hall, 1981). *BAJA CALIFORNIA SUR*: El Arco (SDNHM 1); El Arco, 16 mi W (USNM 1); El Arco, 5.7 mi SSE (MVZ 1); El Arco, 10 mi SSE (MVZ 2); El Arco, 32 mi S (CSULB 1).

Description. *A. l. canfieldae* is darker than *A. l. leucurus*, with a more pronounced orbital ring. It is lighter than *A. l. peninsulae*, but the eye ring is more pronounced. The skull is smaller, with a shorter, heavier rostrum, shorter maxillary toothrow, narrower braincase posteriorly, and smaller bullae than *A. l. leucurus* and *A. l. peninsulae* (Huey, 1929). The pelage is lighter than that of *A. l. extimus* but it is darker on the body, legs, and undertail than *A. l. leucurus* due to an additional dark band on the hairs (Howell, 1938).

Measurements. Means and ranges of external measurements of two adult males and three females of *A. l. canfieldae* were as follows: total length, 220.6 (215-226); tail length, 70.8 (66-78); hind foot length, 36 (35-38); ear (dry) length, 8.2 (8.0-8.5). Cranial measurements of three adult males and three adult females were: greatest length of skull, 38.5 (37.5-39.0); zygomatic breadth, 22.3 (21.9-22.7); length of nasals, 11.7 (11.0-12.6); interorbital breadth, 9.3 (8.9-10.0); postorbital constriction, 13.6 (12.9-14.3); cranial breadth, 18.3 (18.0-19.0); palatilar length, 17.2 (17.0-17.5); maxillary toothrow, 6.9 (6.5-7.1)(Howell, 1938).

Remarks. The geographic limits of this subspecies need to be determined with more precision.

Ammospermophilus leucurus extimus Nelson and Goldman

1929. *Ammospermophilus leucurus extimus* Nelson and Goldman, Jour. Washington Acad. Sci., 19:281.

Type locality. "Saccaton, 15 mi. N Cape San Lucas, Lower California."

Range. This subspecies occurs throughout Baja California Sur from San Ignacio south to Cabo San Lucas, except for the Vizcaino Desert which is apparently uninhabited by *Ammospermophilus*.

Recorded localities. *BAJA CALIFORNIA SUR*: Agua Amarga (SDNHM 1); Agua Caliente (MVZ 4); Agua Caliente, 2 mi W, El Chorro (MVZ 1); Agua Verde (AMNH 1); Bahía Concepción, Punta Sur (SDNHM 7); Cabo San Lucas [=Cape Saint Lucas] (AMNH 1, MVZ 5, SDNHM 7, UCLA 9, USNM 17); Cabo San Lucas, 25 mi NW (CSULB 1); Canipole, 6.6 mi W (USNM 1); Comondú (MVZ 3, SDNHM 3, USNM 9); Comondú, 10 mi NE (MVZ 1); Comondú, San Miguel de, *ca* 5 mi SW (USNM 1); San Miguel de Comondú, 1.9 mi SW (USNM 1); San Miguel de Comondú, 11.1 mi SW (USNM 1); Comondú viejo (USNM 1); Cunano (USNM 1); Ejido Vizcaino, Junction 6.7 mi SE, 1 mi E (USNM 2); El Mulato Peak, 15 mi E La Paz (CM 1); El Potrero, Guajademi, near Muleje (USNM 2); El Pulmo, 1.2 mi N (USNM 2); El Refugio, 4.5 mi N (MSB 16); Hiray, Llanos de Hiray [=Yrais] (MVZ 1); La Burrera, 5.7 mi W (USNM 1); La Burrera, 9.6 mi W (USNM 1); La Candelaria (USNM 2); La Paz (SDNHM 1, USNM 4); La Paz, 4 mi N (MVZ 1); La Paz, 17 km N (CAS 4); La Paz, 17 km N, Puerto Bellendra (CAS 2); Las Cruces (MSB 9); Magdalena Plain, Buenavista (SDNHM 1); Matancita, 75 ft. (USNM 1); Miraflores (SDNHM 1); Miraflores, 225 msnm (KU 1); Miraflores, 7 mi S (SDNHM 1); Mulege, 3 mi W (CSULB 1); Puerto Escondido (SDNHM 1); Punta Lobos (USNM 3); Saccaton, 15 mi N Cabo San Lucas [type locality] (USNM 4; Hall, 1981). San Antonio, 375 msnm (KU 15); San Bruno (USNM 1; Hall, 1981); San Javier (USNM 6); San Javier, 0.5 mi N (SDNHM 1); San Javier, 7.5 mi E. (USNM 1); San Jose del Cabo (AMNH 2, MVZ 1, SDNHM 3, USNM 3); San Jose del Cabo, 6 mi N (MVZ 1); San Jose del Cabo, 1.5 [km or mi?] S (CAS 1); San Jose Rancho, 30 mi N (USNM 2); San Lucas, 29 mi (by road) N (KU 1); San Juanico Bay (Hall, 1981); San Gorgoni Pass (USNM 1); San Pablo (USNM 6); Santana (Hall, 1981); Santiago, 5 mi N, El Carrizalito (MVZ 1); Santiago, Arroyo San Jorge, 7 km SW (USNM 2); Santa Agueda, 4 mi E (USNM 1); Santa Rosalia, 3 km S (MVZ 2); Sierra Santa Marta (USNM 1); Sierra de la Laguna, base W, San Juan de la Serradera (MVZ 1); Todos Santos, 5 msnm (KU 1, MVZ 1).

Description. The pelage of *A. l. extimus* is darker and more brownish than that of *A. l. canfieldae*, but paler than *A. l. peninsulae*, with its rump and thighs described as being more vinaceous than ochraceous (Howell, 1938).

Measurements. Measurements (means and ranges in mm) of 10 adult *A. l. extimus* were: total length, 219.8 (208-237); tail length, 79 (70-87); hind foot length, 37.2 (35-38); ear length, 8.9 (8-10); greatest length of skull, 40.3 (39-41.6); zygomatic breadth, 23 (22.5-23.8); length of nasals, 12.9 (11.5-13.7); interorbital breadth, 9.9 (9.2-10.3); postorbital constriction, 13.5 (12.7-14.9); cranial breadth, 18.6 (18.2-19); palatilar length, 19 (17.5-20); and maxillary toothrow, 7 (6.3-7.6) (Howell, 1938).

Remarks. This subspecies is most similar to *A. l. peninsulae* which occurs north of the Central Desert. The two are separated by the range of *A. l. canfieldae*.

Ammospermophilus leucurus peninsulae (J. A. Allen)

1893. *Tamias leucurus peninsulae* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 5:197.

1907. *Ammospermophilus leucurus peninsulae*, Mearns, Bull. U.S. Nat. Mus., 56:299.

Type locality. San Telmo, Baja California.

Range. This subspecies occurs in northern Baja California west of the Sierra San Pedro Martir and north of the Central Desert.

Recorded localities. *BAJA CALIFORNIA*: Agua Escondido, near Hanson Laguna (FMNH 2; Hall, 1981); Colnett [=Colonet] (MVZ 1); El Alamo (FMNH 1); El Rosario, 12 mi N (MSB 6); El Rosario, 6 mi N (MSB 8); La Huerta, W Base Laguna Hanson Mountains, 2600 ft. (USNM 1); Meling Ranch, 2.8 mi E (USNM 1); Rancho Viejo, 15 mi E Alamo, 3500 ft. (USNM 1); Rancho Viejo, 15 mi E Alamo, 3700 ft. (USNM 1); Rosario, 200 ft. (USNM 2; Hall, 1981); San Fernando, 1400 ft. (USNM 2; Hall, 1981); San Quintin (CAS 1, FMNH 11, SDNHM 9, USNM 2); San Quintin, 25 ft. (USNM 6); San Quintin, 8.5 mi N (MSB 12); San Quintin Bay (USNM 1); San Quintin, San Simon River, 25-100 ft. (USNM 4); San Quintin, 20 mi S (MVZ 6); San Quintin, Boca de Cañon Agua Chiquita (SDNHM 11); San Quintin, 10 mi E, Valle Santa Maria (SDNHM 1); San Quintin, Cabo, 7 mi N, 1.5 W (SDNHM 1); San Rafael (CAS 1); San Rafael Valley, S end, 20 mi S Ojos Negros, 3400 ft. (USNM 1); San Telmo (MVZ 23, AMNH 1, USNM 1); San Telmo 200 ft. (USNM 6); San Telmo, ca. 20 mi SE (USNM 3); Sierra San Pedro Martir, San Telmo (CAS 5); Valle de la Trinidad (MSB 19; MVZ 4; SDNHM 24; Hall, 1981). Valle de la Trinidad, 16 mi S, 5 mi E (MSB 2); Valle de la Trinidad, 8 mi S, 9 mi E (MSB 3); Valle de la Trinidad, 5 mi S, 10 mi E (MSB 8); Valle de la Trinidad, 10 mi S, 10 mi E (MSB 9); Valle de la Trinidad, 11 mi S, 10 mi E (MSB 1); Valle de la Trinidad, 16 mi S, 5 mi E (MSB 1); Valle de la Trinidad, Aguajito Spring (SDNHM 1); Valle de la Trinidad, 6 km S, 17 E (MVZ 2).

Description. *A. l. peninsularis* is most similar to *A. l. extimus* (see above). The skull is larger and the pelage darker than that *of A. l. leucurus*.

Measurements. Means and ranges of two males and three females from the type locality were: total length, 224 (219-230); tail length, 74 (72-77); hind foot length, 39.1 (38.5-40.0); ear (dry) length, 8 (7-9); greatest length of skull, 39.9 (38.9-41.4); zygomatic breadth, 23.2 (22.2-23.8); length of nasals, 12.2 (11.3-12.5); interorbital breadth, 9.8 (9.6-10.0); postorbital constriction, 14.8 (14.0-15.2); cranial breadth, 19.0 (18.7-19.3); palatilar length, 18.0 (17.0-19.0); maxillary toothrow 7.4 (7.0-7.7)(Howell, 1938).

Remarks. The limits of this subspecies are not well established.

Cynomys Rafinesque

1817. *Cynomys* Rafinesque, Am. Mon. Mag., 2:43.

Type species. *Cynomys socialis* Rafinesque, 1817 [=*Arctomys ludoviciana* Ord, 1815].

Description. *Cynomys* is distinguishable from other rodents in northwestern Mexico by its large size (large adults > 1000 g), blunt rostrum, small ears, and heavy, angular skull. *Cynomys* is distinguished from *Spermophilus* by its relatively heavier skull and larger cheek teeth; maxillary toothrow strongly convergent posteriorly; protolophid of p4 complete or nearly so and well developed; metalophid of m3 complete, merging lingually with posterior wall of trigonid well above floor of talonid (Goodwin, 1995). The ventral and dorsal pelage colors are relatively similar and not separated by a sharp lateral line as in *Spermophilus*.

Remarks. Prairie dogs or perritos llaneros were so named because they inhabit the prairies of western North America. The "dog" portion of the common name in both Spanish and English refers to the sound of the alarm call, which sounds much like the bark of a dog (Hoogland, 1995).

Cynomys is closely related to *Spermophilus*, although the exact relationship is still uncertain (Bryant, 1945; Hafner, 1984; Dobson, 1985; Goodwin, 1995). In a revision of fossil prairie dogs, Goodwin (1995) redefined the genus *Cynomys* and its two subgenera. There are five allopatric

species; two occur in Mexico, one of which occurs in northwestern Mexico. They are found in remnant short grass prairies.

Cynomys ludovicianus (Ord)

There are two subspecies, one of which occurs in northwestern Mexico:

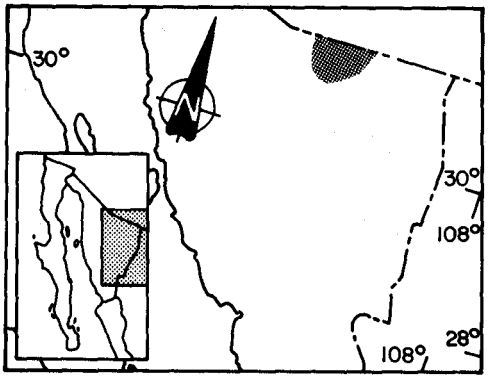
Cynomys ludovicianus arizonensis Mearns

1890. *Cynomys arizonensis* Mearns, Bull. Amer. Mus. Nat. Hist., 2:305.

1892. *Cynomys ludovicianus arizonensis*, Merriam, Proc. Biol. Soc. Washington, 7:158.

Type locality. Point of Mountain, near Wilcox, Cochise Co., Arizona (lectotype).

Range. *Cynomys ludovicianus* occurs in the Great Plains from extreme southern Canada to northwestern Chihuahua and northeastern Sonora. *C. l. arizonensis* occurred in southeastern Arizona, southern and central New Mexico, west Texas, extreme northeastern Sonora, and northwestern Chihuahua (Anderson, 1972; Hall, 1981; Hoffmeister, 1986). Its present distribution is much reduced (Ceballos *et al.*, 1993) and continuing to decline (J. Pacheco, *Personal communication).*



Geographic range of *Cynomys ludovicianus arizonensis.*

Mearns (1907) reported *Cynomys* from near International Boundary Monuments 66 and 98, and Ceballos *et al.* (1993) treated both of these as Sonora records. However, the map available to us indicates that Monument 66 is apparently in Chihuahua, and neither Burt (1938), Anderson (1972), nor Caire (1997) considered the Monument 66 (San Luis and Las Animas) records as occurring in Sonora. Monument 98 is in the San Pedro Valley, and thus definitely in Sonora. However, Mearns (1907) did not mention which on side of the international border the specimens were collected. Thus, there are no definite Sonora specimens (Caire, 1997), and possibly only one published Sonora locality.

Recent work (J. Pacheco, *personal communication*) indicates that there are several small, isolated populations north of Cananea. These represent a short southward extension of the known range of the species in Sonora. Cananea is approximately 40 km SW of where the San Pedro River crosses the United States-Mexican border.

Recorded localities. *SONORA*: Río San Pedro, Mexican Boundary (USNM 19; Hall, 1981) [=monument 98]; San Pedro Valley, Mexican Boundary [=monument 98](USNM 1).

Description. This is a large rodent, reaching 1 kg in mass (Hoogland, 1996). In winter, the dorsal coloration is uniform yellowish, white below, with white chin, throat, and upper lips. In summer, the hairs are more cinnamon or ochraceous (Mearns, 1890). The ears are reduced to a small roll of skin surrounding the external auditory meatus. The tail is at least 20% longer than the hind foot (Hoffmeister, 1986), and the distal third is dark brown. The dental formula is 1/1 0/0 2/1 3/3 = 22 (Hoogland, 1996). There are eight mammae (Hoogland, 1995).

Measurements. Means and ranges (in mm) of 11 males and 5 females from Arizona were: total length, 381.5 (358-405); tail length length, 83.8 (73-95); hind foot length, 58.8 (50-65); greatest length of skull, 62.89 (60.4-65.7); zygomatic breadth, 44.36 (41.1-47.5); length of nasals, 23.69 (22.2-24.85); postorbital breadth, 14.05 (12.7-15.7); maxillary toothrow, 16.36 (15.7-17.25); mandibular toothrow, 14.96 (14.4-15.6); and mastoid breadth, 27.63 (26.75-28.85) (Hoffmeister, 1986).

Remarks. *Cynomys ludovicianus* is sexually dimorphic, with males about 15% larger than females. Adult body weight varies from 500-1400 g (Hoogland, 1995). The skeletal and cranial measurements of *C. ludovicianus* are the largest of any species of *Cynomys*, although body masses of *C. leucurus* and *C. parvidens* are greater during the breeding season (Hoogland, 1996).

Cynomys ludovicianus and *C. mexicanus* (the other member of subgenus *Cynomys*) are very similar with black-tipped tails, but they have non-overlapping geographic distributions. Useful characteristics for separating the two species include tail length, posterior angle of the mandible, and amount of black on the tail. Tail length increases from north to south (78.6 ± 9.2 mm in *C. l. ludovicianus*, 83.8 ± 6.2 mm in *C. l. arizonensis*, and 88.7 ± 10.6 mm in *C. mexicanus*; Mearns, 1890; Hoffmeister, 1986; Hoogland, 1996). The angle of the posterior border of the inflected angle of the mandible is 90° to the axis of the jaw in *C. mexicanus*, and 45° in *C. ludovicianus* (Goodwin, 1995). The distal third of the tail is black in *C. ludovicianus*, whereas the distal half of the tail is black in *C. mexicanus* (Hoogland, 1996). Other prairie dogs (subgenus *Leucocrossuromys*) have a white-tipped tail, thin jugal bones, smaller molars, hibernate, and live in habitats with more shrubs(Hall, 1981; Hoogland, 1996).

Mearns (1890) described *C. arizonensis* as a full species, but Merriam (1892) reduced it to a subspecies of *C. ludovicianus* and it has been treated as such by later workers (Hollister, 1916; Hall and Kelson, 1959). Pizzimenti (1975) questioned the subspecific distinctiveness of *C. l. arizonensis* because multivariate analysis of external, cranial, and bacular measurements indicated considerable overlap with *C. l. ludovicianus*. Chesser (1983a, 1983b) found significant morphological and genetic distances among nearby populations, and local differentiation was greater than regional genetic differences. Consequently, Hoffmeister (1986) treated *C. ludovicianus* as monotypic, but Hall (1981), Hoogland (1996), and Hafner *et al.* (in press) have continued to recognize *C. l. arizonensis*.

Cynomys ludovicianus is closely related to *C. mexicanus*. The latter is probably a relictual species that became disjunct from the main *C. ludovicianus* population in late Pleistocene (Goodwin, 1995). *Cynomys* appeared in the fossil record in late Blancan (Pliocene, 2.5-1.8 million years BP) and both subgenera appeared by early Irvingtonian (early Pleistocene, 1.8-0.75 million years BP) (Goodwin, 1995).

Black-tailed prairie dogs are highly social, and live in large groups variously called "colonies," "towns," or "villages." These usually occupy, 100 ha, and may continue for kilometers. Colony size is normally greater than 1000 individuals, and may include thousands of prairie dogs, often with greater than 10 adults and yearlings per hectare (Hoogland, 1995).

Cynomys ludovicianus inhabits short-grass prairie. They avoid tall grass prairie, possibly because taller vegetation interferes with their social signaling (Goodwin, 1995) or predator detection (Hoogland, 1995). They prefer to colonize areas where the vegetation is short, and they clip down certain plants over 20 cm tall. Some plants such as scarlet globemallow (*Sphaeralcea coccinea*), black nightshade (*Solanum nigrum*), pigweed (*Amaranthus reflexus*), and prairie dog weed (*Dyssodia papposa*), almost never occur outside of prairie dog colonies (Hoogland, 1996).

Survivorship is about 54% for females and 47% for males during the first year. Males live up to five years and females eight years. The burrow systems normally have one or two entrances, are 2-3 m deep, and 5-10 m long, 12 cm in diameter, and may be used for many generations. When there are two entrances, one is built on a low mound (dome crater) and the other has a high mound (rim crater). Several functions have been proposed for the mounds. They may prevent flooding (Hoogland, 1995) or serve as observation points for detecting potential predators (King, 1955). If the burrow system has a low dome crater at one end and a high rim crater at the other, any breeze will create a partial vacuum. This will draw air in through the dome crater and out througth the rim crater, thus providing ventilation for the burrow system (King, 1955, Hoogland, 1995). Finally, the entrances may be results of the energetics of burrow construction; dome nests are easiest to construct at the first entrance (while digging into the ground) and crater nests while digging out of the ground (Cincotta, 1989).

In cold weather many individuals may spend the night in the same burrow, apparently huddling together for warmth. However, during the nesting season, a female will defend her nursery burrow from other individuals (Hoogland, 1995). Escape burrows do not have mounds (Hoogland, 1996).

Cynomys ludovicianus is herbivorous, although occasionally they eat insects such as ground beetles, larvae, or grasshoppers. They are also cannibalistic, and will consume dead adults found above ground. Lactating females often kill the young of other females (Hoogland, 1995). Black-tailed prairie dogs are selective feeders, and the diet varies seasonally (Rogers-Wydeven and Dahlgren, 1982). In summer, the diet includes grasses (*Agropyron* spp., *Bouteloua* spp., *Buchloe dactyloides*), scarlet globemallow (*Sphaeralcea coccinea*), and rabbitbrush (*Chrysothamnus* sp). In winter, prickly-pear cactus (*Opuntia* spp.), roots, and thistles (*Cirsium* spp.) are eaten. Sagebrush (*Artemisia* spp.), threeawn (*Aristida* spp.), prairie dog weed (*Dyssodia papposa*), and horseweed (*Conyza ramosissima*) are avoided (Hoogland, 1995).

Important predators of prairie dogs include coyotes (*Canis latrans*), badgers (*Taxidea taxis*), bobcats (*Lynx rufus*), red foxes (*Vulpes vulpes*), swift foxes (*Vulpes macrotis*), gray foxes (*Urocyon cinereargenteus*), long-tailed weasels (*Mustela frenata*), black-footed ferrets (*Mustela nigripes*), golden eagles (*Aquila chrysaetos*), northern harriers (*Circus cyaneus*), peregrine falcons (*Falco peregrinus*), prairie falcons (*Falco mexicanus*), Cooper's hawk (*Accipiter cooperi*), red-tailed hawks (*Buteo jamaicensis*), ravens (*Corvus corax*), bull snakes (*Pituophis melanoleucus*), rattlesnakes (*Crotalus* spp.) (Hollister, 1916; Hoogland, 1995; Hoogland, 1996). Prairie dogs spend 30-50% of their time scanning for predators (Hoogland, 1995; Hoogland, 1996).

Possibly as a result of extreme coloniality, *Cynomys ludovicianus* is heavily parasitized by protozoans, nematodes, acanthocephalans, Cestoda, ticks (*Ixodes kingi*, *Atricholaelaps glasgowi*), fleas (*Opisocrostis hirsutus*, *O. tuberculatus*, *O. labis*, *Pulex simulans*, *P. irritans*, and *Leptopsylla segnis*), and lice (Hoogland, 1995, Hoogland, 1996). The fleas carry *Pasturella* (=*Yersina*) *pestis*, a non-native bacterium that causes sylvatic (bubonic) plague, to which prairie dogs are still poorly-adapted. Even after several decades of exposure to this introduced pathogen, prairie dogs are very susceptible to plague, and epizootics often kill all the members of a colony (Barnes, 1993).

There are two molts per year (Hoogland, 1996). They do not hibernate, although they may not come above ground for several days at a time during cold weather (Hoogland, 1995). Mating occurs in the spring, but the timing varies with latitude. Females are sexually receptive for only one day per year, and there is a single litter. Copulation usually first occurs at two years of age, and occurs underground. Most (89%) of the adult females that copulate give birth. Gestation is 33-36 days, litter size at birth is 1-8, and 3.1 juveniles per litter appear above ground (Hoogland, 1995; Hoogland, 1996).

The black-tailed prairie dog is among the most social of all rodents (King, 1955). The social system is a harem-polygynous family group called a "coterie." Coteries have one breeding male, 2-3 adult females, several yearlings and juveniles. However occasionally, coteries may have two breeding males (usually brothers), or one male may have two small, adjacent coteries. The females tend to remain in the coterie for their entire lives, and thus the females of a coterie are close relatives. Mean coterie size is 6.1 (range 1-26), but with juveniles there may be up to 40 members. The coterie defends a territory of up to 1/3 ha with as many as 70 burrow entrances. Coterie territories remain relatively constant from generation to generation (Hoogland, 1996).

Black-tailed prairie dogs are keystone species in habitats where they occur. Approximately 170 plant and animal species are associated with prairie dogs (Miller *et al.*, 1993), and many are dependent upon them, for example swift foxes (*Vulpes velox*) and black-footed ferrets (*Mustela nigripes*). Conservation of prairie dogs is closely linked with ecosystem conservation, and thus the issue goes well beyond prairie dogs themselves.

Populations of black-tailed prairie dogs apparently increased dramatically about 100 years ago, possibly due to control of predators and competitors for forage, or due to introduction of livestock (Nowak, 1991). This rapid increase was seen as a menace, and intensive poisoning campaigns followed. Many ranchers feared 1) that cattle and horses would step in the burrow openings and break legs, 2) that prairie dogs feed on the same food as cattle and thus are in competition with domestic livestock, 3) that prairie dogs are prolific breeders, and 4) elimination of prairie dogs will help eliminate their predators, which are also predators of livestock. These fears are often without sound basis (Hoogland, 1995).

Few horses and cattle actually break legs in prairie dog burrows. Prairie dogs are not prolific breeders (Hoogland, 1995). Despite the assertion that "32 prairie dogs consume as much grass as 1 sheep, and 256 prairie dogs as much as 1 cow" (Merriam, 1902a), food habits data (above) indicates that prairie dogs and livestock eat different food plants and thus are not in competition. Prairie dog grazing, burrowing, and nutrient cycling actually improves the quality of the some plant species. Domestic livestock, American bison (*Bison bison*), and pronghorn (*Antilocapra americana*) clearly prefer to graze in prairie dog towns, and they may avoid grazing in areas without prairie dogs (Whicker and Detling, 1988). Prairie dogs are thus beneficial rather than detrimental. Prairie dogs often invade areas overgrazed by cattle, rather than being the cause of the overgrazing (Hoogland, 1995). Ironically, the economic arguments used to justify the poisoning campaigns now appear to be fallacious (Miller *et al.*, 1993) and the costs of eradication often exceed the damage done by prairie dogs (Hoogland, 1995) and ignore the ecological and economic benefits of the species (Whicker and Detling, 1988).

Black-tailed prairie dogs were common in their range until the 1930s. They were extirpated by poisoning campaigns in southern New Mexico in the 1920s (Ceballos *et al.*, 1993) and in Arizona about 1938 (Hoffmeister, 1986). *Cynomys ludovicianus* is listed as threatened in Mexico (Ceballos and Navarro, 1991; NOM-095-ECOL 1994). Ceballos *et al.* (1993) reported that *C. ludovicianus* had disappeared from one of the two known Sonora localities, but it still occupied 700 ha at the other. However, it still occurs near Cananea (J. Pacheco, personal communication), but it is severely threatened and may be close to extinction in Sonora (see remarks above under Distribution).

Cynomys l. arizonensis was a candidate for listing as threatened (Category 2) under the U.S. Endangered Species Act by the U.S. Fish and Wildlife Service in 1994, but all Category 2 species were dropped from further consideration in 1996. However, IUCN considers *C. l. arizonensis* to be DD (Data Deficient; Hafner *et al.*, in press). Although Mexican populations were excluded

from the Hafner *et al.* (in press) report, and will be treated in a separate IUCN publication, the report recommended 1) a taxonomic study to further evaluate the subspecific validity of *C. l. arizonensis*, 2) formal protection for *C. l. arizonensis* in New Mexico and Mexico, 3) surveys and inventories to determine which populations remain, and 4) studying the potential for reintroduction of *C. l. arizonensis* into protected semidesert grassland in areas around the Animas Mountains in New Mexico and the Chiricahua Mountains, Arizona.

Cynomys inhabit areas with better soils for burrow construction. Recent observations by one of us (MVA) in Chihuahua suggest that these areas are often small, surrounded by creosotebush (gobernadora, *Larrea divaricata*), and adjacent to seasonally flooded areas unsuitable for *Cynomys*. Overgrazing exposes the soil, making it more suitable to seeds of *Larrea*. *Larrea* gradually colonizes the areas with better soils and replaces the grasses. Perhaps vegetation changes related to overgrazing, as well as habitat destruction for agriculture and poisoning should be considered as possible causes for the decline of this species.

It would be useful to verify the past and present distribution of *Cynomys* in Sonora, and to determine the extent of any surviving populations in the state. The recommendations of the IUCN report may also be appropriate in Sonora and should be considered.

Sciurus Linnaeus

1758. *Sciurus* Linnaeus, Syst. Nat.10th ed., 1:63.

Type species. *Sciurus vulgaris* Linnaeus, 1758.

Description. *Sciurus* may be separated from other genera of Sciuridae by the following set of characters. The zygomatic arches are straight rather than arcuate, oriented vertically rather than twisted medially, and closer to parallel than in other genera. The dorsal curve of the skull (in profile) turns abruptly downward posterior to the zygomatic arches rather than being gently curved. The interorbital region is as wide as, or wider than, the postorbital region. There is an angular process at the posterior of the jugal. The antorbital canal is a narrow, vertical slit. The tail is long and bushy (Howell, 1938).

Remarks. The typical tree squirrels, genus *Sciurus*, are most similar to the pine squirrels or chicarees, *Tamiasciurus*, but the latter have a dark lateral line on the side of the body, are smaller, and differ in important details of the reproductive system (Mossman *et al.*, 1932; see *Tamiasciurus* account below). The genus appeared in the fossil record in early Miocene (Black, 1972), and have been long associated with deciduous and coniferous forests. We know of no fossil *Sciurus* from northwestern Mexico.

There are 28 species of *Sciurus* in the world (Hoffmann *et al.*, 1993), with five species recorded from northwestern Mexico.

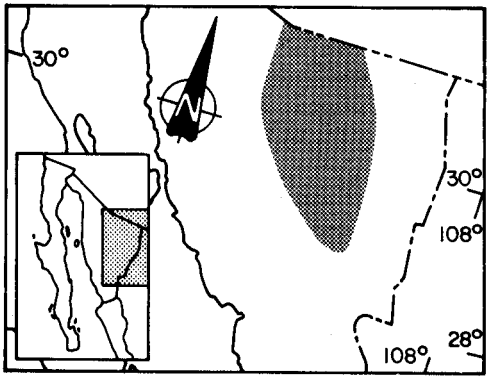
Sciurus arizonensis Coues

There are three subspecies, one of which occurs in northwestern Mexico:

Sciurus arizonensis huachuca J. A. Allen

1867. *Sciurus arizonensis* Coues, Amer. Nat., 1:357.

1894. *Sciurus arizonensis huachuca*, J. A. Allen, Bull. Amer. Mus. Nat. Hist., 6:349.



Geographic range of *Sciurus arizonensis huachuca*.

Type locality. Huachuca Mountains (Cochise Co.), Arizona.

Range. *Sciurus arizonensis* occurs in Arizona, west-central New Mexico, and north-central Sonora. *S. a. huachuca* occurs in the Huachuca, Santa Rita, Pajarito and other mountain ranges in southern Arizona (Hall, 1981; Hoffmeister, 1986). In Sonora, it is known from near Chinapa, Magdalena, Nogales, Santa Cruz, Sierra de los Ajos, Sierra Azul, Sierra de la Madera, Sierra Patagonia, Sierra de Piñitos, and mountains northeast of Cucúrpe (Best and Riedel, 1995; Caire, 1997).

Recorded localities. *SONORA*: Nogales, 32 mi S (USNM 2)(Hall, 1981); Magdalena, 30 mi E (USNM 1); other records in Best and Riedel (1995) and Caire (1978, 1997).

Description. Seasonal pelage differences are more pronounced in *S. arizonensis* than in other tree squirrels, and have been confused with geographic variation. In summer, the dorsal pelage is uniform gray, but with a yellowish-brown tint; in winter it is ochraceous or fulvus mid-dorsally. The tail is black above and yellow-orange to rusty below, bordered with black and edged with white. Rusty yellow post-auricular patches are often present. Individuals feeding on walnuts can have brownish or ochraceous stains on the feet and ventral pelage, which can also be confusing (Hall, 1981).

Sexual dimorphism exists for some characteristics in some populations. In the Huachuca Mountains, Arizona, Hoffmeister (1986) found that females were slightly larger than males in nine measurements, males were larger in one measurement, and that there were no differences in eight measurements. Multivariate analysis of variance found no significant differences between sexes.

The dental formula is 1/1 0/0 1/1 3/3 = 20. P3 is absent, and this characteristic suggests a closer relationship with the fox squirrels than the gray squirrels (Hoffmeister, 1986).

Measurements. Means ± standard deviations (range in parentheses) for external and cranial measurements (in mm) of 40 *S. a. huachuca* from the Huachuca Mountains, Arizona were as follows: total length, 522.6 ± 17.7 (492-574); tail length length, 255.1 ± 12.5 (225-275); hind foo lengtht, 71.6 ± 2.6 (67-77); greatest length of skull, 64.34 ± 0.95 (61.4-65.4); zygomatic breadth, 36.84 ± 0.82 (34.9-38.4); basal length of cranium, 53.88 ± 1.04 (50.4-55.8); basilar length of cranium, 48.21 ± 0.85 (46.5-49.6); interorbital breadth, 20.88 ± 0.61 (19.6-22.7); postorbital breadth, 20.67 ± 0.54 (19.4-21.6); and maxillary toothrow, 11.52 ± 0.34 (10.9-12.4) (Hoffmeister, 1986).

Remarks. *Sciurus arizonensis* is the only tree squirrel in northwestern Mexico with the following combination of characteristics: a white border on the tail, whitish underparts, one upper premolar, and no ear tufts. It can be distinguished from *S. colliaei* and *S. aureogaster* by the white outer band on the tail. The lack of ear tufts and a lateral line separates it from *S. aberti*. *S. griseus* is silvery-gray dorsally all year, whereas *S. arizonensis* will have some brown, especially in winter. *S. nayaritensis* has an orange venter, although *S. arizonensis* will sometimes appear so if they have

been foraging in walnut trees. The lateral edge of the tail is white in *S. arizonensis* and buffy in *S. nayaritensis*.

Hoffmeister (1986) performed a multivariate morphometric analysis of *S. arizonensis* and *S. nayaritensis* specimens from Arizona. He concluded that *S. arizonensis* was monotypic and that it may be conspecific with *S. nayaritensis*. Best and Reidel (1995) followed Hoffmeister in considering *S. arizonensis* monotypic.

A principal components analysis of four external and nine cranial measurements indicated "that three groups of populations are definable: (1) Santa Catalinas-Rincons, (2) northern populations, (3) southern populations" Hoffmeister (1986:210). However since the northern and southern populations were more similar to each other than to the central population, he concluded that "perhaps several such populations could be recognized by subspecific name, but I question that this would serve any useful purpose. Rather, I would regard all populations as part of a single, somewhat variable, unit. Thus, *Sciurus arizonensis* is regarded as monotypic" Hoffmeister (1986:210).

Casual observation of pelage variation in *S. arizonensis* in the field and in museum specimens would predispose one to accept Hoffmeister's conclusions (Brown, 1984; EY, personal observations). However, there are three problems. First, Hoffmeister's principal components analysis and the canonical variate analysis (Hoffmeister, 1986:Figs 5.100.A and 5.100.B) clearly show three well-defined clusters that correspond to the named subspecies, supporting their validity. Second, Hoffmeister (1986:208-209) assumes that the subspecies cannot be valid because the intraspecific variation in *S. arizonensis* is not organized on a north-south gradient. However, the fact that the variation does not follow this pattern does not invalidate the differences among the subspecies. Third, some of the populations in Hoffmeister's (1986) analysis that did not fit his expected geographic pattern were represented by very small samples (n=3 or 4). Consequently, we have followed a conservative treatment here and continue to recognize *S. arizonensis* as polytypic, pending a more complete taxonomic study of this species.

Sciurus arizonensis huachuca and *S. nayaritensis chiricahuae* are separated by about 100 km in southeastern Arizona (the distance from the Huachuca Mountains to the Chiricahua Mountains). In Sonora, *S. a. huachuca* and *S. n. apache* are separated by perhaps 60 km, but possibly much less because some of the localities are imprecise (e.g. río Bavispe). Although the distribution of both species in eastern Sonora is poorly documented, they may be nearly parapatric in places.

Hoffmeister (1986) considered *S. arizonensis* to be a fox squirrel rather than a gray squirrel since they have only one upper premolar, and suggested that Arizona fox squirrel might be a better common name than Arizona gray squirrel. Further, the external and cranial measurements of *S. arizonensis* and *S. nayaritensis* were nearly identical, and the main differences were in color. The various subspecies of *S. niger* (eastern fox squirrel) are more variable in color than the differences between *S. arizonensis* and *S. nayaritensis* (Mexican fox squirrel). Consequently, Hoffmeister (1986) speculated that *S. arizonensis* and *A. nayaritensis* might be conspecific. However, his analyses indicated that Arizona specimens of the two species are completely separated by discriminant function and canonical variate analyses, and he considered the two to be separate species. Further, the presence or absence of P3 is variable (see *S. colliaei* account below), and we are not certain how much weight should be given to it as a character.

Sciurus arizonensis occurs between 1500-2100 m elevation in mountain ranges, but can extend down into semidesert grassland and chaparral areas where there is dense riparian forest. In the Huachuca Mountains they occur from the base of the mountains (oak woodland) to the highest peaks (coniferous forests) (Allen, 1895). However, they prefer diverse, tall, old growth forests

with closed canopies, and do not occur in open cottonwood-willow (*Populus-Salix*) communities. The communities can be deciduous or mixed deciduous and coniferous forests, often in canyon bottoms and along streams, but also in forested areas away from streams. Associated trees include rge species that form tree holes, such as Arizona walnut (*Juglans major*), Arizona sycamore (*Platanus wrightii*), cottonwoods (*Populus angustifolia* and *P. fremonti*), box elder (*Acer negundo*), big-tooth maple (*Acer grandidentatum*), Arizona alder (*Alnus oblongifolia*), Gambel's oak (*Quercus gambeli*), pines (*Pinus ponderosa* and others), Douglas-fir (*Pseudotsuga menziesii*), and ash (*Fraxinus velutina*). Arizona walnut, evergreen oaks (*Q. arizonica, Q. emoryi, Q. grisea*), and madroño (*Arbutus arizonica*) are good indicator species of *Sciurus arizonensis* habitat (Brown, 1984; Hoffmeister, 1986; Best and Reidel, 1995).

Walnuts and acorns are the most important items in the diet, followed by pine nuts, juniper berries, and hackberries. These constitute 67% of the diet. Other important foods include fungi, flower parts, buds, mistletoe (*Arceuthobium* sp.) berries, and some insects and other animal matter. They do not cache food (Brown, 1984; Hoffmeister, 1986; Best and Reidel, 1995). Predators include goshawks (*Accipiter gentilis*), red-tailed hawks (*Buteo jamaicensis*), and bobcats (*Lynx rufus*). Many are killed on roads by cars (Brown, 1984).

There are two molts per year. Summer pelage is browner than winter pelage (Brown, 1984). Breeding occurs from January to May, peaking in April. In the mating chases, multiple males chase a female. There is one litter of 2-4 ($\bar{x} = 3.1$) young per year, born in June (Brown, 1984), and by August all females are lactating (Hoffmeister, 1986). The sex ratio is 1:1 (Brown, 1984).

The nests are built of leaves and are easily seen. In winter, more than one squirrel may occupy the nest (Hoffmeister, 1986). However, they do not appear to hibernate. They can run over rocks as well as rock squirrels (*Spermophilus variegatus*), and if surprised on the ground, will not always take refuge in trees, but run on the ground (Brown, 1984).

In early summer when females are lactating, they can be very secretive, and can remain motionless for over 45 minutes to avoid deteection. They can also be very difficult to locate in the winter when the branches are bare of leaves. Alarm calls are more frequent in the summer when there are young that can benefit from them. They are often quiet, but have several calls (Brown, 1984; Best and Reidel, 1995). Calls apparently are only made from the safety of trees. Predators that elicited alarm calls included coatimundi (*Nasua narica*), spotted skunks (*Spilogale putorius*), snakes, house cats, and humans (Best and Reidel, 1995).

In Sonora, *Sciurus arizonensis* is threatened by habitat loss from logging, forest clearing for agriculture, and burning (Nowak, 1991). There are no recent records from Sonora (Caire, 1978), and it is considered threatened (amenazada) in Mexico (Ceballos and Navarro, 1991; NOM-059-ECOL 1994).

There are few studies on the behavior, ecology, or physiology of *S. arizonensis*, and the species remains poorly known, particularly in Sonora. This is especially unfortunate because of its conservation status. Surveys to determine if populations of *S. arizonensis* still occur in Sonora should be undertaken in the near future. A taxonomic study utilizing electrophoretic or other molecular techniques may help to clarify the questions about the validity of the subspecies.

Sciurus aureogaster Cuvier

There are two currently recognized subspecies, one of which occurs in northwestern Mexico:

Sciurus aureogaster nigrescens Bennett

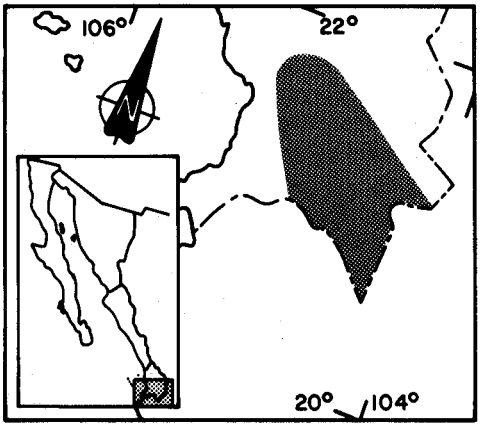
1833. *Sciurus nigrescens* Bennett, Proc. Zool. Soc. London, pt.1:41.

1970. *Sciurus aureogaster nigrescens*, Musser, Amer. Mus. Novit., 2438:16.

Type locality: "...that part of California which adjoins to Mexico" but restricted by Musser (1970:14-15) to "the high mountains south and southeast of the town of Aquixtla, in northern Puebla."

Range. *Sciurus aureogaster* occurs from Nayarit across the trans-volcanic belt and then north along the Sierra Madre Oriental to Tamaulipas and Nuevo León, and south to Guatemala. *S. a. nigrescens* occurs from Nayarit to Puebla and western Veracruz and south to Guatemala.

Recorded localities. *NAYARIT*: Amatlán de Cañas, Rancho Palo Amarillo (AMNH 1); Arroyo Platanar (AMNH 1); Coapan, 1.8 mi NW by road, 4650 ft. (USNM 1); Estanzuela (USNM 14); Estanzuela, 4500 ft. (USNM 4); Ixtlán del Río, 6 mi S, 6800' (KU 1; Musser, 1968); Tepic, Amatlán (AMNH 1).



Geographic range of *Sciurus aureogaster nigrescens*

Description. *Sciurus aureogaster* is one of the most variable in coloration of the American tree squirrels. For simplicity, only the relevant form occurring in northwestern Mexico (in Nayarit) is described here. The upper parts are frosted blue-gray except for the orange, or orange-buff, nape and rump patches. The long dorsal guard hairs are either black with white tips or black with wide subterminal orange bands, and the hairs of the nape and rump are gray basally, then orange, tipped with black. The underparts are white (orange in 1 of 25 specimens). The postauricular patches are white and usually conspicuous, as are the eye ring and feet. The tail is variegated grayish-buff (Musser, 1968). The dental formula is 1/1 0/0 2/1 3/3 = 22.

Measurements. Means ± standard deviations (and ranges) of 37 *S. aureogaster* from Colima (in mm) were: head and body length, 253.9 ± 9.7 (237-273); tail length, 263.0 ± 15.8 (235-291); hind foot, 64.8 ± 2.2 (61-68); ear, 32.0 ± 1.9 (29-35); greatest length of skull, 59.99 ± 0.74 (58.2-60.9) (Musser, 1968).

Means ± standard deviations (and ranges) of the type and seven topotypes of *S. a. nigrescens* from northern Puebla (in mm) were: length of head and body, 274.4 ± 10.8 (260-290); tail length, 255.0 ± 15.6 (230-280); hind foot length, 69.0 ± 2.2 (66-73); greatest length of skull, 60.0 ± 1.6 (58.0-62.2); zygomatic breadth, 34.3 ± 0.87 (32.7-35.5); interorbital breadth, 18.6 ± 0.86 (17.2-19.6); maxillary toothrow, 11.5 ± 0.29 (11.1-11.9) (calculations from data in Musser, 1970).

Remarks. *S. colliaei* is most similar to *S. aureogaster*, but the two are narrowly allopatric, or only overlap slightly in Nayarit. The dorsum is of uniform color from the neck to the rump in *S. colliaei*, whereas in *S. aureogaster* there are patches of orange or rust on the neck and rump. The tail is variegated grayish buff in *S. aureogaster* and variegated orange or chestnut in *S. colliaei*. The postauricular patches are less distinct and buffy in *S. colliaei* (Musser, 1968). *S. aureogaster* has a variegated tail and patches of orange or rust-colored pelage on the neck and rump, whereas *S.*

nayaritensis has a black band and a buff or yellow border on the tail, and a back without neck and rump patches.

This species has a confused taxonomic history. Because of the extensive geographic variation in color, pattern, and measurements, many populations have been named as separate species or subspecies. More than 60 species or subspecies names and combinations have been used for all or part of what is now known as *S. aureogaster* (Musser, 1970). In his revision of *S. aureogaster*, Musser (1968) concluded that given the geographic variation, it was defensible to recognize two, four, or 22 subspecies, and he decided to recognize two. *S. aureogaster* is morphologically similar to, and allopatric or parapatric with, *S. colliaei*, *S. variegatoides*, and *S. yucatanensis* (Musser, 1968).

Sciurus aureogaster is as ecologically versatile as it is variable in coloration. Although they are found primarily in lower elevation tropical forests, some populations occur in oak and pine forests, and one population occurs above 13,000 feet [4000 m] elevation on Volcán Popocatepetl (Musser, 1968). Musser (1968) also found them in sparse forests shading coffee trees and in dense second-growth forests. They occur in old-growth oak woodland, second-growth oak woodland, pine forests, fir forests, oil palm forests with figs and other broadleafed tropical trees, gallery forest, thorn forest, tropical scrub, thinned tropical deciduous forest, nut palms with tropical broadleaf trees, and mangroves.

The food habits have not been studied, but they have been seen eating pine nuts and new tender needles growing at tips of branches, fungi, acorns, berries (Musser, 1968). Alvarez de Toro (1991) mentioned that in Chiapas *Sciurus* occasionally eat birds' eggs and songbird chicks, but it is not clear if the reference applies to *S. aureogaster* or to all *Sciurus* in Chiapas. Throughout the range, *S. aureogaster* does damage to cornfields (Nelson, 1899). In Guerrero, they sometimes damage coconut crops. For this they are considered a pest and are killed in large numbers, although Ramírez-Pulido and López-Foment (1976) showed that they consume at most 7.6% of the crop, and usually much less, and that the damage was insufficient to justify the expense of control efforts.

In northwestern Mexico, *S. aureogaster* is sympatric with *S. nayaritensis*, and probably parapatric with *S. colliaei* (Musser, 1968). In Nayarit and Jalisco, *S. colliaei* occurs in the lowlands and *S. aureogaster* is found on the Mexican Plateau. However, the two occupy similar habitats on the coastal plain in Colima (Musser, 1968).

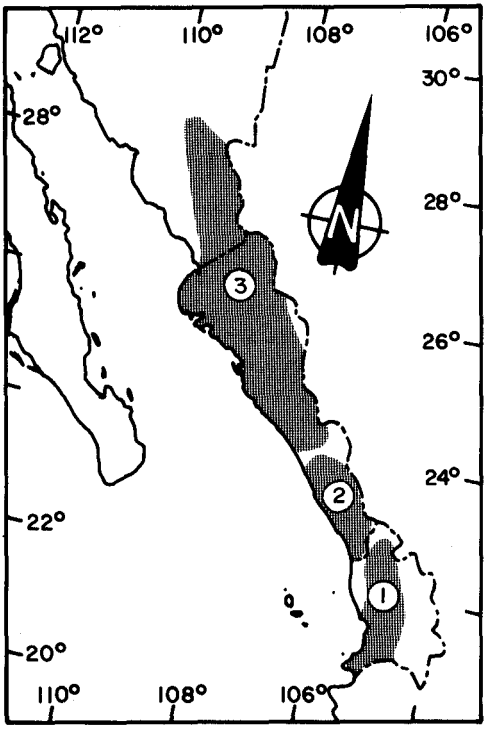
Nelson (1899) assumed that there were summer and winter pelages. However, Musser (1968) was unsure if there were two molts, and could not corroborate Nelson's (1899) observations of seasonal color differences. There do not appear to be data on reproduction.

Musser (1968) found that these squirrels were quiet, and vocalized only when surprised or pursued. He described the call as a "resonant, harsh, trilling chatter." They make leaf nests in taller trees (Musser, 1968).

Sciurus aureogaster is a game species on the Calendario Cinegético. In Nayarit, the squirrel season is from 2 January to 1 March with a limit of two squirrels per day and four in possession (SEMARNAP, 1997).

There is opportunity for a variety of studies with this interesting species. It is surprising that so little has been done with them.

Sciurus colliaei Richardson



Geographic range of *Sciurus colliaei*:
1. *S. c. colliaei* 2. *S. c. sinaloensis*
3. *S. c. truei*

Range. *S. colliaei* occurs from southern Sonora (San Javier) south on the coastal plain and barrancas through Sinaloa, Nayarit, Jalisco, and Colima. There are records from western Chihuahua and Durango (Hall, 1981).

Description. *S. colliaei* has coarse, short, agouti yellowish gray and black hair on the dorsum from head to rump. Underparts are white, or sometimes orangish. The nape of the neck, shoulders, legs and ears are grayish or reddish. The tail is colored like the back, but variegated with gray or yellow, and with white-tipped hairs. There are one or two upper premolars, with P3 missing in 50% of individuals in northern populations (Anderson, 1962). P3 may be present on one side of the jaw and missing on the other in the same individual (Jones *et al.*, 1962). The dental formula is 1/1 0/0 1-2/1 3/3 = 20-22.

Measurements. External measurements (range, in mm, n = 78) of adults of all four subspecies of *S. colliaei* were: total length, 448-537; tail length, 215-280; hind foot length, 59-67. Cranial measurements (range, in mm, n=106) were: occipitonasal length, 54.4-64.6; zygomatic breadth, 30.9-37.6; interorbital breadth, 16.9-22.5; breadth of braincase, 22.2-27.2; maxillary toothrow, 9.8-12.6 (Anderson, 1962:4-5).

Remarks. *S. colliaei* is most similar to *S. variegatoides* and *S. yucatanensis*, but the latter do not occur in northwestern Mexico. In Nayarit, *S. colliaei* is similar to *S. aureogaster*. The variegated tail, yellowish venter, and color pattern described above will separate *S. colliaei* from *S. nayaritensis*. The best character is the variegation on the back. In *S. colliaei*, the dorsum is uniform from head to rump, whereas in *S. aureogaster*, the nape and rump are variegated reddish brown, and the mid-dorsal region is grayish, although some individuals have some light ochraceous in the gray (Musser, 1968; Best, 1995b; EY, personal observations).

S. colliaei, *S. sinaloensis*, and *S. truei* were described as separate species. However, Anderson (1962) found an irregular clinal increase in size from north to south, the reverse of Bergmann's rule. In addition, there was a cline in color (increasingly darker from north to south). The frequency of having the third upper premolar present on both sides of the skull increased clinally from 41% in the north to 100% in the south. The clinal variation and overlap in measurements persuaded Anderson (1962) to conclude that the three groups were actually subspecies of a single

species. *S. colliaei* was named for Dr. C. Collie, Surgeon of the H.M.S. Blossom, who collected the type specimen in 1828 (Nelson, 1899).

S. colliaei is closely related to *S. variegatoides* and *S. yucatanensis*, and the three may be allopatric populations of a single, variable species (Musser, 1968). The range of the closely related *S. aureogaster* separates *S. colliaei* from *S. variegatoides* and *S. yucatanensis*. The pelage and ecological similarities are consistent with this hypothesis (Musser, 1968). Further, the bacula of the three species are similar to each other and to *S. aureogaster* (Bryant, 1945; Burt, 1960). The four species are apparently allopatric. *S. colliaei* and *S. aureogaster* occur about 3 miles [5 km] apart in Colima (Anderson, 1962; Musser, 1968; Hall, 1981), but there does not appear to be gene flow between them (Musser, 1968).

S. colliaei occurs on the coastal plain and in canyons leading to the coastal plain, where they live in a variety of tropical and subtropical habitats including coquito palm (Areaceae) and fig (*Ficus*) forests, thorn forest, tropical broadleaf forest, tropical deciduous forests, oak woodland, cloud forests, and hardwood forests. Other tree squirrels in the Sierra Madre Occidental occur at higher elevations than *S. colliaei* (Anderson, 1962; Musser, 1968; Best, 1995b).

S. colliaei were considered common in tropical or subtropical forests (Ceballos, 1990; Best, 1995b). However, at Chamela in Jalisco, density varied from 0.9 to 4.3 squirrels/km^2 according to habitat and season in subtropical caudifolious and subcaudifolious forest, with greatest abundance in subcaudifolious forest during the dry season (Mandujano, 1997). These are low densities for squirrels (compare to densities of up to two orders of magnitude greater in Nash and Seaman, 1977; Koprowski, 1994; Carraway and Verts 1994). Mandujano (1997) speculated that low availability of fruit may be limiting their densites at this site. There are no detailed dietary studies, but they are known to eat nuts of coquito palms, figs (*Ficus* spp.), and fruits of *Spondias purpurae*, native palm (*Orbygnia cohune*), and coconut (*Cocos nucifera*) (Musser, 1968; Best, 1995b). They build leaf nests in figs and other trees, utilize tree cavities, cavities in old termite nests, and also build stick nests (dreys) (Musser, 1968; Best, 1995b).

There is very little information available on physiology or reproduction in *S. colliaei*. There are four pairs of mammae: one pair pectoral, two abdominal, and one inguinal (Nelson, 1899). Anderson (1972) collected a female with three embryos 5 mm long on 24 May. A female with three embryos 37 mm long was collected on 11 June (Best, 1995b). Best (1995b) indicated that breeding occurs in March and April, and young appear in April, whereas Ceballos and Miranda (1986) mentioned that on the coast of Jalisco reproduction occurs in summer with litters of four or five.

There are no studies of the behavior of this species. Best (1995b:3) reported that it is "largely arboreal, but it may be active on the ground. *S. colliaei* is most active in early morning and at sunset, remaining active throughout the day when overcast." However, tracks are rare because they seldom come to the ground (Ceballos and Miranda, 1986). Obviously, there is much left to discover about the behavior of this species.

S. colliaei is apparently common, and is a game animal. According to the Calendario Cinegético, in Narayit the hunting season for squirrels is from 2 January to 1 March with a daily limit of two, and four in possession (SEMARNAP, 1997).

There seems to be very little information on this species, despite its inclusion on the Calendario Cinegético. Hopefully, detailed studies of life history, behavior, and ecology will be undertaken to provide data for the sound management of the species.

There are four subspecies, three of which occur in northwestern Mexico:

Sciurus colliaei colliaei Richardson

1839. *Sciurus Colliaei* Bachman, Proc. Zool. Soc. London:95. (*nomen nudum*)

1839. *Sciurus colliaei* Richardson, Zool. Capt. Beechey's Voyage...:8, pl.1.

1962. *Sciurus colliaei colliaei*, Anderson, Amer. Mus. Novit., 2093:7.

Type locality. "San Blas in California" [=Nayarit, Mexico].

Range. *S. c. colliaei* is known only from Nayarit.

Recorded localities. *NAYARIT*: Acaponeta, 200 ft. (USNM 2; Hall, 1981); Aticama, 10 ft. (KU 3); Banderas Bay, Mita Point (Hall, 1981); Chacala (USNM 5); Compostela, 9 mi WSW (MSU 1); El Veando 200 ft. (Hall, 1981 = El Venado?); El Venado, 2 mi E, 200 ft. (KU 2); La Union, 5 mi S (KU 10); Las Piedras, 1 mi NE (MSU 1); Las Varas, 800 ft. (USNM 1); Las Varas, 5 mi S, 150 ft. (KU 5; Hall, 1981); Las Varas, 8 mi SSW (KU 2, as *S. c. nuchalis*); Las Varas, 6 mi E, Rancho Maloti (MLZ 2); Platanares, 10 mi E Ruiz (Hall, 1981); Plumosas, 22 km E Matatan, 2500 ft. (KU 4); Rosa Morada, 2 mi SW (KU 2; Anderson, 1962; Hall, 1981); Ruiz, 10 mi E, Plantares (KU 12); San Blas (CAS 2, MVZ 2, MSB 1); San Blas, 50 ft. (USNM 8); San Blas, 75 ft. (USNM 8); San Blas, 4 mi E (MSU 1); San Blas, 8.1 km E (CSULB 1); San Blas, 9 km E (CSULB 5); San Blas, 6 mi E (MSU 6); San Blas, 5 mi SE (KU 3); San Blas, 3 mi N, 100 ft. (KU 1); San Blas, 8.8 mi E, Paso de Soquilpa (USNM 5); Santiago Ixcuintia, 200 ft. (USNM 6; Hall, 1981); Teponahuaxtla (USNM 1); Valle de Banderas (FMNH 1) [no state on tag; there is a Valle de Banderas in SW Nayarit].

Description. *S. c. colliaei* is darker with less orange coloration than the other subspecies in northwestern Mexico. It is smaller than *S. c. nuchalis* to the south, or *S. c. sinaloensis* to the north. The rostrum is short and narrow, with narrow jugals and small auditory bullae (Anderson, 1962).

Measurements. External and cranial measurements (mean ± standard deviation and range, in mm) of adults of *S. c. colliaei* (n = 20) were: total length, 499.1 ± 24.3 (448-537); tail length, 252.2 ± 17.1 (215-280); hind foot length, 63.9 ± 2.5 (59-67). Cranial measurements (mean standard deviation and range in mm) of adults of *S. c. colliaei* (n = 25) were: occipitonasal length, 58.43 ± 1.57 (56.3-63.1); zygomatic breadth, 33.21 ± 1.06 (31.5-35.1); interorbital breadth, 18.76 ± 1.02 (17.1-20.6); breadth of braincase, 24.00 ± 0.86 (22.6-26.1); maxillary toothrow, 11.49 ± 1.28 (10.8-12.5) (Anderson, 1962).

Remarks. Anderson (1962) referred to a north-south cline in darker coloration and larger size, in *S. colliaei*. *S. colliaei* are larger and darker from north to south. However, *S. c. colliaei* is an exception, and is the smallest subspecies.

Sciurus colliaei sinaloensis Nelson

1899. *Sciurus sinaloensis* Nelson, Proc. Washington Acad. Sci., 1:60.

1962. *Sciurus colliaei sinaloensis*, Anderson, Amer. Mus. Novit., 2093:9.

Type locality. "Mazatlán, Sinaloa, Mexico,"

Range. This subspecies occurs in southern Sinaloa.

Recorded localities. *SINALOA*: Aguacaliente, 2 mi E, 800 ft. (KU 3); Cacalotan, 15 mi E, Rancho Picacho (MLZ 1); Concha, 12 mi N, Río Las Cañas (MLZ 1); Cosala, 6 km E, 1500 ft. (KU 3); Casala [=Cosala?], 15 mi WSW (MLZ 2); Escuinapa (AMNH 15); Isla Palmito del Verde (middle) (KU 2; Hall, 1981); Isla Palmito del Verde, 6 mi NW Teacapan (KU 1); Los Peiles (AMNH 3; Hall, 1981); Mazatlán (FMNH 4, USNM 4; Hall, 1981); Mazatlán, 300 ft. (USNM 1); Mazatlán,

Presidio Propre (AMNH 1); Mazatlán, 20 mi SE (Hall, 1981); Montaña Juan Liaiarraga (AMNH 3; Hall, 1981); Palmito, 20 ft. (KU 6, Hall, 1981); Plomosas, 300 ft. (USNM 2); Plomosas, 7 mi ENE, 6000 ft. (KU 1; Hall, 1981); Plomosas, 2 mi SW, 3050 ft. (KU 1); Plomosas, 3 mi SE, 4000 ft. (KU 1); Revolcaderos, 1/2 mi S by highway (Hall, 1981); Rosario, 1 mi E (MLZ 1); Rosario, 20 mi NE, Rancho Santa Barbara (MLZ 2); San Lorenzo, 1.5 mi E (KU 1); Santa Lucia, 5 km SW, 2150 ft. (KU 1; Hall, 1981); Santa Lucia, 5 mi N, Rancho Batel (MLZ 1); Villa Unión, 8 km N, 450 ft. (KU 3; Hall, 1981).

Description. *S. c. sinaloensis* differs from *S. c. colliaei* in beings larger with less blackish and more orange in the pelage, having a larger skull with broader rostrum and jugals, and larger bullae. The back is rusty yellow and the sides and tail are hoary white (Nelson, 1899). *S. c. sinaloensis* is larger than *S. c. truei*, with darker, more orangish pelage, and there is more contrast between the dark orange dorsum and the pale grayish sides, legs, and tail (Anderson, 1962).

Measurements. External measurements (mean and range, in mm) of adults of *S. c. sinaloensis* (n=4) were: total length, 511.7 (500-524); tail length, 249.3 (241-267); hind foot length, 59.3 (57-60). Cranial measurements (mean ± standard deviation and range in mm) of adults of *S. c. colliaei* (n = 21) were: occipitonasal length, 59.10 ± 1.17 (56.5-62.1); zygomatic breadth, 34.10 ± 0.85 (32.3-36.1); interorbital breadth, 18.70 ± 0.70 (17.7-20.1); breadth of braincase, 24.37 ± 0.67 (23.2-25.6); maxillary toothrow, 11.59 ± 0.35 (10.7-12.4) (Anderson, 1962:4-5).

Remarks. Populations of *S. c. sinaloensis*, *S. c. truei*, and S. *c. colliaei* may be allopatric, but more details of the distribution are needed.

Sciurus colliaei truei Nelson

1899. *Sciurus truei* Nelson, Washington Acad. Sci., 1:61.

1962. *Sciurus colliaei truei*, Anderson, Amer. Mus. Novit., 2093:12.

Type locality. Camoa, Río Mayo, Sonora,

Range. *S. c. truei* occurs from southern Sonora south to central Sinaloa.

Recorded localities. *SONORA*: Agua Marin (MVZ 6); Alamos, 8 mi SE, Río Cuchujaqui (KU 1; Hall, 1981); Chinobampo (UCLA 3; Hall, 1981); Camoa, Río Mayo (USNM 2; Hall, 1981); Camoa, Río Mayo, 8900 ft. (USNM 2); Guirocoba, 2 mi E (MVZ 9, UCLA 2); San Javier (UCLA 4; Hall, 1981); Sonora (UCLA 3). *SINALOA:* Badiraguato, 1.5 mi N, 750 ft. (KU 5); Badiraguato, 20 km N, 5 km E, 1800 ft. (KU 4; Hall, 1981); Badiraguato, 13 mi ESE, 800 ft. (KU 4; Hall, 1981); Culiacán, 32 mi SSE (KU 3; Hall, 1981); El Molino (MLZ 4); Presa Sanalona, 11 mi NE, 500 ft. (KU 1); Quila, 15 mi E, Arroyo Guayabita (MLZ 1); San Ignacio, 700 ft. (KU 2; Hall, 1981); Sinaloa, 10 km S, 38 km E, 800 ft. (KU 1; Hall, 1981); Sinaloa, 15 km N, 65 km E, 4700 ft. (KU 8; Hall, 1981); Vaca, 13 km NNE, 1300 ft. (KU 2); Yecorato (MLZ 3).

Description. *S. c. truei* is smaller and lighter in color than the other subspecies (Anderson, 1962).

Measurements. External measurements (mean ± standard deviation and range, in mm) of adults of *S. c. truei* (n = 27) were: total length, 500.2 ± 4.5 (440-534); tail length length, 258.3 ± 9.3 (203-287); hind foot length, 63.5 ± 4.6 (58-67). Cranial measurements (mean ± standard deviation and range in mm) of adults of *S. c. truei* (n = 30): occipitonasal length, 56.10 ± 0.88 (54.4-58.6); zygomatic breadth, 32.48 ± 0.70 (30.9-33.8); interorbital breadth, 18.17 ± 0.48 (17.2-18.9); breadth of braincase, 23.43 ± 0.52 (22.2-24.4); maxillary toothrow, 11.07 ± 0.51 (9.8-11.5) (Anderson, 1962).

Remarks. Specimens from the southern part of the range are intermediate between *S. c. truei* and *S. c. sinaloensis*, suggesting intergradation (Anderson, 1962).

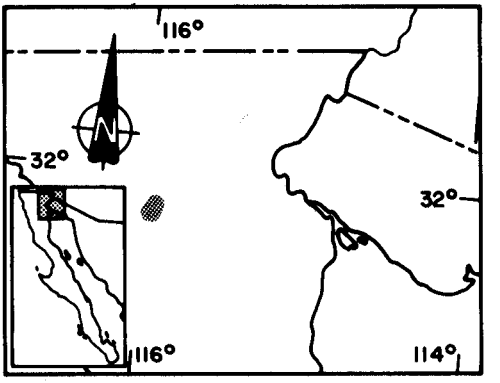
Sciurus griseus Ord

There are three subspecies, one of which occurs in northwestern Mexico:

Sciurus griseus anthonyi Mearns

1897. *Sciurus fossor anthonyi* Mearns, Proc. U.S. Nat. Mus., 20:501.
1907. *Sciurus griseus anthonyi*, Mearns, Bull. U.S. Nat. Mus., 56:264.

Type locality. "Campbell's Ranch, at Laguna, San Diego County, California."



Geographic range of *Sciurus griseus anthonyi*.

Range. *Sciurus griseus* occurs from Washington south through the Cascade Mountains of Oregon and much of California to the Sierra Juárez Mountains, Baja California. *S. g. anthonyi* occurs from the transverse ranges of southern California south to the Sierra Juárez, Baja California. Hall (1981) listed no gray squirrel records for Baja California. However, Mearns (1907) saw them in the Laguna Mountains [=Sierra Juárez] and Huey (1964:104) wrote that "a single adult male specimen collected April 2, 1936, between El Rayo and Laguna Hanson in the Sierra Juárez by the writer marks the only known occurence of the species in Baja California." We know of 15 specimens from six localities and five additional sight records, all in the central portion of the Sierra Juárez (records below and those in Mellink and Contreras, 1993).

Recorded localities. *BAJA CALIFORNIA*: All in the Sierra Juárez as follows: El Rayo (SDNHM 1); Laguna Hanson (MSB 3); Laguna Hanson, W side (32° 03'N, 115° 55'W) (UABC 1); Laguna Hanson, SE side (32° 02'N, 115° 53'W) (Mellink and Contreras, 1993); 3 mi N Laguna Hanson, Parque Nacional (MSB 8); 1 km S Quinta Patricia (32° 02'N, 115° 56'W, 1700 m elevation) (UABC 1).

Description. *Sciurus griseus* has prominent large ears without tufts, a bushy tail with white edges, and upperparts that are uniform silvery gray, without rusty tints. The underparts are whitish, and the white extends onto the throat (Ingles, 1965; Carraway and Verts, 1994). The baculum is 16.5 mm long and resembles that of *S. aberti* (Howell, 1938). The dental formula is 1/1 0/0 2/1 3/3 = 22. *S. g. anthonyi* is slightly smaller, and the dorsal pelage is more pale and less grizzled, than the other subspecies (Mearns, 1907).

Measurements. Ranges of external measurements of *Sciurus griseus* (in mm) are: total length, 500-615; tail length, 240-309; head and body length, 265-323; hind foot length, 67-83; ear length, 29-39 (Carraway and Verts, 1994). Means of cranial measurements of five topotypes of *S. g. anthonyi* were: basal length, 56.3; zygomatic breadth, 37.7; interorbital breadth, 20.9; palatal length, 30.2; length of maxillary toothrow, 11.7 (Nelson, 1899).

Remarks. In *S. griseus*, the dorsum is pure silvery-gray without rusty tones, and white underparts extend up to the throat. *S. carolinensis* (introduced into the Sierra Juárez) has a dark gray dorsum with a rusty wash, and the throat is gray. The hind foot is larger (72-82 mm) in *S. griseus* than in *S. carolinensis* (55-75 mm) (Ingles, 1965). The only other tree squirrel in Baja California is *Tamiasciurus mearnsi*, which is smaller and darker, has a dark lateral line, and at least some yellow on the underparts.

The taxonomy of *S. griseus* has been remarkably stable. All of the subspecies were described and there have been no taxonomic changes since 1907 (see synonomies in Hall, 1981; Carraway and Verts, 1994). The resemblance to the eastern gray squirrel, *S. carolinensis*, is considered superficial; they are placed in different subgenera. *S. griseus* is the only member of subgenus *Hesperosciurus*.

In Oregon and Washington, *S. griseus* is more common in Transition life zone oak woodlands than in coniferous forests (Bailey, 1936). In California, they occur in Lower Sonoran, Upper Sonoran, and Transition life zone forests, and are especially associated with walnuts (*Juglans* sp.) and oaks (*Quercus* sp.). They utilize lower elevation woodlands (*Platanus racemosa*, *Populus fremontii*, *Pinus sabiniana*, *Quercus douglasii*, *Q. wislizenii*, *Q. dumosa*) as well as montane forests (*Pinus ponderosa*, *Abies concolor*, *Pseudotsuga menziesii*, *P. lambertiana*, *Sequoia gigantea*, *S. sempervirens*, and *Q. kelloggii*; Ingles, 1947). They are common in mixed oak and pine forest in the mountains in San Diego County, California, just north of the international border (Bond, 1977). There are no data on habitat use by *S. griseus* in the Sierra Juárez except that they occur in forests (Mellink and Contreras, 1993).

They are scatter hoarders, frequently caching acorns and other food items in small caches later relocated by olfactory cues. Important food items include conifer seeds (some cones are cached for winter use), seeds, berries, acorns, buds, bark, fungi, sap, walnuts, and some leaves (Carraway and Verts, 1994). Fungi may be especially important in summer, and comprised 14-73% of the diet in California (Ingles, 1947; Steinecker and Browning, 1970; Maser *et al.*, 1978).

S. griseus compete for food with California ground squirrels (*Spermophilus beecheyi*) and the introduced eastern gray squirrels (*S. carolineneis*) and fox squirrels (*S. niger*). They also compete with northern flying squirrels (*Glaucomys sabrinus*) and Douglas squirrels (*Tamiasciurus douglasii*) for both food and nest sites, and this competition may limit their distribution (Ingles, 1947; Carraway and Verts, 1994). Aggressive interactions with acorn woodpeckers (*Melanerpes formicivorous*), scrub jays (*Aphelocoma coerulescens*), and Steller's jays (*Cyanocitta stelleri*) have been reported (Ingles, 1947; Carraway and Verts, 1994).

Known predators include red-tailed hawks (*Buteo jamaicensis*), golden eagles (*Aguila chrysaetos*), coyotes (*Canis latrans*), and bobcats (*Lynx rufus*). In the United States, house cats (*Felis silvestris*) and automobiles kill many. Predation may have a relatively minor impact on *S. griseus* populations, and sport hunting is probably several times more important (Ingles, 1947; Carraway and Verts, 1994). Hunters killed 152,700 to 253,400 ($\bar{x}$ = 214,000) per year in California between 1965 and 1971 (Carraway and Verts, 1994).

Population densities varied from 0.25 to 2.5 individuals/ha in California (Grinnell and Storer, 1924). Other studies have reported similar densities (1.8/ha to 4.3/ha) (Ingles, 1947). There are periodic population irruptions, but these apparently decrease in response to disease at high population levels. In one study in Oregon (Cross, 1969, cited in Carraway and Verts, 1994), the high population density was nine times greater than the low density. Home range sizes from radiotracking data in southern Oregon varied from 0.79 to 3.49 ha in winter to 1.75 to 5.56 ha in summer. Home ranges were extended in late summer to harvest distant abundant resources.

Like other *Sciurus*, they are active all year and do not hibernate. Males with black scrota are considered sexually active, and in northern California these occur from February to May. There are one to six (means = 2.67 to 3.0 in three studies) embryos per litter. Of the embryos implanted, 31% were lost in utero. Most young were born in spring and left the nest in mid-April. Young have been seen as late as October implying that there may be two litters per year, but this is not definitely established. Young are born naked and blind, probably in tree hole cavities, and then moved to stick nests ("dreys") either for more room or to avoid parasites in the nests. *S. griseus* make stick nests, rather than the leaf nests or cavity nests used by many other species. The nests are made of heavy sticks on the outside layer, and then with two or three more concentric layers of progressively finer material, and lined with insulation (Carraway and Verts, 1994).

When distrubed, they stop moving, even though they may be in an awkward position. If the danger is low, they may begin alarm calls, foot-stomping, and tail-flicking. They do not seem to notice people and animals that are motionless (Cross, 1969, in Carraway and Verts, 1994).

They have social hierarchies that are maintained by chasing, threat postures, and fighting in extreme cases. Fighting is rare but can cause injuries. The hierarchies are somewhat flexible and can change. Social position and winter and spring home range size were positively correlated, and subordinate individuals do not have access to food until dominant individuals leave, forcing them to be active for longer time periods (Cross, 1969, in Carraway and Verts, 1994).

Sciurus griseus was listed as amenazada (threatened) in Mexico (Ceballos and Navarro, 1991; NOM-059-ECOL 1994). It still exists in the central Sierra Juárez, but is not common. Mellink and Contreras (1993) failed to find it in 1992, but were successful in 1993.

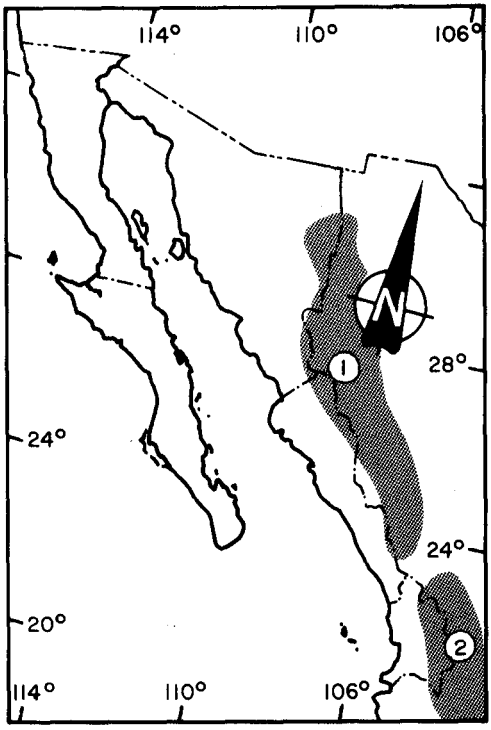
In addition to the specimen records above, Mellink and Contreras (1993) reported five sight records: forest fire control station (32° 00'N, 115° 27'W), La Oliva mine (31° 05'N, 115° 58'W), environs of Laguna Hanson (31° 03'N, 115° 55'W), Las Cuevitas (31° 53'N, 115° 56'W), and Rancho Pino Colorado (31° 53'N, 115° 57'W). Additional surveys to document the population sizes, distribution, and population trends in the limited range in the central Sierra Juárez would be very desirable.

Sciurus nayaritensis J. A. Allen

Range. *Sciurus nayaritensis* occurs in the Sierra Madre Occidental from the Chiricahua Mountains in southeastern Arizona, south to the eastern base of Sierra Nevado de Colima, Jalisco (Hall, 1981). Most of the records are east of Sonora, Sinaloa and Nayarit.

Description. In *S. nayaritensis* the upper parts are brown with a red or ochraceous tint. The venter is reddish or ochraceous, and the color of the venter extends to the legs and feet. The lateral tail hairs are ochraceous at the base, have a large black band in the middle, and an outer buffy, ochraceous or reddish band. The pelage texture is dense and fine. The ears lack tufts of long hairs at the tip. There is only a single upper premolar, the rostrum is relatively broad, the braincase is high in the interorbital region, and the auditory bullae are not greatly inflated (Lee and Hoffmeister, 1963; Hall, 1981; Hoffmeister, 1986; Best, 1995a; EY, personal observations). The dental formula is 1/1 0/0 1/1 3/3 = 20 (Hall, 1981; EY, personal observations). The color varies considerably in the three subspecies, although not as much as between *S. nayaritensis* and *S. arizonensis*.

Remarks. *Sciurus nayaritensis* has only a single upper premolar, whereas *S. aberti* and *S. aureogaster* have two. The number of upper premolars is variable in *S. colliaei*. *Sciurus nayaritensis* can be separated from *S. aberti* by color and the absence of ear tufts. *S. colliaei* has



Geographic range of *Sciurus nayaritensis*:
1. *S. n. apache* 2. *S. n. nayaritensis*

white or gray underparts, whereas the venter is orange in *S. nayaritensis*. *S. aureogaster* has a variegated tail, whereas the tail hairs have a single, large black band in the middle and an outer buffy or orange band in *S. nayaritensis*. *S. arizonensis* is very similar to *S. nayaritensis* in external and skull measurements, but *S. arizonensis* has a gray or white venter and white in the outer band on the tail.

Sciurus niger from eastern North America, *S. nayaritensis*, and *S. arizonensis* are closely related, and may be conspecific (Lee and Hoffmeister, 1963; Hall, 1981; Hoffmeister, 1986). *S. nayaritensis* appears no more different from *S. niger* than some of the subspecies of *S. niger* are from each other. *S. nayaritensis* also appears closely related to *S. oculatus* and *S. alleni*, despite the superficial similarity of the latter with *S. carolinensis*, and the three might also be conspecific (Lee and Hoffmeister, 1963; Hall, 1981). All five species are allopatric, and all have only one upper premolar, whereas other *Sciurus* (except the variable *S. colliaei*) have two upper premolars.

Baker (1956) speculated that a common ancestor of *S. nayaritensis*, *S. oculatus* and *S. alleni* dispersed eastward across Mexico via mountains in Durango, Zacatecas, and Coahuila. However, one could just as easily argue that during one or more glacial periods *S. niger*, or an ancestor, could have moved southwest from Coahuila to Nuevo León, Tamaulipas, and San Luis Potosí into the current range of *S. alleni*. From there, dispersal could have proceeded to the south into the current range of *S. oculatus*, then west into the current range of *S. nayaritensis*. From there they could have moved north along the Sierra Madre Occidental to the Chiricahua Mountains, and finally reached various isolated mountain ranges in Arizona in the current range of *S. arizonensis*. Eastern North American populations of *S. niger* and Arizona populations of *S. arizonensis* are nearly linked by intermittently connected populations of related squirrels on a series of adjacent mountain ranges in Mexico. Understanding the history and relationships of these populations will depend upon future molecular studies, and we hope that someone will undertake them.

Sciurus nayaritensis occurs at elevations of 1560-2700 m in riparian woodlands, oak woodlands, or pine-oak woodlands in Upper Sonoran, Transition, and Canadian life zones. They are most common where evergreen oaks are present (Burt, 1938; Caire, 1978; Best, 1995a). Dominant species in riparian habitats include sycamores (*Platanus* sp.), ashes (*Fraxinus* sp.), walnuts (*Juglans* sp.), and hackberry (*Celtis reticulata*).

Acorns are a staple of the diet, but they also eat pine seeds, walnuts, roots, buds, bulbs (Mearns, 1907; Cahalane, 1939; Hoffmeister, 1986; Best, 1995a). The diet has not been studied in detail and most of the information is based on casual observations.

Sciurus nayaritensis is sympatric in place with *S. aureogaster*, *S. colliaei*, and *S. aberti*. It lives at higher elevations (1200-3000 m) than *S. colliaei* (Musser, 1968), and is abundant at lower elevations than *S. aberti* (Anderson, 1972). Furthermore, *S. aberti* is associated with ponderosa pine (*Pinus ponderosa*) in the Sierra Madre Occidental, just as in the United States (Nash and Seaman, 1977; Allred *et al.*, 1994). It overlaps with *S. aurogaster* in Nayarit, Jalisco and Colima.

There are apparently two molts per year, as in other squirrels (Allen, 1904; Mearns, 1907), but details are not well documented. There have been no studies on reproduction, but pregnant and lactating females have been found in July in Chihuahua (Baker and Greer, 1962; Anderson, 1972). Litter sizes may be small. Three females had two, three and three embryos (Mearns, 1907; Anderson, 1972).

Like *S. arizonensis*, *S. nayaritensis* may be either very secretive (during winter or when females are pregnant or nursing) or conspicuous, depending upon the time of year (Brown, 1984). When potential predators are seen, *S. nayaritensis* remain motionless for long periods of time (over 45 minutes) and can be difficult to see. On the ground, they run to the nearest tree. They are relatively quiet, but do make alarm calls from the safety of trees (Brown, 1984). *S. n. apache* is more vocal than *S. n. chiricahuae* (Best, 1995a).

They forage all year instead of caching food. They do not visit campgrounds, feeding stations, or garbage cans, and eat only native foods (Best, 1995a). However, in the Chiricahua Mountains of southeastern Arizona, they can be rather tame (Cahalane, 1939).

Sciurus nayaritensis has suffered extensive habitat loss due to logging, burning, and clearing of forests for agriculture (Leopold, 1959). Nevertheless, it is a game animal (SEMARNAP, 1997). In Nayarit, the hunting season for squirrels is 2 January to 1 March with a daily limit of two squirrels and four in possession. In Sonora, the season is 31 October to 22 March, with a daily limit of three with six in possession. In Sinaloa, the season is 24 October to 22 March, with a daily limit of three with six in possession.

There seem to be no good data on population abundance or population trends for this species in the available literature. If it is subject to hunting pressure, and at the same time losing habitat, some population studies should be done in the near future.

The three subspecies of *S. nayaritensis* were recognized as separate species until Lee and Hoffmeister (1963) showed that despite the striking dissimilarity in color, the differences are more consistent with subspecies level separation. Two subspecies occur in northwestern Mexico.

Sciurus nayaritensis apache J. A. Allen

1893. *Sciurus apache* J. A. Allen, Bull. Amer. Mus. Nat. Hist.,5:29.

1963. *Sciurus nayaritensis apache*, Lee and Hoffmeister, Proc. Biol. Soc. Washington, 76:188.

Type locality. Western slope of the Sierra de Nacori, 6300 ft., eastern Sonora (Van Rossem, 1936).

Range. This subspecies occurs in the Sierra Madre Occidental from the U.S. border south through Sonora, Chihuahua, Sinaloa, and Durango.

Recorded localities. *SINALOA*: Babizos (MLZ 3); Choix, 18 km NNE (KU 3); Milpillas, 15 mi N, Suratato (MLZ 1); Palmito, 5 km SW, 6100 ft. (KU 2); Plomosas, 7 mi ENE, 6000 ft. (KU 2); Rancho Babizos (MLZ 2); Santa Gertrudis (MLZ 6); Santa Lucia, 19.2 km (by road) NE, 6200 ft.

(KU 2); Santa Lucia, 5 mi N, Rancho Batel (MLZ 1); Sierra de Choix (Hall, 1981); Sierra de Choix, 50 mi NE (USNM 3); Tepetuco, San Felipe (MLZ 1). *SONORA*: Sierra de Nacori, W. slope, 6300 ft.; ca. 3 mi from New Mexico line, SE Cloverdale (USNM 1; Hall, 1981); Baromico (Hall, 1981); Colonia García (Hall, 1981); Guiracoba, 25 mi NE (MLZ 1); Huachinera, 4 mi N (USNM 1); Huachinera, 4 mi SW (USNM 1); Río Bavispe (AMNH 2).

Description. *S. n. apache* has a longer, narrower rostrum than *S. n. chiricahuae*, with the anterior region of the frontals less convex. *S. n. chiricahuae* is described as having richer, darker coloration than *S. n. apache*. *S. n. apache* has a longer tail and hind foot and the skull is slightly shorter and wider than in *S. n. nayaritensis* (Lee and Hoffmeister, 1963).

Measurements. Means ± standard deviations (ranges in parentheses) of 39 *S. n. apache* (sexes combined, adults with P4 erupted, in mm) were: head and body length, 281.8 ± 10.60 (267-301); tail length, 275.0 ± 10.00 (259-298); hind foot length, 77.5 ± 2.60 (73-82); basilar length of skull, 50.03 ± 0.98 (48.5-52.5); zygomatic breadth, 37.48 ± 0.87 (35.1-39.9); nasal length, 21.77 ± 0.87 (20.1-23.7); postorbital breadth, 20.46 ± 0.64 (19.4-21.6); palatilar length, 27.98 ± 0.62 (26.7-29.2); and maxillary toothrow, 12.02 ± 0.28 (11.2-12.5) (Lee and Hoffmeister, 1963).

Remarks. The type specimen of *S. apache* (=*S. n. apache*) was unlabelled, and Allen (1893a) gave the type locality as "northern Chihuahua." Van Rossem (1936) concluded after careful study that the type locality was actually in Sonora. However, Lawrence (1993:66) listed the type locality as "Northwest Chihuahua; Río de Bavispe. 28 December 1890." She died before her manuscript was finished and did not comment on or reconcile the discrepancy with Van Rossem's conclusion. Thus, in the absence of information to the contrary we have accepted Van Rossem's (1936) restriction of the type locality.

The range of variation of *S. n. chiricahuae* (southeastern Arizona) is contained within the variation of *S. n. apache* (Lee and Hoffmeister, 1963).

Sciurus nayaritensis nayaritensis J. A. Allen

1889. *Sciurus alstoni* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 2:167.

1890. *Sciurus nayaritensis*, J. A. Allen, Bull. Amer. Mus. Nat. Hist., 2:vii, footnote.

1963. *Sciurus nayaritensis nayaritensis*, Lee and Hoffmeister, Proc. Biol. Soc. Washington, 76:188.

Type locality. Sierra Valparaíso, Zacatecas, Mexico.

Range. *Sciurus n. nayaritensis* occurs at the southern end of the Sierra Madre Occidental in Durango, Nayarit, Zacatecas, Aguascalientes, and Jalisco.

Recorded localities. *NAYARIT*: Santa Teresa, 6800 ft. (USNM 9); Santa Teresa, 10 mi NW (MLZ 1); Sur de Nayarit (AMNH 1).

Description. *S. n. nayaritensis* has a shorter tail and hind foot and the skull is slightly longer and narrower than in *S. n. apache*. The dorsal coloration of *S. n. nayaritensis* is grayish washed with white whereas *S. n. apache* is blackish washed with buff or yellow (Lee and Hoffmeister, 1963).

Measurements. Means ± standard deviations (ranges in parentheses) of *S. n. nayaritensis* (sexes combined, 41 adults with P4 erupted, in mm) were: head and body length, 287.4 ± 11.55 (264-315); tail length, 269.9 ± 12.40 (237-294); hind foot length, 77.0 ± 12.99 (70-84); basilar length of skull, 50.31 ± 1.09 (48.0-52.7); zygomatic breadth, 37.48 ± 0.86 (35.7-39.1); nasal length, 21.91 ± 0.79 (20.4-23.7); postorbital breadth, 20.27 ± 0.62 (19.2-21.7); and palatilar length, 28.10 ± 0.74 (26.3-30.4); maxillary toothrow, 12.10 ± 0.33 (11.5-13.0) (Lee and Hoffmeister, 1963).

Remarks. The skulls of *S. n. nayaritensis* and *S. n. apache* were not significantly different, which is interesting given the striking color differences between the two (Lee and Hoffmeister, 1963). *S. alstoni* has priority over *S. nayaritensis*, but *S. alstoni* was preoccupied (Allen, 1890c).

Spermophilus Cuvier

Type species. *Mus citellus* Linnaeus, 1766 [=*Spermophilus citellus* (Linnaeus, 1766)].

Description. *Spermophilus* is distinguished by the following characters: feet with five digits, pollux vestigial with a nail; infraorbital foramen oval or triangular, broader than in *Ammospermophilus*; masseteric tubercle medium to large and ventrolateral to infraorbital foramen; dorsal profile of skull with a bend at the junction of rostrum and cranium; M3 and m3 without complex folds in the basins.

Remarks. The typical ground squirrels, genus *Spermophilus,* have diversified more than other sciurid genera, and six rather distinct subgenera are currently recognized (Hall, 1981). Because of this diversity, it seems advisable to indicate the subgenera in the accounts below. We treat *Notocitellus* as a valid subgenus distinct from *Otospermophilus*.

Citellus Oken 1816 was used in place of *Spermophilus* Cuvier 1825 by earlier authors because it had priority (Allen, 1902). However, Oken was not consistent in the use of binomial nomenclature and his names are no longer accepted as valid (Hershkovitz, 1949; International Commission on Zoological Nomenclature, 1956).

There are 12 species in Eurasia and 26 in North America; six species and 11 subspecies occur in northwestern Mexico (Hall, 1981; Jones and Manning, 1989; Hoffmann *et al.*, 1993).

Subgenus *Notocitellus* Howell, 1938

Spermophilus annulatus Audubon and Bachman

There are two subspecies, one of which enters northwestern Mexico:

Spermophilus annulatus goldmani Merriam

1902. *Spermophilus annulatus goldmani* Merriam, Proc. Biol. Soc. Washington, 15:69.

Type locality. Santiago, Tepic, Nayarit, Mexico.

Range. *S. annulatus* has a distribution of about 560 x 100 km in Nayarit, Jalisco, Colima, Michoacan, and Guerrero. *S. a. goldmani* enters northwestern Mexico, where it has a range of about 150 x 35 km in Nayarit. Our records are all within 35 km of the coast and extend as far north as Sauta (21° 44'N).

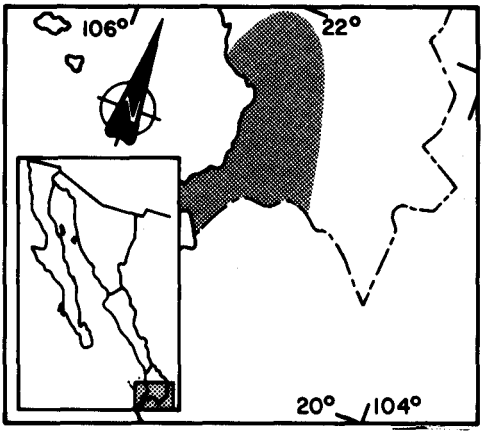
Recorded localities. *NAYARIT*: Arroyo de San Juan Sanches, 1000 ft. (USNM 1; Hall, 1981); Chacala (MLZ 2); Compostela, 2000 ft. (USNM 1; Hall, 1981); Compostela, about 40 mi SW (Hall, 1981); La Union, 5 mi S (KU 1); San Blas (AMNH 1, MCZ 1, MVZ 1; Hall, 1981); San Blas, 75 ft. (USNM 1); San Blas, 800 ft. (USNM 1); Santiago, 200 ft. (USNM 2; Hall, 1981); Sauta (MLZ 1); Tepic, 13 mi W, cerca Jalcocotlán (CAS 1); Venustiano Carranza, 4 mi SW (TCWC 2).

Description. The dorsal coloration is fuscous black with a sprinkling of ochraceous buff. The sides are lighter with more tawny and less fuscous black, whereas the underparts are ochraceous

buff to rufous, and the tail is tawny below. The long, bushy tail is 80-95% as long as the head and body and has ca.15 distinct dark rings (Howell, 1938; Hall, 1981; EY, personal observations).

Audubon and Bachman (1842) stated that the tail was longer than the head and body in *S. annulatus*. However, we (EY and MVA, original data) found that the tail was 89% (80-95%) of the head and body length in eight *S. a. annulatus* that we measured from Colima. The averages in Howell (1938) indicate a mean ratio of 96% for *S. a. goldmani* (see measurements below).

S. a. goldmani has a smaller hind foot (50-54 vs. 54-64 mm; Howell, 1938); more distinct, white eyelids; underparts less intensely ferruginous (Merriam, 1902b), and darker dorsally (Howell, 1938) than *S. a. annulatus*.



Geographic range of *Spermophilus annulatus goldmani*.

Measurements. Standard external measurements (means and ranges, in mm) of 6 adult female *S. a. goldmani* from Nayarit were as follows: total length, 415 (383-430); tail length, 204 (186-216); hind foot length, 51.7 (50-54); ear length, 15.2, (14.5-15.5). Skull measurements of 5 adult females were: greatest length of skull, 53.5 (51.9-55.4); zygomatic breadth, 30.4 (29-32.1); length of nasals, 17.5 (16.8-18.5); interorbital breadth, 13.5 (13-14.1); postorbital constriction, 15.2 (14.5-15.8); width of braincase, 22.2 (21.6-23.1); palatar length, 25 (24-26); maxillary toothrow, 9.7 (9.3-10.1) (Howell, 1938).

External measurments of 9 adults (6 males and 3 females) of *S. a. annulatus* from Colima were ($X \pm SD$, range, in mm): total length, 447.1 ± 15.47 (395-470); tail length, 209.7 ± 8.66 (196-222); hind foot length, 57.2 ± 2.49 (52-61); ear length, 19.2 ± 0.97 (18-21); and weight (g), 395.0 ± 63.79 (315-490) (EY and MVA, original data).

Remarks. *Spermophilus annulatus* is superficially similar to a tree squirrel, but the latter do not have ringed tails. *S. annulatus* can be distinguished from *S. variegatus*, the only other ground squirrel in its range in Nayarit, by the distinct rings on its tail, and its reddish underparts and face. It is about 1/3 larger than *S. adocetus*, and there is no size overlap (e.g., total length 315-353 vs. 383-470 mm) between the two species. *S. adocetus* does not have rings on its tail.

Subgenus *Notocitellus* was described for *S. adocetus* and *S. annulatus*, with the latter as the type species (Howell, 1938). However, based upon musculature and skeletal morphology, Bryant (1945) considered *Notocitellus* synonymous with subgenus *Otospermophilus*. Hall (1981) followed Bryant (1945) in not recognizing *Notocitellus*, and placed *S. annulatus* and *S. adocetus* in *Otospermophilus*.

The bacula of *S. annulatus* and *S. adocetus* are very different from *Otospermophilus* (Howell, 1938; Burt, 1960; EY, unpublished data). The karyotype of *S. adocetus* is more similar to those of *Ictidomys* than *Otospermophilus* (Uribe-Alcocer, 1977), further suggesting that *S. annulatus* and *S. adocetus* do not belong in subgenus *Otospermophilus*. As far as we know, neither Howell nor Bryant ever saw living *S. annulatus*. DNA evidence (R. Harrison, personal communication),

as well as behavior of the living animals (EY and MVA, unpublished data) further suggest that *Notospermophilus* should be recognized as a valid subgenus.

The localities for *S. annulatus* are from sea level to about 1200 m elevation in lowland tropics (Best, 1995c). Unlike most other ground squirrels which avoid forested areas, they inhabit tropical deciduous forests and are associated with vines and tangled brush on large trees (Allen, 1889; EY and MVA, personal observations).

Nelson and Goldman (in Howell, 1938) stated that the burrows were placed in rocks on hillsides and on sandy flats. We (EY and MVA, personal observations) have observed that in Colima their burrows were not necessarily associated with rocks or sandy flats. However, the hillsides where we found burrows appeared to be well drained. They also live in holes in large trees (Allen, 1889), and near humans in holes in sides of dykes, rock walls, and walls of barns (Allen, 1890b). We know of no other *Spermophilus* that inhabits tree holes. Burrow entrances may be in the open or protected by cacti, mesquite, palm fronds, or acacias.

The diet consists of wild fruit and nuts (Allen, 1889); corn and seeds (Allen, 1890b); nuts of oil palm, mesquite beans, cactus seeds, pads of cacti, wild figs, and moho nuts (Nelson and Goldman, in Howell, 1938).

Best (1995c) stated that breeding occurs during the dry season from December to June. However, five of seven males that we (EY and MVA) collected in September 1994 in Colima had scrotal testes and the other two had inguinal testes, suggesting that the breeding season is longer, at least in Colima.

This species is much more arboreal than other ground squirrels. They may be found 3-4 m up in trees (Nelson and Goldman, in Howell, 1938), and run swiftly through the lower branches (EY and MVA, personal observations). The only published information on behavior is an account from the field notes of Nelson and Goldman (in Howell, 1938:28-29).

> "...they may be seen gliding silently from log to log or from one bunch of brush or similar shelter to another, now stopping for a moment to dig a seed or sitting up on their haunches to eat some morsel and then on again. They are often seen 10 or 12 feet up on the trunk of a small tree--sometimes out on the ends of branches after mesquite beans, cactus leaves, or other fruit--and when surprised they frequently run up a tree a few feet, take a hasty look at the intruder, then around the tree, down the other side and away in a direct line, so that before one knows it he may see his expected prey whisk into a brush pile or hole many yards away. Often they will crouch close to the ground and lie very still in the bushes so that they are only seen by accident, while others will steal softly away to some sheltering hole and thence utter short, shrill, whistling or chirping notes at short invervals. This is the only note we have heard them give. When their curiosity is aroused they will draw near, stopping to stand up on their hind feet, sometimes stretching the body up so that the tail is used to help support the body as on a tripod. At the first alarm they scurry away into the first shelter. They carry their tails in a curve quite squirrel-like in character and their motions are more light and agile than those of most spermophiles."

S. annulatus is a game animal (SEMARNAP, 1997). The hunting season for squirrels in Nayarit is from 2 January to 1 March, with *S. annulatus* included in the daily bag limit of two squirrels and four in possession. However, we know of no published information on the current distribution or abundance of this endemic species.

Common names for *S. annulatus* are "tezmo" or "tesmo" (Allen, 1890b; Best, 1995c; EY and MVA, personal observations), "ring-tailed ground squirrel" (Howell, 1938, Best, 1995c, Hall,

1981), "ardilla cola anillada" (SEMARNAP, 1997), and "Goldman's ground squirrel" (for *S. a. goldmani*; Howell, 1938). We prefer "tezmo" because it is the common name used by the people who live in the geographic range of the species.

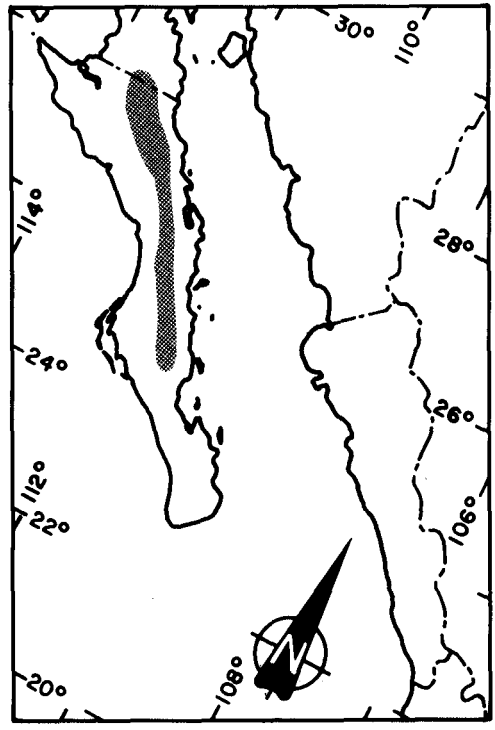
Subgenus *Otospermophilus* Brandt

Spermophilus atricapillus Bryant

1889. *Spermophilus grammurus atricapillus* Bryant, Proc. California Acad, 2 (series 2):26.
1959. *Spermophilus atricapillus*, Hall and Kelson, Mammals of N. Amer., 1:355.

Type locality. "Comondú, Lower California [=Baja California Sur]."

Range. *Spermophilus atricapillus* occurs in mountains of volcanic origin in northern and eastern Baja California Sur. The northernmost known locality, Santa Gertrudis Mission, is about 5 km north of 28° N (the state boundary) in the state of Baja California. The other records are in Baja California Sur, and extend as far south as San Pedro de la Presa, a distance of about 430 km. All of the records are in oasis areas in the Sierra de la Giganta-Sierra San Pedro-Sierra San Francisco mountain chain on the eastern side of the peninsula.



Geographic range of *Spermophilus atricapillus*.

Recorded localities. *BAJA CALIFORNIA*: Misión Santa Gertrudis (SDNHM 7). *BAJA CALIFORNIA SUR*: Canipole, 4.8 mi W (USNM 1); Comondú (MVZ 15, SDNHM 13, USNM 22); Comondú, 1.5 mi SW (CSULB 4); San Jose de Comondú (MVZ 1, UCLA 1); San Miguel de Comondú, 6.5 mi SW, Arroyo Comondú (MVZ 1); San Miguel de Comondú, 1.8 mi SW (USNM 1); San Miguel de Comondú, 3.3 mi SW (USNM 1); San Miguel de Comondú, 4.3 mi SW (USNM 2); San Ignacio (MVZ 5, SDNHM 9, USNM 5); San Ignacio, 20 mi W (SDNHM 1); San Javier (Alvarez Castañeda *et al.*, 1996); San Pablo (USNM 1, 11 specimens--Howell, 1938; Hall, 1981); San Pedro de la Presa (ACMNH 4, CIB 5, Alvarez-Castañeda *et al.*, 1996); Santa Agueda (MVZ 1).

Description. *Spermophilus atricapillus* is a large (400 mm total length) ground squirrel with a long (180 mm), bushy tail. The tail and at least some portions of the dorsum are variegated. The black on the top of the head is continuous with a black patch on the anterior portion of the back which is triangular with its apex at the base of the skull. The posterior portion of the back is pinkish

cinnamon, but in some individuals can be medium brown to chocolate brown with variegated black patches. The sides are variegated pinkish cinnamon. There is no lateral line, and the dorsal pattern continues to the underparts, but becoming slightly lighter ventrally. The tail is variegated black and gray. The skull is similar to other *Otospermophilus*. The dental formula is 1/1 0/0 2/1 3/3 = 22 (Howell, 1938; EY, personal observations).

Measurements. The only published measurements for *S. atricapillus* are external measurements of seven males and five females, and cranial measurements of five males and four females, all topotypes (Howell, 1938, Alvarez-Castañeda *et al.*, 1996). Because of the small sample size, we offer below the original measurements from a larger sample of specimens from ACMNH, CIB, MVZ, and SDMNH. External measurements were taken from specimen tags, and cranial measurements (as defined by Robinson and Hoffmann, 1975) were measured to the nearest 0.1 mm with dial calipers. Weights (in grams) were available for some specimens.

Data below are means ± standard deviations, ranges, and sample sizes for each sex, then results of Student's *t*-tests for sexual dimorphism; "ns" indicates "not significant." Total length, males 442.2 ± 9.44 (405-486, n=30), females 424.1 ± 21.43 (387-465, n=21), t=3.485, $p < 0.05$; tail length, males, 197.7 ± 12.73 (157-217, n=30), females 189.3 ± 14.80 (156-210, n=21), t=2.169, $p < 0.05$; hind foot length, males 56.3 ± 2.26 (51-60, n=30), females 54.3 ± 2.78 (50-60, n=21), t=2.831, $p < 0.05$; ear length, males 26.4 ± 1.77 (24-29, n=19), females 25.0 ± 2.37 (22-29, n=11), t=1.842, ns; weight, males 562.1 ± 68.02 (439.6-706.0, n=17), females 453.1 ± 97.4 (350.0-560.0, n=10), t=3.424, $p < 0.05$.

Cranial measurements were (in mm): greatest length of skull, males 55.86 ± 2.17 (51.3-58.2, n=15), females 53.84 ± 2.16 (50.2-56.5, n=16), t=2.594, $p < 0.05$; zygomatic breadth, males 33.81 ± 2.14 (29.8-36.6, n=15), females 32.75 ± 1.98 (30.2-35.3, n=17), t=1.456, ns; length of nasals, males, 19.28 ± 1.212 (17.1-21.0, n=15), females 18.46 ± 1.187 (16.3-20.4), t=1.931, ns; least interorbital constriction, males 12.11 ± 0.83 (10.5-13.6, n=14), females 11.81 ± 0.95 (10.5-14.4, n=17), t=0.926, ns; least cranial breadth, males 22.74 ± 0.70 (21.7-24.0, n=15), females 22.44 ± 0.73 (21.1-23.8, n=17), t=1.190, ns; palatilar length, males 30.59 ± 1.24 (28.4-32.4, n=15), females 29.37 ± 1.39 (27.2-32.0, n=16), t=2.605, $p < 0.05$; alveolar length of maxillary diastema, males 13.68 ± 0.62 (12.8-14.8, n=15), females 13.12 ± 0.86 (11.9-15.0, n=18), t= 2.047, $p < 0.05$; postpalatal length, males, 19.09 ± 1.28 (16.5-20.4, n=15), females 18.29 ± 1.28 (16.3-20.3, n=15), t=1.712, ns.

Males were consistently larger than females for all characters, and the differences were significant for four of five external measurements and three of eight cranial measurements. Because the differences between means and the sample sizes were small, analysis of larger samples will probably reveal additional characters to be sexually dimorphic.

Remarks. *S. atricapillus* is monotypic. No type was designated from the type series of 29 specimens in the California Academy of Sciences, which unfortunately was destroyed by fire in 1906 (Howell, 1938). Several collections now have topotypes (see records above).

The only other large ground squirrels with long, bushy tails and variegated pelage are *S. beecheyi* and *S. variegatus*, also members of subgenus *Otospermophilus*. *S. beecheyi* and *S. atricapillus* have a dark head that is connected to a dark, somewhat triangular, shoulder patch, whereas in *S. variegatus* the head is darker than the scapular region, and there is no triangular mark. The shoulders are darker than the head in *S. beecheyi*, whereas the head and shoulders are equally dark in *S. atricapillus*. In *S. atricapillus*, the tail is longer (156-217 vs. 145-200 mm) and the skull slightly smaller (greatest length 50.2-58.2 vs. 51.6-62.4 mm) than in *S. beecheyi* (Howell, 1938,

Hall, 1981). Individuals with large dorsal patches of black or chocolate brown occur in *S. variegatus* and *S. atricapillus*, but we have not observed them in *S. beecheyi*.

Spermophilus atricapillus, *S. beecheyi*, and *S. variegatus* are closely related and similar morphologically. *Spermophilus atricapillus*, *S. beecheyi*, and *S. variegatus* are all allopatric, and it is unknown if they are reproductively isolated. *S. atricapillus* was described by Bryant 1889) as a subspecies of what is now *S. variegatus*, then later raised to full species (Howell, 1938).

The known localities in tropical oases have agriculture with dates and other fruits. The squirrels consume the fruit, and thus are considered pests. They are hunted to some extent (Arnaud and Millan, 1995). Abundance data do not exist, except that they are common in some localities and scarce in others (Arnaud and Millan, 1995). Abundance away from oases has not been documented and no observations of the behavior of *S. atricapillus* have been reported.

S. atricapillus is active most, or all, of the year (Alvarez-Castañeda *et al.*, 1996). Specimens have been collected in February, March, April, May, July, September, October, and November, and residents of oases where they live have told us that the squirrels are active all year. The breeding season is unknown, but Alvarez-Castañeda *et al.* (1996) reported that males were scrotal in September. They have five or six pairs of mammae: one or two pectoral, two abdominal, and two inguinal (EY, personal observations).

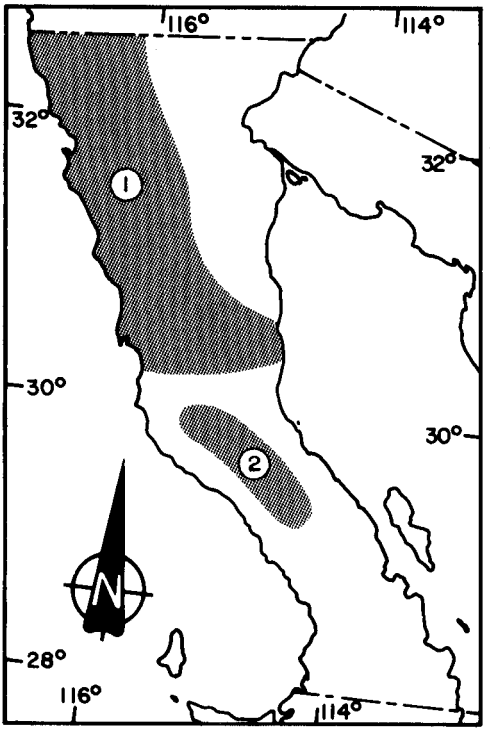
Because *S. atricapillus* apparently occurs only in isolated and somewhat limited populations in oases, it is potentially vulnerable to extermination. However, it has no official conservation status. Although some are hunted in Baja California Sur, it is not included in the Calendario Cinegético (SEMARNAP, 1997). A careful study of the distribution and abundance, food habits, economic damage (and benefits), and population trends of *S. atricapillus* would be a useful contribution.

Spermophilus beecheyi (Richardson)

Range. *S. beecheyi* occurs in Washington, Oregon, and California, and extends its distribution south into the central desert of Baja California.

Description. *Spermophilus beecheyi* is a large (380 mm total length) ground squirrel with a long (150 mm), bushy tail. The tail and dorsum are variegated: the top of the head is gray (mixed black and off-white hairs) and the occipit is browner. The lateral portion of the neck and anterior portion of the shoulders are light gray (white hairs predominate), whereas the dorsal portion of the neck is variegated dark brown. The latter forms a narrow triangle with its apex at the skull that is bordered by light gray, and extends to the mid-dorsal region, where the lateral gray stops and the triangle becomes continuous with the color of the posterior dorsum. The posterior dorsum is a variegated buff and medium brown. Laterally, the body is grayer anteriorly and becoming browner posteriorly. The venter is buffy white. The tail is variegated buffy and black. The skull is similar to other *Otospermophilus*, and the dental formula is 1/1 0/0 2/1 3/3 = 22 (EY, personal observations).

Remarks. *S. atricapillus* and *S. variegatus* also have long, bushy tails and variegated color patterns. However, in *S. beecheyi* the shoulders are darker than the head, whereas in *S. atricapillus* the dark patches on the head, neck, and shoulders are equally dark. In *S. variegatus* the head is darker than the scapular region, and the shoulders do not have a dark triangular area. In *S. atricapillus*, the tail is longer (185-210 vs. 145-200 mm) and the skull slightly smaller (greatest length 54.8-58.5 vs 51.6-62.4 mm) than in *S. beecheyi* (Howell, 1938, Hall, 1981).



Geographic range of *Spermophilus beecheyi*:
1. *S. b. nudipes* 2. *S. b. rupinarum*

S. beecheyi have a strong tendency to locate their burrows under or around large objects such as boulders, rocks, logs, trees, etc. However, they avoid areas with too much ground cover. Apparently they need clear areas for watching for predators. Good drainage for their burrows is also important (Owings and Borchert, 1975). In Oregon, sloping terrain was preferred for constructing burrow systems, and they especially preferred to make burrows on southern exposures. The burrows entered the ground at a 35° angle for about 60 cm, then leveled off and continued for up to 2 m, with several chambers and branches, some of which probably served as drains. Occasionally burrow systems contained acorns and seeds. Squirrels spend about 75% of their time in their burrows in the summer and much more in the winter (Edge, 1934). In California, the burrows were up to 10 m long and about 1.7 m deep with two entrances (Grinnell and Dixon, 1918).

When foraging, food is not eaten where found, but carried in the relatively large cheek pouches to the burrow entrance or a rock pile where it can be eaten in safety. They apparently gather more seeds and eat less green vegetation than other types of ground squirrels (Grinnell and Dixon, 1918). Important items in the diet include acorns, grass seeds, red-stem filaree (*Erodium cicutarium*), tarweeds (*Madia* spp.), lupines (*Lupinus* spp.), clover (*Trifolium* sp.), and a variety of other forbs (Fitch, 1948). They also eat some meat, including grasshoppers, eggs of quail, and gopher snakes. Experiments with captive squirrels indicate that they can eat an average of 12-30 g (dry weight) of food per day (Grinnell and Dixon, 1918; Fitch, 1948).

Unfortunately, they also eat a wide variety of crops: alfalfa, almonds, walnuts, figs, olives, apples, porunes, peaches, melons, grains, clover. Humans have reduced the natural predators of *S. beecheyi*, and provided agricultural crops to increase their food supply. Consequently *S. beecheyi* can be a pest in California, especially in grain fields and almond orchards (Grinnell and Dixon, 1918; Fitch, 1948; Ingles, 1965), and was considered the most injurious rodent in California (Grinnell and Dixon, 1918; Fitch, 1948). Grinnell and Dixon (1918) calculated that 640 squirrels/mi^2 [density of 2.6 squirrels/ha] eat as much as 3 cows or 32 sheep, and in the entire state of California they eat as much as 160,000 cattle or 1,600,000 sheep. This and similar calculations have been widely cited, and used to justify ground squirrel control programs. However, this type of argument (and the arithmetic!) has recently been attacked when applied to prairie dogs (Hoogland, 1995; see comments under *Cynomys ludovicianus*). The argument may be equally weak when applied to *S. beecheyi*, and control efforts, which are sometimes necessary, should be

justified on more solid evidence, especially since such control efforts have varied considerably in effectiveness (Fitch, 1948; Tomich, 1962).

S. beecheyi may occur at densities of up to 23 individuals/ha in California, but the distribution is irregular and the average is probably closer to 0.4/ha (Grinnell and Dixon, 1918). Predators of *S. beecheyi* include golden eagles (*Aquila chrysaetos*), red-tailed hawks (*Buteo jamaicensis*), coyotes (*Canis latrans*), badgers (*Taxidea taxus*), bobcats (*Lynx rufus*), weasels (*Mustela* sp.), rattlesnakes (*Crotalus* sp.), and gopher snakes (*Pituophis melanoleucus*; Grinnell and Dixon, 1918).

In California at elevations above 3000 m all individuals hibernate; adults hibernate for varying lengths of time at lower elevations, while juveniles frequently remain active throughout the winter (Tomich, 1962). Adult males emerge prior to adult females (Linsdale, 1946). At Cataviña, Baja California, *S. beecheyi* are active in June, July, and January (EY, personal observations), and probably all year.

In Oregon, the breeding season occurs in March, lasts about one month, and the young are born in April. There are about 5 young per litter. The young are altricial and weigh about 11 g. They leave the burrow at eight weeks of age and begin foraging outside the burrow (Edge, 1931). In California, pregnant females were found between January and May, but most were pregnant in March and mid-April (Grinnell and Dixon, 1918). There are 6.09 (1-11) embryos per litter in California (Grinnell and Dixon, 1918; Tomich, 1962). Interestingly, the later litters tended to be larger. There is only a single litter per year, as in other species. Gestation is approximately 30 days (Tomich, 1962). There are no data on the length of the breeding season in Baja California.

The behavior of *S. beecheyi* has been studied in California and Oregon in rather different habitats than those of the subspecies that occur in Mexico (Owings *et al.*, 1977; Owings and Coss, 1977). Comparative studies in Baja California would be useful for exploring the relationships between habitat and behavior. Fitch (1948) reported that *S. beecheyi* is not territorial.

S. beecheyi evade raptors by giving a whistled alarm call, and then retreating to a burrow entrance. They give scolding alarm calls from the safety of a burrow entrance for ground predators such as coyotes and bobcats. However, rattlesnakes can enter the burrow, so the ground squirrels use a different strategy. They warn each other of the rattlesnakes' presence by vigorously waving the tail, and they can attack the snake by kicking dirt in its eyes and even attacking and biting the snake, waving their bushy tail in a conspicuous display. *S. beecheyi* in the foothills around the Central Valley in California have natural resistance to rattlesnake venom (Owings and Coss, 1977).

Spermophilus beecheyi is not currently of conservation concern, nor are they listed in the Calendario Cinegético (SEMARNAP, 1997). Common names include California ground squirrel, Beechey ground squirrel, ardillón. There are eight subspecies; two occur in northwestern Mexico:

Spermophilus beecheyi nudipes (Huey)

1931. *Citellus beecheyi nudipes* Huey, Trans. San Diego Soc. Nat. Hist., 7:18.

1959. *Spermophilus beecheyi nudipes*, Hall and Kelson, Mammals N. Amer., 1:355.

Type locality. "Laguna Hanson, Sierra Juárez, Lower California, Mexico, altitude 5200 feet [1600 m]; lat. 31° 58' north, long. 115° 53' west."

Range. *S. b. nudipes* occurs in the Sierra Juárez and Sierra San Pedro Martir and west to the coast, and possibly south to the edge of the Central Desert.

Description. *S. b. nudipes* and *S. b. rupinarum* are similar, except that *S. b. nudipes* is noticably darker, the brown tends to be rustier, and the dark mid-dorsal triangle on the anterior back is more distinct (EY, personal observations).

Recorded localities. *BAJA CALIFORNIA*: Alaska, mi W, La Rumerosa (MVZ 1); Bahía Descanso, lado norte (SDNHM 1); Carretera Norte (CSULB 1); El Alamo (FMNH 1); Ensenada, 50-100 ft. (USNM 1); Ensenada, 20 mi NE (CAS 1); Ensenada, 20 mi S, area de campismo en Punta Banda (CSULB 1); Las Encinas (FMNH 1); Mattomi [=Matomi] (FMNH 1); Ojos Negros (CSULA 1, CAS 1); Ojos Negros, 1 mi E (MSB 1); Pacific Ocean, Mexican Boundary, monument 258 (USNM 1); Parral (FMNH 7); Punta Banda (CSULB 1); San Antonio (FMNH 3); San Jose (MVZ 2); San Jose, 10 mi SE, Mina San Antonio (MVZ 2); San Quintín (FMNH 3); San Quintín, 34 mi E, Rancho Rosarito (SDNHM 2); San Ramon, Boca del río Santo Domingo (MVZ 2); San Simon (AMNH 2); San Telmo (MSB 1); San Telmo, 3 mi E (MSB 4); San Telmo, 20 mi SE (USNM 3); San Ysidro Ranch (USNM 26); Sangre de Cristo (SDNHM 1); Sierra Juarez (CAS 1); Sierra Juarez, base sureste, Los Palmitos (SDNHM 1); Sierra Juarez, Laguna Hanson (FMNH 2, MSB 2, MVZ 4, SDNHM 7, USNM 1); Sierra Juarez, Laguna Hanson, El Rayo, 4500 ft. (USNM 1); Sierra Juarez, Laguna Hanson, El Rayo, 5400 ft. (USNM 5); Sierra San Pedro Martir (AMNH 2, CAS 7, USNM 5); Sierra San Pedro Martir, W slope, 5300 ft. piñon (USNM 2); Sierra San Pedro Martir, El Cajon Canyon en la base (MVZ 6); Sierra San Pedro Martir, La Encantada (MVZ 1); Sierra San Pedro Martir, La Grulla, 7000 ft. (FMNH 3, MVZ 12, USNM 2); Sierra San Pedro Martir, Rancho San Antonio, 2000 ft. (USNM 9); Sierra San Pedro Martir, N end, San Matias Pass, 3500 ft. (USNM 1); Sierra San Pedro Martir, Rancho Santo Tomás, 6000 ft. (USNM 1); Sierra San Pedro Martir, Santa Eulalia (FMNH 6); Santa Ulalia (AMNH 1) [=Santa Eulalia?]; Sierra San Pedro Martir, Vallardes, 6 mi NW, Aguaje del Sauce (MVZ 1); Tecarte Valley (USNM 1); Tijuana, 54 km S, 46 m W de HWY #1 (NSM 1); Trinidad (FMNH 1); Vallecitos (FMNH 1); Vallecitos, 8000 ft. (MVZ 4, USNM 4); Valle de la Trinidad (SDNHM 8); Valle Nachoguero (AMNH 1, USNM 5).

S. beecheyi ssp.? (probably *S. b. nudipes*). Manantial de San Martin (FMNH 2); Rancho San Jose de Castillo, 3 mi W (CSULB 1); Rancho La Progresa (AMNH 2).

Measurements. Below are means and ranges of eight adult male and 11 adult female *S. b. nudipes* from Sierra San Pedro Martir: total length, males 411.6 (386-442), females 397 (357-435); tail length, males 177 (162-196), females 156.5 (146-186); hind foot length, males 56.1 (52-62), females 53.7 (50-57); ear from notch (dry), males.5 (17-20), females, 19 (17-20) (Howell, 1938). Cranial measurements of 6 adult males and 11 adult females were as follows: greatest length of skull, males 56.8 (54.8-59.5), females 54.6 (51.6-56.1); zygomatic breadth, males 35.2 (32.8-35.9), females 34.2 (32.3-35.2); length of nasals, males 20.4 (19-21.7), females, 19.5 (17.5-20.6); interorbital breadth, males 13.7 (11.4-14.8), females 13.3 (12.2-14.6); postorbital constriction, males 16 (15.2-18.1), females 16.1 (15.6-17.3); cranial breadth, males 23.5 (22.8-24.4), females 23 (22.2-24.7); palatilar length, males 27 (26-28), females 25.8 (23.5-27); maxillary toothrow, males 11.2 (10.6-12), females 11.1 (10.4-11.7) (Howell, 1938). In California weights ranged from 435-1009 g (means 626-677 g) for adult males and from 300-892 g (means 502-544 g) for adult females (Tomich, 1962)

Remarks. In general, *S. beecheyi* is notable for living in a wide range of habitats (Tomich, 1962). *S. b. nudipes* occurs from sea level to the higher elevations in southern California (Bond, 1977). The records for northwestern Mexico are from a wide variety of habitats in coastal chaparral, oak woodland, and coniferous forests.

Spermophilus beecheyi rupinarum (Huey)

1931. *Citellus beecheyi rupinarum* Huey, Trans. San Diego Soc. Nat. Hist.,7:17.

1959. *Spermophilus beecheyi rupinarum*, Hall and Kelson, Mammals N. Amer., 1:355.

Type locality. "Cataviña, Lower California [=Baja California], Mexico, lat. 29° 54' north, long. 114° 57' west."

Range. *S. b. rupinarum* occurs in the Central Desert south of the range of *S. b. nudipes* (Huey, 1931; Huey, 1964; Hall, 1981) where it has been known from just two localities.

Recorded localities. *BAJA CALIFORNIA*: Cataviña (SDNHM 4, ACNMH 14); San Fernando, 1400 ft. (USNM 1; Hall, 1981).

Description. *S. b. rupinarum* is lighter in color than *S. b. nudipes* and the dark mid-dorsal triangle on the anterior back is less distinct (EY, personal observations).

Measurements. Means and ranges (in mm) of four adult females of *S. b. rupinarum* were: total length, 421 (415-425); tail length, 181 (170-188); hind foot length, 55; greatest length of skull, 54.2 (53.2-55.3); zygomatic breadth, 32.9 (32.3-34.5); length of nasals, 18.9 (18.5-19.4); interorbital breadth, 12.2 (11.4-14.0); postorbital constriction, 16.1 (15.7-16.4); palatilar length, 26.1 (25-27); cranial breadth, 22.9 (22.6-23.5); maxillary toothrow, 11.2 (10.8-11.6) (Howell, 1938).

Remarks. Howell (1938:162) stated that "the ranges of the two species [*S. beecheyi* and *S. atricapillus*] are apparently separated by an area of low country about 40 miles [64 km] in width, where squirrels of this group do not occur." Howell (1938) did not explain the basis of this statement. The southernmost site for *S. beecheyi* is Cataviña (elevation 550 m), while the northernmost site for *S. atricapillus* is Mission Santa Gertrudis (about 450 m elevation) 248 km to the southeast. The two sites are separated by low mountains of 300-1500 m elevation and examination of topographic maps does not indicate a 40-mile gap of "low country." Perhaps Howell (1938) had a map that gave that impression. What does change between Cataviña and Mission Santa Gertrudis is the rock types. The lighter colored *S. beecheyi* occurs on light colored granite outcrops and the darker *S. atricapillus* in basaltic areas (Huey, 1931; EY, personal observations). Granite outcrops occur every 1-2 km along Highway 1 going south from Cataviña, except for a 16-km gap. The granite is replaced by basalt between the known ranges of the two species, and the limits of the two species should be searched for near the southern limits of the Baja California batholith.

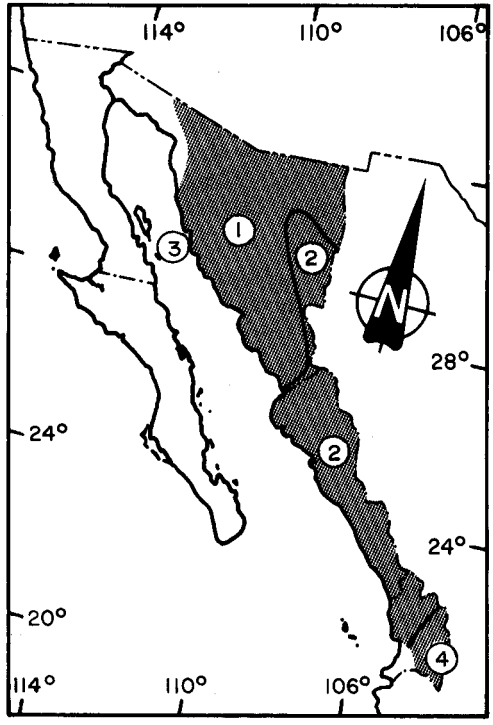
On 28-29 January 1996, EY and MVA observed *S. beecheyi* 16 km S Cataviña (by road) on granite outcrops at km post 190 and also at 70 km S Cataviña (by road) between km posts 243-244 (29° 18.7'N, 114° 16.2'W, 730 m elevation). The identification was certain, but no specimens were obtained. These observations extend the range of *S. beecheyi* 62 km (airline) southeast from Cataviña.

These sight records close the gap between the known ranges of *S. beecheyi* and *S. atricapillus* from 248 km to 184 km. This distance was earlier reported in round figures as 200 km (Alvarez-Castañeda *et al.*, 1996).

Huey (1931) described *S. b. rupinarum* from a small number (3?) of specimens from Cataviña. Howell (1938) redescribed the subspecies from four adult females, and noted that it lacked the darker area on the anterior back. However, the specimens we have seen from Cataviña (ACMNH, n=14) all have this dark, narrow triangle.

The name *rupinarum* (Latin, *rupis*, rock; Jaeger, 1966) is very appropriate for the Central Desert subspecies of *S. beecheyi*; they have a definite association with the large granite boulders in the region. Vegetation near Cataviña and at the site 70 km SE Cataviña is typical of the Central Desert: cardon cacti (*Pachycereus pringlei*), creosote bush (*Larrea divaricata*), cirio (*Idria columnaris*), *Franseria deltoides*, candelaria (*Pedilanthus macrocarpus*), ocotillo (*Fouquieria*), palo verde (*Cercidium microphyllum*), elephant tree (*Bursera*), chuparosa (*Beloperone*), and some grasses. The lighter coloration of this subspecies is probably related to the light colored granite rocks on which they live.

Spermophilus variegatus (Erxleben)



Geographic range of *Spermophilus variegatus*:
1. *S. v. grammurus* 2. *S. v. rupestris*
3. S. v. *tiburonensis* 4. *S. v. variegatus*

Range. *Spermophilus variegatus* occurs from Idaho west to Texas and south to Puebla and Oaxaca (Hall, 1981; Groves, *et al.*, 1988; MVA, unpublished data). *Spermophilus variegatus* is generally distributed in all of Sonora except the Pinacate region, all of Sinaloa, and all but southwestern Nayarit, which is inhabited instead by *S. annulatus*. It is replaced in the Baja California peninusla by *S. beecheyi* and *S. atricapillus*.

Description. *Spermophilus variegatus* is a large (total length 430 mm) ground squirrel with a long (174 mm), bushy tail. The tail and dorsum are variegated black and white or buff. The head is dark in many populations, but there is no dark, triangular marking on the neck and back separating the grayish sides of the neck and shoulders. Some populations have solid, dark chocolate brown or black markings on the head, neck and back. The tail is relatively longer in *S. variegatus* (73-82% of body length) than in *S. beecheyi* (62-77%; Blair *et al.*, 1968), but not as long as in *S. atricapillus* (62-98%, $\bar{x}$=80.9%, n=52, original data). The venter is geographically variable, but is usually lighter than the dorsum and without a sharp lateral line; it may be white, buff, or variegated black and white. The dorsum may be buffy posteriorly in some subspecies. The skull is similar to other *Otospermophilus*, and the dental formula is 1/1 0/0 2/1 3/3 = 22 (EY, personal observations).

Measurements. Standard measurements (ranges, in mm) of adult *S. variegatus* are as follows: total length, 430-540; tail length, 174-263; hind foot length, 53-65; ear length, 15-29; greatest length of skull, 56-67.7; zygomatic width, 34-42.4; length of nasals, 20.4-23.8; interorbital width, 13.2-18.8; postorbital constriction, 16.0-19.6; width of braincase, 23.6-26.6; palatar length, 26-32.5; maxillary toothrow, 10.7-14.0 (Oaks *et al.*, 1987).

Remarks. *S. beecheyi* and *S. atricapillus* have a dark, narrow triangle on the neck, shoulders and anterior dorsum that separates the light gray neck and sides, whereas *S. variegatus* does not. In *S. variegatus*, the anterior dorsum and head are nearly the same color, or the head may be slightly darker. Some individuals in certain populations of *S. variegatus* and *S. atricapillus* have black or chocolate brown markings on the dorsum, but these melanistic individuals still have the other traits of their species.

Muscular and skeletal characteristics of *Otospermophilus* are intermediate between tree squirrels and ground squirrels. Bryant (1945) concluded that in body form, dentition, and shape of skull *Otospermophilus* retained the most primitive characteristics of any subgenus except possibly *Callospermophilus* (mantled ground squirrels).

Spermophilus variegatus is primarily associated with semiarid habitats in the Upper Sonoran life zone, although they also occur in Lower Sonoran and Transition zones. They avoid open plains, deserts, and higher montane forests (Oaks *et al.*, 1987). The absence of records for the Pinacate region is curious. *S. variegatus* is a generalist that does well in rocky, arid zones, and it is a good disperser. The very arid Pinacate region may not be sufficiently productive for this large species.

Burrows are located under large rocks, trees, shrubs, or other obstructions, and there is usually a higher observation point near the burrow opening. Nest burrows are often shallow (0.3-1.0 m deep) and short (1.5-5.8 m) with a main tunnel 10-12 cm in diameter with one to three entrances. The nest burrow may be reused for many years. They also construct auxiliary burrows at some distance from the nest burrow (Oaks *et al.*, 1987). Dens were located on steeper slopes with shade (often under trees), in areas with less ground cover, and with prominent look-out points nearby (Ortega, 1987).

Population densities varied from 2.0 to 5.7 individuals/ha, or in one instance 13/ha (Oaks *et al.*, 1987). At a study site in southeastern Arizona, males had large home ranges during the breeding season in June and July (5.7 to 7.9 ha), and the home range size decreased markedly afterwards (0.7 to 1.6 ha). Female home range sizes were relatively stable (2.4 to 4.5 ha) during the entire active season. There is considerable overlap of home ranges within and between sexes (Ortega, 1990).

Given the wide distribution of *S. variegatus*, a large diversity of food items have been reported by diet studies, and diet varies seasonally and from place to place. Important items in the diet include nuts (acorns, pine nuts, walnuts), seeds, berries, fruit, roots, green vegetation, cacti, invertebrates (grasshoppers, crickets, beetles, larvae, earthworms), and some meat (smaller vertebrates). They can become an agricultural pest, and eat corn, grain, peaches, pears, apricots, plums, and other crops (Howell, 1938; references in Oaks *et al.*, 1987).

Predators of *S. variegatus* include golden eagles (*Aquila chrysaetos*), bobcats (*Lynx rufus*), ringtails (*Bassariscus astutus*), gray foxes (*Urocyon cinereoargenteus*), racoons (*Procyon lotor*), coyotes (*Canis latrans*), badgers (*Taxidea taxus*), rattlesnakes (*Crotalus viridis*), domestic dogs and cats, and humans (Oaks *et al.*, 1987).

Molt occurs once per year in mid-summer, and females molt while still lactating. There is a definite molt line (references in Oaks *et al.*, 1987), whereas ground squirrels in subgenus *Spermophilus* have diffuse molt (Hansen, 1954).

Unlike other ground squirrels, males do not emerge from hibernation ready to breed, but come into reproductive condition after emergence. Also unlike other ground squirrels, the males emerge from hibernation after the females. The mating season lasts one month in Utah at the northern

limit of the distribution, whereas in Texas it lasts about 6 weeks. The gestation period is not known, but pregnant females have been collected from March through July. They may have two litters per year in the southern part of their range, but this is not established with certainty, and most populations only have one litter. Litters average five pups (3-9). Lactation lasts about two months, and weaned pups emerge from the burrows in late May to mid-August. Growth may occur for two years (Oaks *et al.*, 1987).

Rock squirrels are colonial, with maternal groups occupying the best sites for dens, and a dominant male and several subordinate males occupying peripheral locations in the colony. The dominant male(s) defend the colony from other breeding males. Females defend the area around the maternal burrow (Oaks *et al.*, 1987).

Above ground activity occurs at temperatures between 10° and 27-30° C in Utah, but they are active at higher temperatures in Texas, and strong winds and heavy rains inhibit activity (Oaks *et al.*, 1987). There are five different vocalizations, but the most frequent are alarm calls given by adult females; most communication is through posturing. They also communicate using chemical signals from the anal, dorsal, and cheek glands. They are difficult to observe, and are often "trap shy," making behavioral and ecological studies difficult (Oaks *et al.*, 1987).

This species is considered widespread, abundant, and not currently of conservation concern. They adapt well to human presence, and live in rock walls, abandoned buildings, and around farms (EY, personal observations). In Durango, they have utilized man-made fences of lava rocks to extend their distribution long distances from rocky outcrops (Baker, 1960). *Spermophilus variegatus* is a game species (SEMARNAP, 1997) and included in the limits for squirrels.

Spermophilus variegatus is the largest species of ground squirrel, and has the one of the largest geographic ranges of the sciurids occuring in Mexico. They are called "ardillon" locally in most parts of their geographic range in Mexico. There are nine subspecies, and four of these occur in northwestern Mexico:

Spermophilus variegatus grammurus (Say)

1823. *Sciurus grammurus* Say, Long's Account of an Expedition...to the Rocky Mts...,2:72.

1952. *Spermophilus variegatus grammurus*, Hall and Kelson, Univ. Kansas Publ., Mus. Nat. Hist., 5:346.

Type locality. Purgatory River, near mouth of Chacuaco Creek, Las Animas Co., Colorado.

Range. *S. v. grammurus* occurs from Colorado and Oklahoma to California and south throughout much of Sonora.

Recorded localities. *SONORA*: Alamos, 2 mi W (MVZ 1); Alamos, 1 mi NW (MVZ 1); Alamos, 5 mi N (CSULB 1); Alamos, 8 mi SSE (CSULB 1); Alamos, 14 mi W (CSULB 1); Alamos, 8 mi SE, río Cuchujaqui (KU 1); Alamos, 8.4 mi SE (by road), río Cuchujaqui (MSB 1); Bavispe, 12 mi E (MVZ 1); Caborca, 1 mi E (MVZ 1); Caborca, 2 mi E, Cerro Cañedo (MVZ 1); Camoa (Hall, 1981); Camoa, 4 mi W, Hacienda Santa Rosa (MVZ 3); Camoa, Río Mayo (MVZ 4, USNM 1); Ciudad Obregon, 6 mi NNW (KU 2); Cumpas, 3 mi S (by road) (MSB 1); Guaymas, 5 mi NW, 25 ft. (KU 1); Hermosillo (USNM 2); Hermosillo, 1 mi SW (MVZ 2); Imuris (MCZ 1); Imuris, 9 mi N (KU 1); Imuris, 9 mi NNE (KU 3); Magdalena (USNM 1); Minas Providencia (1 UCLA; Hall, 1981); Nacori, 6 mi N, La Estancia (MVZ 1); Nacori Chico, 4.1 mi x carr. NW (MVZ 1); Nogales (USNM 3); Nogales, 2 mi S (USNM 1); Nogales, 15 mi SW (SDNHM 1); Nogales, 23 km S (MCZ 2); Nogales, 32 mi S (USNM 3); Obregon, N Río Yaqui (UW-WSM 1); Ortiz (USNM 1); Pilares, 8 mi E (USNM 1); San Carlos, 4 mi NW (MSB 1); San Javier, 2 mi E, Cerro Colorado

(MVZ 3); San Jose (USNM 1); San Jose Mountains (USNM 2); San Miguelito, 10 mi E by road in mts. (USNM 1); Santa Cruz (USNM 1); Sierra de los Patos (USNM 5); Sonoyta, 15 mi W (CSULB 1).

Description. *S. v. grammurus* is distinguished from other subspecies by its pinkish-buff head and occiput instead of the black occiput characteristic of most *S. variegatus* (Howell, 1938).

Measurements. External measurements (means, in mm) of four male and six female adults from southeastern Arizona were: total length, 477; tail length, 204; hind foot length, 58; ear (dry) length, 19.5. Cranial measurements of 12 adult females from Fort Huachuca, Arizona were: greatest length of skull, 60.5; zygomatic breadth, 37.1; length of nasals, 21.8; interorbital breadth, 14.8; postorbital constriction, 18; cranial breadth, 25.3; palatilar length, 29.2; maxillary toothrow, 11.8 (Howell, 1938).

Remarks. Pelage coloration is relatively stable over the extensive geographic range of *S. v. grammurus* (Howell, 1938).

Spermophilus variegatus rupestris (J. A. Allen)

1903. *Citellus grammurus rupestris* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 19:595.

1959. *Spermophilus variegatus rupestris*, Hall and Kelson, Mammals of N. Amer., 1:353.

Type locality. Durango, Río Sestin (= río de Oro).

Range. *S. v. rupestris* occurs from eastern Sonora southeast through Zacatecas, and including Sinaloa and northern Nayarit.

Recorded localities. *SONORA*: La Casita, 1 mi S, 0.5 mi W, 3300 ft. (KU 1); Oposura (Hall, 1981); San Miguel, 1 mi N, 0.5 mi E, Río Fuerte (KU 1). *SINALOA*: Ahome (MLZ 1); Choix, 26 mi NE, 1300 ft. (KU 1); Choix, 10 mi NE, (KU 1); Choix, 15 mi SW, (KU 1); Culiacan, 25 km W (CSULB 1); El Fuerte, 2.5 mi SW (KU 1); El Fuerte, 6 km NE, 150 msnm (KU 2); El Salado, 300 ft. (KU 1); Guamuchil (MLZ 1); Los Mochis, 10 mi NNW (KU 1); Mazatlán, 70 km NE, El Batel (MVZ 1); Pericos, 1 mi S (KU 1); Presa Hidalgo, 1 mi SE (KU 1); San Blas, 2 mi N, 50 ft. (KU 2) [Nayarit?]; San Miguel, 3 mi NE, 300 ft. (KU 1); Santa Lucia, 1 km NE, 3700 ft. (KU 1); Sierra de Choix (Hall, 1981); Sinaloa, 44 km ENE, 600 ft. (KU 1).

Description. The head of *S. v. rupestris* is dark brown, the dorsum is brownish or buffy, and the underparts are buffy (Howell, 1938).

Measurements. External measurements (in mm) of nine male and 14 female adults from the type locality were: total length, males 503 (451-540), females 499 (463-521); tail length, males 233 (210-248), females 227 (203-241); hind foot length (without claws), males 56.7 (55.5-57.0), females 56 (54-60); ear (dry) length, males 26.3 (25-28), females 26.3 (25-29). Cranial measurements (two males and five females) were: greatest length of skull, 64 (61.2-67.0); zygomatic breadth, 38.8 (37.5-40.9); length of nasals, 23.3 (22.8-23.7); interorbital breadth, 15.2 (14.6-16.0); postorbital constriction, 17.2 (15.5-18.1); cranial breadth, 25.3 (24.6-25.9); palatilar length, 30.6 (29.0-32.5); maxillary toothrow, 12.8 (11.9-13.3) (Howell, 1938).

Remarks. Judging from specimen records, *S. v. rupestris* may be more common in the Sierra Madre Occidental of Chihuahua and Durango than in northwestern Mexico.

Spermophilus variegatus tiburonensis Jones and Manning

1989. *Spermophilus variegatus tiburonensis* Jones and Manning, Occ. Pap. Mus. Texas Tech Univ., 127:1.

Type locality. 3 mi. NE Ensenada del Perro, S end Isla Tiburón, Sonora

Range. This subspecis is restricted to Tiburón Island, Sonora.

Recorded localities. *SONORA*: Isla Tiburón, NW Puerto Willards (SDNHM 2); Isla Tiburón, S end (KU 2); Isla Tiburón, 0.5 mi N, extremo S, Ensenada del Perro (MVZ 1); Isla Tiburón, Ensenada del Perro, 1 mi W, punta sur de Isla Tiburón (MVZ 1); Isla Tiburón, Ensenada del Perro, 3 mi W, punta sur de Isla Tiburón (MVZ 1); Isla Tiburón, Ensenada del Perro, 3 mi NE, parte SE de Isla Tiburón (MVZ 1).

Description. *S. v. tiburonensis* is distinguished from *S. v. grammurus*, which occurs on the adjacent Sonora mainland, by the former's smaller cranial measurements, narrower mesopterygoid fossa, smaller auditory bullae, rounder foramen magnum, less flattened cranium, and shorter maxillary toothrow, and the presence of a dark brownish hood and cape (Jones and Manning, 1989).

Measurements. Measurements (in mm) of the holotype of *S. v. tiburonensis* (an adult male) followed by measurements of an adult female were: total length, 500, 513; tail length, 222, 230; hind foot length, 61, 60; ear length, 25, 25; greatest length of skull, 60.26, 60.05; condylobasal length, 57.46, 56.60; rostral breadth, 10.16, 9.67; postorbital constriction, 16.20, 16.45; zygomatic breadth, 36.18, 36.86; mastoid breadth, 21.09, 21.76; greatest breadth across upper molars, 15.84, 16.51; breadth of mesopterygolid fossa, 4.03, 4.81; alveolar length of maxillary toothrow, 12.53, 12.28; mandibular toothrow, 12.32, 11.86 (Jones and Manning, 1989).

Remarks. Only two of Jones and Manning's (1989) eight specimens were adults. We note that in *S. brunneus* (Yensen, 1991) and other *Spermophilus* (EY, unpublished data), growth continues throughout life and subadults and juveniles are significantly smaller than adults. The smaller measurements and less flattened cranium would be expected in younger specimens. The shorter maxillary toothrow may or may not represent a real difference between mainland populations.

Dorsal color pattern is highly variable in *S. variegatus* (Oaks *et al.*, 1987). Melanism occurs in *S. v. tularosae* from dark-colored lava fields in New Mexico (Howell, 1938) and in *S. v. rupestris* associated with the La Guadiana lava field in Durango (Baker, 1960). *S. v. buckleyi* from the Edwards Plateau in Texas has a black back (Jones and Manning, 1989). Black and chocolate brown markings on the head and shoulders similar to those described for *S. v. tiburonensis* also occur in *S. v. couchi* from Galeana, Nuevo Leon (EY and MVA, personal observations and specimens in the Field Museum of Natural History) and in *S. atricapillus* from Baja California Sur (Alvarez *et al.*, 1996). It may be worthwhile to reexamine the validity of this subspecies.

Spermophilus variegatus variegatus (Erxleben)

1777. *Sciurus variegatus* Erxleben, Systema regni animalis...,1:421.

1898. *Spermophilus variegatus*, Nelson, Science, n.s., 8:898.

1938. *Spermophilus variegatus variegatus*, Howell, N. Amer. Fauna, 56:136.

Type locality. Valley of México, near México City (Nelson 1898).

Range. *S. v. variegatus* occurs from southern Nayarit south and east to Colima and Puebla

Recorded localities. *NAYARIT*: Coapan, 1.8 NW by road (USNM 2); Tepic, 3000 ft. (USNM 1; Hall, 1981); Tepic, 27 mi SW, 3950 ft. (KU 1).

S. variegatus ssp? *SONORA*: Bacerac, 15 mi E (MCZ 1); Bahía Santa Rosa, 6 mi W, Los Carrizales (MVZ 3); Calabozos, 0.5 mi N Carretera 10 (OSU 1); Cocorit, 2 mi W (MLZ 1); Moctezuma, 1 mi S (MVZ 1); Namiquipi (AMNH 1); Presa El Novillo, 7.2 mi S (CSULB 1);

Rancho San Javier, 9 mi W, Sierra Seri (MVZ 3); Saric (UCLA 3); Sonora, 15 mi E (MCZ 1); Tesia (UCLA 1); Tecoripa (UCLA 1). *NAYARIT*: Ojo de Agua (AMNH 5).

Description. *S. v. variegatus* is large with a long tail. The head is blackish, variegated with buffy. The dorsum is gray with many black hairs intermixed, whereas the venter is grayish white or cinnamon buff. The dorsum is grayer and the head darker than many other races.

Measurements. External measurements (in mm) of adult males (n=8) and females (n=7) from central Mexico were: total length, males 499 (470-520), females 479 (447-510); tail length, males 227 (197-249), females 222 (212-233); hind foot length, males 63 (59-65), females 60 (57-64); ear (dry) length, males 18.9 (18-20), females 19.2 (19.0-19.5). Cranial measurements (males, n=9; females, n=7) were: greatest length of skull, males 65.6 (64.1-67.7), females 62.1 (59.0-65.7); zygomatic breadth, males 40.5 (38.1-41.8), females, 38.7 (36.0-42.4); length of nasals, males 23.8 (22.4-24.5), females 21.8 (21.0-22.9); interorbial breadth, males 16.9 (15.5-18.1), females 15.7 (13.7-18.8); postorbital constriction, males 17.7 (16.7-18.8), females 17.9 (16.4-19.6); cranial breadth, males 26.1 (25.5-26.6), females 25.5 (24.3-26.7); palatilar length, males 31.5 (29.8-33.0), females 29.0 (28.5-32.5); maxillary toothrow, males 13.4 (12.8-14.0), females 13.1 (12.7-13.7) (Howell, 1938).

Remarks. This subspecies is abundant in many places in southcentral Mexico. It has managed to cross the transvolcanic belt to reach arid regions in Puebla and Oaxaca (MVA, personal observations).

Subgenus *Ictidomys* J. A. Allen

Spermophilus spilosoma Bennett

There are 13 subspecies of *S. spilosoma*, one of which barely enters northwestern Mexico:

Spermophilus spilosoma canescens Merriam

1890. *Spermophilus canescens* Merriam, N. Amer. Fauna, 4:38.

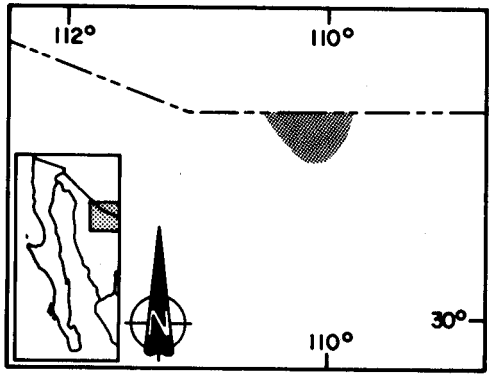
1959. *Spermophilus spilosoma canescens*, Hall and Kelson, Mammals N. Amer., 1:349.

Type locality. "Wilcox, Cochise Co., Arizona."

Range. *S. spilosoma* occurs in the western Great Plains from South Dakota to Texas, and west to Arizona, south to Tamaulipas, and throughout most of the Mexican altiplano. *S. s. canescens* occurs in Arizona, New Mexico, and Chihuahua. In northwestern Mexico, it is known from only four localities in northeastern Sonora, all within 15 km of the International Border.

Recorded localities. *SONORA*: La Noria (Hall, 1981); Naco, 5 mi S, 3 E (CSULB 1); Janos (USNM 1); Santa Cruz River (USNM 1).

Description. *Spermophilus spilosoma* is a small ground squirrel (total length 250 mm). The dorsal color varies geographically, and can be gray, brown, cinnamon or fawn, with more or less square, light-colored dorsal spots from the shoulders to the rump (Hall, 1981; Hoffmeister, 1986). The ear is small, and does not extend above the dorsal surface of the skull, but there is a free pinna. The underparts and feet are white. Dorsally, the tail has the same color as the back, but it is rusty or cinnamon below, and with a black subterminal and a white terminal band laterally and at the tip. In *S. s. canescens*, the dorsal spots are especially conspicuous in the reddish-brown winter



Geographic range of *Spermophilus spilosoma canescens.*

pelage, but less conspicuous in the more orangish summer pelage (Hoffmeister, 1986), and the auditory bullae are large (Anderson, 1972).

Measurements. The mean ± standard deviation and ranges (in mm) of 14 male and 12 female adults of *S. s. canescens* from Willcox, Cochise Co., Arizona were: total length, 225.7 ± 9.8 (203-247); tail length, 69.9 ± 8.6 (54-86); hind foot length, 32.3 ± 1.4 (29-35); greatest length of skull, 38.17 ± 0.64 (36.95-39.6); zygomatic breadth, 23.06 ± 0.47 (22.15-23.90); length of nasals, 12.74 ± 0.55 (11.35-13.70); interorbital breadth, 8.08 ± 0.36 (7.45-8.65); postorbital constriction, 13.46 ± 0.30 (12.7-13.9); cranial breadth, 18.38 ± 0.33 (17.8-19.4); palatilar length, 16.94 ± 0.43 (16.3-17.8); maxillary toothrow, 7.56 ± 0.27 (7.0-8.05); length of auditory bulla, 9.96 ± 0.34 (9.2-1.06). There was no significant sexual dimorphism in this small sample, although males were slightly larger (Hoffmeister, 1986).

Remarks. The small size, spotted rather than variegated dorsal pattern, relatively short tail, and small ears separate this species immediately from the three species of *Otospermophilus*. The dorsal spots separate it from *S. tereticaudus*, which has a uniform colored dorsum. *S. tereticaudus* also has the pinna of the ear reduced to a roll of skin, but the tail is longer, thinner, and unicolored. The tail of *S. spilosoma* is flatter and has a black subterminal band and a white tip. *Ammospermophilus* spp. have a white lateral stripe. *Spermophilus mexicanus* and *S. tridecemlineatus*, which occur further east, have spots in linear series or white stripes, respectively.

Spermophilus spilosoma is most similar to *S. perotensis* of Puebla and Vera Cruz, based on morphology (Howell, 1938), bacula and pelage (Bryant, 1945), karyotype similarities (Nadler, 1962; Nadler and Hughes, 1966; Uribe-Alcocer *et al.*, 1979), and biochemical evidence (Cothran *et al.*, 1977). These analyses also indicated that *S. spilosoma* is more distantly related to *S. mexicanus* and *S. tridecemlineatus*.

Spermophilus spilosoma occurs in a variety of habitats from barren, sandy deserts dominated by creosotebush (*Larrea divaricata*) in the Lower Sonoran life zone to grassy mountain meadows up to 8500 feet [2600 m] elevation in the Transition life zone. In southeastern Arizona, *S. s. canescens* is usually associated with arid mesquite and acacia desert communities, and most of the records are below 5000 feet [1500 m] elevation (Cockrum, 1960; Hoffmeister, 1986).

In Wyoming, they are associated with sandy to sandy-loam soils with a high percentage of bare ground. Perhaps for this reason, they seem to do well in moderately grazed areas with native vegetation, and in areas that have been overgrazed (Streubel and Fitzgerald, 1978).

In several studies, population densities ranged from two to seven individuals/ha. Home ranges varied from 0.5 to 4.86 ha, depending upon sex and season, but the average home range seems to be between 1-1.5 ha (review in Streubel and Fitzgerald, 1978).

In the United States, *S. spilosoma* eats mostly green vegetation (*Salsola pestifer*, *Tribulus terrestris*, *Oryzopsis hymenoides*, *Curcurbita foetissima*, *Thelesperma megapotamicum*, and *Erigonum* sp.) and seeds (*Solanum rostratum*, *Mentzelia nudastricta*, *Croton texensis*, *Prosopis*

juliflora, *Atriplex*, *Helianthus*, *Iris*, and wild gourds--Cucurbitaceae). In late summer, grasshoppers and other insects are eaten. They are also known to prey upon kangaroo rats (*Dipodomys ordii*) and lizards (*Holbrookia maculata* and *Cnemidophorus sexlineatus*) (Struebel and Fitzgerald, 1978; Hoffmeister, 1986).

Predators of *S. spilosoma* include gopher snakes (*Pituophis melanoleuca*) and red-tailed hawks (*Buteo jamaicensis*). Known parasites include roundworms (*Physaloptera* sp., *Rictularia* sp., *Sabulaura* sp.), fleas (*Thrassis pansus*, *T. fotus*, *Echidnophaga gallinaceae*) and a tick (*Dermacentor parumapertus*) (Streubel and Fitzgerald, 1978).

There are two molts per year, but the fall molt is not conspicuous in adults (Streubel and Fitzgerald, 1978). However, Hoffmeister (1986) felt that there was lack of evidence for two molts in Arizona specimens.

Hibernation occurs in the United States (Smith, 1973; Struebel and Fitzgerald, 1978; Hoffmeister, 1986), but it is not clear if they hibernate in southern portions of the range. In Arizona, Hoffmeister (1986) thought that they probably hibernated in all parts of the state, but was not certain about the southern populations. In Chihuahua, they have been collected in all months except February, but Anderson (1972) thought that they probably hibernate above 6000 feet [1900 m] elevation.

In Colorado, yearlings emerge first from hibernation, followed by males in early April, and the females follow 2-4 weeks later. Males enter hibernation in late July to mid-August, but some young were active until October (Struebel and Fitzgerald, 1978).

S. spilosoma has a low rate of pulmonary and cutaneous water loss, a high level of conductance without regard to body weight, and they can decrease conductance and increase insulation at high temperatures. The basal metabolic rate is about 60% of the rate expected from its body weight. Consequently, Hudson and Deavers (1973) classified *S. spilosoma* as a high desert species.

Males had scrotal testes from April-July in Colorado, and from mid-April to early August in New Mexico. Females in New Mexico had open vulvas from late April until mid-May, and pregnant females were observed from mid-May to late July (Streubel and Fitzgerald, 1978). Hoffmeister (1986) and others (references in Streubel and Fitzgerald, 1978) have thought that there are two litters per year, whereas Struebel and Fitzgerald (1978) suggested that this is due to observations of litters conceived late in the breeding season, and that there is only one litter per year. Litter sizes range from 4-12, with most between 5-8. Juveniles weighed 40-50 g when they emerged from the nest burrows (Streubel and Fitzgerald, 1978).

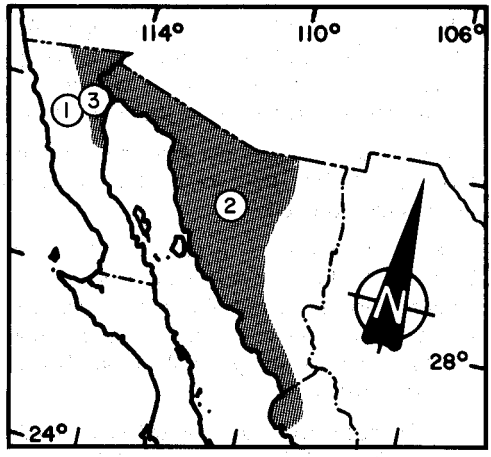
The movement patterns of *S. spilosoma* have been compared to those of lizards. "The body is more or less flattened, the tail kept close to the ground, and they make sudden stops" (A. K. Fisher, in Hoffmeister, 1986:180).

Spermophilus spilosoma is widespread and abundant many places in Mexico, and is sold as a pet in some areas, particularly in the state of San Luis Potosí (MVA, personal observations). It is a game species (SEMARNAP, 1997). Whether it should be of conservation concern or a game species in Sonora is unknown. The distribution in Sonora is poorly documented and more information on its current status in the state is needed.

Subgenus *Xerospermophilus* Merriam

Spermophilus tereticaudus Baird

Range. *Spermophilus tereticaudus* occurs from southern Nevada to southern Sonora and northern Baja California in the Mojave and Sonoran Deserts.



Geographic range of *Spermophilus tereticaudus*:
1. *S. t. apricus* 2. *S. t. neglectus*
3. *S. t. tereticaudus*

Description. The dorsal pelage is more or less uniformly buff, drab, cinnamon, or gray, and darker in the winter than the summer. There are no spots, flecks, or variegations. The underparts are white, and there is a sharp demarcation (=lateral line) between the dorsal and ventral colors. The ear pinnae are reduced to a rim surrounding the external ear. The postorbital process is short and broad. The dental formula is 1/1 0/0 2/1 3/3 = 22 (Howell, 1938; Ernest and Mares, 1987).

Measurements. External measurements (in mm) of adult *S. tereticaudus* were: total length, 204-266; tail length, 60-107; hind foot length, 30-40; greatest length of skull, 34.7-39.8; zygomatic breadth, 21.3-25.4; length of nasals, 10.0-13.7; interorbital breadth, 6.9-10.3; postorbital constriction, 11.3-13.6; breadth of cranium, 16.8-18.8; palatilar length, 15.6-18.6; maxillary toothrow, 6.7-8.5 (Howell, 1938; Hoffmeister, 1986). Ear (notch to tip, 3 fresh specimens ACMNH), 8-9 mm; weight varies from 110-170 g, and averages 125 g (Ernest and Mares, 1987).

Remarks. The uniform dorsal coloration and short, broad postorbital process distinguishes the subgenus *Xerospermophilus*. Other ground squirrels (except *Cynomys*) have spots, stripes, variegations, or other patterns of non-uniform dorsal coloration. Confusion with *Cynomys* is not likely, given the large size and black-tipped tail of the latter, and the white underparts of *S. tereticaudus*. *S. tereticaudus* differs from *S. spilosoma* by its uniform rather than spotted dorsal coloration and round tail.

Spermophilus tereticaudus occurs in flatter areas with sandy soils in the Lower Sonoran life zone. Coarse, hard-packed sand and gravel seems to be preferred. They are associated with desert vegetation such as creosotebush (*Larrea tridentata*), mesquite (*Prosopis juliflora*), palo verde (*Cercidium* spp.), saltbushes (*Atriplex* spp.), and grasses (*Bouteloua aristoides*, and others). (review in Ernest and Mares, 1987).

Population density was 5.3 individuals/ha in southcentral Arizona (Drabek, 1970). In a dense population in Tucson studied by Dunford (1977), January densities were 40/ha. This increased to 210/ha in early May after recruitment of young into the population, then declined through emigration and mortality to 136/ha in late July. The sex ratio at birth was 0.8:1 (females:male), but was 1.1 and 1.2:1 at the time of emergence from the natal burrow, and was 2.7:1 among adults (Dunford, 1977). Home range size was 0.30 ha for adults, and males and female home ranges were not significantly different (Drabek, 1970).

S. tereticaudus eats primarily green vegetation and seeds. In spring, the diet was 80% green vegetation,15% seeds, and 5% insects, but this changed to 100% green vegetation in the summer. By fall the diet was 75% green vegetation and 25% seeds, and in winter 65% green vegetation and 35% seeds. Important items in the diet included grasses, annuals, leaf buds; *Prosopis juliflora* leaves, flowers, bark, and seeds; *Larrea tridentata* fruits; ants, termites, grasshoppers; carrion, including lizards and ground squirrels. Predation on house sparrows (*Passer domesticus*) has been recorded (review in Ernest and Mares, 1987). They are known to feed on crops, including alfalfa, dates, grain fields, and to dig holes in ditches. Consequently they have been persecuted as agricultural pests (Grinnell and Dixon, 1918).

Burrows are often dug at the base of shrubs, but they may also be dug in the open. The soil brought from below is scattered, so no mound is evident at the burrow entrance. Burrows are 25-50 cm deep, but may go down to 1 m. There are 2-4 entrances, and the burrow is usually plugged about 45 cm inside the entrances. They may also modify kangaroo rat burrows (Drabek, 1970).

Known predators of *S. tereticaudus* include coyotes (*Canis latrans*), badgers (*Taxidea taxus*), ravens (*Corvus* sp.), hawks, prairie falcons (*Falco mexicanus*), gopher snakes (*Pituophis melanoleucus*), whipsnakes (*Masticophis flagellum*), Mojave rattlesnakes (*Crotalus scutulatus*), and Gila monsters (*Heloderma suspectum*) (Ernest and Mares, 1987).

There are two molts per year, one in spring and the other in fall (Howell, 1938; Hoffmeister, 1986; Ernest and Mares, 1987). Males accumulate fat earlier in the spring than females, presumably because of the females' metabolic demands of reproduction.

Because *S. tereticaudus* inhabits rather extreme deserts, its physiology has received considerable study. They meet their water requirements by eating succulent foods. They drink free water when it is available, but apparently can live without it. Like some other species of hot desert rodents, oxygen consumption is about 60% of that predicted based upon their body weight. The thyroid gland is inactive in the summer and blood plasma corticosterone levels are low; both of these are associated with the lower metabolic rate and toleration of higher temperatures. Normal body temperature is 36° C, but can increase to 41.4° C in response to ambient temperatures of up to 46° C, which can be tolerated for up to two hours (Ernest and Mares, 1987).

The species undergoes torpor in response to cold, and hibernates in the fall. They are not seen above ground in October, November, or December, although the inactive period may extend from late August until early January in some areas (Hoffmeister, 1986).

Testes begin to enlarge in January, but the onset is 9 days earlier for each 1.27 cm of rainfall in December and January. Males emerge up to four weeks before the females. The mating season is in late February and early March, and females are pregnant from mid-March to late April (Reynolds and Turkowski, 1972; Ernest and Mares, 1987). Gestation is estimated at 25-27 days and lactation continues through June. There are 1-12 young per litter ($\bar{x}$=6.5, n=222), and 75-80% of the variation in litter size is determined by the amount of rainfall in the preceding winter. Litter size increases by one pup for each 2.5 cm of rainfall (Reynolds and Turkowski, 1972). There may be a second litter in July during the summer rainy season (Neal, 1965), but there is no firm evidence for this (Ernest and Mares, 1987). Young are weaned at five weeks, and become sexually mature at 10-11 months of age (Ernest and Mares, 1987).

S. tereticaudus climb into shrubs or small trees, and have been seen harvesting seeds up to 5 m above ground in mesquite trees (Huey, 1927). They are agile on branches strong enough to support

their weight (EY, personal observations). However, "when alarmed in the branches, the squirrels would quickly scramble to the ground and hurry to their burrows for safety" (Huey, 1927:86).

S. tereticaudus is semicolonial, but each squirrel has a separate burrow system most of the year (Drabek, 1970). Males are non-territorial, and dominant over females from January to March. However, females are dominant in April and May while they have litters. Dominance is correlated with weight in males and age in females. Relatives interacted more frequently than non-related animals, and kissed more and fought less than non-relatives during the breeding season (Dunford, 1977).

Spermophilus tereticaudus is not generally of conservation concern. One subspecies in southern California, *S. t. chlorus*, is of concern because of habitat loss (Hafner *et al.*, in press). There are four subspecies, three of which occur in northwestern Mexico:

Spermophilus tereticaudus apricus (Huey)

1927. *Citellus tereticaudus apricus* Huey, Trans. San Diego Soc. Nat. Hist., 5:85.

1959. *Spermophilus tereticaudus apricus*, Hall and Kelson, Mammals N. Amer., 1:358.

Type locality. "Valle de la Trinidad, Lower California [Baja California], Mexico, lat. 31° 20' north, long. 115° 40' west."

Range. *Spermophilus tereticaudus apricus* is known only from Valle de la Trinidad in northern Baja California.

Recorded localities. *BAJA CALIFORNIA*: Valle de la Trinidad (lat. 31° 20'N; long. 115° 40W)(SDNHM 67, MSB 6, UCLA 1; Hall, 1981); Valle de la Trinidad, W end (MSB 3); Valle de la Trinidad, 5 mi S, 10 mi E (MSB 5); Valle de la Trinidad, 6 km S, 17 E (MVZ 2); Valle de la Trinidad, 6 mi S, 10 mi E (MSB 1); Valle de la Trinidad, 8 mi S, 9 mi E (MSB 1); Valle de la Trinidad, 10 mi S, 10 mi E (MSB 4); Valle de la Trinidad, Aguajito Spring (SDNHM 1); Trinidad Valley, NW base Sierra San Pedro Martir (USNM 2).

Description. *S. t. apricus* is distinguished from other *S. tereticaudus* by being darker on the face and less grizzled dorsally. The young are darker and more brownish. The skull has a longer maxillary toothrow, more inflated auditory bullae, a wider and deeper interpterygoid notch, and a deeper and wider braincase (Huey, 1927).

Measurements. External measurements (in mm) of seven adults and three subadults from Valle de Trinidad were: total length, 244.4 (240-260); tail length, 90.3 (83-98); hind foot length, 37.0 (35-39); weight (g), 133.5 (101-191). Cranial measurements of seven males and ten females were: greatest length of skull, 37.5 (36.3-38.5); zygomatic breadth, 22.9 (21.8-23.9); length of nasals, 12.6 (11.9-13.2); interorbital breadth, 8.7 (8.0-9.3); postorbital constriction, 13.0 (11.7-13.6); cranial breadth, 17.9 (17.3-18.5); palatal length, 17.2 (17.0-18.0); maxillary toothrow, 7.8 (7.2-8.2) (Huey, 1927; Howell, 1938).

Remarks. *S. t. apricus* is supposedly isolated (Huey, 1927; Hall, 1981; Ernest and Mares, 1987) and occurs only in the Valle de la Trinidad, a valley 29 km long and 6 km wide on the Pacific slope between the Sierra Juárez and Sierra San Pedro Martir (Huey, 1927). However, D. J. Hafner (in Hafner *et al.*, in press) has observed that they are actually continuous with populations of *S. t. tereticaudus* in the San Felipe desert to the east.

S. t. apricus might be of potential conservation concern because of its restricted distribution. However, information is needed on the distribution of *S. t. apricus*, its current population status, and also on its taxonomic validity.

Spermophilus tereticaudus neglectus Merriam

1889. *Spermophilus neglectus* Merriam, N. Amer. Fauna, 2:17.

1959. *Spermophilus tereticaudus neglectus*, Hall and Kelson, Mammals N. Amer., 1:359.

Type locality. Dolan's Spring [12 mi NW Chloride, Mohave Co.], Arizona.

Range. *S. t. neglectus* occurs east of the Colorado River in the Sonoran desert of Arizona and Sonora.

Recorded localities. *SONORA*: Bahía San Carlos, 1.5 mi N (CSPUP 1); Bahía Kino (SDNHM 1); Bamori, 4 mi N (KU 1); Batamotal (USNM 6); Caborca, 4 mi NW (MVZ 1); Caborca, 1 mi E (MVZ 1); Caborca, 17 mi S (CSULB 1); Caborca, 40 mi NW, Estación Las Enchilayas (FMNH 2); Camoa, Río Mayo (USNM 2); Costa Rica Ranch (USNM 1); Cerro Blanco (FMNH 2); Cienega Well, 30 mi S Mexican Boundary Monument 204 (USNM 1); Colorado River, Mexican Boundary monument 204 (USNM 11); Cruz Piedra (MVZ 2); El Carrizo, 8 mi NW, 40 ft. (KU 1); El Doctor (UCLA 7); Guaymas, 2 mi W, 25 ft. (KU 1); Guaymas, 4 mi SW (KU 1); Guaymas, 4 mi N (UW-WSM 1); Guaymas, 9 mi NW (CSULB 3); Guaymas, 22 mi N (MVZ 1); Guaymas, 0.25 mi from Gulf of California Coast (MSB 2); Hermosillo (USNM 15); Hermosillo, 1 mi S (UCLA 1); Hermosillo, 3 mi S, 800 ft. (KU 8); Hermosillo, 13.4 mi N (CSULB 1); Hermosillo, 19 mi W (MVZ 1); Hermosillo, 21.4 mi W (MVZ 1); Hermosillo, 22 mi S (MVZ 1); Hermosillo, 35 mi W (MVZ 1); Hermosillo, 14 mi WSW; Isla Tiburón (USNM 12); Isla Tiburón, Bahía Santa Rosa, lado este de la isla (MVZ 1); Kino, 1 km E, 20 ft. (KU 1); Kino, 8 mi E, 20 ft. (KU 3); Kino, 21 km E, 25 ft. (KU 3); La Poza, 4 mi W (MVZ 1); Los Alesnas, 1.6 mi SW (MVZ 3); Magdalena, 43.5 mi W (MVZ 1); Mexican Boundary monument 200 (USNM 1); Minas Providencia (FMNH 4); Obregon (UCLA 1); Ortiz (USNM 46); Pozo, 0.7 mi SW (MVZ 6); Pozo Escalante, 7 mi ENE (KU 5); Pozo Escalante, 15 mi ENE (KU 7); Precidio (UCM 2); Puerto Libertad (SDNHM 1); Puerto Libertad, 5 mi N, 19 mi E (KU 1); Puerto Peñasco, 3.9 mi NE (MSB 8); Puerto Peñasco, 27 mi NW (MSB 1); Puerto Rancho (UCLA 1); Punto Chueco, 14.8 mi N (USNM 1); Punta Peñasca, 1 mi NNE (MVZ 2); Punta Peñasco, 2 mi N (CSUN 2); Punta Peñascosa (SDNHM 25); Rancho Carrizos (UCLA 2); Rancho San Javier, 4 mi W, base este Sierra Seri (MVZ 1); Rancho de Costa Rica, Río Sonora (MVZ 2); Querobabi, 5 mi W (KU 2); San Carlos, 5 mi NW (MSB 1); San Carlos, 7 mi SW (MSB 1); San José de Guaymas, 0.5 mi NW, 25 ft. (KU 5); San José de Guaymas, 0.5 mi N, 50 ft. (KU 2); San Luis, 11.9 mi E, Hwy 2, por campo Bahía San Carlos (CSULB 1); Santa Ana, 2 mi SW (KU 1); Sonoyta, 1 mi NE (MVZ 6); Sonoyta, 15 mi W (CSULB 2); Yaqui, 9 mi SSW (MVZ 2).

Description. *S. t. neglectus* has a shorter hind foot and tail than *S. t. tereticaudus*. The skull is larger and the rostrum and interorbital region is narrower in *S. t. neglectus* than in *S. t. tereticaudus* (Howell, 1938).

Measurements. Means ± standard deviations (in mm) of 13 male *S. t. neglectus* from near Hermosillo, Sonora were: total length, 247.0 ± 7.8 (235-260); tail length length, 80.3 ± 5.4 (72-92); hind foot length, 35.8 ± 2.4 (30-39); greatest length of skull, 38.23 ± 0.95 (36.8-39.8); zygomatic breadth, 23.96 ± 0.76 (22.8-25.3); length of nasals, 11.97 ± 0.48 (11.3-12.8); interorbital breadth, 8.51 ± 0.67 (7.7-10.3); postorbital constriction, 12.18 ± 0.46 (11.6-13.1); cranial breadth, 17.78 ± 0.43 (17.2-18.5); palatilar length, 17.29 ± 0.55 (16.4-18.0); maxillary toothrow, 7.99 ± 0.28 (7.6-8.5); bulla length, 10.02 ± 0.40 (9.4-10.7) (Hoffmeister, 1986).

Remarks. Hoffmeister (1986) found sexual dimorphism in *S. t. neglectus* for some characteristics in Arizona, and recommended separate morphometric analyses for the sexes. Light and dark color phases (often drab and cinnamon) occur for both summer and winter pelage in some populations

(Hoffmeister, 1986, Ernest and Mares, 1987). *S. t. neglectus* is larger and darker than *S. t. tereticaudus*, and the two are separated by the Colorado River. There is clinal variation in some characters of *S. t. neglectus*, with larger animals in the south (Hoffmeister, 1986).

Spermophilus tereticaudus tereticaudus Baird

1858. *Spermophilus tereticaudus* Baird, Mammals, Repts. explorations...railroad to the Pacific Ocean, 8:315.
1959. *Spermophilus tereticaudus tereticaudus*, Hall and Kelson, Mammals N. Amer., 1:359.

Type locality. Old Fort Yuma, Imperial Co., California, opposite Yuma, Arizona.

Range. *Spermophilus t. tereticaudus* occurs in the Mojave desert from southern Nevada to the San Felipe Desert in northern Baja California.

Recorded localities. *BAJA CALIFORNIA*: Gardner's Laguna, Salton River (USNM 1); Laguna Salada, lado oeste, Cañon Las Palmas (MVZ 2); Mexicali, 11 mi E, Canal Imperial (MVZ 5); Paso San Matias (CSULB 1); Paso San Matias, cima (SDNHM 1); Pilot Knob, 10 mi W (MVZ 8); Pilot Knob, 20 mi SW, Río Alamo (MVZ 2); San Felipe (CSULB 1, FMNH, MVZ 16, SDNHM 27); San Felipe Bay (USNM 12); San Felipe, 11 mi N, 4 mi W (MSB 14) Los Amigos Camp (MSB 1); San Felipe, 20 mi N (SDNHM 1); Seven Wells (AMNH 1).

Description. *S. t. tereticaudus* is smaller and lighter colored than *S. t. neglectus* (Hoffmeister, 1986).

Measurements. External measurements (in mm) of 11 adult *S. t. tereticaudus* from near the type locality (Howell, 1938) were: total length, 249.5 (235-266); tail length, 91.1 (81-102); hind foot length, 36.2 (33-38). Cranial measurements of 16 adults were: greatest length of skull, 36.5 (34.9-38.3); zygomatic breadth, 23 (21.8-24.0); length of nasals, 11.7 (10.3-12.8); interorbital breadth, 8.9 (8.2-10.3); postorbital constriction, 12.4 (11.7-13.1); breadth of cranium, 17.5 (16.8-18.5); palatilar length, 16.9 (16.0-18.3); maxillary toothrow, 7.2 (6.7-7.8).

Remarks. *S. t. tereticaudus* and *S. t. neglectus* are separated by the Colorado River (Hoffmeister, 1986).

Tamias Illiger

1811. *Tamias* Illiger, Prodromus systematis mammalium et avium..., p.83.

Type species. *Sciurus striatus* Linnaeus, 1758 [=*Tamias striatus* (Linnaeus, 1758)].

Description. *Tamias* are distinguished by a very light skull; short, weak postorbital process; P3 absent; infraobital foramen large, but lacking a canal; keel on ventral surface of baculum, tip curved upward; less than tail 38% total length; body with five longitudinal dark and four light dorsal stripes; stripes on the face (Hall, 1981).

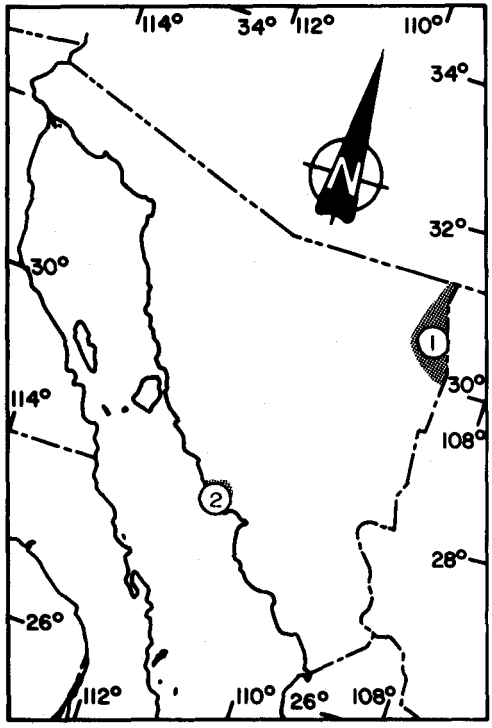
Remarks. The chipmunks are small sciurids, easily recognized by the pattern of alternating dark and light dorsal stripes, stripes on the face, and a long, thin tail. *Ammospermophilus* spp. and *Spermophilus madrensis* have one lateral light stripe (which may or may not be bordered by dark stripes) on each side of the body, but lack stripes on the face. They are also much more robust than *Tamias*.

Howell (1938) divided the chipmunks into two genera, with the eastern chipmunk (*Tamias striatus*) in the genus *Tamias*, and the remaining species in the genus *Eutamias*. *Eutamias* was divided into two subgenera, with subgenus *Eutamias* for the only Eurasian species, *E. sibiricus*, and subgenus *Neotamias* for the remainder. This arrangement was followed for many years (eg.

Hall, 1981). More recently all of the chipmunks have been recognized as members of a single genus *Tamias*, with three subgenera: subgenus *Tamias* for *T. striatus*, subgenus *Eutamias* for *T. sibiricus*, and *Neotamias* for the western chipmunks including the Mexican species (Nadler *et al.*, 1977; Nadler *et al.*, 1985; Levenson *et al.*, 1985; Hoffmann *et al.*, 1993).

These semiarboreal squirrels are familiar residents of wooded canyons, woodlands, and forests, usually in montane habitats. However, populations of *T. dorsalis* and *T. obscurus* occur in hot cactus desert on the Sonora coast and in central Baja California, respectively (Loomis and Stephens, 1965; Callahan and Davis, 1976). There are 25 species of *Tamias* (Hoffmann *et al.*, 1993), and three are known to occur in northwestern Mexico. All species are generally called "chichimocos" in Mexico.

Tamias dorsalis Baird



Geographic range of *Tamias dorsalis*:
1. *T. d. dorsalis* 2. *T. d. sonoriensis*

Range. *T. dorsalis* occurs from extreme southern Idaho and Wyoming south to Durango.

Description. *T. dorsalis* has above average body size and tail length; a dark brown mid-dorsal body stripe, with the other body stripes gray and indistinct; three brown and two white facial stripes; the dorsum washed with gray; the postpalatal region of skull long; the auditory bullae large; and a wide braincase (Hoffmeister, 1986).

Measurements. Extreme measurements of *T. dorsalis* (in mm) were: total length, 200-256; tail length, 72-128; hind foot length, 28-37; ear length, 15-25; greatest length of skull, 33.7-38.9; zygomatic breadth, 18.7-21.1; length of nasals, 10.0-12.8; interorbital breadth, 7.3-9.8; cranial breadth, 15.0-18.4; palatal length, 13.6-15.9; maxillary toothrow, 5.1-6.2; length of baculum shaft, 3.1-3.7; and length of os clitoris, 1.4-1.9 (various subspecies and sample sizes, Howell, 1929; Hoffmeister, 1986; Callahan and Davis, 1977).

Remarks. *Tamias dorsalis* has a distinct dark, mid-dorsal stripe, with a neutral-gray back and indistinct lateral stripes. No other species has the lateral stripes as indistinct. *Tamias obscurus* and *T. merriami* in the Baja California peninsula have less distinct lateral stripes than most other species, but their stripes are better defined than those of *T. dorsalis*.

Tamias d. dorsalis, *T. d. grinnelli*, and *T. d. utahensis* all have Nadler's Karyotype B, but since there are only two karyotypes in *Tamias* (A and B, both with 2n = 38), karyotypes have not been

very helpful in resolving phyletic relationships (Sutton and Nadler, 1969). Cluster analysis using cranial measurements showed that *T. dorsalis* is most closely related to *T. durangae*, *T. obscurus*, *T. cinereicollis*, and *T. canipes* (Levenson *et al.*, 1985). A cladistic analysis based upon allozyme data indicated that *T. dorsalis* is closest to *T. quadrivittatus* and *T. panamintinus* (Levenson *et al.*, 1985). An implication of this is that the faded lateral stripes in *T. merriami* and *T. obscurus* are due to convergence. Fossil *Tamias dorsalis* are known from Utah, Nevada, and Arizona. All are late Pleistocene and Recent. At the Nevada site they comprised 6.5% of the vertebrate sample (Hart, 1992).

They feed on flowers, fruits, and seeds of trees, shrubs, grasses (Hoffmeister, 1986). Seeds are carried in cheek pouches (Hart, 1992). *T. dorsalis* can climb steep rock walls and even saguaro cacti (Hart, 1992; Callahan and Davis, 1976). Like most sciurids, they are diurnal with a bimodal activity pattern. They defend territories in the vicinity of a den, and chase away conspecifics. Other encounters may consist of mutual smelling and/or chases. However, at least in northern Utah, groups of up to 10 females may feed together separated by distances of 3-10 m (Hart, 1992). Dens are located in rock piles, cliffs, crevices, underground burrows, or occasionally in tree holes (Hart, 1992).

Common chipmunk vocalizations include the high intensity "chip," "chuck," and "chipper;" and the low intensity "chatter," "growl," and "squeal;" and vocalizations termed "trill" and "whistle" (Dunford and Davis, 1975). However, *T. dorsalis* does not use a trill or whistle, and the chip has a characteristic terminal pulse which is unique to it and *T. panamintinus* (Dunford and Davis, 1975).

Tamias dorsalis has no official conservation status in Mexico and is not included on conservation lists (e.g., NOM-059-ECOL-1994). However, with the development in the San Carlos area in recent years (EY, personal observations), *T. d. sonoriensis* may be losing habitat. The ranges of both subspecies of *T. dorsalis* in Sonora need further documentation. This is especially important for *T. d. sonoriensis* in the Guaymas area.

There are six subspecies of *Tamias dorsalis,* two of which occur in northwestern Mexico:

Tamias dorsalis dorsalis Baird

1855. *Tamias dorsalis* Baird, Proc. Acad. Nat. Sci. Philadelphia, 7:332.

1992. *Tamias dorsalis dorsalis*, Hart, Mamm. Species, 399:1.

Type locality. Fort Webster, copper mines of the Mimbres, near present site of Santa Rita, Grant Co., New Mexico.

Range. *T. d. dorsalis* occurs south of the Grand Canyon in northern Arizona to northern Durango. Although it is known from the Sierra Madre Occidental of Chihuahua (Anderson, 1972), there is only a single Sonora locality.

Recorded localities. *SONORA*: El Tigre, above Santa María Mine (Hall, 1981).

Description. *Tamias d. dorsalis* is larger than *T. d. sonoriensis*, with a relatively shorter tail, and larger, wider skull (Callahan and Davis, 1977).

Measurements. Specimens of *T. d. dorsalis* from Arizona measured as follows (means ± standard errors, range, in mm): head and body length, 129.9 ± 1.70 (105-159, n=39); tail length, 94.2 ± 1.35 (72-110, n=39); hind foot length, 32.3 ± 0.29 (28-37, n=43); greatest length of skull, 36.39 ± 0.11 (35.1-37.9, n=41); length of nasals, 11.28 ± 0.07 (10.1-12.4, n=44); least interorbital breadth, 8.74 ± 0.06 (7.7-9.7, n=45); cranial breadth, 17.54 ± 0.04 (17.0-18.4, n=47); maxillary toothrow, 5.80

±0.03 (5.2-6.2, n=46); length of baculum shaft, 3.45 ±0.07 (3.1-3.7, n=9); and length of os clitoris, 1.65 ±0.04 (1.4-1.9, n=13) (Callahan and Davis, 1977). See Lidicker (1960) for additional measurements of *T. d. dorsalis* for the Sierra Madre Occidental, Anderson (1972) for Chihuahua, and Hoffmeister (1986) for Arizona.

There is sexual dimorphism in *T. dorsalis*, with females being larger (Hart, 1992). Levenson (1990) found that body size dimorphism was not consistent in all populations. Callahan and Davis (1977) found female *T. d. dorsalis* from Arizona had significantly longer ear, length of braincase, and zygomatic breadth than males, but were not significantly larger for other measurements.

Remarks. *Tamias d. dorsalis* in Arizona is active all year but may be inactive during cold weather; it apparently does not hibernate (Hoffmeister, 1986; Hart, 1992). They breed in May or June, have young in late June or early July, and wean the young in August. However, a pregnant female collected on 8 August 1916 suggests that there may be two litters per year in Arizona (Hoffmeister, 1986; Hart, 1992).

There are no ecological data on *T. d. dorsalis* in Sonora. In Arizona, they are found in a variety of habitats from chaparral, juniper, scrub oak and manzanita, to pines and firs, as long as there are large rocks or cliffs. The elevational range is 975-2900 m. They are often associated with rock squirrels (*Spermophilus variegatus*), but they are more adept on rock faces and cliffs than the heavier-bodied rock squirrels (Hoffmeister, 1986). They can climb trees for food and have been seen as high as 9 m above ground.

Tamias dorsalis sonoriensis (Callahan and Davis)

1977. *Eutamias dorsalis sonoriensis* Callahan and Davis, Southwestern Nat., 22:71.

1992. *Tamias dorsalis sonoriensis*, Hart, Mammalian Species, 399:1.

Type locality. 24 km NE Guaymas, 100 m, Sonora.

Range. *T. d. sonoriensis* occurs in a small area near the coast north of Guaymas, Sonora.

Recorded localities. *SONORA*: Guaymas, 15 mi NW, Bahía San Carlos (MVZ 3); Guaymas, 24 km NE (Hall, 1981); Maytorena, 1 mi SW, 300 ft. (USNM 1); San Carlos Bay, S end (Hall, 1981; Callahan and Davis, 1977); San Carlos, 3.8 mi NW (MSB 1).

Description. *S. d. sonoriensis* is smaller, has a longer tail, a relatively and absolutely narrower rostrum, longer baculum, and longer os clitoris than *S. d. dorsalis* (Callahan and Davis, 1977).

Measurements. Measurements of *T. d. sonoriensis* (in mm, mean ±SE, range, sample size, and t-test level of statistical significance compared to sample above of *T. d. dorsalis)* were: head and body length, 121.8 ±1.33 (111-135, n=19, $p < 0.05$); tail length, 97.9 ±1.62 (84-110, n=17, $p < 0.05$); hind foot length, 32.9 ±0.30 (29-35, n=19, $p < 0.05$); greatest length of skull, 34.91 ±0.18 (33.5-35.8, n=17, $p < 0.05$); length of nasals, 10.99 ±0.12 (10.1-11.7, n=17, $p < 0.05$); interorbital width, 7.84 ±0.09 (7.2-8.7, n=20, $p < 0.05$); cranial breadth, 16.53 ±0.05 (15.9-16.8, n=19, $p < 0.05$); maxillary toothrow, 5.50 ±0.06 (5.0-5.9, n=20, $p < 0.05$); length of baculum shaft, 4.04 ±0.06 (3.7-4.2, n=8, $p < 0.05$); and length of os clitoris, 1.96 ±0.06 (1.8-2.1, n=5, $p < 0.05$) (Callahan and Davis, 1977).

Remarks. Callahan and Davis (1976) used the name *E. dorsalis sonoriensis* prior to publishing their description of the new subspecies the following year (Callahan and Davis, 1977), thereby creating a *nomen nudum*. This *lapsus* is not been noted previously (e.g. Hall, 1981), but does not affect the validity of the name.

Tamias d. sonoriensis inhabits the Lower Sonoran life zone. They have been found in arroyos with permanent water and *Washingtonia* palms, but they also occur several km from permanent water. Associated plants included characteristic desert species such as *Acacia willardiana, Bursera laxiflora, Bursera microphylla, Carnegia gigantea, Cercidium microphyllum, Fouquieria diguetii, Guaiacum coulteri, Haematoxylon brasiletto, Jatropha cuneata, Lemairocereus thurberi, Olneya tesota, Prosopis juliflora, Ruellia californica* (Callahan and Davis, 1976).

Females of *Tamias d. sonoriensis* collected between 20-30 May were lactating and males had recrudescent testes, suggesting an early breeding season (Callahan and Davis, 1976).

Tamias d. sonoriensis feeds upon seeds of *Acacia willardiana* and *Bursera microphylla*, flowers of *Fouquieria diguetii*, and fruits of *Carnegia gigantea* and *Lemairocereus thurberi*. They cached food and took refuge in rock outcrops and talus slopes. Apparently they are able to live in areas without free water by eating succulent plant parts (Callahan and Davis, 1976).

Baculum sizes were very similar between *T. d. dorsalis* and *T. d. nidoensis*, although the samples were small (data in Lidicker, 1960; Callahan and Davis, 1977). Thus, the significant differences in the sizes of the bacula and os clitoris between *T. d. dorsalis* and *T. d. sonoriensis* are interesting. The shapes of the bacula were similar (Callahan and Davis, 1977), but did not overlap in size (measurements above).

The presence of a woodland lizard (*Gerrhonotus kingi*) in the Guaymas area suggests that a former woodland corridor may have existed between Guaymas and the Sierra Madre Occidental (Callahan and Davis, 1977). However, no populations of *T. dorsalis* have been found in the intervening area. The isolation of the Guaymas population, habitat differences, and non-overlap in sizes of bacula suggest that *T. d. sonoriensis* may be approaching species level separation from *T. d. dorsalis*.

Tamias merriami J. A. Allen

1889. *Tamias asiaticus merriami* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 2:176.

1890. *Tamias merriami*, Allen, Bull. Amer. Mus. Nat. Hist., 3:84.

Type locality. San Bernardino Mts, 4500 ft., due north of San Bernardino, San Bernardino Co., California.

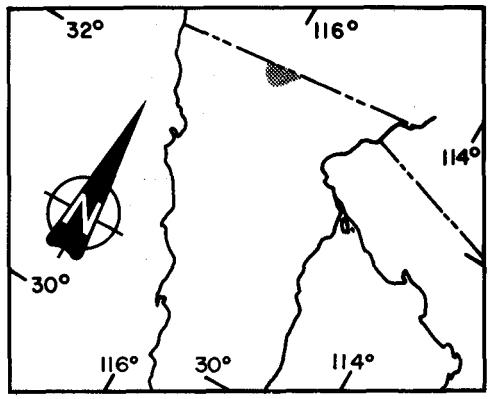
Range. This species occurs in the Coast Range and southern Sierra Nevada Mountains of California, and extends southward to the Nachogüero Valley in extreme northern Baja California.

Recorded localities. *BAJA CALIFORNIA*: Laguna Mountains, Nachogüero Valley (AMNH 1, USNM 1; Hall, 1981); Valle Nachogüero, Punta Norte (MVZ 3).

Description. *T. merriami* has a tail that is 75-97% (usually 80%) of head and body length, edged with white or buffy. In summer, the ears are grayish behind, with sparse fur on the tips, and the auricular patch is grayish and indistinct. The cheeks and underparts are grayish-white; the cheek stripes are dark brown, with the eye stripe reduced to black spots before and behind the eyes. The dorsal stripes are gray or brown, alternating with light grayish stripes, and may be indistinct in winter, as in *T. dorsalis* or *T. obscurus* (Ingles, 1965; Best and Granai, 1994b). The baculum is long (4.9 mm) and thin, with a relatively short tip (Ingles, 1965; Best and Granai, 1994b). Some characters are sexually dimorphic, with the females being slightly larger. As in other *Tamias*, the dental formula is 1/1 0/0 2/1 3/3 = 22 (Howell, 1929).

Measurements. Means ± variances (range, n, statistical significance of t-test for significant sexual dimorphism in parentheses) of external and cranial measurments (in mm) of *T. m. merriami* are

as follows: head and body length, males 133.4 ± 51.95 (120-154, n=21), females 135.7 ± 32.7 (123-147, n=41); tail length, males 109.4 ± 47.3 (93-122, n=21), females 109.5 ± 91.0 (85-124, n=40); hind foot length, males 35.2 ± 2.3 (31-38, n=23), females 36.4 ± 1.9 (34-40, n=41, $p < 0.05$); greatest length of skull, males 38.04 ± 0.80 (36.3-40.1, n=22), females 38.24 ± 0.84 (36.7-40.7, n=38); zygomatic breadth, males 20.36 ± 0.31 (19.4-21.5, n=23), females 20.30 ± 0.21 (19.4-21.4, n=41); length of nasals, males 12.08 ± 0.34 (11.2-13.7, n=23), females 12.56 ± 0.37 (11.4-13.6, n=40, $p < 0.05$); least interorbital breadth, males 8.71 ± 0.20 (7.7-9.5, n=23) males, females 8.55 ± 0.11 (7.9-9.4, n=41); cranial breadth, males 17.64 ± 0.18 (16.8-18.4, n=22), females 17.66 ± 0.16 (16.7-18.4, n=37); maxillary toothrow, males 5.92 ± 0.05 (5.5-6.5, n=23), females 5.93 ± 0.05 (5.5-6.4, n=41) (Callahan, 1977).



Geographic range of *Tamias merriami*.

Remarks. The only subspecies present in northwestern Mexico is *Tamias merriami merriami*. In Mexico, *Tamias merriami* is sympatric only with *T. obscurus*. The pelage is similar, and the two species are best distinguished using characteristics of the baculum (Callahan, 1977). *T. merriami* has longer, thinner bacula and baubella than *T. obscurus*. However, *T. merriami* is also larger than *T. obscurus*, has a longer tail and hind foot, and the two are 100% separable by discriminant analysis of skull and body measurements (Callahan, 1976). In summer, the dorsal stripes are less reddish, and the pelage is darker and more yellowish than in *T. obscurus* (Best and Granai, 1994a; Best and Granai, 1994b).

All three subspecies of *Tamias merriami* have Nadler's Karyotype B (Sutton and Nader, 1969). A cladistic analysis based upon allozyme data indicated that *T. merriami* is closest to *T. obscurus*, and very distantly related to *T. dorsalis* (Levenson *et al.*, 1985).

Tamias merriami and *T. obscurus* are morphologically very similar and were long confused (Callahan, 1975). They were not clearly separated until 1977 (Callahan, 1977). The two are sympatric in the San Bernardino Mountains north of San Gorgonio pass and in the San Jacinto Mountains.

An electrophoretic study using 11 loci found polymorphisms only in the esterases, but no esterase differences between *T. merriami* and *T. obscurus* (Blankenship and Bradley, 1985). Subsequent analysis of vocalizations (Blankenship and Brand, 1987) found significant differences in the chip calls. Chip calls are given during courtship, are species specific, and are probably involved in species recognition.

T. merriami primarily inhabits coniferous forests, but may occur in a variety of habitats when competing chipmunk species are absent such as chaparral, oak woodland, and pinyon-juniper woodland (Blankenship, 1985; Best and Granai, 1994b).

There also appear to be differences in habitat selection between *T. merriami* and *T. obscurus* (Blankenship, 1985). In the two mountain ranges where *T. merriami* and *T. obscurus* occur together, *T. merriami* lives at higher elevation, and in more mesic habitats, particularly coniferous

forests, whereas *T. obscurus* inhabits dry piñon pine (*Pinus monophylla*) woodland. The zones of overlap are often in places such as canyons where the Transition life zone inhabited by *T. merriami* extends down into the Upper Sonoran life zone inhabited by *T. obscurus*, or where there are mosaics of vegetation (Callahan, 1976; Blankenship, 1985; Best and Granai, 1994b). Blankenship (1985) concluded that habitat selection was taking place.

Oaks are important in the diet all year long; *T. merriami* consume buds, flowers, acorns, as well as insects on the trees. However, *T. merriami* eat over 70 species of plants including *Salix* spp., *Ribes*, *Platanus*, *Rosa*, *Rubus*, *Rhus*, *Rhamnus*, *Ceanothus*, *Sambucus*, *Symphorocarpos*, *Lonicera*, *Salvia*, *Montia*, *Asclepias*, *Bromus*, *Lithophragma*, *Erodium*, fungi, mosses, and lichens. They also eat pine (*Pinus*) seeds, juniper (*Juniperus*) berries, and some animal tissue. *T. merriami* steal acorns from the larder trees of acorn woodpeckers (*Melanerpes formicivorus*). Acorns, nuts, seeds, and berries are stored in caches, and thus *T. merriami* is important in forest regeneration. Population size appears positively correlated with rainfall (Best and Granai, 1994b).

Burrows are hidden decaying stumps, hollow trees, or under logs. Nests may be underground, but are often in trees. Tree cavities (3.6-19.5 m above ground) are usually used for maternity nests. Woodpecker cavities, natural cavities, and pocket gopher (*Thomomys*) burrows are important for night shelters (Best and Granai, 1994b).

Predators include coyotes (*Canis latrans*), gray foxes (*Urocyon cinereoargenteus*), bobcats (*Lynx rufus*), badgers (*Taxidea taxus*), weasels (*Mustela* spp.), sharp-shinned hawks (*Accipter striatus*), Cooper's hawks (*A. cooperi*), great horned owls (*Bubo virginianus*), western rattlesnakes (*Crotalus viridis*), garter snakes (*Thamnophis* spp.), and gopher snakes (*Pituophis melanoleucus*). Parasites include coccidians, nematodes, cestodes, mites, ticks, fleas, and cutebrid larvae, and sylvatic plague occurs in *T. merriami* (references in Best and Granai, 1994b). They live up to five years (Best and Granai, 1994b).

Molts of chipmunks are complex and can be confusing. "The seasonal color changes in the genus *Eutamias* are startling, the difference in most species between the gray winter coat and the 'red' or bright golden-fulvous post-breeding pelage being almost incredible. In fact, in some instances, the same animal in different pelages has been named as two different species" (Merriam, 1897:192). There are spring and summer molts, except for the tail which molts just once per year. Molt begins ventrally, then proceeds dorsally to the nose and works posteriorly, ending with the hind feet. However, molt may be patchy. Molt may be interrupted by pregnancy or inactivity in post-breeding males, which leaves the back with exposed blotches of blue-black undercoat (Howell, 1929).

T. merriami drinks the equivalent of about 12% of its body weight per day. When water is scarce, grooming is reduced and the coat becomes oily and dirty, and body mass may be reduced up to 23%, but they can survive drinking the equivalent of 1.5% of the body weight per day (Wunder, 1970; Best and Granai, 1994b). *T. merriami* does not hibernate except at higher elevations and in cold, snowy weather (Best and Granai, 1994b).

Males are in breeding condition between December and May, with a peak in February and March, and some males may have scrotal testes all year. Gestation is about 32 days, and modal litter size is 4 (range from 1-5) (Larson, 1987, in Best and Granai, 1994b).

Calls of *T. merriami* include the high intensity "chip," "chuck," "chipper," and "trill" vocalizations. The "chip" vocalization does not have a terminal pulse like that found in *T. dorsalis* or *T. obscurus*. Trills are frequently emitted in bouts (Dunford and Davis, 1975; Blankenship, 1985).

Compton and Callahan (1995) described copulation in *T. merriami*. One female was pursued by five or six males in a group mating chase, and the group displayed conspicuous leaping maneuvers. After 20 minutes, the female ran up on a branch and a male approached. The two ran around for a few seconds, then the male nuzzled the female's face with his own, apparently scent-marking her. The female jumped to another branch and crouched, the male mounted, and copulation consisted of a series of four series of pelvic thrusts, each lasting about 4 seconds. Between each series of thrusts, the male brushed the female's face with his own. The act lasted 18 seconds, there were no premating vocalizations, and the other chipmunks did not molest the couple. After copulation, the pair separated.

Tamias merriami was listed as "fragile" by Ceballos and Navarro (1991) and is officially "rare" [rara] in Mexico (NOM-095-ECOL-1994). This is presumably because of its restricted distribution in Mexico.

The current status of *Tamias merriami* in the Nochogüero Valley should be investigated. It would be useful to know if *T. merriami* occurs further south in Mexico. Because of its superficial similarity to *T. obscurus*, collecting or use of vocalizations would be necessary to determine the distribution.

Tamias obscurus J. A. Allen

Range. *Tamias obscurus* occurs in southern California and northern Baja California, with a disjunct population in the central part of the peninsula (Callahan, 1977).

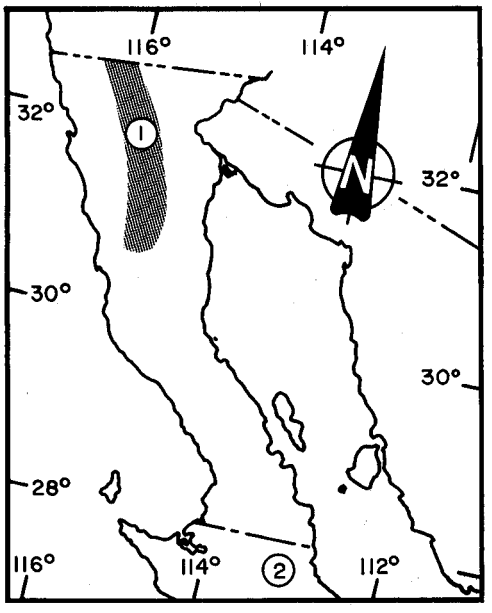
Description. *Tamias obscurus* is generally similar to *T. merriami* (see description above), and the two were long confused (Callahan, 1975; Callahan, 1977). However, in *T. obscurus*, the tail is usually less than 80% of head and body length, and the greatest length of the skull averages less than 38 mm. The skull is flatter than in *T. merriami*. In summer, adults are paler, and less yellowish than *T. merriami*, and the dark dorsal stripes are more reddish. Some characters are sexually dimorphic, with the females being slightly larger (Callahan, 1977). The dental formula is 1/1 0/0 2/1 3/3 = 22.

The baculum of *T. obscurus* is shorter and thicker than that of *T. merriami*, with a relatively broad tip. The two species can be separated by baculum differences, measurements, or vocalizations (Callahan, 1977; Blankenship, 1985; see the account of *T. merriami* above).

Remarks. *T. o. meridionalis* and *T. o. obscurus* both have Karyotype A, whereas *T. merriami* has Karyotype B (Sutton and Nadler, 1969; Callahan, 1975; Callahan, 1977). *T. o. obscurus* occurs in a variety of relatively xeric habitats, and *T. o. meridionalis* has adapted to very arid conditions. No fossils of *T. obscurus* are known (Best and Granai, 1994a).

Jameson and Peeters (1988) state that *T. obscurus* has two litters per year, but J. R. Callahan (in Best and Granai, 1994a) states that there is just one litter per year. The breeding season may be long. *T. o. meridionalis* has young in the nest in February, and subadults by mid-July. However, males were in breeding condition in late June, but no females were lactating in mid-July (Callahan and Davis, 1976). In the Sierra Juárez, *T. o. obscurus* breeds in early March (Callahan, 1976), and females had finished lactation by early May (Allen, 1890a). In the Sierra San Perdo Martir, half-grown young were observed 6-28 May (Allen, 1893b).

About 3-5 days prior to estrus, females sit on exposed perches, calling and grooming. This attracts males from 200 m. Males approach females in a hesitant, jerky manner, and sniff her genital area, or the perch where she has been sitting. At this stage females growl and move away.



Geographic range of *Tamias obscurus*:
1. *T. o. obscurus* 2. *T. o. meridionalis*

By the onset of estrus, several males (2 to 6+) will have gathered in her home range. Estrus lasts several hours and during this time the group of males chases the female, this time with the males vocalizing. At some point, the female stops and allows one of the dominant males in the hierachy to mate with her (Callahan, 1981).

After the breeding season, the surviving males are inactive in their burrows from May to August or September. Because of lack of opportunity to store food, they then remain active longer in the fall, and emerge a month or so earlier in the spring than females (Callahan, 1981).

This species is apparently common in its limited range and not of conservation concern. However, if the geographic distribution of both subspecies, but especially *T. o. meridionalis*, is as small as reported, then any large-scale habitat modifications in the restricted range could have an impact on them.

There are three subspecies, and two of them occur in northwestern Mexico:

Tamias obscurus meridionalis (Nelson and Goldman)

1909. *Eutamias obscurus meridionalis* Nelson and Goldman, Proc. Biol. Soc. Washington, 22:23.

1985. Tamias obscurus meridionalis, Blankenship and Bradley, Bull. S. Calif. Acad. Sci., 84:48.

Type locality. "Aguaje de San Esteban, about 25 miles [40 km] northwestern of San Ignacio, Lower California [Baja California Sur], Mexico (altitude about 1,200 ft [366m])".

Range. This subspecies is known only from the central Baja California peninsula. *Tamias o. meridionalis* occurs in the Sierra San Francisco in northern Baja California Sur. There are sight records, presumably of this subspecies, further north in the Sierra San Borja, and also futher south near Mulege (Callahan, 1977).

Recorded localities. *BAJA CALIFORNIA SUR*: Aguaje de San Esteban, 40 km NW San Ignacio, 366 m elevation (USNM 1; San Esteban is 32.2 km ENE of the San Esteban on modern maps [Callahan and Davis, 1976]); San Pablo, 305 m elevation (USNM 1; Hall, 1981); Rancho Las Calabasas, 17 mi SE San Pablo (Larson, 1964 =32 km E of San Esteban, 27° 35'N, 112° 58'W [Callahan and Davis, 1976]); Las Calabasas, 8 km E, on east slope of Sierra San Francisco, 701 m elev. (Callahan and Davis, 1976); San Gregorio (but not the San Gregorio shown on modern maps; Callahan and Davis, 1976); Montañas San Francisco (CAS 1); Santa Marta, 520 m (Callahan, 1977); El Sausalito (Nelson, 1922, Larson, 1964, Callahan and Davis, 1976). Sight records: Sierra San Borja (Callahan, 1977); Guajademi, 32 km S Mulege (Callahan, 1977).

Description. *Tamias o. meridionalis* has a much smaller, narrower skull; longer tail; smaller size; and paler coloration than *T. o. obscurus* (Callahan, 1977).

Measurements. External and cranial measurments (in mm) of *T. o. meridionalis* (sexes combined, means ± variance and range) were: head and body length, 114.0 ± 57.33 (106-122, n=7); tail length, 102.4 ± 272.30 (81-120, n=5); hind foot length, 33.1 ± 1.04 (31-34, n=7); greatest length of skull, 34.71 ± 0.86 (33.3-35.9, n=8); zygomatic breadth, 18.50 ± 0.27 (17.9-19.2, n=8); length of nasals, 10.64 ± 0.17 (10.0-11.2, n=8); least interorbital breadth, 8.56 ± 0.31 (7.6-9.6, n=8); cranial breadth, 16.58 ± 0.21 (16.2-17.3, n=6); maxillary toothrow, 5.48 ± 0.01 (5.4-5.6, n=5) (Callahan, 1977).

Remarks. Western chipmunks are normally restricted to montane habitats, but *T. dorsalis sonoriensis* (see above) and *Tamias o. meridionalis* live in similar desert areas. *T. o. meridionalis* occurs in a small area (<40 km in diameter (Best and Granai, 1994a) in lower Sonoran life zone palm-cactus associations, although patches of upper Sonoran oak woodland occur in this area. The vegetation is dominated by elephant tree (*Bursera microphylla*), foothill paloverde (*Cercidium microphyllum*), ocotillo (*Fouquieria peninsularis*), mesquite (*Prosopis juliflora*), cacti, and similar desert plants. Permanent water in the area had figs (*Ficus palmeri*) and willows (*Salix* cf. *integrifolia*) (Callahan and Davis, 1976). Interestingly, the habitats of *T. d. sonoriensis* and *T. o. meridionalis* share several dominant plant species (Callahan and Davis, 1976).

In *T. o. meridionalis,* the small size, long tail, narrow skull, and pale coloration may be adaptations to a desert habitat. The small body size, long tail, and pale coloration are consistent with Bergmann's, Allen's, and Gloger's rules, and the narrow skull may facilitate heat loss in desert endotherms (Callahan and Davis, 1977; Callahan, 1977).

T. o. meridionalis nests in cavities in the giant cardon cacti (*Pachycereus pringlei*) which are probably abandoned woodpecker holes (Callahan and Davis, 1976). *Tamias o. meridionalis* was observed to eat a variety of seeds, fruit and flowers: *Bursera microphylla* (seeds), *Cerdidium microphyllum* (seeds), *Lemairocereus thurberi* (flowers, fruits), *Lysiloma candida* (seeds), *Myrtilocactus cochal* (flowers), *Pachycereus pringlei* (flowers), *Prosopis juliflora* (seeds), *Prunus* cf. *intregrifolia* (flowers) (Callahan and Davis, 1976). *T. o. meridionalis* climbs cardon cacti, despite the spines (Callahan and Davis, 1976).

Vocalizations include the chip, chuck, chipper and trill calls. A recording of a single individual of *T. o. meridionalis* has been analyzed (Dunford and Davis, 1975). Trills were interspersed among the chips, similar to the pattern of *T. merriami.* The chip call had no terminal pulse.

The geographic distribution of *T. o. meridionalis* should be better established. The sight records extend the known distribution considerably, and these should be confirmed with specimens.

Tamias obscurus obscurus J. A. Allen

1890. *Tamias obscurus* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 3:70.

Type locality. Sierra San Pedro Martir, near Vallecitos in northern Baja California.

Range. *Tamias o. obscurus* is known from the Sierra Juárez and Sierra San Pedro Martir (Callahan, 1977).

Recorded localities. *BAJA CALIFORNIA*: Aguaje de las Fresas (FMNH 1); Alamo, 10 mi SE (SDNHM 3); Division Rosarito (FMNH 2); Montaña San Pedro Martir (SDNHM 2); Rancho Mehling, 27 mi NE (CSULB 1); Rancho Mehling, 5.6 mi E, Barrera de Roble (MVZ 1); Sierra Juárez, Laguna Hanson (CAS 5, CSULB 1, FMNH 2, MSB 20, MVZ 10, SDNHM 52, USNM

6); Sierra Juárez, Laguna Hanson, 7 mi N (SDNHM 5); Sierra Juárez, Laguna Hanson, Mountain El Rayo (SDNHM 9, USNM 3); Sierra San Pedro Martir (AMNH 54, CAS 29, FMNH 6, USNM 10); Sierra San Pedro Martir, W slope, piñon (USNM 2); Sierra San Pedro Martir, La Encantada (MSB 2); Sierra San Pedro Martir, La Grulla (AMNH 3, MVZ 34, SDNHM 16, FMNH 9, MSB 1, USNM 11); Sierra San Pedro Martir, Santa Eulalia (AMNH 2, FMNH 13); Sierra San Pedro Martir, Santa Rosa (FMNH 3); Sierra San Pedro Martir, Vallecitos (FMNH 6, MSB 4, MVZ 26, USNM 10); Sierra San Pedro Martir, Vallecitos, 1 mi W (by road) (MSB 4); Sierra San Pedro Martir, Vallecitos, 2.4 mi W (by road) (MSB 5); Sierra San Pedro Martir, Vallecitos, 3.9 mi W (by road) (MSB 11); Sierra San Pedro Martir, Vallecitos, 15 km S (MSB 4); Valle de la Trinidad (MVZ 1).

Description. *Tamias o. obscurus* is generally similar to *T. merriami* (see description above), and the two were long confused (Callahan, 1975, Callahan, 1977). The baculum of *T. obscurus* is shorter and thicker than *T. merriami*, with a relatively broad tip. However, in *T. obscurus*, the tail is usually less than 80% of head and body length, and the greatest length of the skull averages less than 38 mm. *Tamias o. meridionalis* has a much smaller, narrower skull; long tail; small size; and pale coloration (see measurements below and Callahan, 1977).

Measurements. External and cranial measurments (in mm, means ± variances, ranges, sample sizes, and statistical significance of *t*-tests for sexual dimorphism) of *T. o. obscurus* were: head and body length, males 127.8 ± 24.72 (115-140, n=23), females 130.8 ± 38.8 (114-140, n=28, $p < 0.05$); tail length, males 91.9 ± 13.15 (85-98, n=20), females 94.7 ± 47.34 (75-105, n=26, $p < 0.05$); hind foot length, males 33.5 ± 2.10 (30-36, n=23), females 36.4 ± 1.88 (34-40, n=41, $p < 0.05$); greatest length of skull, males 38.04 ± 0.80 (36.3-40.1, n=22), females 38.24 ± 0.84 (36.7-40.7, n=38, $p < 0.05$); zygomatic breadth, males 20.36 ± 0.31 (19.4-21.5, n=23), females 20.30 ± 0.21 (19.4-21.4, n=41, $p < 0.05$); length of nasals, males 12.08 ± 0.34 (11.2-13.7, n=23), females 12.56 ± 0.37 (11.4-13.6, n=40, $p < 0.05$); least interorbital breadth, males 8.71 ± 0.20 (7.7-9.5, n=23), females 8.55 ± 0.11 (7.9-9.4, n=41, $p < 0.05$); cranial breadth, males 17.64 ± 0.18 (16.8-18.4, n=22), females 17.66 0.16 (16.7-18.4, n=37, $p < 0.05$); maxillary toothrow, males 5.92 ± 0.05 (5.5-6.5, n=23), females 5.93 ± 0.05 (5.5-6.4, n=41, $p < 0.05$) (Callahan, 1977).

Remarks. *Tamias m. merriami* and *T. o. obscurus* are sympatric in the Nachogüero Valley in extreme northern Baja California (Callahan, 1977). The bacula and os clitoris are diagnostic and the two are completely separable by discriminant analysis (Callahan, 1977), but they are difficult to identify by pelage characteristics.

Tamias o. obscurus occurs in higher chaparral, pinyon-juniper, pine-oak, and pine forests in the Sierra Juárez and Sierra San Pedro Martir where they are almost exclusively associated with masses of granite boulders, which are common in these mountains (Allen, 1893b; Huey, 1964, Callahan, 1977). Callahan (1977:197) found them "abundant at 1370 to 1525 m in rock outcroppings along the road from El Condor to Laguna Hanson," and they occur above 2130 m elevation in pine forests (Howell, 1929).

Burrow entrances of *T. o. obscurus* are protected by large boulders (Best and Granai, 1994a). *Tamias obscurus* does not hibernate and is active all year (Jameson and Peeters, 1988). As in other species of *Tamias*, there are two molts per year. They climb in shrubs, but usually do not climb trees (Allen, 1893b).

Tamiasciurus Trouessart

1880. *Tamiasciurus* Trouessart, Le Naturaliste, 2(37):292.

Type species. *Sciurus vulgaris hudsonicus* Erxleben, 1777 [=*Tamiasciurus hudsonicus* (Erxleben, 1777)].

Description. *Tamiasciurus* are smaller and leaner than typical North American tree squirrels (*Sciurus*). *Tamiasciurus* is distinct from *Sciurus* in having three bullar septae instead of two; the anterior border of the orbit is opposite P4 or the junction of P4 and M1, rather than opposite M2; P3 is absent; a dark lateral stripe is present; the rostrum is relatively shorter, the tail is shorter and flatter than in *Sciurus*, and the hairs are not banded except at the tip (Allen, 1898; Bryant, 1945; Flyger and Gates, 1982).

Mossman *et al.* (1932) found striking differences between the reproductive tracts of *Tamiasciurus* and *Sciurus*. In *Tamiasciurus*, the baculum is vestigial and confined to the glans penis, the minute Cowper's glands are unique, there are no bulbar glands (which otherwise define the family), the penis is threadlike, and the females have a unique coiled vagina. They suggested that *Tamiasciurus* be placed in a different family from *Sciurus*! Other evidence has not supported separate family status (e.g., Hafner *et al.*, 1994).

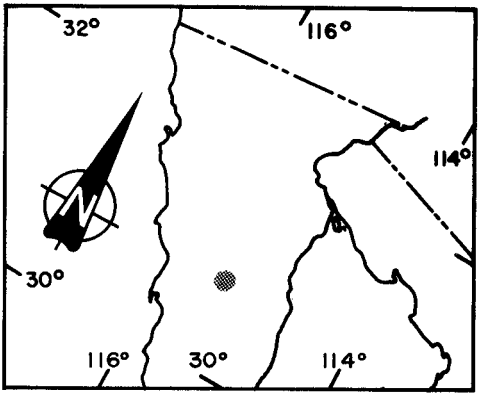
Remarks. There are three species of *Tamiasciurus*. They are associated with North American boreal forests from northern Canada and Alaska south into the United States. One species occurs in the Sierra San Pedro Martir of northern Baja California (Lindsay, 1981):

Tamiasciurus mearnsi (Townsend)

1897. *Sciurus hudsonicus mearnsi* Townsend, Proc. Biol. Soc. Washington, 11:146.
1981. *Tamiasciurus mearnsi*, Lindsay, J. Mammal., 62:680.

Type locality. "San Pedro Martir Mountains, Lower California (altitude about 7,000 feet)."

Range. This species is known from three sites <10 km apart in the Sierra San Pedro Martir, Baja California (Lindsay, 1981, and records below). Hopefully it occurs elsewhere in the pine forests of the Sierra San Pedro Martir. We know of over 40 specimens.



Geographic range of *Tamiasciurus mearnsi*.

Specimen Records. *BAJA CALIFORNIA*: Sierra San Pedro Martir, La Grulla (FMNH 2, MVZ 15, SDNHM 6); Vallecitos (AMNH 1, FNMH 4, MVZ 5, USNM 1); Vallecitos, 3.9 mi W (by road) (MSB 1); Sierra San Pedro Martir (no other data) (AMNH 1, CAS 1, USNM 4); Carretera Norte (CSULB 1).

Description. The dorsal color is pale gray-brown with a reddish-yellow mid-dorsal stripe; undersurface white with scattered yellow spots, but hairs gray at base; dorsal and ventral coloration separated by a distinct black lateral stripe; ears blackish with a small tuft in winter, but

tuftless in summer; top of head light gray; top of nose gray-brown; feet yellowish-white. The tail is black with white outer fringe and some yellow dorsally near base (Townsend, 1897; Allen, 1898; Lindsay, 1981). The dental formula is 1/1 0/0 1/1 3/3 = 20. The dark lateral line is particularly useful in field identification.

Measurements: Means and standard deviations of 32 adults (in mm) were: head and body length, 201.0 ± 13.2; hind foot length, 51.39 ± 5.15; greatest length of skull, 49.17 ± 0.84; zygomatic width, 27.65 ± 0.56; length of nasals, 13.18 ± 0.34; interorbital breadth, 15.00 ± 0.49; width of braincase, 20.49 ± 0.30; maxillary toothrow, 8.17 ± 0.17 (Lindsay, 1981).

Males are slightly larger than females in *Tamiasciurus hudsonicus* (Nellis, 1969, in Flyger and Gates, 1982). However, Lindsay (1981) found sexual dimorphism was limited to local populations in *Tamiasciurus hudsonicus*, and did not find sexual dimorphism in his sample of *T. mearnsi*.

Remarks. *T. mearnsi* is not divided into subspecies. It differs from *T. hudsonicus mogollonensis* by being paler gray dorsally (rather than uniform reddish-brown), and having a reddish-yellow dorsal band. The latter has a white venter. *T. douglasii albolimbatus* is very dark dorsally, has more yellowish on the venter, and a less distinct lateral stripe than *T. mearnsi*. See Lindsay (1981) for additional details and measurements.

Tamiasciurus mearnsi was described as a subspecies of *Sciurus* (*Tamiasciurus*) *hudsonicus*, then recognized as a full species by Allen (1898) on the basis of its geographic isolation. Allen considered *T. mearnsi* to be more closely related to *T. douglasii* than to *T. hudsonicus*, based upon the yellowish tinge on the belly and legs of some specimens. Elliot (1903) considered it a subspecies of *Sciurus* (*Tamiasciurus*) *douglasii*. *Tamiasciurus* was later elevated to generic status (Hayman and Holt in Ellerman, 1940).

Lindsay (1981) compared two external and 17 cranial measurements of *T. mearnsi* with those of the geographically closest subspecies of the other two species, *T. douglasii albolimbatus* from California and *T. hudsonicus mogollonensis* from Arizona. He found that *T. mearnsi* was as distinct from *T. d. albolimbatus* and *T. h. mogollonensis* as the latter were from each other, implying species status for *T. mearnsi*.

Tamiasciurus mearnsi is separated from the nearest populations of *T. douglasii* and *T. hudsonicus* by about 600 km of mostly non-forested lowlands in each case. The San Felipe desert to the east of the Sierra San Pedro Martir is the driest region of Baja California, and provides a formidible barrier between *T. mearnsi* and *T. hudsonicus*. To the north and west of the Sierra San Pedro Martir, Californian chaparral (Brown, 1994) is a barrier between populations of *T. mearnsi* and *T. douglasii* in the Sierra Nevada. However, during the Pleistocene, life zones were 600-1000 m lower, and this would have provided a corridor of coniferous forest between the Sierra Nevada and the Sierra San Pedro Martir (Lindsay, 1981). Ancestors of *T. mearnsi* could have invaded the Peninsula during one or more mesic cycles, perhaps as early as 700,000 yr BP (Hafner and Riddle, 1997). *T. mearnsi* would have been isolated from *T. douglasii* for the last time after the last pluvial maximum, perhaps as recently as 12,000 yr BP.

Reports earlier in this century (Nelson, 1922) indicate that the lowlands between the Sierra San Pedro Martir and Sierra Juárez were forested and almost connected to the California forests and large areas of chaparral were forested as recently as 55-65 years ago. However, Mellink and Contreras (1993) have doubted this report.

Tamiasciurus mearnsi is one of seven species of montane pluvial relicts isolated in the Baja California peninsula since the late Pleistocene (Hafner and Riddle, 1997). Other sciurid species in this category include *Tamias obscurus*, *T. merriami*, and *Sciurus griseus*. Interestingly, *Sciurus*

griseus is the only species of tree squirrel in the Sierra Juárez, and *Tamiasciurus mearnsi* is the only native tree squirrel in the Sierra San Pedro Martir. However, *T. mearnsi* must have occurred in the Sierra Juárez during Wisconsin time.

Tamiasciurus mearnsi is known from about 7000 feet [2100 m], 8200 feet [2500 m] and 9000 feet [2750 m] elevation (Huey, 1964; Allen, 1898; Elliot, 1903) in coniferous forests. The Transition and Canadian Zone forests are dominated by Jeffrey pine (*Pinus jeffreyi*), some sugar pine (*Pinus lambertiana*), two-leaved pine (*P. murrayana*), white fir (*Abies concolor*), plus a few oaks (*Quercus chrysolepis* and *Q. grisea*) and quaking aspen (*Populus tremuloides*) (Elliot, 1903; EY, personal observations).

Tamiasciurus typically have home ranges of 1.3-1.5 ha, and defend territories of 0.2-1.2 ha. Population densities range from 0.4-2.3/ha. Predators include birds of prey, red fox (*Vulpes vulpes*), and pine marten (*Martes americana*), although mortality from predators may be low (Flyger and Gates, 1982).

The physiology and reproduction of *T. mearnsi* has not been studied. *Tamiasciurus* usually have one litter per year, although two litters per year have been reported. Longevity is reported to be up to nine years in captivity, but in the wild, mortality may reach 67% annually. The diet includes conifer buds and seeds, fungi, and sometimes insects (Flyger and Gates, 1982).

We know of no information on the behavior of *T. mearnsi*. *Tamiasciurus* store food in large caches. They remain active all winter, sometimes tunneling in the snow. Dens are in tree hollows or leaf nests (Flyger and Gates, 1982).

Huey (1964:105) considered *T. mearnsi* rare, and that it occurred "only in limited numbers." *Tamiasciurus mearnsi* was considered threatened by Ceballos and Navarro (1991), *amenazada* by Ceballos and Rodriguez (1993), and is officially listed as threatened [amenazada] in Mexico (NOM-095-ECOL 1994), presumably because of its restricted distribution, comments in Huey (1964), and lack of current information. More information is needed on the conservation status and natural history of *Tamiasciurus mearnsi*.

INTRODUCED AND HYPOTHETICAL SPECIES

There are four species of Sciuridae that occur in the forests of the Sierra Madre Occidental of Chihuahua and Durango that could potentially exist in similar habitats in either Sinaloa or Sonora, or both. In addition, one squirrel species has been introduced into Baja California. Because readers could potentially encounter these species in the field, we discuss these species briefly below. We would appreciate receiving reports from readers observing these species.

Sciurus carolinensis

Eastern gray squirrels were introduced at La Sanja (nine individuals) and Arroyo San Rafael (eight individuals) on the western slopes of the Sierra San Pedro Martir in 1946 by a Mr. E. E. Utt. The squirrels still existed at La Sanja in 1956 and at Arroyo San Rafael in 1958 (Huey, 1964). We have no further information on the current status of this introduction.

The only other tree squirrel in the Sierra San Pedro Martir is *Tamiasciurus mearnsi*, which is much smaller and darker, has a distinct lateral stripe, and yellow patches on the belly (see species account above). *Sciurus carolinensis* could be confused with *S. griseus*, which occurs in the Sierra Juárez, and the two would be difficult to distinguish in the field if *S. carolinensis* were introduced

into the Sierra Juárez as well. *S. griseus* is silver gray dorsally, slightly longer (total length > 500 mm, hind foot > 75 mm), and the tail has a narrow white border. *S. carolinensis* is dark gray dorsally, slightly smaller (total length < 500 mm, hind foot < 75 mm), and the tail has long, white-tipped hairs (Ingles, 1965). Realistically, specimens would be necessary to confirm the identification.

Huey (1964) was concerned about the effects of possible competition between *Sciurus carolinensis* and *Tamiasciurus mearnsi*. The latter is already uncommon, and the larger *S. carolinensis* could potentially displace the native species. *Sciurus carolinensis* has been widely introduced into such places as western USA, Europe, South Africa, and Australia. The introduction to Australia failed (Koprowski, 1994), and hopefully the introduction to the Sierra San Pedro Martir has failed, or will fail.

Spermophilus madrensis

The Sierra Madre mantled ground squirrel, or "chalote colino," is known from several localities in Chihuahua (Anderson, 1972) and more recently from Durango (Servín, *et al.*, 1996). It should occur in Sinaloa and Sonora as well.

This species is recognized by the lateral stripes on the sides of the body, but unlike chipmunks or chichimocos (*Tamias*) it has a tail less than 1/3 of the body length, is heavier bodied, and lacks stripes on the face. Antelope ground squirrels (*Ammospermophilus*) have a longer, whitish tail and occur at lower elevations.

Spermophilus madrensis was listed as "fragile" (Ceballos and Navarro, 1991, Ceballos and Rodriguez, 1993) but the reasons were not stated. The Norma Oficial Mexicana (NOM-095-ECOL 1994) listed *S. madrensis* as rare (rara). After observing them in the Sierra Madre Occidental in 1994, we agree that the species should be of conservation concern. The species is still common in some areas, but we are concerned about its future.

Logging and fire suppression in the Sierra Madre Occidental are having the same effects as elsewhere in western North America (EY, personal observations). In coniferous forests in western North America in past centuries, periodic natural fires killed small trees, but large individuals survived, and forests a century or two ago (before fire suppression) were more open and park-like than at present. Fire suppression has resulted in high survival of small trees and shrubs, and they have filled in the spaces between larger trees, invaded meadows, and radically changed the structure of the forest. Now wildfires are catastrophic because the large trees are surrounded by smaller trees that carry the fire up into their branches, and the result is crown fires that kill all the trees (Arno, 1980; Steele *et al.*, 1986; Barrett, 1988).

The invasion of open forests by small trees and shrubs has serious consequences for herbivores that depend upon herbaceous vegetation on the forest floor. As the canopy cover increases, the ground becomes more shaded, and the grasses and herbs eaten by ground squirrels gradually die. As this process continues, and the forest composition changes to higher densities of smaller trees, we should expect decreases in populations of herbivores such as *S. madrensis* that depend upon plants growing in open forests. Small trees are invading the pine forests in the Sierra Madre Occidental in areas where we have seen *S. madrensis* (EY and MVA, personal observations). For this reason, we think this species should be of considerable conservation concern.

Glaucomys volans

One subspecies of the southern flying squirrel or *ardilla voladora* (*Quimichpatlan* in Nahuatl), *G. v. madrensis*, occurs in the Sierra Madre Occidental of Chihuahua (Goldman, 1936). It is known from two specimens (USNM 261693 and 261694) from "Sierra Madre, Chihuahua" (Anderson, 1972).

This is the only flying squirrel in northwestern Mexico, and can be easily recognized by the gliding membrane or patagium. Except for the two specimens, nothing is known about this species in Chihuahua. For example, a recent treatment of geographic distribution and habitat selection of *G. volans* in Mexico (Manzano Fischer, 1993) does not even mention this subspecies. They may occur, or may have occured in the past, in the portion of the Sierra Madre Occidental in Sonora or Sinaloa.

G. volans has a fragmented distribution in Mexico and Central America, where it inhabits oak woodland, pine forest, pine-oak forest, and mesophytic forests. They are most abundant in areas with larger trees which have more crevices and holes for nests (Manzano Fischer, 1993).

Flying squirrels in other areas also depend upon old growth forests, and are sensitive to logging and other disturbances (Hafner *et al.*, in press). Logging has probably eliminated many areas with suitable trees for *G. volans* in the Sierra Madre Occidental. Thus, it may be important to determine the distribution and conservation status of *G. v. madrensis* in the near future.

Ceballos and Navarro (1991) considered *G. volans* threatened, and it is officially listed as threatened (amenazada) in Mexico (NOM-095-ECOL 1994).

Sciurus aberti

The tassel-eared squirrel is known from pine forests above 2000 m elevation in the Sierra Madre Occidental in Chihuahua and Durango (Anderson, 1972; Hoffmeister and Diersing, 1978). They depend upon ponderosa pine (*Pinus ponderosa*) for food and nest sites (Nash and Seaman, 1977). We know of no reason to suppose that this species does not occur in the Sierra Madre Occidental of eastern Sonora and Sinaloa. *Sciurus a. barberi* occurs from Pacheco, Chihuahua south to Río Papigochic (Hoffmeister and Diersing, 1978), and possibly enters Sonora. *Sciurus a. durangi* occurs south of río Papigochic as far south as west central Durango (Hoffmeister and Diersing, 1978). It could enter eastern Sinaloa, and possibly Sonora.

Sciurus aberti is recognized by the tufts or "tassels" of hair at the tips of the ears, although the tufts are reduced in summer pelage. The head and body are steel gray dorsally, with a black lateral band, and white venter. There is usually a patch of reddish in the middle of the back. The tail is black or gray black with white hairs (Hoffmeister and Diersing, 1978). *Tamiasciurus* is not known to occur in the Sierra Madre Occidental, so there should be no confusion with them.

All three subspecies of *S. aberti* in Mexico are listed as rare (NOM-095-ECOL 1994).

Tamias durangae

The Durango chipmunk or chichimoco occurs in southern Chihuahua and Durango (Anderson, 1972) and may cross into Sinaloa. This was formerly considered a subspecies of Buller's chipmunk (*T. bulleri*) but raised to species status by Callahan (1980).

This species may be distinguished from the cliff chipmunk (*T. dorsalis*), which also occurs in the Sierra Madre Occidental of Sonora, by the presence of five distinct dark and four pale (nearly

white) body stripes (Best *et al.*, 1993). In *T. dorsalis*, the stripes are indistinct except for the dark median stripe.

Tamias durangae has no conservation status and is probably common.

DISCUSSION

The genera of sciurids can be thought of as having progressive specialization for arid environments (Howell, 1938). *Sciurus* and *Tamiasciurus* are always associated with woodlands or forests. *Tamias* are usually associated with forests or woodlands, but sometimes rocks seem to provide the vertical habitat structure for them. *Cynomys* are closely associated with grasslands, while *Ammospermophilus* are desert dwellers. *Spermophilus* likewise exhibit a pattern of progessive xeric specialization. The subgenera occupy a range of habitats from tropical deciduous forest (*Notospermophilus*), rocky areas (*Otospermophilus* and *Callospermophilus*), tall grass prairie (*Poliocitellus*), short grass prairie (*Ictidomys*), intermontane grasslands and meadows (*Spermophilus*), and deserts (*Xerospermophilus*). This sequence roughly corresponds to a pattern of increasing aridity in western North America.

The greatest diversity of sciurids in northwestern Mexico occurs in Sonora (nine species), followed by Baja California (seven), Nayarit (five), and Sinaloa and Baja California Sur (three each). Sonora has three faunal influences: forest species in the Sierra Madre Occidental, desert species with ranges that extend into Arizona, and a grassland species with a range that extends into New Mexico and Chihuahua. Baja California has forest species associated with the California-Sierra Juárez-Sierra San Pedro Martir axis, and desert species. Nayarit has forest species associated with the Sierra Madre Occidental and tropical species. The low sciurid diversity in Baja California Sur and Sinaloa may be due to fewer faunal influences in both cases.

Three species are endemic to northwestern Mexico, and all three occur in the Baja California peninsula. *Ammospermophilus insularis* is an island endemic, *Tamiasciurus mearnsi* is isolated on an "island" mountain range, and *Spermophilus atricapillus* may be isolated by oases in a mountain chain of dark lava rocks. The topographic discontinuities of the peninsula have generated a high rate of endemism not duplicated elsewhere in the region. The other center of endemism is the Sierra Madre Occidental, but the endemic species occuring there have their ranges in other states outside of the region and/or are hypothetical in northwestern Mexico (*Spermophilus madrensis*, *Tamias durangae*, *Sciurus nayaritensis*).

Nine species are of conservation concern (six classified as threatened, three as rare). *Sciurus griseus*, *Tamias merriami*, *Tamiasciurus mearnsi* are montane species with small geographic ranges in the mountains of northern Baja California. The first two are at the southern limits of their distributions, and are not of conservation concern in the United States (Hafner *et al.* in press). However, *Tamiasciurus mearnsi* has its entire distribution in the Sierra San Pedro Martir and is globally threatened. Thus, it should have a higher conservation priority than the other two species. Three hypothetical species (*Sciurus aberti*, *Spermophilus madrensis*, and *Glaucomys volans*) in the Sierra Madre Occidental of Chihuahua and Durango are rare and threatened by forest changes. *Sciurus arizonensis* and *Cynomys ludovicianus* are of concern due to habitat loss in Sonora. *Ammospermophilus insularis*, an island endemic in Baja California Sur, would be vulnerable to a variety of threats due to the small size of the island it inhabits.

The native *Sciurus* are either game species, or threatened. The game species are all habitat generalists, whereas the threatened species depend upon mature forests. We need more

information on population trends in all of these species. Likewise, we know of no information on reproductive rates, population trends, or other biological data to calculate sustainable harvests for *Spermophlus annulatus*.

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FAMILY GEOMYIDAE

James L. Patton

Introduction

Pocket gophers of northwestern Mexico belong primarily to two species in the genus *Thomomys*, although populations of *Pappogeomys bulleri* enter into extreme southern Nayarit (Hall 1981). This geographic area is diverse in habitat and especially in topography, and in general pocket gophers are poorly represented in museum collections from these Mexican states. Much of this region of Mexico is remote with difficult logistical access, and few collectors have made the effort to get the series of specimens needed for statistical analysis or for analyses by modern biochemical and chromosomal perspectives.

Botta's pocket gopher *(Thomomys bottae* [Eydoux and Gervais]) is the common entity found throughout the Baja California peninsula, as currently understood, and in the lowlands of northern and coastal Sonora and northwestern Sinaloa. The Southern pocket gopher, *Thomomys umbrinus* (Richardson), replaces Botta's in the uplands and mountains of eastern Sonora, and throughout Sinaloa from the central coast south and east to the spine of the Sierra Madre Occidental, into northern Nayarit. Throughout this very diverse geographic region, vegetation and soil types change radically over even short segments of geography, so it is not at all surprising to note that some 42 local races of one or the other of these two species have been described and are in current use.

The distinction between *T. bottae* and *T. umbrinus* is not an easy one, even where the two have been studied in great depth ecologically, morphologically, and genetically in southern Arizona (see Patton and Dingman 1968; Patton 1973; Hoffmeister 1969, 1986). Indeed, the two species are known to hybridize, with sterile F_1 males and F_1 females of limited fertility. Patton (1973) and Hoffmeister (1986) record the following characters as diagnostic for the two species in southern Arizona, characters which generally hold throughout Sonora. Botta's pocket gopher is a moderate to large-sized *Thomomys* with a highly variable dorsal color but lacking a prominent medial black stripe; mammary glands arranged in two pectoral and two inquinal pairs in most females; long and straight baculm averaging over 10.5 mm; maxillo-frontal suture usually concave and usually reaching the lacrimal near its center. In contrast, the Southern pocket gopher is a small to medium-sized *Thomomys* with a pronounced dark dorsal stripe extending from the nose nearly to the base of the tail in most specimens, and with the color of the sides below the dark stripe with a somewhat irridescent or purplish hue; one pair of pectoral and two pairs of inguinal mammae in most females; a short and curved baculum, averaging 8.5 mm in length; and a maxillo-frontal suture usually straight or convex and intercepting the lacrimal somewhere on the medial half. Dunnigan (1967) notes similar means to distinguish between these two species in Sinaloa.

Genetic mapping of geographic units has not been accomplished for either species throughout most of their respective ranges in northwestern Mexico. A few samples of *T. bottae* collected along the entire length of the Baja California peninsula, as well as a few from northern and southern Sonora, were included in Patton and Smith's (1990) review of this species in the United States, a review which emphasized California populations. Also, genetic (protein electrophoretic) and chromosomal studies have been broadly accomplished for *T. umbrinus* from throughout its range (Hafner *et al.*, 1987). However, in neither case has the detailed geographic sampling, with adequate sample sizes, been attempted, yet such are clearly required both to establish the validity of local races and to assort them into regional geographic units that have phylogenetic meaning (see Smith and Patton 1988; Patton and Smith 1990, for examples).

In the review that follows, I have summarized the known ranges and characteristics of taxa of pocket gophers currently known from northwestern Mexico, based on the literature and several museum collections. In some cases, I have suggested nomenclatural changes, stemming from studies we have completed on adjacent samples from the United States (*e. g.*, Patton and Smith 1990). In other cases, I suggest where such changes will be made in the future upon appropriate analyses of existing materials and field collections from critical geographic areas. Simply based on my experience in the review of *Thomomys bottae* from California, which reduced the 46 prior subspecies to 15, it is very unlikely for example that the Baja California peninsula harbors 27 distinct races (*e. g.*, Huey 1945, 1964). Time and additional studies will determine how many races of *Thomomys* actually are present in Baja California, and the other Mexican states reviewed herein. Indeed, if this summary is to serve any major purpose, it is to rekindle interest in the systematics of these fascinating animals, and especially to rekindle an interest in collecting new series from other geographic localities, complete with chromosomal and other genetic data.

Species Accounts

Thomomys bottae (Eydoux and Gervais)

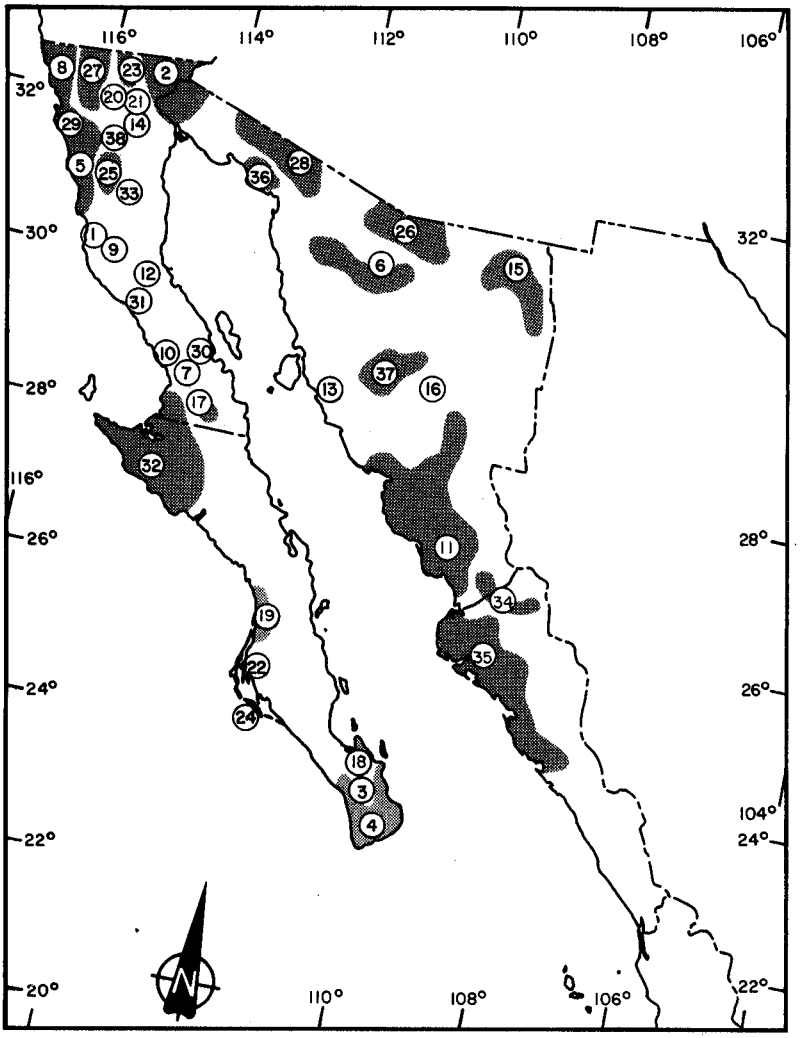
Botta's pocket gopher has an extremely broad geographic range, from southern Oregon to the tip of the Baja California peninsula on the west coast, eastward through the central Great Basin to the southern Rocky Mountains, southward throughout the interior deserts and desert mountain ranges of the Southwest, and into the lowlands of the northern Mexican states of Sonora, Sinaloa, Chihuahua, Coahuila, and Nuevo Leon. Across this broad range, the species may be found in virtually any patch of friable soil, from the rich and deep valley bottoms to shallow and rocky montane slopes and desert outwash areas. It ranges in elevation from below sea level in Death Valley National Park in California to above timberline in the Sierra Nevada, Rocky Mountains, and isolated desert ranges. Consequently, Botta's pocket gopher can be found associated with an extremely wide range of local vegetation types, from desertscrub to coniferous forests. However, as with other pocket gophers, it is a resident of open habitats (meadows, along stream sides, and so forth) where soils are sufficiently deep to maintain permanent burrow systems.

Given its broad geographic and ecologic range, it is not surprising that Botta's pocket gopher is one of the world's most variable small mammals in general aspects of body size and coloration, a fact exemplified by the large number of subspecies described. Individuals inhabiting deep and friable soils tend to be larger in body size than those occurring in more shallow and harder soils. Body size is often seen to vary with elevation, but the relationship may be one of increasing or decreasing size, where, again, the size variation probably relates to elevational variation in soil

depth and thus to habitat quality. Individuals range in dorsal color from dark blackish-brown through various shades of reddish and yellowish browns, pale grays and yellows, to nearly white. Ventral coloration usually mirrors that of the back, but patches of white on the throat, chest, and/or abdomen are not uncommon. The general coloration of a given population is closely tied to the color of the soil that is inhabited--animals in dark and humic soils are darkly colored, those in the pale sands of the deserts are similarly pale gray or near-white. Melanistic or albinistic individuals maybe common, particularly in smaller and more isolated populations.

The great degree of differentiation observed among populations of this species (and other pocket gophers as well) results only in part from the broad range occupied. Botta's pocket gopher, and all other gopher species as well, is also characterized by small local populations wherein both sexes occupy individually defended and mutually exclusive territories comprised of self-dug burrow systems. Male burrows tend to be be longer and more dendritic than those of females, such that each male system may contact those belonging to several females. Typically all adult females in a population will reproduce during the season while only relatively few males will. Competition between males for reproductive access to females is apparently high, as some males do not breed at all while others will sire litters from several adjacent females. As a consequence, the sex ratio of adult populations is typically skewed strongly in favor of females. This skew in sex ratio is particularly dramatic in populations where male body size is largest, and thus where the degree of sexual dimorphism is greatest. Litter size varies greatly geographically, but is usually at a modal number of 4 to 5, with a maximum size of 10 pups per pregnancy. However, litter size can vary significantly between local populations that differ extensively in habitat quality, as females in alfalfa fields in the California deserts have litter sizes averaging over 6 while those in adjacent desertscrub are only about 4. The gestation period is short, about 19 to 21 days; the young are born altricial with no hair and with the eyes closed. However, growth is rapid, and young are expelled from their mother's burrow by about 35 days of age. Dispersal is largely above ground, during the dark of the night, and young females have a greater chance of finding a place to settle and construct a burrow than do young males, particularly in dense populations. When the breeding season is three or more months long, females can and will breed the season of their birth wile males aparently do not reach reproductive maturity until the year following their birth. As a result, adult female body size becomes limited by their ascendancy into reproductive activity and males continue to grow for a more prolonged period.

The breeding season itself varies extensively in its timing, typically in relation to the availability of local resources. For example, breeding occurs from January through April in the low elevations of central and coastal California, following the onset of the winter rainy season and flush growth of green vegetation. This is a period adequate for a maximum of only two litters by a given female. At high elevation in the Sierra Nevada, however, breeding does not occur until after snow melt in the late spring, again coincidental with the spurt of green plant growth. The growing season at high elevations can probably accommodate only a single litter per female per season. However, there can be considerable plasticity in the breeding season length for a given female. In irrigated alfalfa fields in the California deserts, the breeding season will last from January or February through November (the time of actual irrigation) while adjacent desert populations breed only during the period of February to April. While the desert female will produce one litter per season, that female in the alfalfa field can potentially produce 3 to 5 litters. Thus, the length of the breeding season, the precocious breeding of juvenile females, the average litter size, and the eventual degree of adult sexual dimorphism all result from variation in general habitat quality among populations.



Geographic range of *Thomomys bottae*:

1. *T. b. abboti*
2. *T. b. albatus*
3. *T. b. alticolus*
4. *T. b. anitae*
5. *T. b. aphrastus*
6. *T. b. basilicae*
7. *T. b. borjasensis*
8. *T. b. bottae*
9. *T. b. brazierhowelli*
10. *T. b. cactophilus*
11. *T. b. camoae*
12. *T. b. catavinensis*
13. *T. b. convergens*
14. *T. b. cunicularis*
15. *T. b. divergens*
16. *T. b. estanciae*
17. *T. b. homorus*
18. *T. b. imitabilis*
19. *T. b. incomptus*
20. *T. b. jojobae*
21. *T. b. juarezensis*
22. *T. b. litoris*
23. *T. b. lucidus*
24. *T. b. magdalenae*
25. *T. b. martirensis*
26. *T. b. modicus*
27. *T. b. nigricans*
28. *T. b. phasma*
29. *T. b. proximarius*
30. *T. b. rhizophagus*
31. *T. b. ruricola*
32. *T. b. russeolus*
33. *T. b. siccovallis*
34. *T. b. simulus*
35. *T. b. sinaloe*
36. *T. b. vanrossemi*
37. *T. b. winthropi*
38. *T. b. xerophilus*

Junvenile individuals of both sexes are forced from their mother's burrow following weaning. Their dispersal distance is generally limited, with maximum distances recorded of less than one kilometer and average distances of less than 400 meters. However, extirpated populations are typically recolonized quickly, particularly in areas where gophers are generally common, suggesting that dispersal is a major means of colony formation. Mature adults occasionally move their territories, but this is rare; rather, once established, an adult will remain in its territory until death. Population density ranges from less than 5 adult individuals per hectare in remote desert regions to a maximum of some 80 adults in irrigated alfalfa fields. Maximum longevity is less than three years for females and typically less than two years for males; somewhat more than 50 percent of any given population may completely turnover each year. Only about 15 to 20 percent of young born each season survive to breed in the following one. Young are commonly taken by predators during their over-ground dispersal, and both young and adults will be taken as they push excavated dirt from the entrance to their burrows. Common predators are raptors and owls, a variety of snakes, and mammalian carnivores, especially weasels, badgers, bobcats, and coyotes. While Botta's pocket gopher is still considered a major agricultural pest through most of its range, this species is also an extremely important and positive agent in soil aeration and production.

On a geographic scale, Botta's pocket gopher has been characterized by a matrix of population structures. Some are considered to have a high potential for gene flow, as among local populations in areas where animals are relatively uniformly distributed across geography; others form small isolated islands in areas where local populations are limited to patches of available habitat otherwise surrounded by inhospitable lands. The degree of differentiation between and thus evolutionary potential of these two extreme population types has been considered of importance in explaining the very high level of diversity recognized for Botta's pocket gopher, and other species of gophers as well (see review in Patton and Smith 1989; 1990; Patton 1990).

Subspecies: Geographic distributions of each recognized subspecies are given in the accompanging map. Specimens are listed by locality from a few museum collections, as follows: MVZ = Museum of Vertebrate Zoology, University of California; KU = University of Kansas; and USNM = Division of Mammals, National Museum of Natural History, Smithsonian Institution. Specimens recorded in the literature are cited by that reference. Measurements are in millimeters; unless otherwise noted, all measurements reported are from specimens in the MVZ collections.

Thomomys bottae abbotti Huey

1828. *Thomomys bottae abbotti* Huey, Trans. San Diego Soc. Nat. Hist., 5:89-90.

Type locality. "1 mile east of El Rosario, Lower California 30°03' LN, 115°48' LW [Baja California].

Range. Known only from the river bottom association at the type locality and to the southeast at San Fernando Mission. Huey (1945) suggests that the range will eventually be found on the coast south of El Rosario.

Description. A large bodied pocket gopher, distinctly pale ochraceous brown in dorsal coloration, lacking any darkening along the dorsal line of the back and rump, with a heavy skull, proportionately long rostrum, and wide zygomatic arches.

Selected measurements. Of the type (Huey 1928) are: total length, 250; tail length, 78; hind foot length, 31; ear lenght, 5; greatest skull length, 43.8; zygomatic breadth, 27.0; interorbital constriction, 6.1; nasal length, 15.2; maxillary toothrow length, 9.8.

Remarks. Most similar to *martirensis* of the higher elevations of the Sierra San Pedro Mártir, but generally paler in color.

Thomomys bottae albatus Grinnell

1912. *Thomomys albatus* Grinnell, Univ. Calif. Publ. Zool., 10:172.

1933. *Thomomys bottae albatus*, Grinnell, Univ. Calif. Publ. Zool., 40:1430.

Type locality. "west side Colorado River at old Hanlon Ranch, near Pilot Knob, Imperial Co., California."

Range. Colorado Desert of southeastern California and northeastern Baja California Norte, including the southern Coachella Valley, Imperial Valley, and lower Colorado River Valley. In northern Baja California, this subspecies is common in the irrigated section below the International Boundary to El Major, east to the delta of the Colorado River, and west to the eastern base of the Cocopah Mountain Range (see Grinnell and Hill 1936; Huey 1945, 1964).

Recorded localities. *BAJA CALIFORNIA*: (1) Alamo River, 20 mi SW Pilot Knob, 50 ft (MVZ); (2) 5 mi E Cerro Prieto, 30 ft (MVZ); (3) 7 mi E Cerro Prieto, 30 ft (MVZ); (4) eastside Heading-Imperial Canal, 11 mi E Mexicali (MVZ); (5) 20 mi E Mexicali (Huey 1945); (6) Colorado River, 20 mi S Pilot Knob (MVZ). Localities in Sonora include: (1) Colorado River, 20 mi S International Boundary (recorded as *phasma* in Burt 1938).

Description. One of the larest-bodied and palest forms of *T. bottae, albatus* is characterized by proportionately longer, broader, and deeper skulls than its geographically adjacent relatives to the west (*nigricans*) and northwest (*pallescens*).

Selected measurements. Ranges of character means for samples from southeastern California (from Patton and Smith 1990): Total length, 224.4-247.2; tail length, 70.8-83.3; hind foot length, 31.5-33.8; greatest skull length, 39.3-42.4; zygomatic breadth, 23.9-26.4; mastoid breadth, 20.4-22.1; interorbital constriction, 6.7-6.8; nasal length, 13.4-14.8; maxillary toothrow length, 8.2-8.9.

Remarks. This form clearly intergrades with the subspecies *pallescens* through the Coachella Valley of California, but it is not known to contact the ranges of *riparius* to the north through the Pichaco Narrows along the Colorado River or any of those subspecies to the south and southwest in northern Baja California Norte. This is the only member of the Basin and Range Geographic Genetic Group west of the Colorado River, as recognized by Patton and Smith (1990) based on protein electromorphic characters.

Thomomys bottae alticolus J. A. Allen

1899. *Thomomys fulvus alticolus* Allen, J. A. Bull. Amer. Mus. Nat. Hist., 12:13.

1915. *Thomomys bottae alticolus*, Bailey, V. N. Amer. Fauna, 39:34.

Type locality. "Sierra Laguna, 7000 feet, Lower California" [Baja California Sur].

Range. Known only from the higher elevations of the Victoria Mountains in the Cape region of Baja California Sur.

Recorded localities. (1) El Sauce, Victoria Mts, 4000 ft (MVZ); (2) Laguna Valley, Victoria Mts., 6000 ft (MVZ); 7 mi NW San Bartolo (Huey 1945).

Description. A small, dark race, reddish-brown to orangish-brown in dorsal color, darker and less fulvous than anitae from the Cape region to the south; incisors orthodont.

Selected measurements. Total length, 186-216; tail length, 56-77; hind foot length, 28-32; greatest skull length, 34.0-40.2; zygomatic breadth, 21.3-23.9; mastoid breadth, 18.8-19.6; interorbital constriction, 6.3-6.5; nasal length, 11.7-14.5; maxillary toothrow length, 7.4-8.3.

Remarks. Huey's (1945) assignment of specimens from northwest of San Bartolo to this subspecies was admittedly arbitrary, as he did not have material of true *alticolus* for comparison. Based on specimens in the MVZ collections, this race is quite distinct from the adjacent races in the lowlands to the north, east, and south.

Thomomys bottae anitae J. A. Allen

1898. *Thomomys bottae anitae* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 10:146.

Type locality. "Santa Anita, Lower California" [Baja California Sur].

Range. Known from the lower elevations along the eastern and southern coast of the Cape region of Baja California Sur south of the Magdalena Plain.

Recorded localities. (1) San José del Cabo (MVZ; Huey 1945); (2) Los Barrilos (Huey 1945); (3) Eureka (MVZ); (4) La Laguna (MVZ); (5) 6 mi N San José del Cabo (MVZ); (6) San Lucas, at Cape (MVZ); (7) 6 km N & 10 km E Santiago, 60 m (MVZ); (8) Todos Santos (MVZ); and (9) 5 km W El Triunfo, 380 m (MVZ); Miraflores (KU).

Description. A moderate-sized pocket gopher, this race has a strong yellowish-brown dorsal color with slightly darker mid-back; the skull is remarkable for its straight nasals.

Selected measurements. Total length, 195-235; tail length, 61-75; hind foot length, 28-35; greatest skull length, 42.0; zygomatic breadth, 26.5; mastoid breadth, 21.0; interorbital constriction, 8.0; nasal length, 14.6; and maxillary toothrow length, 7.5-8.2.

Remarks. Samples of this race combine with those of *cactophilus, russeolus*, and *litoris* to form a very uniform geographic unit based on protein electromorphic characters, well differentiated from samples of northern Baja California (*xerophilus*) and southwestern California (*bottae* and *nigricans;* see Patton and Smith 1990).

Thomomys bottae aphrastus Elliot

1903. *Thomomys bottae aphrastus* Elliot, Field Columbia Mus., Publ. 79, Zool. ser., 3:219.

Type locality. "San [=Santo] Tomás, Lower California" [Baja California].

Range. From Santo Tomás in the Santo Tomás Valley east to the extreme western end of El Valle de la Trinidad, south along the foothills of the Sierra San Pedro Mártir. This race reaches the coast at Johnson's Ranch and covers the coastal plain to below San Quintín.

Recorded localities. (1) El Valle de la Trinidad (MVZ; Huey 1945); (2) Las Cabras (Huey 1945); (3) Santo Domingo (MVZ; Huey 1945); (4) Valladeros (MVZ); (5) Aguaje del Sauce, 2600 ft, 6 mi NW Valladores (MVZ); (6) Arroyo Nuevo York, 200 ft, 15 mi S Santo Domingo (MVZ); (7) Colnett, lat. 21° (MVZ); (8) San José, 2500 ft (MVZ); (9) San Ramon, mouth of Santo Domingo River (MVZ); (10) San Telmo, 600 ft (MVZ); (11) Socorro (MVZ).

Description. A moderately small race with reddish-brown dorsal coloration and bright sides similar to that of *nigricans* to the north. The skull is lightly bones with weak-angled, fragile, and parallel zygomatic arches, lacking even the almost square flared typical of nigricans, but the upper incisors are weakly procumbent as in *nigricans*.

Selected measurements. Total length, 222; tail length, 69; hind foot length, 29; ear length, 7.5; greatest skull length, 38.0; zygomatic breadth, 25.0; interorbital width, 6.0; nasal length, 12.5; maxillary toothrow length, 7.5.

Remarks. Placed in synonymy with *T. b. nigricans* by Bailey (1915), but resurrected by Huey (1945) who admits that it differs only minimally in color and in size from that more northern subspecies. I suspect that future studies will show that *aphrastus* does indeed form a clinal relationship with *nigricans* and probably does not deserve separate status.

Thomomys bottae basilicae Benson and Tillotson

1940. *Thomomys bottae basilicae* Benson and Tillotson, Proc. Biol. Soc. Washington, 53:93 (renaming of *T. b. occipitalis,* Benson and Tillotson, 1939, Proc. Biol. Soc. Wash., 52:151).

Type locality. "La Misión, 2 miles west of Magdalena, Sonora."

Range. Central Rio Magdalena, from northwest of Caborca to type locality.

Recorded localities. (1) 16.7 mi N Caborca, 450 ft (MVZ); (2) 1 mi E Caborca, 925 ft (MVZ); (3) 1 mi S Altar, 900 ft (MVZ); (4) 1 mi SW Magdalena, 2500 ft (KU).

Description. A medium-sized dark-colored race of *Thomomys bottae* characterized by relatively great extensions of the supraoccipital region posterior to the lamdoidal crest. Dorsal color ochraceous-buff with gray based hairs; sides lighter but of same general color.

Selected measurements. Total length, 220-257; tail length, 64-93; hind foot length, 29-33; ear lenght, 6-7; greatest skull length, 41.1-42.7; zygomatic breadth, 25.1-27.0; mastoid breadth, 20.9-21.3; interorbital constriction, 6.7-6.8; nasal length, 14.2-14.8; maxillary toothrow length, 8.5-9.0.

Remarks. I see little difference between the type series of *basilicae* and the large series of *modicus* from the Santa Cruz River Valley near Nogales and north into Arizona, other than slight differences in color and body size noted by Benson and Tillotson (1939). I suspect that future studies may prove these to be synomymous.

Thomomys bottae borjasensis Huey

1945. *Thomomys bottae borjasensis* Huey, Trans. San Diego Soc. Nat. Hist., 10:262.

Type locality. "San Borjas Mission, Baja California, 28°52' LW, 113°53' LN."

Range. Known only from the type locality.

Descrpition. A brownish animal, with less buff and more gray than the brownish-color gophers along the northwestern Pacific coast and foothills, borjasensis has a narrow rostru, squarer and more angular zygomatic arches, shoter and more rounded braincase, and more rounded bullae. Its brownish color contrasts sharply with the pallid coloration of *russeolus,* which occurs to the immediate south.

Selected measurements Of the type (Huey, 1945) are: total length, 210; tail length, 65; hind foot length, 26; ear length, 5; greatest skull length, 35.7; zygomatic breadth, 21.8; interorbital constriction, 6.3; nasal length, 12.4; maxillary toothrow length, 6.6.

Remarks. Huey (1945) considered *catcophilus,* distributed to the northwest, to be the closest relative of *borjasensis,* and otherwise belonging to the "...chain of brownish colored gophers" that occur from the California border to San Borjas Mission along the Pacific coast and inland in the foothills and mountain tops of the northern peninsular ranges.

Thomomys bottae bottae (Eydoux and Gervais)

1836. *Thomomys bottae* Eydoux and Gervais, Magasin de Zoologie, Paris, 6:23-24.

Type locality. "coast of California" (restricted to the vicinity of Monterey by Baird, 1856, Proc. Acad. Nat. Sci., Philadelphia 7:335).

Range. Central and southern coastal California and northwestern coastal Baja California Norte, generally from the San Francisco Bay south to Ensenada, east through the lower San Joaquin Valley, through the mountains surrounding the southern end of the San Joaquin Valley to the Tehachapi and Piute mountains at the southern end of the Sierra Nevada, and east to the western edge of Owens Lake and the Coso, Argus, and Panamint mountains; through the Transverse Ranges; through the Los Angeles Basin; and south on the coastal plain to at least Ensenada in northwestern Baja California Norte.

Recorded localities. *BAJA CALIFORNIA*: (1) 5 mi S Monument 258 (Huey 1945); (2) Guatay (about 25 mi N Ensenada (Huey 1945); (3) N coast Punta Banda, 7.5 mi W Maneadero (MVZ).

Description. A moderate to large-sized pocket gopher with a moderate to quite dark brown dorsal coloration, this subspecies possesses a robust skull with a proportionately short and broad rostrum, long tooth-row and small bullae. Complete description and analysis given in Patton and Smith (1990:112-114).

Selected measurements. Ranges of character means for samples from San Diego Co., California (from Patton and Smith 1990). Total length, 204.2-233.0; tail length, 62.3-71.5; hind foot length, 27.3-29.5; greatest skull length, 36.3-40.9; zygomatic breadth, 22.2-24.1; mastoid breadth, 18.6-20.7; interorbital constriction, 5.9-6.0; nasal length, 11.8-14.3; maxillary toothrow length, 8.3-8.6.

Remarks. Includes *sanctidiegi* Huey (1945:258-259) according to Patton and Smith (1990). The transition between *bottae* and *nigricans,* the subspecies to the immediate east in the western foothills of the Peninsular Ranges in southern California and adjacent Baja California is sharp, particularly in an abrupt shift to a smaller bodied animal and change in color from dark brownish black to reddish brown.

Thomomys bottae brazierhowelli Huey

1960. *Thomomys umbrinus brazierhowelli* Huey, Trans. San Diego Soc. Nat. Hist., 12:407.

1996. *Thomomys bottae brazierhowelli,* Ramírez-Pulido *et al.* Occas. Papers, The museum, Texas Tech Univ., 158:38.

Type locality. "San Fernando Mission, Baja California, lat. 30°."

Range. Known only from the type locality and eastward over the alluvial silt soils of Llano de San Agustín.

Recorded localities. *BAJA CALIFORNIA*: (1) Mission San Fernando, 1750 feet (MVZ); (2) San Fernando, 1100 feet (MVZ).

Description. A moderate-sized to large, dark, full tawny colored pocket gopher with a darker median dorsal stripe and face; skull angular and rugose, with wider and square zygomatic arches and rounded and inflated auditory bullae.

Selected measurements. Of the type (Huey, 1960): Total length, 235; tail length, 76; hind foot length, 33; ear length, 5; greatest skull length, 40.2; zygomatic breadth, 25.9; interorbital constriction, 7.0; nasal length, 14.3; maxillary toothrow length, 8.2.

Remarks. Most similar in color to *abbotti* to the immediate northwest, and likely to prove to be a synonym of this race with further analyses.

Thomomys bottae cactophilus Huey

1929. *Thomomys bottae cactophilus* Huey, Trans. San Diego Soc. Nat. Hist., 5:241.

Type locality. "Punta Prieta, Lower California, 28°56' LW, 114°12' LN" [Baja California].

Range. Known only from the type locality and from the area near the Pacific coast at Santa Rosalía Bay.

Recorded localities. *BAJA CALIFORNIA*: (1) Santa Rosalia Bay (Huey 1945); (2) 4.5 km S & 14 km W El Rosarito, 1 m (MVZ); (3) Santo Dominguito, 15.1 mi S Punta Prieta (MVZ); (4) 16 km S & 5 km W Punta Prieta (MVZ).

Description. A very small, pale yellowish-brown colored race with very small subauricular dark patches and a small, gracile skull.

Selected measurements. Total length, 173-219; tail length, 57-69; hind foot length, 25-29; ear length, 4-7; greatest skull length, 31.1-38.3; zygomatic breadth, 18.3-24.0; mastoid breadth, 16.6-20.5; interorbital constriction, 6.0-6.1; nasal length, 9.5-13.1; maxillary toothrow length, 6.8-8.0.

Remarks. Huey (1929) considered this race to be a connecting link between *abbotti* and *russeolus*. See remarks under *catavinensis,* below.

Thomomys bottae camoae Burt

1937. *Thomomys bottae camoae* Burt, Occas. Papers Mus. Zool. Univ. Michigan, 344:1.

Type locality. "Camoa [Río Mayo], Sonora."

Range. Basins of the lower Rio Yaqui and Rio Mayo and the coastal plain of southern Sonora.

Recorded localities. *SONORA*: (1) 1.7 mi E Soyopa, Rio Yaqui (MVZ); (2) Presa Obregón, Rio Yaqui, 150 ft (KU); (3) San José de Guaymas (Burt 1937); (4) 0.5 mi SE San José de Guaymas (KU) (5) Tésia (Burt 1937); (6) north side Rio Mayo, 6 mi W Camoa (MVZ); (7) Rio Mayo, Navojoa (MVZ).

Description. Large bodied, yellowish-brown to orangish-brown pocket gopher with distinctly narrow rostrum.

Selected measurements. Total length, 224-281; tail length, 70-95; hind foot length, 30-36; ear length, 6-7; greatest skull length, 41.4-47.2; zygomatic breadth, 25.6-30.2; mastoid breadth, 21.7-23.7; interorbital constriction, 6.6-7.1; nasal length, 13.9-16.1; and maxillary toothrow length, 8.9-9.2.

Remarks. This subspecies is one of the more unique geographic units of T. bottae, as defined by electromorphic genetic analyses (see Patton and Smith 1990), as it representes one of six major geographic units defined by these characters. However, since only one population was examined in this study, it is not possible to determine the extent of this geographically differentiated unit.

Thomomys bottae catavinensis Huey

1931. *Thomomys bottae catavinensis* Huey, Trans. San Diego Soc. Nat. Hist., 7:45.

Type locality. "Cataviña, Lower California, 29°54' LN, 114°57' LW" [Baja California].

Range. Known only from the palm-filled valley at the type locality; according to Huey (1945) may well extend both east and west of Cataviña but only limitedly.

Description. According to Huey (1931), *catavinensis* is like *cactophilus* in size, which it most nearly resembles, but in color is grayer with an ashy cast rather than with the buffy ochraceous of *cactophilus;* smaller and grayer than *abbotti.* It most distinctive character is its color. Cranially, *catavinensis* has a more rounded brain case than *cactophilus* and is lighter in structure and smaller in size than that of *abbotti.*

Selected measurements. No measurements given in original description.

Remarks. The characters given by Huey (1931) to distinguish *catavinensis* from both *cactophilus* and *abbotti* are of the type that characterize local populations rather than geographic regional units. I suspect that further specimens and more comprehensive analyses will show that these three form a graded series which cannot readily be divisible into separate entities as the current names imply. If this proves to be the case, the older name (*cactophilus*) would apply.

Thomomys bottae convergens Nelson and Goldman

1934. *Thomomys bottae convergens* Nelson and Goldman, Jour. Mamm., 15:123.

Type locality. "Costa Rica Ranch, delta of Sonora River, southwest of Hermosillo, Sonora."

Range. Low desert plains at the mouth of the Rio Sonora.

Recorded localities. *SONORA*: (1) 2.5 mi SE Rancho de Costa Rica, 200 ft (MVZ).

Description. A large, rather light-colored pocket gopher, similar to *winthropi* from the central Rio Sonora, but paler, more buffy, and less heavily mixed with black; skull similar to that of *winthropi* but rostrum narrower, zygomata narrower with sides distinctly converging anteriorly.

Selected measurements. Total length, 219-247; tail length, 71-87; hind foot length, 28-32; ear length, 6-7; greatest skull length, 37.8-44.2; zygomatic breadth, 23.3-26.8; mastoid breadth, 19.5-22.8; interorbital constriction, 6.9-7.0; nasal length, 11.8-14.3; maxillary toothrow length, 7.8-8.7.

Remarks. Probably a synonym of *winthropi*, which occurs in the central section of the Rio Sonora.

Thomomys bottae cunicularius Huey

1945. *Thomomys bottae cunicularius* Huey, Trans. San Diego. Soc. Nat. Hist., 10:252-253.

Type locality. "Los Palmitos (western end of Pettie Basin), on the southeastern base of the Sierra Juarez (desert slope), 31°44' LN, 115°36' LW, Baja California."

Range. Known only from the type locality.

Description. Gray, with buffy suffusion on the sides, lacking the pale coloration of forms from the Colorado Desert to the northeast (*lucidus* and *albatus*), suggesting relationships with the darker subspecies to the west along the Pacific coast (*bottae, nigricans, juarezensis*). This race is smaller in body and cranial size that those races either to the west or northeast.

Selected measurements Of the type (Huey, 1945) are: total length, 215; tail length, 68; hind foot length, 28; ear length, 4; greatest skull length, 38.4; zygomatic breadth, 22.7; interorbital constriction, 5.6; nasal length, 13.3; maxillary toothrow length, 8.0.

Remarks. Known only from three specimens from the type locality, *cunicularius* is probably another of those ephemeral populations characteristic of desert ranges; future studies, including

additional collection, are likely to demonstrate that this race is a synonym for one of those to the west.

Thomomys bottae divergens Nelson and Goldman

1934. *Thomomys bottae divergens* Nelson and Goldman, Jour. Mamm., 15:122-123.

Type locality. "Four miles west of Huachinera, Bavispe River, northeastern Sonora (altitude about 4000 feet)."

Range. Upper Rio Bavispe in the vicinity of Huachinera north along the Rio Bavispe to south of Esqueda.

Recorded localities. *SONORA*: (1) Rio Bavispe, 1 mi N Huachinera (MVZ); (2) Rio Bavispe, 11 mi N Huachinera (MVZ); (3) Bacerac (Nelson and Goldman 1934); (4) Rio Bavispe, 8 mi N Colonia Oaxaca (MVZ); (5) 13.3 mi S Esqueda (MVZ).

Description. A large, rather dark orangish-brown pocket gopher, with upper parts somewhat cinnamon and heavily mixed with black over mid-back; skull large, less angular with broad nasals and small bullae.

Selected measurements. Total length, 219-238; tail length, 69-86; hing foot length, 27-33; ear length, 6-7; greatest skull length, 38.2-39.8; zygomatic breadth, 23.1-23.4; mastoid breadth, 19.7-19.8; interorbital constriction, 6.6-6.7; nasal length, 12.4-13.5; maxillary toothrow length, 7.7-7.9.

Remarks. Considered closely allied to *modicus* to the northwest and to *winthropi* to the southwest.

Thomomys bottae estanciae Benson and Tillotson

1939. *Thomomys bottae estanciae* Benson and Tillotson, Proc. Biol. Soc. Wash., 52:152-153.

Type locality. "La Estancia, 6 miles north of Nacori, Sonora."

Range. Known only from the type locality. Specimens from Matape in the University of Kansas collections are probably of this subspecies, but I have not examined them.

Description. A medium-sized, cinnamon to reddish colored race characterized by a relatively narrow occipital region, broad interorbital region, and wide-spreading zygomatic arches. Generally paler that all other subspecies of *T. bottae* from Sonora.

Selected measurements. Total length, 208-249; tail length, 66-76; hind foot length, 29-32; ear length, 7-9; greatest skull length, 37.5-43.3; zygomatic breadth, 23.9-26.8; mastoid breadth, 19.2-22.7; interorbital constriction, 6.7-6.9; nasal length, 12.2-14.2; maxillary toothrow length, 8.1-9.1.

Thomomys bottae homorus Huey

1949. *Thomomys bottae homorus* Huey, Trans. San Diego Soc. Nat. Hist., 11:55.

Type locality. "1 mile east of Rancho Lagunitas, Baja California, 28°20' LN, 113°15' LW."

Range. Hilly sections of extreme northeastern Viscaino Desert, from vicinity of Calmallí (1200 feet) eastward to the summit of the Peninsular backbone near the type locality (about 1900 feet).

Recorded localities. *BAJA CALIFORNIA*: (1) Calmallí (Huey 1949); (2) Rancho Union, 15 mi E Calmallí (Huey 1949); (3) Arroyo San Luis, 8 mi W Calmallí, 800 ft (MVZ); (4) Rancho Lagunitas (Huey 1949).

Description. Somewhat darker in color than *russeolus,* the geographically nearest race, with a tinge of brownish; a narrow skull with round, elongated braincase; less procumbent incisors; uninflated auditory bullae.

Selected measurements. Of the type (Huey, 1949) are: total length, 227; tail length, 73; hind foot length, 30; ear length, 5; greatest skull length, 38.5; zygomatic breadth, 23.2; interorbital constriction, 6.4; nasal length, 12.9; maxillary toothrow length, 8.1.

Remarks. Huey (1949) considers that this race belongs to "...the gray-colored races usually found in more arid desert sections..."

Thomomys bottae imitabilis Goldman

1939. *Thomomys bottae imitabilis* Goldman, Proc. Biol. Soc. Wash., 52:30-31.

Type locality. "La Paz, southern Lower California" [=Baja California Sur].

Range. Known only from the type locality.

Description. Smaller, with duller and less rufescent color than neighboring and related *anitae;* skull short, with relatively broad rostrum. Similar to *incomptus* of the Madgalena Plain, but smaller and general coloration more cinnamon.

Selected measurements. From Goldman (1939) are: total length, 208-234; tail length, 71-82; hind foot length, 28-32; greatest skull length, 35.7-39.0; zygomatic breadth, 21.8-24.5; mastoid breadth, 18.5-20.4; interorbital constriction, 6.4-6.6; nasal length, 11.5-12.8; maxillary toothrow length, 7.5-8.5.

Remarks. Differs only slightly from nearby *anitae* in color but is closer to adjacent *alticolus* in cranial characters. Probably all three of these races are consubspecific.

Thomomys bottae incomptus Goldman

1939. *Thomomys bottae incomptus* Goldman, Proc. Biol. Soc. Wash., 52:29-30.

Type locality. "San Jorge, near Pacific coast west of Pozo Grande and about 25 miles southwest of Comondú, southern Lower California (altitude 50 feet)" [Baja California Sur].

Range. Magdalena Plain from the type locality south at least to Matancita, near Soledad.

Recorded localities. *BAJA CALIFORNIA SUR*: (1) Matancita (Goldman 1939); (2) Santo Domingo (Huey 1945); (3) San Gregorio Ranch, northwest of La Purisima (MVZ).

Description. Larger than *anitae* to the south, with dorsal color near pinkish buff rather than cinnamon; skull also like that of *anitae*, but larger and lighter in structure with more procumbent upper incisors and more inflated auditory bullae.

Selected measurements. From Goldman (1939) are: total length, 224-247; tail length 75-81; hind foot length, 30-34; greatest skull length, 41.1-43.9; zygomatic breadth, 22.2-27.5; mastoid breadth, 20.6-21.6; interorbital constriction, 6.2-7.0; nasal length, 13.0-14.0; maxillary toothrow length, 8.1-8.5.

Remarks. Considered most similar to, and probably intergrading with, *russeolus* of the Viscaino Desert to the north, although decidedly larger in size and darker in color.

Thomomys bottae jojobae Huey

1945. *Thomomys bottae jojobae* Huey, Trans. San Diego Soc. Nat. Hist., 10:256-257.

Type locality. "Sange de Cristo, Baja California, 35° 52'LN, 116° 06' LW."

Range. Known only from the western foothills of the Sierra Juárez in the Valle de San Rafael.

Description. According to Huey (1945), *jojobae* can be distinguished from *juarezensis,* which occupies the pine forest in the mountains directly to the east, by its smaller size and brighter dorsal and ventral color. Cranially, *jojobae* has a more fragilely boned skull, with a more slender rostrum and smaller incisors. From *nigricans*, the range of *nigricans* which lies to the northwest, *jojobae* is paler and more buffy in color all over, with a ligher and more fragile skull.

Selected measurements Of the tye (Huey, 1945) are: total length, 218; tail length, 65; hind foot length, 26; ear length, 4; greatest skull length, 37.7; zygomatic breadth, 21.5; interorbital constriction, 6.2; nasal length, 13.0; maxillary toothrow length, 8.0.

Remarks. As with *juarezensis* (below), I suspect that the *jojobae* will be shown to be a simple extension of *nigricans* when additional materials and more thorough analyses are completed. The characters given in the original description only underscore general differences that can be observed between any small series of pocket gophers from throughout the general region from southern California and northwestern Baja California west of the crest of the Peninsular Ranges, Sierra Juárez, and Sierra San Pedro Mártir (see Patton and Smith 1990).

Thomomys bottae juarezensis Huey

1945. *Thomomys bottae juarezensis* Huey, Trans San Diego Soc. Nat. Hist., 10:255-256.

Type locality. "Laguna Hanson, Sierra Juárez, Baja California Norte."

Range. Known only from the forested summit of the Sierra Juárez.

Recorded localities. *BAJA CALIFORNIA*: (1) El Rayo (Huey 1945); (2) Los Pozos, 4200 ft, Sierra Juárez (MVZ).

Description. In the description of this taxon, Huey considered *juarezensis* to be most similar to the nearby *T. b. nigricans,* which occurs at lower elevation in the oak belt as opposed to the pine forest. It is said to lack the fulvous sides and have a more grayish tone, tending toward black. Cranially, it has a more rounded skull with more inflated bullae, broader interorbital region and heavier and broader rostrum.

Selected measurements. Total length, 190-225; tail length, 55-65; hind foot length, 25-29; greatest skull length, 36.3-40.5; zygomatic breadth, 21.4-24.7; mastoid breadth, 17.9-20.2; interorbital constriction, 5.8-6.4; nasal length, 12.4-14.6; maxillary toothrow length, 7.9-8.1.

Remarks. The difference between this subspecies and *nigricans* appears to me to be on the same order as between *nigricans* and *jacinteus*, described by Grinnell and Swarth (1914) from the pine forests atop the San Jacinto Mountains in southern California. Patton and Smith (1990), however, showed that *jacinteus* is best considered a junior synonym of *nigricans*, and I suspect that further studies will indicate that *juarezensis* is as well.

Thomomys bottae litoris Burt

1940. *Thomomys bottae litoris* Burt, Occas. Papers Mus. Zool. Univ. Michigan, 424:1.

Type locality. "Stearns Point, Magdalena Bay (west side), Lower California" [Baja California Sur].

Range. Known only from the type locality. All specimens trapped on a single day from the narrow sand point on east side of Magdalena Bay, where mounds were numerous over the entire point.

Description. Upper parts "avellaneous", or sayal brown, slightly darkened on the mid-dorsum, paler on the sides, and merging to pinkish buff ventrally; distinct black patch surrounding ear pinnae; skull angular, upper incisors orthodont. Smaller and distinctly darker (less yellowish) than *magdalenae;* slightly smaller in size with more angular skull and orthodont as opposed to procumbent incisors relative to *incomptus*.

Selected measurements From Burt (1938) are: total length, 196-242; tail length, 66-83; hind foot length, 29-33; ear length, 6-7.5; greatest skull length, 37.5-41.5; zygomatic breadth, 22.0-26.9; mastoid breadth, 18.8-21.9; interorbital constriction, 6.1-6.7; nasal length, 12.5-14.3; maxillary tooth row length, 8.0-8.4.

Thomomys bottae lucidus Hall

1932. *Thomomys bottae lucidus* Hall, Proc. Biol. Soc. Wash., 45:67.

Type locality. "Las Palmas Canyon, 200 feet altitude, west side of Laguna Salada (north of 32° N latitude), Lower California", [=2 miles east of Gaskill's Tanks, Baja California].

Range. Known only from two localities in mesquite association on the west side of Laguna Salada.

Recorded localities. *BAJA CALIFORNIA*: (1) 6 mi S & 3.5 mi E Mt. Springs [Imperial Co., California], in Mexico (MVZ).

Description. Color very pale yellowish buff above and white below; size very small; skull with inflated and rounded bullae. Paler and smaller than *albatus* to the north and east, but otherwize similar.

Selected measurements. Total length, 187-210; tail length, 62-76; hind foot length, 28-31; ear length, 3-4; greatest skull length, 34.5-36.4; zygomatic breadth, 20.8-20.9; mastoid breadth, 18.3-18.5; interorbital constriction, 6.4-6.6; nasal length, 10.7-11.7; maxillary toothrow length, 7.9-8.2.

Remarks. The habitat and geographic area of this race is contiguous with that of *albatus* in the Colorado Desert to the north in southeastern California and the delta of the Colorado River to the east. Grinnell and Hill (1936) question the validity of *lucidus*. Huey (1945:252) considered this "...race to be one of those pioneer colonies confined to an extremely limited area", suggesting that this is an ephemeral population like that of many desert regions (see Patton and Smith 1990).

Thomomys bottae magdalenae Nelson and Goldman

1909. *Thomomys magdalenae* Nelson and Goldman, Proc. Biol. Soc. Wash., 22:24-25.

1945. *Thomomys bottae magdalenae*, Huey, Trans. San Diego Soc. Nat. Hist., 10:264.

Type locality. "Magdalena Island, Lower California," [Baja alifornia Sur].

Range. Known only from the type locality of Magdalena Island. Specimens from nearby Mangrove Island, Magdalena Bay, in the MVZ collections are herein allocated to this subspecies. These are paler than *anitae* on the adjacent mainland and closer in color and size to that described for *magdalenae*.

Description. Similar to *anitae* but much paler, more buffy; skull larger, more massive and much more angular. Closest to *russeolus* in color.

Selected measurements. Of the type (Nelson and Goldman 1909) are: total length, 225; tail length, 87; hind foot length, 36; basilar length of skull, 38.4; zygomatic breadth, 29.1; maxillary toothrow length, 8.9.

Remarks. It is probably best to consider *incomptus* and *litoris* as synonyms of *magdalenae*, as the degree of color difference is well within normal geographic variation.

Thomomys bottae martirensis J. A. Allen

1898. *Thomomys umbrinus martirensis* Allen, J. A. Bull. Amer. Mus. Nat. Hist., 10:147.
1945. *Thomomys bottae martirensis*, Huey, Trans. San Diego Soc. Nat. Hist., 10:257.

Type locality. "San Pedro Mártir Mountains (alt. 8200 feet), Baja California, Mexico" [=La Grulla Meadow, Sirra San Pedro Martir, 7400 feet, Baja California].

Range. Known from the higher elevation pine forests of the Sierra San Pedro Mártir.

Recorded localities. *BAJA CALIFORNIA*: (1) Valladares Creek, Sierra San Pedro Mártir (Huey 1945); (2) Vallecitos, 8500 ft (MVZ); (3) Concepción, 6000 ft (MVZ).

Description. A moderate to large-bodied, dull grayish brown race, varied with blackish above with suffusion of pale fulvous on the sides and a blackish ear patch; skull heavy and angular.

Selected measurements. Total length, 190-240; tail length, 55-68; hind foot length, 28-33; greatest skull length, 35.3-42.2; zygomatic breadth, 20.5-24.2; mastoid breadth, 17.0-21.1; interorbital constriction, 5.8-6.4; nasal length, 12.4-15.3; maxillary toothrow length, 7.3-8.8.

Remarks. Future studies will probably note that this subspecies, along with *aphrastus, jojobae* and *juarezensis*, is a synonym of *nigricans*, which occurs at lower elevations on the west slope of the Peninsular ranges from southern California into northwestern Baja California (see accounts of those subspecies, above).

Thomomys bottae modicus Goldman

1931. *Thomomys fulvus modicus* Goldman. Jour. Washington Acad. Sci., 21:418.
1934. *Thomomys bottae modicus*, Nelson and Goldman, Jour. Mamm., 15:122.

Type locality. "La Osa, southern end of Altar Valley, Pima Co., Arizona."

Range. Santa Cruz River Basin and tributaries, from San Rafael Valley in Santa Cruz Co. south through north-central Sonora and hence north again through Nogales to Tucson (see Hoffmeister 1986).

Recorded localities. *SONORA*: (1) Cerro Blanco (Burt 1938); (2) 23 mi S & 5 mi E Nogales (KU); (3) 35 mi NW Magdalena (Burt 1938); (4) 5 mi E Pitiquito (Burt 1938); (5) Santa Cruz, 4500 ft (MVZ); (6) 2 mi NW Santa Cruz, 4700 ft (MVZ); (7) 5 mi N Cananea, 4750 ft (MVZ); (8) 9 mi NNE Imuris (KU); (9) Casita, 40 km S Nogales, 3300 ft (MVZ); (10) 2 mi S & 0.5 mi W La Casita, 3300 ft (KU).

Description. A moderate to large, dark yellowish-brown pocket gopher with a heavy, angular skull. Details of characters and geographic variation given in Patton (1973) and Hoffmeister (1986).

Selected measurements. Ranges of means from Patton (1973): Total length, 207.1-230.5; tail length, 64.3-72.9; hind foot length, 28.3-30.3; basilar length, 31.5-35.1; zygomatic breadth, 20.9-24.9; mastoid breadth, 18.7-20.2; interorbital constriction, 6.4-6.5; nasal length, 12.4-14.3; maxillary toothrow length, 7.8-8.4.

Remarks. This subspecies of *T. bottae* hybridizes with *T. umbrinus* (subspecies *intermedius*) in Sycamore Canyon of the Patagonia Mountains, Santa Cruz Co., Arizona (Patton and Dingman 1968; Hoffmeister 1969; Patton 1973). Hybrid males are sterile and hybrid females exhibit about a 50% reduction in fertility. It is partially on the basis of this evidence that *T. bottae* and *T. umbrinus* are considered separate species (see review in Hoffmeister 1986).

Thomomys bottae nigricans Rhoads

1895. *Thomomys fulvus nigricans* Rhoads, Proc. Acad. Nat. Sci. Philadelphia, 47:36.

1915. *Thomomys bottae nigricans*, Bailey, N. Amer. Fauna, 39:56.

Type locality. "Witch Creek, San Diego Co., California"; 2753 feet, 1 mi W Julian.

Range. Peninsular Ranges and their western foothills of southern California and northern Baja California Norte, from San Gorgornio Pass in the north through the Sierra Juárez. In Baja California, this subspecies ranges along the International Boundary from Nachoguero Valley westward to El Valle de Las Palmas, then south to Las Cruces some 15 miles inland of Ensenada. Its range does not reach the coast at any point. The habitat occupied throughout this range is primarily live oak woodland situated within the broad chaparral belt of the coastal foothill slopes.

Recorded localities. *BAJA CALIFORNIA*: (1) Agua Hechicera (MVZ); (2) Las Cruces Canyon, 20 mi E Ensenada, 2600 ft (MVZ); (3) north end Nachoguero Valley, 3400 ft (MVZ); (4) 13 mi W & 1 mi N Rumorosa (MVZ); (5) 20 mi E & 1 mi S Tecate (MVZ); (6) south end Valle de Las Palmas (MVZ).

Description. A moderately small, dark reddish brown pocket gopher with proportionately small tympanic bullae and somewhat procumbent upper incisors. Specimens from lower elevations are richer in color with more brighter fulvous sides; those from higher elevations are duller in color, more grayish-black than reddish brown, and typically lack the brighter sides.

Selected measurements. Ranges of character means from samples from eastern San Diego Co., California (Patton and Smith 1990): Total length, 201.7-216.4; tail length, 64.3-71.7; hind foot length, 26.8-27.8; greatest skull length, 35.3-38.2; zygomatic breadth, 21.3-22.9; mastoid breadth, 17.8-19.1; interorbital constriction, 5.9-6.0; nasal length, 12.1-13.6; maxillary toothrow length, 7.6-7.8.

Remarks. The range of this subspecies borders that of *bottae* to the west at lower elevations along the coast and at the western edge of San Gorgonio Pass, and with *perpallidus* to the east of San Gorgonio Pass. Includes *affinis* Huey (1945), type locality at Jacumba, San Diego Co., California, whose range was given as the Jacumba Valley on both sides of the International Boundary (see Patton and Smith 1990). Probably also includes the subspecies *aphrastus, jojobae, juarezensis,* and *martirensis* in northwestern Baja California (see accounts of those subspecies).

Thomomys bottae phasma Goldman

1933. *Thomomys fulvus phasma* Goldman, Proc. Biol. Soc. Wash., 46:72.

1935. *Thomomys bottae phasma*, Goldman, Proc. Biol. Soc. Washington, 48:157.

Type locality. "Two miles south of Tule Tank, Tule Desert, near Mexican Boundary, Yuma County, Arizona."

Range. Known from lower part of Gila River and Sonoita River valleys and desert region of southwestern Arizona and northwestern Sonora, east of the Colorado River Valley to at least Quitobaquito.

Recorded localities. *SONORA*: (1) Cienega Well, 30 mi W Monument 204 (Burt 1938); (2) Pozo de San Emeterio, 8.5 mi N Quitovac (MVZ); (3) north side Rio Sonoita, Sonoita (MVZ); (4) 0.5 mi NE Sonoita (MVZ); (5) 1 mi E Rio Sonoita at Batamote, 30 mi SW Sonoita (MVZ); (6) Tinajas de los Papagos, Sierra del Pinacate (MVZ).

Description. One of the palest known forms of *T. bottae,* dorsal coloration pale pinkish buff with slightly darkened face and ears; venter whitish; skull small and less angular than similar-colored but larger *albatus* to the west in the Colorado River Valley.

Selected measurements. Total length, 211-233; tail length, 63-70; hind foot length, 27-30; ear length, 6-7; greatest skull length, 36.6-43.0; zygomatic breadth, 23.6-27.1; mastoid breadth, 19.0-21.8; interorbital constriction, 6.6-7.1; nasal length, 11.7-14.5; maxillary toothrow length, 7.5-8.0.

Remarks. Considered a junior synonym of *T. b. pusillus* Goldman (type locality at Coyote Mountains, 3000 feet, Pima Co., Arizona) by Hoffmeister (1986).

Thomomys bottae proximarius Huey

1945. *Thomomys bottae proximarius* Huey, Trans. San Diego Soc. Nat. Hist., 10:261.

Type locality. "Boca La Playa, 16 miles west of Santo Tomás, Baja California (mesa bordering the sea), 31°32' LN 116°38' LW."

Range. Known only from the type locality.

Description. A small, dark brown race, smaller than *bottae* to the immediate north and *aphrastus* to the south along the coast. Cranially, similar to *aphrastus,* through the skull is uniformly smaller in size, with a more arched zygoma, and without procumbent upper incisors.

Selected measurements. Of the type (Huey, 1945) are: total length, 215; tail length, 69; hind foot length, 28; ear length, 5; greatest skull length, 37.7; zygomatic breadth, 23.7; interorbital constriction, 5.6; nasal length, 13.4; maxillary toothrow length, 7.5.

Remarks. Except for its size, this race could easily be assigned to *bottae* along the coast to the immediate north. Huey (1945) notes that the small size probably results from its occupation of the stony mesa-like benches adjacent to the ocean, a habitat that should influence body size to the smaller dimensions. Since body size is so plastic in *T. bottae* pocket gophers, this is a poor character upon which to base subspecies recognition (Patton and Brylski 1987; Smith and Patton 1988).

Thomomys bottae rhizophagus Huey

1949. *Thomomys bottae rhizophagus* Huey, Trans. San Diego Soc. Nat. Hist., 11:54-55.

Type locality. "Las Flores, 7 miles south of Bahía de Los Angeles, Baja California, 28°50' LN 113°32' LW."

Range. Known only from the type locality, where it was abundant in the sandy soil on the dry, alluvial valley floor.

Description. Similar in color to *borjasensis* from the Pacific slope to the west, but slightly more tawny, but cranially it is longer, heavier, with a wider rostrum and more rounded, inflated braincase, and more compressed and less inflated auditory bullae.

Selected measurements. Of the type (Huey, 1949) are: total length, 222; tail length, 76; hind foot length, 30; ear length, 5; greatest skull length, 37.1; zygomatic breadth, 21.9; interorbital constriction, 6.2; nasal length, 13.8; maxillary toothrow length, 8.1.

Remarks. Huey (1949) notes that *rhizophagus is* a member of the more dark-colored pocket gopher group from the Pacific coast and Peninsular ranges, despite its presence on the east-central Gulf coast.

Thomomys bottae ruricola Huey

1949. *Thomomys bottae ruricola* Huey, Trans. San Diego Soc. Nat. Hist., 11:53-54.

Type locality. "4 miles north of Santa Catarina Landing, Baja California, 29°35' LN 115°17' LW."

Range. Known from the type locality and from Rancho Ramona, a locality some four miles northeast of Santa Cararina.

Description. A small-sized pocket gopher of pale dorsal color, with a grayish cast, and very small auricular black patches; zygomatic arches rounded, not angular; rostrum short; molariform teeth small; and bullar flat, not inflated.

Selected measurements. Of the type (Huey, 1949) are: total length, 223; tail length, 70; hind foot length, 28; ear length, 5; greatest skull length, 38.9; zygomatic breadth, 24.7; interorbital constriction, 5.9; nasal length, 13.8; maxillary toothrow length, 8.9.

Remarks. Known from only two specimens.

Thomomys bottae russeolus Nelson and Goldman

1909. *Thomomys bottae russeolus* Nelson and Goldman, Proc. Biol. Soc. Wash., 22:25.

Type locality. "San Angel, 30 miles west of San Ignacio, Lower California," [Baja California Sur].

Range. Known from the eastern side and northeastern rim of the Vizcaíno Desert.

Recorded localities. *BAJA CALIFORNIA SUR*: (1) 10 mi SE Mesquital, 400 ft (MVZ); (2) Vizcaino (MVZ).

Description. A small to medium-sized pocket gopher of pale ochraceous buff dorsal coloration overlying gray-based hairs; undereparts creamy white; skull small, light, not angular, with inflated and rounded bullae, and short rostrum.

Selected measurements. Total length, 190-232; tail length, 64-72; hind foot length, 28-33; ear length, 5-6; greatest skull length, 34.2-38.7; zygomatic breadth, 20.2-22.8; mastoid breadth, 17.7-20.1; interorbital constriction, 5.8-6.2; nasal length, 11.1-12.7; maxillary toothrow length, 7.3-7.6.

Remarks. This is one of four subspecies from the central and southern Baja California peninsula that have been examined for protein electromorphic characters and relationship, a group which forms a geographic unit rather distinct from others defined for the complete range of *T. bottae* (Patton and Smith 1990).

Thomomys bottae siccovallis Huey

1945. *Thomomys bottae siccovallis* Huey, Trans. San Diego Soc. Nat. Hist., 10:258.

Type locality. "El Cajón Canyon, 3200 feet altitude, east base of Sierra San Pedro Mártir, Baja California, 30°54'N 115°10'W."

Range. Known only from the type locality, a very secluded canyon on the desert side of the Sierra San Pedro Mártir (Huey 1945).

Description. This subspecies is close in color to *martirensis* from the higher elevations of the Sierra San Pedro Mártir, but differs from it in a few cranial characters, namely a shorter, wider, and heavier rostrum, more angular zygomatic arches, and less swollen bullae. From *xerophilus* to the north, *siccovallis* is larger, with a more heavily boned skull, and with brown as opposed to gray coloration.

Selected measurements. Total length, 203-204; tail length, 64-71; hind foot length, 28; ear length, 3-4; greatest skull length, 35.3; zygomatic breadth, 20.4; mastoid breadth, 17.9; interorbital constriction, 5.9; nasal length, 12.3; maxillary toothrow length, 6.9.

Remarks. Huey (1945) considered *siccovallis* to be closely related to *martirensis,* which occurs in the higher elevations of the same mountain range, but its color and size (as well as habitat) is closer to *nigricans.*

Thomomys bottae simulus Nelson and Goldman

1934. *Thomomys simulus simulus* Nelson and Goldman. Jour. Mamm., 15:120-121.

1967. *Thomomys bottae simulus,* Dunnigan, Radford review, 21(3):146.

Type locality. "Alamos, southern Sonora (altitude 1200 feet)."

Range. Alamos River Valley in the vicinity of the type locality, probably ranging northward along the western basal slopes of the Sierra Madre, and southward to at least Choix, in the upper Rio Fuerte Valley, Sinaloa (Dunnigan 1967).

Recorded localities. *SONORA*: (1) 1 mi NW Alamos, 1500 ft (MVZ). *SINALOA*: (2) Rio Choix, 3 km NE Choix (MVZ); (3) 16 km NNE Choix, 1700 ft (KU); (4) 13 km NNE Vaca, 1300 ft (KU); (5) El Cajón, 1700 ft (KU); (6) 0.75 mi ENE El Cajón (KU); (7) 0.25 mi S El Cajón, 1800 ft (KU); (8) 1 mi S El Cajón, 1800 ft (KU). Specimens recorded by Burt (1938) from near Guiracoba and Baromico, southeastern Sonora, are probably of T. umbrinus eximius (see account, below).

Description. A rather small, cinnamon-buff subspecies with a narrow, smoothly rounded skull.

Selected measurements. Total length, 196-218; tail length, 65-71; hind foot length, 27-29; ear length, 6-8; greatest skull length, 37.8-39.8; zygomatic breadth, 22.6-25.2; mastoid breadth, 19.2-21.1; interorbital constriction, 6.1-6.4; nasal length, 12.4-13.2; maxillary toothrow length, 7.8-8.1.

Remarks. Originally allocated to its own species, *T. simulus,* this taxon was compared and considered most similar to *T. umbrinus* by Nelson and Goldman (1934). Based on characters of the skull and general coloration, however, simulus is considered only a subspecies of *T. bottae* (see also Dunnigan 1967).

Thomomys bottae sinaloae Merriam

1901. *Thomomys sinaloae* Merriam, Proc. Biol. Soc. Wash., 14:108.

1967. *Thomomys bottae sinaloae*, Dunnigan, Radford Review, 21(3):152.

Type locality. "Altata, Sinaloa."

Range. Valley of the Rio Fuerte in northern Sinaloa south along the coastal plain to the Rio San Lorenzo (Dunnigan 1967).

Recorded localities. *SINALOA*: (1) 10 mi NNW Los Mochis (KU); (2) 5 km SW Los Mochis (KU); (3) 7 mi SW Los Mochis (KU); (4) 1 mi N & 0.5 mi E San Miguel, Rio Fuerte (KU); (5) 3 mi NE El Fuerte (KU); (6) 2 mi N San Blas, 50 ft (KU); (7) 1 mi N Zaragoza, 30 ft (KU); (8) south side Rio Sinaloa, Sinaloa, 125 ft (MVZ); (9) 1 mi E Sinaloa, 180 ft (KU); (10) Santa Maria Island, 10 ft (KU); (11) 24 km S Guasave, 20 ft (KU); (12) San Ignacio Island, 10 ft (KU); (13) 4 km SW Navolato, 20 ft (KU); (14) 1 mi E Altata, 5 ft (KU); (15) 2 km S El Dorado, 20 ft (KU); (16) Guamuchil, 150 ft (KU); (17) 12 mi N Higueros (KU); (18) El Salado, 300 ft (KU); (19) 1.5 mi SW San Lorenzo (KU).

Description. A large-bodied subspecies of pale dull chestnut brown dorsal color fading into paler chestnut fulvous underparts; skull rather large and angular with strongly spreading depressed and sharply angular zygomatic arches; small auditory bullae.

Selected measurements. Total length, 218-261; tail length, 70-89; hind foot length, 27-34; ear length, 6-7; greatest skull length, 38.1-45.4; zygomatic breadth, 24.0-30.0; mastoid breadth, 19.2-23.3; interorbital constriction, 6.3-7.1; nasal length, 11.7-14.5; maxillary toothrow length, 8.2-9.4.

Remarks. In Dunnigan's (1967) review of the pocket gophers of Sinaloa, he did not compare *sinaloae* with *camoae*, which is distributed in the southern Sonoran Gulf coast to the north; it is likely that these two subspecies will be shown to be synonyms with further analyses. Includes *varus* Hall and Long (1960), with type locality near El Dorado, according to Dunnigan (1967).

Thomomys bottae vanrossemi Huey

1934. *Thomomys bottae vanrossemi* Huey, Trans. San Diego Soc. Nat. Hist., 8:1-2.

Type locality. "Punta Peñascosa, Sonora."

Range. Known only from the vicinity of the type locality.

Recorded localities. *SONORA*: (1) 1 mi N Punta Peñasco (MVZ); (2) SE base Cerro La Cholla, 6 mi WNW Punta Peñasco, 50 ft (MVZ); (3) 0.5 mi S Crater Elegante, 34 mi SW Sonoita, 900 ft (MVZ).

Description. This is a small-bodied, pale cinnamon-colored race, very similar to that of phasma to the immediate north, but with a somewhat narrower skull, less widely spreading zygomatic arches, narrower rostrum, and more fully inflated auditory bullae.

Selected measurements. Total length, 173-225; tail length, 58-78; hind foot length, 25-30; ear length, 5-7; greatest skull length, 32.2-36.7; zygomatic breadth, 19.4-22.7; mastoid breadth, 17.0-19.2; interorbital constriction, 6.5-6.7; nasal length, 10.1-12.4; maxillary toothrow length, 7.3-7.9.

Remarks. As noted by Huey (1934), this race is only marginally differentiated from *phasma*, which occupies the desert country to the immediate north in northwestern Sonora and adjacent Arizona. It is likely, therefore, to be a synonym of that more northern race.

Thomomys bottae winthropi Nelson and Goldman

1934. *Thomomys bottae winthropi* Nelson and Goldman, Jour. Mamm., 15:122.

Type locality. "Hermosillo, Sonora."

Range. Known from the middle section of the Rio Sonora Valley, at least from just west of Hermosillo to near Ures.

Recorded localities. *SONORA*: (1) 1 mi W Hermosillo, 700 ft (KU); (2) 1 mi SW Hermosillo, 925 ft (MVZ); (3) 14 mi S & 1 mi W Hermosillo, 500 ft (KU); (4) San José de Gracia, 20 mi NE Hermosillo, 1150 ft (MVZ).

Description. A moderate to large-bodied pocket gopher with a dark yellowish-brown dorsal coloration thinly mixed with black; grayish below; skull large, angular, and massive, with widely spreading zygomatic arches and relatively uninflated auditory bullae.

Selected measurements. Total length, 235-280; tail length, 68-93; hind foot length, 31-36; ear length, 6-7; greatest skull length, 41.5-47.3; zygomatic breadth, 26.5-31.1; mastoid breadth, 21.6-24.4; interorbital constriction, 6.8-7.0; nasal length, 13.9-17.1; maxillary toothrow length, 9.1-9.8.

Remarks. Three subspecies are recorded for the general region of the Rio Sonora Valley: *convergens* near the mouth, *winthropi* in the central portions, and *estanciae* upriver. Except in minor variations in body size and pale to darker coloration, these three appear to belong to the same taxon. It is also likely that this group is synonymous with *basilicae* and *modicus*, named from the Rio Magdalena and Rio Santa Cruz valleys, to the north. All of these share the same general underlying color and cranial shape, and future analyses may group all of these taxa together.

Thomomys bottae xerophilus Huey

1945. *Thomomys bottae xerophilus* Huey, Trans. San Diego Soc. Nat. Hist., 10:257.

Type locality. "near Diablito spring, summit of San Matías Pass (between Sierra Juárez and Sierra San Pedro Mártir), Baja California Norte."

Range. Known from San Matias Pass and from the eastern section of El Valle de la Trinidad.

Recorded localities. *BAJA CALIFORNIA*: (1) 6 km W & 17 km E Valle de la Trinidad, 905 m (MVZ).

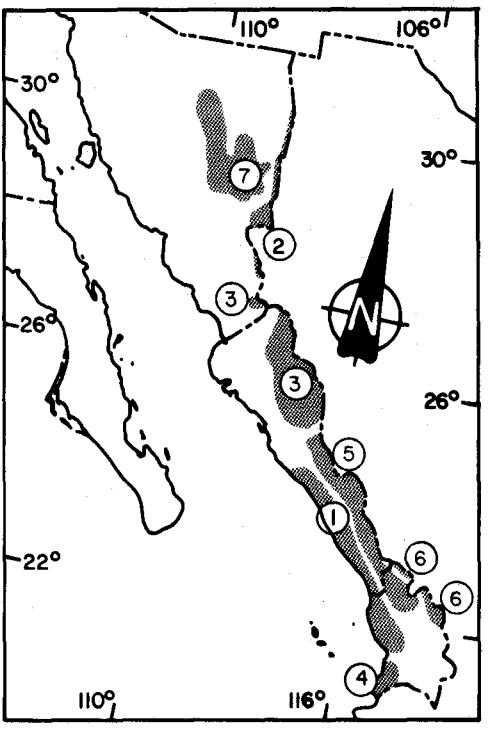
Description. This subspecies is slightly smaller in size and grayer (instead of brownish buff) than *jojobae*, from the foothills of the Sierra Juárez to the west, with a proportionately shorter, heavier rostrum with heavier molariform teeth. From the mountaintop forms, *juarezensis* and *martirensis*, *xerophilus* differs in being smaler in size and grayer in color, with more diminutive cranial characters over-all. From *aphrastus*, *xerophilus* is likewise smaller in size and grayer, as opposed to brownish, in color, with a proportionately heavier, shorter rostrum.

Selected measurements. Total length, 198-231; tail length, 64-78; hind foot length, 27-28; ear length, 6-7; greatest skull length, 34.4-38.6; zygomatic breadth, 20.8-23.1; mastoid breadth, 19.1-19.3; interorbital constriction, 6.1-6.4; nasal length, 11.4-13.9; maxillary toothrow length, 7.1-7.9.

Remarks. Based on protein electromorphic characters, samples allocated to this subspecies have their relationship with specimens otherwise assignable to both *bottae* and *nigricans* in southwestern California (Patton and Smith 1990).

Thomomys umbrinus (Richardson)

The Southern pocket gopher is a relatively small to medium-sized species in which males average larger than females. It is the only species of its genus throughout most of its range in Mexico. However, in the northwestern part of its range, the Southern pocket gophers meets Botta's, and the two are not always easy to distinguish (see comments above). Typically, the Southern pocket gopher occupies higher elevation habitats (oak woodland and pine forests) while adjacent Botta's pocket gopher is more common in deeper valley soils, but this is not so in central Sonora.



Geographic range of *Thomomys umbrinus*.
1. *T. u. atrovarius* 2. *T. u. chihuahuae*
3. *T. u. eximius* 4. *T. u. extimus*
5. *T. u. musculus* 6. *T. u. sheldoni*
7. *T. u. sonoriensis*

Very few studies have been accomplished on the Southern pocket gopher, especially when considering the vast amount of information available on Botta's and Northern pocket gophers. Most populations of Southern pocket gophers occur in the relatively poorly accessible higher elevations of the Sierra Madre Occidental, the western part of the Central Plateau, and the volcanic peaks of the Transverse Volcanic Belt of western and central Mexico. Populations of this species are known from several mountain ranges in Arizona and New Mexico in the southwestern United States, probably occur in the ranges in adjacent northern Sonora, and along the semi-tropical western Mexican coast from central Sinaloa into Nayarit. Based on a combination of chromosomal and biochemical character differences, there are apparently five nearly equally distinct geographic groups of populations distributed across this area. Across the range of the Southern pocket gopher, local populations may differ in color and in body size nearly as much as for Botta's pocket gopher. Pale color and very small size are attributes of the xeric-adapted populations in the lowlands of the Central Plateau of Mexico; dark rich reddish-brown to blackish-brown and larger bodied animals are found in the deeper, more humic soils of montane meadows in the Sierra Madre Occidental and from the isolated volcanoes of central Mexico. The population from the shores of Lago Patzcuaro in the state of Michoacan, Mexico, is black, as are those from coastal Sinaloa and Nayarit. This pocket gopher ranges in habitat from lowlying desert grassland and scrublands through the oak and pine-oak woodlands of intermediate elevations, to grassy meadows within higher elevation pine and fir forests. There has been an increase in the presence of this species in some areas due to an expansion of farming in former grasslands and in irrigation of sectors in the deserts.

The population biology of this species is, where know, essentially the same as that for the more common Botta's pocket gopher. Individuals of both sexes live in self-dug, exclusive use burrow systems, and the surface mounds of fresh earth provide clear evidence of the presence of pocket gophers in any area. Populations typically contain a larger number of adult females than adult males; and males are usually larger in size than females, with the degree of difference increasing as the average size of males increases. The breeding season varies greatly throughout the species' range. Separate winter and summer peaks were noted in populations from the Mexican state of Coahuila, but animals in southern Arizona bred only during the late winter and early spring. It is likely that populations in the higher elevations breed only following snow melt. Litter size averages about 4 to 5 pups, with a maximum of around 8 to 10. Longevity is probably less than two or three years, maximum, and most young probably do not reach reproductive maturity before they are predated. Common predators would include hawks and owls, snakes, weasels, badgers, bobcats, and coyotes. These animals are vegetarian in diet, like all pocket gophers, and relish both below-ground and above-ground plant parts, primarily of forbs. Individuals are active year-round, constructing burrows under snow at high elevations during the winter months. Tunnel excavation and mound-building activity, however, can occur any time, day or night, suggesting that there is no typical pattern of daily activity rhythm.

Thomomys umbrinus atrovarius J. A. Allen

1898. *Thomomys atrovarius* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 10:148.

1934. *Thomomys umbrinus atrovarius*, Nelson and Goldman, Jour. Mamm., 15:119.

Type locality. "Tatemales [near Rosario], Sinaloa."

Range. Coastal plain of southern Sinaloa and northern Nayarit, from the Rio San Lorenzo to at least Acaponeta.

Recorded localities. *SINALOA*: (1) 1 mi SE Camino Real, 400 ft (KU); (2) 5 mi NW Mazatlan (KU); (3) 1 mi N Sigueros, 50 m (MVZ); (4) 8 km SE Elota, 250 ft (KU); (5) 8 km N Villa Union, 450 ft (KU); (6) 3 mi E El Roble (KU); (7) 5 mi WSW La Cruz, 10 ft (KU). *NAYARIT*: (8) Navarrete (USNM); (9) Paso de Soquilpa, 8.8 mi E San Blas (USNM); (10) 1 mi S Lo de Marcos (USNM).

Description. A medium to small-sized pocket gopher; dorsal coloration uniformly plumbeous slightly tinged with brown, and markedly sparsely distributed hair; skull with narrow nasals and moderately procumbent upper incisors.

Selected measurements. Total length, 210-234; tail length, 69-79; hind foot length, 27-32; ear length, 7-10; greatest skull length, 36.1-39.7; zygomatic breadth, 22.2-26.0; mastoid breadth, 18.4-20.4; interorbital constriction, 7.0-7.3; nasal length, 12.3-14.0; maxillary toothrow length, 7.7-8.4.

Remarks. The most distinctive of the five geographic genetic groups of *T. umbrinus* (Hafner *et al.* 1987), it is quite likely that *atrovarius* is part of a complex of pocket gophers that includes *musculus* and *extimus* (see below) with limited geographic range in southern Sinaloa and northern Nayarit that represent a species distinct from true *umbrinus* from the Sierra Madre Occidental, central Plateau, and Transvolcanic belt of Mexico.

Thomomys umbrinus chihuahuae Nelson and Goldman

1934. *Thomomys umbrinus chihuahuae* Nelson and Goldman, Jour. Mamm., 15:114.

Type locality. "Sierra Madre, about 65 miles east of Batopilas, Chihuahua (altitude 7000 feet)."

Range. High elevations of the Sierra Madre of central and southern Chihuahua. Two specimens in the MVZ collections from 1 mi W Yécora, near the Chihuahua border, seem best allocated to this race. As such, these represent the only known locality of *chihuahuae* in the state of Sonora (see Anderson 1972 for general range of this subspecies).

Description. Moderate size, upper parts near cinnamon, purest along sides, and mixed with black on head and over back; skull robust with zygomata squarely spreading but narrowing posteriorly, and upper incisors strongly recurved.

Selected measurements. Of the type (Nelson and Goldman 1934) are: total length, 224; tail length, 72; hind foot length, 31; greatest skull length, 39.3; zygomatic breadth, 25.3; mastoid breadth, 19.2; nasal length, 14.5; maxillary toothrow length, 7.8.

Remarks. This subspecies inhabits the rather arid, high plateaus somewhat isolated by deep river canyons that transect this part of the Sierra Madre; the area is very poorly collected and this gopher is likely to be found broadly distributed in the oak and pine zones of the mountains of eastern Sonora.

Thomomys umbrinus eximius Nelson and Goldman

1934. *Thomomys umbrinus eximius* Nelson and Goldman, Jour. Mamm., 15:118-119.

Type locality. "Sierra de Choix, about 20 miles northeast of Choix, Sinaloa."

Range. Known from the foothills and mountains of extreme southeastern Sonora through northeastern and central Sinaloa.

Recorded localities. *SONORA*: (1) Guiarcoba, 1500 ft (MVZ); (2) 2 mi E Guiracoba (MVZ). *SINALOA*: (3) 18 km NNE Choix (KU); (4) 44 km ENE Sinaloa, 600 ft (KU); (5) 15 km N & 65 km E Sinaloa (MVZ, KU); (6) 1.5 mi N Badiraguato, 750 ft (KU); (7) 13 mi ESE Badiraquato (MVZ, KU); (8) 1 mi E El Cajón, 3700 ft (MVZ, KU); (9) 1 mi S Pericos (MVZ, KU).

Description. A small, dark-colored race closely resembling *sheldoni* and *chihuahuae* from the higher elevations to the east in the Sierra Madre Occidental. Upper parts reddish-brown heavily mixed with black, becoming paler and more cinnamon along the sides; skull small and of slender proportions; nasals narrow; upper incisors strongly recurved.

Selected measurements. Of the type (Nelson and Goldman, 1934) are: total length, 194; tail length, 64; hind foot length, 27.5; greatest skull length, 35.0; zygomatic breadth, 22.4; mastoid breadth, 17.7; interorbital constriction, 6.9; nasal length, 12.2; maxillary toothrow length, 7.5.

Remarks. A well-marked, small race inhabiting the oak belt of the middle elevations along the western slope of the Sierra Madre and outliner ranges. The relationships of this race to *chihuahuae* in the higher elevations to the east and north remain to be established, but the two races are likely to integrade.

Thomomys umbrinus extimus Nelson and Goldman

1934. *Thomomys umbrinus extimus* Nelson and Goldman, Jour. Mamm., 15:119-120.

Type locality. "Colomo, southern Nayarit (altitude 600 feet)."

Range. Arid tropical coastal plains in extreme southern Nayarit.

Recorded localities. *NAYARIT*: (1) 3.5 mi SSW Las Varas (KU); (2) 2 mi WNW Valle de Banderas (KU); (3) 6 mi E El Colomo, 400 ft (KU).

Description. A dark subspecies allied to *atrovarius* and *musculus* but more brownish and less blackish; size much larger; skull larger and heavier, with especially widely spreading zygomatic arches, small auditory bullae, and procumbent incisors.

Selected measurements. Of the type (Nelson and Goldman, 1934) are; total length, 235; tail length, 75; hind foot length, 31.5; greatest skull length, 42.0; zygomatic breadth, 27.3; mastoid breadth, 20.6; interorbital constriction, 7.0; nasal length, 13.7; maxillary toothrow length, 8.3.

Remarks. This subspecies is closely related to both *atrovarius* and *musculus*, differing primarily by size and slightly more brownish coloration (see Nelson and Goldman 1934). Perhaps it should be considered a synonym of *atrovarius*.

Thomomys umbrinus musculus Nelson and Goldman

1934. *Thomomys umbrinus musculus* Nelson and Goldman, Jour. Mamm., 15:119.

Type locality. "Pedro Pablo (about 22 miles east of Acaponeta), Sierra de Teponahuaxtla, Nayarit (altitude 3500 feet)."

Range. Tropical western slopes of Sierra Madre Occidental from southern Sinaloa into northern Nayarit.

Recorded localities. *SINALOA*: (1) Plomosas, 18 mi SE Culiacán (MVZ, KU; Nelson and Goldman 1934); (2) 3 to 7 mi SE Plomosas (KU); (3) 12 mi NE Presa Sanalona (MVZ, KU); (4) 6 km E Cosala, 1500 ft (KU); (5) Aguacaliente, 800 ft (KU); (6) 3.5 mi NE San Lorenzo, 500 ft (KU); (7) San Ignacio, 8 mi SE of San Juan (KU); (8) Copala (KU).

Description. A dark, nearly unicolored race similar to *atrovarius*, but smaller and coloration dark brown as opposed to black; pelage coarse and sparse as in *atrovarius*. Skull small, with narrow nasals, smaller and uninflated auditory bullae; more similar to that of *sheldoni* from the higher elevations to the east than to *atrovarius* to the west.

Selected measurements. Of the type (Nelson and Goldman, 1934) are: total length, 202; tail length, 64; hind foot length, 28; greatest skull length, 36.6; zygomatic breadth, 22.7; mastoid breadth, 17.9; interorbital constriction, 6.6; nasal length, 11.2; maxillary toothrow length, 6.8.

Remarks. Considered to present a link between the high elevation *sheldoni* of the Sierra Madre Occidental and *atrovarius* of the coastal plain.

Thomomys umbrinus sheldoni Bailey

1915. *Thomomys sheldoni* Bailey, North Amer. Fauna, 39:93-94.

1934. *Thomomys umbrinus sheldoni*, Nelson y Goldman, Jour. Mamm., 15:113.

Type locality. "Santa Teresa (6800 feet altitude), Tepic" [Sierra de Nayarit, Nayarit].

Range. Higher elevations of Sierra Madre Occidental from southwestern Chihuahua through Durango, extreme western Zacatecas, and northern Nayarit.

Recorded localities. *NAYARIT*: (2) Mesa del Nayarit (USNM); (3) Rancho Viejo, 13 km SW Santa Teresa (USNM); (4) Ocota airstrip (USNM).

Description. A moderate-sized, bright brownish animal with a darker mid-back of mixed black; large skull with long and narrow nasals and slender rostrum, wide interorbital region, and slightly procumbent upper incisors.

Selected measurements. Of the type (Bailey, 1915) are: total length, 210; tail length, 64; hind foot length, 29; basilar length of skull, 37.0; zygomatic breadth, 25.0; mastoid breadth, 19.0; interorbital breadth, 7.0; nasal length, 14.5; maxillary toothrow length, 8.0.

Remarks. This subspecies is one of a series distributed along the crest of the Sierra Madre Occidental from northern Chihuahua to Zacatecas and Nayarit; the relationships of these remain to be established.

Thomomys umbrinus sonoriensis Nelson and Goldman

1934. *Thomomys umbrinus sonoriensis* Nelson and Goldman, Jour. Mamm., 15:118.

Type locality. "10 miles east of Chinapa, Sonora River Valley, northern Sonora (altitude 3000 feet)."

Range. Irregularly broken or mountainous region west of the Sierra Madre Occidental in northeastern Sonora, including the central Rio Yaqui Valley near El Novillo northward through the Rio Moctezuma Valley and eastward through the Rio Harros Valley and included drainages.

Recorded localities. *SONORA*: (1) near Mina San Eufracio, 10 mi by road NE Chinapa, 3700 ft (MVZ); (2) Moctezuma, 2250 ft (MVZ); (3) 3 km NE Moctezuma (MVZ); (4) 1 mi S Moctezuma, 2300 ft (MVZ); (5) east bank Rio Yaqui at El Novillo (MVZ); (6) west bank Rio Yaqui at El Novillo (MVZ); (7) Bacanora (MVZ); (8) 1 mi N Sahuaripa (MVZ).

Description. Small to moderate-sized subspecies with ochraceous sides and distinct dark median stripe along back from back of head to rump, and with irridescent purplish hue; skull heavy and broad, with broad rostrum at base, short nasals, heavy zygomatic arches, and procumbent upper incisors.

Selected measurements. Total length, 199-235; tail length, 70-82; hind foot length, 27-30; ear length, 6-8; greatest skull length, 36.9-38.4; zygomatic breadth, 22.6-25.1; mastoid breadth, 18.2-19.7; interorbital constriction, 6.4-6.5; nasal length, 11.9-13.1; maxillary toothrow length, 7.4-7.5.

Remarks. Appears to be closely related to *T. u. intermedius* from the mountains of southern Arizona (see Hoffmeister 1986 for details of range), based on morphological as well as chromosomal and protein electromorphic characters (Hafner *et al.*, 1987). One or the other of these two races probably occurs in the oak belt of most, or all, of the isolated ranges northwest of the Rio Bavispe drainage to the Arizona border. Additional collecting in this entire area is warranted.

Pappogeomys bulleri

This is primarily a montane species occurring in soils mostly of volcanic origin in the pine-oak-madroña zone in western Jalisco and Nayarit, Mexico. It is most abundant in the higher elevations in meadows supporting grasses and forbs, but has been taken in semi-tropical environments in the larger canyons dissecting the western slope of the coastal ranges in association with tropical shrubs. Seven subspecies are currently recognized (following Russell 1968), with only one known from Nayarit, where there is possibly limited contact with *Thomomys umbrinus*. Little or nothing is known about the natural history of this animal.

Subspecies: Seven, only one of which is known from Nayarit, as follows:

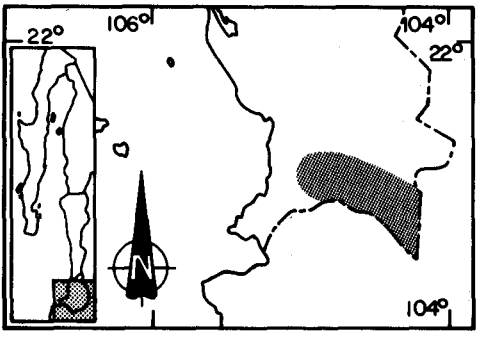
Pappogeomys bulleri nayaritensis Goldman

1939b. *Pappogeomys bulleri nayaritensis* Goldman, Jour. Mamm., 20:94-95.

Type locality. "Jalisco, about 10 miles south of Tepic, Nayarit, Mexico (altitude 5000 feet)."

Range. Southern Nayarit into north-central Jalisco in foothills and mountains north of Rio de Ameca; altitudinal range from 3000 feet on the western slope to 6800 feet.

Recorded localities. *NAYARIT*: (1) San Pedro Lagunillas, 2 mi east side of lake (USNM); (2) Estanzuela (USNM); (3) 10 km N Jala (USNM); (4) 2 mi E Jalcocotan (USNM).



Geographic range of *Pappogeomys bulleri*.

Description. A large subspecies with relatively long tail and large hind foot. Dorsal color dull ochraceous-brown, with irregular spots of white on venter, chin, and throat. Skull long and narrow, especially across the zygomatic arches; rostrum broad and long.

Selected measurements. From Russell (1968) are: total length, 232-249; tail length, 63-83; hind foot length, 29-35; greatest skull length, 39.2-42.9; zygomatic breadth, 24.8-30.1; mastoid breadth, 22.1-24.9; maxillary toothrow length, 8.2-9.6.

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1999, pags. 351-442.

FAMILY HETEROMYIDAE

James L. Patton and Sergio Ticul Alvarez-Castañeda

Subfamily Perognathinae Coues

These are small to medium sized mice, ranging from 100 to 230 mm in total length and from 5 to 60 g in weight. The body form is quadrupedal and rather "mouse" like. They are scansorial to quasi-ricochetal in locomotion, but all four feet contact the ground with each stride; rapid movement is by an erratic quadrupedal bound, not a bipedal hop (Bartholomew and Cary,1954). The hind feet and legs are typically longer than murid rodents, the pes has five clawed digits and a naked or only partly haired sole. Body hairs are of two types, straight and relatively long overhairs and a thin underfur of short and often strongly curved hairs. The upper incisors are grooved, there are four cheek-teeth as with all heteromyids, and the molars are brachydont, rooted, and sexta tuberculate, wearing into a horse-shoe shaped bilophodont condition before becoming obliterated with advanced age. Cranially, the squamosal is in broad contact with the parietal on the dorsal surface of the skull; the anterior zygomatic root is not greatly enlarged on joining the lacrimal; there is a large orbital non-ossification usually including the ethmoid foramen; the incisive foramen is small; the auditory bullae are greatly expanded, with the mastoid portion visible in dorsal view; and the inflated interior of the mastoid and tympanic bullae are filled with spongy trabeculae. A stapedius muscle is lacking in the middle ear. The cervical vertebrae are all independent. The baculum is relatively long and slender with a swollen base and typically an upturned tip (straight in some species and tridigitate in *C. hispidus*). Details of descriptive morphology can be found in Burt (1936), Brylski (1993), Hafner and Hafner (1983), Homan and Genoways (1978), Merriam (1889), Osgood (1900), Ryan (1989), Wahlert (1985), Webster and Webster (1975), and Wood (1935).

There are two groups of Recent pocket mice within the subfamily, commonly known as the silky (*Perognathus*) and spiny (*Chaetodipus*) pocket mice. These two groups were long considered as subgenera of the single genus *Perognathus* (Merriam,1889; Osgood, 1900; Hall, 1981), but Hafner and Hafner (1983) provided reasons for their separation at the generic level. This recommendation has been followed by most recent treatments (*e.g.*, Patton, 1993; Williams, *et al.*, 1993), and will be followed here. The two genera can be distinguished as follows (modified from Williams *et al.*, 1993).

Chaetodipus - Sole of hind foot naked; pelage relatively coarse, often with stiff, spine-like bristles on rump; stiff, coarse hairs usually project across anterior margins of ear pinna; antitragus of ear pinna lobed; tail always longer than head and body and usually both crested and penicillate; mastoid bulla usually not projecting posteriorly beyond plane of occiput; postero-medial border of mastoid bulla usually projecting as a distinct indentation into the supraoccipital; interparietal

width equal to or greater than interorbital breadth; vesicular glands of males short, globular in shape, and yellow- to gray-colored (pinkish and granular in fresh specimens).

Perognathus - Posterior one-third to one-half of sole of hind foot with sparse covering of short hairs; pelage relatively fine and soft, never with stiff, spine-like bristles on rump; no long, stiff, coarse hairs projecting across anterior margin of ear pinna; antitragus of ear usually not lobed; tail equal to or only slightly longer than head and body, never crested and usually not penicillate; mastoid bulla projecting posteriorly beyond the plane of the occiput; postero-medial border of mastoid bulla not projecting as a distinct indentation into the supraoccipital; interparietal width nearly always less than interorbital breadth; vesicular glands of males elongated, tube-like, "J"-shaped, and translucent.

Genus *Chaetodipus*

1889. *Chaetodipus* Merriam, N. Amer. Fauna, 1:5, 25 October.

Type species. *Perognathus* [*Chaetodipus*] *spinatus* Merriam, 1889, N. Amer. Fauna, 1:5.

Diagnosis. Characteristics as for genus except baculum tapers to a simple, nonlobed tip; no supraorbital bead or ridge on frontal; squamosal portion of zygomatic arch firmly attached to meatal part of auditory bulla; supraoccipital forms indentation into mastoid bulla; diploid number of chromosomes, in so far as is known, 36 to 56.

Comparisons. See accounts of *Burtognathus* and *Perognathus* for comparison with those taxa.

Remarks. The subgenus *Chaetodipus* as applied here differs from the subgenus of Merriam (1889) as it was applied by him and subsequent authorities except Hoffmeister (1986).

Species Accounts

Chaetodipus arenarius arenarius (Merriam)

1894. *Perognathus arenarius* Merriam, Proc. Calif. Acad. Sci., ser. 2, 4:461.

1976. *Perognathus dalquesti*, Roth, J. Mam., 57:562.

1983. *Chaetodipus arenarius arenarius*, Hafner and Hafner, Great Basin Nat. Mem., 7:25

Type locality. From San Jorge, near Comondu, Baja California Sur, Mexico.

Range. Limited to the sandy soils on the Baja California Peninsula, from near the international boundary in northeastern Baja California southward to near the southern cape in Baja California Sur; not known from the eastern Gulf slope from about El Barril, Baja California, south to near La Paz, Baja California Sur; and Sierra de las Cacachilas and Isla Cerralvo in the southern Gulf of California (see Huey, 1964; Hall, 1981; Lackey, 1991a). *C. a. arenarius* occurs on sandy soils from near the cape region northward to the southern part of the Vizcaino Desert on the Pacific coast of Baja California Sur.

Recorded localities. *BAJA CALIFORNIA SUR*: San Jorge, near Comondu (Merriam, 1894). Tres Pachitas; Todos Santos-Pescadero (Banks, 1964).

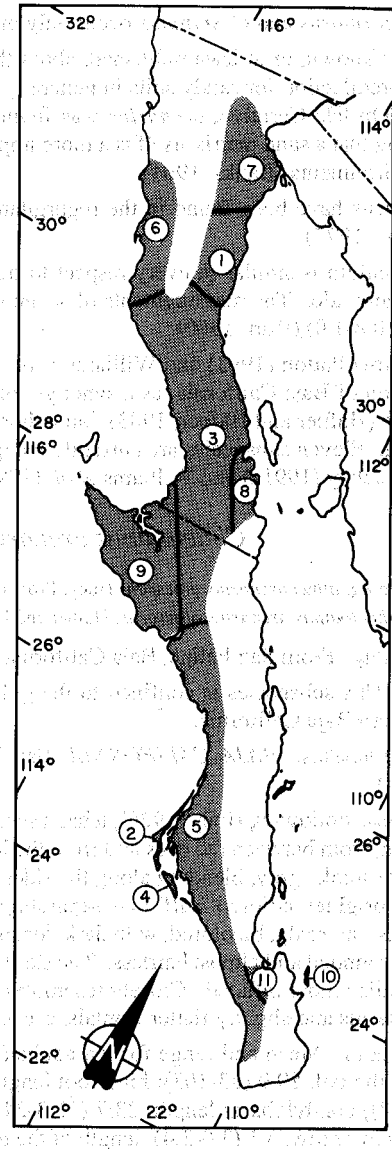
Description. This is a moderately small species within the genus, with a crested tail that is longer than the head and body and small ears. The pelage is relatively soft and usually lacks stiff bristles or spines. The dorsal color is a pale light gray or yellowish gray; there is no clearly developed buff lateral stripe. The length of the head and body averages about 70; the length of the tail ranges about 85; and the ear around 8 (Best, 1993). The skull is short and broad, with a somewhat vaulted

braincase, slender and parallel zygomatic arches, an interparietal more than twice as broad as it is long and strapshaped to slightly pentagonal, and slender nasals (see Lackey, 1991a).

Measurements. The means and ranges of 12 females (Banks, 1964) are: total length, 168.3 (155-180); length of tail, 90.5 (80-96); greatest length of skull, 24.8 (23.7-25.5); basilar length, 18.6 (17.4-19.4); frontonasal length, 16.9 (16.5-17.4); mastoid width, 13.2 (12.7-13.6).

Remarks. Detailed comparisons of *C. arenarius* with other species of pocket mice from the Baja California peninsula can be found in Lackey (1991a). This species is one of those within the genus that generally lacks any spines on the rump, and can be readily distinguished by this feature alone from others within its range (namely, *C. spinatus*, *C. californicus*, and *C. fallax*), as well as by smaller size and a much paler pelage color. It is sympatric, or nearly so, with three other relatively soft-haired species that also generally lack spines, namely *C. baileyi*, *C. formosus*, and *C. penicillatus*. From *C. baileyi*, *C. arenarius* differs by its much smaller size (hind foot 25 mm versus 26 mm; Williams *et al.*, 1993); from *C. formosus* by its generally smaller size and shorter ear (9 mm versus 9 mm), less well-developed crest on the tail, much less inflated bullae, and light yellow-gray as opposed to darker gray coloration; and from *C. penicillatus* by its smaller size, more annulated appearing tail, and broader skull, and grayish instead of yellow-brown coloration.

In northeastern Baja California where all four species that lack rump spines, as well as *C. spinatus*, are sympatric, or nearly so, *C. arenarius* and *C. penicillatus* are confined to very sandy soils, *C. baileyi* extends from sandy to stony pavements,



Localization of *Chaetodipus arenarius*:

1. *C. a. albescens*
2. *C. a. albulus*
3. *C. a. ambiguus*
4. *C. a. ammophilus*
5. *C. a. arenarius*
6. *C. a. helleri*
7. *C. a. mexicalis*
8. *C. a. paralios*
9. *C. a. sabulosus*
10. *C. a. siccus*
11. *C. a. sublucidus*

while *C. formosus* and *C. spinatus* occur only on rocky slopes.

Little is known, or at least published, about the ecology and life history of this species, other than its predilection for sandy soils in generally flat and arid desert scrub communities (Lackey, 1991a). On Isla Cerralvo, *arenarius* was found in patches of sandy soil well up into arroyos, suggesting that a sand matrix itself is a more important determinant of local distribution than flat, open environments (Banks, 1964).

Specimens have been found in the regurgitated pellets of barn owls (Lopez-Forment C. and Urbano V., 1977).

The baculum is similar in every respect to that of *penicillatus,* except that the base is sligtly higher than wide. The measurements of seven speciments are: length 10.5 (9.7-12.1); heigth of base 0.9 (0.8-1.0) (Burt, 1960).

We follow Patton (1993) and Williams *et al.* (1993) in regarding *C. dalquesti* Roth, from the cape region of Baja California, as a synonym of *C. a. arenarius*. The two forms have the same karyotype (Hafner and Hafner, 1983), but a thorough analysis of their relationships has yet to be published. Eleven subspecies are currently recognized, as mapped. The synopsis presented here follows Lackey (1991a) and Williams *et al.* (1993).

Chaetodipus arenarius albescens (Huey)

1926. *Perognathus arenarius albescens* Huey, Proc. Biol. Soc. Washington, 39:67.

1983. *Chaetodipus arenarius albescens*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From San Felipe, Baja California, Mexico.

Range. This subspecies is confined to the gulf coastal region in the vicinity of San Felipe in northeastern Baja California.

Recorded localities. *BAJA CALIFORNIA*: San Felipe (Huey, 1926; Patton *et al.*, 1981 as *C. arenarius*).

Description. Following Huey (1926), it has a semi-silky pelage of extremely light color; the dorsal coloration, from between the eyes and from the level of the back of the ears to the base of the tail, is uniform smoke gray, blending along the sides to the white underparts; some specimens have a definite, brighter colored buff line separating the entire darker upperparts from the white underparts; tail scaly, bicolored, with dark dorsal stripe, and slight terminal brush of longer hairs; ears well rounded and almost hairless. The skull is similar to that of *C. arenarius*, but smoother and audital bullae more inflated. Closely resembles *C. a. helleri*, except that it is larger, has slightly broader nasals and slightly flatter frontals, especially between the lachrymal bones.

Measurements. Mean and range for ten adults (Huey, 1926) are: total length, 165.3 (155-182); length of the tail, 89.9 (83-103); hind foot length, 21.6 (20-23); ear length, 5 (all); weight, 15.1 (10.9-19.8); condylobasal length, 23.7 (23.3-24.8); width of bullae, 12.3 (11.8-12.7); length of maxillary toothrow, 3.1 (3.0-3.4); length of the nasals, 9.1 (8.4-9.7); interorbital constriction, 6.1 (6.0-6.5).

Remarks. No information about the natural history is known

Chaetodipus arenarius albulus (Nelson and Goldman)

1923. *Perognathus penicillatus albulus* Nelson and Goldman, Proc. Biol. Soc. Washington, 36:159.

1983. *Chaetodipus arenarius albulus*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From Magdalena Island, Baja California Sur, Mexico.

Range. Known only from Isla Magdalena, Baja California Sur.

Recorded localities. *BAJA CALIFORNIA SUR*: Magdalena Island (Nelson and Goldman, 1923; Huey, 1926). Magdalena Bay (Anthony, 1925). Estero Salinas (Alvarez, 1960).

Description. Following Nelson and Goldman (1923), this is a small and unusually light-colored form, most closely allied to *C. a. arenarius,* but upperparts decidedly paler, the buff element much less obscured by dusky hairs. The colors of the type are: upper parts in general near light buff, palest on cheeks, shoulders, sides, and outer surface of hind limbs, finely and rather inconspicuously mixed or lined with brownish black on top of head and over back; underparts, fore limbs, and hind feet white; tail light brownish above, whitish below. The skull closely resembles that of *C. a. arenarius*, but averages smaller, less massive. It is also similar to that of *C. a. ammophilus,* but decidedly smaller with relatively weaker zygomatic arches.

Measurements. Means and ranges of nine adults (Nelson and Goldman, 1923) are: total length, 156 (147-164); length of tail, 86 (79-98); hind foot length, 23.2 (21-23). The measurement of the skull of the type are: greatest length, 22.8; mastoid width, 12; zygomatic width, 11.2; interorbital breadth, 6.1; length of maxillary toothrow, 3.4; interparietal, 7 x 3.4; length of nasals, 8.7; zygomatic width, 11.2.

Remarks. The pallid coloration of this pocket mouse appears to be associated with that of the shifting sand dunes it inhabits. It appears to be restricted to Magdalena Island, but is evidently very closely allied to the darker form which occurs on the adjacent mainland (Nelson and Goldman, 1929). The Estero Salinas is on the peninsula in front of Isla Magdalena (Alvarez, 1960). This subspecies is considered threatened by the Mexican Government (NOM-059-ECOL-1994).

Chaetodipus arenarius ambiguus (Nelson and Goldman)

1929. *Perognathus arenarius ambiguus* Nelson and Goldman, Proc. Biol. Soc. Washington, 42:108.

1983. *Chaetodipus arenarius ambiguus*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From Yubay, 30 mi SE Calamahue, 2,000 ft, Baja California.

Range. This subspecies extends from near Chapala southward to the middle of the Vizcaino Desert in Baja California Sur.

Recorded localities. *BAJA CALIFORNIA SUR*: Calamahue; Calamahue Canyon (mouth); La Lomita Maria; Pozo Altamirano; Pozo San Augustin (20 miles east of San Fernando); Punta Prieta; Rancho Mesquital (33 miles west of Calmalli); San Andres; San Fernando; San Ignacio (20 miles west); Santo Domingo; San Francisquito; Santa Clara Mountains; Santa Rosalia Bay; Scammon's Lagoon (south side); Turtle Bay (or San Bartolome); Yubay, 30 mi SE Calamahue, 2000 ft (Nelson and Goldman, 1929). 25 mi N Punta Prieta (Villa, 1941). Between El Arco and San Ignacio (Alvarez, 1960). San Fernando; Pozo San Agustin, 20 mi E San Fernando; Mouth Calamahue Canyon; Pozo Altamirano, 20 mi San Ignacio; San Andres; 25 mi N Punta Prieta (Hall, 1981).

Description. Following Nelson and Goldman (1929), it is similar to *C. a. arenarius,* but smaller and paler colored. The color of the type is light buff upper parts, obscured by overlying black-tipped hairs; buff lateral line absent; under parts, fore-limbs and hind feet white; tail brownish above, white below. The skull is similar in general to that of *C. a. arenarius* and *C. a. albescens* but averages smaller, with relatively smaller mastoid and audital bullae. These differences most noticeable particularly in comparison to *C. a. arenarius*.

Measurements. The means and ranges of five specimens (Nelson and Goldman, 1929) are: total length, 163 (157-167); length of tail, 92 (88-96); hind foot length, 22 (22-23.5). The measurements of the skull of the type are; greatest length, 22.6; greatest breadth, 12; interorbital breadth, 6.2; length of maxillary toothrow, 3.2; interparietal, 5.8 x 2.8; length of nasals, 8.3; width of nasals, 2.3.

Remarks. *Chaetodipus arenarius ambiguus* is slightly larger than *C. a. helleri* with decidedly paler coloration. Rather closely resembling *C. a. albescens,* but color usually distinctly darker. Buff lateral line absent or faint. The skull differs from that of *C. a. helleri* mainly in larger average size (Nelson and Goldman, 1929).

This subspecies occupies the central section from San Fernando south to the Vizcaino Desert, the region of perhaps the most extreme aridity in Baja California (Nelson and Goldman, 1929).

Chaetodipus arenarius ammophilus (Osgood)

1907. *Perognathus penicillatus ammophilus* Osgood, Proc. Biol. Soc. Washington, 20:20.

1983. *Chaetodipus arenarius ammophilus*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From Santa Margarita Island, Baja California Sur, Mexico.

Range. Known only from its type locality of Santa Margarita Island, off the western coast of Baja California Sur.

Recorded localities. *BAJA CALIFORNIA SUR*: Santa Margarita Island (Osgood, 1907b).

Description. Following (Osgood, 1907b), the size is nearly equal to *C. a. siccus*; color paler; mastoids smaller. Size decidedly greater than *C. a. arenarius*; color averaging paler; skull larger and heavier; mastoids relatively smaller. The coloration is much as *arenarius* but averaging paler; paler than in *C. a. siccus*, and not exhibiting a gray phase. General effect of upperparts drab; basal part of hairs of upperparts pale gray slightly tinged with fawn; no obvious lateral line; underparts creamy. The skull is similar in general to that of *C. a. siccus*, but mastoids smaller; larger and heavier and with relatively smaller mastoids than that of *C. a. arenarius*.

Measurements. The means and range of nine topotypes (Osgood, 1907b) are: total length, 181 (171-188); length of tail, 105 (100-113); hind foot length, 94 (23.5-25.55). Skull of the type: greatest length, 26.1; basilar length, 18; mastoid width, 13.2; zygomatic width, 13.1; interorbital constriction, 6.6; nasals, 9.4; interparietal, 7.3 x 3.8; diastema, 6.4; maxillary toothrow, 3.8.

Remarks. This form may be distinguished from both *C. a. arenarius* and *C. a. siccus* by its relatively small mastoids. Specimens from Isla Magdalena, which lies near Isla Margarita, represent the subspecies *C. a. albulus* and do not approach *C. a. ammophilus* in size or cranial characters, although both subspecies are rather pale. This subspecies is considered threatened by the Mexican Government (NOM-059-ECOL-1994).

Chaetodipus arenarius helleri (Elliot)

1903. *Perognathus helleri* Elliot, Field Columbian Mus., Publ. 74, Zool. Ser., 3:166.

1983. *Chaetodipus arenarius helleri*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From San Quentin [San Quintin], Baja California, Mexico.

Range. This race is known only from the San Quintin Plain on the northwestern Pacific coast.

Recorded localities. *BAJA CALIFORNIA*: San Quintin (Elliot, 1903). West Side of the San Quintin Bay (Anthony, 1925). San Quintin and vicinity (Huey, 1926). N San Quintin (Villa, 1941).

Description. Following Elliot (1903), in size it is similar to *C. a. arenarius*; the color above is mixed black and dark buff, giving a dark yellowish-brown appearence to the upper parts, very different from the pale buff-drab of *C. a. arenarius*. Distinct bright buff lateral line from nose to rump; under parts pure white; tail above dark brown, almost dusky; beneath pure white pencil like upper part dusky; hands and feet gray, ears dark brown. The skull has shorter nasals, broader rostrum, wider interorbital space, brain case broader, mastoids less prominent, and smaller and more anteriorly pointed bullae.

Measurements. The mean and ranges for 15 specimens (Elliot, 1903) are: total length, 159; length of tail, 83; hind foot length, 20.5; ear length, 8; occipitonasal length, 23.0; basilar length of Hensel, 14.0; interorbital breadth, 6.0; length of maxillary toothrow, 3.0; width across mastoid bullae, 11.5; length of nasals, 7.5; width of rostrum, 4.0; zygomatic breadth, 11.5; greatest width of brain case, 10.5; palatal arch to alveoli of incisors, 8.5.

Remarks. *C. a. helleri* and *C. a. albescens* from San Felipe are totally different in color and are separated from each other by the San Pedro Martir mountains, 10,000 feet high, and the two coastal ranges (Elliot, 1903).

Chaetodipus arenarius mexicalis (Huey)

1939. *Perognathus arenarius mexicalis* Huey, Trans. San Diego Soc. Nat. Hist., 9:57.

1983. *Chaetodipus arenarius mexicalis*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From the Los Muertos Canyon fan at Gaskill's Tank, near Laguna Salada, 32° 27' LN, 115° 53' LW, Baja California, Mexico.

Range. Found on sandy ground on the western side of Laguna Salada (Huey, 1964).

Recorded localities. *BAJA CALIFORNIA*: Los Muertos Canyon fan at Gaskill's Tank, near Laguna Salada (Huey, 1939). De Mara's Well, Laguna Salada (Hall, 1981).

Description. Resembles *C. a. albescens*, considered by Huey (1939) to be its closest relative structurally and geographically, but is darker dorsally and either lacks, or has only a very faint buffy lateral line. Cranially, this race has a basally broader and slightly heavier rostrum as well as slightly more inflated bullae than *albescens*. It dorsal color is closest to that of *C. a. ambiguus* from the central part of the peninsula.

Measurements. Measurements of the type include: total length, 176; length of tail, 102; hind foot length, 23; ear length (crown), 5; greatest length of skull, 23.7; interorbital breadth, 6.1; length of maxillary toothrow, 3.2; width across mastoid bullae, 12.0; length of nasals, 8.5 (from Williams *et al.*, 1993).

Remarks. According to Huey (1939a), this subspecies may range northward into the state of California, although the species has not been taken in the United States.

Chaetodipus arenarius paralios (Huey)

1964. *Perognathus arenarius paralios* Huey, Trans. San Diego Soc. Nat. Hist., 13:113.

1983. *Chaetodipus arenarius paralios*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From [El] Barril, 28° 20' LN, on the Gulf of California, Baja California, Mexico.

Range. This race occurs on the gulf coast from near Bahia Los Angeles southward to the vicinity of the type locality at El Barril, Baja California.

Recorded localities. *BAJA CALIFORNIA*: [El] Barril, San Francisquito Bay; Los Flores; Los Angeles Bay (not typical) (Huey, 1964).

Description. Following Huey (1964), this race is extremely pale, almost white with a tinge of brown over the lightly grizzled dorsal area. The side stripes are obscure or missing on some specimens and the tail stripe is notably pale. The skull of *C. a. paralios* is large and is flat across the brain case.

Measurements. The measurements of the type (Banks, 1964) are: total length, 150; length of tail, 81; hind foot length, 22; ear length (crown), 5; greatest length of skull, 24.0; interorbital constriction, 6.3; length of nasals, 8.9; length of maxillary toothrow, 2.9.

Remarks. *Chaetodipus arenarius paralios* differs from *C. a. albescens* in being slightly larger and in having a brownish cast to its dorsal pelage. The tail stripe is notably pale and the brownish side stripes found on the darker subspecies of this species are obscure or missing on most specimens of *C. a. paralios*. From *C. a. ambiguus* in being decidedly paler, and little comparison is required to separate specimens. Compared with *C. a. sublucidus,* it is pale and appears to be nearly white. Cranially, *C. a. paralios* differs from all three in the main larger and the braincase is more nearly flat (Banks, 1964). Only the measurements of the type have been published.

Chaetodipus arenarius sabulosus (Huey)

1964. *Perognathus arenarius sabulosus* Huey, Trans. San Diego Soc. Nat. Hist., 13:114.

1983. *Chaetodipus arenarius sabulosus*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From the mainland on S side Scammon's Lagoon, Baja California Sur, Mexico.

Range. The race is distributed from Bahia Santa Rosalia southward through the western Vizcaino Desert to the vicinity of Laguna San Ignacio.

Recorded localities. *BAJA CALIFORNIA SUR*: Mainland on S side Scammon's Lagoon (Huey, 1964). Santa Rosalia Bay; Norther part of San Ignacio Lagoon; Turtle bay (Hall, 1981).

Description. Following Huey (1964), it is pallid in color on the face, sides of head, and body. Dorsally, the pelage is slightly grizzled. The median side stripe is light brown and very faintly marked, as is the upper side of the tail. The skull is dome-like across the brain case and has a compressed appearance when viewed dorsally.

Measurements. The measurements of the type (Huey, 1964) are: total length, 165; length of tail, 91; hind foot length, 21; ear length, 5; greatest length of skull, 23.5; interorbital breadth, 6.1; length of maxillary toothrow, 2.9; width across mastoid bullae, 12.3; length of nasals, 8.8.

Remarks. Compared with *C. a. ambiguus, C. a. sabulosus* is paler in color and has a narrower, dome-shaped skull. Compared with *C. a. arenarius*, it is paler in overall color, is less grizzled dorsally and the side stripes and stripe on top of the tail are paler and less heavily marked. The skull is more dome-shaped and not as broad across the bullae (Huey, 1964). Only the measurements of the type are published.

Chaetodipus arenarius siccus (Osgood)

1907. *Perognathus penicillatus siccus* Osgood, Proc. Biol. Soc. Washington, 20:20.

1983. *Chaetodipus arenarius siccus*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From Ceralvo [Cerralvo] Island, Baja California Sur, Mexico.

Range. Known only from its type locality of Isla Cerralvo in the Gulf of California, Baja California Sur.

Recorded localities. *BAJA CALIFORNIA SUR*: Cerralvo Island (Osgood, 1907b; Banks, 1964; Servin *et al.*, 1992).

Description. Following Osgood (1907b), the size is decidedly larger than in *C. a. arenarius*, very weak rump bristles rarely present; color dimorphic, buff phase slightly darker than in *arenarius*, gray phase decidedly different; skull large and heavy; mastoids rather large. The color is practically as in *arenarius* but averaging slightly darker; general effect of upperparts buff fawn; lateral line narrow, pinkish buff; underparts creamy. The skull is similar to that of *C. a. arenarius* but decidedly larger and heavier; mastoids rather large; ascending branches of supraoccipital broad; similar to that of *C. a. ammophilus* but averaging larger with relatively large mastoids.

Measurements. The means and ranges of external measurements of ten topotypes (Osgood, 1907b) are: total length, 175 (165-187); length of tail, 98 (92-102); hind foot length 24.5 (23.5-26). Skulls of type and one topotype: greatest length 25.9; 26.9; basilar length, 17.7; 18.9; mastoid width 13.8; 13.8; zygomatic width, 12.6; 13; interorbital constriction, 6.6; 6.6; nasals, 8.9; 9.6; interparietal, 7.2 x 3.1; 7.5 x 3.8; diastema 6; 6.7; maxillary toothrow, 4; 3.9.

Remarks. This subspecies is considered as threatened by the Mexican Government (NOM-059-ECOL-1994).

Chaetodipus arenarius sublucidus (Nelson and Goldman)

1929. *Perognathus arenarius sublucidus* Nelson and Goldman, Proc. Biol. Soc. Washington, 42:109.

1983. *Chaetodipus arenarius sublucidus*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. La Paz, Baja California [Sur].

Range. Known from sandy areas near the vicinity of La Paz, Baja California Sur.

Recorded localities. *BAJA CALIFORNIA SUR*: La Paz (Nelson and Goldman, 1929). 17 km NE La Paz (Servin *et al.*, 1994).

Description. Following Nelson and Goldman (1929), its closely allied to *C. a. albulus*, but darker in color, the general tone of upper parts tending toward ochraceous-tawny instead of light ochraceous-buff. Similar in general to *C. a. arenarius*, but averaging smaller and decidedly paler, the upper parts much less heavily overlaid with black; skull differing in detail. The color of the type is upper parts near light ochraceous-tawny, finely and inconspicuously overlaid with brownish black; buff lateral line absent; under parts, entire forearms and hind feet white; tail scantily haired, light brownish above, whitish below. The skull is about as in *C. a. albulus,* of Magdalena Island. Compared with that of *C. a. arenarius,* the skull averages smaller, and relatively narrower with relatively smaller, less inflated mastoid and auditory bullae.

Measurements. Means and ranges for external measurements of ten adult topotypes (Nelson and Goldman, 1929) are: total length, 157 (151-166); length of tail, 87.7 (83-95); hind foot length, 21.6 (21-22). The measurements of the skull of the type are: greatest length, 24.8; greatest breadth, 12.6; interorbital breadth, 6.3; length of maxillary toothrow, 3.2; width across mastoid bullae, 12.6; interparietal, 6.4 x 3.7; length of nasals, 9.4; width of nasals, 2.3.

Remarks. This subspecies has an unusually limited but well defined range, covering the very arid desert of the small sloping basin a few miles in extent, lying about the southern and southwestern

part of Bahia La Paz. To the north and south its range is limited by mountainous areas and to the west by the divide between the drainage to the Gulf and to the Pacific (Nelson and Goldman, 1929). The most important environmental variable governing the presence of this subspecies is sandy soil (Cortes-Calva and Alvarez-Castañeda, 1997).

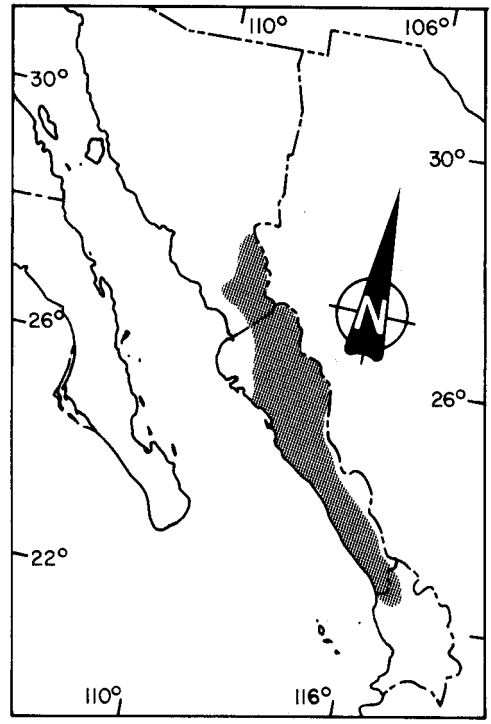
Chaetodipus artus (Osgood)

1900. *Perognathus artus* Osgood, N. Amer. Fauna, 18:55.

1983. *Chaetodipus artus*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From Batopilas, Chihuahua, Mexico.

Range. This species is known from southeastern Sonora south throughout Sinaloa, except the coastal area of northwestern Sinaloa, the canyon bottoms of southestern Chihuahua and western Durango, and northern Nayarit. It has an apparent dendritic distribution, following stream courses in much of southeastern Sonora into the barranca bottoms of western Chihuahua and Durango where tropical deciduous vegetation grows (Anderson, 1972; Baker and Greer, 1962), but is more broadly distributed in the hill country of Sinaloa and Nayarit.



Localization of *Chaetodipus artus*.

Recorded localities. *NAYARIT*: San Ignacio (Wilson, 1985). *SINALOA*: 35 mi (52 km) N Culiacan (Ingles, 1959). Rancho Rosalita, 26 mi NE Choix; 4 mi NE Terrero; 1 mi S Pericos; 12 mi N Culiacan; 32 mi SSE Culiacan; 6 mi N, 0.5 mi E El Dorado; El Dorado (Hall and Ogilvie, 1960). San Lorenzo (Patton *et al.*, 1981). *SONORA*: Guirocoba (Burt, 1938). Carimechi; Rio "Cuchahaque", 11.3 mi E Alamos; 9 mi SE Alamos, 1000 ft (Burt and Hooper, 1941). Alamos (Patton *et al.*, 1981).

Description. This is a moderately sized pocket mouse, total length about 190, with a long, crested and penicillate tail approximately 95 in length, a moderate sized hind foot (23-24 long), and long ears, averaging about 11 in height. The skull is relatively long (27) and narrow (mastoid breadth, 13), with a relatively long and attenuate rostrum, very small and rugose mastoid bullae, and thus an especially wide interparietal. General description can be found in Best and Lackey (1992a).

Measurements. The mean and range (in mm) of 14 specimens from Chihuahua (Anderson, 1972) are: total length, 177.1 (160-200); length of tail, 94.6 (73-110); hind foot length, 22.6 (21-24); ear length, 11.0 (10-12); weight, 19.3 (13.1-27.5); occipitonasal length, 25.7 (24.9-26.9); occipitobullar length, 6.8 (6.3-7.2); occipitomaxilary length, 15.9 (15.6-16.6); anterior zygomatic

breadth, 12.2 (11.3-12.8); posterior zygomatic breadth, 12.5, (11.9-13.2); interorbital bread, 6.1 (5.5-6.8); anteroposterior interparietal dimension, 3.3 (2.4-3.8); lateral interparietal dimension 7.6 (6.9-8.3).

Remarks. Externally similar to sympatric *C. goldmani*, this species can be distinguished by its slightly smaller size, darker dorsal coloration, less hairy tail, less prominent rump spines, and broader dorsal tail stripe. It has a slightly shorter and narrower skull with less inflated and more rugose mastoid bullae with a strongly marked transverse ridge; smaller tympanic bullae; wider supraoccipital; ascending processes of premaxillae extend posterior to nasals a distance greater than the least breadth of one nasal bone; and deeper palatal pits among other characters (see Anderson, 1964). The range of *artus* overlaps with that of *C. pernix* from central Sinaloa south into northern Nayarit. These two species are readily distinguished by differences in size (large in *artus*, smaller in *pernix*) and presence (*artus*) or absence (*pernix*) of visible rump spines. In southern Sonora, *artus* is smaller than close-by but nonsympatric *baileyi* and larger than *penicillatus* and *pernix*, and differs from all three by its darker coloration and presence of rump spines. This species has less inflated and more rugose mastoid bullae than any other pocket mouse in the northern Mexican states of Sonora, Sinaloa, and Nayarit.

This is the only species in the genus which is not found even in part of its range in one or more sections of the Sonoran Desert, as defined by Shreve and Wiggins (1964). Rather, *artus* is an inhabitant of the more mesic and interior short-tree, or tropical deciduous forest along the western base of the Sierra Madre Occidental. At sites where it is sympatric with *C. goldmani*, *artus* is more typically confined to the more mesic microhabitats, especially within the riparian communities along stream courses (Patton, 1969a). It and *C. pernix* can be sympatric throughout most of Sinaloa, but the latter is usually found in softer, looser soils. No detailed analysis of habitat associations between this pair of taxa has as yet been made.

There are no published accounts on the population biology, life history, demographic, or other ecological variables of *C. artus*. Pregnant females in the Museum of Vertebrate Zoology collections were taken in the months of May and July; litter size varied from 2 to 5.

Hall and Ogilvie (1960) suggested *C. artus* was conspecific with *C. goldmani*, but Anderson (1964) and Patton (1969a) showed the two are in fact sympatric over a broad area in southeastern Sonora and northeastern Sinaloa. No subspecies have been formally recognized in the literature, but no analysis of geographic variation has as yet been undertaken.

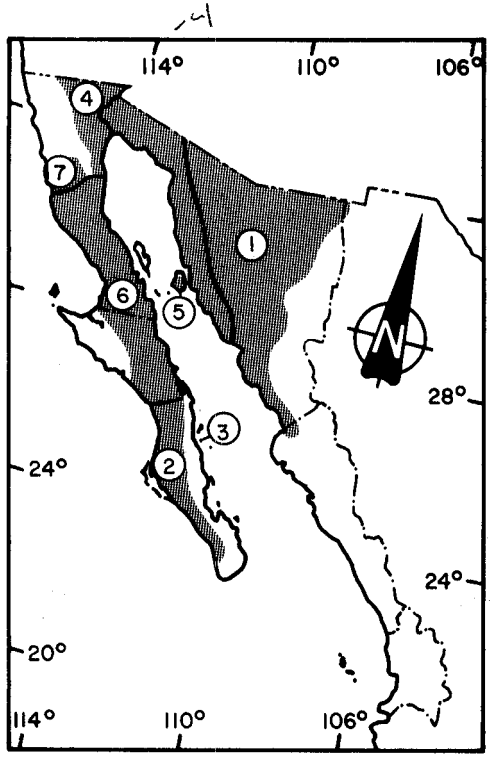
Chaetodipus baileyi baileyi (Merriam)

1894. *Perognathus baileyi* Merriam, Proc. Acad. Nat. Sci. Philadelphia, 46:262.

1983. *Chaetodipus baileyi baileyi*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From Magdalena, Sonora, Mexico.

Range. Nearly coincidental with the Sonoran Desert (as defined by Shreve and Wiggins, 1964), *C. baileyi* ranges from southeastern California across southern Arizona to extreme southwestern New Mexico, and hence south along the western half of Sonora to northwestern Sinaloa, and down nearly the entire length of the Baja California Peninsula, excluding the cape region, and is present on several islands in the Gulf of California. The species distribution has been mapped in detail for Arizona (Hoffmeister, 1986) and New Mexico (Findley *et al.*, 1975), and a generalized range map can be found in Paulson (1988a). The subspecies *C. b. baileyi* ranges from the Colorado river in southwestern Arizona, the southern edge of the Mogollon Plateau in central Arizona, and southwestern New Mexico southward into the foothills of the Sierra Madre Occidental and the



Localization of *Chaetodipus baileyi*:
1. *C. b. baileyi* 2. *C. b. extimus*
3. *C. b. fornicatus* 4. *C. b. hueyi*
5. *C. b. insularis* 6. *C. b. mesidios*
7. *C. b. rudinoris*

coastal plain of Sonora to northern Sinaloa (Hall, 1981; Hoffmeister, 1986; Patton and Jones, 1972).

Recorded localities. *SINALOA*: 1 mi S, 6 mi E El Carrizo; 42.1 km N Los Mochis (Patton and Jones, 1972). *SONORA*: Alamo Wash (35 mi NE Magdalena); Ures; Hermosillo; Bahia San Carlos; San Jose de Guaymas; Obregon (Burt, 1938). Puerto Libertad; Bahia San Carlos (Cockrum and Bradshaw, 1963). Pinacate; Carbo; Bahia Kino; Guaymas; Vicam; Navojoa (Patton, 1972). Navojoa (Patton and Jones, 1972). Bacadehuachic; Bacerac; Huasabas; Moctezuma; Tepache; Rebeico; Tonichi; Mazatlan; Hermosillo; Pitahaya; Coyotes; Navojoa; Desemboque; Pinacate (Patton *et al.*, 1981 as *C. baileyi*).

Description *Chaetodipus baileyi* is one of the largest species in the genus, with a total length usually more than 200 and a hind foot usually greater than 26 (see comparative measurements in Best, 1993). It lacks stiff rump spines, has a soft yellowish gray-brown dorsal pelage color and a self-colored white venter. The ears are moderately large, usually greater than 9 mm; the tail is long, strongly crested, and buff to gray above, whitish below. The skull is large and robust; the mastoid portion of the auditory bullae is moderately inflated; the interorbital region is wider than the width of the interparietal; and the tooth row is long, averaging more than 4 mm.

Measurements. Average measurements of 13 female specimens from southern Arizona (Hoffmeister, 1986) are: body length, 91.9; hind foot length, 27.8; occipito-nasal length, 29.6; fronto-nasal length, 19.7; length of nasals, 11.5; interorbital breadth, 7.1; mastoid breadth, 15.6; zygomatic breadth, 13.8; length mastoid bullae; 9.7; maxillary toothrow length, 4.3; width of interparietal, 6.5; length of interparietal, 4.0; distance between stylomastoid foramen, 12.3.

Remarks. This species can readily be distinguished from all sympatric or near-sympatric chaetodipine pocket mice by the combination of its large size and lack of evident stiff rump spines. Confusion is really only possible between *baileyi* and *C. penicillatus* in Arizona and Sonora, or between *baileyi* and *C. formosus* in eastern California and Baja California. All three species lack rump spines, but, again, *baileyi* is significantly larger in most dimensions of the body and skull. It is much larger than sympatric *C. pernix* (in Sonora and Sinaloa) and *C. arenarius* (in Baja California), the other two species that lack rump spines. It is nearly the same size as *C. hispidus* in southeastern Arizona, but differs by its long and crested tail and grayish, instead of yellowish brown dorsal coloration. From all other species (*C. californicus, C. fallax, C. spinatus* in southern

California and Baja California; *C. intermedius* in Arizona and Sonora; and *C. goldmani* in Sonora and northern Sinaloa), *baileyi* can be readily distinguished by its lack of rump spines and larger body size.

Chaetodipus baileyi is characteristic of Lower Sonoran vegetation, where it can be found sympatric, or nearly so, with a wide range of other pocket mice, including *C. pernix, C. goldmani*, and *C. penicillatus* in southern and eastern Sonora; with *C. penicillatus* and *C. intermedius* in southern Arizona and northwestern Sonora; and with *C. formosus, C. penicillatus, C. spinatus*, and *C. arenarius* in Baja California. This species, in general, prefers the rock-strewn pavements of desert bajadas where the soil matrix is soft alluvium, in the ecotonal area between rocky hill sides and desert flats (Bateman, 1967; Rosensweig and and Winakur, 1969; Wondolleck, 1978). Thus, it is typically segregated by habitat from the sand-dwelling *arenarius, penicillatus*, or *pernix*, and *saxicolous, spinatus, fallax, formosus*, and *intermedius*, although local overlap can be found. It occurs in the same microhabitats as *goldmani* in the thornscrub of eastern Sonora. Much of the range of this species is coincidental with jojoba, the Sonoran Desert endemic shrub *Simondsia chinensis* (Sherbrooke, 1976).

Bailey's pocket mouse has been included in several ecological studies on the dynamics of desert communities, beginning with the early work of Rosensweig and Winakur (1969) and extending through the studies of Price (1978; 1983), M'Closky (1978; 1980), and Reichman (1975). In laboratory experiments, *baileyi* selects larger seeds than congeners (Price, 1983), and cheek-pouch contents contain fewer, but larger seeds (M'Closky, 1980) than other sympatric heteromyids. In general, this species is a dietary generalist, feeding on a variety of seeds but also varying amounts of insects and green plant materials (Reichman, 1975). It is the only desert rodent known that can metabolize the waxy oils of joboba seeds (Sherbrooke, 1976). The volume of the cheek pouches is sufficiently large to enable an individual to carry its daily energy requirements at one time (Morton *et al.*, 1980). Individuals are active year-round (Reynolds and Haskell, 1949), with seasonal peaks in activity during autumn and lows during winter months (Reichman and Van de Graff, 1973). Males are typically in breeding condition for a longer period than females, with peak reproduction in late spring followed by a second short season in late summer (Reynolds and Haskell, 1949). Young-of-the-year born in spring can breed that summer. The average litter size is 3.5 (Paulson, 1988a).

Local populations can be quite dense under favorable conditions, with trap success rates as high as 10% and densities ranging between 17 and 86 individual per hectare reported (M'Closky, 1980; Olding and Cockrum, 1979).

The baculum of this species is relatively small for the size of the animal. Is is a simple spicule similar to that in *formosus*. The shaft in nearly straight and the basal end is slightly enlarged. The measurements from 15 specimens are: length 9.2 (8.5-11.0); height of base 0.64 (0.5-0.8) (Burt, 1960).

This species has no close relatives within the genus, at least based on protein electrophoretic comparisons (Patton *et al.*, 1981). Eight subspecies are usually recognized in the literature (Hall, 1981; Paulson, 1988a; Patton, 1993; Williams *et al.*, 1993), all of which occur in, or are confined to, the northwestern Mexican states of Sinaloa, Sonora, Baja California, and Baja California Sur. Hoffmeister (1986) considered *domensis* to be indistinguishable from *baileyi;* Goldman (1928) noted that *domensis* mainly differed from *baileyi* in its more pale-colored upper parts.

Chaetodipus baileyi extimus (Nelson and Goldman)

1930. *Perognathus baileyi extimus* Nelson and Goldman, J. Washington Acad. Sci., 20:223.

1983. *Chaetodipus baileyi extimus*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From Tres Pachitas, 700 ft, 36 mi S La Paz, Baja California Sur, Mexico.

Range. Known from southern and southwestern Baja California Sur from the type locality of Tres Pachitas, 36 mi S La Paz, north to Comondu, Matancita, and San Jorge (Hall, 1981).

Recorded localities. *BAJA CALIFORNIA SUR*: Pichilingue Bay (Towsend, 1912). Calamahue; Calmalli; Comondu; Matancita; Onyx; Punta Prieta; San Bruno; San Francisquito; San Ignacio; San Ignacio (20 miles west); San Jorge; Santa Rosalia (10 miles west); Tres Pachitas (Nelson and Goldman, 1930). Magdalena desert, Santo Domingo region (Alvarez, 1958). Comondu; Matancitas; San Jorge (Hall, 1981).

Description. Following Nelson and Goldman (1930), they are a light, buff subspecies with nearly pure white forearms and grayish ears. The color of the type is: upper parts near pinkish buff, the top of head and dorsum moderately overlaid with black-tipped hairs, becoming thinner and less conspicuous on sides; a narrow, buff lateral line present; under parts, fore limbs and hind feet white; ears thinly clothed with fine grayish hairs; tail above grayish-brown near base, becoming purer brown toward tip, dull white below. The skull is closely resembles that of *C. b. rudinoris,* but braincase narrower, the narrowing mainly in the parietals and interparietal; mastoids and auditory bullae rather small, but closely approaching those of *rudinoris*.

Measurements. The means and range of six specimens (Burt, 1932) are: total length, 201 (188-223); tail vertebrae, 111 (103-124); hind foot, 25 (24-27); greatest length of skull, 29.3 (28.5-30.9); basal length (groove on incisor to condyle), 24.9 (24.2-26.7); greatest mastoid breadth, 15.2 (14.7-15.8); length of mastoids, 9.5 (9.3-10.2); interorbital constriction, 6.9 (6.8-7.0); length of nasals, 11.6 (10.1-12.5); interparietal length, 4.0 (3.7-4.3); interparietal width, 6.1 (5.8-6.3); length of maxillary tooth row, 4.1 (4.0-4.4).

Remarks. *C. baileyi extimus* is similar to *C. b. rudinoris*, but lighter more buff, the upper parts in general less overlaid with black; sides decidedly lighter; outersides of forearms white, or nearly pure white, instead of distinctly suffused with plumbeous ears clothed with grayish, instead of dusky hairs, and tail grayer above near base (Nelson and Goldman, 1930).

Alvarez (1958) collected this subspecies in a dense shrub, very moist area. Cortes-Calva and Alvarez-Castañeda (1997) determined a relationship between the presence of the species and the vegetative cover, concluding the most importat variable for the area near Bahia de La Paz is the space between plants, and the species are mainly present in modified areas.

Chaetodipus baileyi fornicatus (Burt)

1932. *Perognathus baileyi fornicatus* Burt, Trans. San Diego Soc. Nat. Hist., 7:164.

1983. *Chaetodipus baileyi fornicatus*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From Monserrate Island, 25° 38' LN, 111° 02' LW, Gulf of California, Baja California [Sur], Mexico.

Range. Known only from the type locality of Isla Montserrat in the Gulf of California.

Recorded localities. *BAJA CALIFORNIA SUR*: Montserrat Island (Burt, 1932).

Description. Following Burt (1932), the specimens are a dark-colored insular race, differing from the mainland race *C. b. extimus* in distinctly darker coloration with less cinnamon overwash, in

having a more highly arched skull (antero-posteriorly), smaller, less inflated mastoids, smaller auditory bullae, and broader, heavier jugals. The interparietal is also longer and narrower without a distinct fifth anterior angle.

Measurements. The means and ranges of 10 specimens (Burt, 1932) are: total length, 192 (179-202); length of tail, 102 (94-109); hind foot length, 26 (25-27); greatest length of skull, 25.8 (27.9-29.1); basal length (groove on incisor to condyle), 23.1 (23.4-24.6); greatest mastoid breadth, 14.3 (14.1-14.5); length of mastoids, 8.9 (8.3-9.2); interorbital constriction, 6.5 (6.3-6.9); length of nasals, 10.9 (10.1-11.4); interparietal length, 3.6 (3.4-3.9); interparietal width, 6.4 (6.1-6.6); length of maxillary tooth row, 4.3 (4.0-4.4).

Remarks. This insular race with its dark coloration and small mastoids is set off sharply from all other races of the *Chaetodipus baileyi* (Burt, 1932). The holotype is now housed in the Dickey Collection at the University of California at Los Angeles (Williams *et al.*, 1993).

No specimens have been taken on Isla Montserrat during the past three years (Alvarez-Castañeda *in litt.*). This subspecies is considered rare by the Mexican Government (NOM-059-ECOL-1994).

Chaetodipus baileyi hueyi (Nelson and Goldman)

1929. *Perognathus baileyi hueyi* Nelson and Goldman, Proc. Biol. Soc. Washington, 42:106.

1983. *Chaetodipus baileyi hueyi*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From San Felipe, northeastern Baja California, Mexico.

Recorded localities. *BAJA CALIFORNIA*: El Mayor; El Mayor (13 miles north); San Felipe (Nelson and Goldman, 1929). San Felipe (Patton, 1972). San Felipe; Punta Prieta; Mission San Fernando (Patton *et al.*, 1981 as *C. baileyi*).

Description. Following Nelson and Goldman (1929), this subspecies is similar to *C. b. baileyi* and *C. b. rudinoris,* but general color of upper parts decidedly paler, more ashy, the dusky element less developed than in either. The color of the type is ashy gray with a light buff suffusion on the upper parts, the head and dorsal area finely and rather inconspicuously lined with black; a faint buff lateral line present; under parts, fore limbs and hind feet white; ears scantily clothed with fine whitish hairs; tail light brownish above, white below. The skull closely resembles that of *C. b. rudinoris* but mastoid and auditory bullae are larger, as in *C. b. baileyi.* It differs from *C. b. baileyi* in narrower rostrum, greater posterior extension of premaxillae beyond nasals, and in slenderness of ascending branches of supraoccipital.

Measurements. The measurements of the type given by Nelson and Goldman (1929) are: total length, 196; length of tail, 106; hind foot length, 24; greatest length of skull, 27.5; interorbital breadth, 6.4; length of maxillary toothrow, 3.7; width across mastoid bullae, 14.3; length of interparietal, 4.4; width of interparietals, 5.7; length of nasals, 10.5; width of nasals, 2.5; zygomatic breadth, 14.5.

Range. Distributed from southeastern California west of the Colorado River into northeastern Baja California as far south as the type locality at San Felipe on the gulf coast.

Remarks. Like various other pocket mice from the vicinity of San Felipe, this subspecies is distinguished by extremely pale coloration. Although the type is barely mature, as indicated by lack of wear on the molars, the condition of the mammae shows that young had been suckled (Nelson and Goldman, 1929).

Chaetodipus baileyi insularis (Townsend)

1912. *Perognathus baileyi insularis* Townsend, Bull. Amer. Mus. Nat. Hist., 31:122.

1983. *Chaetodipus baileyi insularis*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From Tiburon Island, Gulf of California, Sonora, Mexico.

Recorded localities. *SONORA*: Tiburon Island (Townsend, 1912; Patton, 1972).

Description. Following Townsend (1912), they are in size and color about the same as *C. penicillatus pricei*. Skull in general rather narrow; rostrum and nasals narrow; interparietal large; ascending branches of supraoccipital narrow; and maxillary arm of zygoma weak.

Measurements. The means and extremes of eight specimens (Burt, 1932) are: total length, 202 (185-211); length of tail, 115 (103-123); hind foot length, 26 (24-27); greatest length of skull, 28.2 (27.2-29.3); basal length (groove on incisor to condyle), 23.6 (22.7-24.5); greatest mastoid breadth, 14.4 (13.8-15.1); length of mastoids, 9.4 (9.2-9.7); interorbital constriction, 6.7 (6.2-7.1); length of nasals, 10.9 (10.6-12.0); interparietal length, 4.1 (3.5-4.4); interparietal width, 6.7 (6.4-7.0); length of maxillary tooth row, 4.0 (3.8-4.2).

Range. Known only from the type locality on Isla Tiburon, off the Sonoran coast in the Gulf of California.

Remarks. This subspecies is considered rare by the Mexican Government (NOM-059-ECOL-1994).

Chaetodipus baileyi mesidios (Huey)

1964. *Perognathus baileyi mesidios* Huey, Trans. San Diego Soc. Nat. Hist., 13:112.

1983. *Chaetodipus baileyi mesidios*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From San Borja Mission, near 28° 45' LN, Baja California, Mexico.

Range. Found in the mid portions of the Baja California peninsula, this subspecies ranges south from Catavina to Bahia Concepcion.

Recorded localities. *BAJA CALIFORNIA*: San Borja Mission (Huey, 1964). Onyx; Calamahue; Isla Smith; San Bruno Concepcion Bay; Punta Prieta (Hall, 1981).

Description. Following Huey (1964), this subspecies is recognizable by its silky, grizzled dorsal pelage with a darker buff median line and long tail thickly haired over the outer half of its length. Its skull is broad and flat across the parietals with swollen audital bullae.

Measurements. The measurements of the type (Huey, 1964): total length, 212; length of tail, 121; hind foot length, 25; ear length (crown), 6; greatest length of skull, 29.7; interorbital breadth, 7.0; length of maxillary toothrow, 4.1; width across mastoid bullae, 15.6; length of nasals, 7.0.

Remarks. Compared with *C. baileyi extimus*, *C. b. mesidios* has more grizzled dorsal pelage with darker colored sides and brighter, broader median buff stripes. The skull is more nearly flat and broader and has slightly more swollen, less truncated audital bullae. Compared with *C. b. hueyi*, it has darker and more grizzled pelage dorsally. The skull is not so broad and is slightly more rounded and not so flattened in profile. Compared with *C. b. rudinoris* is lighter in dorsal pelage color. The skull has less inflated bullae with slightly more slender nasals (Huey, 1964). Only measurements of the type have been published.

Chaetodipus baileyi rudinoris (Elliot)

1903. *Perognathus baileyi rudinoris* Elliot, Field Columbian Mus., Publ. 74, Zool. Ser., 3:167.

1983. *Chaetodipus baileyi rudinoris*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From San Quentin [San Quintin], Baja California, Mexico.

Range. Distributed from the coastal plain near San Quintin and foothill slopes of the southern end of the Sierra San Pedro Martir south to the region of El Marmol and Mission San Fernando (Huey, 1964).

Recorded localities. *BAJA CALIFORNIA*: San Quintin (Elliot, 1903). Rosarito (Hall, 1981).

Description. Following Elliot (1903), it is similar to *C. b. baileyi* but darker, with very slender nasals, mastoids larger, upper incisors more slender. The upper parts and sides pale buff finely lined with black, darkest on head; sides of nose, cheeks and line above eyes pale yellowish buff lined with black; ochraceous lateral line from lips to thighs; under parts pure white; tail above and pencil dark brown. beneath yellowish-white; hands and feet grayish white.

Measurements. Measurments of the type (Elliot, 1903): total length, 232; length of tail, 128; hind foot length, 27; ear length, 1 1.5; occipitonasal length, 31.0; basal length of Hensel, 22.0; interorbital breadth, 6.5; length of maxillary toothrow, 4.0; width across mastoid bullae, 15.0; width of interparietals, 6.5; length of nasals, 10.0; width of nasals (anterior), 3; width of rostrum, 4.0; zygomatic breadth, 16.0; distance from palatal arch to alveolus of incisor, 12.0; greatest width of basioccipital between bullae, 5.0.

Remarks. This subspecies while darker than typical *C. baileyi* is remarkable for its very slender nasals, by which it can be distinguished from any other known form (Elliot, 1903). Except for the holotypes of *C. b. rudinoris* and *knekus* (Elliot, 1903; considered a synonym of *rudinoris*) no measurements have been published (Williams *et al.*, 1993).

Chaetodipus californicus (Merriam)

1889. *Perognathus californicus* Merriam, N. Amer. Fauna, 1:26.

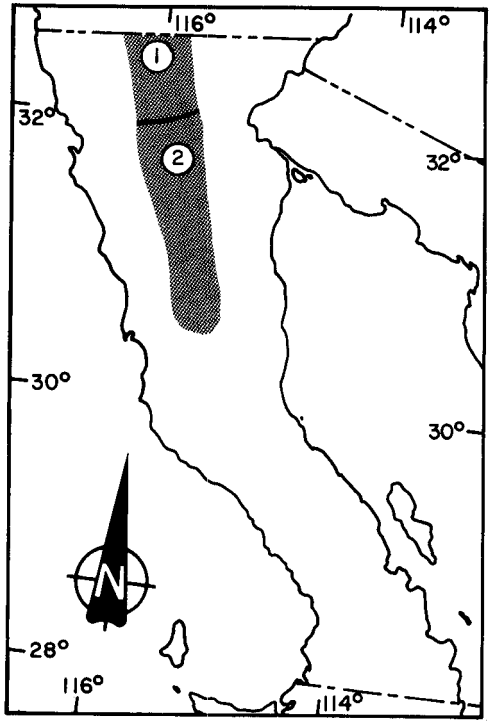
1983. *Chaetodipus californicus*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From Berkeley, Alameda Co., California.

Range. Chaparral (Upper Sonoran), oak grassland, and coastal shrub communities of California and northern Baja California, ranging from the San Francisco Bay area southward in the coastal ranges west of the Central Valley to the Sierra San Pedro Martir, Baja California, and from Placer Co. on the western slope of the Sierra Nevada through the Transverse ranges in southern California.

Description. This is among the largest species in the genus, along with *C. baileyi* and *C. hispidus* (see Best, 1993, for comparative measurements). It is characterized by a relatively long, strongly crested and penicillate tail; numerous stiff spines on the rump, sometimes extending onto the sides; relatively long and square-tipped ear pinna; and relatively small mastoid bullae with a broad interparietal. The ratio of the length of the tail to head and body ranges from about 1.15 to 1.55; the ear is more than 10 mm in length (from the notch); and the width of the interparietal is usually greater than 8.1 mm. This species is typically dark, grizzled, reddish-brown, with a sharply evident buff-colored lateral line separating the dorsal pelage from the self-color white venter.

Remarks. This species is generally similar in most respects to other medium to large-sized members of the genus with distinct spines on the rump, but it needs comparison here only with its sympatric, or near-sympatric congeners, *C. fallax* and *C. spinatus*. From *fallax*, it can be



Localization of *Chaetodipus californicus*.
1. *C. c. femoralis* 2. *C. c. mesopolius*

distinguished, however, by its longer (more than 10 mm) and somewhat squared-topped (as opposed to rounded) ears, slightly larger size, relatively longer tail, and broader interparietal. These also differ in general habitat, with *californicus* typically found in Upper Sonoran (primarily chaparral) and *fallax* in Lower Sonora (primarily desert scrub) habitats. From *C. spinatus*, the range of which it might contact in the extreme southeastern part of its distribution, *californicus* differs by having fewer spines, particularly absent in the shoulder region, a darker and more brownish as opposed to lighter and more yellowish-gray dorsal pelage, a conspicuous stripe of buff-colored hair on the sides, a relatively longer tail, a longer ear, and wider interparietals.

Occurs primarily on hard-pan soils. Its range overlaps with that of *C. fallax*, which is usually found at lower elevations in coastal sage or desert scrub (Lower Sonoran) communities. For example, in the San Gabriel Mountains in southern California, Vaughan (1954) records *fallax* from the coastal sage scrub association on the south slope of the range, with an elevational range extending to about 2000 feet, but *californicus* in the chaparral association above this elevation.

As is true for most pocket mice, the diet of this species is mostly seeds, supplemented with insects and green vegetation particularly during periods of water stress. They typically undergo a pattern of daily torpor, but are active year-round and do not hibernate. They dig burrows, and are typically solitary, but local densities can be reasonably high, equal to those of any other species in the genus. Young are born in the spring and early summer, with litter size usually about four and with one to two litters per year. As with most pocket mice, gestation is about 21 to 28 days.

The baculum of this species is long, with a proximal bulb and a shaft which curves gradually upward to near the end where the distal tip has an abrupt upward turn. Mesurements of four adults are: length 11.4 (11.1-11.6); height of base 0.92 (0.9-1.0) (Burt, 1960).

Most accounts (*e.g.*, Hall, 1981; Williams *et al.*, 1993) list seven subspecies in addition to the dominant form, with two occurring in northwestern Mexico. The species has never been reviewed, however, and the extent to which these races represent biologically meaningful entities remains unknown. The two races in Baja California include (following Huey, 1964; Hall, 1981).

Chaetodipus californicus femoralis (J. A. Allen)

1891. *Perognathus* (*Chaetodipus*) *femoralis* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 3:281.

1983. *Chaetodipus californicus femoralis*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From Dulzura, San Diego Co., California.

Recorded localities. *BAJA CALIFORNIA*: Hanson Lagoon; Hanson laguna Mts. (Hall, 1981).

Description. Following Allen (1891), above prevailing tint blackish, faintly suffused with pale grayish buff, more pronounced on the sides, and bounded below by a broad lateral line of dull orange buff. The pelage of the whole dorsal surface consists of coarse hairs and bristles without underfur; bristly hairs are pale grayish plumbeous basally, subapically broadly ringed with pale buff and tipped with black; they are mixed with coarse grooved spines, some of which are wholly black and others wholly pale buff. Below, whole fore limbs, and inner surface of the hind limbs nearly to the tarsus, white; no light eye-ring; no light spots at base of ears; outer surface of hind limbs blackish to the feet, with long conspicous yellowish white bristles on the thighs; upper surface of the hind feet grayish white; tail sharply bicolor, blackish above and at the tip, grayish white below.

Measurements. The measurements of 20 specimens (Benson, 1930) are: total length, 216 (201-227); length of tail, 124 (105-143); hind foot length, 27 (25-28); ear length, 10 (9-11); greatest length of skull, 28.3 (26.8-29.1); fronto-nasal length, 18.6 (17.7-19.3); length of nasals, 10.7 (10.1-11.5); great width across mastoid, 14.0 (13.7-14.2); interorbital breadth, 6.9 (6.5-7.2); length of maxillary toothrow, 4.1 (3.9-4.4).

Range. This subspecies occupies chaparral communities on the Pacific Slope of San Diego Co., ranging southward along the Peninsular Ranges into Baja California through the Sierra de Juarez and northwestern slopes of the Sierra San Pedro Martir.

Remarks. Data abouth the biology and ecology of the subspecies are unknown

Chaetodipus californicus mesopolius (Elliot)

1903. *Perognathus femoralis mesopolius* Elliot, Field Columbian Mus., Publ. 74, Zool. Ser., 3:168.

1983. *Chaetodipus californicus mesopolius*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From Penon [Piñon], 5,000 ft, San Pedro Martir Mountains, Baja California, Mexico.

Range. It is only known from the Sierra San Pedro Martir.

Recorded localities. *BAJA CALIFORNIA*: Piñon, 5,000 ft, San Pedro Martir Mountains (Elliot, 1903). Agua de las Fresas; Santa Eulalia; Santa Rosa (Hall, 1981).

Description. Following Elliot (1903), this form is large in size, ear large, hind foot and tail long, similar to *C. femoralis* in color but grayer, lacking the bistre color so characteristic of that subspecies. Skull with greater interorbital constriction and somewhat less mastoid breadth. The color above is pale gray and light buff lined with black; nose and side of face pale buff lined sparingly with black; sides grayer than upper parts; lateral line light buff; under parts, hands and feet pure white; tail and pencil dusky above, white beneath; ears light brown.

Measurements. The measurements of the type (Elliot, 1903) are: total length, 232; length of tail, 136; hind foot length, 27; ear length, 14; occipitonasal length, 27.0; basilar length of Hensel, 18.0; interorbital breadth, 6.0; width across mastoid bullae, 13.0; length of nasals, 10.0; width of nasals

(anterior), 3.0; posterior width of nasals, 2.0; width of rostrum, 5; zygomatic breadth, 13.0; distance from palatal arch to alveolus of incisor, 10.0.

Remarks. This form was distinguished from *C. c. femoralis* primarily based on its grayer color, which, in *Chaetodipus*, generally suggests an animal in juvenile pelage (see Williams *et al.*, 1993). It appears to be restricted to the San Pedro Martir range, which is separated from the Laguna Hanson mountains on the north by an approximately fifty-mile stretch of broken hills and mesas, and a strip of desert, the elevation of this tract ranging from 3,000 to 6,000 feet. In the Laguna Hanson mountains *C.* c. *femoralis* was taken (Elliot, 1903).

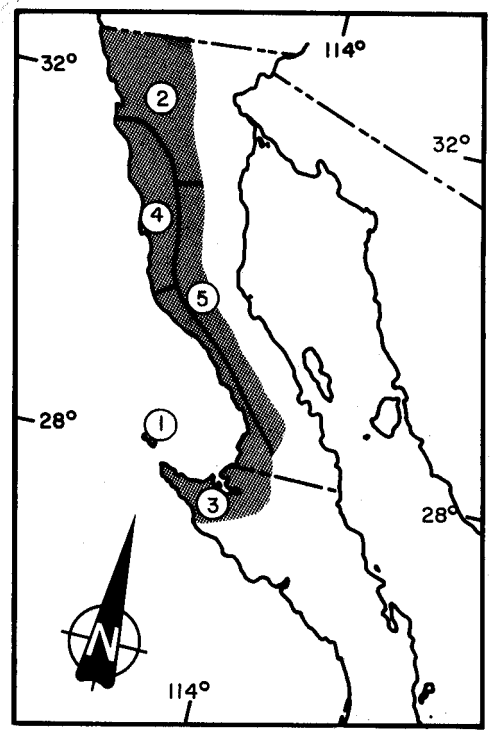
Chaetodipus fallax fallax (Merriam)

1889. *Perognathus fallax* Merriam, N. Amer. Fauna, 1:19.

1983. *Chaetodipus fallax fallax*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From San Bernardino [Reche Canyon, 3 mi SE Colton, 1,250 ft], San Bernardino Co., California.

Range. This species has one of the smallest ranges of any member of the genus. It is limited to southern California, from the north side of the Transverse Ranges, south through northwestern Baja California along the Pacific coast to Bahia San Bartolome, including Isla Cedros (Lackey, 1996; Williams *et al.*, 1993). *C. f. fallax* is distributed from the southern slopes of the San Gabriel and San Bernardino mountains in southern California, south through the coastal sage zone into northern Baja California, from Jacumba west to the Pacific Ocean and south to El Valle de la Trinidad and to Ensenada, mainly on the western slopes of the Sierra Juarez and more coastal hills.



Localization of *Chaetodipus fallax*:
1. *C. f. anthonyi* 2. *C. f. fallax*
3. *C. f. inopinus* 4. *C. f. majusculus*
5. *C. f. xerotrophicus*

Recorded localities. *BAJA CALIFORNIA*: Ensenada; Cañada del rio San Diego, cerca de Tijuana; Sangre de Cristo (Villa, 1941). El Valle de las Palmas; N side of Descanso Bay; Ensenada; 6 mi E Ensenada; Boundary S Jacumba, California; Sangre de Cristo; El Valle de la Trinidad (not typical); summit of San Matias Pass (not typical) (Huey, 1960b).

Description: This is a medium-sized pocket mouse with relatively short and rounded ears (less than 9 mm), distinct spines are present on the rump and flanks, the tail is long and both crested and penicillate, and the dorsal coloration ranges from a rich brown in specimens from along the coast to light grayish-brown at inland localities on

the margins of the desert. A buff-colored lateral line is present, and the underparts are self-colored white or creamy white. The cranium is arched, the interparietal is wide with a conspicuously obtuse anterior angle, the mastoids are relatively large, the rostrum is attenuated and narrow, and the nasofrontal suture is slightly or not at all emarginate. The total length averages about 190 mm, tail about 105 mm, greatest skull length about 26.6 mm, and maxillary tooth row length about 4 mm.

Measurements. Osgood (1900) gave average external measurements for six individuals and average cranial measurements for three individuals from the type locality, as follows: total length, 192; length of tail, 110; hind foot length (dry), 23; ear length (crown, dry), 9; occipitonasal length, 26.0; basilar length of Hensel, 18.0; width across mastoid bullae, 12.9; length of interparietal, 3.8; width of interparietal, 7.8; interorbital width, 6.6; length of nasals, 6.0.

Remarks. This species really only needs comparison with *C. californicus*, with which it might be locally sympatric. As noted under the account of that species, *californicus* is distinctly larger in size, with longer and obviously more square-topped as opposed to rounded ears. The two also differ in primary habitat (see below), but otherwise are quite similar. Compared to other pocket mice which may be sympatric or nearly so, the rump spines of *fallax* will differentiate it from *arenarius*, *baileyi*, and *formosus*, as will its buff lateral line. The rump spines of *fallax* are not nearly as well developed as in *spinatus*, where they extend onto the shoulders.

In the laboratory under a range of controlled conditions, this species will select substrates characterized by coarse, light soil (Price and Longland, 1989), similar to the conditions under which they are typically found in nature. Their habitat ranges from rocky areas within shrub communities both on desert slopes and the coast. The typical habitat along the Pacific is coastal sage scrub vegetation (Price and Kramer, 1984; Price and Waser, 1984). In the La Puerta Valley in southeastern San Diego County, California, *fallax* was collected with six other species of pocket mice, five *Chaetodipus* (*baileyi*, *californicus*, *formosus*, *penicillatus*, and *spinatus*) as well as *Perognathus longimembris*, perhaps the richest assemblage of pocket mice anywhere (von Bloeker, 1932). It occupies typically more xeric and open habitats at elevations below that of *californicus*, the stony soils above the sandy desert fans where *C. penicillatus* and *P. longimembris* are likely to be found, but the same types of soils in which *C. baileyi*, *C. formosus*, and *C. spinatus* occur. No studies have been made on how these species partition their habitat in areas of sympatry.

Like many other pocket mice and kangaroo rats (but certainly not all), the San Diego pocket mouse can persist on a diet of dry seeds and no free water, without losing weight (MacMillen, 1964). Urine concentrating ability has been examined by MacMillen and Hinds (1983), resting metabolism by Hinds and MacMillen (1985), and general metabolic rates as a function of habitat by Hulbert *et al.* (1985). Mice can be active above ground throughout the year, but long-term trapping data in the San Gabriel Mountains of southern California (Vaughan, 1954) indicate that they are not active on nights when the temperature fell below 5° C. Thus, the species might remain underground for weeks at a time during prolonged cold weather. Reproduction apparently occurs primarily in late winter and spring, but a second peak has been noted in the fall at some localities (MacMillen, 1964; Vaughan, 1954). Its diet consists mostly of seeds, like other pocket mice, but the species may be an effective herbivore under some conditions; Meehan *et al* (1977) report that *C. fallax* and *C. baileyi* were responsible for extensive cropping of leaves and shoots of herbaceous perrenials. Vaughan (1954) also reported that *fallax* consumed *Opuntia* pads, although this activity has been debated (MacMillen, 1964). Home range sizes have been measured at 0.3 ha, with no difference in size as well as little overlap between the sexes (MacMillen, 1964). Maximum

densities have been measured at 52 mice per hectare during the spring months, with average longevity of marked individuals only about 5 months (Ryan, 1968; McClenaghan, 1983).

Hall (1981), following Huey (1964), considers *C. anthonyi* as a species separate from *C. fallax*, but most subsequent authors view it only as a subspecies (Patton, 1993; Williams *et al.*, 1993; Lackey, 1996). It has the same karyotype as does *fallax* sampled throughout its range (Patton, 1970). In addition to *anthonyi*, there are five other subspecies currently recognized for this species, four of which occur along the Baja California peninsula (see Huey, 1960b). The only subspecies not in Baja California (*pallidus* Mearns, E.A. 1901. Proc. Biol. Soc. Wash., 14:135) is distributed along the desert slopes of the Transverse and Peninsular ranges in southern California, with a type locality of Mountain Spring, half-way up the east slope of the Coast Range Mountains, on the Mexican Boundary Line, in San Diego County, California. While it has not been recorded in Mexico, it may extend south along the eastern slope of the Sierra Juarez. Huey (1960b), however, failed to find the species at places on the desert slopes of the Sierra Juarez where he expected it.

Chaetodipus fallax anthonyi (Osgood)

1900. *Perognathus anthonyi* Osgood, N. Amer. Fauna, 18:56.

1983. *Chaetodipus fallax anthonyi*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From South Bay, Cerros [Cedros] Island, Baja California, Mexico.

Range. Known only from Isla Cedros, Pacific Ocean, Baja California.

Recorded localities. *BAJA CALIFORNIA*: Isla Cedros (Osgood, 1900).

Description. Color above grayish fawn mixed with black; lateral line brownish fawn, poorly defined; ears dusky; white subauricular spot present; tail dusky above, whitish below. Skull similar to *C. f. fallax* but cranium less arched; rostrum heavier; mastoids smaller; interparietal smaller and shorter; zygomatic breadth greater anteriorly.

Measurements. The measurements of the holotype (Osgood, 1900): total length, 168; length of tail, 92; hind foot length, 23.5; occipitonasal length, 25.4; basilar length of Hensel, 17.4; interorbital breadth, 6.0; width across mastoid bullae, 12.9; length of interparietal, 2.6; width of interparietals, 5.8; length of nasals, 10.2.

Remarks. *C. fallax anthonyi* is characterized as being smaller than typical *fallax*, but is similar in size to *C. f. Inopinus*, the subspecies on the mainland opposite Cedros Island.

Chaetodipus fallax inopinus (Nelson and Goldman)

1929. *Perognathus fallax inopinus* Nelson and Goldman, Proc. Biol. Soc. Washington, 42:110.

1983. *Chaetodipus fallax inopinus*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From Turtle Bay [Bahia Tortugas; also known as Bahia San Bartolome], Baja California Sur, Mexico.

Range. This race occurs on the narrow coastal strip from the mouth of the Rio Santa Catarina in Baja California south to the type locality at Bahia Tortugas [San Bartolome], Baja California Sur.

Recorded localities. *BAJA CALIFORNIA SUR*: San Bartolome Bay (Towsend, 1912). Bahia Tortugas (Nelson and Goldman, 1929). Santa Catalina Landing; Santa Rosalia Bay (Huey, 1960b).

Description. Following Nelson and Goldman (1929), it is closely allied to *C. f. fallax* and *C. f. pallidus,* but smaller and upper parts more rufescent than usual in either; skull differing in smaller size and structural details. The color of the type is lighter in upper parts near ochraceous-buff, but slightly more tawny, this color purest along lateral line, but much obscured on head and back by overlying black-tipped hairs, the combination producing a brownish tawny effect; under parts and feet white; outer sides of forearms faintly tinged with buff; tail blackish above, white below. The skull is similar to those of *C. f. fallax* and *C. f. pallidus,* but smaller, less massive; rostrum relatively more slender; dentition lighter; incisors narrower; molariform toothrows relatively shorter; auditory bullae relatively rather large.

Measurements. Total length, 180; length of tail, 104; hind foot length (dry), 23; greatest length of skull, 25.5; interorbital breadth, 6.2; length of maxillary toothrow, 3.5; width across mastoid bullae, 13.2; length of interparietal, 4.3; width of interparietals, 6.6; length of nasals (median line), 9.3; width of nasals, 2.5.

Remarks. Compared with that of *C. anthonyi* in general, this subspecies is similar but more ruddy in color and has quite distinctive cranial characteristics. Rump spines present as usual in the species. The skull is broader posteriorly, with zygomata narrower, more convergent anteriorly, the sides, therefore, less nearly parallel; interorbital space broader; interparietal larger; audital bullae larger, more inflated (Nelson and Goldman, 1929).

Other than those of the holotype, there are no published measurements for *inopinus.*

Chaetodipus fallax majusculus (Huey)

1960. *Perognathus fallax majusculus* Huey, Trans. San Diego Soc. Nat. Hist., 12:418.

1983. *Chaetodipus fallax majusculus*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From San Quintin, Baja California, Mexico.

Range. This is another coastal race, ranging from its type locality at Bahia San Quintin, Baja California south to El Rosario and northeast to Las Cabras.

Recorded localities. *BAJA CALIFORNIA*: 3 mi S San Telmo; Las Cabras; Santo Domingo (30° 47' LN); 1 mi S San Ramon; S San Ramon; north end of San Quintin; 10 mi SE San Quintin; Santa Maria, near San Quintin; 5 mi E San Quintin; 1 mi E El Rosario; 4 mi E El Rosario; 10 mi E El Rosario; mouth of Canyon San Juan de Dios; Aguaita (not typical) (Huey, 1960b). Las Cabras; 10 mi E El Rosario (Hall, 1981).

Description. Following Huey (1960b), this race is darker in dorsal coloration than any other member of the species, clearly so when a series of specimens is examined. It has a very robust body with a relatively shorter tail that is brightly bicolored and well tufted. An unusually large number of spine-like white bristle hairs are present over the posterior part of the body.

Measurements. The mesaurements of the type (Huey, 1960b) are: total length, 191; length of tail, 105; hind foot length, 24; ear length, 6; greatest length of skull, 26.7; interorbital breadth, 6.9; length of maxillary toothrow, 3.6; width across mastoid bullae, 14.7; length of nasals, 9.8.

Remarks. No measurements have been published for specimens other than the holotype.

Chaetodipus fallax xerotrophicus (Huey)

1960. *Perognathus fallax xerotrophicus* Huey, Trans. San Diego Soc. Nat. Hist., 12:419.

1983. *Chaetodipus fallax xerotrophicus*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From 2 mi NE Chapala, Baja California, Mexico.

Range. Distributed inland of the coastal races *inopinus* and *majusculus*, in the foothills of the Sierra San Pedro Martir, Sierra San Miguel, and Sierra de San Borja.

Recorded localities. *BAJA CALIFORNIA*: Matome; San Agustin; Rancho Ramona, 7 mi N Santa Catalina; San Andreas (*sic*); 25 mi N Punta Prieta; San Fernando Mission (Hall and Kelson, 1959). San Fernando Mission; 5 mi SE San Fernando; San Agustin; Rancho Ramona, 7 mi N Santa Catarina; Onyx; 3 mi S El Marmol; 13 mi NW Chapala; 2 mi NE Chapala; 25 mi N Punta Prieta; San Andreas (not typical) (Huey, 1960b). Punta Prieta; Mision San Fernando (Patton *et al.*, 1981 as *C. fallax*).

Description. Following Huey (1960b) this race, in dorsal view of the series, is slightly paler than *C. f. majusculus,* but is decidedly darker than the coastal form, *C. f. inopinus,* and *C. f. pallidus,* the race that inhabits the California desert. *C. f. xerotrophicus* is similar to but has a smaller body size than the nominate race, *C. f. pallidus* and *C. f. majusculus,* and larger than *C. f. inopinus*, and differs from them all by having a longer tail. The skull of *C. f. xerotrophicus* can be differentiated from *C. f. majusculus* in being lighter-boned, with less inflated bullae, and a smaller braincase, with a flatter, less-curved profile and more slender rostrum. From *C. f. inopinus*, *xerotrophicus* is more heavily boned and larger in size.

Measurements. The measurements of the type (Huey, 1960b) are: total length, 210; length of tail, 127; hind foot length, 24; ear length, 6; greatest length of skull, 26.8; interorbital breadth, 6.2; length of maxillary toothrow, 3.7; width across mastoid bullae, 14.0; length of nasals, 10.4.

Remarks. No measurements other than those of the holotype, are available.

Chaetodipus formosus (Merriam)

1889. *Perognathus formosus* Merriam, N. Amer. Fauna, 1:17.

1983. *Chaetodipus formosus formosus*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From St. George, Washington Co., Utah.

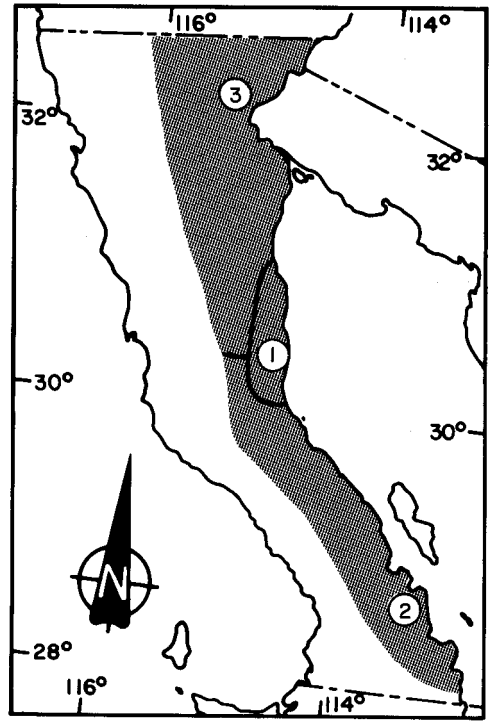
Range. The Long-tailed pocket mouse is distributed throughout the southern Great Basin, Mojave, and Colorado sections of the Sonoran Desert, from western and southern Utah, northwestern Arizona north of the Grand Canyon, western and southern Nevada, eastern and southeastern California, and eastern Baja California south to El Barril (Huey, 1964; Williams *et al.*, 1993).

Description. This is a medium-sized mouse, with a total length about 190 mm, tail length of 105 mm, and hind foot length of 24 mm. The tail is long and with a very well developed crest; the mastoids are enlarged, projecting beyond the plane of the occiput. Proportionally, this is one of the longest-tailed species in the genus, with the tail between 125 and 130 percent of the head and body length.

Remarks. This species can be found sympatric, or nearly so, with *C. arenarius*, *C. baileyi*, *C. fallax*, *C. penicillatus*, and *C. spinatus* in southeastern California and adjacent northeastern Baja California. It can be distinguished from all of these species by its moderately well-inflated auditory bullae, particularly the mastoid portion that extends posteriorly to the occiput. Externally, it differs from *fallax* and *spinatus* by the lack of rump spines; and from *arenarius* by its larger size, proportionately longer and more crested tail, and gray as opposed to pale yellowish dorsal color. This species is most similar to *baileyi* and *penicillatus*, differing from the former by being smaller in all body measurements and with grayish as opposed to yellowish gray dorsal color, and

from the latter by its longer and more strongly crested tail, as well as by bullar expansion. *C. formosus* and *C. baileyi* are unique among chaetodipine pocket mice in having a nearly straight bacula without an upturned tip (Burt, 1960).

Individuals of this species generally prefer rocky soils, often on rocky slopes or at the base of cliffs, within a desert scrub habitat association. They are found on lava flows in many areas within their range, on rocky or gravelly soils of dry stream beds, and on desert pavements with marble-sized rocks (Hall, 1946; Hoffmeister, 1986). Thus, Long-tailed pocket mice are likely to overlap in habitat with *C. spinatus* and perhaps *C. fallax* in Baja California, but can be readily distinguished from these two species by the lack of rump spines.



Localization of *Chaetodipus formosus*:
1. *C. f. cinerascens* 2. *C. f. infolatus*
3. *C. f. mesembrinus*

As with most species of pocket mice, this one is also primarily a seed-eater, supplementing their diets seasonally with flowers and leaves, fruits, and sometimes insects. Smith and Jorgensen (1975) record the breeding season as beginning in the spring and continuing through summer. The litter size averages over five young, with a range of two to six. Young of the year may become reproductively active, but breeding is usually confined to animals which are at least 12 or more months old. The species has been collected in the winter, suggesting that it does not hibernate (Hoffmeister, 1986).

This species was traditionally placed in the subgenus *Perognathus* (Osgood, 1900; Hall, 1981), largely because of its relatively well-inflated auditory bullae despite possession of external features (such as elongated crested tail, hispid pelage, and naked soles of the hind feet) more typical of *Chaetodipus*. Protein electromorphic data clearly align *formosus* with *Chaetodipus* (Patton *et al.*, 1981), and all recent authors have included it within this genus (*e.g.*, Hafner and Hafner, 1983; Patton, 1993; Williams *et al.*, 1993). Nine subspecies are listed in Hall (1981) and Williams *et al.* (1993), three of which occur within the Baja California peninsula (Huey, 1964).

Chaetodipus formosus cinerascens (Nelson and Goldman)

1929. *Perognathus formosus cinerascens* Nelson and Goldman, Proc. Biol. Soc. Washington, 42:105.
1983. *Chaetodipus formosus cinerascens*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From San Felipe, northeastern Baja California, Mexico.

Range. Known from the arid rocky hills in the gulf coastal desert in the vicinity of the type locality at San Felipe, Baja California, Mexico. Its southern limits along the coast are unknown (Huey, 1964).

Recorded localities. *BAJA CALIFORNIA*: San Felipe (Nelson and Goldman, 1929). San Felipe; NE El Marmol (Huey, 1954).

Description. Following Nelson and Goldman (1929), this is a small and extremely pallid subspecies closely allied to *C. f. mesembrinus*, but distinguished by ashy gray coloration of upperparts, with scarcely a trace of the dull buff-brownish suffusion present in *mesembrinus*. The upper parts coloration of the type is light ash-gray, finely and rather inconspicuously mixed with black owing to overlying black-tipped hairs which are most numerous along median line on head and over back; under parts, including lips, lower part of cheeks, entire fore limbs and hind feet white; tail light brownish above, becoming darker toward tip; white below. The skull is very similar to that of *C. f. mesembrinus,* but smaller; rostrum and nasals very slender and the interorbital region apparently narrower.

Measurements. Total length, 155; length of tail, 75; hind foot length, 22.8; weight, 15.8 g; greatest length of skull, 24.3; interorbital breadth, 6.1; length of maxillary toothrow, 3.4; width across mastoid bullae, 13.6; length of interparietal, 3.5; width of interparietals, 5.0; length of nasals, 9.3; width of nasals, 2.2.

Remarks. Most of the mammals of the region of San Felipe are very light in color, and this subspecies follows the same general rule. This is a region of extreme aridity and continuous intense sunshine. Because the soil is a light color, even where the surface is not covered with whitish drifting sand, the pale color of the mammals is undoubtedly caused by environmental influences (Nelson and Goldman, 1929). No additional measurements for *cinerascens* other than for the holotype have been published.

Chaetodipus formosus infolatus (Huey)

1954. *Perognathus formosus infolatus* Huey, Trans. San Diego Soc. Nat. Hist., 12:1.

1983. *Chaetodipus formosus infolatus*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From 7 mi W San Francisquito Bay, 28° 30' LN, Gulf of California, Baja California, Mexico.

Range. Distributed along the central gulf coast south of the range of *cinerascens*, from El Marmol to El Barril.

Recorded localities. *BAJA CALIFORNIA*: 7 mi W San Francisquito Bay; [El] Barril; 3 miles S El Marmol; 3 miles W El Marmol (Huey, 1954).

Description. Following Huey (1954), in color, *C. f. infolatus* is the most pallid, dorsally, of all the known races of *Chaetodipus formosus*. In this characteristic, it even exceeds the pallor of the ashen-colored *C. f. cinerascens* that inhabits the extremely arid, stony areas northward near San Felipe, Baja California, Mexico. It is larger in size than *C. f. cinerascens* and has a proportionately larger cranium with larger, more inflated mastoid bullae.

Measurements. The only published measurements are those from the type: total length, 187; length of tail, 104; hind foot length, 25; ear length (crown), 6; occipitonasal length, 27.5; interorbital breadth, 6.6; length of maxillary toothrow, 3.8; width across mastoid bullae, 14.6; length of nasals, 10.2.

Remarks. No data about the ecology and biology of the subspecies are known.

Chaetodipus formosus mesembrinus (Elliot)

1904. *Perognathus mesembrinus* Elliot, Field Columbian Mus., Publ. 87, Zool. Ser., 3:251.

1983. *Chaetodipus formosus mesembrinus*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From Palm Springs, Riverside Co., California.

Range. This form occurs throughout the desert area of southern California south to the southern end of Laguna Salada in northern Baja California.

Recorded localities. *BAJA CALIFORNIA*: Matome (Hall, 1981).

Description. This is a small, pale desert form. The upper parts and thighs mixed drab gray and buff; no lateral line; lips, entire under parts, forelegs, fore and hind feet white; tail above and pencil brownish drab, beneath whitish; ears dark brown, bases covered with tufts of drab gray. The skull is shorter than typical *C. formosus,* but equally broad and with the same large mastoid bullae but which project further posterior to the occiput.

Measurements. Measurements taken from Williams *et al.* (1993): total length, 195; length of tail, 114; hind foot length, 23; ear length, 11; total length of skull, 21; basilar length of Hensel, 18; interorbital breadth, 7.0; length of maxillary toothrow, 4.0; length of mastoid bulla, 9.0; width across mastoid bullae, 14.0; length of nasals, 9.4; zygomatic breadth, 13.0; greatest parietal width, 10.5; palatal length, 10.0; length of mandible, 12.5; length of mandibular toothrow, 3.5.

Remarks. No other published measurements for *mesembrinus* are known. Length of skull given by Elliot (1904) suggests either an error in measuring or recording, or a juvenile specimen (Williams, *et al.*, 1993).

Chaetodipus goldmani (Osgood)

1900. *Perognathus goldmani* Osgood, N. Amer. Fauna, 18:54.

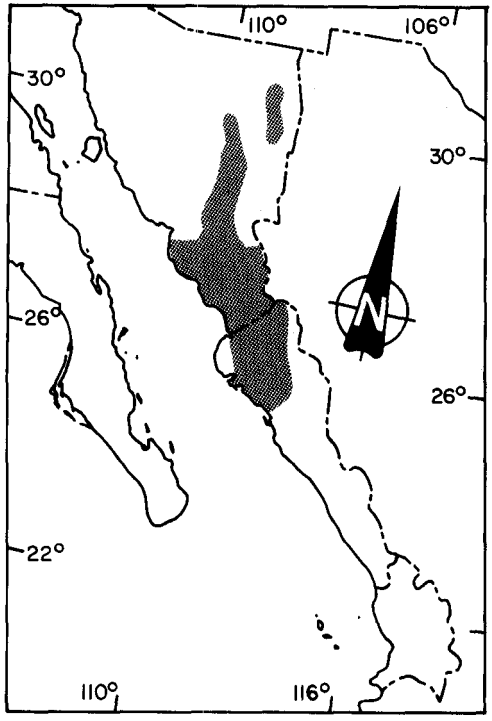
1983. *Chaetodipus goldmani*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From Sinaloa, Sinaloa, Mexico.

Range. Known from the coastal plain from northern Sinaloa inland through the Rio Sinaloa and Rio Fuerte valleys, north into Sonora along the coast as far as Ciudad Obregon and inland into the foothills of the Sierra de Alamos and Sierra Madre Occidental throughout the Rio Mayo (to extreme western Chihuahua) and Rio Yaqui drainages, including the Rio Moctezuma. An isolated population is known from northeastern Sonora, from near Huachinera in the upper Rio Bavispe drainage south to Nacori Chico, but the species is apparently absent from the middle and lower sections of this effluent of the Rio Yaqui (see Patton, 1969a; Lackey and Best, 1992).

Recorded localities. *SINALOA*: Sinaloa (Osgood, 1900). 2.5 mi N El Fuerte; 10 mi NNW Los Mochis (Hall and Ogilvie, 1960). El Carrizo; El Fuerte; San Blas (Patton *et al.*, 1981). *SONORA*: Alamos; Camoa (Osgood, 1900). Tesia; Chinobampo (Burt, 1938). Rio Mayo, near Carimechi (Burt and Hooper, 1941). Aduana; Alamos (Ingles, 1959). 1 mi E Buena Vista, on Rio Yaqui reservoir, 1000 ft; Camoa; Tesia; Alamos; 4.5 mi SE Alamos, 1000 ft; Chinobampo; 3 mi NNW Bacarachi (Bacavachi) (Hall and Ogilvie, 1960). Rio Cuchujaqui; 0.5 mi N La Aduana; 6.7 mi N, 17.3 mi E Navajoa [Navojoa] (Cockrum and Bradshaw, 1963). Alamos; SE Alamos; Esperanza; Navojoa; N Navojoa; Nuri; Rebeico; Tonichi; El Novillo; Moctezuma; Bacanora; Sahuaripa; Nacori Chico; NE Nacori Chico; El Coyote; Aribabi (Patton *et al.*, 1981).

Description. This is a medium-to large-sized species, nearing 200 mm in total length, a tail of over 100 mm on average, and a hind foot over 24 mm on average. The pelage is hispid and moderately



Localization of *Chaetodipus goldmani.*

developed rump spines are present. Dorsal coloration is a dark grayish-brown sprinkled with an admixture of black. A lateral line of pinkish buff is apparent. Melanistic animals can be found on the malpais south of Moctezuma in north-central Sonora (Findley, 1967). The ears are blackish and long, averaging over 11 mm, with a prominent antitragal lobe that is wider at the base than the apex. The tail is sharply bicolored, blackish above and white below, and moderately crested and penicillate. The skull is heavy, with relatively uninflated mastoid portions of the auditory bullae and a stout rostrum. Greatest skull length averages 27 mm, cranial width about 13.5 mm, and maxillary tooth row length slightly less than 4 mm. Summary measurements for external and cranial dimensions can be found in Straney and Patton (1980) and Best (1993).

Measurements. The mean and range of a five specimens from Chihuahua (Anderson, 1972) are: Total length, 182.4 (170-192); length of tail, 96.6 (87-102); hind foot length, 24.3 (23-25); ear length, 9.8 (9-10); weight, 21.4 (19-23); occipitonasal length, 26.5 (25.8-27.1); occipitobullar length, 7.5 (7.3-7.6); occipitomaxilary length, 16.2 (16.0-16.5); anterior zygomatic breadth, 12.8 (12.6-13.1); posterior zygomatic breadth, 13.1, (12.7-13.7); interorbital bread, 6.1 (5.7-6.4); anteroposterior interparietal dimension, 3.6 (3.3-3.8); lateral interparietal dimension 7.3 (6.9-7.6).

Remarks. This species is sympatric, or nearly so, with *C. penicillatus* and *C. baileyi* in the northern part of its range, with *C. penicillatus*, *C. baileyi*, and *C. pernix* along the coastal plain of southern Sonora, and with *C. artus* in the interior foothills of southeastern Sonora and northeastern Sinaloa. It can be readily distinguished from the first three species by the presence of rump spines, its darker, grizzled brownish pelage streaked with black, and its larger ears. It is slightly smaller than *baileyi*, but larger than either *penicillatus* or *pernix*. Anderson (1964) details distinctions between *goldmani* and *artus* in areas of sympatry. Characters differentiating these two species are described above under the latter species.

This species occurs from thornscrub habitats along the coast of Sinaloa and Sonora into short-tree forest to the east in the Sierra Madrean foothills. In the Rio Yaqui drainage, the species is found in the Foothills of Sonora section of the Sonoran Desert (Shreve and Wiggins, 1964), habitat dominated by organ pipe and hecho columnar cactus, tree ocotillos, and mesquite. In the upper Rio Bavispe drainage, *goldmani* is found in the lower montane woodlands and riparian habitats. It occurs in a wide variety of soil types, usually in hard soils composed of fine silt grains, but also on rocky hillsides. In coastal areas where it is sympatric with *penicillatus* and *pernix*,

goldmani is more common on rocky slopes and the other two on flatter, sandier bottomlands. In interior regions of the central Rio Yaqui basin, *goldmani* is found on rocky slopes and hard soils, again *penicillatus* in looser, sandier soils, and *baileyi* on stony bajadas. In short-tree forest habitats, *goldmani* is found in the xeric areas away from the more mesic stream sides where *artus* is common (Patton, 1969a).

Little has been published regarding the population biology of this species, except habitat range (*e.g.*, Burt and Hooper, 1941; Patton, 1969a; summarized in Lackey and Best, 1992). Pregnant or lactating females are recorded from the months of April through August (specimens in the Museum of Vertebrate Zoology collections), suggesting breeding proceeds following the winter rains and continues with the summer monsoon season. Scar or embryo counts from these specimens ranged from two to four.

The baculum is a fairly large, sigmoid-shaped bone with sligthtly enlarged basal end and an upturned distal end which forms approximately a right angle with the shaft. The base is slightly higher than wide. The mesaurements of five specimens are: length 13.5 (13.2-14.1); height of base 0.96 (0.9-1.1) (Burt, 1960).

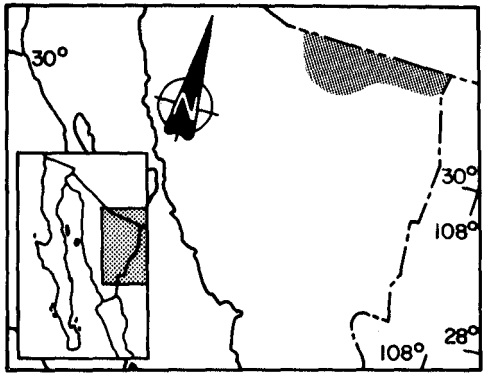
There are no described races of this species, although its range is divided into six distinct and contiguously allopatric chromosome races (Patton, 1969a). In southern Sonora and northern Sinaloa, these races are geographically bounded by the major river courses in the region, the Rio Mayo, Rio Fuerte, and Rio Cuchijaqui. Chromosomal hybrids are known between two of the races in southeastern Sonora and adjacent Sinaloa. Populations belonging to the northern and southern races are largest, with geographically intermediate populations of smaller size. Straney and Patton (1980) examine geographic variation in external and cranial dimensions, and relate that variation to both phylogenetic and environmental determinants. Variation in protein electromorphic loci was examined by Patton *et al.* (1981).

Chaetodipus hispidus Baird

1858. *Perognathus hispidus* Baird, S. F. 1857 [1858]. Reports of Explorations and Surveys...., 8(1):421.
1983. *Chaetodipus hispidus*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. Charco Escondido [Tamaulipas], Mexico (24 leagues W of Matamoros).

Range. This species ranges from North Dakota in the United States through the Great Plains southeast to central Tamaulipas, Mexico, and southwest into New Mexico, southeastern Arizona, northeastern Sonora, and adjacent Chihuahua. There is an apparently disjunct population in central Mexico from southern Coahuila and Durango to Hidalgo (Paulson, 1988b).



Localization of *Chaetodipus hispidus*.

Description. One of the larger species of chaetodipine pocket mice, *C. hispidus* has a total length usually longer than 200 mm, a tail length about equal to or slightly shorter than head and body length, and a hind foot length averaging more than 25 mm (Paulson, 1988b; Best, 1993). The tail is unique among chaetodipine pocket

mice in lacking a crest. The pelage is coarse, dorsally mixed ochraceous and blackish, with a distinct ochraceous lateral band, and white venter. The skull is large and robust, interorbitally broad, supraorbital beads are evident, and the mastoids are relatively small and do not extend posteriorly. The baculum is straight but has a unique tridigitate tip.

Remarks. This species is the most distinctive in the genus, and can be distinguished from any other pocket mouse by the combination of generally bright ochraceous, as opposed to grayish or brownish, dorsal coloration, relatively small and uninflated mastoid bullae, and relatively short, noncrested tail.

This species is common in short-grass and open bunch-grass prairie and scrub habitats of the western and central Great Plains and desert grasslands, extending south through similar habitats throughout the Mexican Plateau. It enters tropical deciduous forest on the coastal slopes of Tamaulipas. It can be found on a variety of soil substrates, ranging from rocky or gravelly areas that are dense to alluvial sandy soils. In southeastern Arizona, Hispid pocket mice can be found sympatrically with the Desert pocket mouse, *C. penicillatus*, in the alluvial base and valley floors (Hoffmeister and Goodpaster, 1954; Hoffmeister, 1986).

These are primarily seed eaters, with the diet shifting seasonally depending upon availability, although some green plant material may be taken. They cache large quantities of seeds, which form winter food stores as this species does not store fat reserves nor hibernate. Individuals are aggressive and solitary, inhabiting self-dug borrow systems. Females may produce two litters in a season, which extends from spring through late summer, with litter sizes reported to range from 2 to 9. MacMillen and Hinds (1983) note that Hispid pocket mice are less efficient in regulating water balance than other species in the genus.

Hoffmeister (1986) erected the subgenus *Burtognathus* to contain *C. hispidus* as its sole member, diagnosed on the basis of its distinct bacular morphology, all biarmed autosomal chromosome complement, presence of a supraorbital ridge or bead, squamosal portion of the zygomatic arches usually free of the auditory bullae, and of supraoccipital indentation into the mastoids. Glass (1947) reviewed the species, noting a general size cline from north to south. In his revision of the species, he recognized four subspecies, recording *C. h. paradoxus* (Merriam, 1889) from southern New Mexico, southern Arizona, and northern Chihuahua. Anderson (1972) also allocated Chihuahuan specimens to this subspecies, but Hoffmeister (1986) and Hoffmeister and Goodpaster (1954) regarded the samples from southern Arizona as distinct, allocating these to *C. h. conditi* (J. A. Allen). Hispid pocket mice in Sonora (vicinity of Cananea, records in the Museum of Vertebrate Zoology) undoubtedly belong to this taxon, regardless of whether it is considered distinct from, or synonymous with, *paradoxus*. The type locality of *conditi* is San Bernardino Ranch [17 mi E Douglas], Cochise Co., Arizona, just north of the international border from Sonora.

Chaetodipus intermedius intermedius (Merriam)

1889. *Perognathus intermedius* Merriam, N. Amer. Fauna, 1:18.

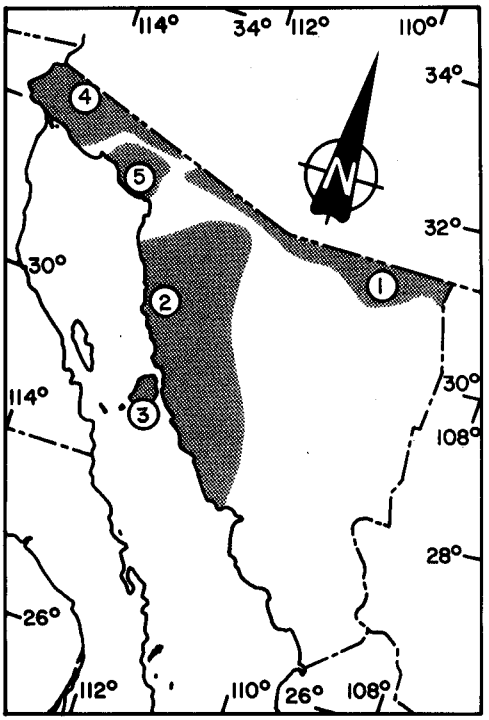
1983. *Chaetodipus intermedius*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From Mud Spring, Mohave Co., Arizona.

Range. Broadly distributed in rocky habitats in the Sonoran and Chihuahuan deserts of the southwestern United States (southern Utah, Arizona, New Mexico, and trans-Pecos Texas) into northern Mexico (western and northern Sonora and northern and central Chihuahua) (see Hoffmeister, 1986; Williams *et al.*, 1993). Hoffmeister (1986) records *C. i. intermedius* along the

Sonoran border in southern Arizona, from east of Sonoita to the southern end of the Huachuca Mountains. While no records are known from adjacent parts of Sonora along this section of the international border, Rock pocket mice certainly occur there.

Description. The Rock pocket mouse is a small to medium sized member of the genus (total length about 170 to 175 mm; tail length about 95 mm; hind foot length 20-23 mm; and skull length about 24 to 25 mm). Rump spines are present, but are often difficult to detect. The anterior edge of the interparietal is 'strap-shaped' (nearly straight), not angled forward. The supraoccipital forms a sharp-angled wedge between the interparietal and mastoid bulla. The bullae are moderately inflated, almost extending posteriorly to the plane of the occiput. The rostrum is relatively narrow. The tail is crested with a terminal tuft and bicolored. The dorsal color is darkish, varying from grayish buff to dark brownish-black and black in specimens from malpais habitats.



Localization of *Chaetodipus intermedius*:
1. *C. i. intermedius* 2. *C. i. lithophilus*
3. *C. i. minimus* 4. *C. i. phasma*
5. *C. i. pinacate*

Remarks. This species might be sympatric, or nearly so, with at least four other species in the genus, namely *baileyi*, *hispidus*, and *penicillatus*. It can be readily distinguished from any of these species by the presence of rump spines, but these are not as well developed and obvious as in species such as *fallax*, *goldmani*, and *spinatus*, so care must be taken. It is much smaller than both *baileyi* and *hispidus* in nearly all external and cranial dimensions, has a crested tail which *hispidus* lacks, and has much smaller bullae than *baileyi*. The Rock pocket mouse is not sympatric with *formosus* (the two occur on opposite sides of the Colorado River in Arizona and California), but can be distinguished from this species by its rump spines and much less inflated mastoid bullae. It is most easily confused with the Desert pocket mouse, *C. penicillatus*, but can be separated from it by the rump spine, smaller hind foot (usually less than 23 mm rather than more), interparietal with a straight rather than angled suture along the anterior face, and thus not pentagonal or five-sided; wedge-shaped as opposed to truncate bullae; and narrower rostrum. The two also differ in habitat (see below). The range of *intermedius* approaches that of *goldmani* in Sonora, but there are no known areas of sympatry. The two can be distinguished by size, with *goldmani* larger; by color, with *goldmani* darker and more brownish; and by its weaker and less obvious, but still present, rump spines.

Chaetodipus intermedius is strongly restricted to rocks and rocky habitats, mostly on steep slopes with sparse desert shrub cover in rocky ravines or bajadas. The species is very characteristic of and essentially limited to the Sonoran Desert and, in Mexico, to the Lower Colorado, Plains of

Sonora, and Central Gulf Coast sections. Individuals are never found in broad expanses of sand. In this respect, Rock pocket mice are always segregated by substrate differences from sympatric Desert pocket mice. The close association with rocky substrates is reflected in the range of coloration, where individuals on lava flows in New Mexico, Arizona, and Sonora are characteristically black, or a very dark brownish-black, closely matching the color of the substrate. In Sonora, black individuals are well known from the Pinacate malpais in the extreme northwestern part of the state. Light colored subspecies are also known, in areas where the rocky substrates are pale, such as within the light-colored rocks around Tinajas Altas, on the border between Arizona and Sonora.

Like most species in the genus, the Rock pocket mouse breeds in the late spring and early summer over most of its range, with an average of about 4 young per litter (range in Arizona of 1 to 7; Hoffmeister, 1986). Population densities have been recorded to range from less than 10 to nearly sixty individuals per hectare (Ruffner *et al.*, 1978). The diet is almost exclusively comprised of seeds, supplemented with insects and optuntia; little if any green vegetation has been recorded (Reichman, 1975).

Hall (1981) and Williams *et al.* (1993) list 12 subspecies within *C. intermedius*, four of which have been mapped with known localities in Sonora, and a fifth that probably extends into the state.

Chaetodipus intermedius lithophilus (Huey)

1937. *Perognathus intermedius lithophilus* Huey, Trans. San Diego Soc. Nat. Hist., 8:355.

1983. *Chaetodipus intermedius lithophilus*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From Porto [Puerto] Libertad, summit of rocky hill 1.5 mi NNW fresh water spring on beach, Sonora, Mexico.

Range. This race occurs along the gulf coast from about Puerto Penasco south to Bahia San Carlos, and east in the coastal plain as far inland as Caborca and near Hermosillo.

Recorded localities. *SONORA*: Puerto Libertad, summit of rocky hill 1.5 mi NNW fresh water spring on beach (Huey, 1937). Hermosillo; Punta Chueca (Patton *et al.*, 1981, as *C. intermedius*).

Description. Following Huey (1937), it is darker and more grayish dorsally than either *C. i. intermedius* or *C. i. phasma* and lacks the pinkish cast found in these two northern races. In size *lithophilus* resembles *phasma* and is slightly smaller than *intermedius*. Cranially, the mastoid bullae are less extended and the posterior part of the skull is slightly more arched and deeper than in either of the other two mentioned forms.

Measurements. The means and ranges of eight specimens (Huey, 1937) are: total length, 166.8 (162-170); length of tail, 91.7 (82-97); hind foot length, 20.1 (19-21); ear length, 5; occipitonasal length, 23.3; occipitonasal length, 23.3 (22.4-24.2); interorbital breadth, 6.0 (5.9-6.2); length of maxillary toothrow, 3.2 (3.1-3.4); width across mastoid bullae, 12.6 (12.2-12.9); length of nasals, 9.0 (8.8-9.3).

Remarks. No data about the biology and ecology of the subspecies are known.

Chaetodipus intermedius minimus (Burt)

1932. *Perognathus penicillatus minimus* Burt, Trans. San Diego Soc. Nat. Hist., 7:164.

1983. *Chaetodipus intermedius minimus*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From Turner's Island, 28 43' LN, 112 19' LW, Gulf of California, Sonora, Mexico.

Range. Known only from the type locality.

Recorded localities. *SONORA*: Turner's Island (Burt, 1932)

Description. This is a small, dark-colored race which Burt (1932) erroneously placed in the *Chaetodipus penicillatus* group. Coloration of upperparts blackish-brown interspersed with light pinkish-cinnamon; base of hairs plumbeous; dorsal surface of tail pale bister; ventral surface soiled yellowish-white; lateral line present, but indistinct. Skull small with small mastoids and auditory bullae.

Measurements. The measurement of the type and only specimen collected by Burt (1932) are: total length, 162; tail vertebrae, 67; hind foot, 20; greatest length of skull, 23.9; basal length (groove on incisor to condyle), 19.5; greatest mastoid breadth, 12.5; length of mastoids, 7.1; interorbital constriction, 6.2; length of nasals, 9.2; interparietal length, 3.6; interparietal width, 7.1; length of maxillary tooth row, 3.5.

Remarks. Originally described as a subspecies of *C. penicillatus*, Hoffmeister (1974) showed this form, known only from Isla Datil (Turner's Island) off the southeastern tip of Isla Tiburon in the Gulf of California, is correctly allocated to *intermedius*. The holotype is in the Dickey Collection of the University of California at Los Angeles collection (Williams *et al.*, 1993).

Burt (1932) said that one specimen of *minimus* was taken in sandy soil. He considered the specimen collected distinct in skin and skull characteristics from any large series of *C. penicillatus seri* from nearby Isla Tiburon. This subspecies is considered as threatened by the Mexican Government (NOM-059-ECOL-1994).

Chaetodipus intermedius phasma (Goldman)

1918. *Perognathus intermedius phasma* Goldman, Proc. Biol. Soc. Washington, 31:22.

1983. *Chaetodipus intermedius phasma*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From Tinajas Atlas, 1,400 ft, Gila Mountains, Yuma Co., Arizona.

Range. This race extends over the Colorado Desert section of the Sonoran Desert in southwestern Arizona into adjacent northwestern Sonora.

Recorded localities. *SONORA*: Papago Tanks, Sierra Pinacate (Blossom, 1933). Papago Tanks; 40 mi W Sonoyta [Sonoita] (Burt, 1938). Pinacate (Patton *et al.*, 1981, as *C. intermedius*).

Description. A small and pale race, upper parts between light buff and pale ochraceous-buff, purest on cheeks, sides, and across hips, the top of head and back with thinly overlying dusky-tipped hairs; under parts, limbs, and feet white; tail brownish above, white below, except penciled tip which is brownish all around. Skull similar to, but smaller than, that of *C. i. intermedius*.

Measurements. Hoffmeister (1986) gave statistics for four samples of *phasma* from Arizona. Measurements of the holotype are (from Williams *et al.*, 1993): total length, 165; length of tail, 97; hind foot length, 20.5; greatest length of skull, 23.0; interorbital breadth, 5.8; length of maxillary toothrow, 3.4; width across mastoid bullae, 12.3; length of interparietal, 2.6; width of interparietal, 6.1; length of nasals, 8.5.

Remarks. *C. i. pinacate* (Blossom, 1933) is a melanistic race that inhabits the Pinacate Lava Flows in northwestern Sonora. However, Hoffmeister (1986) found that it does not differ in external or

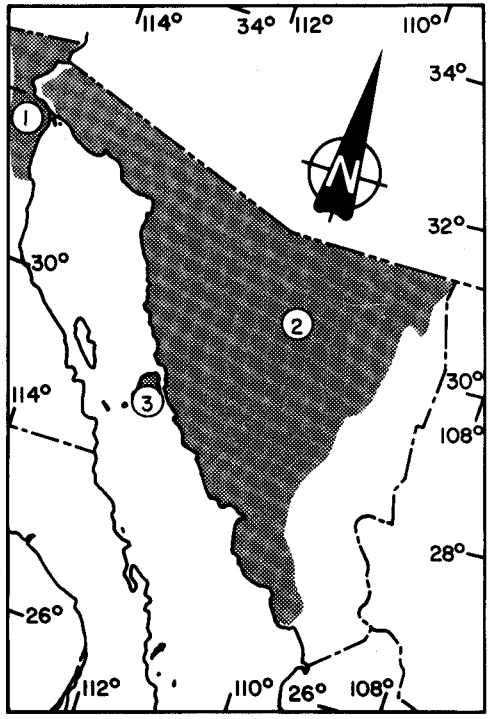
cranial measurements from neighboring *phasma* from lighter colored soils, and Williams *et al.* (1993) formally synonymized it with *phasma*.

Chaetodipus penicillatus (Woodhouse)

1852. *Perognathus penecillatus* [*sic*] Woodhouse, Proc. Acad. Nat. Sci. Philadelphia, 6:200.
1983. *Chaetodipus penicillatus*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. San Francisco Mountains, New Mexico (later thought to be northeast side of San Francisco Mountains, Coconino Co., Arizona); fixed as 1 mi SW Parker, Yuma Co., Arizona by Hoffmeister and Lee (1967).

Range. This species is known from Chihuahuan, Sonoran, and Mojave desert regions of the southwestern United States and adjacent Mexico. It ranges from Death Valley in southeastern California to northeastern Baja California, eastward and southward through southern Nevada to extreme southwestern Utah, central and southern Arizona south of the Mogollon Rim, the coastal regions of Sonora to the lower Rio Mayo, southern New Mexico, the Trans-Pecos region of Texas, and the desert portions of the Mexican Plateau in the states of Chihuahua, Coahuila, Nuevo Leon, western Tamaulipas, Zacatecas, San Luis Potosi, and Durango (Hoffmeister and Lee, 1967; Williams *et al.*, 1993). Those subspecies east of the Continental Divide near the Arizona-New Mexico border (*eremicus* and *atrodorsalis*) were recently elevated to specific status by Lee *et al.* (1996), under the name *C. eremicus* (Mearns), based on differences in karyotype (Patton, 1970), nuclear genes (Patton *et al.*, 1981), and mitochondrial DNA (Lee *et al.*, 1996).



Localization of *Chaetodipus penicillatus*:
1. *C. p. angustirostris* 2. *C. p. pricei*
3. *C. p. seri*

Description. This is a medium-sized species, with a relatively long (usually 10 to 20 mm longer than head and body) and crested tail, short ears, no spines on the rump, and a comparatively faint or even absent buff lateral stripe. The total length ranges from about 165 to 190 mm, the tail from 88 to 101 mm, and the ear typically 8 mm or less (Williams *et al.*, 1993; Best, 1993). The proximal two-thirds of the tail is relatively sparsely haired, with a distinctly annulated pattern. The skull is characterized by the anterior extension of the supraoccipital between the interparietal and mastoid relatively broad, strap-like, and squared at the anterior end, a pentagonal (as opposed to strap-shaped) interparietal, and relatively uninflated mastoid bullae. The dorsal coloration is grayish-or pinkish-brown mixed with black and dark browns; the tail has a distinct dorsal stripe.

Remarks. The Desert pocket mouse may be distinguished readily from sympatric *C. baileyi* by its much smaller size and much less inflated auditory bullae, and from sympatric *C. goldmani* and near-sympatric *C. artus* by its smaller size, grayer overall color, and lack of rump spines. However, it is quite similar in general appearance to, and thus often difficult to differentiate from, other small to medium-sized chaetodipine pocket mice, particularly with *C. arenarius*, *C. formosus*, *C. intermedius*, and *C. pernix* with which it can be sympatric in various parts of its range. The combination of lack of rump spines, pentagonal as opposed to strap-shaped interparietal, and less-inflated mastoid bullae distinguish *penicillatus* from *intermedius*. From *arenarius*, *penicillatus* differs by grayer as opposed to yellowish color, larger size, more annulated appearing tail in life, and narrower skull; from *formosus* by less developed crest on the tail and much less-inflated mastoid bullae, which do not extend posterior of the occiput; and from *pernix* by a generally larger size, lack of a buff lateral stripe, a somewhat more crested tail, wider interorbital region, and larger mastoid bullae (see Williams *et al.*, 1993, and references therein). However, small-bodied samples from east-central Sonora, allocated to *pernix* by Burt (1938) are, in fact, *penicillatus* based on chromosomal and biochemical characters (Patton, *et al.*, 1981), so the size differences between these two species are only useful in areas of sympatry or near-sympatry along the coastal regions of southern Sonora. These two species are also known to hybridize naturally near Vicam, in the coastal plain north of Ciudad Obregon (Patton and Soule, 1967).

As restricted by Lee *et al.* (1996), the Desert pocket mouse occurs exclusively within the Sonoran Desert in sandy or silty soils on desert valley floors, although in a wide range of desert scrub habitat associations. It does not overlap in habitat with sympatric *intermedius* nor largely with *baileyi* (see accounts, above), but can occur in the same soils sympatrically with both *arenarius*, where these two overlap in extreme northeastern Baja California near San Felipe, and *pernix* in coastal southern Sonora. If, and how, overlap between these two pairs is maintained is unknown.

Desert pocket mice breed in late spring and summer, from the months of April to August. Litter sizes range from 2 to 8, with a mean near 5; the gestation period is about 26 days. Diets are almost exclusively seeds, supplemented with other plant parts. The species can reach relatively high densities, with more than 50 individuals per hectare (Hoffmeister, 1986).

The baculum has a base near circular in cross secction; the shaft forms a long sigmoid shape in lateral view and tapers gradually from the slightly enlarge base to a pointed upturned tip; it is similar to *goldmani*. The measurement of 27 specimens are: length 11 (9.0-12.9); heigth of base 0.8 (0.5-1.3) (Burt, 1960).

The most recent revision based on geographic trends in morphology is by Hoffmeister and Lee (1967). Excluding two subspecies now allocated to the Chihuahuan Desert *C. eremicus* (see Lee *et al.*, 1996), there are six subspecies recognized for the Desert pocket mouse, three of which occur in Mexico.

Chaetodipus penicillatus angustirostris (Osgood)

1900. *Perognathus penicillatus angustirostris* Osgood, N. Amer. Fauna, 18:47.

1983. *Chaetodipus penicillatus angustirostris*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From Carriso [Carrizo] Creek, Colorado Desert, Imperial Co., California.

Range. Distributed in the southern Mojave Desert of eastern California south through the Colorado Section of the Sonoran Desert to the vicinity of San Felipe on the northeastern Gulf coast of Baja California.

Recorded localities. *BAJA CALIFORNIA*: Monte del Coyote, near Jacumba; Valle la Puerta (Villa, 1941). San Felipe; Buena Vista Camp (Hall and Kelson, 1959). San Felipe (Patton *et al.*, 1981 as *C. penicillatus*).

Description. Following Osgood (1900) are: similar to *P. penicillatus,* but smaller; color about the same; skull ligthter and with longer and more slender rostrum; nasals ascending premaxilar long and narrow, much more slender than in *penicillatus*; interparietal avaraging larger and more angular.

Measurements. Total length, 191; length of tail, 105; hind foot length (dry), 24.4; greatest length of skull, 27.1; width across bullae, 13.3; breadth across maxillary arches, 12.9; nasal length, 11.1; interorbital breadth, 6.4.

Remarks. Length of foot (dry) listed on the tag of the holotype was 23.9 mm. Based on chromosomal (Patton, 1969b) and nuclear allozyme genes (Patton *et al.*, 1981), the western Arizonan population of *C. p. penicillatus* probably should be allied with *angustirostris* rather than with populations of *penicillatus* from central Arizona.

Chaetodipus penicillatus pricei (J. A. Allen)

1894. *Perognathus pricei* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 6:318.

1983. *Chaetodipus penicillatus pricei*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From Oposura [Moctezuma], Sonora, Mexico.

Range. This race occurs from southern Arizona and extreme southwestern New Mexico south along the coastal plains of Sonora at least to Navojoa in the lower Rio Mayo and east throughout most of the Rio Yaqui drainage.

Recorded localities. *SONORA*: Batamotal (Hall and Kelson, 1959). North shore of Bocochibampo Bay (Cockrum and Bradshaw, 1963). Hermosillo; Magdalena; Ortiz; Quitobaquita; Sonora; Sonoyta [Sonoita] (Osgood, 1900). 8.5 mi NE Colonia Oaxaca; 1 mi N Huachinera (Patton and Soule, 1967). Hermosillo; Baserac; Suaqui Grande; Tecoripa; Mazatan; Tonichi; Guasimas; Pitahaya; Vicam; Coyotes; Desemboque; Pinacate (Patton *et al.*, 1981, as *C. penicillatus*). 2 mi N Bahia Kino (Hall, 1981).

Description. A subspecies of medium to small size; tail of medium length; hind foot short; total length medium (usually between 170 and 180); skull small; occipitonasal length short; nasals short; interorbital constriction narrow; toothrow short; mastoid breadth great relative to length of skull. Color dark in most populations, with specimens from northwestern Sonora and adjacent Arizona pale; ground color light grey-grown with admixture of dark hairs; lateral line prominent; postauricular patch absent or not promiment (see Hoffmeister and Lee, 1967).

Measurements. Total length, 157; length of tail, 90; hind foot length, 23; ear length,7.5; greatest length of skull, 23.0; basilar length, 18; interorbital breadth, 5.5; length of maxillary toothrow,3.5; width across mastoid bullae, 11.5; length of interparietal, 4.0; width of interparietals, 8.0; length of nasals, 7.7; zygomatic breadth, 11.5; length of rostrum, 9.6.

Remarks. This is a small subspecies, both externally and cranially, being especially small in occipitonasal length, length of nasals, and interorbital breadth. See Hoffmeister and Lee (1967) for a discussion of areas of integradation as well as differentiation between *C. p. pricei* and *C. p. penicillatus*.

Chaetodipus penicillatus seri (Nelson)

1912. *Perognathus penicillatus goldmani* Townsend, Bull. Amer. Mus. Nat. Hist., 31:122.

1912. *Perognathus penicillatus seri* Nelson, Proc. Biol. Soc. Washington, 25:116. Renaming of *goldmani* Townsend, 1912.

1983. *Chaetodipus penicillatus seri*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. from Tiburon Island, Gulf of California, Sonora, Mexico.

Range. Known only from Isla Tiburon in the east-central part of the Gulf of California.

Recorded localities. *SONORA*: Tiburon Island (Townsend, 1912). Petrel Bay (Burt, 1938).

Description. A subspecies of small size; short nasals, narrow interorbital region; and short toothrow. Color light; ground color light pinkish cinnamon; postauricular patch not conspicuous (see Hoffmeister and Lee, 1967).

Measurements. The means and ranges of 18 specimens (Burt, 1932) are: total length, 171 (161-195); length of tail, 98 (92-106); hind foot length, 23 (22-24); greatest length of skull, 24.3 (23.1-25.6); basal length (groove on incisor to condyle), 20.2 (19.3-21.0); greatest mastoid breadth, 13.1 (12.1-13.0); length of mastoids, 7.8 (7.4-8.1); interorbital constriction, 5.9 (5.5-6.3); length of nasals, 9.0 (8.4-9.7); interparietal length, 3.5 (2.9-4.0); interparietal width, 6.6 (6.0-7.2); length of maxillary tooth row, 3.5 (3.3-3.8).

Remarks. This subspecies is considered as threatened by the Mexican Government (NOM-059-ECOL-1994).

Chaetodipus pernix pernix (J. A. Allen)

1898. *Perognathus pernix* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 10:149.

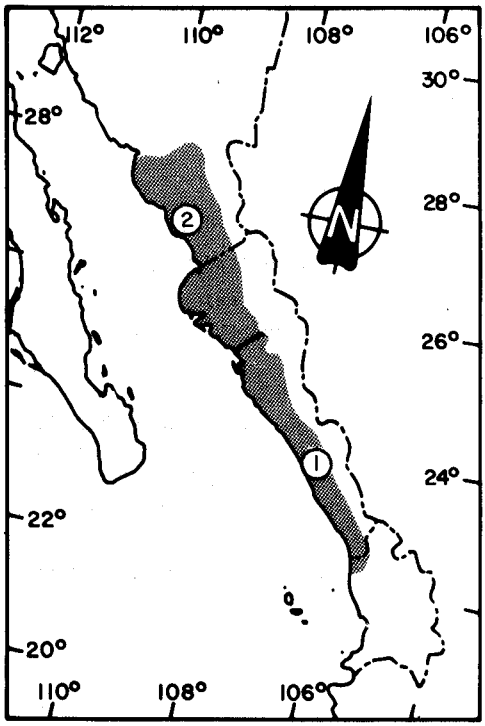
1983. *Chaetodipus pernix perni*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From Rosario, Sinaloa, Mexico.

Range. The species *C. pernix* occurs from the coastal plain of southern Sonora south to northern Nayarit (Best and Lackey, 1992b; Williams *et al.*, 1993). The northern-most location is Presa Alvaro Obregon, on the Rio Yaqui north of Ciudad Obregon, and the southern-most is at Playa Novilleros on the coastal strand in northwestern Nayarit (records in the Museum of Vertebrate Zoology). *C. p. pernix* is distributed from north-central Sinaloa, near Pericos, to extreme northwestern Nayarit. Specimens recorded by Burt (1938) from Tecoripa in central Sonora are of *C. penicillatus*, not *pernix* (see account for *penicillatus*, above).

Description. This is a small-bodied member of the genus, with a long and thinly haired, but crested tail, medium-sized ears, and dark and slightly hispid pelage. Specimens from the northern part of the range in Sonora (subspecies *rostratus*) are paler and larger than those from the southern part (subspecies *pernix*). The skull is small, narrow, and elongate, with small mastoids, a constricted interorbital region, broad interparietal, broad nasals, and small cheek teeth (Best and Lackey, 1992b).

Recorded localities. *NAYARIT*: Playa Novilleros; Acaponeta (Hall, 1981). *SINALOA*: Rosario (J. A. Allen, 1898). Chele (Hooper, 1955). 6 mi NE Ciudad de Mazatlan (Ingles, 1959). Pericos (Patton *et al.*, 1981 como *C. pernix*). Hacienda Island, a few miles W Escuinapa; Altata (Hall, 1981). *SONORA*: Aduana (Ingles, 1959). Esperanza; Coyotes; Navojoa; Pitahaya; Vicam (Patton *et al.*, 1981, as *C. pernix*).



Localization of *Chaetodipus pernix*:
1. *C. p. pernix* 2. *C. p. rostratus*

Measurements. Osgood (1900) gave average measurements for three specimens from the type locality as: total length, 175; length of tail, 97; hind foot length, 22.3; occipitonasal length, 24.4; basalilar length of Hensel, 17.4; interorbital breadth, 5.4; width across mastoids, 12.2 ; length of nasals,9.2; length of interparietal, 3.3; width of interparietal, 7.2.

Remarks. This species is sympatric with four others in the genus. It differs readily from *C. baileyi* by its much smaller size, much less well-inflated mastoid bullae, and much darker dorsal coloration. From both *C. artus* and *C. goldmani*, *pernix* differs by its smaller size and lack of rump spines. It is quite similar to *C. penicillatus*, but can be distinguished in areas of sympatry in southern Sonora by the characteristics listed above under that species.

This species occupies thornscrub habitats along the coast of southern Sonora and northern Sinaloa, grading into tropical deciduous, short-tree forest inland in this region, as well as throughout central and southern Sinaloa and northern Nayarit. It has been collected along the edges of agricultural fields adjacent to the coastal dunes at Playa Novilleros in extreme northwestern Nayarit. Throughout its range, the Sinaloan pocket mouse prefers sandy or silty soils. Where sympatric with *C. goldmani* in Sonora, the latter occupies rockier soils and steeper slopes. It is truly syntopic with *C. penicillatus* in the alluvial soils of the lower Rio Yaqui and Rio Mayo valleys.

This is a little studied mouse. It is granivorous, as are other members of the genus. Reproduction apparently occurs in the late spring and summer, based on data from specimens in the Museum of Vertebrate Zoology collections. Hooper (1955) collected two pregnant females in April. Litter sizes range from 2 to 5.

The base of the baculum is higher than wider and the distal end curves upward sharply. It differs from *goldmani* chiefly in being smaller. The length of one specimen is 11.1; heigth of base 1.0 (Burt, 1960).

There are two races currently recognized. These differ substantially in diploid number (*rostratus*, 2n=52 versus *pernix*, 2n=36 or 38; Patton, 1967; 1970) but share close genetic similarity based on allozymes (Patton *et al.*, 1981).

Chaetodipus pernix rostratus (Osgood)

1900. *Perognathus pernix rostratus* Osgood, N. Amer. Fauna, 18:51.

1983. *Chaetodipus pernix rostratus*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From Camoa, Rio Mayo, Sonora, Mexico.

Range. This race occurs from the lower Rio Yaqui valley south throughout coastal Sonora and Sinaloa to south of Guamuchil.

Recorded localities. *SINALOA*: San Rafael, 10 mi N Guamuchil; San Miguel Zapote; Rio Fuerte (Patton and Soule, 1967). *SONORA*: Camoa, Rio Mayo (Osgood, 1900). Obregon; Tesia (Burt, 1938). Guiracoba (Hall, 1981). Vicam (Patton and Soule, 1967). Specimens recorded by Burt (1938) from Tecoripa belong to *C. penicillatus*, not *C. pernix* (see above).

Description. External size and proportions similar to *C. p. pernix*, but skull quite different. Upper parts slightly lighter and grayer than *pernix*; general color broccoli brown rather than hair-brown; facial area distinctly paler than back and sides; lateral line pinkish buff; lower parts soiled white. Skull shorter and broader than that of *pernix*; rostrum very heavy; nasals, premaxillae, and premacillary branches of zygomata all distinctly heavy; interparietal, mastoids, and auditory bullae similar to that of *pernix*.

Measurements. Osgood (1900) listed average measurements of topotypes as (4 individuals for external and 3 individuals for cranial measurements): total length, 161; length of tail, 88; hind foot length, 22.5; occipitonasal length, 22.7; basilar length of Hensel, 16.5; width across mastoids, 11.7; length of nasals, 8.6; least interorbital breadth, 5.5; length of interparietal, 3.4; width of interparietal, 5.5.

Remarks. Chromosomal complement (2n=52) quite different from that of *C. p. pernix* (2n=36-38; Patton, 1970). This subspecies is known to hybridize with *C. penicillatus* on the coastal plain near Vicam, Sonora (Patton and Soule, 1967).

Chaetodipus spinatus spinatus (Merriam)

1889. *Perognathus spinatus* Merriam, N. Amer. Fauna, 1:21,.

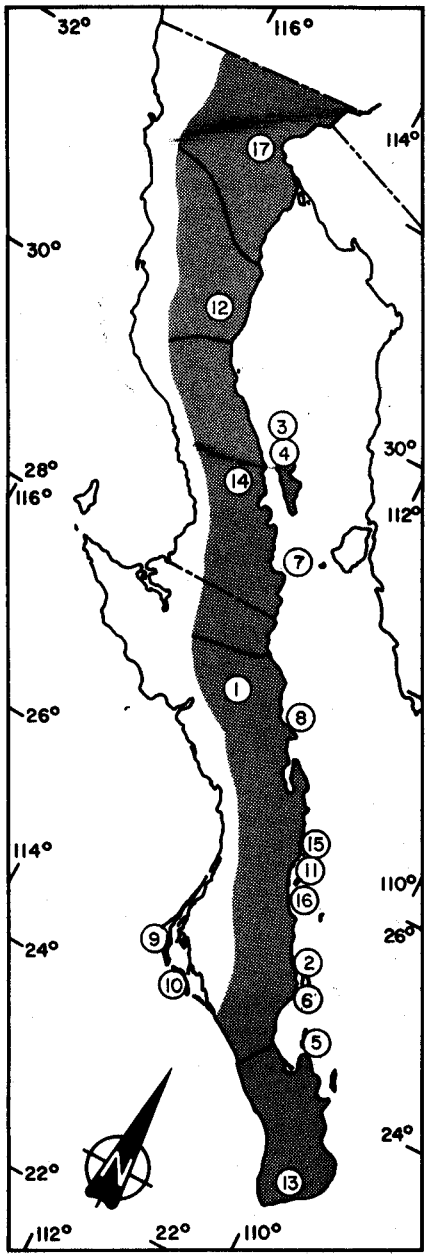
1983. *Chaetodipus spinatus spinatus*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From lower Colorado River, 25 mi below [S] the Needles, San Bernardino Co., California.

Range. The Colorado Desert of southeastern California and the Baja California peninsula; ranges from extreme southern tip of Nevada south along the Colorado River, and from the Coachella and Imperial valleys in California, southward into Baja California to Cabo San Lucas. It has not been recorded from the cooler and moister Pacific coast of Baja California north of the Sierra de la Laguna in the cape region, including the Magdalena Plain, but it is found on Magdalena and Margarita islands off of the Pacific coast of Baja California Sur. It is also known from many of the islands along the gulf coast of the Baja California peninsula (Mejia, Angel de la Guardia, San Lorenzo, San Marcos, Coronados, Carmen, Danzante, San Jose, San Francisco, and Espiritu Santo; see Hall, 1981; Huey, 1964). The nominal subspecies *C. s. spinatus* is distributed along the western side of the Colorado River from extreme southern Nevada south through southeastern California and northeastern Baja California to the vicinity of San Felipe on the Gulf of California.

Recorded localities. *BAJA CALIFORNIA*: San Felipe (Huey, 1960a). Cocopah Mts. (Hall, 1981).

Description. This is a medium to medium-large species with a long, crested tail, small ear pinnae, very pronounced spines on the rump and often extending on the flanks to the shoulder region, and usually without a lateral buff stripe. The skull is comparatively flat dorsally, rather narrow, with small mastoid bullae and thus moderately wide interparietals. The upper parts are a drab gray-brown, with the hairs plumbeous basally, pale tan subterminally, and often black-tipped.



This species averages nearly 200 mm in total length, with the tail 115 mm, hind foot 24 mm, and skull length about 26 mm.

Measurements. Means for five (Huey, 1930; 1960a) are: total length, 184.8; length of tail, 106.4; hind foot length, 22.2; ear length, 5.0; great length of skull, 24.4; with across bullae, 12.2; interorbital constriction, 6.2; length of nasals, 9.2; length of maxilar toothrow, 3.5.

Remarks. Spiny pocket mice may be sympatric with *C. arenarius*, *C. baileyi*, *C. fallax*, *C. formosus*, or *C. penicillatus*, and near-sympatric with C. *californicus*. The species is readily distinguished from any other by its very distinctive and well-developed spines on the rump and flanks, except *californicus* and *fallax*. Its spines are typically even more developed than are those of *californicus* and *fallax*, but *spinatus* also differs from these two generally by the lack of a buff lateral stripe. These, and other characteristics, are noted in individual accounts above.

C. spinatus is typically found on rocky, desert slopes and other rocky soils in low elevation desert shrub communities. It shares this habitat with *C. fallax* and *C. formosus* in northeastern Baja California and adjacent California, and can overlap with *C. baileyi* in hard-pan and stony soils of the lower slopes, but it is absolutely segregated by habitat from sandy soil occupants, such as *C. arenarius* and *C. penicillatus*.

Lackey (1991b) summarizes the sparse information available on the ecology and life

Localization of *Chaetodipus spinatus*:

1. *C. s. broccus*	2. *C. s. bryanti*
3. *C. s. evermanni*	4. *C. s. guardiae*
5. *C. s. lambi*	6. *C. s. latijugualis*
7. *C. s. lorenzi*	8. *C. s. macrosensis*
9. *C. s. magdalenae*	10. *C. s. margaritae*
11. *C. s. occultus*	12. *C. s. oribates*
13. *C. s. peninsulae*	14. *C. s. prietae*
15. *C. s. pullus*	16. *C. s. seorsus*

17. *C. s. spinatus*

history of this species. Most information deals with habitat range (recorded above); there have been no studies of population dynamics, seasonal variation in activity, reproduction, or other attributes.

The baculum has a slightly enlarged basal end that is nearly circular across section and entire bone is sigmoid in shape in lateral outline. Measurements of 51 specimens are: length 10.9 (9.3-13.0); heigth of base 0.68 (0.4-0.9) (Burt, 1960).

Eighteen subspecies are currently recognized for the Spiny pocket mouse, of which 17 occur in Mexico (Hall, 1981; Lackey, 1991b; Williams *et al.*, 1993). Most are known only from islands either in the Gulf of California or off the southern Pacific coast of Baja California Sur.

Chaetodipus spinatus broccus (Huey)

1960. *Perognathus spinatus broccus* Huey, Trans. San Diego Soc. Nat. Hist., 12:410.

1983. *Chaetodipus spinatus broccus*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From San Ignacio, 27° 17' LN, Baja California Sur, Mexico.

Range. This race occurs over the northern three-fourths of the peninsula in Baja California Sur, generally on the slopes of the Sierra de la Giganta.

Recorded localities. *BAJA CALIFORNIS SUR*: Llano de San Bruno; 12 mi S Mulege, Concepcion Bay; Canipolo; Comondu (Huey, 1960a). Loreto (Bassols, 1981). Llanos de San Bruno; 12 mi S Mulege, Concepcion Bay; Comondu (Hall, 1981).

Description. Following Huey (1960a), it differs from *C. s. prietae* in its larger size and proportionately longer tail. The skull is flatter and less rounded. The most pronounced character, for which the race is named, is a well developed pointed projection on the underside of the zygomatic arch where the jugal joins the maxilla.

Measurements. Means of five males from the type locality (Huey, 1960a) are: total length, 196; length of tail, 112.2; hind foot length, 21.4; ear length, 5.2; greatest length of skull, 25.6; interorbital breadth, 6.4; length of maxillary toothrow, 3.3; width across mastoid bullae, 12.7; length of nasals, 9.8.

Remarks. Compared with *C. s. peninsulae*, *C. s. broccus* is smaller, with smaller ears and smaller skull. The pointed projection on the zygomatic arch, however, is larger and more prominently developed (Huey, 1960a).

Chaetodipus spinatus bryanti (Merriam)

1894. *Perognathus bryanti* Merriam, Proc. California Acad. Sci., ser. 2, 4:458.

1983. *Chaetodipus spinatus bryanti*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From San Jose Island, Gulf of California, Baja California [Sur].

Range. Known only from Isla San Jose, Gulf of California, Baja California Sur.

Recorded localities. *BAJA CALIFORNIA SUR*: San Jose Island (Merriam, 1894; Towsend, 1912).

Description. This is a large member of the spinatus group, with a distinctly long and more heavily crested tail than other members; the ears are longer and darker; the whiskers longer and heavier, teaching the middle of the back; and the pelage is coarser and more spiny. Coloration of the upper parts is drab gray, becoming brownish on te back in old pelage, abundantly lined with black hairs; the under parts, fore and hind feet and fore legs are white; there is no lateral stripe; the tail is

bicolored, dusky above, white beneath. The skull is similar to that of the nominate subspecies, but very much larger (total length 27 instead of 23); interparietal more than twice as broad as long, strap-shaped or very broadly and flatly pentagonal. Compared with *C. s. peninsulae* from the adjacent mainland, the skull is marrower and slightly smaller, but the cranial differences are slight.

Measurements. The means and ranges for 23 specimens (Burt, 1932) are: total length, 190 (167-196); length of tail, 113 (88-125); hind foot length, 24 (23-25); greatest length of skull, 25.5 (24.1-26.7); basal length (groove on incisor to condyle), 21.0 (19.8-22.0); greatest mastoid breadth, 12.7 (12.2-13.5); length of mastoids, 7.7 (7.1-8.2); interorbital constriction, 6.7 (6.3-7.4); length of nasals, 10.1 (9.2-11.4); interparietal length, 3.9 (3.4-4.4); interparietal width, 7.7 (6.9-8.4); length of maxillary tooth row, 3.6 (3.4-3.9).

Remarks. This is the largest taxon of the *spinatus* group. It is considered as threatened by the Mexican Government (NOM-059-ECOL-1994).

Chaetodipus spinatus evermanni (Nelson and Goldman)

1929. *Perognathus evermanni* Nelson and Goldman, Proc. Biol. Soc. Washington, 42:111.

1983. *Chaetodipus spinatus evermanni*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From Mejia Island, near north end of Angel de la Guardia [= Guarda] Island, Gulf of California, Baja California.

Range. Known only from Isla Mejia, near the north end of Isla Angel de la Guardia, Gulf of California, Baja California.

Recorded localities. *BAJA CALIFORNIA*: Mejia Island (Nelson and Goldman, 1929; Banks, 1967; Gill, 1981).

Description. Following Nelson and Goldman (1929), this is a small species of the *Chaetodipus spinatus* group, resembling typical *spinatus* externally but underlying plumbeous area of pelage darker and more sharply defined; delicate structure of cranium, especially attenuation of nasals and narrowness of frontal and parietal regions, quite distinctive. Rump bristles present, and tail with an elongated terminal tuft as in *spinatus*. The color of the type has light ochraceous buff upper parts, darkened by overlying black tipped hairs with sharply defined plumbeous under color showing through, the result being a dull, grizzled, grayish-brown general tone; under parts, forelimbs, and hind feet white; tail brownish above, white below. The skull is in general similar to that of *C. s. spinatus,* but smaller, relatively narrower, and lighter in structure; braincase narrower and proportionately more arched above, nasals much narrower, more tapering, their width near posterior ends exceeded by that of ascending branches of premaxillae (nasals broader than premaxillae posteriorly in *C. s. spinatus),* the ends with a deep emargination between them; interorbital space narrower; mastoid and audital bullae smaller, dentition about as in *spinatus*.

Measurements. The means and ranges for 27 specimens (Banks, 1967) are: total length, 151 (144-155); tail vertebrae, 79 (76-82); hind foot, 21 (20-21); greatest length of skull, 23.9 (23.2-24.8); basal length (groove on incisor to condyle), 19.8 (19.4-20.4); greatest mastoid breadth, 11.8 (11.7-11.9); length of mastoids, 6.7 (6.6-6.8); interorbital constriction, 5.8 (5.8-5.9); length of nasals, 9.3 (8.8-9.4); interparietal length, 3.3 (3.1-3.5); interparietal width, 7.4 (7.3-7.5); length of maxillary tooth row, 3.5 (3.4-3.6).

Remarks. *Chaetodipus spinatus evermanni* differs so strongly from the widely ranging mainland form that specific recognition may be warranted. Its small island habitat has been described as rough and volcanic, cut by steep, rocky canyons (Nelson and Goldman, 1929). This subspecies

is probably extinct by the introduction of non native species. Is considered as threatened by the Mexican Government (NOM-059-ECOL-1994).

Chaetodipus spinatus guardiae (Burt)

1932. *Perognathus spinatus guardiae* Burt, Trans. San Diego Soc. Nat. Hist., 7:165.

1983. *Chaetodipus spinatus guardiae*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From Puerto Refugio, north end Angel de la Guardia [Guarda] Island, 30 ft, Gulf of California, Baja California, Mexico.

Range. Occurs only on Isla Angel de la Guardia, with the type locality at Puerto Refugio, on the north end of the island.

Recorded localities. *BAJA CALIFORNIA*: Angel de la Guardia Island (Burt, 1932; Banks, 1967; Gill, 1981).

Description. Following Burt (1932), it is a small-sized, light-colored race of the *Chaetodipus spinatus* group, resembling *C. s. evermanni* from Mejia Island to the north, but somewhat larger and more pallid in coloration. It is the palest member of the *spinatus* group known from the islands of the gulf. The lateral line is less distinct than in *evermanni*; rump spines are present, but not conspicuous; tail tuft less prominent than in most races of *spinatus*. Skull similar to that of *evermanni*, but interpterygoid space wider and pterygoids less flattened when viewed ventrally; interparietal averages smaller. This race differs from specimens taken at Concepcion Bay on the mainland of Baja California chiefly in smaller size and paler coloration.

Measurements. The means and extremes for 36 specimens (Burt, 1932) are: total length, 161 (140-175); length of tail, 87 (75-96); hind foot length, 22.5 (20-23); greatest length of skull, 24.6 (23.3-26.2); basal length (groove on incisor to condyle), 20.2 (18.8-21.4); greatest mastoid breadth, 12.1 (11.3-12.7); length of mastoids, 6.9 (6.4-7.3); interorbital constriction, 6.0 (5.6-6.5); length of nasals, 9.8 (8.6-10.6); interparietal length, 3.0 (2.6-3.5); interparietal width, 7.1 (6.4-7.6); length of maxillary tooth row, 3.7 (3.5-4.1).

Remarks. Burt (1932) considers that the channel separating Angel de la Guardia Island from Mejia Island, about 150 yards wide, to be an effective barrier isolating the two races. The holotype is now in the Dickey Collection at the University of California at Los Angeles. This subspecies is considered as threatened by the Mexican Government (NOM-059-ECOL-1994).

Chaetodipus spinatus lambi (Benson)

1930. *Perognathus spinatus lambi* Benson, Univ. California Publ. Zool., 32:452.

1983. *Chaetodipus spinatus lambi*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From San Gabriel, Espiritu Santo Island, Gulf of California, Baja California Sur, Mexico.

Range. Known only from Isla Espiritu Santo, Gulf of California, Baja California Sur

Recorded localities. *BAJA CALIFORNIA SUR*: Espiritu Santo Island (Benson, 1930).

Description. Following Benson (1930), it is a small pocket mouse that can be distinguished from *C. s. peninsulae* and *C. s. bryanti* by smaller size of head and body, smaller, narrower, more delicate skull, and much smaller mastoids. The color is about as in *peninsulae*. The colors of the type are: upper parts in general light pinkish cinnamon heavily lined with bister; underparts, fore limbs, and feet, white, faintly washed with cream color; tail white beneath, bister above, lightest at pencil;

most dorsal hairs tipped with bister, each with a subterminal band of light pinkish-cinnamon, and light quaker-drab base. Some dorsal hairs are longer and lack the subterminal band. These and the dark tips of the other hairs produce the lined appearance of the pelage. Spines are white. The skull, compared with *peninsulae*, is smaller, narrower, more delicate; zygomatic processes of maxillae narrower and forming more acute angle with rostrum; rostrum more slender; mastoids much less inflated.

Measurements. The means and ranges for eight adults (Burt, 1932) are: total length, 175 (163-187); length of tail, 99 (89-107); hind foot length, 23 (22-24); greatest length of skull, 25.7 (25.1-26.6); basal length (groove on incisor to condyle), 21.1 (20.6-21.5); greatest mastoid breadth, 12.2 (11.9-12.7); length of mastoids, 7.0 (6.6-7.2); interorbital constriction, 6.8 (6.2-7.1); length of nasals, 10.2 (9.8-11.0); interparietal length, 3.2 (3.1-3.3); interparietal width, 7.5 (7.1-8.0); length of maxillary tooth row, 3.7 (3.4-3.9).

Remarks. Some specimens of *C. s. lambi* overlap in characteristics with those of *C. s. peninsulae*. However, all exhibit a more brownish tinge than most specimens of *peninsulae* and the hair is slightly less coarse. This race is darker than *C. s. occultus, C. s. bryanti,* and *C. s. margaritae.* The skull equal in size to that of *C. s. spinatus* but more slender, more delicate, and with smaller mastoids. The skull is also equal in size, but flatter than, that of *occultus*. Compared with *magdalenae* and *margaritae*, the skull is smaller (basilar length of Hensel in four specimens averages 16.8 mm) (Benson, 1930).

All the insular races of the *spinatus* group, except *bryanti* of San Jose Island, are characterized as having smaller mastoids than the mainland races (Benson, 1930). Cortes-Calva and Alvarez-Castañeda (1997) found that this subspecies has its main distribution in canyon bottoms on Isla Espiritu Santo. This subspecies is considered as threatened by the Mexican Government (NOM-059-ECOL-1994).

Chaetodipus spinatus latijugularis (Burt)

1932. *Perognathus spinatus latijugularis* Burt, Trans. San Diego Soc. Nat. Hist., 7:168.

1983. *Chaetodipus spinatus latijugularis*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From San Francisco Island, 24° 50' LN, 110° 34' LW, Gulf of California, Baja California [Sur], Mexico.

Range. Known only from Isla San Francisco, Gulf of California, Baja California Sur.

Recorded localities. *BAJA CALIFORNIA SUR*: San Francisco Island (Burt, 1932).

Description. Following Burt (1932), this is a medium-sized and dark-colored form, with wide, flat jugals. The lateral line is indistinct. Skull medium-sized; nasals usually tapering toward posterior termination that is rarely emarginate; interparietal convex on anterior border, but without a distinct fifth angle; supraorbital ridges trenchant; jugals broad, short, and flattened dorso-ventrally; zygomatic processes of maxillaty and squamosal heavy and approaching one another in center of arch; mastoids and auditory bullae medium, relative size about as in *C. s. bryanti*.

Measurements. The means and ranges of nine specimens (Burt, 1932) are: total length, 179 (170-188); length of tail, 106 (100-110); hind foot length, 22 (22-22); greatest length of skull, 25.5 (24.2-26.8); basal length (groove on incisor to condyle), 21.1 (20.4-22.0); greatest mastoid breadth, 12.6 (12.2-12.9); length of mastoids, 7.5 (7.2-7.8); interorbital constriction, 6.7 (6.5-7.0);

length of nasals, 9.5 (9.0-10.3); interparietal length, 3.6 (3.5-3.7); interparietal width, 7.3 (6.9-7.5); length of maxillary tooth row, 3.9 (3.6-4.0).

Remarks. *Chaetodipus spinatus latijugularis* differs from *C. s. bryanti* from San Jose Island in smaller size, distinctly darker coloration without the yellowish admixture on upperparts, non-emargine nasals at posterior termination, heavier jugals, and interparietal strap-shaped as opposed to pentagonal. This subspecies differs from *C. s. lambi* from Espiritu Santo Island in the length of interparietal, and posteriorly tapering nasals; and from *C. s. peninsulae* in darker coloration and heavier jugals. *C. s. latijugularis* is set off sharply from *bryanti* to the north, *lambi* to the south, and *peninsulae* to the west by its darker coloration and broad, flattened jugals. It approaches *pullus* in coloration (Burt, 1932). This subspecies is considered as threatened by the Mexican Government (NOM-059-ECOL-1994).

Chaetodipus spinatus lorenzi (Banks)

1967. *Perognathus spinatus lorenzi* Banks, Proc. Biol. Soc. Washington, 80:101.

1983. *Chaetodipus spinatus lorenzi*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From South San Lorenzo Island, 28° 36' LN, 112° 51' LW, Gulf of California, Baja California, Mexico.

Range. Known only from Isla San Lorenzo, Gulf of California, Baja California.

Recorded localities. *BAJA CALIFORNIA*: South San Lorenzo Island; North San Lorenzo Island (Banks, 1967).

Description. Following Banks (1967), it is similar in size to *C. s. guardia*, but darker in color and with a shorter, shallower skull; lighter in color and much smaller than *C. s. Prietae;* and somewhat larger than *C. s. evermanni,* brownish rather than gray in overall coloration. This race is distinguished from all these populations by the extremely dark dorsal tail stripe and by the shorter, shallower skull.

Measurements. Means and ranges for 20 specimens (Banks, 1967) are: total length, 152.9 (142-160); length of tail, 77.7 (68-86); greatest length of skull, 23.8 (23.0-24.6); skull width, 11.7 (11.3-12.0); skull depth, 8.0 (7.7-8.4); length of nasals, 9.1 (8.7-9.7).

Remarks. South San Lorenzo Island is listed on recent Mexican maps as Isla San Lorenzo; North San Lorenzo Island (28° 42' LN, 112° 57' LW) is also known as Isla Las Animas. This subspecies is considered as threatened by the Mexican Government (NOM-059-ECOL-1994).

Chaetodipus spinatus magdalenae (Osgood)

1907. *Perognathus spinatus magdalenae* Osgood, Proc. Biol. Soc. Washington, 20:21.

1983. *Chaetodipus spinatus magdalenae*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From Magdalena Island, Pacific Ocean, Baja California [Sur], Mexico.

Range. Known only from Isla Magdalena, Baja California Sur.

Recorded localities. *BAJA CALIFORNIA SUR*: Magdalena Island (Osgood, 1907b).

Description. Following Osgood (1907b), size and color nearly as in *C. s. peninsulae*; mastoids smaller; rostrum lightly longer. Mastoids as in *C. s. margaritae;* size smaller; rostrum longer and broader. The coloration is very similar to that of *peninsulae* and *margaritae*, but somewhat more deeply vinaceous; upperparts fawn mixed with dusky, chiefly viewed as fine lines; lateral line very

narrow, fawn colored; underparts creamy white. The skull size about as in *peninsulae*; mastoids smaller; rostrum slightly longer; mastoids as in *margaritae*; rostrum nasals, and skull throughrout more elongate.

Measurements. Means and range for ten topotypes (Osgood, 1907b) are: total length, 194 (188-200); length of tail, 115 (ll0-122); hind foot length, 24 (23.5-25). Skulls of type and one topotype, respectively: greatest length, 26.4, 26.8; basilar length, 17.9, 18; mastoid width, 12.6, 12.7; zygomatic width, 12.8, 12.7; interorbital constriction, 6.9, 6.7; nasals, 10.5, l0.6; interparietal, 8.1 x 3.6, 7.5 x 3.3; diastema, 6, 6.5; maxillary toothrow, 4.3, 4.

Remarks. No ecological data are known

Chaetodipus spinatus macrosensis (Burt)

1932. *Perognathus spinatus macrosensis* Burt, Trans. San Diego Soc. Nat. Hist., 7:166.

1983. *Chaetodipus spinatus macrosensis*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From San Marcos Island, 27° 13' LN, 112° 05' LW, Gulf of California, Baja California Sur, Mexico.

Range. Known only from Isla San Marcos, Gulf of California, Baja California Sur.

Recorded localities. *BAJA CALIFORNIA SUR*: San Marcos Island (Burt, 1932).

Description. Following Burt (1932), this is a small, dark-colored race of *Chaetodipus spinatus*, approaching in external characters specimens from Concepcion Bay, Baja California, but differing from them in smaller size; relatively longer tail; relatively longer nasals; smaller interparietal, and paler coloration. Lateral line present but indistinct; median rump spines black-tipped, lateral ones white. Skull small; nasals relatively long, straight sided for posterior one-half; mastoids and audital bullae small.

Measurements. The means and ranges for 17 topotypes (Burt, 1932) are: total length, 168 (150-178); length of tail, 97 (88-103); hind foot length, 21 (21-22); grearest length of skull, 24.4 (22.2-25.5); basal length (groove on incisor to condyle), 20.0 (18.5-20.5); grearest mastoid breadth, 11.9 (11.4-12.5); length of mastoids, 7.0 (6.4-7.5); interorbital constriction, 6.1 (5.6-6.4); length of nasals, 9.3 (8.2-10.0); interparietal length, 3.6 (3.4-3.8); interparietal width, 7.1 (6.7-7.5); length of maxillary tooth row, 3.6 (3.4-3.8).

Remarks. This race differs from *guardiae* chiefly in darker coloration and relatively longer tail (Burt, 1932). The holotype is the Dickey Collection at the University of California at Los Angeles. This subspecies is considered threatened by the Mexican Government (NOM-059-ECOL-1994).

Chaetodipus spinatus margaritae (Merriam)

1894. *Perognathus margaritae* Merriam, Proc. California Acad. Sci., ser. 2,4:459.

1983. *Chaetodipus spinatus margaritae*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From Santa Margarita Island, Pacific Ocean, Baja California [Sur], Mexico.

Recorded localities. *BAJA CALIFORNIA SUR*: Santa Margarita Island (Merriam, 1894).

Description. The color of the upper parts varies from drab-gray on the sides to grizzled black and yellowish-brown on the back, the latter due to a coarse admixture of black hairs; under parts and feet are white; tail is bicolored, dusky above and whitish beneath. The skull is similar to that of the nominate subspecies, but slightly longer, more arched and relatively narrower posteriorly; the

interparietal is broadest in the middle instead of anteriorly, with the parieto-occipital suture opposite middle, instead of anterior corner; lacrymals decidedly larger; posterior ends of nasals and premaxillary together forming a deep emargination.

Measurements. Merriam (1894) gave external measurements of two specimens (measured fresh); no other data on measurements are available for *margaritae*: [external measurements from dry skin] total length, 170; length of tail, 102; hind foot length, 22.5; ear length (anterior base), 8.5; occipitonasal length, 25.9; basilar length of Hensel, 18.0; interorbital breadth, 6.5; width across mastoid bullae, 12.0; length of interparietal, 3.7; width of interparietals, 8.0; length of nasals, 10.3.

Range. Known only from Isla Santa Margarita, Pacific Ocean, Baja California Sur.

Remarks. This subspecies is considered as threatened by the Mexican Government (NOM-059-ECOL-1994).

Chaetodipus spinatus occultus (Nelson)

1912. *Perognathus spinatus nelsoni* Townsend, Bull. Amer. Mus. Nat. Hist., 31:122.

1912. *Perognathus spinatus occultus* Nelson, Proc. Biol. Soc. Washington, 25:116. Renaming of *nelsoni* Townsend, 1912.

1983. *Chaetodipus spinatus occultus*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From Carmen Island, Gulf of California, Baja California [Sur], Mexico.

Range. Known only from Isla del Carmen, Gulf of California, Baja California Sur.

Recorded localities. *BAJA CALIFORNIA SUR*: Carmen Island (Townsend, 1912).

Description. Comparared with *C. spinatus peninsulae*, the color is gray and lacks the drab-brown effect seen in *peninsulae*; general size similar, but tail slightly shorter, decidedly shorter than in *bryanti* (Townsend, 1912).

Measurements. Burt (1932) listed means and ranges for five specimens as: total length, 182 (168-205); length of tail, 100 (90-115); hind foot length, 22 (21-23); greatest length of skull, 25.5 (23.3-27.3); basal length, 20.9 (19.1-22.4); greatest mastoid breadth, 12.6 (11.7-13.0); length of maxilar toothrow, 39 (3.6-4.0); nasal length, 9.8 (8.9-10.5); interorbital breadth, 6.5 (6.1-6.8).

Remarks. *C. s. occultus* (Nelson, 1912) is a renaming of *C. s. nelsoni* Townsend (1912). This subspecies is considered threatened by the Mexican Government (NOM-059-ECOL-1994).

Chaetodipus spinatus oribates (Huey)

1960. *Perognathus spinatus oribates* Huey, Trans. San Diego Soc. Nat. Hist., 12:409.

1983. *Chaetodipus spinatus oribates*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From San Fernando Mission, 30° LN, Baja California, Mexico.

Range. Rocky slopes of the Sierra San Pedro Martir and the Sierra San Miguel southward to the vicinity of La Ramona, northeast of Santa Catarina, in Baja California.

Recorded localities. *BAJA CALIFORNIA*: Las Cabras; Parral; Matome (Hall and Kelson, as *C. s. spinatus*). San Fernando Mission; Rancho Ramona, 8 mi N Santa Catarina; Las Cabras (Huey, 1960a). Rancho Ramona, 8 mi N Catalina (Hall, 1981).

Description. Following (Huey, 1960a), this race is recognizable by its very spiny and grizzled, blackish dorsal pelage, darker than in other races, and its small body, having a proportionately

long, well tufted, and bicolored tail; underparts and feet are white, with little or no blending of color on the sides.

Measurements. The averages of three speciemns (Huey, 1960a) are: total length, 190.4; length of tail, 110.4; hind foot length, 22.0; ear length, 5.0; greatest length of skull, 24.6; interorbital breadth, 6.3; length of maxillary toothrow, 3.4; width across mastoid bullae, 12.7; length of nasals, 9.3.

Remarks. Compared with *C. spinatus rufescens, C. s. oribates* is much darker in dorsal pelage color, with a skull slightly heavier-boned in most dimensions. Compared with *C. s. prietae, oribates* is slightly darker and more grizzled, with a proportionately longer tail. The skull of *oribates,* when compared with the skulls of both of these races, is rounder as seen either from the side or from the rear, and has heavier maxillary arches and nasals; the bullae also are more rounded and inflated (Huey, 1960a).

Huey (1960a) encountered individuals of this subspecies on rocky terrain from the western foothills bordering Llano de San Agustin, at 30° LN.

Chaetodipus spinatus peninsulae (Merriam)

1894. *Perognathus spinatus peninsulae* Merriam, Proc. California Acad. Sci., ser. 2, 4:460.

1983. *Chaetodipus spinatus peninsulae*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From San Jose del Cabo, Baja California Sur, Mexico.

Range. Occurs throughout the cape region of Baja California Sur from approximately the level of Bahia de la Paz to the southern tip.

Recorded localities. *BAJA CALIFORNIA SUR*: Cape San Lucas; San Jose del Cabo; Pichililigue Bay; Miraflores; San Bernado Mountains (Townsend, 1912). La Paz, Mesa, 19 mi N La Paz; 7 mi NW San Bartolo; Miraflores; Los Barriles; 9 mi NE Cape San Lucas; San Jose del Cabo; Cape San Lucas (Huey, 1960a).

Description. Larger than the nominate subspecies, wiht much larger ears, and coarser pelage; well developed rump spines; tail slender and sparsely crested. Coloration of upper parts drab-gray heavily lined with black hairs, becoming brownish in worn pelage; under parts and feet white; tail bicolored, dusky above and white below. Skull large and flat, with angles of the interparietal usually rounded.

Measurements. Means of 12 specimens (Huey, 1930) are: total length, 195.2; length of tail, 111.7; hind foot length, 21.3; ear length, 5.1; condilobasal length, 25.5; width across bullae, 12.3; nasal length, 9.9; interorbital breadth, 6.5; length of maxillary toothrow, 3.4.

Remarks. Merriam (1894) regarded this form to be sufficiently distinct from typical spinatus to be recognized as a separate species, were it not for intermediate specimens from the middle part of the Baja California peninsula. Cortes-Calva and Alvarez-Castañeda (1997) examined the ecology of this race, concluding that soil type was the moste important variable determining its presence in the area near Bahia de La Paz.

Chaetodipus spinatus prietae (Huey)

1930. *Perognathus spinatus prietae* Huey, Trans. San Diego Soc. Nat. Hist., 6:232.

1983. *Chaetodipus spinatus prietae*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From 25 mi N Punta Prieta, 29° 24'LN, 114° 24' LW, Baja California, Mexico.

Range. Distributed throughout the central part of the Baja California peninsula, from near San Agustin, Baja California, south to near Mision Santa Gertrudis, inland, and El Barril on the Gulf coast, Baja California Sur.

Recorded localities. *BAJA CALIFORNIA*: 25 mi N Punta Prieta; San Agustin; Catavina (Huey, 1930). San Agustin (Hall and Kelson, 1959). Cataviña (not typical); 25 mi N Punta Prieta; San Borjas Mission; 12 mi E El Arco; Santa Gertrudis Mission; [El] Barril (Huey, 1960a). 25 mi N Punta Prieta; [El] Barril (Banks, 1967). Cataviña; El Barril; Santa Gertrudis Mission; San Borja Mision; 12 mi E El Arco (Hall, 1981).

Description. Following Huey (1930), compared with *spinatus,* larger both in body and cranial measurements. In color it is much darker, with a gray cast as in *spinatus,* grizzled somewhat like *peninsulae.* The skull of *prietae* is more nearly like *peninsulae* in several characteristics, though it has a rounder brain case, approaching that of *spinatus.* However, the interparietals are flat, as in *peninsulae.*

Measurements. Means and ranges of measurements of eight females and ten males (Banks, 1967) are: total length, 174.9 (165-186); 186.6 (179-195); length of tail, 99.6 (91-108); 108 (105-112). The measurement of the skull (males and females) from 22 specimens are: greatest length, 24.6 (23.8-25.8); skull width, 12.6 (12.1-13.1); skull depth, 8.3 (7.7-8.6); length of nasals, 9.3 (8.5-10.3).

Remarks. Compared to *C. s. peninsulae, prietae* is grayish rather than brown in color and not so heavily grizzled (Huey, 1930).

Chaetodipus spinatus pullus (Burt)

1932. *Perognathus spinatus pullus* Burt, Trans. San Diego Soc. Nat. Hist., 7:166.

1983. *Chaetodipus spinatus pullus*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From Coronados Island, 26° 06' LN, 111° 18' LW, Gulf of California, Baja California Sur, Mexico.

Range. Found only on Isla Coronados, Gulf of California, Baja California Sur.

Recorded localities. *BAJA CALIFORNIA SUR*: Coronados Island (Burt, 1932).

Description. Following Burt (1932), this is a medium-sized, dark-colored race of the *Chaetodipus spinatus* group. It is set off sharply from *C. s. occultus* from Isla Carmen, its nearest island neighbor, by distinctly darker coloration of upperparts (less yellowish), slightly larger size, longer tail, lighter dentition, longer nasals, and more inflated audital bullae.

Measurements. The means and ranges for seven specimens (Burt, 1932) are: total length, 183 (170-192); length of tail, 104 (96-111); hind foot length, 23 (22-23); grearest length of skull, 25.8 (25.1-26.5); basal length (groove on incisor to condyle), 21.3 (20.5-22.2); grearest mastoid breadth, 12.7 (12.6-12.9); length of mastoids, 7.3 (6.9-7.6); interorbital constriction, 6.4 (6.2-6.5); length of nasals, 10.3 (9.9-10.8); interparietal length, 3.9 (3.7-4.1); interparietal width, 7.8 (7.6-8.0); length of maxillary tooth row, 3.5 (3.4-3.7).

Remarks. *Chaetodipus spinatus pullus* differs from *C. s. broccus* taken on the peninsula at Concepcion Bay in larger size, slightly paler coloration without the yellowish lateral lines (white of underparts meets the dark upperparts abruptly), and more prominent tuft on end of tail (Burt, 1932). *C. s. pullus* is closer to *C. s. occultus* from nearby Isla Carmen in skull characteristics and in having the pronounced tuft on the terminal portion of the tail (Burt, 1932). The holotype is the Dickey Collection at the University of California at Los Angeles (Williams *et al.*, 1993).

Isla Coronados is a small volcanic island about 1.75 miles long, north to south, and between 1 and 1.5 miles wide. It is 1.5 miles from the mainland at the nearest point. There is a low sand spit on the southwest side of the island, otherwise it is rough and covered with dark brown (nearly black in some places) lava. The dark color of the pocket mice thus matches with the dark background of the island (Burt, 1932). This subspecies is considered threatened by the Mexican Government (NOM-059-ECOL-1994).

Chaetodipus spinatus serosus (Burt)

1932. *Perognathus spinatus serosus* Burt, Trans. San Diego Soc. Nat. Hist., 7:167.

1983. *Chaetodipus spinatus serosus*, Hafner and Hafner, Great Basin Nat. Mem., 7:25.

Type locality. From Danzante Island [Isla Danzante Primero], 25° 47' LN, 111° 11' LW, Gulf of California, Baja California Sur, Mexico.

Range. Occurs only on Isla Danzante Primero, Gulf of California, Baja California Sur.

Recorded localities. *BAJA CALIFORNIA SUR*: Danzante Island (Burt, 1932).

Description. Following Burt (1932), this is a medium-size, dark-colored race, intermediate in color between *C. s. occultus* from Carmen Island and *C. s. pullus* from Coronados Island.

Measurements. The means and ranges of seven specimens (Burt, 1932) are: total length, 181 (167-196); length of tail, 103 (98-111); hind foot length, 23 (22-24); greatest length of skull, 25.1 (24.5-25.7); basal length (groove on incisor to condyle), 21.0 (20.4-21.4); greatest mastoid breadth, 12.3 (12.0-12.4); length of mastoids, 7.2 (7.0-7.4); interorbital constriction, 6.5 (6.3-7.1); length of nasals, 9.8 (9.0-10.6); interparietal length, 3.6 (3.5-3.6); interparietal width, 7.3 (6.9-7.6); length of maxillary tooth row, 3.7 (3.6-3.8).

Remarks. *Chaetodipus spinatus serosus* differs from *C. s. occultus* chiefly in darker coloration and in having more rounded auditory bullae and smaller mastoids; from *C. s. pullus* in somewhat paler coloration with more of the yellowish admixture of upperparts, and in shorter nasals and smaller interparietal; from *C. s. bryanti* in smaller size, relatively shorter tail, and darker coloration; and from *C. s. peninsulae* in darker coloration, more rounded and more highly arched skull with nasals more deeply emarginate at posterior termination, and in smaller mastoids (Burt, 1932). The holotype is the Dickey Collection of the University of California at Los Angeles.

Danzante is a small island only 1.5 miles from the mainland and about the same distance from Isla Carmen. The specimens on which the above description is based were taken along a small beach on the southwest side of the island (Burt, 1932). This subspecies is considered threatened by the Mexican Government (NOM-059-ECOL-1994).

Genus *Perognathus*

1839. *Perognathus* Wied, Nova Acta Phys.-Med. Acad. Caesar. Leop.-Carol., 19(1):368.

Type Species. *Perognathus fasciatus* Wied, 1839, Nova Acta Phys.-Med. Acad. Caesar. Leop.-Carol., 19(1):368.

Diagnosis. Size small, total length from about 100 to 200 mm, weight from about 5 to 30 g; body form quadrupedal and scansorial; hind limbs longer than forelimbs; tail relatively short, length usually averaging less to slightly more than length of head and body; tail without prominent distal, dorsal crest or terminal tuft of hairs, although several species have a slight crest and terminal tuft (pencil); tail some shade of brown or buff above, whitish below; proximal one-fourth to one-half

of sole of hind foot with sparse covering of short hairs; ear pinna short and rounded, and without a lobed antitragus except in *P. parvus* and *P. alticola;* antero-lateral edge of ear pinna without covering of long, coarse hairs; generally a contrasting, light buff area on the head around ear pinna (postauricular patch), and a small, whitish spot below the external auditory meatus; dorsal surfaces generally some shade of buff or brownish, usually tinged with black; usually a clear, buff lateral stripe without blackish tinge; undersides usually whitish; in general, hairs relatively short, soft, and oval to flattened in cross section; hairs lack dorsal trough except, in so far as is known, *P. amplus;* longer, stiff, spine-like hairs never present in pelage of dorsal and lateral surfaces; mastoid bullae usually extending beyond the plane of the occiput; tympanic bullae nearly meeting anteriorly on the ventral surface of the skull; exoccipital without strong lateral indentations of mastoid bullae; interparietals compressed and narrower than interorbital breadth; phallus relatively short in length; soft tissue of phallus extends about two-thirds of the length of the baculum; phallus lacks external spines but has urethral lappets; baculum relatively short in length, with swollen, bulbous proximal end and slender, slightly upturned distal end; vesicular glands of male reproductive system elongated and tube-like with hooked end and translucent; head of spermatozoa approximating a triangle, with rounded vertices; tendon at origin of *M. rectus femoris* fan-shaped (Hafner and Hafner, 1983; Hall, 1981; Homan and Genoways, 1978; Ryan, 1989; Wood, 1935).

Remarks. This diagnosis is based on recent species. The genus *Perognathus* includes as synonyms *Cricetodipus* Peale,1848 (type species *C. parvus),* a name that also was subsequently applied, for a time, to some species of *Dipodomys; Abromys* Gray, 1868 (type species *A. lordi,* a synonym of *P. parvus*), and *Otognosis* Coues, 1875 (type species *O. longimembris).* Considerable taxonomic confusion arose as a result of S. F. Baird, E. Coues, J. E. Gray, T. R. Peale, and others misapplying the names *Perognathus fasciatus, Perognathus hispidus, Abromys lordi,* and *Cricetodipus parvus.* Merriam (1889) and Osgood (1900) were largely responsible for clarifying the nomenclature and stabilizing the taxonomy of pocket mice. As conceived herein, the genus *Perognathus* does not include the hispid-haired species of *Chaetodipus* nor *Perognathus formosus* Merriam, which has been shown to be a species of *Chaetodipus* (Homan and Genoways, 1978; Patton *et al.*, 1981).

Most of the structural characteristics that are of value in distinguishing species are related to size, proportions, and color, all of which exhibit considerable individual and geographic variation, making identification keys based on skins and skulls cumbersome.

Perognathus amplus amplus Osgood, 1900

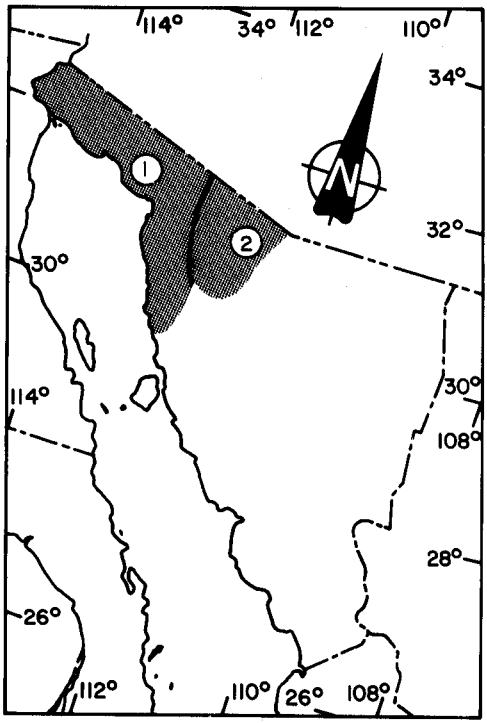
1900. *Perognathus amplus* Osgood, N. Amer. Fauna, 18:32.

Type locality. From Fort Verde, Yavapai Co., Arizona.

Range. This species occurs apparently as a series of disjunct populations from central and southwestern Arizona southward into northwestern Sonora. The range in Arizona is mapped by Hoffmeister (1986). *P. a. amplus* is distributed from central and southwestern Arizona south into northwestern Sonora along the coast, as far south as Puerto Libertad.

Recorded localities. *SONORA*: Pagago Tanks, 2 mi WNW Puerto Libertad (Hall, 1981).

Description. This is a medium-sized species of the genus with a relatively long tail, large hind feet, inflated mastoid bullae, and a compressed interparietal. Both head and body and tail length range between 70 and 90 mm, with the ratio between these dimensions varying from 0.88 to 1.33 (Williams *et al.*, 1993). The length of the hind foot is generally 20 mm or longer. Dorsal color



Localization of *Perognathus amplus*:
1. *P. a. amplus* 2. *P. a. taylori*

is variable, but usually orangeish tan sprinkled with black, with individuals on dark lava substrates sometimes almost black. There is a light-colored postauricular patch present, but it is not especially conspicuous. The subspecies *P. a. amplus* is the largest of the group (Hoffmeister, 1986).

Measurements. Mean and range of 23 adults from southwestern Arizona (Hoffmeister, 1986) are: body length, 74.3 (66-75); hind foot length, 20.1 (17.9-21.0); occipitonasal length, 23.6 (22.1-24.8); fronto-nasal length, 15.8 (14.5-16.7); nasal length, 9.1 (8.2-10.0); interorbital breadth, 5.1 (4.7-5.5); mastoid breadth, 14.0 (13.0-14.8); zygomatic breadth, 12.0 (10.8-13.0); length of mastoid bullae, 9.2 (8.8-9.6); maxillary toothrow length, 3.6 (3.4-3.8); width of interparietal, 3.0 (2.3-3.8); length of interparietal, 2.8 (2.3-3.2); distance between stylomastoid foramen, 11.8 (11.2-12.2).

Remarks. We follow Hoffmeister (1986) in regarding *rotundus* Goldman (1932) to be a junior synonym of the nominate subspecies. As a species, this pocket mouse is most similar to *P. longimembris*, and is readily confused with that species. No single character of skin or skull is known that will distinguish all individuals of either species. Williams *et al.* (1993) note that *amplus* differs from *longimembris* in larger average size and in having a wider upper premolar; greatest length of skull generally exceds 23.2 mm in *amplus*, usually less than 23.1 in *longimembris*; and hind foot length usually 20 mm or more versus 19.5 or less. Hoffmeister (1986) provides detailed comparisons between these two species in Arizona. In areas adjacent to the international boundary with Sonora, the two species can be distinguished as follows: length of toothrow (*amplus,* 3.4 mm or greater; *longimembris*, 3.1 mm or less), occipitonasal length (*amplus,* 22.0 mm or greater; *longimembris*, 21.4 mm or less); mastoidal breadth (*amplus,* 12.9 mm; *longimembris,* mm); length of body (*amplus,* 65 mm or greater; *longimembris,* 64 mm or less); and height of skull (*amplus*, 8.6 mm on average; *longimembris*, 7.6 mm on average). It is potentially sympatric with *P. flavus* southwest of Caborca in northwestern Sonora, but can be readily distinguished from this species by its larger overall size and both absolutely and proportionally longer and slightly penicillate tail.

This species inhabits Mojave and Sonoran desert scrub communities and parts of the Great Basin desert scrub (along the Little Colorado River in northern Arizona). In the southern part of the range, it is most commonly found in mesquite or creosote bush, cactus, and palo verde communities, usually in soft or sandy soils of flat desert plains and valley floors (Hoffmeister, 1986; Reichman, 1975).

These are granivorous specialists, with diets minimally supplemented with green plant materials and, sometimes, insects (Reichman, 1975). Breeding apparently begins in late winter and extends into the early summer, coincidental with the winter rainy season. Mean litter size has been reported at 3.35 young, with a range of 1 to 5 (Smith and Jorgensen, 1975). They apparently enter prolonged torpor during winter months and are not active above ground for extended periods of time (Reichman and Van de Graff, 1973).

The baculum is the typical for members of this group; the base is wider than high and the sharp tapers gradually from the bulbous base to the pointed tip. It is 7.1 long and the base 0.7 wide (Burt, 1960).

Four subspecies are currently recognized for the species (Williams *et al.*, 1993), two of which occur in the state of Sonora.

Perognathus amplus taylori Goldman

1932. *Perognathus amplus taylori* Goldman, Jour. Washington Acad. Sci., 22:488.

Type localities. From Santa Rita Range Reserve (near Northeast Station), 35 mi S Tucson, about 4,000 ft, Pima Co., Arizona.

Range. This race is found to the east of *amplus*, in south-central Arizona, extending south into northwestern Sonora from Sonoita to the vicinity of Caborca (see Hoffmeister, 1986).

Recorded localities. *SONORA*: 13 mi W Caborca (Hoffmeister, 1986).

Description. This is the smallest subspecies of *P. amplus*, characterized by short body and tail, short hind feet, small skull, short toothrow, relatively long bullae, and pinkish buff color.

Measurements. Goldman (1932) gave averages and ranges of measurements for 10 adult topotypes; Hoffmeister (1986) gave statistics for measurements of samples of 26 individuals from south of Tucson, Arizona, as: body length, 68.1 (58-79); hind foot length, 20.1 (19.0-22.0); occipitonasal length, 22.7 (21.5-23.5); fronto-nasal length, 15.2 (14.2-15.8); nasal length, 8.5 (7.9-8.8); interorbital breadth, 5.2 (4.8-5.7); mastoid breadth, 13.5 (12.9-14.2); zygomatic breadth, 11.7 (11.1-12.4); length of mastoid bulla, 9.0 (8.4-9.4); maxillary toothrow length, 3.3 (3.1-3.5); width of interparietal, 3.3 (3.0-3.7); length of interparietal, 3.0 (2.5-3.3); distance between stylomastoid foramen, 11.6 (11.2-12.3).

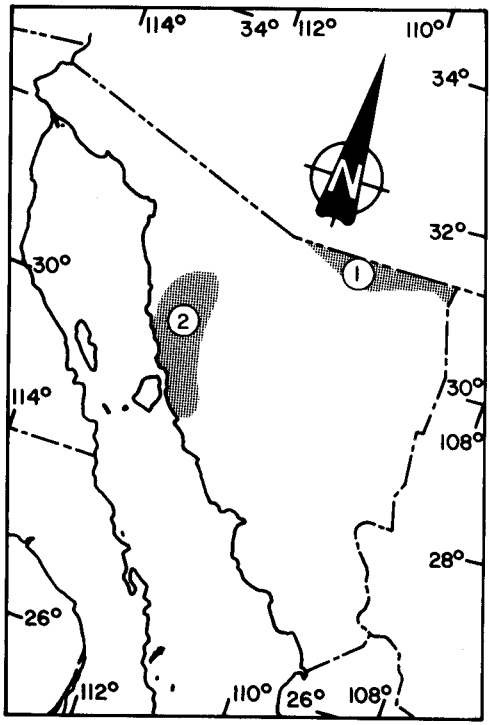
Remarks. Hoffmeister (1986) examined four specimens from near Caborca, Sonora, stating that their small size certainly excluded them from belonging to the nominate subspecies, and allocated them to *taylori* although noting that they were smaller in size than typical of this subspecies.

Perognathus flavus flavus Baird

1855. *Perognatus* [*sic*] *flavus* Baird, Proc. Acad. Nat. Sci. Philadelphia, 7:332.

Type localities. From El Paso, El Paso Co., Texas;.

Range. Widely distributed throughout most of west-central and southwestern Great Plains and intermountain basins of the United States and the Central Plateau of Mexico, with a disjunct population on the central coastal plain of Sonora in the lower Rio Sonora drainage. The species also occurs in the extreme northeastern section of Sonora adjacent to the international border, with records from near Cananea (Museum of Vertebrate Zoology). *P. f. flavus* is a broadly distributed taxon occurring through the desert grasslands of west Texas, New Mexico, southeastern Arizona, and south throughout most of Chihuahua into north-central Durango.



Localization of *Perognathus flavus*:
1. *P. f. flavus* 2. *P. f. sonoriensis*

Recorded localities. There are no published records of this subspecies in northwestern Mexico, but specimens from the following localities are in the collections of the Museum of Vertebrate Zoology: *SONORA*: 5 mi N Cananea; La Sauceda, 15 mi NNE Cananea; 2.3 mi S Santa Cruz.

Description. This is a diminutive pocket mouse, averaging only about 7 grams in weight, with a head and body length about 60 mm or less, short tail (averaging 85% of head and body length), tapering to a blunt tip without a terminal pencil of hairs It has a very soft pelage, hence its common name, but no more soft than many other members of the genus. The upperparts are finely lined with black on ochraceous buff; the dorsal color is heavily overlain with blackish-tipped hairs, contrasting with the clear buff postauricular patch and the narrow buff lateral line; the underparts are pure white.

Measurements. Mean and ranges of 14 specimens from southeastern Arizona (from Hoffmeister, 1986) are: body length, 57.0 (53-63); length of tail, 47.8 (40-51); hind foot length, 16.5 (16-18); occipitonasal length, 20.0 (19.4-20.4); fronto-nasal length, 13.0 (12.6-13.4); nasal length, 7.2 (6.9-7.7); interorbital breadth, 4.4 (4.1-4.8); mastoid breadth, 12.0 (11.4-12.7); zygomatic breadth, 10.3 (9.8-10.8); length of mastoid bulla, 7.9 (7.4-8.3); maxillary toothrow length, 3.0 (2.8-3.2); width of interparietal, 3.1 (2.4-3.7); length of interparietal, 2.4 (2.0-2.6); distance between stylomastoid foramen, 10.4 (9.7-10.9).

Remarks. This species can be easily distinguished from the other two members of the genus occurring in northwestern Mexico (*amplus* and *longimembris*) by its smaller size and short tail, more conspicuous and pale-colored post-auricular patch, and smaller skull with proportionately larger mastoid bullae.

Silky pocket mice occur in sparse desert scrub and dessert grasslands habitats, ranging through Lower and Upper Sonoran communities to an elevation maximum of nearly 2,500 meters. They can be found in both sandy and pebbly soils, but seem to prefer less compacted soils. A complete synopsis of published habitat characteristics can be found in Best and Skupski (1994).

As is true of all pocket mice, *P. flavus* is primarily a granivore, feeding on the seeds of a wide variety of perennial and annual species. It nests in self-constructed burrows, often in abandoned earthen mounds of pocket gophers, with a complex of tunnels reaching depths of 35 cm. Their burrows may contain large caches of seeds. Reproduction typically occurs in spring and summer, but may begin as early as late winter and extend into fall. Females may reach reproductive maturity before year, and may have two reproductive peaks in a given year, although one is perhaps more

common. Average litter size is 3 to 4, with a range from one to six. Gestation is three to four weeks. This species can fluctuate greatly in population numbers seasonally as well as from year to year. A more thorough description of its natural history, including complete reference list, can be found in Best and Skupski (1994).

The baculum has a large bulbous basal end, is wider than high; the shaft curves up in the middle and again at the distal end. Mesaurements of six speciments are: length 6.8 (6.3-7.2); heigth of base 1.1 (1.0-1.2) (Burt, 1960).

There are 14 recognized subspecies of Silky pocket mice (Best and Skupski, 1994; Hall, 1981; Williams *et al.*, 1993), two of which occur in the state of Sonora.

Perognathus flavus sonoriensis Nelson and Goldman

1934. *Perognathus flavus sonoriensis* Nelson and Goldman, Jour. Washington Acad. Sci., 24:267.

Type locality. From Costa Rica Ranch, lower Rio Sonora, Sonora, Mexico.

Range. Known from along the coast of Sonora from Las Alesnas, southwest of Caborca south as far as near Empalme.

Recorded localities. *SONORA*: Costa Rica Ranch (Nelson and Goldman, 1934). 3 mi S Maytorena (Cockrum and Bradshaw, 1963). 10 mi N Empalme (Bradshaw and Hayward, 1960).

Description. Following Nelson and Goldman (1934), this race is closely allied to *Perognathus flavus flavus,* but upper parts less heavily overlaid with black, owing to shortening of dark tips of hairs; ears less blackish; black facial markings obsolescent; hind foot apparently shorter; cranial details distinctive. The color of the type includes a near pinkish buff upper parts finely mixed or overlaid with black, the dark hairs most numerous on top of head and over back: lateral line rich pinkish buff, broad and distinct from cheeks to thighs, with a narrow downward extension reaching to near forearm; under parts and limbs white; muzzle white; dark. V-shaped, facial marking narrow and indistinct: ears lined internally with mixed grayish and brownish hairs; tail dull whitish, nearly unicolor. The skull is very similar to that of typical *favus*, but rostrum and nasals shorter, zygomata more widely spreading anteriorly, and molariform teeth smaller.

Measurements. hind foot length, 15; occipitonasal length, 19.3;interorbital breadth, 4.2; length of maxillary toothrow, 2.8; width across mastoid bullae, 11.7; length of interparietal, 3.0; width of interparietals, 3.2; length of nasals, 6.5; width of nasals, 2.0; zygomatic breadth (posteriorly), 10.3.

Remarks. No other published information is available.

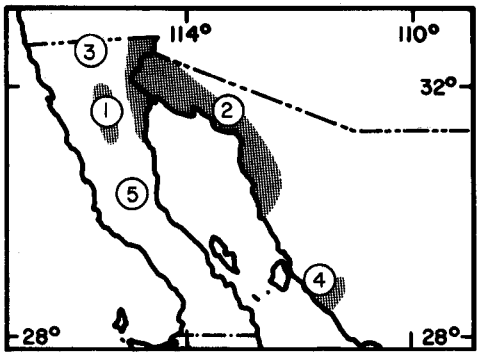
Perognathus longimembris (Coues)

1875. *O[tognosis]. longimembris* Coues, Proc. Acad. Nat. Sci. Philadelphia, 27:305

Type localities. From Fort Tejon, Tehachapi Mountains, Kern Co., California.

Range. Distributed throughout the Great Basin, Mojave, and western sections of the Sonoran Desert, southward from southeastern Oregon, extreme southwestern Idaho, and western Utah through Nevada, eastern California, and western Arizona, and extending into northern Baja California and around the northern margins of the Gulf of California in Sonora. An apparently disjunct population occurs in the vicinity of Bahia Kino on the central Sonoran coast (see Hall, 1981; Hoffmeister, 1986; Williams *et al.*, 1993).

Description. This is a small-bodied species with a relatively long, slightly penicillate tail, with medium-sized interparietals, and a narrow upper premolar. The ratio of the length of tail to head and body nearly always exceeds 1.03, ranging to about 1.40; the hind foot is relatively short, ranging from 15 to 20 mm; the mean occipitonasal length is always less than 22.0 mm, with only rare individuals exceeding this length; and the width of the upper premolar varies from about 0.75 to 0.95 mm (see Hoffmeister, 1986; Williams *et al.*, 1993).



Localization of *Perognathus longimembris*:
1. *P. l. aestivus* 2. *P. l. bombycinus*
3. *P. l. internationalis* 4. *P. l. kinoensis*
5. *P. l. venustus*

Remarks. Features that distinguish this species from its close relative, *P. amplus*, are given in the account of that species; see also details given in Hoffmeister (1986). Little pocket mice are potentially sympatric with the Silky pocket mouse on the central Sonoran coast in the general area of Bahia Kino. These two are readily distinguished by differences in body size (*longimembris* is larger), degree of mastoid bullar inflation (*longimembris* less inflated), and absolute and relative tail length (*longimembris* longer).

Little pocket mice live on and in sandy or gravelly soils, often in terrain that is rolling or broken by ravines and rocks. They range in general habitat from Great Basin, Mojave, and Sonoran desert scrub communities.

The species can be very common locally, with densities estimated at more than one hundred per hectare in Nevada (Hall, 1946). However, individuals are only seasonally active, being absent above ground, and presumably hibernating, during the winter (O'Farrell, 1974; Bartholomew and Cade, 1957). Reproduction occurs during the spring and early summer; the mean litter size has been reported as 4.6, with a range of 2 to 6 (Hoffmeister, 1986). As with other pocket mice, these feed primarily on seeds.

The baculum has a the bulbous proximal end varies from being wider than high to higher than wide. The bone in this species is the smallest of those represented in northwestern Mexico. Measurements from 13 speciments are: length 5.2 (4.1-6.6); heigth of base 0.5 (0.4-0.8) (Burt, 1960).

Sixteen subspecies are recognized (Hall, 1981; Williams *et al.*, 1993), six of which occur in the states of Baja California and Sonora. A seventh subspecies, *P. l. pacificus* (Mearns, E. A. 1898. Bull. Amer. Mus. Nat. Hist., 10:299, with type locality on the shore of the Pacific Ocean at International Boundary marker 258, San Diego Co., California), undoubtedly extends into Baja California on the coastal strand in the vicinity of Tijuana.

Specimens from the north of the Transverse ranges in west-central California, assigned to this species (Hall, 1981), are *P. inornatus*. The northern distributional limits of *P. longimembris longimembris* are not known. The type locality is in a position where either or both *P. longimembris* and *P. inornatus neglectus* may occur, but no pocket mice have been taken from there in this century. The holotype may not have come from Ft. Tejon, but rather from somewhere

in the surrounding country, perhaps the Mojave Desert side of the Transverse ranges (Osgood, 1918).

Perognathus longimembris aestivus Huey

1928. *Perognathus longimembris aestivus* Huey, Trans. San Diego Soc. Nat. Hist.,5:87.

Type locality. From Sangre de Cristo, Valle San Rafael on western base of Sierra Juarez, 31° 52' LN, 116° 06' LW, Baja California, Mexico.

Range. Known from the western base of the Sierra Juarez, from near the type locality at Sangre de Cristo, Valle San Rafael, south to El Valle de la Trinidad (Huey, 1964).

Recorded localities. *BAJA CALIFORNIA*: Sangre de Cristo, Valle San Rafael on western base of Sierra Juarez; Valle de la Trinidad, (Huey, 1928). Sangre de Cristo (Huey, 1930; Villa, 1941).

Description. Compared with *C. l. panamintinus,* this form is slightly brighter in color with fewer black-tipped hairs dorsally. The pearl grey of the base of the pelage extends well down the back toward the rump. This character is variable, however, and, in some cases, covers the entire back. The most prominent characters of this form are cranial, contrasting sharply with the corresponding characters of other members of the *longimembris* group. The mastoid bullae are large and inflated, giving a much greater width to the skull posteriorly and compressing the interparietal into an almost equal-sided pentagon. The auditory bullae are also larger and give the skull a deeper appearance (Huey, 1928).

Measurements. Huey (1939a) listed measurements for five males and three females: total length, 142.3 (130-148); length of tail, 77.4 (68-83); hind foot length, 19.1 (17-20); greatest length of skull, 22.7 (22.0-23.2); interorbital breadth, 5.2 (4.8-5.7); width across mastoid bullae, 13.1 (12.8-13.5); length of nasals, 8.1 (8.0-8.5).

Remarks. Like other populations of *P. longimembris* from the southwestern part of its range, the mastoid bullae are greatly inflated; whether *aestivus* is distinct from adjacent subspecies is equivocal, however (Williams *et al.*, 1993).

Perognathus longimembris bombycinus Osgood

1907. *Perognathus longimembris bombycinus* Osgood, Proc. Biol. Soc. Washington, 20:19

Type locality. From Yuma, Yuma Co., Arizona.

Range. This race is distributed along the lower Colorado River Valley in southeastern California and southwestern Arizona south around the northern end of the Gulf of California in northwestern Sonora (south to Puerto Libertad and inland to Bamori and near Caborca) and northeastern Baja California (from near Mexicali south to San Felipe).

Recorded localities. *BAJA CALIFORNIA*: San Felipe (Huey, 1939b). *SONORA*: Pinacate Lava flows (Patton, 1967). Colonia Lerdo (Hall, 1981).

Description. This is a small-sized race of *P. longimembris*; hind feet are short; skull is short, narrow, flattened; toothrow is short; interparietal is only slightly wider than long; interorbital breadth is usually less than 5.0 mm; depth of skull is usually 7.8 mm or less.

Measurements. Hoffmeister (1986) records means and ranges from 13 specimens from southwestern Arizona as: body length, 59.0 (53.5-65.0), hind foot length, 18.2 (17-19); occipitonasal length, 20.3 (19.0-21.2); fronto-nasal length, 13.7 (12.8-14.3); nasal length, 7.5

(6.9-8.0); interorbital breadth, 4.7 (4.4-4.9); mastoid breadth, 12.0 (11.5-12.6); zygomatic breadth, 9.9 (9.2-10.4); length of mastoid bulla, 8.5 (8.1-8.9); maxillary toothrow length, 2.9 (2.7-3.0), width of interparietal, 2.7 (2.4-3.5); length of interparietal, 2.5 (2.3-2.7); breadth across stylomastoid foramen, 10.7 (10.1-11.3).

Remarks. Hoffmeister (1986) suggests that *P. l. kinoensis* Huey (1935) is indistinguishable from *bombycinus*.

Perognathus longimembris internationalis Huey

1939. *Perognathus longimembris internationalis* Huey, Trans. San Diego Soc. Nat. Hist., 9:47.

Type locality. From the Baja California side of the International Boundary at Jacumba, San Diego Co., California.

Range. Known from the San Felipe and La Puerta valleys in San Diego Co., California, to adjacent northern Baja California at the type locality in the Jacumba Valley.

Recorded localities. *BAJA CALIFORNIA*: Baja California side of the International Boundary at Jacumba, San Diego Co., California (Huey, 1939b).

Description. Following Huey (1939b), individual specimens of *P. l. internationalis* resemble, in general color, specimens of *C. l. brevinasus* and *C. l. longimembris,* whose ranges are to the north, and *C. l. aestivus*. Taken in series, however, *internationalis* has a brighter tone, with the buff coloration of the under pelage a clearer, warmer color tone. The skull of *internationalis* has longer, broader nasals, and is broader posteriorly, especially across the tympanic bullae, than that of either *brevinasus* or *longimembris*. In comparison with *aestivus*, *internationalis* lacks the extremely broadened tympanic bullae, being intermediate in this respect between the rather narrow-skulled *brevinasus* and *longimembris* and the extremely broadened *aestivus*. It differs from *aestivus* more notably in having much less inflated auditory bullae and a more rounded brain case.

Measurements. Huey (1939b) gave measurements for five adults of each sex: total length, 141; length of tail, 78; hind foot length, 19; ear length (crown), 5; greatest length of skull, 21.9; interorbital breadth, 5.2; length of maxillary toothrow, 3.1; width across mastoid bullae, 12.6; length of nasals, 7.5.

Remarks. This subspecies seems to represent a form structurally intermediate between the coastal basin subspecies, *brevinasus* and *pacificus,* and the inland desert forms, *bangsi* and *aestivus,* a situation to be expected on the basis of its intermediate geographic position. Subspecies recognition is equivocal (Williams *et al.*, 1993).

Perognathus longimembris kinoensis Huey, 1935

1935. *Perognathus longimembris kinoensis* Huey, Trans. San Diego Soc. Nat. Hist., 8:73.

Type locality. From Bahia Kino (northern end of the sand dune peninsula that borders the bay and forms the northern arm of the estuary), Sonora, Mexico.

Range. Known from the type locality at Bahia Kino eastward up the valley of the Rio Sonora to west of Hermosillo and south along the coast to Estero Tastioto.

Recorded localities. *SONORA*: Bahia Kino (northern end of the sand dune peninsula that borders the bay and forms the northern arm of the estuary) (Huey, 1935).

Description. Following (Huey, 1935), this race is darker than *P. l. bombycinus* its nearest relative. The most prominent characters of this form are cranial, and compared with *bombycinus,* the skull of *kinoensis* is more rounded and narrower across the bullae. The interparietal is almost square in shape, and the nasals are longer and more attenuated.

Measurements. Total length, 135; length of tail, 80; hind foot length, 17; ear length (crown), 4; greatest length of skull, 20.7; interorbital breadth, 4.6; length of maxillary toothrow, 2.6; width across mastoid bullae,11.4; length of nasals, 7.2.

Remarks. Like other *Perognathus* living in relatively humid environments, the bullae are less inflated and the posterior cranial region less constricted than populations from arid environments. This subspecies appears to be little differentiated from *bombycinus* from farther north, and is thus likely a junior synonym (see Hoffmeister, 1986).

Perognathus longimembris venustus Huey

1930. *Perognathus longimembris venustus* Huey, Trans. San Diego Soc. Nat. Hist., 6:233.

Type locality. From San Agustin, 30° LN, 115° LW, Baja California, Mexico.

Range. Known only from the type locality at San Agustin, Baja California.

Recorded localities. *BAJA CALIFORNIA*: San Agustin (Huey, 1930).

Description. Compared with *P. l. aestivus*, this race is much darker in color and has a decidedly bicolored tail, the black tail-stripe running the full caudal length, terminating with a black tip. The pinna is also covered with black hairs. Cranially, *P. l. venustus* has a longer tooth row, and the frontals are slightly higher and rounder. This latter character does not seem to bear relation to age. The mastoid bullae are more rounded and do not extend as far posteriorly, while the auditory bullae are more attenuated and not as heavily inflated basally (Huey, 1930).

Measurements. Huey (1939a) gave measurements for three specimens: total length, 135.3 (130-140); length of tail, 76.3 (75-78); hind foot length, 19; greatest length of skull, 21.9 (21.7-22.4); interorbital breadth, 5.1 (5.0-5.4); width across mastoid bullae, 12.5 (12.4-12.7); length of nasals, 7.7 (7.2-8.0).

Remarks. There are few, if any, significant differences in the measurements listed by Huey (1939a) for *venustus* and *aestivus*, leaving only the "much darker color" of the former as apparently diagnostic, a situation that may not warrant taxonomic separation (see Williams *et al.*, 1993).

Subfamily Dipodomyinae Coues

Two Recent genera are usually placed within this subfamily, the kangaroo rats (*Dipodomys*) and kangaroo mice (*Microdipodops*). Only the kangaroo rats extend into northwestern Mexico, as the kangaroo mice are limited in their distribution to the Great Basin Desert of the western United States. The body size ranges from small to large, with weights from 10 to about 170 g. The body form is ricochetal, with elongated hind limbs and shortened, slender forelimbs; the tail exceeds the head and body length; and the soles of the hind feet are covered with dense hair; the body hair is long, smooth, soft to the touch. The upper incisors are deeply grooved, the molars hypsodont and ever-growing, or nearly so in *Dipodomys*. The auditory bullae are enormously inflated, with the mastoid portion expanded dorsally and extending posteriorly well beyond the occipital plane; the interior is hollow, without a spongy network of trabeculae, as in other genera in the family.

Dipodomys

1841. *Dipodomys* Gray, Ann. Mag. Nat. Hist., ser. 1, 7:521, August.

Type Species. *Dipodomys phillipsii* Gray, 1841, Ann. Mag. Nat. Hist., ser. 1, 7:521, August.

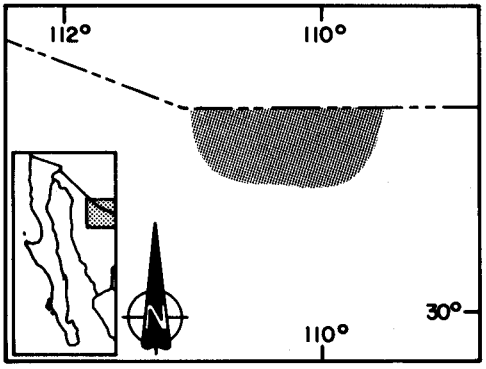
Diagnosis. General form ricochetal, with elongated hind limbs, short forelimbs, short neck with compressed and partially fused cervical vertebrae, and with tail usually longer than head and body, crested and penicillate. First digit of hindfoot vestigial or absent externally; underparts, foreleg, forefoot, dorsal surface of hind foot, upper lip, spot above eye, and spot behind ear white; white stripe across flank, extending to base of tail; base of tail white all around; white stripes extend along sides of tail from base to near tip; dorsal side of tail dark, and ventral side usually so; upper parts some shade of buff or brown; large sebaceous gland on back between shoulders; cheek teeth hypsodont, with molars evergrowing, or nearly so; auditory bullae huge, with mastoid portion expanded dorsally to restrict size of interparietal and extending posteriorly well beyond the occipital plane; baculum moderate in length and with strongly upturned tip and swollen base (see Hafner and Hafner, 1983; Wahlert, 1985; Williams et al., 1993; and Wood, 1935).

Dipodomys ordii ordii Woodhouse

1853. *D*[*ipodomys*]. *ordii* Woodhouse, Proc. Acad. Nat. Sci. Philadelphia, 6:224.

Type locality. Neotype. El Paso, El Paso Co., Texas (designated by Merriam, 1890:45, as the "Duplicate type").

Range. From southeastern Washington southward through the Great Basin, and from southwestern Saskatchewan and southeastern Alberta southward through the western Great Plains to western Texas through Hidalgo (Baumgardner and Schmidly, 1981; Hall, 1981; Setzer, 1949). *D. o. ordii* of southeastern Arizona, southern New Mexico, northern Chihuahua, and northeastern Sonora (Hall, 1981).



Geographic range of *Dipodomys ordii ordii*.

Recorded localities. *SONORA*: Santa Cruz; Alamo Wash, 35 mi NW Magdalena (Baird, 1857). Fronteras (Allen, 1895). Alamo Wash; 35 mi NW Magdalena (Burt, 1938). Nogales; Santa Cruz; 5 mi Cananea; Alamo Wash; 35 mi NW Magdalena (Setzer, 1949).

Description. A small to medium-sized kangaroo rat; five toes on the hind feet; relatively short tail and ears; maxillary arch relatively slender; rostrum comparatively short. The ratio of lengths of tail to head and body normally averages between about 1.16 and 1.26 and the width of the skull across the bullae ranges between about 22.3 and 26.3 (Grinnell, 1922; Setzer, 1949).

Measurements. The means and range for 14 specimens from Chihuahua (Anderson, 1972) are: Total length, 237.8 (221-252); length of tail, 129.9 (110-141); hind foot length, 37.4 (36-39); ear length, 13.5 (12-15); greatest length of skull, 37.9 (36.3-38.9); basilar length of skull, 23.4 (23.0-24.5); great breath across bullae, 24.1 (23.8-24.8); breadth across maxillary processes, 20.5 (19.3-20.9); breadth of rostrum, 3.7 (3.4-4.1); length of nasal, 13.8 (13.0-15.5); interorbital breadth, 13.1 (12.5-13.9).

Remarks. In New Mexico and Texas, *D. ordii* is found in *Yucca*, *Prosopis*, *Artemisia*, *Quercus havardi*, and *Gutieriza sarothrae* (Dice, 1930; Garner, 1974; Best and Hoditschek, 1986). Gestation is 28 to 32 days (Day *et al.*, 1956; Duke, 1944). Number of embryos ranges from 1 to 6 with a mean of 3.5 (Hall, 1946). There may be two litters each year (Alcorn, 1941). The baculum is similar in every respect to that of *herrmanni* (Burt, 1960). *Dipodomys ordii* has a diploid number of 72 chromosomes with all autosomes biarmed, of which 4 pairs are metacentric, 26 pairs are submetacentric, and 5 pairs are subtelocentric. The X chromosome is submetacentric and the Y chromosome is acrocentric to subtelocentric (Stock, 1974; Patton and Rogers, 1993a).

Dipodomys gravipes Huey

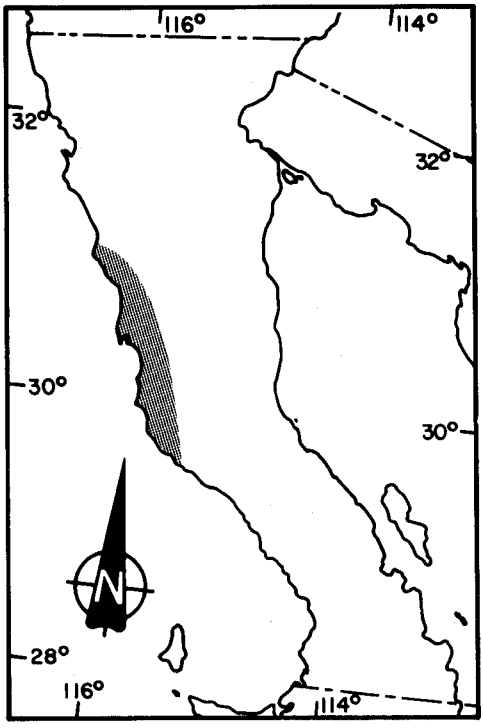
1925. *Dipodomys gravipes* Huey, Proc. Biol. Soc. Washington, 38:83.

Type locality. 2 mi W Santo Domingo Mission, Baja California, Mexico, 30° 45' LN, 115° 58'.LW

Range. *Dipodomys gravipes* is known from the San Quintin Valley in Baja California, from near San Telmo south of El Rosario.

Recorded localities. *BAJA CALIFORNIA*: 2 mi W Santo Domingo Mission (Huey, 1925). 3 mi S San Telmo; 2 mi W Santo Domingo Mission; mouth of Agua Chiquitin Canyon; Santa Maria near San Quintin; 1 mi S San Ramon (Huey, 1957).

Description. The San Quintin kangaroo rat has five toes on the hind feet, is medium large in size with a small ear pinna, and has a thick tail of medium length; the skull is relatively wide; width across the maxillary arches averaging more than 54.8% of the greatest length of skull; maxillary root of the zygomatic arch has a sharp posteroexternal angle (Williams *et al.*, 1993).



Geographic range of *Dipodomys gravipes*.

Measurements. The mean and range of 56 males (Best, 1993b) are: total length, 306.8; length of tail, 176.1; hind foot length, 44.8; ear length, 13.3; greatest length of skull, 41.6; interorbital width, 10.9; length of nasals, 4.0; breadth across maxillary arches, 6.1; greatest width, 26.0. The mean and range of 54 females (Best, 1993) are: total length, 300.0; length of tail, 173.2; length of hind foot, 44.1; length of ear, 13.5; greatest length of skull, 40.6; interorbital width, 10.8; length of nasals, 3.9; breadth across maxillary arches, 6.1; greatest width, 25.7.

Remarks. *Dipodomys gravipes* is larger than *D. merriami* and *D. simulans*. It can be distinguished from the former by having five toes on the hind feet; in comparison to *D. simulans*, *D. gravipes* has shorter ears, longer hind feet, larger body size, and a tail that is thicker, paler, and less sharply

bicolored (Best and Lackey, 1985); the head is wider, which is apparent externally as well as being reflected in measures of cranial width.

Best and Lackey (1985) reviewed the relationships of *D. gravipes* to other species of *Dipodomys*. Alvarez-Castañeda *et al.* (1995) consider it a key species in the province San Diegina in their study of zoogeography of Northwestern Mexico. This species is considered as endangered by the Mexican Government (NOM-059-ECOL-1994).

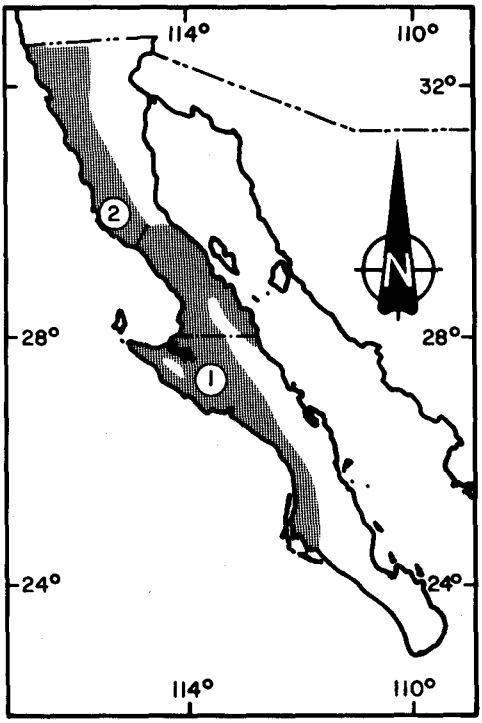
Dipodomys simulans simulans (Merriam)

1904. *Perodipus streaton simulans* Merriam, Proc. Biol. Soc. Washington, 17:144.

1993. *Dipodomys simulans simulans*, Williams, Genoways and Braun, Biol. of Heteromyidae. Amer. Soc. Mamm., Spc. Publ., 10:86

Type locality. Dulzura, San Diego Co., California.

Range. The species is found from the Los Angeles Basin and San Jacinto mountains of southern California, southward in Baja California to the vicinity of Bahia Almejas, Baja California Sur. *Dipodomys simulans simulans* ranges from southern California southward Baja California near Santa Catarina, including the slopes of the Sierra Juarez and Sierra San Pedro Martir.



Geographic range of *Dipodomys simulans*:

Recorded localities. *BAJA CALIFORNIA*: 2 mi W Mision Santo Domingo; Las Cabras; San Jose (Huey, 1925). El Rayo; Sierra Juarez; Valle de la Trinidad; El Rosario (Villa, 1941). Just south of the International boundary near Jacumba, California; 3 mi NW Neji; Tres Picos Mine, Near Juarez; Rosarito Beach; N side Descanso Bay; Ensenada; 14 mi S Ensenada; Santo Thomas; Laguna Hanson; 1 mi E Laguna Hanson; El Rayo, Sierra Juarez; Sangre de Cristo; El Valle de la Trinidad, extreme western end; El Valle de la Trinidad. Aguaito Spring: Summit of San Mat'as Pass, Diablito spring; La Grulla, Sierra San Pedro Martir; 8 mi N Santa Catalina (Rancho La Ramona); 7 mi N Santa Catalina; 4 mi N Santa Catalina landing; (Huey, 1951). Ensenada; Valladares; Rosarito; Rosarito Divide (Hall and Kelson, 1952). 14 mi N Laguna Hanson; Valle de la Trinidad; Sierra Juarez; El Rosario (Alvarez, 1960).

Description. A medium-sized kangaroo rat with five toes on the hind feet, moderately long ear pinnae, relatively narrow breadth across the maxillary arches, and 60 chromosomes. Length of head and body averages about 115 mm and length of hind foot averages less than 42 mm; greatest length of skull averages less than 39.5 mm and maxillary breadth averages less than 21.0 mm.

Measurements. Of the holotype following Williams *et al.* (1993) are: total length, 280; length of tail, 165; hind foot length, 40; greatest length of skull, 38.00; width across bullae, 24.40; breadth across maxillary arches, 20.15; nasal length, 13.30; interorbital breadth, 12.65.

Remarks. *Dipodomys simulans* may be distinguished from *D. gravipes* by the narrower breadth across the maxillary arches, smaller hind feet, and larger ears (Williams *et al.*, 1993).

Huey (1951) treated *D. peninsularis* as a species, and Best (1978) listed it as a subspecies of *D. agilis*. Huey (1962) considered *D. antiquarius,* from Sierra Borja, Baja California, to be closest to *D. stephensi*, but Lackey (1967) could find no significant differences between samples of *D. antiquarius* and *D. peninsularis*. Stock (1974) postulated *D. antiquarius* was a subspecies of *D. agilis* (now *simulans*).

Grinnell (1922) and Huey (1951) noted only slight and inconsistent differences in specimens of *D. a. agilis* and *D. simulans*. Best (1978) considered that *D. paralius* was indistinguishable from *D. a. plectilis*. Morphometric analyses (Best, 1981a, 1983) did not show little differentiation among *D. a. martirensis, D. a. plectilis,* and *D. simulans*, so all the subspecies of *D. agilis* and *D. paralius* are under *D. simulans simulans* (see Williams *et al.*, 1993; Sullivan and Best, 1997).

Dipodomys simulans has the densest population of any form of *Dipodomys* in northern Baja California. No specimen yet examined lacks the fifth toe or hallax, which is occasionally revealed in some Californian species of *Dipodomys* (Huey, 1951).

The baculum is sligthly smaller than others with the large, bulbous basal ends. Measurements of eight specimens are: length, 9.7 (9.0-10.3); height of base 1.6 (1.3-1.9); width of base, 1.3 (1.1-1.4) (Burt, 1960).

Dipodomys simulans peninsularis (Merriam)

1907. *Perodipus simulans peninsularis* Merriam, Proc. Biol. Soc. Washington, 20:79.

Type locality. Santo Domingo [Landing], 28° 51' LN, 114° LW, Baja California.

Range. Occurs in the central and southern portions of the Baja California Peninsula, from the vicinity of San Fernando Mission, Baja California southward to the vicinity of Magdalena and Almejas bays, near 24° 30' LN.

Recorded localities. *BAJA CALIFORNIA*: La Lomita Maria; Mesquital; 11 mi S Punta Prieta (Huey, 1957). *BAJA CALIFORNIA SUR*: Santo Domingo [Landing] (Merriam, 1907). Calmalli (Villa, 1941). Santo Domingo Landing; 5 mi W El Ca–on; Calmalli; 4 mi E El Arco; 5 mi E El Arco; 12 mi E El Arco, Rancho Mira Flores; Santa Gertrudis Mission; Rancho Union, 15 mi E Calmalli; 1 mi E Rancho Lagunitas; Pozo Altimirano; Campo Los Angeles; San Ignacio; 18 mi E San Ignacio; 10 mi W Santa Rosalia, Valle del Yaqui; Santa Teresa Bay, Gulf of California; 7 mi W San Francisquito Bay; San Jorge; Santo Domingo 25° 30' LN; 7 mi N el refugio; 9 mi S El refugio; Matancito [Matancitas] (Huey, 1957). Calmalli (Alvarez, 1960).

Description. Similar in general to *simulans* but considerably larger, tail crest more strongly developed, and pelage more silky (Merriam, 1907). Ground color paler buff only ligthly lined with dark hairs; nose patch small and not connected with whisker-masks. Skull like that of *simulans* but maxillary arch slightly narrower, with angle less pronunced; mastoids slightly larger and deeper; interparietal area narrower.

Measurements. The mean and range of three male topotypes (Huey, 1951) are: total length, 291 (285-302); length of tail, 196.3 (170-189); hind foot length, 42.0 (42-42); greatest length of skull, 40.3 (39.7-41.0); width across bullae, 25.3 (24.8-26.1); breadth across maxillary arches, 20.6

(20.1-20.9); nasal length, 13.9 (13.7-14.1); width of maxillary arch al middle, 4.7 (4.6-4.9). The mean and range of three females topotypes (Huey, 1951) are: total length, 281.0 (274-287); length of tail, 167.3 (162-173); length of hind foot, 41.3 (40-42); greatest length of skull, 39.6 (39.3-39.9); width across bullae, 25.5 (25.3-25.7); breadth across maxillary arches, 21.5 (21,1-21.8); nasal length, 13.8 (13.8-14.0); width of maxillary arch al middle, 4.9 (4.5-5.3).

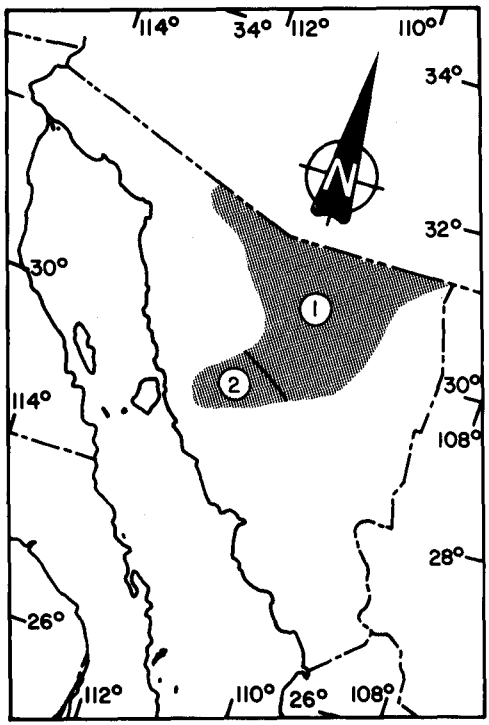
Remarks. Best (1978) regarded *D. antiquaris* as indistinguishable from *D. p. pedionomus*, and *D. peninsularis* was not specifically distinct from *D. simulans*, and considered *pedionomus*, *eremoecus*, and *australis* as subspecies of *D. simulans*. Subsequently, Best (1983) showed a close similarity between *Dipodomys p. peninsularis*, and *D. p. australis*, whose geographic ranges are contiguous. Williams *et al.* (1993) include these three subspecies of *D. peninsularis* and *D. anticuarius* as junior synonyms of *D. simulans peninsularis*, while Sullivan and Best (1997) list all these as synonym of *D. s. simulans*.

Dipodomys spectabilis Merriam

1890. *Dipodomys spectabilis* Merriam, N. Amer. Fauna, 4:46.

Type locality. Dos Cabezos, Cochise Country, Arizona.

Range. This species occurs south-central Arizona dna northern Sonora, eastward to Trans-Pecos Texas, extending north in Arizona to the Four Corners Region and south through New Mexico to northeastern Durango. A disjunct population occurs south of the range of *D. nelsoni* in east-central Zacatecas, northeastern Aguascalientes, and western San Luis Potosi (Williams *et al.*, 1993).



Geographic range of *Dipodomys spectabilis*:
1. *D. s. perblandus* 2. *D. s. intermedius*

Description. One of the largest species of kangaroo rats, with four toes on the hind feet and with a tail terminating in a large, white tuft of hairs (tuft exceeds 25 mm in length, typically about 40 mm) bordered proximally by a band of black hairs; lateral white stripes of tail present only on about the proximal half; underside of tail, proximal to white tuft, dark colored; head and body length averaging from about 128 to 150 mm; the auditory bullae relatively large and inflated; skull relatively wide across the maxillary arches (breadth averaging from about 25.0 to 26.3) (Williams *et al.*, 1993).

Remarks. *Dipodomys spectabilis* is most similar in size and appearance to *D. nelsoni;* see the account of the latter species for diagnostic characters. It is also similar in size to the four-toed species, *D. deserti*, from which *D. spectabilis*

can be distinguished by the prominent black border to the white tail tuft, the dark underside to its tail, generally smaller hind feet (usually averaging from 47 to 52 in *spectabilis* and from 52 to 53.5 in *deserti*), and a less inflated skull with a wider interorbital region and wider breadth across the maxillary arches (Nader, 1978; Williams *et al.*, 1993).

Dipodomys spectabilis are conspicuosly sexually dimorphic, with males significantly larger in several characteristics (Best, 1988, 1993).

The baculum of *Dipodomys spectabilis* is the largest in the genus (Best and Schnell, 1974). The bulbous basal end is sculptured in old animals, and is higher than wide. From the basal end, the shaft tapers gradually to the pointed tip, upturned at approximately a right angle to the nearly straight shaft (Burt, 1960). Bacula average 16.7 long, 2.3 wide at the base, and 2.6 high at the base (Best and Schnell, 1974).

The different subespecies of *Dipodomys spectabilis* have 2n = 72 chromosomes, but differ in both autosomal and sex chromosomes morphology (Stock, 1974). *D. s. spectabilis* has 35 acrocentric chromosomes and a fundamental number of 70.

Dipodomys spectabilis intermedius Nader

1965. *Dipodomys spectabilis intermedius* Nader, Proc. Biol. Soc. Washington, 78:50.

Type locality. 16.7 mi SW Bamori, about 1,900 ft, Sonora, Mexico.

Range. West central Sonora, Mexico, from Querobabi on the north, southward to Carbo and westward to about 17 mi southwest of Bamori (Nader, 1978).

Recorded localities. *SONORA*: 16.7 mi SW Bamori, 1900 ft; 5 mi W Querobabi; 45 mi N Hermosillo, 2100 ft (Nader, 1965).

Description. Following Nader (1965), this is a small subspecies of *Dipodomys spectabilis* averaging in total length 318.5 to 325.0; tail length, 184.9 to 188.8; ear length about 16.6; distal white tip of the tail short, averaging 20.0 to 21.0; light in weight, averaging 98.9 to 106.1 grams. Upper parts are light ochraceous-buff mixed with pinkish buff; sides with more evident pinkish buff; arietiform markings dusky; plantar stripes light brown; dorsal and ventral tail stripes darkish; subterminal band at end of tail blackish; tuft of hairs at base of tail ventrally grayish.

The skull is of small size; greatest length averaging 43.0 to 43.2; basal length averaging 31.0; breadth across maxillary arches small; posterolateral edge of maxillary arches slightly flared; rostrum narrow; auditory bullae small; greatest breadth across bullae averaging 27.0 to 27.7; supraoccipital and interparietal narrow; least width of supraoccipital averaging 1.7 to 2.0; narrow across exoccipitals; external openings of auditory meatuses oval; incisor usually small; mandible small, mandibular length averaging 17.9 to 18.0. Also see measurements.

Measurements. Mean and extremes of seven specimens from the type locality (Nader, 1965) are: Total length, 325.0 (314.0-330.0); tail length, 184.9 (174.0-195.0); length of white tip of tail, 20.0 (13.0-25.0); hind foot length, 47.6 (46.0-49.0); body length, 137.3 (130.0-146.0); greatest length of skull, 43.05 (42.1-44.2); basal length, 31.04 (30.5-31.8); length of nasals, 15.7 (15.2-16.8); greatest breadth across bullae, 27.7 (27.2-28.7); rostral width, 4.3 (4.1-4.4); bullar depth, 14.4 (14.2-15.2); alveolar length of maxillary tooth row, 5.9 (5.3-6.3); least width of supraoccipital, 1.75 (1.4-2.2); breadth across exoccipitals, 13.14 (12.7-13.4); mandibular length, 17.9 (17.3-18.5); weight (grams), 98.8 (94.9-105.7).

Remarks. *Dipodomys spectabilis intermedius* is a small, pinkish buff subspecies, with a short white tip on the tail. It is closely related to *D. s. perblandus*. Because the former subspecies is

intermediate morphologically between *D. s. perblandus* and *D. nelsoni*, the name *intermedius* seems appropriate. *D. s. intermedius* does not represent the terminus of clinal variation within the range of measurements of *D. s. perblandus*. *D. s. intermedius* is more pinkish; slightly smaller in many body and skull measurements of *D. s. perblandus* (Nader, 1965).

Dipodomys spectabilis intermedius intergrades with *D. s. perblandus* in central Sonora. One adult from S mi W Querobabi which is referred herein to *D. s. intermedius*, has a wide interparietal, wide supraoccipital, and small round openings of the external auditory meatuses, similar to those of *D. s. perbilandus*.

Variations within *D. s. intermedius* include the following: one of five adults from 45 mi N Hermosillo has the breadth across the maxillary arches and the greatest breadth across the bullae slightly larger than the typical. In two of seven adults from 16.7 mi SW Bamori, the least width of the supraoccipital approaches that of *D. s. perblandus* (Huey, 1957).

Specimens from 45 mi N Hermosillo were found associated with grass and palo fierro or ironwood (*Olneya tesota*) and those from 16.7 mi SW Bamori were found associated with grass, creosote (*Larrea* sp.), and palo verde (*Cercidium* sp.). Similar habitat to that from which specimens of *D. s. intermedius* have been taken is available in areas nearby, and future collecting will probably show that this subspecies has a wider geographic range. The limited number of specimens available from Sonora probably reflects the difficulty of access for collecting in much of this region (Huey, 1957).

Dipodomys spectabilis perblandus Goldman

1933. *Dipodomys spectabilis perblandus* Goldman, Jour. Washington Acad. Sci., 23:466.

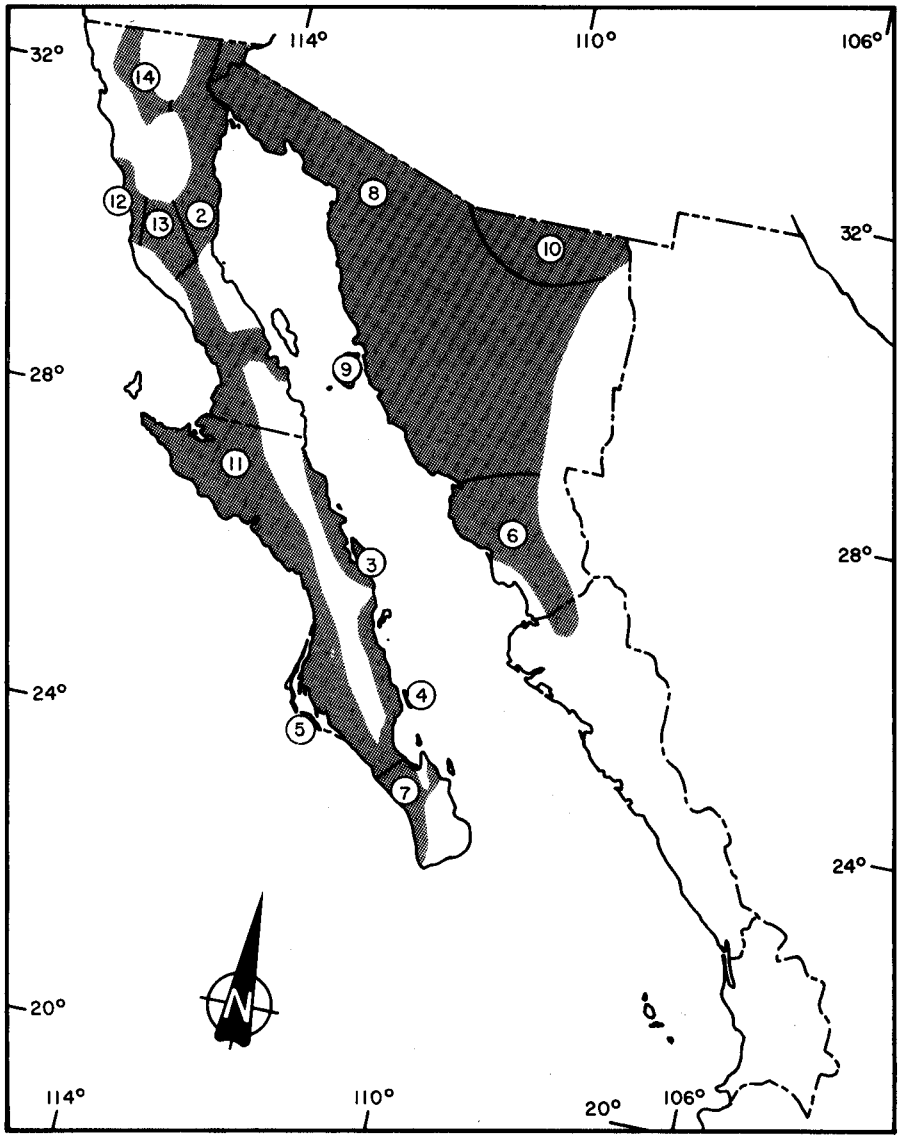
Type locality. Calabasas, about 3,500 ft, Santa Cruz Co., Arizona.

Range. Found in south central Arizona southward to north central Sonora.

Recorded localities. *SONORA*: Cerro Blanco (Elliot, 1907). 2 mi S Sasabe (Dice y Blossom, 1937). Noria; 2 mi S Sasabe (Burt, 1938). Magdalena (Goldman, 1933). Ebano (Villa, 1941). La Sauceda, 15 mi NNE Cananea; 9 mi N Cananea (Alvarez, 1960). Pozo de San Emeterio, 8.5 mi N Quitovac; Cerro Blanco; Magdalena; Llano; 20 mi S Santa Ana *ca.* 2,600 ft (Nader, 1978).

Description. Following Goldman (1933), this subspecies is closely allied to *Dipodomys spectebilis spectabilis* from southeastern Arizona, but smaller and paler, the upper parts more thinly mixed with black; black facial mask less distinct; tail less extensively tipped with white cranial characters, also distinctive. The color of the type (fresh pelage) is: upper parts in general light ochraceous buff, purest on cheeks, shoulders, sides, and outer surfaces of thighs, the top of head and back thinly mixed with black; under parts, postauricular and supraorbital spots, fore limbs, hind feet above, hip stripes, and tail at extreme base all around pure white; tail beyond base black mixed with gray above and below, becoming nearly black in a subterminal zone all around, abruptly interrupted by pure white tip 40 millimeters in length, the sides white along lines narrowing gradually and disappearing in the subterminal area mentioned; soles of hind feet brownish; ears whitish externally, except anterior fold which is dusky, thinly clothed internally with minute black hairs. The skull is similar to that of *D. s. spectabilis*, but decidedly smaller; mastoids relatively smaller; interparietal and supraoccipital usually relatively broader at constriction between mastoids; dentition lighter, the incisors and molariform teeth distinctly narrower.

Measurememts. Nader (1978) Total length, 326.6 (315-335); length of tail, 193.6 (184-204); hind foot length, 48.3 (47-50); greatest length of skull, 44.6 (43.0-45.3); width across bullae, 28.1



Geographic range of *Dipodomys merriami*:

1. *D. m. annulus*
2. *D. m. arenivagus*
3. *D. m. brunensis*
4. *D. m. insularis*
5. *D. m. margaritae*
6. *D. m. mayensis*
7. *D. m. melanurus*
8. *D. m. merriami*
9. *D. m. mitchelli*
10. *D. m. olivaceus*
11. *D. m. platyeephalus*
12. *D. m. quintinensis*
13. *D. m. semiparalius*
14. *D. m. trinidadesnsis*

(27.7-28.6); length of nasals, 16.1 (15.0-16.8); breadth across maxillary arches, 25.7 (25.3-25.9); interorbital breadth, 14.6 (14.0-15.3); alveolar length of maxillary toothrow, 5.9 (5.6-6.2); rostral breadth. 4.6 (4.3-4.7).

Remarks. *Dipodomys spectabilis perblandus* is a well marked subspecies, although not far removed geographically from *D. s. spectabilis*. It occupies the desert area west of the range of *D. s. spectabilis*, which is typical of the higher plateau region of southeastern Arizona (Goldman, 1933). In northern Sonora, they live in habitat dominated by *Prosopis* under which there is grass, mostly *Aristida* and *Bouteloua* (Dice and Blossom, 1937).

D. s. perblandus has 2n = 72 with 12 submetacentric chromosomes, 31 acrocentric chromosomes, and a fundamental number of 78 (Stock, 1974).

Dipodomys merriami merriami Mearns

1890. *Dipodomys merriami* Mearns, Bull. Amer. Mus. Nat. Hist., 2:290.

Type locality. New River, between Phoenix and Prescott, Maricopa Co., Arizona.

Range. The species is widely distributed from northwestern Nevada southward to the Baja California Peninsula, Sonora through Aguascalientes (Hall, 1981). *D. m. merriami* occurs from northwestern Nevada, southward through the Rio Yaqui Valley in southern Sonora (Lidicker, 1960).

Recorded localities. *BAJA CALIFORNIA*: Imperial canal, 11 mi E Mexicali; Seven Wells; E side Cocopah Mtns, 21 mi SSE Mexicali, 100 ft; Domos arenosas, 15 mi W Yuma; 1 mi S U. S. Mexican boundary, 10 mi W Pilot Knob; Alamos River, 20 mi SW Pilot Knob, 50 ft; Colorado River, 20 mi S Pilot Knob; Colorado River, lat 32° 15' N (Lidicker, 1960).

SONORA: Ortiz; Guaymas (Merriam, 1893). Cerro Blanco (Elliot, 1907). 3 mi S Hermosillo; Costa Rica (45 mi SW Hermosillo); Ures; San Jose de Guaymas (Burt, 1938). Costa Rica (Villa, 1941). 5 mi N Guaymas; 80 mi N Hermosillo; 11 mi N Cd. Obregon (Booth, 1957). 5 mi W Alamos (Ingles, 1958). Paso MacDougal, Pinacate region; Sierra Pinacate, 40 mi W Sonoyta [Sonoita]; Papago Tanks, Pinacate Mtns; between Sonoyta and Papago tankls, Altar Province; 0.5 mi S Crater Elegante, 34 mi S Sonoyta [Sonoita], 900 ft; Batamote, Rio Sonoyta [Sonoita], 30 mi SW Sonoyta [Sonoita]; 3 mi NE Tinajas de los Papagos, Sierra del Pinacate; Tinajas de los Papagos, Sierra del Pinacate; 2 mi S Sierra Blanca, 16 mi E Punta Peñascosa; 1 mi NNE Punta Peñascosa; 1 mi NE Punta Peñascosa; Cerro La Cholla, 6 mi WNW Punta Peñascosa, 50 ft; Pozo de Cipriano, 10 mi WSW Sonoyta [Sonoita]; 0.5 mi NE Sonoyta [Sonoita]; Pozo de San Emeterio, 8.5 mi N Quitovac; 5 mi S Sasabe, on New Altar Rd, 1400 ft; 16.7 mi (by rd) n caborca, 450 ft; 2 mi E Pitiquito; 1 mi W Altar, *ca* 900 ft; 1.6 mi SW Alesnas, 20 mi WSW Caborca, 1900 ft; 13 mi SW Caborca; 3 mi N Puerto de Lobos, 200 ft; Cerro del Viejo, Altar Province; 16.7 mi SW Bamori, 1900 ft; 9 mi SSW Yaqui; Punta Cirio, 5 mi S Puerto Libertad, 20 ft; Llano; 20 mi S Santa Ana; 5 mi N Cornelio; Puerto Gonzalitos, 33.4 mi S Santa Ana, 2700 ft; Poza; 56 mi N Hermosillo (by highway); 45 mi N Hermosillo; 30 mi N Hermosillo (by highway); 14 mi N Hermosillo, 1100 ft; San Jose de Gracia, 20 mi NE Hermosillo, 1150 ft; 11.9 mi N Hermosillo; 1 mi N Batue, Rio Moctezumac; 10 mi SE Punta Arena, 75 mi W Hermosillo, 10 ft; Sierra Seri, 9 mi W San Javier, 70 mi W Hermosillo; Puerto Kino, 20 ft; Costa Rica Ranch, 45 mi SW Hermosillo; 11.3 mi W Hermosillo, 650 ft; Hermosillo; 3 mi S Hermosillo; 5 mi S Hermosillo, 1100 ft; 15 mi S Hermosillo; 5 mi NE Tastiota; Ortiz; 0.5 mi NW San Jose de Guaymas, 25 ft; 1 mi E San Jose de Guaymas; 50 ft; Batamotal; 7/10 mi SW Pozo, 8 mi NW Guaymas; 2.5 mi WSW Guaymas, 15 ft; 2 mi W Guaymas, 25 ft; 4 mi SE Empalme; Guasimas, 15 ft; Pitahaya, 40 km SE Empalme,

100 ft; Sotello ranch, Altar province (Lidicker, 1960). 6 mi E Agua Prieta; 3 mi S Hermosillo; Rancho Costa Rica, 45 mi SW Hermosillo (Alvarez, 1960).

Description. A small-sized kangaroo rat (head and body length averages less than about 105 mm and greatest length of skull averages less than 37 mm in all populations; Lidicker, 1960) with four toes on the relatively slender hind feet, and with a tail terminating in a crest and tuft of dusky or blackish-brown hairs; mastoid bullae usually relatively more inflated and rostrum narrower than in most other species; rostrum not decidedly shortened and face not noticeably narrower than most other species.

Measurements. Following Lidicker (1960) are: body length about, 100; total length, 240-250; hind foot length, 37-38; cranial length averages about, 35.5; maxillary breath usually, 19.0-19.5; least interorbital breadth average 12,5 to 13; greatest breagth average 22.5-23.0; nasal length 13.0-13.5; basal length usually 24 or more.

Remarks. *Dipodomys merriami* is most similar in size and appearance to the other small-sized, four-toed species, *D. nitratoides;* all other four-toed species are considerably larger and most have a prominent tuft of white hairs at the tip of the tail. *D. merriami* differs from *D. nitratoides* in generally being larger in size, and in having a longer and wider rostrum (nasal length usually averages greater than 13.1 in *D. merriami* and less than 12.3 mm in *D. nitratoides*; Hoffmann, 1975; Lidicker, 1960).

Mearns (1890) listed it as 281 mm, the difference apparently being that Mearns measured to the end of the hairs on the tail.

Hall (1981) treated *Dipodomys margaritae* as a species distinct from *D. merriami*, although Lidicker (1960) considered it to be a subspecies of *D. merriami*; we concur with Lidicker. Lidicker (1960) provided measurements for each of the subspecies of *D. merriami.*

The baculum is relative long. The moderately enlarged basal end tapers gradually into the shaft which has a slight ventral curvature rather then a dorsal one near the distal end. The tip does not curve dorsally at as acute an angle. The basal end is slightly, if any, higher then wide. Measurements of 51 specimens are: leength 10.8 (9.3-11.7; heigth of base, 1.2 (1.0-1.7); width of base, 1.06 (0.8-1.3).

Dipodomys merriami annulus Huey

1951. *Dipodomys merriami annulus* Huey, Trans. San Diego Soc. Nat. Hist., 11:224.

Type locality. El Barril, Gulf of California, 28 20' LN, 112 50' LW, Baja California, Mexico.

Range. From near Bahia Los Angeles to Bahia Santa Teresa (Huey, 1951).

Recorded localities. *BAJA CALIFORNIA*: El Barril; Bahia Santa Teresa; Bahia San Francisco; 7 mi W Bahia San Francisco; Los [las] Flores, cerca de Bahia [de] los Angeles (Huey, 1951). Bahia de los Angeles (Booth, 1957). Los [Las] Flores, Bahia de Los Angeles; 7 mi W San Francisquito bay; San Francisquito bay; [El] Barril; San Borja Mission; Santa Teresa Bay (Lidicker, 1960).

Description. Following Huey (1951), compared with *Dipodomys merriami platycephalus*, *D. m. annulus* is nearly equal in size, but is paler dorsally and has a darker crest on its bicolored tail. In color tone, *D. m. annulus* resembles *D. m. arenivagus* but is several shades darker. Here the resemblance ends, for *annulus* is larger and has the black tail of the Cape district races. Compared with *Dipodomys m. brunensis, D. m. annulus* is more pallid and has a bicolored tail. In fact, as the name implies, it is the connecting link in the two racial chains, and has dominant characteristics of both. The skull of *D. m. annulus*, compared with that of *D. m. platycephalus*, is similar in size,

but has more inflated mastoid bullae and several other minor unmeasurable characteristics, such as very sharply angled zygomatic arches and truncated auditory bullae, which sets *annulus* apart from either *platycephalus* or *brunensis*.

Measurements. The mean and range of five males (Huey, 1951) are: total length, 248.2 (244-252); length of tail, 145.6 (140-150); hind foot length, 39.4 (38-40); greatest length of skull, 36.4 (35.3-37.2); width across bullae, 23.4 (22.3-24.3); spread of maxillary arches, 20.2 (19.5-21.1); great length of nasals; 13.5 (13.0-14.0); width of maxillary arch at middle, 5.3 (5.2-6.0). The mean and range of five females (Huey, 1951) are: total length, 250.2 (250-251); length of tail, 149.8 (148-151); length of hind foot, 38.4 (37-40); greatest length of skull, 36.4 (35.9-37.0); width across bullae, 23.4 (22.9-23.9); spread of maxillary arches, 20.2 (19.0-21.0); great length of nasals, 13.5 (13.0-14.1); width of maxillary arch at middle, 5.3 (5.0-5.5).

Remarks. Huey (1951) mentions the type locality of the darker *D. m. platycephalus* on the Pacific slope is less than 40 miles and almost directly west of Barril, so the presence of this pallid race so near reflects the decidedly arid character of this Gulf coast region, and is further evidence of the differentiating influence of the elements within short distances along the climatically variable peninsula.

Dipodomys merriami arenivagus Elliot

1904. *Dipodomys m[erriami]. arenivagus* Elliot, Field Columbian Mus., Publ. 87, Zool. Ser., 3:249.

Type locality. San Felipe, Baja California, Mexico.

Range. From south of the U. S. border and west of the Colorado River Delta, southward to San Felipe and east of the Sierra San Pedro Martir and Sierra Juarez, Baja California (Huey, 1951).

Recorded localities. *BAJA CALIFORNIA*: San Felipe (Elliot, 1904; Villa, 1941). San Felipe; 5 mi N San Felipe; 30 mi N San Felipe; 40 mi N San Felipe; De Mara's Well, Western side Laguna Salada; Gaskill's Tank, east base Sierra Juarez (Huey, 1951). 6 mi S, 33 mi E Mountain Springs (Calif); Las Palmas Canyon, W side Laguna Salada, 15 mi S north end, 200 ft; De Mara's Well, W side Laguna Salada; Signal Mountain; SE base Signal Mtn; Cerro Centinela, 13 mi WSW Mexicali, 300 ft; 13 mi N El Mayor; 40 mi N San Felipe; 30 mi N San Felipe; San Felipe; mouth El Cajon Canyon, base San Pedro Martir Mtns, 2,300 ft; La Bocana de la Canon de Santa Maria, 10 mi E Mission de Santa Maria; 15 mi NW Calamahue Mission, 1,600 ft; Puerto de Calamajue; (Iaskill's Tank, Los Muertos Canyon Fan, near Laguna Salada; 40 mi N San Felipe; 5 mi N San Felipe; San Felipe; Canyon Esperanza; Valley E base San Pedro Martir Mtns. (Lidicker, 1960). San Felipe; 58 km SE, 23 km W San Felipe (Alvarez, 1960).

Description. Following (Lidicker, 1960), the color is extremely pale pinkish buff, dusky tips of hairs absent; arietiform markings extremely pale or absent; dorsal tail stripe and caudal pencil very light brown; ventral tail stripe either entirely gone, remaining only as a distal remnant, or present as a pale, thin streak; plantar stripes either completely absent, greatly reduced, or pale, thin, and sometimes reddish; supraoccipital spot usually prominent; cheeks generally pure white all the way to orbit.

Measurements. The mean and range of five males (Huey, 1951) are: total length, 246 (235-256); length of tail, 146.6 (140-155); hind foot length, 38.2 (37-39); greatest length of skull, 35.8 (35.0-36.7); width across bullae, 23.3 (22.8-23.7); spread of maxillary arches, 19.2 (18.6-19.6); great length of nasals, 12.7 (12.2-13.4); width of maxillary arch at middle, 5.0 (4.6-5.2). The mean and range of five females (Huey, 1951) are: Total length, 242.0 (233-253); length of tail, 141.6

(132-151); length of hind foot, 37.2 (36-39); greatest length of skull, 35.7 (34.7-37.0); width across bullae, 22.9 (22.6-23.8); spread of maxillary arches, 19.0 (18.1-19.7); great length of nasals, 13.0 (12.0-13.8); width of maxillary arch at middle, 4.9 (4.7-5.0).

Remarks. Lidicker (1960) considers this subespecies as the most specialized of the entire species, because it lives in some of the driest and hottest deserts of North America.

Dipodomys merriami brunensis Huey

1951. *Dipodomys merriami brunensis* Huey, Trans. San Diego Soc. Nat. Hist., 11:225.

Type locality. Llano de San Bruno, Baja California [Sur], Mexico.

Range. From near El Valle de Yaqui, about 12 km NW Santa Rosalia, southward to the southern end of Bahia Concepcion, Baja California (Huey, 1951).

Recorded localities. *BAJA CALIFORNIA SUR*: Cape San Lucas; San Jose del Cabo; Santa Anita; 7 miles south of Miraflores; Agua Caliente; La Paz, 15; Tres Pachitas (Huey, 1951). 10 mi W Santa Rosalia, Valle del Yaqui; Llano de San bruno; Mulege; Bahia Consepcion, 13 mi SE Mulege, 10 ft; S end Bahia Concepcion; Santa Rosalia, SE end Bahia Consepcion, 25 ft; Canipoli; El Valle del Yaqui, NW of Santa Rosalia; San Bruno; Llano de San Bruno (Lidicker, 1960). Arroyo Leon, near Loreto (Alvarez, 1960).

Description. Following (Huey, 1951) this subspecies closely resembles *D. m. Platycephalus* in size, its nearest geographic relative. In dorsal coloration it is darker, in general color tone tending toward *Dipodomys merriami melanurus* of the extreme Cape region. The tail tuft color is blacker than that of *platycephalus*. Both the mastoid and tympanic bullae are larger and more inflated.

The mastoid bulla of the skull of *D. m. brunensis* is more inflated than that of *D. m. melanurus*, and a number of the specimens have smaller ears. This ear characteristic in *Dipodomys*, specially when the whole genus is considered,is directly related to the inflation or deflation of the mastoid bullae. As a general rule, the species having large inflated mastoids have smaller external pinna than do those whose mastoid bullae are moderate in size. In *Dipodomys meriami*, this characteristic is too variable and has too little racial stability to warrant its use as a means to differentiate between races.

Measurements. The mean and range of five males (Huey, 1951) are: total length, 251.4 (245-258); length of tail, 154.6 (146-168); hind foot length, 38.0 (37-39); greatest length of skull, 37.0 (36.3-37.6); width across bullae, 23.9 (23.5-24.5); spread of maxillary arches, 20.1 (19.4-20.6); great length of nasals, 13.7 (13.3-14.2); width of maxillary arch at middle, 5.0 (4.5-5.3). The measurements of 2 skins and one skull of females (Huey, 1951) are: total length, 248, 250; length of tail, 151, 151; length of hind foot, 38, 40; greatest length of skull, 37.1; width across bullae, 23.0; spread of maxillary arches, 20.0; great length of nasals, 13.8; width of maxillary arch at middle, 5.0.

Remarks. Compared with *D. m. melanurus*, *brunensis* has the same color tone, but is lighter and has a lighter colored tail. The difference in dorsal color is attributable to the climatic influences shown in the ranges of the two races. Both *brunensis* and *melanurus* occupy sections of the peninsula that are climatically different than the region occupied by their relatives to the north and west.

Dipodomys merriami insularis Merriam

1907. *Dipodomys insularis* Merriam, Proc. Biol. Soc. Washinrton. 20:77.

Type locality. San Jose Island, Gulf of California, Baja California [Sur], Mexico.

Range. Only known of San Jose Island, Gulf of California.

Recorded localities. *BAJA CALIFORNIA*: San Jose Island (Townsend, 1912). Southwest side; Southeast end San Jose Island (Huey, 1951). San Jose Island; Southwest side San Jose Island; S end San Jose Island; Southeast end San Jose Island (Lidicker, 1960).

Description. Following Merriam (1907), the size is small; color pale pinkish buff only lightly lined with dark hairs; nose and whisker patches only faintly developed. The ground color is pinkish buff with vinaceous tinge on rump and flanks, as in *D. margaritae*. The skull is small but rather broad, with very broad maxillary arches. Compared with *D. m. platycephalus* the skull is smaller; frontoparietal shield much narrower; and mastoid bullae decidedly smaller.

Measurements. Mean measurements of 9 adult males and 16 adult females (Best and Thomas, 1991) are: total length, 258.2 and 243.9; length of body, 108.2 and 97.3; length of tail, 150.0 and 146.6; hind foot length, 40.1 and 38.4; ear length, 13.0 and 13.5; basal length of cranium, 20.8 and 20.7; greatest length of cranium, 36.4 and 36.0; maxillary arch spread, 20.7 and 20.9; interorbital width, 11.1 and 11.2; nasal length, 13.4 and 13.7; intermaxillary width, 7.4 and 7.2; alveolar length, 4.9 and 4.6; lacrimal length, 3.5 and 3.6; maxillary arch width, 5.7 and 5.7; basioccipital length, 4.7 and 4.7; greatest depth of cranium, 11.6 and 11.5; greatest width of cranium, 22.8 and 22.7; zygomatic width, 17.8 and 17.6; and nasal width, 3.6 and 3.5.

Remarks. Often regarded as a separate species (e.g., Huey, 1964), we follow Williams *et al.* (1993) in treating *insularis* as one a subspecies amid the chain of mainland races of *D. merriami*. In certain basic characters, however, such as the shape of the bullae, which are smaller than those of the mainland races, and the correspondingly large ears, general pelage color, and robust appearance, it contrasts so strongly with the geographically nearest mainland relative *D. m. brunensis*, that integration cannot be assumed (Huey, 1951). Lidicker (1960) included samples of *D. insularis* in his analysis of geographic variation in *D. merriami* because of the possibility that it might prove to be a subspecies of the latter species. He retained specific rank for *D. insularis*, however, because of its greater structural divergence from the norm among samples of all subspecies of *D. merriami*. Best and Janecek (1992) found that *D. insularis* was significantly different in several morphological traits from samples of *D. merriami* from the mainland, but they classified it as a subspecies of *D. merriami* based on allozymic similarities.

Compared with *D. m. melanurus* from the mainland of the Cape region: color very much paler and of different tone; crested part of tail paler and less strongly crested; ears larger. Compared with *D. m. platycephalus*: general color paler; tail crest browner. The young are decidedly paler than young of *D. m. platycephalus* (Merriam, 1907).

The vegetation of Isla San Jose is most plentiful in the canyons and drainages and the rocky higher slopes are extremely barren (Nelson, 1922). Best and Thomas (1991) collected specimens in open habitat about 100 m from the beach, in an area with a vegetative cover of 65%. The remaining 35% was bare ground with desert pavement.

Lidicker (1960) found considerable sexual dimorphism, with males being larger than females; he provided external and cranial measurements for samples of males and females. No embryos were present in an adult female collected in May, but the presence of a subadult female collected in that month indicated young may be born in late February or March (Best and Thomas, 1991).

The mesurement of the baculum of an adult and a subadult male, respectively, are: length, 12.4, 10.7; height of base, 1.4, 1.4; and width of base, 1.2, 1.3 (Best and Thomas, 1991). This subspecies is considered threatened by the Mexican Goverment (NOM-059-ECOL-1994).

Dipodomys merriami margaritae Merriam

1907. *Dipodomys margaritae* Merriam Proc. Biol. Soc. Washington, 20:76.

Type locality. [Santa] Margarita Island, Baja California Sur, Mexico.

Range. Occurs only on Santa Margarita Island off the Pacific Coast, Baja California Sur.

Recorded localities. *BAJA CALIFORNIA*: Santa Margarita Island (Huey, 1951; Lidicker, 1960).

Description. Following Merriam (1907), it is of very small size (nearly as small as *D. nitratoides exilis*); color pale pinkish buff almost ochraceous buff, moderately lined with dark hairs. Tail crest small and weak; ventral stripe continuous; lateral white stripes reaching nearly to tip of vertebrae. Ground color similar to *D. m. arenivagus* but less pure obcured by intermixture of dark hairs. The skull is very small and light with slender rostrum and nasals; remarkably small bullae; rather broad frontoparietal shield and intermatoid rather squarely spreading (but short) anterior arm of zygomata broad and strongly angled maxillary arch. Skull short, same size as *D. m. parvus,* from which it differs markedly in smaller and less inflated mastoid bullae (especially the rear section which does not project so far posteriorly), and less conspicously in longer nasals, longer (and slightly broader) maxillary arches, which stand out more squarely. Both have rather broad frontoparietal shields and interparietals, and clearly belong to same group although they differ greatly in color.

Measurements. Mean measurements of three adult males and one adult female (Best, 1992) are: total length, 238.7, 247.0; length of body, 91.3, 97.0; length of tail, 147.3, 150.0; hind foot length, 38.0, 39.0; ear length, 13.0, -; basal length of cranium, 19.8, 19.6; greatest length of cranium, 35.0, 34.6; maxillary arch spread, 19.4, 19.3; interorbital width, 11.2, 11.0; nasal length, 13.2, 12.9; intermaxillary width, 7.0, 7.0; alveolar length, 4.9, 4.8; lacrimal length, 3.3, 3.2; maxillary arch width, 5.3, 4.9; basioccipital length, 4.6, 4.4; greatest depth of cranium, 11.4, 11.7; greatest width of cranium, 21.9, 21.5; zygomatic width, 17.6, 17.5; nasal width, 3.3, 3.0.

Remarks. *D. m. margaritae* requires comparison with only *D. m. parrus*, its small size (skull 33.5 x 22) alone being sufficient to distinguish it from all others except *D. nitratoides exilis*, and its bullae are smaller even than those of *D. n. exilis* (Merriam, 1907).

The range of variation shown by the limited avilable material of this species stands well beyond that shown by a good series from the nearby mainland. The bullae are much smaller and less inflated and the pelage is decidedly pale, as is the tail tuft. The ratio of tail to body lengh is smaller than that of the nearby mainland species. There seems to be no valid reason to reduce either this species or *D. insularis* a subspecies, for there is no evidence of intergradation (Huey, 1951).

Lidicker (1960), in his analysis of geographic variation in *D. merriami*, concluded that *D. margaritae* did not warrant specific status and assigned it as a subspecies of *D. merriami*, an opinion with which Huey (1964) disagreed. Hall (1981) listed *D. margaritae* as a species without reference to Huey (1964) or Lidicker (1960). We believe Lidicker's (1960) conclusions are based on the most comprehensive analysis, and concur with his assignment of *D. margaritae* as a subspecies of *D. merriami*. Huey (1951) and Lidicker (1960) listed measurements for samples of this subspecies.

Santa Margarita Island is desertlike in character with sparse vegetation. The low area in the middle contains more abundant vegetation. Among the most notable species are *Pachycereus calvus* and *P. pectenaboriginum*, *Machaerocereus gummosus*, *Lemaireocereus thurberi*, *Fouquieria peninsularis*, *Jatropha canescens*, and *Pedilanthus macrocarpus* (Nelson, 1922).

Dipodomys margaritae apparently is not common on Santa Margarita Island and probably is restricted in its distribution to the lowland area between the northern and southern mountain ranges. One specimen was captured during 80 trap-nights in July 1986 and none were captured during 440 trap-nights in September 1990 (Best, 1992).

The baculum of an immature specimen was 9.8 mm in length 1.5 mm in height of base, and 1.0 mm in width of base (Best, 1992).

This subspecies is considered endangered by the Mexican Goverment (NOM-059-ECOL-1994).

Dipodomys merriami mayensis Goldman

1928. *Dipodomys merriami mayensis* Goldman, Proc. Biol. Soc. Washington, 41:141.

Type locality. Alamos, Sonora, Mexico.

Range. From Rio Yaqui Valley of southern Sonora southward to extreme northern Sinaloa (Lidicker, 1960).

Recorded localities. *SINALOA*: 1 mi NE El Fuerte (Lidicker, 1960). *SONORA*: Camoa (Goldman, 1928). Alamos; Camoa (Goldman, 1937). Guirocoba; Chinobampo; Tesia; Camoa (Burt, 1938). 1 mi S Vicam, 200 ft; 6 mi NNW Ciudad Obregon; 1 mi N Ciudad Obregon, 200 ft; Los Medanos, 30 mi SW Obregon; 25 mi NW Navojoa; 22.5 mi NW Navojoa; Camoa, Rio Mayo; 3 mi NNW Bacavachi, 100 ft; 12 mi WNW Alamos; 10 mi WNW Alamos; 3 mi W Alamos, 1200 ft; 1 mi NW Alamos, 1500 ft; 1 mi W Alamos; W side Alamos; Alamos; 33 mi SSE Navojoa (Lidicker, 1960). Camoa, Rio Mayo; 15 mi W Alamos (Alvarez, 1960).

Description. Following Goldman (1937), this is a rather dark-colored form, most closely allied to *Dipodomys merriami merriami*, but upper parts darker, tail blacker; skull differing most prominently in greater expansion of maxillary arches. Hind foot with four toes as usual in the species. The coloration of the type (fresh pelage) is: upper parts in general near cinnamon buff of Ridgway, moderately mixed with black, the dark hairs giving a finely lined appearance, especially on top of head and over back; under parts, fore limbs, hind feet above, supraorbital and postauricular spots, usual hip stripes and tail at extreme base all around pure white; tail beyond extreme base slightly blackish along upper and lower median stripes to near tip where the lengthening hairs are blackish all around, the sides white passing gradually into dusky subterminally, the lighter under color persisting to extreme tip; outer sides of ankles and soles of hind feet distinctly blackish; dark facial markings rather broad and conspicuous. The skull is similar to that of *D. m. merriami*, but maxillary arches broader, the lateral angles more everted and hook-like; rostrum slightly heavier, the nasals slightly broader anteriorly than usual in *D. merriami*; mastoid and auditory bullae about the same. Resembling that of *D. m. melanurus* in development of maxillary arches, but mastoid and auditory bullae decidedly smaller.

Measurements. Following Lidicker (1960) are: length of tail averaging less than 145; greatest length of skull averaging only little more than, 35.0; and 22.3 in greatest breadth.

Remarks. While this kangaroo rat is closely allied to the widely ranging typical subspecies, it is easily distinguished by the rather well-marked combination of color and cranial characteristics

listed above. It somewhat resembles *D. m. melanurus* of Baja California Sur, but is darker and cranial distinctions have been mentioned (Goldman, 1937).

Dipodomys merriami melanurus Merriam

1894. *Dipodomys merriami melanurus* Merriam, Proc. California Acad. Sci., Ser. 2, 3:345.

Type locality. San Jose del Cabo, Baja California Sur, Mexico.

Range. From near San Jorge on the north end of the Magdalena Plain, southward through the Cape region of Baja California Sur (Lidicker, 1960).

Recorded localities. *BAJA CALIFORNIA SUR*: Miraflores (Townsend, 1912). 9 mi S El Refugio, Magdalena Plain; Buena Vista, Magdalena Plain; Matancitas, Magdalena Plain; Santo Domingo (25° 30' LN), Magdalena Plain; San Jorge; Cape San Lucas; San Jose del Cabo; Santa Anita; 7 mi S Miraflores; Agua Caliente; La Paz; Tres Pachitas (Huey, 1951). San Jorge (25° 44' LN, 112° 07' LW), 5 ft; Buena Vista, Magdalena Plain; Santo Domingo (25° 31' LN) Santo Domingo (25° 30' LN); Matancita; near El Refugio; 24.3 mi by road SE El Refugio, 24° 33' LN, 111° 35' LW, 100 ft; La Paz; 1 mi S La Paz; 2 mi SW La Paz; Muertos Bay, 24 LN; Agua Caliente, 800 ft; Todos Santos; Miraflores; 7 mi S Miraflores; 6 mi N San Jose del Cabo; San Jose del Cabo; Cape San Lucas (Lidicker, 1960).

Description. Following Merriam (1894), this subspecies is similar to *D. merriami* but smaller and with the terminal third of the tail abruptly blackish. The coloration of the upper parts is pale ochraceous-buff mixed rather sparingly with black-tipped hairs; crescents at base of whiskers small; face and supraorbital spot white; not dusky on ankle: upper and lower tail-stripes continuous to tip, meeting considerably anterior to end of vertebrae, the crested penicillate part blackish.

Measurements. The mean and range of five males (Huey, 1951) are: total length, 252 (248-257); length of tail, 150.4 (144-160); hind foot length, 37.0 (36-38); greatest length of skull, 36.6 (35.9-37.8); width across bullae, 23.4 (22.9-24.0); spread of maxillary arches, 20.0 (19.4-21.3); great length of nasals, 13.1 (12.5-13.8); width of maxillary arch at middle, 5.3 (5.0-5.8). The mean of five females (Huey, 1951) are: total length, 245.0; length of tail, 147.2; length of hind foot, 37.4; greatest length of skull, 35.4; width across bullae, 22.6; spread of maxillary arches, 19.9; great length of nasals, 12.5; width of maxillary arch at middle, 5.2.

Remarks. The holotype was destroyed in the San Francisco earthquake and fire of 1906. After the fire, a new catalog was started; thus, CAS 539 now represents a different specimen. Lidicker (1960) synonymized *D. m. llanoensis* with *D. m. melanurus*, because the former exhibited intermediate characteristics between typical *D. m. melanurus* to the south and *D. m. platycephalus* to the north. Huey (1964) retained *D. m. llanoensis* "as a means of cataloging the geographic variation shown by the specimens." Hall (1981) cited Huey (1964) as his reason for recognizing *D. m. llanoensis*. We concur with Lidicker (1960).

Dipodomys merriami mitchelli Mearns

1897. *Dipodomys mitchelli* Mearns, Proc. U .S. Natl. Mus., 19:719, 30 July.

Type locality. Tiburon Island, Gulf of California, Sonora, Mexico.

Range. Known only from Tiburon Island, Gulf of California, Sonora (Hall, 1981).

Recorded localities. *SONORA*: Tiburon Island (Mearns, 1897; Townsend, 1912). E side Tiburon Island; Bahia Santa Rosa, E side Tiburon Island; Ensenada del Perro, S end Tiburon Island;

Tiburon Island (Lidicker, 1960) Ensenada de Los Perros, S Isla Tiburon; Bahia Santa Rosa, E Isla Tiburon (Alvarez, 1960).

Description. Following Mearns (1897) is similar to *Dipodomys merriami simiolus*, but sligthtly smaller, with much shorter ears and stronger coloration; tail much heavily coated than that of the corresponding mainland; darker band on upper and under surfaces black; ears more densely clothed than in *D. m. simiolus,* and are almost black instead of buffy white; dark stripe on the under side of the hind foot intensenly black; under pelage having darker slate color.

Measurements. Following Mearns (1897) are: length of tail, 140; hind foot length, 38.5; greatest length of skull, 36.5; width across bullae, 22.5; length of nasals, 13.3.

Remarks. Mearns (1897) made a comparation with *D. m. melanurus* of Baja California and consider that they are very different.

Dipodomys merriami olivaceus Swarth

1929. *Dipodomys merriami olivaceus* Swarth, Proc. California Acad. Sci., ser. 4, 18:356.

Type locality. Fairbank, Cochise Co., Arizona.

Range. From southeastern Arizona and western New Mexico southward around the northern end of the Sierra Madre Occidental into northeastern Sonora on the west and central Chihuahua on the east (Willson *et al.*, 1993).

Recorded localities. *SONORA*: La Mision, 2 mi W Magdalena; Magdalena; 6 mi E Agua Prieta, 4,100 ft; 30 km S Agua Prieta on R.R. (Lidicker, 1960).

Description. Following Lidicker (1960) are dark, often with an olivaceous cast; arietoform marking very dark and prominent; tailstripes broad and medium to dark brown; plantars dark brown and extended to the es; peneilsvery dark.

Measurements. The mean and range of 18 specimens from Chihuahua (Anderson, 1972) are: total length, 241.9 (195-273); length of tail, 144.2 (125-163); hind foot length, 37.4 (30.7-41); ear length, 12.6 (10-15). Anderson (1972) does not give the skull measurements.

Dipodomys merriami platycephalus Merriam, 1907

1907. *Dipodomys platycephalus* Merriam, Proc. Biol. Soc. Washington, 20:76.

Type locality. Calmalli, Baja California, Mexico.

Range. From the southern end of the Sierra San Pedro Martir and San Fernando, southward to about 26° 15' LN, including the entire Vizcaino Desert, but not extending to the Gulf coastal regions (Lidicker, 1960; Williams *et al.*, 1993).

Recorded localities. *BAJA CALIFORNIA*: Mezquital: Campo los Angeles: Santa Rosalia; Punta Prieta (Villa, 1941). Santo Domingo (28° 12 LN, 115° 04 LW); South side of Scammon's lagoon (Huey, 1927). San Francisquito; mouth of Calamahue Canyon; Ubai (=Yubay), 30 mi S Calamahue; San Borjas Mision; Santa Rosalia Bay, La Lomita Maria (Miller's Landing), Santo Domingo Landing (28° 15' LN); mainland on south side of Scammon's Lagoon; Mesquital; 5 mi W El Cañon (10 mi W Calmalli); Calmalli; 4 mi E El Arco; Pozo Altamirano; Campo los Angeles; 1 mi E Rancho Lagunitas (Huey, 1951). 3 mi W El Marmol; San Agustin; 5 mi S El Marmol; 12.5 mi by road S El Marmol; San Fernando; Rancho Ramona, 8 mi n Santa Catarina; 7 mi N Santa Catarina; Santa Catarina landing; Cataviña; 13 mi NW Chapala; 2 mi NW Chapala; 25 mi

N Punta Prieta; 24 mi NW Punta Prieta, 2,000 ft; Punta Prieta; Valle de Agua Amarga (15 mi W Bahia de Los Angeles); San Andres; 11 mi S Punta Prieta; Santa Rosalia Bay; Santo Domingo landing; Mesquital; 10 mi SE Mesquital, 400 ft; Calmalli. (Lidicker, 1960). El Mesquital: Campo Los Angeles; Santa Rosalia; Punta Prieta (Alvarez, 1960). *BAJA CALIFORNIA SUR*: Turtle Bay; 1 mi SE Cabo Tortola, 27° 38' LN; S Scammon's Lagoon (mainland): Campo Los Angeles; Punta Abreojos (Lidicker, 1960).

Description. Following Merriam (1907) in the original description, this subspecies is externally similar to *D. merriami simiolus* but the skull is different. The ground color is ochraceous buff moderately lined with dark hairs; ankle same color (not dusky). The skull in general is like that of *D. m. merriami*, but extraordinarily broad; maxillary arches of zygomata broadly and squarely spreading (as in *Perodipus streatori* [=*D. heermanni*]) fronto-parietal shield exceedingly broad; interparietal area broad; mastoid bullae normal.

Measurements. The mean and range of five males (Huey, 1951) are: total length, 250.2 (245-261); length of tail, 148.4 (140-155); hind foot length, 37.4 (36-38); greatest length of skull, 36.4 (35.3-37.5); width across bullae, 23.2 (22.6-23.9); spread of maxillary arches, 20.0 (19.9-20.3); great length of nasals, 13.0 (12.7-13.9); width of maxillary arch at middle, 5.1 (4.8-5.6). The mean and range of five females (Huey, 1951) are: total length, 247 (238-257); length of tail, 145.4 (140-150); hind foot length, 37.4 (37-38); greatest length of skull, 36.5 ()34.7-37.6); width across bullae, 23.1)22.7-23.7); spread of maxillary arches, 20.1 (19.4-21.1); great length of nasals, 13.4 (12.5-14.5); width of maxillary arch at middle, 5.3 (5.0-5.5).

Remarks. Lidicker (1960) synonymized *semipallidus* with *platycephalus* because he found them to be intergrades between *quintinensis* and *platycephalus*. Huey (1951, 1964) distinguished *semipallidus* entirely on the basis of slightly darker coloration, which Lidicker (1960) did not consider worthy of subspecific recognition. Hall (1981) retained *semipallidus* for reasons not stated. We concur with Lidicker (1960) that the slight and inconsistent differences in color attributed to *semipallidus* by Huey (1951, 1964) do not merit recognition as a separate subspecies.

Dipodomys merriami quintinensis Huey

1951. *Dipodomys merriami quintinensis* Huey, Trans. San Diego Soc. Nat. Hist., 11:222.

Type locality. 5 mi E San Quintin, Baja California Mexico.

Range. Occurs on the San Quintin Plain along the Pacific coast, from near Santo Domingo southward to the region of El Rosario, Baja California.

Recorded localities. *BAJA CALIFORNIA*: Santo Domingo; San Quintin (Villa, 1941; Alvarez, 1960). Santo Domingo (30° LN); 1 mi S San Ramon; north end San Quintin Plain; San Quintin; Santa Maria near San Quintin; 5 mi E San Quintin; mouth of agua Chiquita Canyon; 7 mi SE San Quintin; 3 mi E El Rosario; 8 mi E El Rosario (Huey, 1951). N end San Quintin Plain; San Ramon, mouth Santo Domingo River; 1 mi San Ramon; Santo Domingo; Arroyo Nuevo York, 15 mi S Santo Domingo; near San Quintin: San Quintin; Agua Chiquita, 4 mi E San Quintin; 10 mi E San Quintin; Santa Maria, near San Quintin; 10 mi E El Rosario, 600 ft (Lidicker, 1960).

Description. The pelage color of *D. m. quintinensis*, when viewed in series, is darker than in *D. m. parvus*, with which it is most similar. This form furnishes a good demostration of the need for large series to establish color values in species that show considerable variation in this respect. Compared with *D. m. parvus*, *D. m. quintinensis* averages larger; its tail tuft is lighter in density of black, and it has a larger ear. It differs from *D. m. trinidadensis* in being darker and in having

a slightly smaller skull. Compared with *D. m. semipallidus., its intergrading relative and apparent ancestor to the southward, D. m. quintinensis* is darker, both in pelage color and in tail tuft. In both body size and skull size it is smaller than *D. m. semipallidus*. Its differentiation, like that of *D. m.trinidadensis*, seems to have involved a reduction in size.

Measurements. The mean and range of five males (Huey, 1951) are: total length, 241.2 (235-246); length of tail, 144 (140-148); hind foot length, 36.4 (35-39); greatest length of skull, 35.0 (33.6-36.5); width across bullae, 22.3 (21.7-22.7); spread of maxillary arches, 19.2 (18.8-20.1); great length of nasals, 12.8 (12.5-13.4); width of maxillary arch at middle, 4.8 (4.5-5.1). The mean and range of five females (Huey, 1951) are: total length, 242.0 (231-250); length of tail, 140.8 (134-148); length of hind foot, 35.8 (35-37); greatest length of skull, 34.9 (33.3-36.3); width across bullae, 22.6 (21.2-23.1); spread of maxillary arches, 19.2 (18.7-19.9); great length of nasals, 12.2 (11.8-12.8); width of maxillary arch at middle, 5.0.

Remarks. This form, like *D. m. parvus* and *D. m. trinidadensis*, provides another example of parallel development. All three branch separately from a desert stock line, with no known interconnecting links of relationship along the Pacific Slope. In other words, each appeared to be separate invaders into an as yet completely unoccupied region of different climatic conditions. The effect of the change in climate is recorded in their degree and pattern of differentiation. It is likely that parallel correlations between meteorological data taken in the three localities for an adequate period and subspecies differences would indicate a strong relationship between gradients in climate and morphology.

Dipodomys merriami trinidadensis Huey

1951. *Dipodomys merriami trinidadensis* Huey, Trans. San Diego Soc. Nat. Hist., 11:220.

Type locality. Aguajito Spring, El Valle de la Trinidad, Baja California, Mexico.

Range. Lidicker (1960) outlined a discontinuous range form the Jacumba Valley and Mountain Springs region of California, southward to El Valle de la Trinidad along the western border of the Sierra Juarez, Baja California, Mexico.

Recorded localities. *BAJA CALIFORNIA*: San Francisco Bay (Townsend, 1912). Sangre de Cristo (Villa, 1941; Alvarez, 1960). Sangre de Cristo; El Valle de la Trinidad; summit of San Matias Pass, Diablito spring (Huey, 1951). N end of San Quintin plain; San Ramon, mouth Santo Domingo River; International bondary at Jacumba; Valle La Puerta, near boundary; Sangre de Cristo [Valle en la San Rafael]; El valle de la Trinidad, Aguajito Spring; El Valle de la Trinidad, 2,500 ft; summit San Matias Pass, near Diablito Spring (Lidicker, 1960).

Description. Compared with *D. m. arenivagus*, *D. m. trinidadensis* is darker in dorsal color, more closely resembling *D. m. parvus* and showing distinctly the effect on coloration of the Pacific slope environmental condition. The tail of *D. m. trinidadensis* is heavily striped above and below, with a greater area covered by the darker dorsal and ventral stripes than by the white sides stripes. This is in sharp contrast to the relative area covered by ventral and dorsal stripes on the tail of *D. m. arenivagus*, in some specimens of which the ventral stripe is almost lacking. *D. m. trinidadensis* is smaller then *D. m. arenivagus* and larger than *D. m. parvus*.

Cranially, the relationship with its desert relative is apparent, as there is a wide gap in general shape of the skull between *D. m. trinidadensis* and *D. m. parvus*. This is shown in a limited degree by the measurements, though the contour of the skull and the inflation of the bullae do not lend themselves well to measurements. Compared with *D. m. arenivagus*, *D. m. trinidadensis* has a

more elongated skull, because of the more compressed mastoid bullae. The auditory bullae are larger, more inflated, and less trumpet-shaped.

Measurements. The mean and range of five males (Huey, 1951) are: total length, 241.8 (234-255); length of tail, 143.8 (138-154); hind foot length, 37.4 (36-38); greatest length of skull, 35.5 (35.4-35.9); width across bullae, 22.5 (22.1-23.1); spread of maxillary arches, 18.9 (18.4-19.5); great length of nasals, 12.6 (12.4-12.9); width of maxillary arch at middle, 4.8 (4.7-5.0). The mean and range of five females (Huey, 1951) are: total length, 240.8 (238-248); length of tail, 142.6 (140-145); length of hind foot, 37.0 (36-38); greatest length of skull, 35.6 (35.0-36.7); width across bullae, 22.6 (22.2-23.4); spread of maxillary arches, 18.7 (18.4-19.1); great length of nasals, 12.8 (12.6-13.4); width of maxillary arch at middle, 4.6 (4.3-5.2).

Remarks. Lidicker (1960) discussed the possibility that *D. m. trinidadensis* was polyphyletic, and that the diagnostic characters exhibited by the disjunct populations were examples of convergence. A more likely hypothesis, according to Lidicker (1960), is that the populations are relicts of a formerly more widely-distributed population. The northern populations of this taxon was classified as *D. m. simiolus* by Grinnell (1922). Huey (1951) listed means and ranges of measurements for samples of males and females from Baja California.

Dipodomys deserti deserti Stephens

1887. *Dipodomys deserti* Stephens, Amer. Nat., 21:42.

Type locality. Mojave River [3 or 4 miles from, and opposite Hesperia], San Bernardino Co., California.

Range. The species can be found from southwestern Utah, southerward to northwestern Sonora, and northeastern Baja California (Nader, 1978). *D. d. deserti* from southeastern Utah, western Arizona, northwestern Sonora, northeastern Baja California (Williams *et al.*, 1993).

Recorded localities. *BAJA CALIFORNIA*: San Felipe (Villa, 1941). 40 mi N San Felipe; 30 mi N San Felipe; San Felipe; De Mara's Well on western side of Laguna Salada, 35 mi below international boundary. 61 km NE, 3.4 km W San Felipe; 56 km S San Felipe (Alvarez, 1960). *SONORA*: El Doctor (Burt, 1938). Rancho Noche Buena Viejo, 120 mi SE, 12 km N Sonoyta [Sonoita]; 1 mi NNE Punta Peñasco (Alvarez, 1960).

Description. A large kangaroo rat with four-toed hind feet; tail with ventral coloration the same as or only slightly darker than the lateral light stripes, and with no dark band proximal to the white, distal tuft; skull with greatly inflated auditory bullae; interparietal usually absent in dorsal view in adult specimens; supraoccipital so compressed as to be barely visible dorsally (1 mm or less) (Williams *et al.*, 1993). *D. deserti* has the flattest skull of any member of the genus (Merriam, 1890)

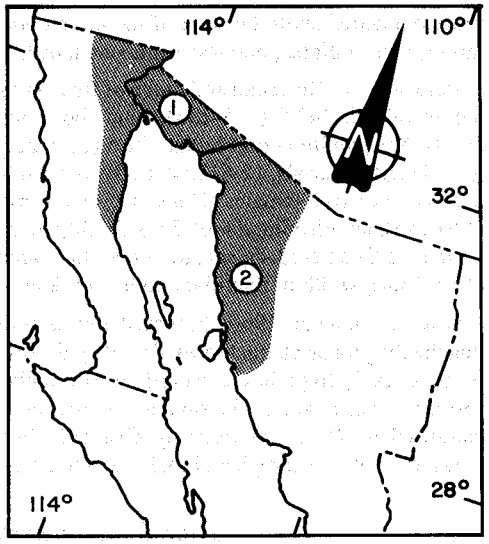
Measurements. From Nader (1978) are: total length, 342.0 (313-376); length of tail, 206.3 (187-229); hind foot length, 53.5 (51-56); greatest length of skull, 45.5 (44.5-46.5); width across bullae, 30.2 (28.9-31.4); length of nasals, 16.8 (16.1-17.5); breadth across maxillary arches, 23.3 (22.1-25.0); interorbital breadth, 13.7 (13.2-14.5); length of alveolar maxillary toothrow, 6.2 (5.8-6.5); length of alveolar mandibular toothrow, 6.0 (5.7-6.2).

Remarks. *Dipodomys deserti* can be distinguished from all other species by its large size, absence of a vestigial fifth toe on the hind feet, and usual absence of a darker ventral stripe on the tail. *D. deserti* can be differentiated from *D. spectabilis* by its lack of a dark-colored band of hairs bordering the white tail tuft, generally smaller hind feet, and a flatter skull, with a broader

interorbital region and greater breadth across the maxillary arches (Hall, 1981; Nader, 1978; Williams *et al.*, 1993).

The desert kangaroo rat is adapted to live in the lowest, hottest, and most arid regions of North American deserts (Nader, 1978). It is asociated with loose sandy soils dominated by *Larrea* or *Prosopis* (Williams *et al.*, 1993). The gestation period is 29 to 32 days (Butterworth, 1961) and the number of embryos ranges from one to six with a mean of 3.43 and a mode of 3.0. One or possibly two litters (February and May) are produced each year (Nader, 1978). Reproductive activity begins early in January and continues through early July (Best, *et al.*, 1989).

The fundamental number of chromosome is 108. There are 3 metacentric chromosomes, 16 submetacentrics, 4 subtelocentrics, 8 acrocentrics and telocentrics, the X chromosome is submetacentric, and the Y is acrocentric-subtelocentric (Stock, 1974).



Geographic range of *Dipodomys deserti*:
1. *D. d. deserti* 2. *D. d. sonoriensis*

Dipodomys deserti sonoriensis Goldman

1923. *Dipodomys deserti sonoriensis* Goldman, Proc. Biol. Soc. Washington, 36:139.

Type locality. La Libertad Ranch, 30 mi E Sierra Seri, Sonora, Mexico.

Range. Found on the coastal plain of west central Sonora.

Recorded localities. *SONORA*: La Libertad Ranch, 30 mi E Sierra Seri (Goldman, 1923). Rancho Costa Rica (Burt, 1938). Hermosillo (Villa, 1941). Rancho Dolores, 7 mi ESE Rancho Libertad, 47 mi W Hermosillo; Hermosillo (Alvarez, 1960).

Description. General characters closely allied to *Dipodomys deserti deserti*, but general color of upper parts decidedly darker, more heavily overlaid with black, the buffy element of a vinaceous instead of ochraceous tone. Skull differing in detail, especially the weaker development of the maxillary arches and jugals (Goldman, 1923). The characteristics of the type (Goldman, 1923) are: upperparts in general light vinaceous-buff, rather heavily overlaid or mixed with black, especially on rump; nose, area at base of vibrissae, and orbital rings distinctly blackish; under parts, fore limbs, hip stripes, hind feet above, and sides of tail white as usual in the species; tail blackish above (tip missing in type), a narrow dusky median line below. The skull closely resembles that of *D. d. deserti*, but maxillary arches weaker; lacrymals larger, their extension along posterior border of maxillary arches equalling about one-half the distance to outer angle (extension distinctly less than one-half this distance in *D. d. deserti*); jugals more slender; squamosal (as viewed from above) less broadly articulating with parietal; mastoid bullae more fully inflated along line of contact with parietals.

Measurements. From Nader (1978) are: total length, 362.0 (345-385); length of tail, 210.7 (198-231); hind foot length, 52.0 (52-55); greatest length of skull, 46.7 (45.6-47.8); width across bullae, 31.1 (30.3-32.1); length of nasals, 17.4 (16.2-18.6); breadth across maxillary arches, 24.6 (23.3-25.9); interorbital breadth, 14.9 (14.2-15.7); length of alveolar maxillary toothrow, 6.0 (5.6-6.4); length of alveolar mandibular toothrow, 6.1 (5.7-6.5).

Remarks. Specimens from parts of southwestern Arizona are somewhat darker in color in upper parts than typical *Dipodomys deserti*, and apparently grade toward the form described here. *D. d. sonoriensis* probably has an extensive range over the sandy plains of northwestern Sonora (Goldman, 1923). *D. d. sonoriensis* is the largest subspecies and the darkest colored, being "nearly blackish" (Nader, 1978).

Subfamily Heteromyinae Coues

Members of this subfamily are medium to large-sized mice, ranging from 180 to 360 mm in total length; the body form is quadrupedal and generally mouse- or rat-like; the tail is neither tufted nor crested, naked in appearance with annular rows of scales usually visible; locomotion is scansorial, with a bounding, quasi-richochetal movement at fast pace; the hind limbs are larger than the forelimbs; the pes has five clawed digits; the sole may be naked or clothed with fine hairs; the pelage is stiff or hispid, with body hairs of three types (straight, relatively long and widened overhairs; wide, troughed overhairs; and a thin underfur of slightly wavy hairs; the anterior face of the upper incisor is smooth or may have a shallow groove; the molars are progressively hypsodont, rooted, and tuberculate; the enamel cusp pattern is lost to wear early in life; lophs of P4 unite first at lingual then at labial sides, surrounding a central basin in a majority of species; the squamosal is in broad contact with the parietal on the dorsal surface of the skull and is not perforated by the auditory bullae; the orbital walls are completely ossified; two pterygoid fossae are present; the auditory bullae are moderately expanded, with their inflated interior filled with spongy trabeculae; the mastoid bullae do not extend onto the dorsal surface of the skull nor project posteriorly of the occipital plane. These are the most murine-like members of the family, and are, in many ways, more similar structurally to ancestral heteromyids and geomyids than they are to living heteromyids (see Wood, 1935). Further details of body form can be found in the accounts of Genoways (1973), Wahlert (1985), Brylski (1993), and Hafner (1993). A complete list of recent taxa included in the subfamily can be found in Patton (1993) and Williams *et al.* (1993); the latter includes keys to the two extant genera and their included species. Only one species in the genus *Liomys* occurs northwestern Mexico.

Genus *Liomys* Merriam, 1902

1902. *Liomys* Merriam, Proc. Biol. Soc. Wash., 15:44

Type species. *Heteromys alleni* [= *Liomys irroratus alleni*] Coues, 1881, Bull. Mus. Comp. Zool., 8:187.

Comments. Generally referred to as spiny pocket mice, a common name also shared with *Chaetodipus* among the heteromyids of northwestern Mexico, members of this genus are typically much larger with much stiffer pelage, lack distinct rump spines but have stiff hairs throughout, have much smaller and less inflated bullae with no dorsal mastoid inflation, an essentially naked and noncrested tail, naked soles on the hind feet, and rather hypsodont cheek teeth that wear flat early in life. The genus was revised by Genoways (1973). Only the single species *Liomys pictus*

(Thomas, 1893) is found in the northwestern Mexican states of Nayarit, Sinaloa and Sonora. However, *L. irroratus* occurs in Jalisco where its distribution approaches the border between that state and Nayarit (Genoways, 1973). In his revision of the genus, Genoways (1973) recognized four subspecies of *L. pictus*, two of which occur within northwestern Mexico: *L. p. pictus* (Thomas) and *L. p. hispidus* (J. A. Allen).

Liomys pictus pictus (Thomas, 1893)

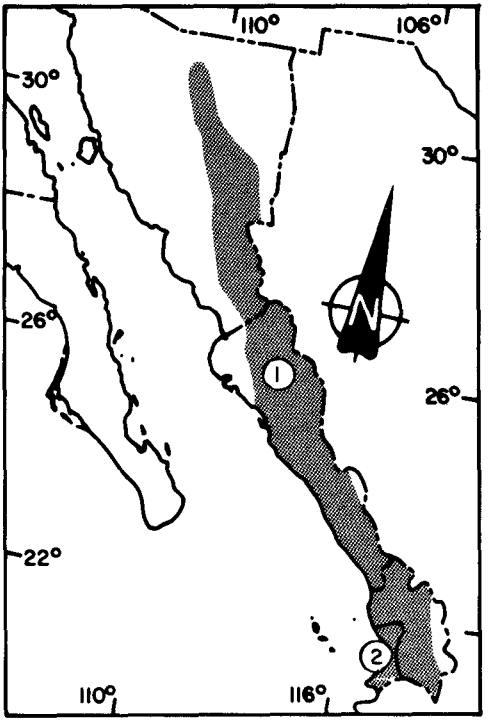
1893. *Heteromys pictus* Thomas, Ann. Mag. Nat. Hist., ser. 6, 12:233
1911. *Liomys pictus*, Goldman, N. Amer. Fauna, 34:33.

Type locality. From Mineral San Sebastian, 4300 ft, Jalisco..

Range. This subspecies occurs along the west coast of Mexico from extreme southwestern Nayarit, Jalisco, Colima, Michoacan, Guerrero, Oaxaca, Chiapas, into northwestern Guatemala, and across the Isthmus of Tehuantepec into southern Veracruz (Genoways, 1973; McGhee and Genoways, 1978).

Recorded localities. *NAYARIT*: Compostela; Navarrete; Santiago (Goldman, 1911). 10 mi E San Blas, 5 mi S Las Varas (Hall, 1981).

Description. A medium to small-sized member of the genus, reddish brown above, with a ochraceous lateral stripe, and white below. The sole of the hind feet is finely haired. The pelage is hispid, with stiff spines intermingled with slender soft hairs. The total length averages 240 mm, tail length 124 mm, and hind foot length 29 mm. The cranium is relatively narrow in comparison with its length.



Localization of *Liomys pictus*:
1. *L. p. hispidus* 2. *L. p. pictus*

Measurements. The mean and range of five topotypes (Goldman, 1911) are: total length, 251 (232-260); length of tail, 136 (117-146); hind foot length, 29.4 (27.5-31); greatest length of the skull, 31.9 (30.9-33); zygomatic breadth, 14.3 (14.1-15); interorbital constriction, 7.5 (7.2-7.8); length of nasals, 13.3 (13.2-13.6); width of braincase, 13.8 (13.2-14); alveolar length of upper molar series, 4.9 (4.6-5).

Remarks. This taxon is readily distinguished from any other sympatric heteromyid in northwestern Mexico by virtue of its distinct murine-like body form, large size, naked and noncrested tail, harsh and rather spiny pelage, and skull without dorsal expansion of the mastoid bullae. This is the only species of the genus in northwestern Mexico, although the range of *L. irroratus* approaches the geographic limits of this region near the Nayarit border in Jalisco (Genoways, 1973). In areas of sympatry, *pictus* can be distinguished from *irroratus* by its smaller

external and cranial size; presence of a loph connection between the entostyle to the hypocone in the upper permanent premolar; a ventral keel on the baculum; narrow as opposed to broad pterygoid wings; and reddish-brown dorsal color with an ochraceous lateral stripe rather than grayish-brown with a pale pinkish to buff lateral stripe (see Genoways, 1973).

Little is known of the ecology and population biology of Painted spiny pocket mice. They are regarded as solitary, aggressive, and nocturnal. Breeding has been recorded in every month except January and October at various localities throughout the range, but the season in northwestern Mexico is most likely to coincide with spring through fall. Litter sizes have been reported from one to six, with a modal number of four. Available information is summarized by McGhee and Genoways (1978).

The baculum has a basal bulbous end which is usually higher than wide and tapers gradually into a slightly upcurved shaft. Subterminally, just before the tip turns upward, the shaft is flattened dorsoventrally, but immediately following, it is flattened laterally to form a ventral keel on the upturned tip. Measurements of 26 specimens are: length 8.8 (8.0-10.0); heigth of base, 1.3 (0.9-1.7); width of base 1.1 (0.8-1.5) (Burt, 1960).

Liomys pictus hispidus (J. A. Allen)

1897. *Beteromys hispidus* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 9:56.

Type locality. From Rancho El Colomo, Compostela, Nayarit.

Range. This race has an extremely large range, with a distribution from Jalisco through Nayarit northward throughout Sinaloa to eastern and central Sonora south of Nogales, and inland into the canyon bottoms of western Chihuahua and Durango..

Recorded localities. *NAYARIT*: Acaponeta; Amatlan; Ojo de agua (near Amatlan); Pedro Pablo; Rancho Palo Amarillo (Near Amatlan); Tepic (Goldman, 1911). 3.5 mi E San Blas (Hooper, 1955). 4 mi NE San Blas (Hooper, 1957). Acaponeta; Amatlan; 7 mi ESE Amatlan de Cañas, 4750 ft; 7 3/10 mi ESE Amatlan de Cafias, 5000 ft; 7 1/2 mi ESE Amatlan de Cañas, 5,000 ft; Compostela, Rancho El Colomo; 2 m i S Compostela, 2900 ft; Huajicori, Rio de Bajar; 3 mi SE Huajicori; 5 mi SE Huajicori; 1 mi E Ixtlan del Rio 3700 ft; 1/2 mi W Jalisco-Nayarit border on Mexican Hwy 15; La Cuchara, approximately 40 mi E Acaponeta; Ojo de Agua, near Amatlan; Pedro Pablo; Platanares, 10 mi E Ruiz; Playa Novilleros; 3 km S Playa Novilleros; Rancho Palo Amarillo, near Amatlan; 2 mi SW Rosamorada; 17 mi E San Blas; 29 km E San Blas, 50 m; 1 mi SW San Jose del Conde, 3000 ft; 1 l/2 km N San Miguel; 4 mi N Santa Isabel, 3800 ft; 2 mi N Santa Isabel, 3800 ft; 2 mi WNW Tepic, 3200 ft; Tepic; 20 mi SE Tepic, 3500 ft; 17 km SE Tuxpan, 480 ft (Genoways, 1973). Highway Tepic-San Blas (Bassols, 1981). *SINALOA*: Culiacan; Sierra de Choix (50 mi NE Choix); Sinaloa; Escuinapa; Mazatlan; Plomosa; Rosario (Goldman, 1911). Copala (Reeder, 1953). Chele (Hooper, 1955). 4 mi NW Agua Nueva, 50 ft; 20 km N, 5 km E Badiraguato, 1800 ft; 1 l/2 mi N Badiraguato, 750 ft; 1 mi SE Camino Real, 400 ft; Chele, 15 mi N Rosario, 300 ft; 18 km NNE Choix; 16 km NNE Choix, 1700 ft; 1 mi N Comanito; 1/2 mi S Concepcion, 250 ft; 1 1/2 mi E Concordia, 250 ft; 3 mi NE Copala, 2500 ft; 1 mi N Copala, 3200 ft; Copala, 1600 ft; 5 mi SW Copala, 750 ft; Cosala, 1300 ft; 6 mi E Cosala, 1500 ft; 2 mi E Costa Rica, 100 ft; 16 mi NW Culiacan; 12 mi N Culiacan, 400 ft; Culiacan; 32 mi SSE Culiacan; 1 mi S El Cajon, 1800; El Dorado; 2 km S El Dorado, 20 ft; 6 km NE El Fuerte, 150 m; 3 mi NE El Fuerte, 200 ft; 6 km E El Fuerte, 400 ft; Elota; 2 mi NW Escuinapa, 500 ft; Escuinapa; 15 mi SE Escuinapa; 27 mi SE Guamuchil on Mexican highway; 24 km S Guasave, 20 ft; Hacienda San Jose, 21 mi NE Rosario, 350 ft; Isla Palmito de la Virgen, 15 ft; Isla Palmito del Verde (middle);

Isla Palmito del Verde (S end); km marker 1206 on Mexican Hwy 15; 6 mi W La Concha, 10 ft; La Cruz, 30 ft; Laguna, 17 km SW Choix, 500 ft; 7 3/10 km SW Matatan, 500 ft; 7 1/2 km SW Matatan, 500 ft; 20 mi N Mazatlan; 9 mi N Mazatlan; 10 km N Mazatlan; 5 mi NW Mazatlan; 4 mi N Mazatlan; 3 mi NNW Mazatlan, 25 ft; 1 mi N Mazatlan, 25 ft; Mazatlan; 5 mi WSW Mazatlan; Panuco, 22 km NE Concordia; 23 km W Pericos, 200 ft; 1 mi S Pericos; Piaxtla, 100 ft; Plomosas; 2 mi SW Plomosas, 3050 ft; 12 mi NE Presa Sanalona, 600 ft; 11 mi ENE Presa Sanalona, 500 ft; Puerta de Canoa, 11 mi N, 21/2 mi E Mazatlan; W side Rio Chametla, 1 mi NE Rosario; Rosario; 4 mi SW Rosario; 5 mi SSE Rosario, 100 ft; San Juan, 8 mi SE San Ignacio; San Ignacio, 700 ft; 5 km SW San Ignacio, 200 m; 1 km NE Santa Lucila, 3700 ft; Santa Lucila, 3600 ft; 1 mi E Santa Lucila, 4200 ft; 2 mi SW Santa Luda, 3750 ft; 44 km ENE Sinaloa, 600 ft; 8 km N, 22 km E Sinaloa, 400 ft; Sinaloa; 1 mi E Sinaloa, 180 ft; 10 km S, 38 km E Sinaloa, 800 ft; 6 mi NNW Teacapan; Teacapan, Isla Palmito del Verde; 13 km NNE Vaca, 1300 ft; 34 mi NE Villa Union on Mexican Hwy 40; 8 km N Villa Union, 450 ft; 2 mi W Villa Union; 18 mi SE Villa *Union, 300 ft (Genoways, 1973). SONORA*: Alamos; near Alamos; Camoa (Goldman, 1911). Guirocoba; Chinobampo; Tesia; Tecoripa; Ures (Burt, 1938). Alamos, 54 km E Navajoa, 1000 ft; 1 mi NW Alamos, 1500 ft; Alamos; 1 mi E Alamos; 9 mi SE Alamos; Camoa, Rio Mayo; Chinobampo; Guirocoba; 2 mi E Guirocoba; La Estancia, 6 mi N Nacori, 2150 ft; Las Delicias [+1/4 mi E of plaza], Alamos; Matape, 105 km E Hermosillo 2300 ft; 23 mi S, 5 mi E Nogales, 3200 ft; Rio Alamos; Rio Cuchahaqui; E bank Rio Yaqui; 1 mi S El Novillo; Tecoripa; Tesia (Genoways, 1973).

Measurements. Greatest length of skull, 30.5; interorbital constriction, 7.1; mastoid breadth, 13.9; length of nasals, 12:3; length of rostrum, 13.4; length of maxillary toothrow, 5.0.

Remarks. The subspecies name *hispidus* applies to populations along the northwestern coast of Mexico that vary in a clinal fashion from medium-sized individuals in Sonora and northern Sinaloa to relatively small individuals in northern Nayarit. In the vicinity of San Blas, Nayarit, *hispidus* intergrades with *pictus* from coastal areas to the south. Specimens from the vicinity of Tepic, Nayarit, and southeastward through Nayarit to just south of Guadalajara, Jalisco, are intermediate in size between *pictus* to the west and *hispidus* to the north, but possess cranial characters that ally them with *hispidus*.

This race occurs in silty to hard-pan soils of the Sonoran Foothills section of the Sonoran Desert, in north-central Sonora, south in tropical deciduous, or short-tree forest in southern Sonora, Sinaloa, and Nayarit. Burt (1938) trapped it in cultivated fields at Tecoripa and at Ures, and at Tesia they were common along the second bottom of the river. It is more common in mesic habitats, such as riparian communities, than in drier zones (Genoways, 1973). It is the most tropical heteromyid in northwestern Mexico, although its distribution in this area is closely coincidental with the combined ranges of *C. artus*, *C. goldmani*, and *C. pernix*, except for its absence along the coastal lowlands of southern Sonora and northwestern Sinaloa. Painted spiny pocket mice have been taken sympatrically with each of these three species of *Chaetodipus*.

Bassols (1981) recorded *Androlaelaps casalis*, *Steptolaelaps liomydis*, and *Hypoaspis* from Nayarit. Genoways (1973) includes both *sonorana* Merriam (type locality of Alamos, Sonora) and *escuinapae* J. A. Allen (type locality at Esquinapa, Sinaloa) as synonyms.

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FAMILIA MURIDAE

Sergio Ticul Alvarez-Castañeda y Patricia Cortés-Calva

Introducción

La familia Muridae es la mas ampliamente representada en el noroeste de México. Esta diversidad se debe principalmente a la fisiografía tan especial de la península y a la presencia de las islas del Golfo de California. La península de Baja California tiene una longitud superior a los 1500 kilómetros y una anchura promedio de 80 kilómetros, con dirección prácticamente norte sur. Posee una sierra discontinua que la recorre casi en su totalidad paralelamente a la línea de costa, lo que ha provocado que se tenga una gran diversidad de hábitats, desde el desértico con precipitación mínima, hasta zonas con una marcada temporada de lluvias. Respecto a la región continental se tiene que la planicie costera se encuentra bordeada en su extremo este por la Sierra Madre, lo que ha permitido que en la región de Nayarit y Sinaloa se encuentren áreas con selva baja, mientras que para la zona de Sonora que la vegetación sea del tipo xerofila. En la cabecera del Golfo de California se encuentra el desierto mas extremoso del país.

Cuando nos propusimos realizar la revisión bibliográfica de la familia Muridae en el noroeste de México, pensamos que existiría una gran cantidad de información sobre las diferentes especies que habitan en la región. Sin embargo, encontramos que para muchas de las subespecies y algunas especies existentes en la región, la única información con la que se cuenta se remonta a la descripción original de las mismas. De hecho,para una de ellas no se tienen registradas medidas somáticas y craneales, y para otras los datos disponibles son muy escasos. Estos resultados llamaron nuestra atención debido a que la subfamilia Cricetinae es una de las más estudiadas para México, incluso con varias publicaciones acerca de estas especies en la región (Huey, 1964; Carleton, 1973; 1977; 1980; 1981; 1989; Wilson, 1985; 1991; Wolozyn y Wolozyn, 1982).

En Baja California se encontró la menor cantidad de información de las subespecies; existe total desinformación de algunas de las poblaciones, principalmente de las islas, por lo que nos hemos propuesto hacer un estudio más detenido muchas de estas subespecies en los próximos años.

Otra información importante de esta familia es que, en la región, es la que tiene el mayor número de especies y subespecies extintas. La mayoría de las extinciones han ocurrido en islas y están asociadas a la introducción de especies no nativas. Además, debe mencionarse que la lista de especies que se encuentran protegidas por el gobierno de México es muy amplia (Norma Oficial Mexicana, 1994).

Oryzomys

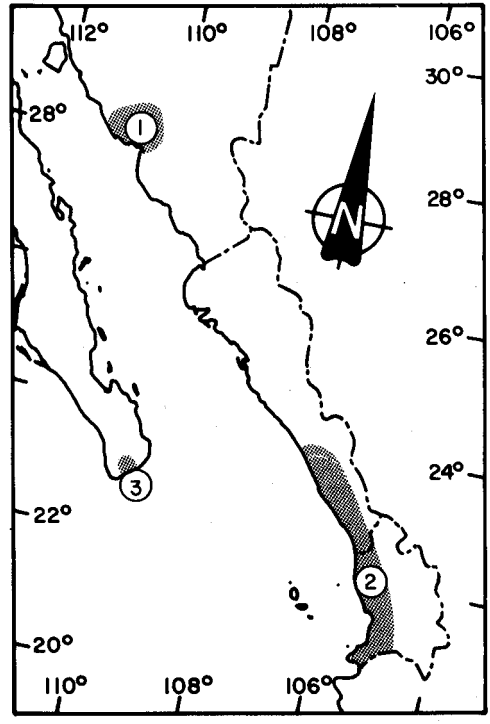
Oryzomys couesi (Alston)

1877. *Hesperomys couesi* Alston, Proc. Zool. Soc. London, for 1876:756.
1918. *Oryzomys couesi*, Goldman, N. Amer. Fauna, 43:29.

localidad típica. Cobán, Guatemala.

Distribución. En la vertiente del Pacífico, desde la parte media de Sonora por la planicie costera, y en la del Golfo desde la parte media de Estados Unidos hasta Panamá (Hall, 1981).

Descripción. Según Goldman (1918) *Oryzomys couesi* es similar a *O. palustris*, pero de pelo más corto; coloración más brillante, en lugar de castaño grisáseo, es decir, de ocrácea amarillenta a ocre pardo. Dorsalmente varía de amarillo claro a amarillo rojizo, hasta ocre amarillento u ocre pardo, e incluso puede ser castaño rojizo; las mejillas, los hombros, los costados, el rostro, la parte superior y posterior de la cabeza se mezclan con pelos negros; ventralmente varia desde blanco hasta amarillo claro u ocre amarillento claro; y se extiende a color salmón claro; las orillas externas de las orejas son negras, en la parte interna contiene pelo corto entrepelado que varia de gris a ocre amarillento o rojo óxido; patas blancas, cola castaño obscura dorsalmente y blancuzca ventralmente.



Localización de *Oryzomys couesi*:
1. *O. c. lambi* 2. *O. c. mexicanus*
3. *O. c. peninsulae*

Comentarios. El báculo tiene tres espinas en su parte distal. Las laterales son más anchas que la central; el cuerpo es delgado y se ensanchá hacia la base, la que es casi tan amplia como la parte distal. Visto dorsoventralmente, la base presenta dos canales en la parte media, uno ventral y el otro dorsal, con una longitud de 3.6 (3.0-4.5) y una anchura de 2.2 (1.7-3.0).

Para el noroeste de México se considera que la especie tiene tres subespecies válidas. Una de la península de Baja California posiblemente extinta (Alvarez-Castañeda, 1994) y dos en la región continental.

Oryzomys couesi lambi Burt

1934. *Oryzomys couesi lambi* Burt, Proc. Biol. Soc. Washington, 47:107.

localidad típica. San José de Guaymas, Sonora.

Distribución. Conocido solamente de la localidad tipo.

Registros. *SONORA*: San José de Guaymas (Burt, 1934a).

Descripción. Los ejemplares tienen de cola corta y de color oscuro. La coloración dorsal es castaño grisácea clara entrepelada, con tonos de amarillentos en las ancas; las mejillas son grisáceas; ventralmente es blanco con pelo grisáceo en la base, incluyendo garganta y barbilla; cola castaño en su porción dorsal y pálida ventralmente. Cráneo con los yugales muy débiles.

Medidas. La media de cuatro ejemplares (Burt, 1934a) son: longitud total, 227; longitud de la cola, 113; longitud de la pata, 29; longitud total del cráneo, 30.4; anchura zigomática, 16.3; anchura interorbital, 4.6; ancho de la caja craneal, 11.6; longitud de los nasales, 11.9; forámen anterior del paladar, 6.2; longitud de la serie de dientes superiores, 4.8.

Comentarios. Según Burt (1934a) *O. c. lambi* se diferencia por su coloración castaño grisácea en lugar de la ocre amarillenta: cola más corta; yugales débiles, forma de los pterigoides. En relación con *O. c. peninsularis* se distingue por su menor tamaño (proporción de cuerpo y cola similar), cola relativamente mas corta, coloración obscura, cráneo menos angular con los yugales robustos (Burt, 1934a).

Oryzomys couesi mexicanus J. A. Allen

1897. *Oryzomys mexicanus* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 9:52.

1918. *Oryzomys couesi mexicanus*, Goldman, N. Amer. Fauna, 43:33.

localidad típica. Hacienda de San Marcos, Tonina, Jalisco.

Distribución. Desde Sinaloa hasta el límite de Oaxaca con Chiapas, por la vertiente del Pacífico.

Registros. *NAYARIT*: 8 mi E San Blas (Gardner y Patton, 1976). Santiago (Hall, 1981). *SINALOA*: Mazatlán; Chele; Rosario (Hall, 1981).

Descripción. Según Allen (1897) esta especie es muy semejante en tamaño y proporción a *Oryzomys palustris*, pero diferente en coloración. La porción dorsal del organismo presenta una tonalidad castaño rojiza, delineada con algunos pelos de tonos oscuros en las puntas; mientras que a los lados la coloración es medianamente obscura, la parte trasera del cuerpo es más clara; ventralmente es blanca con algunos matices grisáceos; las patas están cubiertas con algunos pelos de tonos gris plata; las orejas son castaño obscuras, externamente cubiertas con pelaje corto, mientras que internamente los pelos son amarillentos y largos; la cola esta prácticamente desnuda, ligeramente más obscura en la parte dorsal que en la ventral. El cráneo tiene la porción del acanalamiento supraorbital robusto, más que en el grupo de *O. palustris*; los nasales, son largos y angostos; el borde postpalatino tiene forma de "V" en lugar de ser más o menos cuadrado; el forámen anterior del palatino es ancho. El cráneo es completamente más estrecho que *O. palustris*

Medidas. Las del ejemplar examinado por Allen (1897) son: longitud total, 279; longitud de la cola, 142; longitud de la pata, 30; longitud de la oreja, 13; longitud total del cráneo, 30.5; ancho interorbital, 5; ancho de la caja craneal, 12; longitud de los nasales, 11.5; longitud de la serie de dientes maxilares, 5.

Comentarios. Núñez *et al.* (1981) la colectan en la zona del Tuito, Jalisco, cerca del límite con Nayarit, en la selva baja caducifolia, pastizal y el ecotono entre la selva y el bosque de encino. Además, registra un macho con longitud testicular de 12 mm para el mes de agosto.

Gardner y Patton (1976) mencionan que el cariotipo de la especie es 2n=56 y el FN=56, con un par de pequeños metacéntricos y de acrocéntricos grandes y los restantes 25 de diferentes tamaños. El cromosoma X es acrocéntrico grande y el Y es acrocéntrico diminuto.

Oryzomys couesi peninsulae Thomas

1897. *Oryzomys peninsulae* Thomas, Ann. Mag. Nat. Hist., ser. 6, 20:548.

1993. *Oryzomys couesi peninsulae*, Musser y Carleton, Mammal species of the World. Smiths. Inst. :XXX

localidad típica. Santa Anita, San José, Baja California [Sur].

Distribución. Cuenca del río Santa Anita incluyendo el estero de San José.

Registros. *BAJA CALIFORNIA SUR*: Santa Anita, San José del Cabo (Thomas, 1897).

Descripción. La descripción de la subespecie según Thomas (1897) es: cercana a *O. couesi* y *O. fulgens*. La coloración dorsal es gris pálido, gradualmente cambia a ocre en el área trasera, superficie interna de las extremidades blancas; orejas castaño pálido; las patas traseras y delanteras de color blanco plata; cola ligeramente crespada, superficialmente castaño con la punta terminal obscura, ventralmente blanquecina. Cráneo fuerte y robusto, con surco supraorbital bien definido.

Medidas. Las del organismo tipo (Thomas, 1897) son: longitud de cabeza y cuerpo, 148; longitud de la cola, 150; longitud de la pata, 34; longitud de la oreja, 18; longitud basilar, 27.3; anchura mayor, 18.7; longitud de los nasales, 13 x 3.9; forámen palatino, 7 x 3; longitud de la serie de dientes maxilares, 5.

Comentarios. Alvarez-Castañeda (1994), después de hacer colectas intensivas en el área teórica de distribución de la población, considera que posiblemente *Oryzomys couesi peninsulae* se encuentre extinta, siendo las causas la contaminación del cuerpo de agua del Valle de Santa Anita, la desecación de los cuerpos de agua y la formación del centro turístico de los Cabos.

Oryzomys nelsoni Merriam

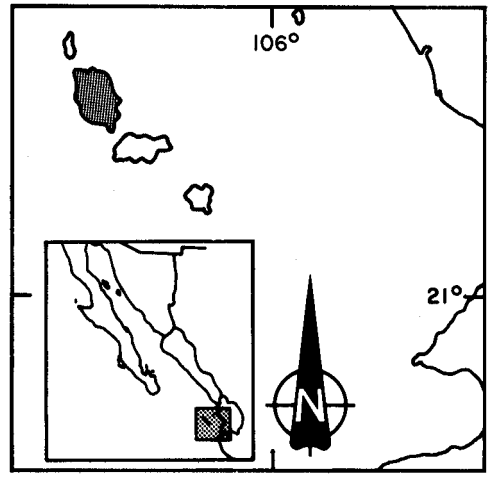
1898. *Oryzomys nelsoni* Merriam, Proc. Biol. Soc. Washington, 12:15.

localidad típica. Isla María Madre, Islas Tres Marías, Nayarit.

Distribución. Restringida a la Isla María Madre en las Islas Tres Marías, Nayarit.

Registros. *NAYARIT*: Isla María Madre, Islas tres Marías (Merriam, 1898).

Descripción. Según Wilson (1991), es una rata grande con la cola mucho más larga que el cuerpo. Dorsalmente amarillo ocráceo, más intenso en las caderas. La cabeza, los hombros y las partes bajas de los costados más pálidas y en la parte superior de la cabeza, cara y espalda, con pelos de coloración más obscura, ventralmente es blanco; orejas cubiertas con pelos finos de color gris; cola castaño pálida dorsalmente y ventralmente amarillenta cerca de la punta de la base. El cráneo es grande, ancho y masivo; rostro robusto y fuertemente curvado.



Localización de *Oryzomys nelsoni*.

Medidas. Las medidas del tipo según (Merriam, 1898) son: longitud total, 342; longitud de la cola, 190; Longitud de la pata, 38. No proporciona las medidas craneales.

Comentarios. Nelson (1899) sólo encontró a esta especie en la localidad de Ojo de Agua a 1,800 ft de altura. Wilson (1991) comenta que intentó colectar sin éxito ejemplares en el mismo sitio en que Nelson y Goldman en 1897 habían colectado los cuatro individuos originales, por lo que considera a la especie como posiblemente extinta.

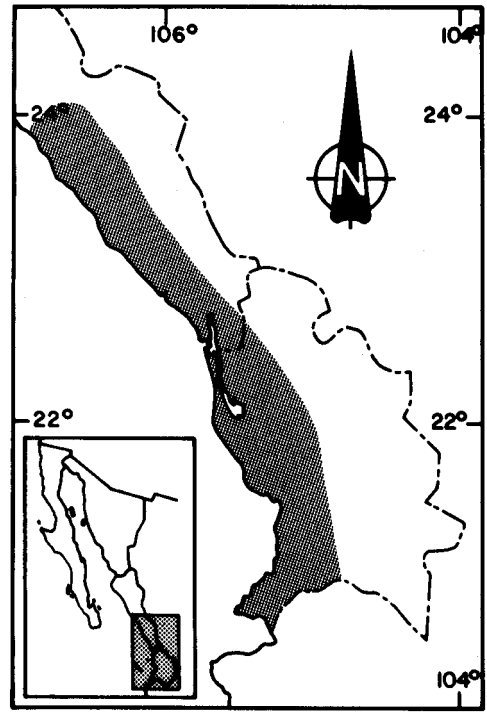
Oryzomys melanotis melanotis Thomas

1893. *Oryzomys melanotis* Thomas, Ann. Mag. Nat. Hist., ser. 6, 11:404.

localidad típica. Mineral San Sebastián, Jalisco.

Distribución. Por ambas vertientes de México hasta el Istmo de Tehuantepec y la península de Yucatán (Hall, 1981). *O. m. melanotis*, de la parte media de Jalisco por la planicie costera hasta el sur de Sinaloa.

Registros. *NAYARIT*: Santiago (Hall, 1981). *SINALOA*: Los Limones (Hall, 1981).



Localización de *Oryzomys melanotis melanotis*.

Descripción. Según Thomas (1893), en la descripción original, la subespecie es de tamaño pequeño, siendo la más esbelta y delgada de las poblaciones por él analizadas; pelo lacio y denso; coloración gris rojizo, brillante y más claro en las ancas; labios, partes internas de los miembros y vientre blancos; el pelo del vientre con la base grisácea con la línea lateral bien definida. Orejas grandes proyectándose por encima del pelo, cubiertas por pelos negros, contrastado con la coloración de la cabeza; cola larga, negra dorsalmente y blanca ventralmente; cráneo considerado de tamaño pequeño; nasales anchos, más largos que la longitud del proceso premaxilar; longitud interorbital ancha; límites anterior y posterior del interparietal se forman dos curvas similares; el foramen anterior del paladar termina al nivel del primer molar superior y de longitud similar a la distancia al tercer molar superior; dientes pequeños y delicados.

Medidas. Las del tipo según Thomas (1893) son: longitud del cuerpo, 97; longitud de la cola, 127; longitud de la pata trasera (sin considerar las uñas), 27; con uñas, 28; longitud de la oreja desde la escotadura, 18; longitud basal, 25.1; anchura zigomática, 15.2; longitud de los nasales, 12.0; anchura interorbital, 5.1; anchura de la caja craneal, 12.8; longitud del interparietal, 3.4; anchura del interparietal, 10.0; longitud del paladar, 15.5; longitud de los molares superiores, 4.3.

Comentarios. Núñez *et al.* (1981) colectan ejemplares de esta subespecie en la zona de transición entre la selva y el encinar y en los bosques de encino. Para el mes de agosto capturaron un macho escrotado y una hembra con seis embriones.

El báculo es muy similar al de *O. fulvescens*, pero con la espina central mucho más delgada, las laterales más gruesas y no con la apariencia de círculo en la porción distal. El cuerpo es largo, y la base, con una tendencia a la forma romboide; longitud 3.5 (3.1-3.9) y anchura 1.5 (1.2-2.0).

Oligoryzomys

Oligoryzomys fulvescens lenis Goldman

1915. *Oryzomys fulvescens lenis* Goldman, Proc. Biol. Soc. Washington, 28:130.

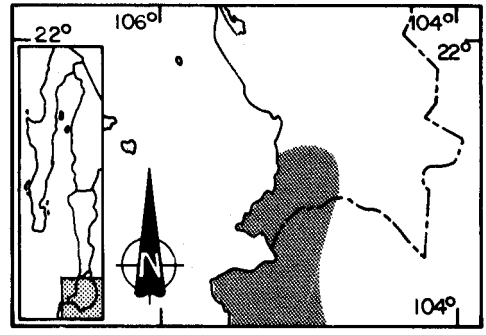
1993. *Oligoryzomys fulvescens lenis*, Musser y Carleton, p.718 in Mammals species of the Wirld (D. Wilson y D. H. Reeder, eds.), Smithsonian Institution Press, Washington, D. C.

localidad típica. Los Reyes, Michoacán.

Distribución. La especie se distribuye por ambas vertientes de México, desde Nayarit y Tamaulipas hasta Centroamérica (Hall, 1981). *Oligoryzomys fulvescens lenis,* desde la parte media de Oaxaca, por la vertiente del Pacífico, hasta el sur de Nayarit.

Registros. *NAYARIT*: Cerca de Santa Isabel (Hall. 1981).

Descripción. El organismo tipo (Goldman, 1915a) tiene: coloración dorsal amarillo ocre; el pecho de color amarillo mate, al igual que los hombros y la parte baja de los costados; la cabeza y la espalda delineada con pelo oscuro; las extremidades internas de tonos más claros, exceptuando la barbilla y la boca, los cuales son blancos; región externa de la oreja de tonalidad obscura, mientras que la región interna, con pelos amarillo ocráceos; patas blancas; cola en la parte superficial ligeramente obscuras, mientras que por debajo es de color carne. El cráneo es ancho como *O. f. fulvescens*; zigomático más desarrollado; piezas maxilares del zigoma y las ramas ascendentes del premaxilar, anchas y robustas; dentición fuerte pero semejante en algunos ejemplares de *O. f. fulvescens*.



Localización de *Oligoryzomys fulvescens lenis*.

Medidas. Del organismo tipo (Goldman, 1915a) son: longitud total, 198; longitud de la cola, 115; longitud de la pata, 23; longitud mayor del cráneo, 22.6; anchura zigomática, 12.3; anchura interorbital, 3.4; longitud de los nasales, 8.6; longitud del forámen anterior del palatino, 3.9; longitud de la serie de dientes maxilares, 3.0.

Comentarios. *Oligoryzomys f. fulvescens* es una forma pálida de *O. fulvescens* distribuida a lo largo de la costa del Pacífico en las elevaciones bajas. Aparte de la coloración pálida, se distingue por el cráneo ancho y abultado (Goldman, 1915a). Núñez *et al.* (1981) los capturan asociados al bosque de encino y a la selva media subperennifolia. También menciona que en Jalisco colectaron un macho escrotado en el mes de agosto.

El báculo es del tipo de los microtinos, con tres puntas en la parte distal, las dos laterales cerradas en su porción distal, dando la apariencia de un círculo entre ambas. El cuerpo es largo y cilíndrico

con la base triangular, la que presenta en la región central una pequeña muesca dorsoventral (Burt, 1960).

El cariotipo para un ejemplar de esta especie de Costa Rica es 2n=58, FN=68, con un par grande y cuatro chicos de metacéntricos y submetacéntricos, tres pares subtelocéntricos grandes y 18 acrocéntricos pequeños; los cromosomas Y y X son acrocéntricos de tamaño medio, el Y es más pequeño (Gardner y Patton, 1976).

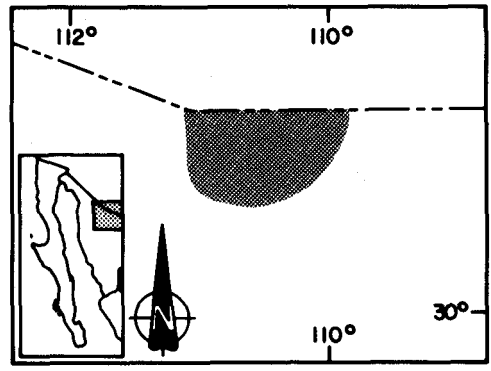
Reithrodontomys

Reithrodontomys montanus montanus Baird

1855. *Reithrodontomys montanus* Baird, Proc. Acad. Nat. Sci. Philadelphia, 7:335.

localidad típica. Parte alta del Valle de San Luis, Condado de Saguache, Colorado (restringido por J. A. Allen, 1895).

Distribución. La especie se distribuye por la parte central de los Estados Unidos, desde Dakota del norte hasta Durango. *Reithrodontomys montanus montanus* tiene distribución muy puntual, restringiéndose a las partes altas de las serranías mexicanas (zona montañosa de Nogales, Sonora).



Localización de *Reithrodontomys montanus*.

Registros. *SONORA*: 14 mi S Nogales, 3500 ft (Hoffmeister, 1959); 18 mi S Agua Prieta, 4000 ft; 14 mi S Nogales, 3500 ft (Hooper, 1952a).

Descripción. Según Hooper (1952a), la subespecie presenta cola demasiado pequeña en comparación al cuerpo, la que no excede las dos pulgadas; orejas pequeñas, membrana engrosada con pelaje largo y grueso; dorsalmente la coloración es pálida (amarillo-grisáceo): la región externa de las orejas y los costados, amarillo castaño con algunas tonalidades rojizas; ventralmente, de tonalidad blanquecina. Cráneo similar al de *R. burti*, caja angosta con fuerte depresión posterior; arco zigomático robusto en la región anterior; diámetro anterior y posterior del zigomático igual; frontales constriñidos fuertemente en la región interorbital, siendo esta anchura menor a la del rostro; rostro corto y ancho; bula auditiva moderadamente inflada.

Medidas. La media y el intervalo de seis organismos del Oeste de Texas y Nuevo Mexico (Hooper, 1952a) son: longitud total, 120 (114-130); longitud de la cola, 55 (48-63); longitud de la pata, 16 (15-17) longitud de la oreja, 14 (13-16); longitud del cráneo, 19.6 (19.1-20.1); anchura zigomática, 10.1 (9.9-10.4); anchura de la caja craneal, 9 (8.6-9.2); anchura interorbital, 2.8 (2.7-3.0); longitud del rostro, 6.6 (6.2-6.9); longitud de la hilera de dientes maxilares, 3.3 (3.2-3.5).

Comentarios. Hooper (1952a) comenta que los especímenes de Sonora pudieran ser también clasificados como *R. m. griseus*, pero considera que cumplen más con las características de *R. m. montanus*. El hábitat donde ocurre presenta principalmente vegetación esparcida con pastos cortos, herbáceas y algunas plantas con crecimiento lento. El sustrato tiene buena drenación y es

frecuentemente arenoso. *R. megalotis* cohabita con *R. montanus*. Sin embargo, se encuentra principalmente en lugares con vegetación densa (Hooper, 1952a).

Reithrodontomys burti Benson

1939. *Reithrodontomys burti* Benson, Proc. Biol. Soc. Washington, 52:147.

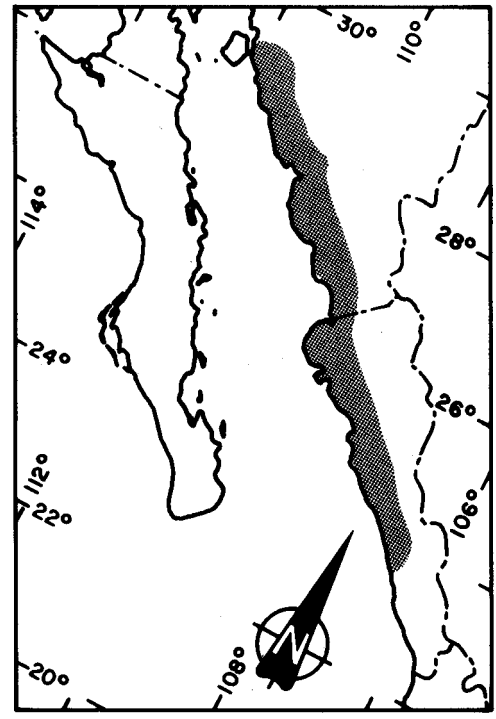
localidad típica. Rancho de Costa Rica, río Sonora, Sonora.

Distribución. En la planicie costera del Pacífico, desde el oeste de Hermosillo hasta la parte media de Sinaloa.

Registros. *SINALOA*: 1 mi S Pericos (Hall, 1981). *SONORA*: 1 mi W Mayterrena (Bradshaw y Hayward, 1960). 11.3 mi W Hermosillo, Rancho de Costa Rica, río Sonora (Benson, 1939). 11 mi W Hermosilla [Hermosillo], 600 ft (Hooper, 1952a).

Descripción. Según Benson (1939), es de tamaño pequeño, con cola corta; patas relativamente pequeñas; orejas grandes. El color del cuerpo es pálido y más claro alrededor de las orejas; pecho amarillento. El cráneo es angular; zigomático cortado en punta; foramen infraorbital grande (7.3 mm); báculo ligeramente derecho.

Medidas. La media y el intervalo de 18 machos (Benson, 1939) son: longitud total, 129 (124-132); longitud de la cola vertebral, 59 (53-66); longitud de la pata, 16.4 (16-17); longitud de la oreja, 15.5 (14-17); longitud mayor del cráneo, 20.3 (19.7-21.2); ancho de la caja craneal, 9.6 (9.3-10.1); longitud del báculo (10 especímenes), 7.3 (6.0-8.3).



Localización de *Reithrodontomys burti*.

Comentarios. En comparación con *R. montanus*, es similar en tamaño, pero difiere en la longitud de las orejas. El cráneo es grande; nasales relativamente grandes; zigomático más angular, siendo ancho en la parte anterior; báculo grande, ligeramente curvo más o menos cilíndrico en la base. Comparado con *R. megalotis*: ligeramente más pequeño; orejas largas; cráneo más angular; arcos zigomáticos más robustos; báculo semejante en tamaño, más o menos recto y una porción ligeramente curvo; en la base es un poco más cilíndrico. Según Benson (1939), de las especies de *Reithrodontomys*, *R. montanus* es la que tiene mayor similaridad con *R. burti*. La relación entre estas dos especies no es cercana, al considera las diferencias que se observan en la morfología del báculo (Benson, 1939). *R. montanus* ocurre en el noreste de Sonora únicamente a 200 mi al noreste de la distribución de *R. burti*.

En el rancho de Costa Rica, *R. burti* fue abundante en el campo en un rastrojo de trigo donde dos años antes no había sido atrapado ninguno a pesar de haber efectuado un trampeo intensivo. Los ejemplares de 11.3 milas oeste de Hermosillo fueron recolectados en terreno plano con pastos seco; árboles de mesquite, palo verde y palo fierro dispersos. Muy probablemente éste sea el hábitat de la especie (Hooper, 1952a).

Burt (1938) hace mención de un ejemplar pequeño que fue tentativamente referido a *R. m. megalotis* y probablemente sea un integrante de *R. burti* (Hooper, 1952a).

Reithrodontomys megalotis megalotis (Baird)

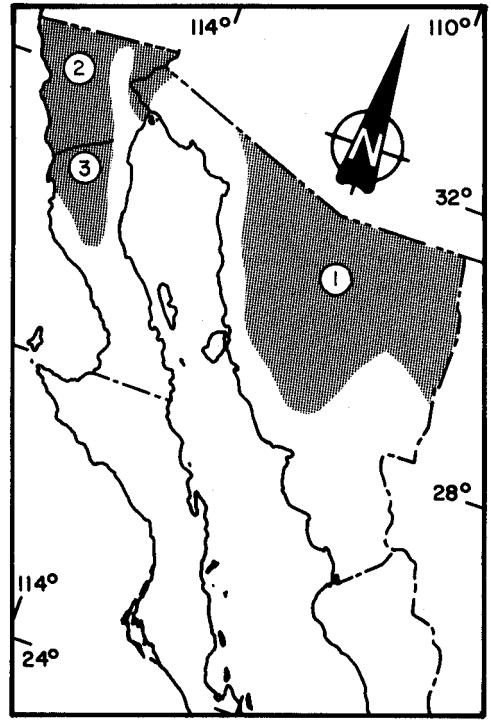
1858. *Reithrodon megalotis* Baird, Mammals, *in* Repts. Expl. Surv., 8:451.

1893. *Reithrodontomys megalotis*, J. A. Allen, Bull. Amer. Mus. Nat. Hist., 5:79.

localidad típica. Entre Janos Chihuahua y San Luis Springs, Condado Grant, Nuevo México.

Distribución. Desde el suroeste de Canadá hasta la región centro sur de la República (Hooper, 1952a; Webster y Jones, 1982). En la región de estudio, desde el delta del río Colorado, parte del desierto del Altar, hasta el altiplano Central.

Registros. *SONORA*: 30 mi S Mojonera 204 (Howell, 1914). El Doctor; San José de Guaymas (Burt, 1938). 5 mi N Cananea, 4750 ft; Ciénega Well, 50 ft; Nogales, 4000 ft; 15 mi NNE Cananea, La Sauceda, 4700 ft; Puerto de los Lobos, cerca del nivel del mar; 20 mi S de la frontera de Estados Unidos y Sonora mesa, 100 ft (Hooper, 1952a).



Localización de *Reithrodontomys megalotis*:
1. *R. m. megalotis* 2. *R. m. longicaudus*
3. *R. m. peninsulae*

Descripción. Según Hooper (1952a), la coloración dorsalmente es canela fuerte, mientras que la parte ventral y las patas son blancas; los costados y la cola, pálidos; el lomo es ligeramente más oscuro que los laterales; el pelo distalmente tiene una coloración rosa-canela, subapicalmente es canela oscuro, mientras que el resto es gris oscuro; garganta blanca; el pectoral es canela rosáceo en su porción distal y oscuro basalmente; cola bicolor siendo más obscura en el dorso que el vientre. La caja craneal es ovalada con línea externa, tan ancha como larga; frontales fuertemente constriñidos interorbitalmente, con un ligero acanalamiento supraorbital en los ejemplares viejos; rostro ligeramente largo y estrecho; arcos zigomáticos robustos; zigomáticos con muesca grande, anteroposterior y transversal de dimensiones iguales; fosa mesopterigoidea estrecha; foramen de

los incisivos estrecho y largo; molares simples, hueco esfenopalatino grande (como la hilera de los molares) y oblongo.

Medidas. El intervalo de medidas mencionado por Hooper (1952a) es: longitud del cuerpo, 58-75; longitud de la pata, 16-18 ; longitud de la oreja, 14. La longitud del cráneo es 19.6- 21.2.

Comentarios. Las especies de *R. m. saturatus*, *R. m. alticolus*, *R. m. amoles* y *R. m. zacatecae*, presentan pelajes oscuros y rojizos; se caracterizan por habitar tierras altas. En *megalotis*, se ha observado que generalmente habitan localidades áridas en planicies centrales y en el noroeste de los desiertos de México; su pelaje es pálido o amarillento.

Morfológica y ecológicamente *R. megalotis* ocupa una posición intermedia entre *montanus*, *chrysopsis* y *sumichrasti*. Las afinidades cercanas de *R. megalotis* parecen estar más relacionadas con *montanus*; comparativamente ambas no son especializadas, siendo más generalizada *montanus*, cuyos representantes son más pequeños, de cola corta y orejas pequeñas. El cráneo presenta arco zigomático y fosa pterigoidea anchos; el ángulo de la rama mandibular es fuertemente deflectado. Estas estructuras reflejan lo grande de los músculos pterigoideos y quizá el complejo masetérico (Rinker y Hooper, 1950). Los molares son comparativamente simples sin accesorios esmaltados en la corona y en las cúspides. Ambas especies habitan los sitios de pastos abiertos y en climas templados; *montanus* ocurre en ambientes secos y mucho más abiertos con buena drenación, y *megalotis* vive principalmente en ambientes húmedos, donde las coberturas vegetales son densas con especies arbustivas. Hooper (1952a) hace mención de características morfológicas del cráneo, dientes y algo de líneas de evolución.

Burt (1938) comenta que el ejemplar de San José de Guaymas tiene una coloración diferente a la típica de *R. m. megalotis* y que si el número de ejemplares fuera más amplio ésta podría ser otra subespecie. Según lo mencionado por Hooper (1952a), los integrantes de esta subespecie son diferenciables de las demás subespecies que se distribuyen a lo largo de la Sierra Madre Oriental y Occidental. De igual manera se hace mención de que no queda claro el parentesco entre *R. megalotis* y *R. zacatecae* de las inmediaciones altas de la Sierra Madre Occidental. *R. megalotis* se asocia principalmente con áreas de pastos y matorral cerca de zonas con agua, aunque en los desiertos se les ha encontrado alejados de ésta. Hooper (1952a) comenta que ejemplares de la subespecie fueron colectados en dunas; al parecer esta especie se beneficia con los sistemas de irrigación que se tiene en el delta del río Colorado. *R. m. megalotis* vive dentro de una amplia variedad de ambientes (desiertos, salinas a lo largo de las playas y en bosque de montaña de pino y encino; usualmente ésta ausente en bosques densos, pero comúnmente se le encuentra en claros de bosque donde existen pastos y arbustos). En la región árida de México, se encuentra asociado a lugares con algún suministro de agua, pastizales esparcidos como mesquites, yuca, uña de gato, así como en áreas cultivadas. Su ocurrencia ha aumentado gracias a las prácticas agrícolas y se ha observado con ocho especies más. Esta es la única especie con amplia distribución en Estados Unidos y la única que habita la península de Baja California.

La especie tiene 16 razas geográficas, de las cuales cinco están representadas en México. Esta especie presenta tres subespecies para la región noroeste de México, dos de ellas se restringen a la zona montañosa del norte de la península de Baja California.

Reithrodontomys megalotis longicaudus (Baird)

1857. *Reithrodon longicauda* Baird, Mammals *in* Repts. Expl. Surv....., 8(1):451.

1913. *Reithrodontomys megalotis longicauda* Grinnell, Proc. California Acad. Sci., ser 4, 3:300.

localidad típica. Petaluma, Condado de Petaluma, California.

Distribución. De la vertiente oeste de la Sierra de Juárez al norte, hasta Oregón.

Registros. *BAJA CALIFORNIA.* Las Encinas; Trinidad, Montes San Pedro Mártir (Elliot, 1903b). Rancho Viejo, 15 mi E Alamos (Hall, 1981).

Descripción. Según Howell (1914) es similar a *megalotis*, de colores oscuros y mas intensos. La coloración de invierno es con el dorso negro entrepelado con ocráceo amarillento. En el lomo, domina el negro y se desvanece a ocráceo amarillento en los costados; línea lateral amarilla y bien definida; orejas del mismo color que el dorso; entrepelado con pelos ocráceos; patas grises blancuzcas; cola bicolor, castaño obscura dorsalmente y gris blancuzca ventralmente; vientre blanquecino grisáseo, usulamente con tonos de ocre amarillento. El cráneo es similar al de *megalotis*, pero más pequeño.

Medidas. La media y el intervalo de 13 ejemplares (Howell, 1914) son: longitud total, 139 (130-146); longitud de la cola, 73 (68-79); longitud de la pata, 17 (16-18). La media de las medidas craneales de 12 ejemplares son: longitud del cráneo, 20.2; anchura de la caja craneal, 9.8; longitud de los nasales, 7.7; anchura del foramen anterorbital, 2.

Comentarios. Hooper (1952a) menciona una sinonimia entre *pallidus* y *klamathensis*.

Reithrodontomys megalotis peninsulae (Elliot)

1903. *Reithrodontomys peninsulae* Elliot, Field Columb. Mus., Publ. 74, Zool. Ser., 3:164.

1914. *Reithrodontomys megalotis peninsulae,* A. H. Howell, N. Amer. Fauna, 36:35.

localidad típica. San Quintín, Baja California.

Distribución. Conocido de la Sierra de San Pedro Mártir y el área del Rosario en Baja California Sur.

Registros. *BAJA CALIFORNIA*: Socorro; Pozo Luciano, ladera NW Sierra de San Pedro Mártir; Rosario; San Telmo (Hall, 1981); San Quintín, Baja California (Elliot, 1903b)

Descripción. Elliot (1903b), en la descripción original, menciona que la coloración es obscura con tonalidades castaño rojizas y tonos negros entremezclados; la cabeza y el cuerpo tienen tonos más claros en la parte lateral en combinación con tonos grisáceos; la coloración va de gris claro a blanco, efecto debido a la coloración agrisada de la piel; a los lados del pecho la coloración es ocrácea; cola dorsalmente castaño oscuro y blanca en la parte ventral; patas blancas y orejas castaño oscuro. De manera general, es de tamaño grande; la longitud de la cola es menor que la mitad de la longitud total; el pelaje es más rojizo que en *R. m. longicaudus*; cráneo y nasales grandes.

Medidas. Elliot (1903b) en la descripción original proporcionólas siguientes medidas: longitud total, 170; longitud de la cola, 89; longitud de la pata, 17.5; longitud de la oreja, 16; longitud occipitonasal, 27; anchura zigomática, 10; constricción interorbital, 3; longitud de los nasales, 13.5.

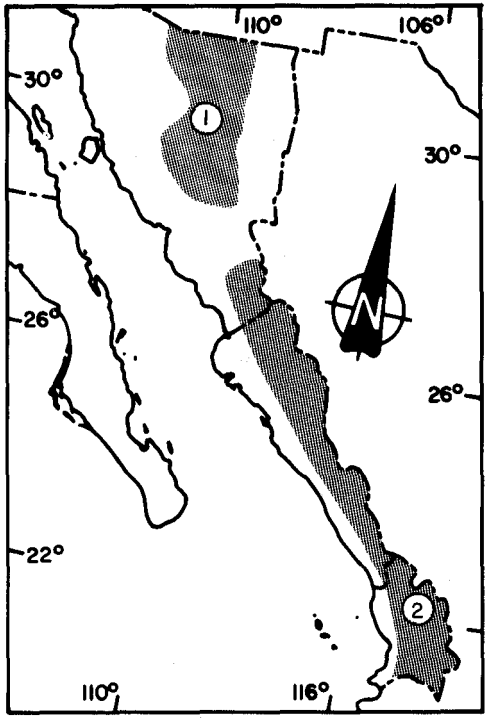
Comentarios. Difiere de las demás subespecies básicamente por la longitud de la cola en relación con el resto del cuerpo; se diferencia perfectamente de *R. l. longicaudus*. Elliot (1903b) señala que Heller encontró a esta especie en San Quintín, haciendo mención de lo común que era encontrarla en praderas húmedas, pero desaparecía tierra adentro.

Reithrodontomys fulvescens fulvescens J. A. Allen

1894. *Reithrodontomys mexicanus fulvescens* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 6:319.
1895. *Reithrodontomys fulvescens fulvescens*, J. A. Allen, Bull. Amer. Mus. Nat. Hist., 7:138.

localidad típica. Oposura, 2 000 ft, Sonora.

Distribución. La especie ocurre desde Arizona y el sur de Missouri hasta el sur de Nicaragua (Spencer y Cameron, 1982). En el área de estudio, en la parte centro norte de Sonora.



Localización de *Reithrodontomys fulvescens*:
1. *R. f. fulvescens* 2. *R. f. tenuis*

Registros *SONORA*: Oposura (J. A. Allen, 1894). Oposura; Providencia (Howell, 1914). San Javier; Tecoripa; Chinobampo; Tésia (Burt, 1938). 10 mi N Matape, Rancho Banochari, 2700 ft; 6 mi N Nacori, La Estancia, 2150 ft; 2 mi SW Magdalena, La Misión, 2 900 ft; Nogales 3900 ft; Oposura, 2000 ft; Minas Providencia 3000-3500 ft (Hooper, 1952a).

Descripción. Según la descripción original de Allen (1894), la coloración dorsal corresponde a un castaño amarillo, entremezclado con tonalidades obscuras; línea lateral amarillo rojizo; blanco ventralmente, el pelaje en sus dos terceras partes gris; orejas obscuras, cola indistintamente bicolor; dorsalmente es castaño claro, siendo más claro en la región ventral; patas de coloración blanco tierroso; primer tubérculo cubierto con pelaje fino. Puede ser diferenciado de *R. f. tenuis*, por el tamaño grande de los molariformes y por su coloración obscura y rojiza; de *R. f. canus* es más difícil diferenciarlo: en comparación con *R. f. tenuis* dorsalmente son menos amarillentas y los hombros, cabeza de color más parecido a la espalda y costados, menos grises que en *R. f. canus*.

Medidas. Del organismo tipo (Allen, 1894). longitud total, 183; longitud de la cola, 102; longitud de la pata, 19; longitud de la oreja, 14.

Comentarios. Uno de los caracteres distintivos de la especie es el tercer molar. Las 15 subespecies de *R. fulvescens* son moderadamente pequeñas tanto en cuerpo como en cráneo. La coloración del pelaje varía geográficamente. En áreas húmedas el dorso es una mezcla de negros y castaño-rojizo, las pinas son obscuras interna y externamente, y en su interior son amarillentas. En ambientes áridos la coloración dorsal es amarilla pálida, las orejas pálidas y revestidas con pelos amarillentos, mientras que las partes internas son desde amarillas hasta blanquecinas; la línea lateral puede o no estar presente; la superficie de las patas puede ser amarilla o blanquecina, pero no oscuras. Los subadultos presentan tonalidades más claras y pálidas que los adultos. El cráneo

de *R. fulvescens* tiene apariencia característica, el rostro es robusto; la ramificación premaxilar es amplia dorsalmente, contribuyendo a una gran superficie de hueso en la cara dorsal del rostro, como se ha visto en otras especies del subgénero; la caja craneal es elongada; los frontales, inflados, y éstos se unen con el premaxilar, el maxilar y los huesos lacrimales. La placa zigomática es amplia como la fosa mesopterigoidea; el zigomático no es tan superficial como en *R. sumichrasti*; el foramen de los incisivos es alargado tanto como lo amplio del rostro; el hueco esfenopalatino es oblongo (Hooper, 1952a).

Burt (1938) menciona la asociación de esta subespecie con zonas de pastizal, en San Javier a lo largo de un río con piedras, pastos y arbustos bajos; en Tésia en un pastizal, y en Chinobampo en la zona de pastos que rodean a las áreas de cultivo. Tiene un gran intervalo geográfico, encontrándole en diversos tipos de climas; para la región noroeste, se observa en áreas de matorral, pastizales (Matson y Baker, 1986). El mezquite (*Prosopis*) es el indicador principal de la presencia de *fulvescens*. Baker y Greer (1962) recolectan la subespecie en Durango asociada a la flora riparia a lo largo de los ríos que recorren el desierto, en pastizal mixto y matorral desértico, además moncionan que es muy probable que el pastoreo haya reducido el hábitat y, por ende, la población de la especie. Especie presente con dos subespecies, ambas de la región continental.

Reithrodontomys fulvescens tenuis J. A. Allen

1899. *Reithrodontomys tenuis* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 12:15.

1914. *Reithrodontomys fulvescens tenuis*, A. H. Howell. N. Amer. Fauna, 36:45.

localidad típica. Rosario, 200 ft, Sinaloa.

Distribución. A lo largo de la costa del Pacífico, a partir del valle sur de Sonora (Alamos), cubriendo Sinaloa y la región norte de Nayarit (Tepic), incluyendo la Sierra Madre (Hooper, 1952a).

Registros. *NAYARIT*: Tepic, 3000 ft (Hooper, 1952a). *SINALOA*: Rosario (Allen, 1899). Chele (Merriam, 1892). 4 mi NW agua Nueva, 50 ft Altata cerca del nivel del mar; 6 mi E Mazatlán, Castillo, 300 ft; Culiacán; Escuinapa, 130 ft; 21 mi NE Rosario, Hacienda San José; Sinaloa, 200 ft (Hooper, 1952a). *SONORA*: Alamos (Howell, 1914). Guirocoba (Burt, 1938). Guirocoba, 1500 ft cerca de los Alamos entre 1500-4500 ft (Hooper, 1952a).

Descripción. Según Allen (1899) es similar a *R. f. fulvescens*, pero mucho más pequeña, menos gris y con mucho menos pelo en la cola. Dorso castaño amarillento, tonos ligeramente oscuros; lateralmente amarillo claro, lo que forma una línea lateral ancha que se visualiza notoriamente por debajo de las mejillas y por los ojos. Ventralmente blanco grisáceo (en uno de los organismos la tonalidad fue amarillenta); la base del pelo de color plúmbeo; las orejas rojizo oscuro con pelo fino; cola castaño agrisado dorsalmente más oscuro que en los laterales y en la parte de abajo; patas blanco tierroso.

Medidas. Las medidas del organismo tipo, Allen (1899) son: longitud total, 152; longitud de la cola, 81; longitud de la pata, 20; longitud de la oreja, 15.

Comentarios. Burt (1938) comenta que los ejemplares de Guirocoba fueron colectados en un área con pastizal. Hooper (1955) hace mención de que seis ejemplares de la localidad de Chele cayeron en trampas debajo de arbustos y de vid que bordean bosque ripario de higo y otros árboles tropicales. Está muy relacionada con *R. f. fulvescens* de Oposura Sinaloa, mas sin embargo, es mucho más pequeña, siendo intermedia en tamaño con *R. m. longicaudus*. Se capturaron hembras lactantes en el mes de agosto (Hooper, 1955).

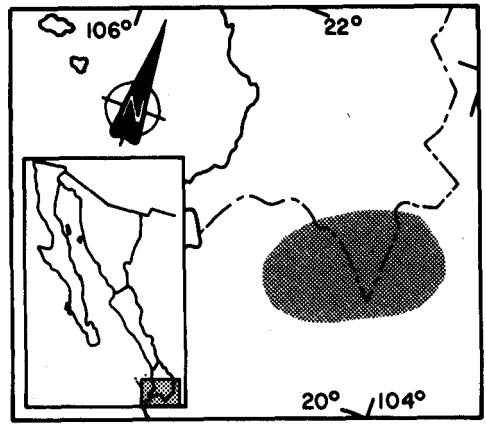
Reithrodontomys hirsutus Merriam

1901. *Reithrodontomys hirsutus* Merriam, Proc. Washington Acad. Sci., 3:553.

localidad típica. Ameca, 4,000 ft, Jalisco.

Distribución. En las montañas de elevación media del oeste de Jalisco y sur de Nayarit, entre los 1,000 y 1,400 m.

Registros. *NAYARIT*: 2-4 mi Santa Isabel, 3800 ft; 1 mi SW San José del Conde, 3000 ft (Hooper, 1952a; Hall, 1981). 1 mi E Ixtlán del río, 4000 ft (Hooper, 1952a).



Localización de *Reithrodontomys hirsutus*.

Descripción. Según Hooper (1952a), son de color canela con negro entrepelado, dorsal y lateralmente, pero no en la línea lateral; ventralmente y en las partes internas de las patas y la garganta, van de canela rosáceo claro a canela amarillento; orejas con pelos negros en la parte externa y canela con negro en la interna; cola castaño dorsalmente, no totalmente pálida ventralmente; patas traseras de blancas a amarilla rosácea; cadera de castaño a negro; caja craneal grande; rostro ancho y moderadamente largo; arco zigomático ancho; anchura interorbital angosta; placa zigomática angosta; bulas auditivas y dientes maxilares más pequeños que *R. fulvescens*.

Medidas. El promedio y el intervalo de 12 ejemplares de Santa Isabel, Nayarit (Hooper, 1952a) son: longitud total, 189 (175-202); longitud de la cola, 108 (100-115); longitud de la pata, 21 (20-22); longitud de la oreja 17 (16-17); longitud total del cráneo, 23.8 (22.9-24.6); anchura zigomática, 12.4 (12.0-12.8); anchura de la caja craneal, 11.1 (10.4-11.5); anchura interorbital, 3.6 (3.1-3.8); longitud del rostro, 8.3 (7.7-8.7); longitud de la hilera de dientes maxilares, 3.7 (3.5-3.8).

Comentarios. Especie monotípica: se conoce su distribución en la parte oeste-central de México, en los estados de Jalisco y Nayarit. Se han encontrado relacionados zonas de laderas pedregosas, con arbustos y vegetación decidua, siendo colectados en áreas abiertas con zonas de lava, bosque deciduo entre 1.2 a 2.4 m de altura, con pendiente de entre 30 y 40 grados, en cañones con vegetación siempre verde en la base y agua permanente (Hooper, 1952).

Baiomys

Baiomys musculus musculus (Merriam)

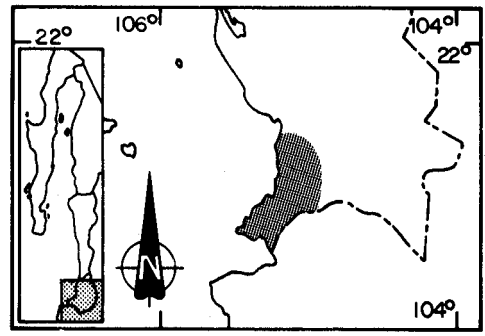
1892. *Sitomys musculus* Merriam, Proc. Biol. Soc. Washington, 7:170.

1907. *Baiomys musculus*, Mearns, Bull. U. S. Nat. Mus., 56:381

localidad típica. Colima, Colima

Distribución. La distribución de la especie abarca desde el sur de Nayarit, por la vertiente del Pacífico, hasta Nicaragua, incluyendo el Eje Volcánico Transversal (Packard y Mongomery,

1978). *Baiomys musculus musculus*, desde la parte sur de Nayarit ,a lo largo de la costa del Pacífico, hasta Michoacán.



Localización de *Baiomys musculus musculus*.

Registros. *NAYARIT*: 3 mi NNW Las Varas, 150 ft (Packard, 1960).

Descripción. Dorso castaño olivo con matices oscuros; pelo de tono gris en la base, mientras que las puntas son negras; la cara y la cabeza más pálidos que el resto del cuerpo; los pelos de la garganta y la barbilla blancos; interior de las extremidades, de amarillo rosáceo pálido a blanco amarillento; patas blanquecinas a grises. Cranealmente se caracteriza por su longitud nasobasilar de más de 19 mm; anchura zigomática mayor de 10; rostro curvo a la altura de la sutura frontoparietal; cingulum y segunda cúspide de los dientes pronunciadas (Packard, 1960; Packard y Montgomery, 1978).

Medidas. El promedio y el intervalo de ocho ejemplares (Packard, 1960) son: longitud total, 125.5 (115-135); longitud de la cola, 47.5 (42-54); longitud del cuerpo, 75.6 (68-81); longitud de la pata, 16.5 (16-17); longitud occipitonasal, 20.3 (19.8-20.7); anchura zigomática, 10.7 (10.3-11.1); longitud postpalatal, 7.4 (7.1-7.7); anchura interorbital, 4.0 (3.9-4.1); longitud del forámen de los incisivos, 4.3 (4.1-4.5); longitud del rostro, 7.3 (6.9-7.6); anchura de la caja craneal, 9.8 (9.4-10); altura de la caja craneal, 7.1 (6.7-7.2); longitud alveolar de la hilera de dientes maxilares, 3.4 (3.3-3.6).

Comentarios. Merriam (1892) describió a *Sitomys* [=*Baiomys*] *musculus* con base en 23 especímenes de distintas localidades; de acuerdo con la descripción original, *B. musculus* se asemeja al ratón doméstico.

Con respecto a *B. taylori*, *B. musculus* difiere en tamaño del cuerpo, además de tener la cola, las patas y orejas más largas. Osgood (1909) asigna a los organismos de Colima, Guerrero, Jalisco, Michoacán, Morelos, Oaxaca, Puebla, Sinaloa, Veracruz y Zacatecas como subespecie de *B. musculus*; posteriormente Russell (1952) describió la subespecie *B. m. infernatis*, y Goodwin (1959), a *B. m. nebulosus*. Las distintas revisiones de algunos autores han dejado claro el intervalo de distribución de las subespecies de *B. musculus* (Hooper, 1952b; Luken, 1955; Hall y Kelson, 1959; Packard, 1960).

El tamaño de los organismos, así como el del cráneo, es mucho menor en las subespecies cuya distribución es sureña es decir, *B. m. pullus*, *B. m. grisescens*, *B. m. nigrescens* (excepto *B. m. handleyi*), más que en las subespecies con distribución norteña como *B. m. musculus*, *B. m. brunneus* y *B. m. infernatis*. El incremento en el tamaño de sur a norte tiene congruencia con la regla de Bergman; los individuos pequeños ocurren en lugares cálidos. En sitios ubicados al sur con altitudes mayores son grandes, en comparación con los de lugares con elevación menor, excepto cuando las dos especies son simpátricas.

Osgood (1909) sugiere que el grado de humedad relativa pueden en algunas ocasiones, controlar la tonalidad del pelaje tanto en *B. taylori* como en *B. musculus*. En *B. musculus*, las subespecies obscuras (*B. m. brunneus*, *B. m. nigrescens* y *B. m. pullus*) ocurren en zonas que presentan constante humedad relativa, mientras que las subespecies de tonalidades pálidas, *B. m. infernatis*,

B. m. musculus, *B. m. hendleyi* y algunos de *B. m. grisescens* y *B. m. pallidus*, en zonas con baja humedad relativa.

Con respecto a la conducta de estos organismos se ha escrito que, en los distintos hábitats, empiezan su actividad en las primeras horas de la noche. Packard (1960) menciona que posiblemente estos organismos sean diurnos a crepusculares. Se han observado restos de estos roedores en egagropilas de buho (*Tyto alba*) y presumiblemente son consumidos por algunos carnívoros (mamíferos y aves rapaces). Debido a sus hábitos, se minimiza la presión de los depredadores nocturnos. En lo que se refiere a su alimentación, consumen nueces, cortezas, semillas y hojas. Hall y Dalquest (1963) utilizaron en Veracruz trozos de plátano como atrayente en sus trampeo. Para la reproducción se ha inferido, por evidencia de embriones y de hembras lactantes, que se realiza durante todo el año. Packard (1960) registra preñación y lactancia en las hembras a lo largo de todos los meses, a reserva de enero, abril, mayo y junio, las cuales obtienen en promedio de 2.92 crías por camada en 20 conteos, con un intervalo de 2-4 embriones.

Núñez *et al.* (1981) comenta haber colectado ejemplares en zona de pastoreo densamente poblada de leguminosas arbustivas espinosas. Ellos comentan que para el mes de noviembre se encontraron dos hembras en estado de lactancia. López-Forment *et al.* (1971) comentan haber colectado la subespecie en cultivos de maíz y "bules".

El cariotipo es 2n = 48 y el FN = 65-66. El cromosoma Y es subtelocéntrico de tamaño medio y el X es grande con dos brazos (Lee y Elder, 1977).

Baiomys taylori (Thomas)

1887. *Hesperomys* (*Vesperimus*) *taylori* Thomas, Ann. Mag. Nat. Hist., ser. 5, 19:66.

1907. *Baiomys taylori*, Mearns, Bull. U. S. Nat. Mus., 56:381.

localidad típica. San Diego, Condado de Duval, Texas.

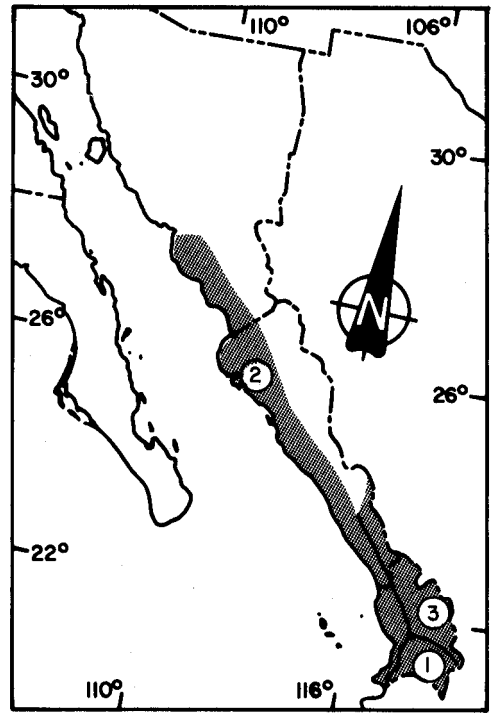
Distribución. La especie se distribuye aproximadamente desde el paralelo 19° en México hacia el norte por tres ramas: la que está ubicada más al occidente, por la vertiente del Pacífico hasta el sur de Sonora; la central, por la Sierra Madre de Occidente hasta el sur de Arizona y Nuevo México, y la oriental, hasta el este de Texas (Eshelman y Cameron, 1987).

Descripción. Según Osgood (1909), la coloración dorsal es pálida, mezclada con tonalidades obscuras, mientras que los lados son de coloración castaño verdoso; esta misma coloración se presenta en la cabeza y en la cara; no tiene anillo orbital, con un manchón en la barbilla; línea lateral, no aparente; ventralmente, gris humo entremezclado con crema rojizo; las patas, gris humo, mientras que los tarsales son ligeramente oscuros; las oreja cubiertas con pelos grisáceos, produciéndose el mismo efecto que el resto del cuerpo; cola, con ligera distinción bicolor, siendo completamente obscura en la parte superior, mientras que ventralmente es gris. Referente al cráneo, éste es muy pequeño, mucho más que *B. musculus*; la línea dorsal externa ,uniformemente arqueada; nasales cortos y anchos, sobresalen ligeramente por las ramas ascendentes de los premaxilares; espacio interorbital amplio y proporcionalmente de forma angulada; palatino largo y paralelos a los lados; bulas auditivas moderadas.

Comentarios. Para el noroeste de México son reconocidas tres subespecies, las cuales están consideradas como las de tonalidades más pálidas de la especie. El color del pelaje está relacionado con el color del sustrato donde viven (Blair y Blossom, 1948). *B. taylori* difiere de *B. musculus* en: longitud de la pata; longitud occipitonasal; anchura zigomática; rostro deflectado ventralmente cerca de la sutura frontoparietal, la que está gradualmente curvada al punto más

anterior de los nasales; cíngulum acanalado y las cúspides secundarias de los dientes reducidas o ausentes; báculo estrecho en la base y en la punta en forma de perilla, con proyecciones laterales y con longitud promedio de 3.0 mm.

Hooper (1955) capturó especímenes en Sinaloa entre pastos, hierbas y vid en un terreno abandonado. Al Tomar en consideración la amplia distribución de esta especie, se sabe que puede habitar ambientes xéricos (Packard, 1960). Stickel y Stickel (1949) mencionan que el ámbito hogareño de *B. taylori* en hábitat herbáceo fue de menos de 100 pies cuadrados, pero Blair (1953) menciona que esto no ha sido bien registrado por Stickel y Stickel (1949). Respecto a los hábitos, estos roedores son crepusculares a nocturnos (Packard, 1960); de igual manera se registró este comportamiento en Michoácan (Hall y Villa-R., 1949). Es usualmente la primera especie que se captura en las trampas, la que es muy abundante en las áreas de cultivo, en especial en las de azúcar. Las madrigueras son hechas con hierbas y palitos entre rocas o cactus (Packard, 1960). Sus hábitos alimenticios se basan en semillas de cactus y hojas, así como en algunas raíces (Packard, 1960).



Localización de *Baiomys taylori*:
1. *B. t. allex* 2. *B. t. canutus*
3. *B. t. paulus*

Respecto a la reproducción, ésta se lleva al cabo a lo largo del año; los meses en los que no se ha observado preñación es en junio y octubre; el tamaño promedio de camada es de 2.5, un poco menor en comparación con *B. musculus* (Packard, 1960). Eshelman y Cameron (1987) coinciden en que la especie se puede reproducir durante todo el año, pero comentan que presenta dos picos de reproducción: uno a finales del otoño y el otro a principios de la primavera. Su periodo de gestación es de 20 a 23 días, con 2.5 crías por parto en promedio. El báculo mide en promedio 2.53 de longitud y el ancho de la base es de 0.5 mm, siendo el cuerpo del báculo más corto y delgado que en *B. musculus* (Packard, 1960).

El cariotipo (Hsu y Benirschke, 1967) es de 2n=48, con cromosomas acrocéntricos. El cromosoma Y es telocéntrico pequeño y el X es subtelocéntrico grande.

Baiomys taylori allex (Osgood)

1904. *Peromyscus allex* Osgood, Proc. Biol. Soc. Washington, 17:77.

1958. *Baiomys taylori allex*, Packard, Proc. Biol. Soc. Washington, 71:17.

localidad típica. Colima, Colima.

Distribución. Según Packard (1958) puede distribuirse en el norte de Colima, al oeste de Jalisco y al sur de Nayarit.

Registros. *NAYARIT*: No registrado hasta la fecha.

Descripción. Según Osgood (1904) es de color similar a *B. musculus*; tamaño más pequeño; cráneo pequeño y menos robusto; igual en tamaño al de *B. taylori*; caja craneal angosta y mas elongada; mas pequeña que *B. musculus*; nasales cortos; bula auditiva más pequeña; molares pequeños.

Medidas. El promedio y el intervalo de nueve adultos de Colima (Packard, 1958) son: longitud total, 105.5 (100-113); longitud de la cola, 42.0 (38-47); longitud de la pata trasera, 13.3 (13-14). longitud occipito-nasal, 17.8 (17.57-18.4); anchura zigomática, 9.3 (8.8-9.7); constricción interorbital, 3.4 (3.2-3.5); longitud del rostro, 5.7 (5.4-6.0); anchura de caja craneal, 8.5 (8.3-8.8); longitud de hilera de dientes maxilares 3.0 (2.8-3.0).

Comentarios. No se cuenta con mayores datos sobre su biología y ecología.

Baiomys taylori canutus Packard

1960. *Baiomys taylori canutus* Packard, Univ. Kansas Publ., Mus Nat. Hist., 9:643.

localidad típica. 1 mi S pericos, Sinaloa.

Distribución. De la parte central de Nayarit a lo largo de la costa oeste de Sinaloa, extendiéndose hacia el norte hasta la parte sur de Sonora (Packard, 1960).

Registros. *NAYARIT*: Acaponeta; 13.5 mi S Unión Acaponeta; 2 mi SW Rosa Morada [Rosamorada]; 3 mi SE Tepic; 2 mi WNW Tepic, 3,200 ft (Packard, 1960). *SINALOA*: Culiacán, 175 ft; 15 mi N Rosario, Chelé, 300 ft; Esquinapa; Mazatlán; 15 mi N Rosario, Chelé, 300 ft; Rosario; Estación del ferrocarril Esquinapa, 43 ft (Packard, 1960). *SONORA*: 10.6 mi SE Ciudad Obregón; 1 mi NNW Navajoa [Navojoa] (Packard, 1960).

Descripción. De manera general es castaño-amarillo tierroso (algunos especímenes, con tonalidades castaño oliváceos); el pelo presenta tonos oscuros en la porción proximal, mientras que las dos terceras partes es castaño grisáceo; el color que rodea los ojos es amarillo pálido; ventralmente es gris claro, con tonalidades amarillas; cola castaño olivo oscuro en el dorso y ventralmente más clara (Packard, 1960).

Al compar las distintas subespecies, *B. t. paulus* se diferencia en la coloración de las patas y la cola es unicolor; el ancho de la caja craneal, ligeramente de mayor tamaño; la longitud de la hilera de dientes maxilares de menor tamaño. *Baiomys t. analogous* es de vientre pálido; la cola, pálida y peluda; yugal extendido ventralmente cerca del punto inmediato en lugar de abajo de la hilera de molares superiores; nasales cortados en la parte anterior; foramen infraorbital poco profundo con respecto a la línea media del cráneo; cuerpo y cráneo son más pequeños (Packard, 1960). *B. t. allex* difiere en la coloración más grisácea obscura; las patas son grices; foramen de los incisivos ahusado y la parte posterior redondeada (Packard, 1960).

Medidas. El promedio y el intervalo de 13 adultos de 15 mi N Rosario, Chelé, Sinaloa, 300 ft (Packard, 1960) son: longitud total, 109.6 (99-120); longitud de la cola, 43.4 (38-49); longitud de la pata trasera, 11.2 (10-12). Las medidas craneales de 19 organismos de distintas localidades (Packard, 1960) son: longitud occipito-nasal, 18.2 (17.7-18.9); anchura zigomática, 9.6 (9.2-10.1); constricción interorbital, 3.6 (3.4-3.8); longitud del rostro, 5.9 (5.5-6.6); anchura de caja craneal, 8.7 (8.3-8.9); longitud de la hilera de dientes maxilares 3.1 (3.0-3.2).

Comentarios. Burt (1938), equivocadamente, asignó a los especímenes de Ciudad Obregón a *B. t. paulus*, probablemente debido al tamaño, sugiriéndola como subespecie distinta para el estado de Sonora (Packard, 1960).

Packard (1960) hace mención que la variación del color del suelo en las distintas localidades tiene una relación directa con la coloración de las poblaciones. En Nayarit, particularmente en la parte centro y sur, los organismos son intermedios en cuanto a la coloración presente entre las especies grises del norte y las mayormente obscuras del sur (*B. t. allex*). Al parecer estos organismos tienen una menor ocurrencia en la parte norte de la distribución mencionada para la especie; durante tres noches consecutivas con 100 trampas cada una, se colectaron dos ejemplares en la localidad tipo y únicamente se conocen seis organismos para Sonora, los cuales fueron obtenidos en regiones de riego de Ciudad Obregón y Navojoa (Packard, 1960).

Baiomys taylori paulus (J. A. Allen)

1903. *Peromyscus paulus* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 19:598.

1912. *Baiomys taylori paulus*, Miller, Bull. U.S. Nat. Mus., 79:137.

localidad típica. Río Sestín, noroeste de Durango.

Distribución. Principalmente al este y oeste de la Sierra Madre Occidental; para la región noroeste ocurre en la parte baja del sureste de Sinaloa (Packard, 1960).

Registros. *NAYARIT*: 2 millas (3.2 km) N Tepic (Ingles, 1959). *SINALOA*: Escuinapa (Blossom y Burt, 1942). Chelé (Hooper, 1955).

Descripción. Según Packard (1960), es de tamaño mediano a pequeño parecido al de *B. musculus* o *B. m. brunneus*, aunque diferente en color. Dorsalmente la coloración es castaño grisácea; el interior de las extremidades, claro o blanco grisáceo; la base del pelaje es plúmbeo y la punta es blanquecina; en algunos especímenes el color de la panza es amarillento.

Medidas. Packard (1960) registra el promedio y el intervalo de seis organismos de la localidad tipo: longitud total, 109 (106-117); longitud de la cola, 44.5 (43-48); longitud de la pata, 13.1 (12.7-14.0); longitud occipitonasal, 17.5 (17.4-18.0); ancho zigomático, 9.3 (9.1-9.5); ancho interorbital menor, 3.5 (3.4-3.6); ancho de caja craneal, 8.6 (8.5-8.8); longitud del rostro, 5.9 (5.7-6.0); longitud de los dientes maxilares, 3.2 (3.1-3.4).

Comentarios. Allen (1903) hace mención que los juveniles tienen coloración más clara,;el cambio en la tonalidad del pelo en relación con la edad es muy marcado en *B. t. paulus*. Hooper (1955) menciona que 37 especímenes de Chelé, Sinaloa, fueron colectados entre hierba, arbustos y vid, los que bordeaban un campo de barbecho en un enmarañamiento de arbustos. Baker (1960) y Baker y Greer (1962) comentan que esta subespecie se asocia a las áreas de pastizales y que el pastoreo afecta negativamente a las poblaciones.

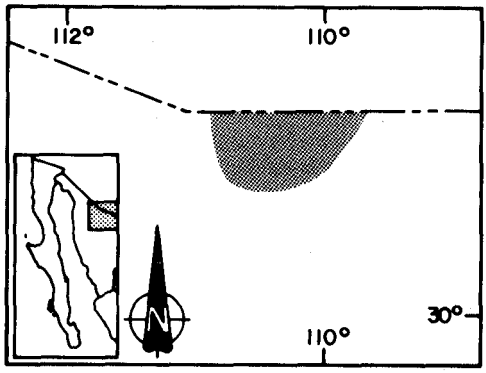
Onychomys

Onychomys leucogaster ruidosae Stone y Rhen

1903. *Onychomys ruidosae* Stone y Rhen, Proc. Acad. Nat. Sci. Philadelphia, 55:22.

1913. *Onychomys leucogaster ruidosae*, Hollister, Proc. Biol. Soc. Washington, 26:216.

localidad típica. Rancho Hales, Ruidoso, Condado de Lincoln.



Localización de *Onychomys leucogaster ruidosae*.

Distribución. La especie se distribuye desde el sur de Canadá, por el centro de los Estados Unidos hasta Tamaulipas y el norte de Sonora (McCarty, 1978). *O. l. ruidosae,* en la parte norte de Sonora, Chihuahua, Arizona y Nuevo México.

Registros. *SONORA*: La Noria (Mearns, 1907). Río Santa Cruz (Hollister, 1914). Valle de San Bernardino; río San Pedro (Burt, 1938).

Descripción. Según Stone y Rhen (1903), en general la coloración corresponde a un rojizo opaco; la parte trasera es un poco más clara; la cabeza y la nuca, obscuras con algunas tonalidades rojizas; orejas gris oscuro con finos pelos blanco plata entremezclados, siendo más abundantes hacia la punta; la barbilla gris rosáceo pálido; la parte interna de las extremidades es blanca, aunque la base del pelo es grisáceo; la cola, ligeramente peluda. El cráneo de *O. l. ruidosae* es muy parecido a *O. l. melanophrys*, pero difieren en el ancho del rostro y de los nasales, siendo más truncada la región occipital; la fosa interpterigoidea es angosta y el proceso condilar de la mandíbula es robusto y sólido.

Medidas. Del organismo tipo (Stone y Rhen, 1903): longitud total, 156; longitud de la cola, 47; longitud de la pata, 22.

Comentarios. Según lo mencionado por Stone y Rhen (1903), ésta tiene relación con *O. l. fuliginosus* y *O. torridus*, pero se pueden diferenciar por lo angosto del cráneo y lo delicado de los dientes incisivos; además el rostro y los nasales son angostos, y las bulas auditivas, pequeñas. De *O. torridus* es fácilmente distinguible por la coloración gris de la cabeza y la indefinida línea lateral y el tamaño.

Egoecue (1960) registra que la gestación es de entre 29 y 32 días, con un periodo de lactancia de entre 26 y 37 días. La época de reproducción es de febrero a agosto (Egoecue, 1960). Se ha registrado que consume saltamontes y semillas de girasol, lo que almacenan en sus madrigeras como alimento para el invierno (Bailey y Sperry, 1929).

El cariotipo de *O. leucogaster* es de 2n=46 y el FN=92. El cromosoma Y es subtelocéntrico y el X es submetacéntrico (Hsu y Benirschke, 1967; Baker *et al.*, 1979).

Onychomys torridus (Coues)

1874. *Hesperomys* (*Onychomys*) *torridus* Coues, Proc. Acad. Nat. Sci. Philadelphia, 26:183.

1889. *Onychomys torridus*, Merriam, N. Amer. Fauna, 2:3.

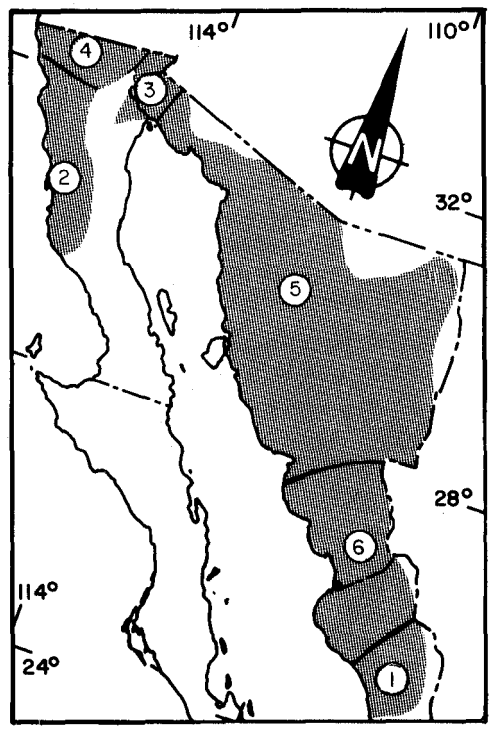
localidad típica. Camp Grant, Condado de Graham, Arizona.

Distribución. Desde la parte Central de Nevada y California hasta San Luis Potosí, relacionada con el desierto Sonorense (McCarty, 1975). *Onychomys torridus torridus* en la región de estudio ocurre en la parte norte de Sonora.

Registros. *SONORA*: San José de Guaymas; 0.5 mi N Puerto Libertad; Bahía Cholla, 5 mi NW Punta Peñasco (Cockrum y Bradshaw, 1963). Cerro Blanco y Magdalena (Hollister, 1914).

Descripción. Los ejemplares de esta especie se caracterizan por tener la cola corta, casi de la mitad del tamaño del cuerpo; la región dorsal de la cabeza, el lomo y los superiores de los laterales son castaño pálido a canela rosado; las ventrales son blancas; cola bicolor con la punta blanca; las patas delanteras tienen cinco tubérculos plantares, y las traseras, cuatro; el primero y el segundo de los molares superiores están bien desarrollados y el tercero es reducido. El primer molar superior tiene dos cúspides internas y tres externas (McCarty, 1975).

Medidas. La media y el intervalo de 15 ejemplares de Chihuahua (Anderson, 1972) son: longitud total, 145.5 (131-159); longitud de la cola, 51.1 (46-55); longitud de la pata, 20.6 (18-22); longitud de la oreja, 17.8 (16-22); longitud occipitonasal, 25.8 (24.5-27.3); longitud alveolar de los dientes maxilares, 4.1 (38-4.2); longitud del rostro, 8.1 (7.5-8.7); anchura de la caja craneal, 11.1 (10.7-11.8); anchura posterior del arco zigomático, 12.9 (12.5-13.7); anchura de los molares, 1.3 (1.2-1.6); anchura interorbital, 4.4 (4.3-4.7).



Localización de *Onychomys torridus*:

1. *O. t. knoxjonesi* 2. *O. t. macrotis*
3. *O. t. pulcher* 4. *O. t. ramona*
5. *O. t. torridus* 6. *O. t. yakiensis*

Comentarios. Burt (1938) comenta que en el estado de Sonora también se puede encontrar la subespecie de *Onychomys t. torridus*, previamente registrada por Hollister (1914), con coloración intermedia entre *O. t. torridus* y *O. t. yakensis* (Burt, 1938), pero en trabajos posteriores se ha descartado la presencia de *O. t. torridus* para Sonora. Por otro lado, existe la posibilidad de que *O. t. perpallidus* se distribuya también en Sonora (Burt, 1938), pero hasta la fecha no se ha registrado formalmente.

Baker (1966) la colecta en Durango en una área con pastizal, uña de gato, juníperos y mesquites. El periodo de gestación que se ha registrado para ejemplares de esta especie está entre 27 y 32 días; el reproductivo es entre mayo y agosto, con el máximo entre mayo y julio (Taylor, 1968).

Tiene una dieta casi completamente a base de artrópodos (Horner *et al.*, 1964). Habitan en zonas desérticas con matorral, encontrándoseles en la región biótica del desierto Sonorense (Bailey y Sperry, 1929). La densidad de ejemplares por hectárea es muy baja (Chew y Chew, 1979).

El número de cromosomas es de 2n=48 y el FN=80, de los cuales son submetacéntricos grandes, metacéntricos y submetacéntricos. El cromosoma Y es acrocéntrico (Hsu y Benirschke, 1968; Baker *et al.*, 1979).

La especie se encuentra representada por seis subespecies, tanto del norte de la península como de la región continental una de ellas es de reciente descripción.

Onychomys torridus knoxjonesi Hollander y Willig

1992. *Onychomys torridus knoxjonesi* Hollander y Willig, Occas. Papers Mus. Texas Tech Univ., 148:1-4.

localidad típica. 12 mi NE Presa Sanalona, 600 ft.

Distribución. Del sur del río Sinaloa y oeste de la Sierra Madre Occidental, en el centro de Sinaloa hacia el sur por la planicie costera (Hollander y Willig, 1992).

Registros. *SINALOA*: 8 km N, 22 km E Sinaloa, 400 ft; 1 mi E Sinaloa, 180 ft; 24 km S Guasave, 20 ft; 1.5 mi N Badiraguato, 750 ft; 1 mi S Perico; 12 mi N Culiacán; 3 mi E San Pedro, 550 ft; 1 mi E Altata; 12 mi NE Presa Sanalona, 600 ft; 7 mi ENE Presa Sanalona, 600 ft; 2 mi E Costa Rica, 100 ft; 6 mi N, 1.5 mi E El Dorado; 5 km SW San Ignacio, 200 m (Hollander y Willig, 1992).

Descripción. En la descripción original de la subespecies, Hollander y Willig (1992) mencionan que ésta es de tamaño medio, color oscuro y rostro corto y ancho.

Medidas. El promedio del tipo (Hollander y Willig, 1992) son: longitud total, 140; longitud de la cola, 51; longitud de la pata, 21.5; longitud de la oreja, 20; longitud total del cráneo, 25.2; anchura zigomática, 13.1; constricción interorbital, 4.3; longitud de la serie de dientes mandibulares, 3.9.

Comentarios. Al compar *Onychomys torridus knoxjonesi* contra *O. t. yakiensis*, la primera es más obscura, con bandas dorsales que se extienden desde la cara a la nariz y manchas conspicuas en la base de las orejas.

Onychomys torridus macrotis Elliot

1903. *Onychomys torridus macrotis* Elliot, Field Columb. Mus., Publ., 74, Zool. ser., 3:155.

localidad típica. Cabeza del río San Antonio, al oeste de la bajada de la Sierra de San Pedro Mártir, Baja California.

Distribución. De San Quintín al río San Antonio, Trinidad y el Alamo, con una elevación de 5,000 ft, montañas de San Pedro Mártir, Baja California (Elliot, 1903c). Al norte de la parte alta del Valle de la trinidad, hasta la Sierra de Juárez, en el sur en el Valle de San Quintín, pasando por la Sierra de San Miguel y la parte central de la Sierra San Pedro Mártir.

Registros. *BAJA CALIFORNIA*: Alamo; Trinidad; San Quintín (Hall, 1981). Cabeza del río San Antonio, al oeste de la bajada de la Sierra de San Pedro Mártir (Elliot, 1903c)

Descripción. Según Elliot (1903c), los organismos son de tamaño medio y coloración pálida; orejas y patas largas; parte externa de las extremidades blancas. La parte superficial del cuerpo es de tonalidad vinácea pálida, con una línea fina dorsal, siendo a la altura de la cabeza castaño oscuro; lateralmente el cuerpo tiene una apariencia vinácea; el anillo orbital es negro; los labios, pecho y partes internas de las patas delanteras y traseras son blancas; la cola es obscura en la superficie dorsal, mientras que por debajo es blanca; las orejas, castaño grisáceo pálido, pero el borde, oscuro con mechón de pelos en la base.

Medidas. Las dadas por Elliot (1903c) son: longitud total, 155; longitud de la cola, 55; longitud de la pata trasera, 21; oreja, 20.5; longitud occipito-nasal, 26.0; anchura zigomática, 13.5; constricción interorbital, 4.5; longitud de los nasales, 7.5.

Comentarios. Este género aparentemente estuvo poco representado a lo largo de la travesía realizada por Mr. Heller, describiéndola como una especie de tonalidad pálida de orejas y cola

larga, no teniendo nada en común con *O. t. ramona*, la cual se encuentra geográficamente cercana al área del Valle de San Bernardino al sur de California (Elliot, 1903c).

Onychomys torridus pulcher Elliot

1904. *Onychomys pulcher* Elliot, Field Columb Mus., Publ. 87, Zool. Ser., 3:243.

1913. *O[nychomys]. t[orridus]. pulcher*, Hollister, Proc. Biol. Soc. Washington, 26:215.

localidad típica. Cerca de Morongo, Cerro de San Bernardino, California.

Distribución. Para el área de estudio se tienen localidades del delta del río Colorado.

Registros. *BAJA CALIFORNIA*: Siete pozos, al suroeste del río Colorado en Baja California (Hall, 1981).

Descripción. Generalmente de tamaño medio y color pálido. Dorsalmente amarillento, con algunas tonalidades rojizas, siendo más oscuro hacia la parte trasera (amarillo salmón); lateralmente, la cara, nariz, labios y parte interna de las extremidades, de color blanco; superficialmente la cola es blanco tierroso, mientras que lateral y ventralmente es blanca; la base de las orejas blancas con la punta castaño oscuro; algunos pelos largos y blancos cubren la base de la oreja; presencia de anillo oscuro alrededor del ojo (Elliot, 1903).

Medidas. Las proporcionadas por Elliot (1903a) son: longitud total del cuerpo, 150; longitud de la cola, 55; longitud de la pata, 21; longitud de la oreja, 18.5; longitud total del cráneo, 25.5; anchura zigomática, 13.5; constricción interorbital, 5.0; longitud de los nasales, 9.0; longitud palatal, 10.0; longitud de la serie de dientes superiores, 4.0; longitud de la mandíbula, 15.0; longitud de la serie de dientes mandibulares, 4.0.

Comentarios. Según Elliot (1904), es una de las especies más bonitas debido a la coloración rosada y amarillo salmón; de igual manera comenta que esta especie no se asemeja a ninguna de las especies de *Onychomys*, quizá en tamaño a *O. t. macrotis*, pero es completamente diferente en color. Esta es una forma desértica que habita en las montañas y a lo largo del paso de Morongo, hacia el desierto de Mojave.

Onychomys torridus ramona Rhoads

1893. *Onychomys ramona* Rhoads, Amer. Nat., 27:833.

1904. *Onychomys torridus ramona*, Merriam, Proc. Biol. Soc. Washington, 17:124.

localidad típica. Cañón Reche, 1250 ft., 4 mi SE Colton, Valle de San Bernardino, California.

Distribución. Se distribuye en la zona de la Sierra de la Rumorosa, Baja California, continuándose hasta el sur de California (Hall, 1981).

Registros. *BAJA CALIFORNIA*: Valle de Tecate (Hall, 1981).

Descripción. Rhoads (1893) menciona que es más grande que *O. torridus*; con las orejas más grandes; color similar a *O. longicauda*, pero con una línea dorsal apreciable y más corta; cola más corpulenta, cráneo en promedio tan largo como el de *O. torridus*, pero de las mismas proporciones; mandíbula más grande, y el proceso coronoides más desarrollado.

Medidas. Las del tipo son (Rhoads, 1893): longitud total, 147; longitud de la cola, 48; longitud de la pata, 18; longitud de la oreja, 12.

Comentarios. No se tiene datos de su biología y ecología.

Onychomys torridus yakiensis Merriam

1904. *Onychomys torridus yakiensis* Merriam, Proc. Biol. Soc. Washington, 17:124.

localidad típica. Camoa, río Mayo, Sonora.

Distribución. De la zona de Guaymas y Ciudad Obregón en Sonora, hasta Culiacán en Sinaloa.

Registros. *SINALOA*: 6 mi N, 1.5 mi E El Dorado, 12 mi N Culiacán (Jones *et al.*, 1962). San Ignacio (Wilson, 1985). 13 km NNE Vaca, 1300 ft; 16 km NNE Choix, 1700 ft; Laguna, 17 km SW Choix, 500 ft; 3 mi NE El Fuerte, 200 ft; 2.5 mi N El Fuerte; 7 mi SW Los Mochis, 20 ft; 44 km ENE Sinaloa, 600 ft (Holander y Willig, 1992). *SONORA*: Alamos; Camoa (Hollister, 1914). Chinobampo; Tésia; Ciudad Obregón; Tecoripa (Burt, 1938). Río Cuchujaqui; Costa Norte de la Bahía de Bocochibampo (Cockrum y Bradshaw, 1963). 15 km N Hermosillo; 15.4 mi S Guaymas; Alamos; 12 mi E Alamos, río Cuchujaqui; 7.6 mi SE Alamos; Camoa, río Mayo (Holander y Willig, 1992).

Descripción. Merriam (1904) describe una coloración similar a la de *O. t. ramona*, pero el tamaño es ligeramente más grande (el promedio de la longitud de la pata es de 22.5 en lugar de 20.5). Area media dorsal de la corona a la base de la cola, usualmente más oscuro que la espalda y los costados. Al compar con *O. t. torridus*, *O. t. longicaudus* y *O. t. ramona*, los dientes molares, particularmente los anteriores, son anchos y robustos; el palatal usualmente termina en una proyección media; en *O. t. torridus* y *O. t. ramona* éste es cóncavo.

Medidas. Las del organismo tipo (Merriam, 1904) son: longitud total, 154; longitud de la cola, 53; longitud de la pata trasera, 22.

Comentarios. Burt (1938) menciona que los ejemplares fueron colectados en áreas con arbustos y solamente en una localidad se les encontró asociada también con pastos. En ninguno de los casos se les encontró en regiones próximas al agua.

Peromyscus

Peromyscus eremicus eremicus (Baird)

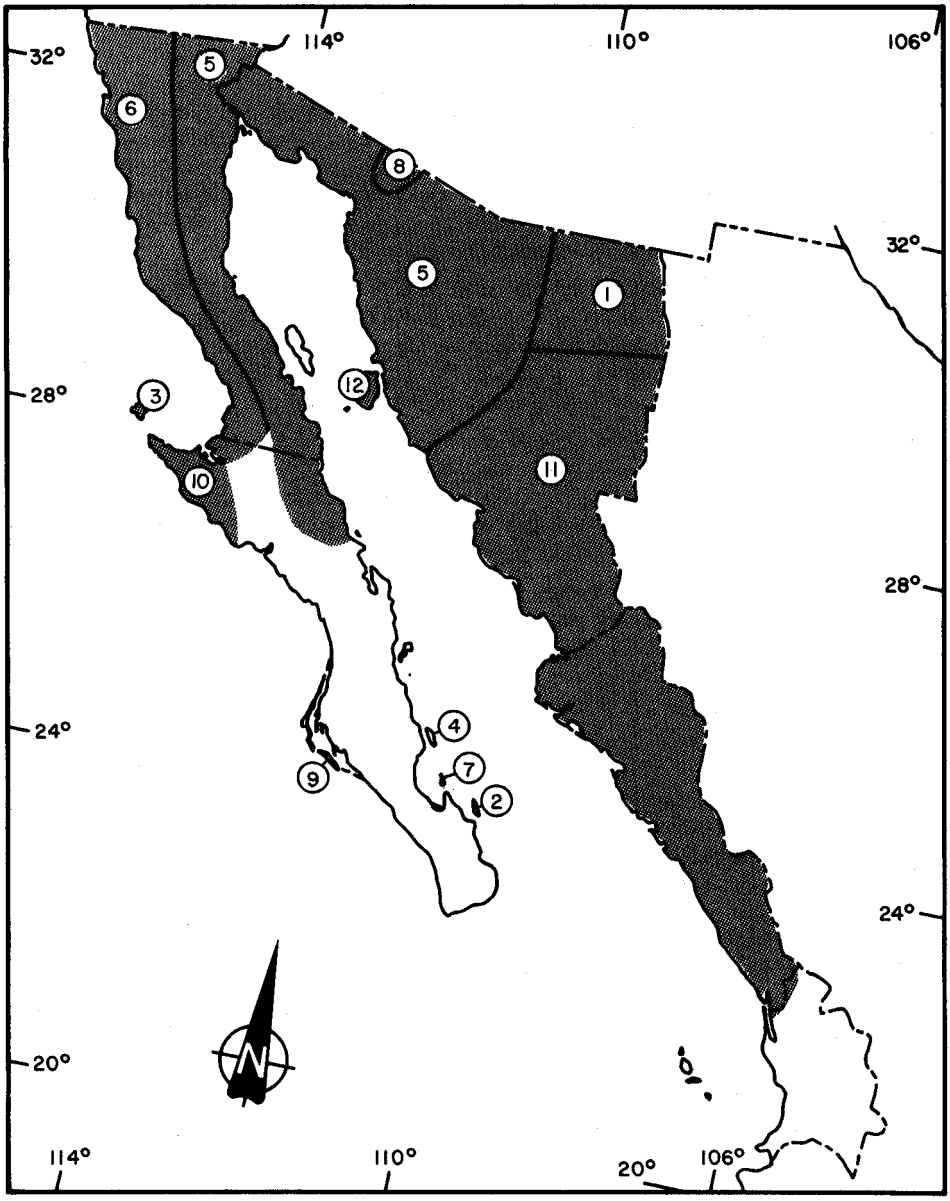
1858. *Hesperomys eremicus* Baird, Mammals *in* Repts. Expl. Surv. . . ., 8(1):479.

1895. *Peromyscus eremicus*, J. A. Allen, Bull. Amer. Mus. Nat. Hist., 7:226.

localidad típica. Antiguo fuerte Yuma, Condado Imperial, California, sobre el río Colorado enfrente de Yuma Arizona.

Distribución. La especie se distribuye al suroeste de los Estados Unidos hasta San Luis Potosí, por el centro de México y por la vertiente del Pacífico, hasta Sinaloa y gran parte de la península de Baja California (Veal y Caire, 1979). *Peromyscus eremicus* desde la parte media de Sonora hasta California, sur de Nevada y Arizona, la costa del Golfo de la península de Baja California y al este invade el altiplano central de México.

Registros. *SONORA*: Cerro Blanco; Mina providencia; Poso [Pozo] de Luis; Quitobaquita; Sonoyta [Sonoita] (Osgood, 1909). 100 mi Hermosillo (Avise *et al.*, 1974). Rancho Costa Rica; Punta Sargento; Puerto Peñasco (Hall, 1981). *BAJA CALIFORNIA*: Yubay; Agua Dulce; Montañas Negras; Calamahué; Montañas Cocopah; Laguna Gardner; río Hardy; Matomí; Palomar; Parral; La Remada; Parteaguas Rosario; San Francisquito; Siete pozos (Osgood, 1909). Bahía San Francisco (Townsend, 1912). Las Cruces; Punta Pulpito; Coyote cove; Calmallí (Lawlor, 1971b).



Localización de *Peromyscus eremicus*:

1. *P. e. anthonyi*	2. *P. e. avius*	3. *P. e. cedrosensis*	4. *P. e. cinereus*
5. *P. e. eremicus*	6. *P. e. fraterculus*	7. *P. e. insulicola*	8. *P. e. papagensi.*
9. *P. e. polypolius*	10. *P. e. propinquus*	11. *P. e. sinaloensis*	12. *P. e. tiburonensis*

Descripción. Según Osgood (1909), es de tamaño medio; cola más larga que el cuerpo y cubierta con pelos cortos, no pincelada; orejas relativamente grandes, cubiertas con pelos muy finos o desnudas; planta del pie desnuda hasta el calcáreo; pelo suave y sedoso; coloración amarillenta con entrepelados negros o gris muy fino, no concentrándose en la parte media. La coloración dorsal es ocrácea amarillenta con entrepelado oscuro; línea lateral ocre amarillento, la que contrasta con la coloración dorsal; lados y parte superior de la cara grisácea; cola obscura dorsal y blanquecina ventral; vientre blanco puro o con poco entrepelado amarillento; mancha pectoral algunas veces presente. Cráneo de tamaño medio, caja craneal alta y de cierta manera elongada; región infraorbital bien desarrollada; nasales ligeramente anchos y poco cóncavos, cerca de su parte posterior; los maxilares siempre terminan por detrás de los nasales.

Medidas. La media y el intervalo de diez adultos (Osgood, 1909) son: longitud total, 183 (172-192); longitud de la cola, 101 (94-108); longitud de la pata, 20.5 (20-21); longitud de la oreja (en seco), 17.5 (17.3-17.8). Las medidas craneales de un ejemplar son: longitud total, 25.7; longitud condilobasal, 19.5; anchura zigomática, 12.7; anchura interorbital, 3.9; longitud de los nasales, 9.4; longitud postpalatal, 8.9; longitud de los dientes maxilares, 3.9.

Comentarios. *Peromyscus eremicus* se puede diferenciar de las del resto del género por el patrón de las cúspides de los molares, la que es relativamente sencilla (Linzey y Layne, 1969). Es considerada como una especie de amplia distribución en el desierto Sonorense y Chihuahuense, relacionándose con la vegetación desértica. Asociado principalmente a zonas pedregosas (Commissaris, 1960), aunque también lo encontramos en áreas arenosas.

Veal y Caire (1979) dan un gran número de referencias en relación con los hábitats en los que puede ser encontrado *P. eremicus*. Habita desde las zonas desérticas hasta los malpaís y vegetación costera, y en general son más abundantes en las áreas con suelos arenosos, aunque también se les encuentra en áreas rocosas. Es una especie que tiene mucha actividad arbórea, que llega a consumir semillas de mesquite sobre los árboles.

Baker (1960) registra para Coahuila que las hembras preñadas para todos los meses del año, a excepto de agosto a octubre, con 2.7 embriones en promedio. Veal y Caire (1979) comenta que es probable que se reproduzca a lo largo de todo el año, con un pico de actividad de marzo a abril (Lewis, 1972). Con respecto al aparato reproductor, los testículos son proporcionalmente menores, las glándulas bulbares están presentes y al parecer no son muy diferentes de las de *P. leucopus*; la próstata dorsal está particularmente dividida en una media y un lóbulo lateral (Linzey y Layne, 1969). Linzey y Layne (1974) realizan la descripción de los espermatozoides para *P. eremicus*, dando las siguientes medidas (micrones): longitud de la cabeza, 5.9 ± 0.12; anchura de la cabeza, 3.5 ± 0.05; longitud de la parte media, 16.6 ± 0.08; longitud de la cola, 53.5 ± 2.42.

López-Forment y Urbano (1977) encuentran restos de esta especie en regurgitaciones de lechuza de campanario (*Tyto alba*) para San Ignacio, Baja California Sur.

El cariotipo está constituido por 2n=48, siendo todos los autosomas birrameos; los grandes son subtelocéntricos o submetacéntricos; los pequeños son próximos a metacéntricos. El cromosoma Y es submetacéntrico de tamaño medio y el X es grande con los brazos iguales (Lawlor, 1971a).

Esta especie tiene once subespecies en la región noroeste de México, con área de distribución desde las islas del Golfo de California, islas del Pacífico, la Península de Baja California y la porción continental.

Peromyscus eremicus anthonyi (Merriam)

1887. *Hesperomys* [*Vesperimus*] *anthonyi* Merriam, Proc. Biol. Soc. Washington, 4:5.

1907. *Peromyscus eremicus anthonyi,* Mearns, Bull. U. S. Nat. Mus., 56:438.

localidad típica. Campo apache, Montes Big Hachita, Condado de Hidalgo, Nuevo México.

Distribución. La parte noroeste de Sonora; el resto de su área de distribución se restringe a una área entre los límites de Nuevo México, Arizona y Chihuahua.

Registros. *SONORA*: Magdalena (Cockrum, 1961).

Descripción. Siguiendo a Osgood (1909), es muy similar a *P. eremicus*, pero más oscuro y de colores más brillantes; orejas poco más pequeñas; mancha pectoral usualmente presente. La coloración dorsal es ocrácea amarillenta, con entrepelado negro en la región dorsal; cabeza con entrepelado gris y amarillento, principalmente en las mejillas; ventralmente blanco crema, a excepción de la mancha pectoral amarillenta ocrácea que se extiende desde las axilas hasta la mitad del vientre; cola obscura dorsal y clara ventral, pero no bicolor; patas blanco crema, ancas obscuras. Cráneo igual al de *P. e. eremicus*.

Medidas. La media y el intervalo de diez ejemplares (Osgood, 1909) son: longitud total, 194 (188-202); longitud de la cola, 108 (102-113); longitud de la pata, 21.5 (21-22). No da las medidas del cráneo.

Comentarios. *Peromyscus eremicus anthonyi* se puede diferenciar del resto de las subespecies por la longitud del paladar; hilera de dientes maxilares y cola; anchura de la fosa mesopterigoidea y lo profundo de la bula (Anderson, 1972). Jones (1964) registra un hembra preñada para junio en Durango.

Peromyscus eremicus avius Osgood

1909. *Peromyscus eremicus avius* Osgood, N. Amer. Fauna, 28:247.

localidad típica. Isla Cerralvo, Golfo de California, Baja California Sur.

Distribución. Isla Cerralvo, Baja California Sur.

Registros. *BAJA CALIFORNIA SUR*: Isla Cerralvo (Osgood, 1909; Banks, 1964a).

Descripción. Osgood (1909), en la descripción original comenta que es similar a *P. eva*, pero de mayor tamaño; orejas pequeñas; coloración ventral ocrácea en lugar de blanquecina; cráneo más grande con molares más robustos. La coloración dorsal es muy similar a la de *P. eva*; interparietal ligeramente más grande; molares notoriamente más grandes y robustos, similares a los de *P. e. fraterculus*.

Medidas. La media y el intervalo de 21 machos (Banks, 1964a) son: longitud total 190.2 (176-208); longitud de la cola, 101.0 (89-115); longitud de la pata, 20.0 (19-20); longitud total del cráneo, 24.9 (24.1-25.6); longitud basilar, 20.4 (19.4-21.2); anchura de la caja craneal, 12.0 (11.5-12.5); anchura interorbital, 3.9 (3.7-4.1); longitud de los dientes maxilares, 3.9 (3.6-4.2). La media y el intervalo de 17 hembras son: longitud total, 195.5 (182-216); longitud de la cola, 101.8 (78-118); longitud de la pata, 20.5 (19-22); longitud total del cráneo, 24.8 (23.9-25.9); longitud basilar, 20.4 (19.6-21.4); anchura de la caja craneal, 12.0 (11.3-12.4); anchura interorbital, 3.9 (3.7-4.0); longitud de los dientes maxilares; 3.9 (3.6-4.0).

Comentarios. Osgood (1909) considera que los principales caracteres que permiten su fácil diferenciación son: su longitud mas grande; orejas pequeñas; ventralmente amarillento en lugar

de blanco, y sus molares robustos. Banks (1964a) comenta que esta especie en muy abundante en el lado oeste de la isla, en las zonas pedregosas y en los causes de los arroyos. Sin embargo, nosotros la encontramos mucho más abundante en la región este, asociada a las zonas de grandes piedras y próxima a la playa, disminuyendo en número a medida que se alejaba de la costa, en zonas donde la vegetación muy escasa y arbustiva. Con respecto a la actividad reproductiva menciona que ésta se realiza en la primavera y, de manera esporádica, hasta los meses de otoño (Banks, 1964a). Por las colectas que se han hecho, se sabe que hay gran cantidad de hembras preñadas en en mayo. Esta subespecie se encontró asociada más a las áreas pedregosas que a las que tienen vegetación densa. En general la isla en sus partes bajas, tiene sustrato arenoso, pero en las altas es pedregoso. La Norma Oficial Mexicana (1994) la considera como subespecie amenazada de extinción.

Peromyscus eremicus cedrosensis J. A. Allen

1898. *Peromyscus cedrosensis* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 10:154.

1909. *Peromyscus eremicus cedrosensis*, Osgood, N. Amer. Fauna, 28:244.

localidad típica. Isla Cerros [Cedros], Océano Pacífico, Baja California Sur.

Distribución. Conocido únicamente de isla Cedros, Baja California.

Registros. *BAJA CALIFORNIA*: isla Cedros (J. A. Allen, 1898; Osgood, 1909; Townsend, 1912).

Descripción. Según la descripción original de Allen (1898), la parte dorsal es castaño, mezclado con tonos amarillo-rojizos, además de tonos oscuros; presenta línea lateral de color ocre; ventralmente es de color blanco; internamente la coloración de la piel es grisácea, con una línea conspicua longitudinal que se extiende hasta el abdomen; patas blancas; la parte baja de la tibia es de coloración más obscura; planta de la pata desnuda; orejas largas, de color castaño pálido y desnudas; la cola es castaño pálido unicolor, desnuda.

Medidas. Las del tipo (Allen, 1898) son: longitud total 194; longitud de la cola, 107; longitud de la pata, 20; longitud de la oreja, 15; longitud total del cráneo, 26; anchura mastoidea 10.5; anchura zigomática 10, posterior 13; anchura interorbital 3.5; longitud de los nasales, 9.6.

Comentarios. Según Osgood (1909) es similar a *P. eva*, pero con una coloración más obscura; más pálida que *P. e. fraterculus*; orejas pequeñas; cráneo ligeramente más grande, con nasales más largos. Es semejante en coloración a *P. e. fraterculus*, pero mucho más obscura, con línea lateral más clara, y una mancha pectoral marcada y constante (Allen, 1898).

Banks (1964b) considera que la población de la isla es baja en el mes de abril, colectándose seis machos con una longitud testicular de entre 8 y 14 mm, una hembra con un embrión de 22.0 mm, cuatro sin actividad y tres lactantes. La Norma Oficial Mexicana (1994) la considera como amenazada de extinción.

Peromyscus eremicus cinereus Hall

1931. *Peromyscus eremicus cinereus* Hall, Proc. Biol. Soc. Washington, 44:87.

localidad típica. Isla San José, Golfo de California, Baja California [Sur].

Distribución. Isla San José, Baja California Sur.

Registros. *BAJA CALIFORNIA SUR*: isla de San José (Hall, 1931; Avise *et al.*, 1974).

Descripción. Según la descripción original (Hall, 1931), son de tamaño pequeño; cráneo ligeramente levantado o abultado; dorsalmente gris claro y ventralmente blanco, con una mancha pectoral ocrácea. *P. e. cinereus* es más pequeño y menos coloreado que *P. eva*. El tamaño y la forma del cráneo son más similares a *P. e. insulicola*, pero *P. e. cinereus* es mucho más claro.

Medidas. Las medidas de un ejemplar depositado en la colección de mamíferos del Centro de Investigaciones Biológicas del Noroeste son: longitud total, 180; longitud de la cola, 100; longitud de la pata, 20; longitud total del cráneo, 23.3; anchura zigomática, 11.1; anchura interorbital, 4.2; anchura de la caja carneal, 11.1; longitud de los nasales, 9.3; anchura de los nasales, 3.1; longitud de los dientes maxilares, 3.3; longitud de los dientes mandibulares, 3.3.

Comentarios. Hall (1931) hace la descripción de esta subespecie con un solo ejemplar. Se han encontrado en toda la isla, observándose que su distribución no depende del sustrato, sino más bien de la vegetación. Las colectas más abundantes fueron en aquellos sitios en los que la vegetación es más cerrada (Cervantes *com. per.*). Sánchez *et al.* (1997) comenta de una hembra preñada para el mes de junio. La Norma Oficial Mexicana (1994) la considera como amenazada de extinción.

Peromyscus eremicus fraterculus (Miller)

1892. *Vesperimus fraterculus* Miller, Amer. Nat., 26:261.

1898. *P[eromyscus] eremicus fraterculus*, J. A. Allen, Bull. Amer. Mus. Nat. Hist., 10:154.

localidad típica. Dulzura, condado de San Diego, California.

Distribución. Del área de Villa de Jesús María, al norte de la zona de dunas caminantes, por la vertiente del Pacífico hasta el sur de California.

Registros. *BAJA CALIFORNIA*: Ensenada; las Encinas; Trinidad; Cabeza del río San Antonio; San Antonio; Rosarito; San Quentin [Quintín] (Elliot, 1903), Cañón Salado; Ensenada; Las Encinas; Valle de Nachoguero; Piñón; Rancho Viejo; San Antonio; río San Antonio; Ojo de agua San Matías; San Fernando; San Quentin [Quintín]; Socorro; Valle de Tecate; Trinidad: Valladores (Osgood, 1909). San Quintín (Herrin, 1970). Sierra de Santa Clara (Lawlor, 1971b).

Descripción. Similar a *P. e. eremicus* pero marcadamente más oscuro; más castaño rojizo y más negruzco en verano; ventralmente color crema o amarillento en lugar de blanco; cola larga. La coloración dorsal es castaño rojizo entremezclado con negro, concentrándose este último color en la parte media; cabeza con poco o mucho de gris, principalmente áreas de la región postorbital; ventralmente crema blancuzco con una pequeña marca pectoral rojiza aleonado. El cráneo es prácticamente igual al de *P. e. eremicus*.

Medidas. El promedio y el intervalo de las medidas dadas para 13 ejemplares por Miller (1892) son: longitud total, 181.1 (200-167); longitud de la cola, 103.0 (118-78); longitud de la pata, 20.1 (22-18); longitud de la oreja, 16.1 (18-15). El promedio y el intervalo de las medidas dadas para cuatro machos y dos hembras por Miller (1892) son: longitud basilar, 20.2 (21.4-19.0); longitud basilar de Hensel, 17.8 (19.0-16.4); anchura zigomática, 12.0 (12.6-11.4) ; anchura interorbital, 3.8 (4.0-3.6); longitud de los nasales, 8.6 (9.6-8.6); longitud de los dientes maxilares, 3.6 (3.8-3.4); longitud de los dientes mandibulares, 3.8 (4.0-3.6).

Comentarios. Osgood (1909) comenta que por la coloración es muy sencilla la separación de esta subespecie de *P. e. eremicus*.

Peromyscus eremicus insulicola Osgood.

1909. *Peromyscus eremicus insulicola* Osgood, N. Amer. Fauna, 28:246.

localidad típica. Isla Espíritu Santo, Golfo de California, Baja California [Sur].

Distribución. Isla Espíritu Santo, Baja California Sur.

Registros. *BAJA CALIFORNIA SUR*: Isla Espíritu Santo (Osgood, 1909; Avise *et al.*, 1974).

Descripción. Osgood (1909), en la descripción original, menciona que es muy similar a *P. eva*, pero de coloración más obscura y que tiene en la región pectoral una marcada mancha ocrácea amarillenta. La coloración dorsal es ocrácea amarillenta mezclada con oscuro más conspicuo, produciendo un efecto de color vináceo; ventralmente crema blancuzco, con una mancha pectoral ocrácea bien definida que se extiende hasta el principio del abdomen; cola obscura ligeramente más clara ventralmente. El cráneo es similar al de *P. eva*, pero más estrecho y menos robusto, con molares no robustos.

Medidas. Las de dos ejemplares (Osgood, 1909) son: longitud total, 196-200; longitud de la cola, 115-113; longitud de la pata, 20-19.5; longitud de la oreja (en seco), 16.5-16.7; longitud total del cráneo, 25.9; longitud condilobasal, 19.3; anchura zigomática 12.4; anchura interorbital, 3.9; longitud de los nasales, 9.5; longitud pospalatal, 9.2; longitud de los dientes maxilares, 3.6.

Comentarios. Osgood (1909) describe *Peromyscus e. insulicola* con tres ejemplares. Las características que mejor definen son: la mancha pectoral, el menor tamaño del cráneo y los molares no robustos. Lawlor (1971b) comenta que esta población se parece en la morfología craneal y del báculo a *P. eremicus*, pero que en su aspecto externo se asemeja a *P. eva*.

Habita en toda la isla desde la parte del sur, hasta los cañones de la zona norte; en ambos casos se encontró asociada a las zonas más pedregosas. Cabe hacer la aclaración de que la vegetación de la isla no es muy abundante, y donde está presente tiende a ser de tamaño pequeño. En la zona norte esta especie fue la más abundante, principalmente en las zonas pedregosas. La Norma Oficial Mexicana (1994) la considera como amenazada de extinción.

Peromyscus eremicus papagensis Goldman

1917. *Peromyscus eremicus papagensis* Goldman, Proc. Biol. Soc. Washington, 30:110.

localidad típica. Sierra del Pinacate, Sonora.

Distribución. Restringido a la Sierra del Pinacate.

Registros. *SONORA*: Sierra del Pinacate (Goldman, 1917).

Descripción. En la descripción original, Goldman (1917) la considera similar a *Peromyscus e. eremicus* y *P. e. anthonyi*, pero dorsalmente es oscuro con tonos amarillentos vináceos en lugar de amarillento ocráceo; los costados son castaño claro; la parte superior de la cabeza y el lomo son muy oscuros, con algunos pelos negros; ventralmente blanco y la base obscura, excepto la barba y los labios con la base blanca; orejas y anillo alrededor de los ojos negruzcos; patas blancas; cola bicolor, obscura dorsalmente y blancuzca ventralmente, excepto la punta, que es completamente negra.

Medidas. Las del tipo (Goldman, 1917) son: longitud total, 196; longitud de la cola, 102; longitud de la pata, 20.5; longitud total del cráneo, 25.5; anchura zigomática, 13.3; ancho interorbital, 4; longitud de los nasales, 8.9; longitud de los molares superiores, 3.8.

Comentarios. Goldman (1917) menciona que la coloración castaño clara de los costados puede ser variable entre ejemplares, mientras que la coloración dorsal es constante. Blossom (1935) comenta que en los laboratorios de genética de vertebrados de la Universidad de Michigan probaron que la coloración de *P. e. papagensis* es inherente a la subespecie.

Peromyscus eremicus polypolius Osgood

1909. *Peromyscus eremicus polypolius* Osgood, N. Amer. Fauna, 28:248.

localidad típica. Isla Margarita, Baja California [Sur].

Distribución. Isla Margarita, Baja California Sur.

Registros. *BAJA CALIFORNIA SUR*: Isla Margarita (Townsend, 1912).

Descripción. Osgood (1909) comenta que la subespecie es similar a *P. eva*, pero de color más grisácea; cráneo y rostro más deprimido; caja craneal corta y más inflada. La coloración dorsal de la cabeza a la cadera es grisácea, obscura y rosa amarillento; el gris domina en la cabeza, hombros y lomo; el amarillento, en la cadera; los costados son como el lomo; parte baja de los costados amarillento rosado o amarillo ocráceo pálido; también presenta una especie de línea abajo de las mejillas; ventralmente crema amarillento pálido, pero no tan blanco como en *P. eva*; mancha pectoral poco desarrollada; patas blancas; cola más obscura dorsalmente. El cráneo es similar al de *P. eva*, pero el rostro es más delgado y deprimido; parte infraorbital del zigomático débil y más comprimida; caja craneal relativamente corta, ancha e inflada; molares relativamente más grandes.

Medidas. La media y el intervalo de diez ejemplares (Osgood, 1909) son: longitud total, 192 (183-200); longitud de la cola, 109.5 (100-117); longitud de la pata, 19.5 (19-20); longitud de la oreja (seca), 15.7 (14.0-16.8). Las medidas craneales del tipo son: longitud total, 24.0; longitud condilobasal, 18.0; anchura zigomática, 12.2; anchura interorbital, 4.0; longitud de los nasales, 8.7; longitud pospalatal, 8.0; longitud de los dientes maxilares, 3.9.

Comentarios. Banks (1964b) comenta haber colectado un macho en abril con la longitud de los testículos de 8.0 mm. Los ejemplares de la especie fueron capturados en las pendientes pedregosas de la isla, casi desde la playa misma hasta las partes altas, encontrándose cerca de los asentamientos humanos. En las áreas arenosas no fueron colectados. La Norma Oficial Mexicana (1994) la considera como amenazada de extinción.

Peromyscus eremicus propinquus J. A. Allen

1898. *Peromyscus eremicus propinquus* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 10:154.

localidad típica. Bahía San Pablo, Baja California.

Distribución. Desde Punta Elefante, al norte de Bahía Tortuga, hasta punta Malarrimo al este y laguna de San Ignacio al sur y la zona de dunas del desierto del Vizcaíno al noreste y este.

Registros. *BAJA CALIFORNIA SUR*. Punta San Pablo (Allen, 1898). San Andrés (Osgood, 1909). Bahía Tortuga (Lawlor, 1971b). Bahía Playa María (Hall y Kelson, 1959).

Descripción. La región dorsal tiene tonalidades pálidas (castaños, grisáceas y amarillo rojizas), las cuales se observan más fuertemente en los laterales, con línea lateral amarillo rojiza; ventralmente de color blanco; la piel de color gris; patas blancas; la parte baja de la tibia obscura; orejas grandes y desnudas; cola superficialmente obscura y ligeramente clara en la parte ventral, prácticamente desnuda excepto en la punta (Allen, 1898).

Medidas. Somáticas del tipo (Allen, 1898) son: longitud total 190; longitud de la cola, 100; longitud de la pata, 18.5; longitud de la oreja, 19.

Comentarios. Allen (1898), en la descripción de *Peromyscus eremicus propinquus* de Punta San Pablo, Baja California Sur, comenta que es muy similar a *P. e. fraterculus*, pero que puede diferenciarse por su coloración y el tamaño de las orejas. Osgood (1909) considera a *P. e. propinquus* como sinónimo de *P. e. eva*. Al analizar Osgood (1909) seis ejemplares de San Andrés (aproximadamente 10 km E San Pablo, Baja California Sur), comenta que es difícil situar a los ejemplares en una u otra subespecie, ya que tres presentan características en el vientre de *P. e. eva* y tres son amarillentos como *P. e. fraterculus* y también las medidas dadas por Osgood (1909) son intermedias; por lo tanto, los ejemplares revisados por Osgood (1909) son intermedios entre las dos subespecies. Sin embargo, Lawlor (1983), al separar *P. eva* de *P. eremicus*, no menciona nada acerca de los ejemplares de Osgood, ni a qué especie pertenecen; por lo tanto, existe la posibilidad de que los ejemplares asignados a *P. e. propinquus* sean o una forma válida o existan ejemplares simpátricos de las dos especies antes mencionadas, aunque se considera que es necesario realizar estudios más específicos al respecto.

El área de distribución está muy bien delimitada, ya que al oeste se encuentra el Océano Pacífico; al este, la zona de dunas, y al sur, la laguna de San Ignacio y el área de salitrales. La distancia más próxima entre *P. e. propinquus* y *P. e. fraterculus* son 100 kilómetros en una área con dunas caminantes.

Peromyscus eremicus sinaloensis Anderson

1972. *Peromyscus eremicus sinaloensis* Anderson, Bull. Amer. Mus. Nat. Hist., 148:342.

localidad típica. 26 mi NE Choix, Sinaloa.

Distribución. Por la vertiente oeste desde el sur de Sinaloa hasta la región norte y centro de Sonora, incluyendo las partes bajas del río Mayo y río Fuerte en Chihuahua (Anderson, 1972).

Registros. *SINALOA*. Culiacán (Osgood, 1909 como *P. e. anthonyi*). Culiacán (Hall, 1981). 26 mi NE Choix (Anderson, 1972). SONORA: Carimechi (Burt y Hooper, 1941como *P. e. anthonyi*). río Cuchujaqui; Bahía San Carlos; 6.7 mi N, 17.3 m E Navojoa; 0.5 mi N La Aduana; Playa Norte Bahía Bocochibampo (Cockrum y Bradshaw, 1963 como *P. e. anthonyi)*. Ortíz (Anderson, 1972).

Descripción. Subespecie distinguible por su coloración obscura rojiza; cola larga y molares pequeños (Anderson, 1972).

Medidas. Promedio e intervalo de seis ejemplares (Anderson, 1972) son: longitud total 198.1 (178-205); longitud de la cola, 110.9 (88-127); longitud de la pata, 19.8 (17-22); longitud de la oreja, 19.8 (19-20); longitud total del cráneo, 25.3 (24.4-26.2); anchura zigomática 12.9 (12.4-13.6); anchura interorbital, 4.0 (3.8-4.3); longitud del rostro, 7.62 (7.3-7.9); longitud de los dientes maxilares, 3.8 (3.7-4.0).

Comentarios. Esta subespecie se puede diferenciar del resto de las subespecies de *P. eremicus* por lo corto de los nasales, por el cráneo liviano y el rostro ancho, la fosa mesopterigoidea y lo grande de laa cola y las orejas.

Peromyscus eremicus tiburonensis Mearns

1897. *Peromyscus tiburonensis* Mearns, Proc, U. S. Nat. Mus., 19:720.

1909. *Peromyscus eremicus tiburonensis*, Osgood, N. Amer. Fauna, 28:250.

localidad típica. Isla Tiburón, Sonora.

Distribución. Conocido únicamente de la isla Tiburón, Sonora.

Registros. *SONORA*: Isla Tiburón (Mearns, 1897: Townsend, 1912). Batamotal; Ortíz; Isla Tiburón (Osgood, 1909).

Descripción. Osgood (1909), en la revisión del género, comenta que es más pequeño que *P. e. anthonyi* y que tiene el cráneo ligeramente diferente. Con respecto a la coloración es más oscuro que *P. eremicus*, similar a *P. e. anthonyi.* El ejemplar tipo es blanco ventralmente y sin la mancha pectoral. El cráneo es similar a *P. e. eremicus* pero más pequeño, con el rostro más deprimido; dientes y bula auditiva pequeños, en proporción al cráneo.

Medidas. Las medias del tipo Mearns (1897) son: longitud total, 170; longitud de la cola, 92; longitud de la pata, 18; longitud de la oreja, 15; longitud total del cráneo, 24; longitud condilobasal, 18.2; anchura zigomática, 12; longitud de los nasales, 8; longitud de los dientes maxilares, 3.4.

Comentarios. Osgood (1909) menciona que la única característica que distingue a *Peromyscus e. tiburonensis* de *P. e. anthonyi* es su menor tamaño. Al parecer, Mearns (1897) hace la descripción con un solo ejemplar, que es el mismo que revisa Osgood (1909), más otros tres de las localidades mencionadas; sin embargo, parece que es necesaria la revisión de esta subespecie para tener más argumentos que permitan su diferenciación y comprueben su validez. La Norma Oficial Mexicana (1994) la considera como amenazada de extinción.

Peromyscus eva eva Thomas

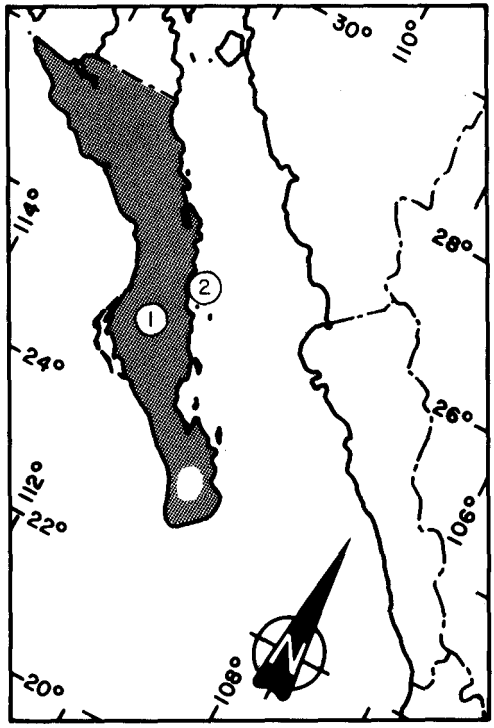
1898. *Peromyscus eva* Thomas, Ann. Mag. Nat. Hist., ser. 7, 1:44.

localidad típica. San José del Cabo, Baja California Sur.

Distribución. La especie se encuentra desde la Sierra de Santa Marta, en la parte media de la península, hasta la región de Los Cabos, no incluyendo la planicie del desierto de Vizcaíno, además de la isla del Carmen (Lawlor, 1971b), la subespecie nominal tiene la misma distribución, aunque no se encuentra en la isla del Carmen.

Registros. *BAJA CALIFORNIA*: Calmallí (Osgood, 1909; Lawlor, 1971b). *BAJA CALIFORNIA SUR*: Aguaje de Santana; Cabo San Lucas; Comondú; El Potrero; La Paz; Matancita; Paso Hondo; Pescadero; Bahía Playa María; San Ignacio; 20 mi W San Ignacio; San Jorge; San José del Cabo; Punta San Pablo; Santa Anita; Montañas de Santa Clara; Sierra [de La] Laguna; Tres Pachitas; Bahía Tortuga (Osgood, 1909). Mulege; Bahía Concepción; Montañas de San Bernardo; Miraflores (Townsend, 1912, como *P. eremicus polypolius*). Sierra de La Giganta, 600 m; Desierto de Santo Domingo; Sierra de La Giganta, 1200 m (Alvarez, 1958). San Ignacio; El Potrero; Puerto Escondido; Las Cruces; Bahía de los Muertos; San José del Cabo; Cabo San Lucas; Santa Anita; Miraflores; 12.1 mi NW San Bartolo; Pescadero; Tres Pachitas; La Laguna; San Antonio; Las Cruces; Todos Santos; Matancitas; San Jorge; El Patrocinio; 20 km W San Ignacio; Aguaje de Santana; Puerto Escondido (Lawlor, 1971b). Punta Trinidad (Avise *et al.*, 1974).

Descripción. En la revisión del género *Peromyscus*, Osgood (1909) comenta que *P. eva* es similar a *P. e. fraterculus*, pero la cola más es larga; pelaje más corto; color más rojizo; orejas en promedio más chicas; en apariencia similar a *Oryzomys*; cráneo esencialmente similar al de *P. eremicus*. La coloración dorsal es ocrácea amarillenta, mezclada conspícuamente con líneas obscuras uniformemente distribuidas, excepto en la parte baja de los costados; el efecto de la coloración de los costados es castaño rojizo con canela; línea lateral distinguible, en ocasiones más ancha en la parte media de los costados, de color ocráceo amarillento; cabeza, incluyendo la nariz, mejillas y



Localización de *Peromyscus eva*:
1. *P. e. eva* 2. *P. e. carmeni*

la región orbital, gris pálido mezclada con ocre; con un estrecho anillo alrededor de los ojos; orejas castaño pálido y prácticamente desnudas; parte ventral blanca sin la mancha pectoral; cola más obscura dorsalmente, aunque puede ser toda negruzca; patas blancas. El cráneo es similar al de *P. eremicus*, pero más pequeño y con la caja craneal más pequeña y angosta, y molares no robustos.

Medidas. La media y el intervalo de diez ejemplares (Osgood, 1909) son: longitud total, 198 (185-218); longitud de la cola, 114 (100-128); longitud de la pata, 20.4 (20-21); longitud de la oreja (en seco), 16.6 (15.6-17.2). Las siguientes medidas se establecieron para un ejemplar de Santa Anita (Osgood, 1909): longitud total del cráneo, 25; longitud condilobasal, 19.3; anchura zigomática, 12.7; anchura interorbital, 4; longitud de los nasales, 9.2; longitud pospalatal, 9; longitud de los dientes maxilares, 3.3.

Comentarios. Osgood (1909) comenta que es la forma más diferente de *P. eremicus* (en ese momento se consideraba una subespecie). Asemeja a un *Oryzomys* pequeño o alguna de las especies mexicanas de *Reithrodontomys*. *P. eva* se distribuye en todo el estado de Baja California Sur, teniendo áreas de simpatría con *P. eremicus*. Cabe la aclaración de que mucho del material de las colecciones debe de ser revisado para la correcta asignación a esta especie, ya que en su gran mayoría se encuentra como *P. eremicus*. Al ser considerada durante mucho tiempo como una subespecie de *P. eremicus*, Burt (1960) comenta de la diferencia del báculo entre *P. eva* y *P. eremicus*.

Lawlor (1971b) encuentra a las dos poblaciones en algunas localidades como simpátricas, y que se pueden dividir en dos especies con base en las siguientes características: *P. eva* es más grande en la longitud de cola; la anchura zigomática; longitud y anchura de los dientes maxilares, y la comisura del zigomático, que es poco profunda en comparación con *P. eremicus*; presenta 36 vertebras en la cola, contra 30-34 de *P. eremicus*. En *P. eva* el pelo es corto y con coloración amarillenta castaño de textura fina, con tendencia a tener gris en el rostro, y en *P. eremicus* tiene mezclas de castaño oscuro o negro. Posiblemente la característica más diagnóstica es el báculo, ya que en *P. eva* es delgado, con la punta cartilaginosa pequeña; base pequeña y redondeada.

Cromosómicamente es muy similar a *P. eremicus* (Lawlor, 1971b), por lo que se considera a *P. eremicus* como su ancestro. Esta especie es endémica de la península de Baja California con dos subespecies: una de la región peninsular y la otra de la isla Carmen.

Peromyscus eva carmeni Townsend

1912. *Peromyscus eremicus carmeni* Townsend, Bull. Amer. Mus. Nat. Hist., 31:126.

1971. *Peromyscus eva carmeni,* Lawlor, Occas. Paper Mus. Zool., Univ. Michigan, 661:17.

localidad típica. I sla Carmen, Golfo de California, Baja California Sur.

Distribución. Solamente conocida de Isla Carmen, Baja California Sur.

Registros. *BAJA CALIFORNIA SUR*: Isla Carmen (Townsend, 1912; Lawlor, 1971b; Avise *et al.*, 1974).

Descripción. Townsend (1912) menciona que la especie es similar a *P. e. eva*, pero de coloración más grisácea y menos anaranjado, teniendo la región ventral más crema; patas traseras largas; dientes grandes e hilera de dientes maxilares larga.

Medidas. Townsend (1912) menciona las siguientes: longitud total, 197; longitud de la cola, 111; y longitud de la pata trasera, 22.

Comentarios. Banks (1964b) menciona haber colectado un macho en la parte sur de la isla, con longitud testicular de 3.0 mm y una hembra sin actividad. Sánchez *et al.* (1997) colecta hembras preñadas en mayo y julio. La isla presenta una serranía en la parte centro, mientras que en el lado sur oeste se encuentra una planicie. En ambos sitios se intentó colectar esta especie, sólo siendo efectivas las colectas en la parte plana de la isla. La Norma Oficial Mexicana (1994) la considera como amenazada de extinción.

Peromyscus merriami merriami Mearns

1896. *Peromyscus merriami merriami* Mearns, Proc. U. S. Nat. Mus., 19:138.

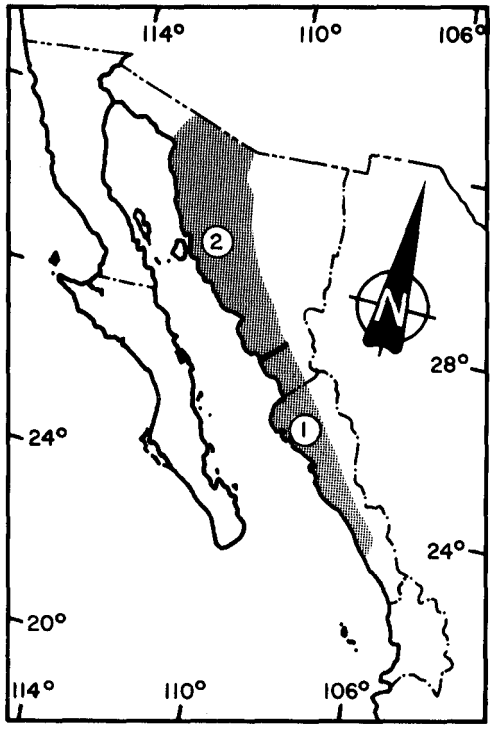
localidad típica. Sonoyta [Sonoita], Sonora.

Distribución. Desde el sur de Arizona, por toda la parte baja de Sonora, hasta el límite con Sinaloa (Hoffmeister y Lee, 1963).

Registros. *SONORA*: Sonoyta [Sonoita] (Mearns, 1896). 21 mi SSE Nogales; 23 mi S, 0.5 mi W La Casita; 10 mi S Casa Blanca; 0.5 mi N Puerto Libertad; 28 mi S Altar, 25 ft; Desemboque (Cockrum y Bradshaw, 1963; Hoffmeister y Lee, 1963). Presa Obregón (Lawlor, 1971a). 2 mi S, 0.5 mi W Casita, 3300 ft; 21 mi SSE Nogales; 23 mi S, 5 mi W Nogales, 3200 ft; 9 mi NNE Imuris; 2.5 mi N, 2 mi E Santa Ana; 1.5 mi N Puerto Libertad; 9 mi N, 11 mi E Hermosillo; 9 mi N, 25 m E Hermosillo; 3 mi W Esperanza, río Yaqui; 6 mi NNW Ciudad Obregón; 11 mi Cd. Obregón (Hoffmeister y Diersing, 1973). Cerca de Nogales (Avise *et al.*, 1974).

Descripción. Hoffmeister y Lee (1963) comentan que la especie se caracteriza por tener el báculo más largo que *P. eremicus* y la base en forma de espátula; patas traseras grandes, más de 21.6; orejas grandes, usualmente más de 20; frecuentemente con el proceso mastoideo prominente; cráneo grande, longitud total más de 25.8; y dientes maxilares más de 4.0; distancia interorbital ancha; borde posterior del paladar generalmente redondeado, sin el proceso medio; mancha pectoral ocrácea y ventralmente con tonos crema. La subespecie se caracteriza por su color pálido; cabeza grisácea pálida; patas blancas; cola bicolor, gris o amarillenta dorsal y blanco ventral; orejas grises y con poco pelo; orejas y patas grandes en proporción a la longitud total; cráneo relativamente ancho a largo; longitud de los dientes maxilares grande.

Medidas. La media y el intervalo de 26 ejemplares [de cerca de Arivaca en Arizona] (Hoffmeister y Lee, 1963) son: longitud total, 198.5 (185-218); longitud de la cola, 102.5 (96-113); longitud de la pata, 22.7 (22-23.0); longitud de la oreja, 21.0 (20-22); longitud total del cráneo, 26.1



Localización de *Peromyscus merriami*:
1. *P. m. goldmani* 2. *P. m. merriami*

(25.3-27.4); anchura mastoidea, 11.8 (11.5-12.4); anchura interorbital, 3.92 (3.6-4.1); longitud de los nasales, 9.3 (8.8-10.1); longitud de los dientes maxilares, 4.2 (4.0-4.4).

Comentarios. *Peromyscus merriami* se puede diferenciar de *P. eremicus*, por su tamaño más largo; cráneo más robusto, debido a lo grande de su arco zigomático; canal infraorbital grande y báculo grande (Lawlor, 1971b).

Hoffmeister y Lee (1963) comentan que el hábitat que ocupa está caracterizado por la presencia de grandes mesquites con un mínimo de rocas y pendientes. Commissaris (1960) menciona que se encuentra asociada principalmente a zonas con suelos profundos, y Lawlor (1971b), que prefiere las zonas riparias o los desiertos con densidad de arbustos.

El báculo de *P. merriami* es más largo que el de *P. eremicus*, además de que la curvatura es ventral, mientras que en *P. eremicus* es dorsal. Al respecto proporcionan diferentes medidas para *P. m. merriami*: longitud del báculo, 9.60 (8.33-10.51); ancho en la base, 1.65 (1.32-1.94), ancho en el cuerpo 0.5 mm antes de la punta, 0.273 (0.233-0.312) (Hoffmeister y Lee, 1963).

Peromyscus merriami goldmani Osgood

1904. *Peromyscus goldmani* Osgood, Proc. Biol. Soc. Washington, 17:75.

1952. *Peromyscus merriami goldmani*, Hall y Kelson, Univ. Kansas Publ., Mus. Nat. Hist., 5:368.

localidad típica. Alamos, Sonora.

Distribución. El sur de Sonora y las dos terceras partes del norte de Sinaloa, por la vertiente del Pacífico (Hoffmeister y Lee, 1963).

Registros. *SONORA*: Alamos (Osgood, 1904). 6 mi NNW Ciudad Obregón, 1 mi W Alamos; Vado Cuchijaqui, 9 mi ESE Alamos; 33 mi SSE Navojoa (Hoffmeister y Lee, 1963). 1 mi W Alamos; Vado Cuchijaqui, 9 mi ESE Alamos; 33 mi SSE Navajoa (Hoffmeister y Diersing, 1973). *SINALOA*: 6 mi N, 1.5 mi E El Dorado; 2.5 mi N El Fuerte; El Fuerte (Jones *et al*, 1962). 2.5 mi NE El Fuerte; El Fuerte; 13 mi NE Los Mochis; 4 mi N Terrero; 1 mi S Pericos; 12 mi N Culiacán; 6 mi N, 1.5 mi E El Dorado; 32 mi SEE Culiacán (Hoffmeister y Lee, 1963; Hoffmeister y Diersing, 1973).

Descripción. Hoffmeister y Lee (1963) la caracterizan por su color oscuro, en la fase gris; el dorso es gris con poco de castaño; ventralmente amarillento; mancha pectoral ocrácea; cola no

marcadamente bicolor, gris obscura dorsal y ligeramente más clara ventral o enteramente unicolor; patas blanco grisáceo; orejas castaños con pelos esparcidos; cola larga; orejas y patas relativamente cortas en proporción a la longitud total; cráneo largo; anchura mastoidea ancha en comparación con la longitud del cráneo.

Medidas. La media y el intervalo de ocho ejemplares de la parte central de Sinaloa (Hoffmeister y Lee, 1963) son: longitud total, 203.8 (183-215); longitud de la cola, 107 (98-119); longitud de la pata, 21.1 (20-23); longitud de la oreja, 19.7 (17-21); longitud total del cráneo, 26.5 (25.1-27.0); anchura mastoidea, 11.5 (11.2-11.9); anchura interorbital, 3.9 (3.8-4.1); longitud de los nasales, 9.6 (9.3-10.0); longitud de los dientes maxilares, 4.0 (3.7-4.2).

Comentarios. Hoffmeister y Lee (1963) mencionan que a pesar de examinar muy pocos ejemplares, pueden observar un clinal norte-sur dentro de la subespecie, pero a pesar de esto se pueden distinguir de *P. m. merriami.*

Hoffmeister y Lee (1963) comentan que no se tiene caracterizado el hábitat de esta subespecie, pero que puede ser similar al de *P. m. merriami.* Se tiene registros de hembras preñadas para el mes de noviembre (Jones *et al.*, 1962).

El báculo de *P. m. goldmani* es similar en forma al de *P. m. merriami* con las siguientes medidas: longitud total, 9.56 (8.72-10.30); ancho en la base, 1.53 (1.17-1.79); ancho en el cuerpo 0.5 mm antes de la punta, 0.258 (0.230-0.306) (Hoffmeister y Lee, 1963).

Peromyscus guardia guardia Townsend

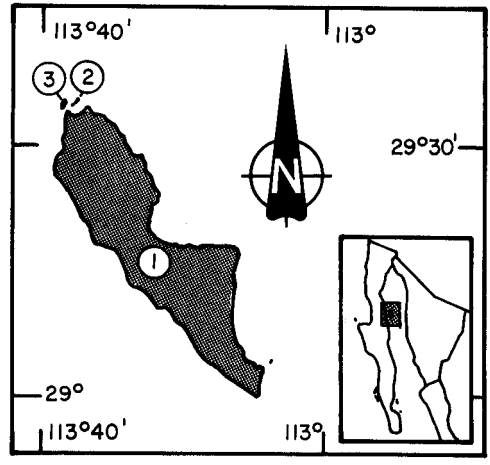
1912. *Peromyscus guardia* Townsend, Bull. Amer. Mus. Nat. Hist., 31:126.

localidad típica. Isla Angel de la Guarda, Golfo de California, Baja California.

Distribución. Restringido a la isla Angel de la Guarda, Golfo de California, Baja California.

Registros. *BAJA CALIFORNIA*: Isla Angel de la Guarda (Townsend, 1912; Banks, 1967b; Brand y Ryckman, 1968; Lawlor, 1971a; Avise *et al.*, 1974).

Descripción. Según Townsend (1912), esta especie puede ser diferenciada por ser más grande que *P. eremicus*; menos pálida; líneas externas del cráneo menos arqueadas; cráneo similar al de *P. eremicus*, pero el arco zigomático más comprimido anteriormente y el rostro más largo. Foramen de los incisivos corto no sin llegar a la línea formada por el borde anterior de los primeros molares superiores; fosa interpterigoidea ancha; bula auditiva grande.



Localización de *Peromyscus guardia*:
1. *P. g. guardia* 2. *P. g. harbisoni*
3. *P. g. mejiae*

Medidas. La media y el intervalo de 15 ejemplares (Banks, 1967b) son: longitud total, 206.3 (189-223); longitud de la cola, 112.9 (95-123); longitud total del cráneo, 26.4 (25.5-26.9); anchura del interparietal, 8.0 (7.2-8.8); longitud del paladar, 4.4 (4.2-4.6); longitud de los nasales, 9.4 (9.0-9.9).

Comentarios. Con respecto al origen de esta especie se tienen dos teorías: que esta especie, al igual que *P. interparietalis,* es descendiente de *P. eremicus*, por la invasión de Angel de la Guarda y la posterior desaparición de la unión entre ésta y San Lorenzo, o que cada una tiene su origen independiente de *P. eremicus* (Banks, 1967b; Brand y Ryckman, 1969; Lawlor, 1971b; Avise *et al.*, 1974). Aunque Carleton (1989) menciona similitud genética con *P. eremicus* de la península. Se puede distinguir de *P. eremicus* por ser de mucho mayor tamaño, por el rostro mucho más grande y el arco zigomático comprimido anteriormente.

Peromyscus guardia se restringe a isla Angel de la Guarda y a dos pequeñas islas que se encuentran al norte de ésta, que en algún momento debieron de ser parte de la primera, Granito y Mejía. Las tres islas son rocosas y las dos últimas muy pequeñas, con muy poca vegetación y hábitat muy poco diversificado. Hooper y Musser (1964) consideran, con base en las características del falo, que debe de ser una especie incluida en el grupo *eremicus*.

Lawlor (1971a) realiza un análisis para comparar esta especie con *P. interparietalis, P. eremicus, P. stephani* y *P. boylii*, para lo que utiliza la morfología relacionada con la osteología, pelaje, órganos sexuales externos y otros caracteres anatómicos, serológicos y citológicos.

Brand y Ryckman (1968) la colectan en las islas Mejía y Angel de la Guarda, principalmente en las playas rocosa, más que en el interior de la isla. Ellos infieren que al parecer estas poblaciones dependen más de la materia arrojada por el mar que de la vegetación de la isla.

Banks (1967b) comenta que el periodo reproductivo de la subespecie es a principios de la primavera; colectó en marzo una hembra con dos embriones de 15 mm y tres sin actividad. También obtuvo ejemplares con pelaje grisáceo. Brand y Ryckman (1968) colectan ejemplares en junio, de los cuales dos hembras estaban preñadas. Por otra parte realizan un análisis de entrecruzamientos de *P. guardia* y *P. interparietalis*, obteniendo híbridos fértiles en la primera generación, pero no alcanzan a determinar si son fértiles en la segunda, aunque los ejemplares exhiben condiciones de heterocigosis y son diferentes de sus padres en algunas medidas craneales y somáticas.

Mellink (1992a) hace el intento de colectar esta especie en Angel de la Guarda sin tener resultados y considera que las otras dos subespecies pueden estar actualmente extintas. La causa puede ser la introducción de especies exóticas y el establecimiento de campos pesqueros en las islas; los autores del presente, trabajo adquieren los mismos resultados para mayo de 1997.

Especie con tres subespecies, todas ellas endémicas de islas. La Norma Oficial Mexicana (1994) considera a *P. guradia* como en peligro de extinción.

Peromyscus guardia harbisoni Banks

1967. *Peromyscus guardia harbisoni* Banks, Jour. Mamm., 48:215.

localidad típica. Isla Granito, 29° 33' LN, 113° 34' LW, Golfo de California, Baja California.

Distribución. Restringido a la isla Granito, Golfo de California, Baja California.

Registros. *BAJA CALIFORNIA*: Isla Granito (Banks, 1967b; Lawlor, 1971a).

Descripción. Similar a *P. g. guardia*, pero de cola más pequeña; pálido dorsalmente y blanco ventralmente. Más pequeño que *P. g. mejiae*, mucho más pálido y cola con menos pelos que las dos subespecies anteriores.

Medidas. Las medias y el intervalo de ocho ejemplares (Banks, 1967b) son: longitud total, 201.8 (192-207); longitud de la cola, 104.3 (97-110); longitud total del cráneo, 26.3 (24.0-26.6); anchura

del interparietal, 7.7 (7.0-8.4); longitud del paladar, 4.3 (4.1-4.5); longitud de los nasales, 9.9 (9.4-10.8).

Comentarios. Banks (1967b) menciona que isla Granito también es conocida como isla Blanca o isla Alcatraz: su sustrato es muy claro, lo que contrasta con lo oscuro de isla Mejía. Con respeto a la reproducción, Banks (1967b) colecta para marzo dos hembras sin mostrar indicios de actividad reproductiva.

Mellink (1992a), después de hacer colectas en isla Granito, no obtiene ejemplares de *Peromyscus guardia*, más en cambio sí de *Rattus rattus*, por lo que considera a *P. g. harbisoni* como posiblemente extinta. En 1997 los autores del presente capítulo colectaron en la isla Granito obteniendo los mismos resultados que Mellink (1992a), además de colectar *Mus musculus*.

Peromyscus guardia mejiae Burt

1932. *Peromyscus guardia mejiae* Burt, Trans. San Diego Soc. Nat. Hist., 7:174.

localidad típica. Isla Mejía (29° 33' LN, 113° 35' LW), Golfo de California, Baja California.

Distribución. Restringido a la isla Mejía, Golfo de California, Baja California.

Registros. *BAJA CALIFORNIA*: Isla Mejía (Burt, 1932a; Banks, 1967b; Brand y Ryckman, 1968; Lawlor, 1971a).

Descripción. Similar a *P. g. guardia* pero más grande y oscuro; dorsalmente oscuro con entrepelado "canela-vináceo claro" y ventralmente blanco. El cráneo es más grande y angosto (Burt, 1932a). Banks (1967b) menciona que ésta tiene la cola más grande de las tres subespecies.

Medidas. Las medias y el intervalo de seis ejemplares (Banks, 1967b) son: longitud total, 210.5 (206-216); longitud de la cola, 115.8 (111-122); longitud total del cráneo, 26.6 (25.7-27.2); anchura del interparietal, 7.9 (7.2-8.5); longitud del paladar, 4.4 (4.2-4.6); longitud de los nasales, 9.8 (9.3-10.1).

Comentarios. Burt (1932a) considera que la causa de la diferencia entre las subespecies es el canal que separa las islas Mejía y Angel de la Guarda. Banks (1967b) comenta que la isla Mejía presenta un substrato muy oscuro. Brand y Ryckman (1968) colectan en junio en la isla y no obtienen hembras preñadas.

Mellink (1992a) realiza coletas en isla Mejía, obteniendo que la población de *P. g. mejiae* debe de tener problemas muy severos o puede ser considerada como extinta. En la isla solamente se colecto *Mus musculus*. Los que suscriben, en 1997 obtuvieron los mismos resultados.

Peromyscus interparietalis interparietalis Burt

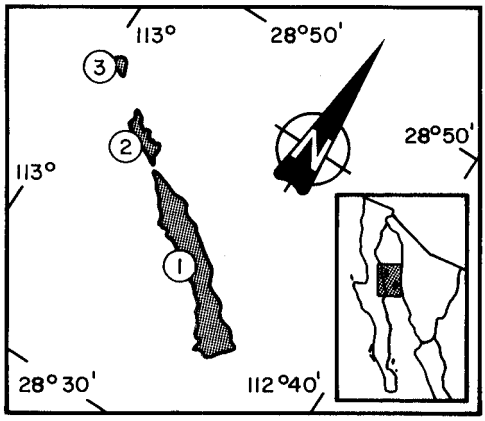
1932. *Peromyscus interparietalis* Burt, Trans. San Diego Soc. Nat. Hist., 7:175.

localidad típica. Isla San Lorenzo Sur, Baja California.

Distribución. Restringido a la isla de San Lorenzo Sur, Baja California.

Registros. *BAJA CALIFORNIA*: isla San Lorenzo Sur (Burt, 1932a; Banks, 1967b; Lawlor, 1971a; Doty y Kart, 1972; Avise *et al.*, 1974).

Descripción. Burt (1932a) menciona que es similar a *P. guardia*, pero con la pata trasera más chica y la cola más corta. El cráneo se diferencia de *P. guardia* por lo ancho de la fosa interpterigoidea; el foramen de los incisivos termina al nivel de los primeros molares superiores; interparietal muy ancho. Se diferencia del resto de las especies por la anchura del interparietal.



Localización de *Peromyscus interparietalis*:
1. *P. i. interparietalis* 2. *P. i. lorenzi*
3. *P. i. ryckmani*

Medidas. Promedio e intervalo de 16 ejemplares examinados por Banks (1967b) son: longitud total, 201.0 (187-212); longitud de la cola, 110.0 (98-117); longitud del cuerpo, 90.9 (85-99); longitud total del cráneo, 25.8 (25.0-27.2); anchura del interparietal, 9.33 (8.8-9.9); longitud del palatal, 3.8 (3.6-4.1); longitud de los nasales, 9.4 (8.8-10.0).

Comentarios. Esta especie se restringe al archipiélago de Salsipuedes, San Lorenzo Norte (o Animas) y San Lorenzo Sur (o San Lorenzo), que por algún periodo de tiempo debieron haber sido una sola isla y anterior a esto estar conectadas a la península. En general estas islas son rocosas con muy poca vegetación y hábitat muy poco diversificado.

Banks (1967b) considera que esta especie es un linaje de *P. eremicus*, teniendo similaridad genética con *P. eremicus* de la península (Carleton, 1989). Se puede diferenciar de *P. eremicus* y *P. guardia* por lo ancho del interparietal; el foramen de los incisivos no cruza el plano de los molariformes; el cráneo es aplanado en la base de los arcos zigomáticos; el borde posterior de los nasales es redondo más que cuadrados y por la anchura del interparietal (Banks, 1967b).

Lawlor (1971a) realiza un análisis de la osteología, pelaje, órganos sexuales externos y otros caracteres anatómicos, serológicos y citológicos de esta especie, comparándola con *P. guardia, P. eremicus, P. stephani* y *P. boylii*.

Brand y Ryckman (1968) la colectan principalmente en las playas rocosa, más que en el interior de la isla, por lo que infieren que al parecer dependen más de la materia arrojada por el mar que de la vegetación de la isla.

Brand y Ryckman (1969) realizan un análisis de entrecruzamientos de *P. interparietalis* y *P. eremicus*, obteniendo que los híbridos son fértiles en F1 y F2, aunque consideran que el número de crías disminuirá por generación, quedando híbridos intermedios entre los padres en algunos aspectos, pero exhiben condiciones de heterocigosis y son diferentes de sus padres en algunas medidas craneales y somáticas.

Con respecto al tracto reproductivo, Linzey y Layne (1969) encontraron que la glándula vesicular está menos curvada: la próstata dorsal observada en *P. eremicus* no se encuentra en *P. interparietalis*.

Mellink (1992a), sin realizar ningún monitoreo sobre las tres subespecies de *P. interparietalis*, comenta que sus poblaciones pueden ser altamente vulnerables por la introducción de fauna exótica a las islas en las que habitan. Especie con tres subespecies, todas ellas endémicas de las islas. La Norma Oficial Mexicana (1994) la considera como especie rara.

Peromyscus interparietalis lorenzi Banks

1967. *Peromyscus interparietalis lorenzi* Banks, Jour. Mamm., 48:216.

localidad típica. Isla San Lorenzo Norte [Animas], Baja California.

Distribución. Restringido a la isla de San Lorenzo Norte [Animas], Baja California.

Registros. *BAJA CALIFORNIA*: isla San Lorenzo Norte (Banks, 1967b; Lawlor, 1971a).

Descripción. Similar a *P. i. interparietalis,* pero más pequeña en la longitud total y más grande en la longitud del cuerpo; por consiguiente, con la cola relativamente corta. Hueso del paladar más largo que en *P. i. interparietalis*; interparietal angosto, rara vez extendido; sutura entre escuamosal y parietal; pelo mucho más castaño, canela amarillento más que gris, con la línea canela más ancha.

Medidas. La media e intervalo de 19 ejemplares examinados por Banks (1967b) son: longitud total, 194.7 (187-215); longitud de la cola, 98.5 (90-110); longitud del cuerpo, 96.2 (91-105); longitud total del cráneo, 25.6 (24.9-26.5); anchura del interparietal, 8.8 (8.1-9.4); longitud del palatal, 4.1 (3.9-4.4); longitud de los nasales, 9.6 (9.1-10.3).

Comentarios. La isla de San Lorenzo Norte es considerada en gran cantidad de mapas como Animas. Banks (1967b) colecta en marzo una hembra con cuatro embriones grandes. Registra además un nido de diámetro de cuatro pulgadas bajo las piedras y con la apariencia de un nido de pájaro. Observaciones y colectas realizadas en mayo por quienes suscriben registran hembras lactantes y con presencia de embriones y machos con escrotación. La Norma Oficial Mexicana (1994) la considera como amenazada de extinción.

Peromyscus interparietalis ryckmani Banks

1967. *Peromyscus interparietalis ryckmani* Banks, Jour. Mamm., 48:216.

localidad típica. Isla Salsipuedes (28° 45' LN, 112° 59' LW), Golfo de California, Baja California.

Distribución. Restringido a la isla de Salsipuedes, Baja California.

Registros. *BAJA CALIFORNIA*: Isla Salsipuedes (Banks, 1967b; Brand y Ryckman, 1968; Lawlor, 1971a).

Descripción. La coloración de los ejemplares es castaño y en general es muy similar a *P. i. interparietalis* y *P. i. lorenzi*, pero más pequeño, de cola más corta y de vientre más blanco. Se diferencia además de *P. i. interparietalis* por el cráneo más corto y el hueso del paladar más largo.

Medidas. La media y el intervalo de ocho ejemplares examinados por Banks (1967b) son: longitud total, 189.4 (182-198); longitud de la cola, 98.1 (96-104); longitud del cuerpo, 92.0 (86-99); longitud total del cráneo, 25.0 (24.4-25.6); anchura del interparietal, 9.0 (8.5-9.5); longitud del palatal, 4.0 (3.9-4.1); longitud de los nasales, 9.4 (9.0-9.9).

Comentarios. Banks (1967b) colecta ejemplares con pelaje juvenil en junio y octubre. Brand y Ryckman (1968) colectan seis hembras preñadas en junio. Estos autores realizan un estudio del crecimiento de crías en laboratorio y concluyen entre otras cosas que, bajo estas condiciones, la especie se reproduce durante todo el año. En este trabajo presentan datos del desarrollo diario de las crías y registran que tienen el número máximo de crías en mayo. Observaciones y colectas realizados en mayo de 1997 por quienes suscriben, señalan que los ejemplares mostraron actividad reproductiva, hembras lactantes y con presencia de embriones y machos con escrotación.

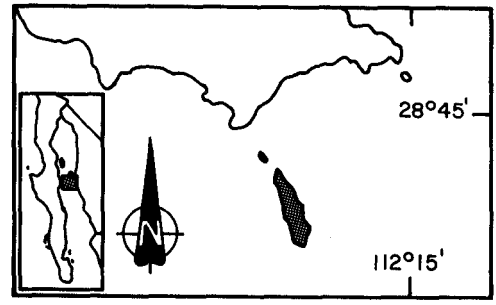
Peromycus collatus Burt

1932. *Peromycus collatus* Burt, Trans. San Diego Soc. Nat. Hist., 7:172.

localidad típica. Isla Turner (28° 34' LN, 112° 19' LW), Golfo de California, Sonora.

Distribución. Restringido a isla Turner, Sonora.

Registros. *SONORA*: isla Turner (Burt, 1932a; Lawlor, 1971a como *P. eremicus*).



Localización de *Peromyscus collatus*.

Descripción. Burt (1932a) la considera como un miembro del grupo *crinitus*. Externamente similar a *P. eremicus tiburonensis*, principalmente en la coloración y el pelaje; coloración más obscura que *P. crinitus stephensi*, y del tamaño de *P. e. tiburonensis* y *P. c. stephensi*. Cráneo y arco zigomático comprimido anteriormente; rostro deprimido, corto y ancho; el primero y segundo molares superiores con cúspides rudimentarias, como en *P. c. stephensi*, pero diferentes de ésta en la anchura; rostro corto con incisivos relativamente anchos; bula auditiva menos inflada.

Medidas. La media de diez ejemplares según Burt (1932a) es: longitud total, 174; longitud de la cola, 94; longitud de la pata, 20; longitud de la oreja, 15; longitud total del cráneo, 24.0; longitud condilobasal, 21.3; anchura zigomática, 12.3; anchura interorbital, 3.9; longitud de los nasales, 8.7; longitud de la hilera de dientes maxilares, 3.5.

Comentarios. Burt (1932a) menciona que *P. collatus* combina las características externas de *P. eremicus* y las craneales de *P. crinitus*. Hooper y Musser (1964), después de revisar el falo, consideran que es similar al de *P. eremicus*, por lo que debe ser considerado dentro de este grupo. Esto contradice lo mencionado por Burt (1932a) en cuanto a que *P. collatus* es del grupo *crinitus*. La isla Turner también es conocida como isla Dátil. La Norma Oficial Mexicana (1994) la considera como amenazada de extinción.

Peromyscus dickeyi Burt

1932. *Peromyscus dickeyi* Burt, Trans. San Diego Soc. Nat. Hist., 7:176.

localidad típica. Isla Tortuga, Golfo de California, Baja California [Sur].

Distribución. Isla Tortuga, Baja California Sur.

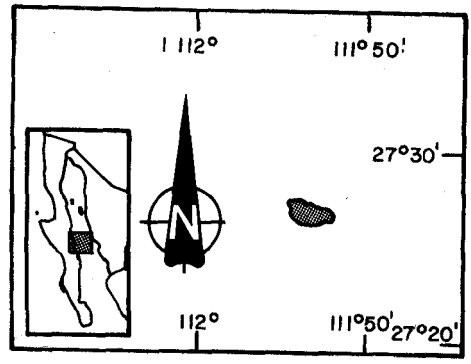
Registros. *BAJA CALIFORNIA SUR*: Isla Tortuga (Burt, 1932a; Avise *et al.*, 1974).

Descripción. Burt (1932a) comenta que la coloración dorsal es obscura mezclada con "canela-rosado"; orejas obscuras; línea lateral presente; planta de la pata desnuda; cola bicolor; ventralmente blanco con entrepelados "canela-rosado"; los juveniles son gris oscuro. El cráneo es ancho y de aspecto cuadrado; arcos zigomáticos casi paralelos; rostro robusto; nasales anchos anteriormente; premaxilares proyectándose posteriormente al límite de los nasales; incisivos robustos; bulas auditivas pequeñas; mandíbula fuerte.

Medidas. La media de 17 ejemplares registrados por Burt (1932a) son: longitud total, 191; longitud de la cola, 91; longitud de la pata, 22; longitud de la oreja, 20; longitud total del cráneo,

26.6; longitud condilobasal, 24.3; anchura zigomática, 13.6; anchura interorbital, 4.0; longitud de los nasales, 9.8; longitud de los dientes maxilares, 4.5.

Comentarios. Hooper y Musser (1964), al revisar el falo de esta especie, consideran que, por su parecido con *P. eremicus*, debe de ser incluida como especie del grupo *eremicus*. Carleton (1989) propone, con base en el parecido morfológico y genético, que se originó de *P. eremicus*. La Norma Oficial Mexicana (1994) la menciona como una especie rara.



Localización de *Peromyscus dickeyi*.

La eficiencia de colecta en 1997 fue del 9%. Se encontro asocida principalmente a las laderas rocosas (Cortés-Calva y Alvarez-Castañeda, en prensa). En la isla fueron muy abundantes las viboras de cascabel.

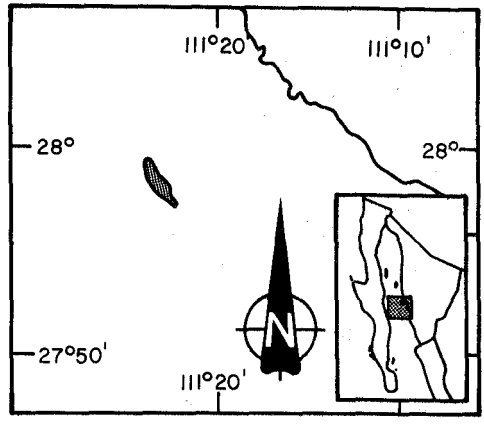
Peromycus pembertoni Burt

1932. *Peromycus pembertoni* Burt, Trans. San Diego Soc. Nat. Hist., 7:176.

localidad típica. Isla San Pedro Nolasco (27° 58' LN, 111° 24' LW), Sonora.

Distribución. Restringido a la isla San Pedro Nolasco, Sonora.

Registros. *SONORA*: isla San Pedro Nolasco (Burt, 1932a; Lawlor 1971b)



Localización de *Peromyscus pembertoni*.

Descripción. Según Burt (1932a), los ejemplares de esta especie son de cuerpo grande y cola corta, similar a *P. dickeyi*. La coloración dorsal es "canela-vináceo claro" mezclada con finas líneas negras, más pálida que *P. dickeyi*; cabeza más pálida que el dorso; cola bicolor, castaño dorsal y blanca ventral; vientre blanco. El cráneo se diferencia de *P. dickeyi*, por ser más robusto; anchura del zigomático angosta anteriormente; sutura entre los frontales y el parietal forman un ángulo en la línea media; interparietal ancho anteroposteriormente; rostro fuerte como en *P. dickeyi*; los premaxilares se extienden por atrás de los nasales.

Medidas. Según Lawlor (1971b), las medias y la desviación estándar de siete ejemplares adultos son: longitud total, 210.6 ± 2.0; longitud de la cola, 104.9 ± 0.05; longitud de la pata, 24.5 ± 0.20; longitud total del cráneo, 27.3 ± 0.18; anchura mastoidea, 12.2 ± 0.05; anchura zigomática, 14.3 ± 0.07; longitud de los nasales, 10.1± 0.07; longitud de los dientes maxilares, 4.4 ± 0.04.

Comentarios. San Pedro Nolasco es una de las dos islas del Golfo de California que tiene dos especies de *Peromyscus* (Burt, 1932a). Lawlor (1971b) considera que *P. pembertoni* se derivó de *P. merriami*; además menciona que el báculo es más largo que en *P. merriami*, pero que esta especie es más parecida a ésta que a *P. eremicus*. Lawlor (1971b) menciona no haber tenido éxito en la colecta de *P. pembertoni* en la isla de San Pedro Nolasco.

En 1997 los autores del trabajo presente trampearon en la isla de San Pedro Nolasco, no obteniendo a la especie, mas sí varios ejemplares de *P. boylii*. Cabe destacar que el hábitat de la isla se encuentra en buenas condiciones sin que muestre gran alteración, lo que dificulta pensar que la especie pueda estar extinta. Por otro lado, Bernardo Villa (*com. pers.*) comenta que a principio de los ochentas estuvo buscando intensamente esta especie en la isla, sin éxito. Actualmente esta especie se considera como extinta, aunque la Norma Oficial Mexicana (1994) la registra como en peligro de extinción.

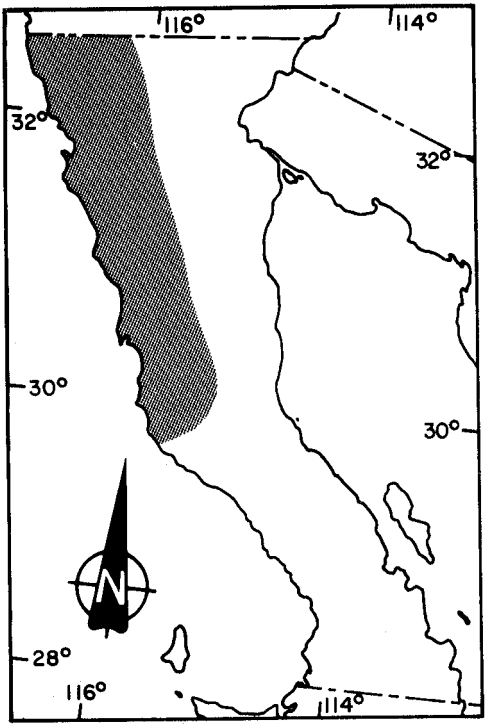
Peromyscus californicus insignis Rhoads

1895. *Peromyscus insignis* Rhoads, Proc. Acad. Nat. Sci. Philadelphia, 47:33.
1907. *Peromyscus californicus insignis*, Mearns, Bull. U. S. Nat. Mus., 6:429.

localidad típica. Dulzura, Condado de San Diego.

Distribución. La especie ocurre desde California hasta la parte noroeste de Baja California. *Peromyscus californicus insignis*, de San Quintín, por la vertiente del Pacífico, hasta California.

Registros. *BAJA CALIFORNIA*: San Pedro Mártir, 4300 ft (Allen, 1893). Ensenada; Trinidad; Las Encinas; Rosarito; División Rosarito; Montes San Pedro Mártir; San Quentin [Quintín] (Elliot, 1903). 20 mi E, 1 mi S Tecate; 7.5 mi WSW Maneadero: En el Valle de la Trinidad (Smith, 1979).



Localización de *Peromyscus californicus insignis*.

Descripción. Según Osgood (1909), es similar a *P. c. californicus*, pero ligeramente más pequeño y pálido; cráneo pequeño; molares menos robustos. La coloración dorsal es rojiza aleonada, siendo grisácea en la región del lomo, mientras que los costados son mayormente rojizos; con castaño verdoso en la cabeza, a excepción de las mejillas, que están bordeadas por abajo con una línea rojiza; la región dorsal, mezclada con pelos negros, principalmente en la zona central del lomo; costados mucho más pálidos; ventralmente blanco crema, a excepción de la base de la cola que es rojizo; mancha pectoral usualmente ausente; extremidades amarillo rojizas, siendo más oscuras cerca de los carpos; manos

y patas blancas, con un línea obscura que se extiende las piernas hacia las patas; anillo oscuro alrededor de los ojos; cola bicolor, obscura y blancuzca sin mucho contraste. El cráneo es grande, de proporciones regulares; nasales moderados; bula auditiva grande; molares robustos; patrón del primero y segundo molares superiores con dos involuciones simples del lado externo.

Medidas. Las medias y el intervalo de seis ejemplares topotípicos (Osgood, 1909) son: longitud total, 233 (220-245); longitud de la cola, 134 (124-140); longitud de la pata, 25; longitud de la oreja (en seco), 20.3 (20-20.7). Las medidas craneales de un ejemplar son: longitud total, 28.5; longitud condilobasal, 21.5; anchura zigomática, 14.2; anchura interorbital, 4.5; longitud de los nasales, 10.3; longitud pospalatal, 10.2; longitud de los dientes maxilares, 4.

Comentarios. Del análisis del tracto reproductivo, Linzey y Layne (1969) observan que para esta especie la vesícula es curvada como en *P. eremicus,* y las dos prostatas ventrales son apróximadamente del mismo tamaño.

Peromyscus maniculatus Wagner

1845. *Hesperomyscus maniculatus* Wagner, Wiegmann's Arch. Für Naturgesch., Jahng. 11, 1:148.

1898. *Peromyscus maniculatus*, Bang, Amer. Nat., 32:496.

localidad típica. Moravian Settlements en Labrador.

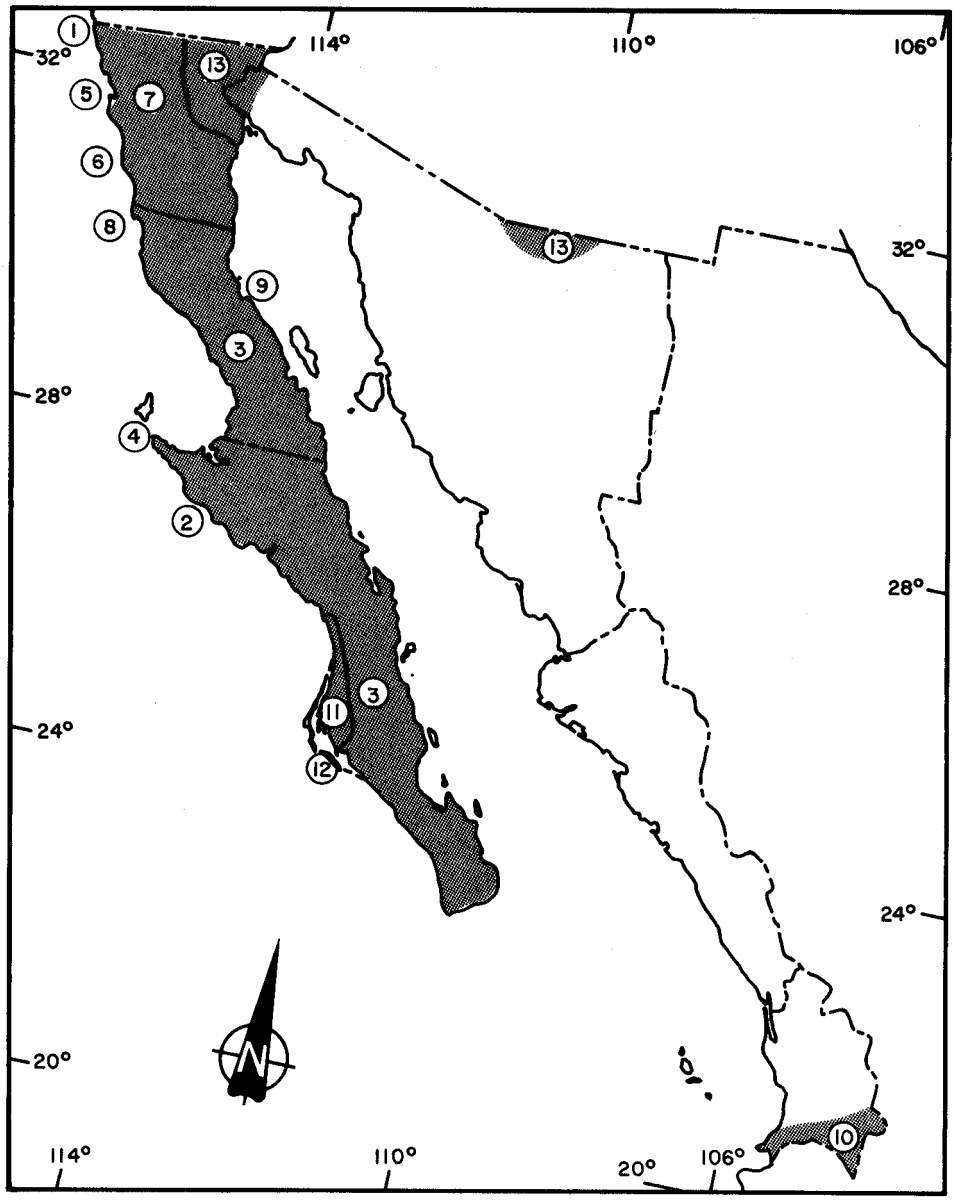
Distribución. Desde Canadá, con excepción del sureste de los Estados Unidos, hasta el altiplano central de México, incluyendo la península de Baja California (Hall, 1981).

Descripción. Según Osgood (1909), los organismos son de tamaño medio; cola moderadamente larga; región media dorsal poco contrastada; la parte interna de las patas peluda, excepto en los cojinetes y entre ellos; cola muy peluda y bicolor. La parte dorsal y los laterales son de coloración castaño oscuro; región media dorsal obscura, desde la parte de atrás de los hombros y extendiéndose hasta la base de la cola; región orbital y base de la barba negras; orejas obscuras; región prearicular con mechones de pelos blanquecinos; parte interna de las extremidades blancas; patas blancas; cola bicolor, siendo de color castaño oscuro en la porción dorsal mientras que ventralmente es blanca. Los organismos juveniles tienen la cabeza, laterales y partes internas de color sepia, producto de una combinación de negro y rojizo; región media dorsal, hasta la base de la cola obscura, con ligera mezcla de tonos claros; cola intensamente obscura; orejas obscuras como en los adultos, mientras que los más juveniles son de matices grisáceos, y en las partes internas de las extremidades, blanquecinos. El cráneo es tan largo como en *P. m. gracilis*; caja craneal amplia y aplanada, poco profunda; nasales largos y angostos; rostro ligero; palatino ligero proporcionalmente grande y paralelo a los lados.

Comentarios. Hooper (1958) realiza una minuciosa descripción del falo de esta especie y la utiliza como patrón para la descripción de todas las especies del género *Peromyscus*. Siendo de la mitad de la longitud de la pata trasera, el glande es un cuarto de la longitud total.

Linzey y Layne (1974) realizan la descripción de los espermatozoides de la especie, dando las siguientes medidas (micrones): longitud de la cabeza, 5.2 ± 0.08; anchura de la cabeza, 3.0 ± 0.05; longitud de la parte media, 16.7 ± 0.08; longitud de la cola 53.1 ± 1.53.

Osgood (1909) hace mención de que el *maniculatus* típico es muy similar a las subespecies de *arcticus*, pero tiene la cola ligeramente más larga y con algunas diferencias del cráneo. Mientras que para *gracilis* se diferencia por la longitud de la cola, la coloración obscura, la gran extensión de la coloración obscura dorsal y los caracteres craneales, siendo notable el ancho y lo aplanado de la caja cerebral.



Localización de *Peromyscus maniculatus*:

1. *P. m. assimilis*
2. *P. m. cineritius*
3. *P. m. coolidgei*
4. *P. m. dorsalis*
5. *P. m. dubius*
6. *P. m. exiguus*
7. *P. m. gambelii*
8. *P. m. geronimensis*
9. *P. m. hueyi*
10. *P. m. labecula*
11. *P. m. magdalenae*
12. *P. m. margaritae*

Especie con 13 subespecies en el noroeste de México, que se distribuyen en diferentes islas, en la península y en la región continental.

Peromyscus maniculatus assimilis Nelson y Goldman

1931. *Peromyscus maniculatus assimilis* Nelson y Goldman, Jour. Mamm., 12:305.

localidad típica. Isla Coronadas, Oceáno Pacífico, Baja California.

Distribución. Isla Coronadas, Baja California.

Registros. *BAJA CALIFORNIA*: Isla Coronadas (Mearns, 1896; Osgood, 1909; Nelson y Goldman, 1931c).

Descripción. Subespecie grande y obscura, similar a *P. m. dubius* en apariencia externa, pero cranealmente tiene sus diferencias. La cabeza y la parte anterior del lomo es castaño canela, en contraste con la parte posterior del lomo y la cadera, que tiene entrepelado negro; costado canela; ventralmente de manera general blancuzco; región inguinal y una pequeña área en la base de la cola ocráceo amarillenta; parte interna de los miembros posteriores blanquecinos, y la externa, castaño con oscuro; patas blancas; cola ligeramente bicolor. Cráneo similar en forma y tamaño al de *P. m. dubius*, pero el rostro menos curvado y el frontal menos convexo cerca de la raíz anterior del zigomático; la sutura fronto-parietal forma un ángulo agudo; ramas ascendentes del premaxilar ligeramente más posteriores; interparietal ancho.

Medidas. Las medidas del tipo (Nelson y Goldman, 1931c) son: longitud total, 178; longitud de la cola, 80; longitud de la pata (en seco), 22.5; longitud total del cráneo, 25.6; longitud condilobasal, 24.2; anchura zigomática, 13.0; anchura interorbital, 4.2; longitud de los nasales, 10; longitud de los dientes maxilares, 4.

Comentarios. Osgood (1909), en la revisión del género *Peromyscus,* considera que los ejemplares de isla Coronados [Coronadas] deben de ser incluidos en *Peromyscus maniculatus dubius*. Nelson y Goldman (1931c) al revisar el mismo material que Osgood (1909), mencionan que existen caracteres suficientes para considerar a la población de esta isla como diferente.

Peromyscus maniculatus cineritius J. A. Allen

1898. *Peromyscus cineritius* Allen, Bull. Amer. Mus. Nat. Hist., 10:155.

1909. *Peromyscus maniculatus cineritius*, Osgood, N. Amer. Fauna, 26:100.

localidad típica. Isla San Roque, Oceáno Pacífico, Baja California [Sur].

Distribución. Isla San Roque, Baja California Sur.

Registros. *BAJA CALIFORNIA SUR*: Isla San Roque (Allen, 1898; Osgood, 1909).

Descripción. Tamaño grande; coloración gris claro. Dorsalmente de color gris "ceniza", entremezclado con tonos oscuros en la punta del pelo y tonos amarillo-rojizos; ventralmente blanco hasta la base de la piel; patas blancas; cola bicolor, dorsalmente castaño oscuro y ventralmente más clara; la punta a manera de pincel.

Medidas. Las medidas del organismo tipo (Allen, 1898) son: longitud total, 191; longitud de la cola, 83; longitud de la pata, 21; longitud de la oreja, 15; longitud total del cráneo, 27.5; anchura mastoidea, 11.0; anchura interorbital, 3.3; longitud de los nasales, 9.5.

Comentarios: Esta especie es miembro del grupo *texanus*, pero difiere de los demás miembros por la coloración y el gran tamaño (Allen, 1898). Osgood (1909) comenta que es la subespecie que

más fácilmente se puede distinguir de las formas insulares por su coloración grisácea, la cual es equivalente a la de subadultos de otras subespecies.

La isla es una pequeña meseta que sobresale en el Oceáno Pacífico; la vegetación perenne es prácticamente inexistente, y se pueden concentrar plantas anuales. En 1946 se establece en la isla un grupo de exploradores de guano que trabajan hasta 1977; durante este periodo es introducida en la isla la rata negra, que es controlada con venenos. Al parecer este control, junto con la competencia, tuvo mayor acción sobre las poblaciones de roedores nativos que sobre los introducidos, extinguiendo a los primeros (Alvarez-Castañeda y Cortés-Calva, 1996). La Norma Oficial Mexicana (1994) la considera como amenazada de extinción.

Peromyscus maniculatus coolidgei Thomas

1898. *Peromyscus leucopus coolidgei* Thomas, Ann. Mag. Nat. Hist., ser. 7, 1:45.

1909. *Peromyscus maniculatus coolidgei*, Osgood, N. Amer. Fauna, 28:94.

localidad típica. Santa Anita, Región del Cabo, Baja California [Sur].

Distribución. Desde San Quintín, toda la península al sur, con excepción de la costa del Pacífico; desde el norte de bahía Magdalena, al sur de la laguna de San Ignacio (Goldman, 1909), incluyendo isla Smith (Laylor, 1971b).

Registros. *BAJA CALIFORNIA*: Rosario; San Andrés; San Fernando; San Francisquito (Osgood, 1909). Rosario; San Francisquito, Isla Smith (Lawlor, 1971b). Pista de Santa Catalina (Calhoun *et al.*, 1988). *BAJA CALIFORNIA SUR*: Bahía Tortuga; Santa Rosalía; Agua Dulce; San Ignacio; 20 mi W San Ignacio; Santo Domingo; Santa Anita; San José del Cabo; Cabo San Lucas (Osgood, 1909).

Descripción. Según Goldman (1909), es más grande que *P. m. gambeli*, como *P. m. sonoriensis*; color pálido y más ocráceo que *P. m. gambeli*, incluso más pálido que *P. m. sonoriensis*. La coloración del pelo sin desgaste (Goldman, 1909) es: lomo, cabeza y costados de color ocráceo amarillento claro, mezclado y uniformemente oscuro, dando apariencia general de color arcilla; línea lateral poco notoria; orejas blancuzcas con manchas notorias a la base; ventralmente completamente blanco; patas, piernas y tarsales blancos; cola bicolor, castaño-grisáceo dorsal y blanco ventral. Con respecto al cráneo, éste es más pequeño que el de *P. m. sonoriensis*.

Medidas. Las medias y el intervalo de siete ejemplares examinados por Osgood (1909) de la región de los cabos son: longitud total, 171 (162-178); longitud de la cola, 82 (79-86); longitud de la pata, 21; longitud de la oreja (seca), 16.3 (15.4-18); longitud total del cráneo, 25.4; longitud condilobasal, 20; anchura zigomática, 13.4; anchura interorbital, 3.8; longitud de los nasales, 9.4; longitud pospalatal, 9.2; longitud de los dientes maxilares, 3.9.

Comentarios. Osgood (1909) menciona que las diferencias entre *P. m. coolidgei* y *P. m. sonoriensis* son prácticamente mínimas, siendo la coloración la más conspicua, ligeramente más clara que la primera. Lawlor (1971b) registra ejemplares colectados en la isla Smith, cerca de bahía de los Angeles, como *P. maniculatus*. Menciona que es conocida localmente como Coronados y que con predominancia de Cholla y Cardones. Hall (1981) lo asigna a *P. m. coolidgei*.

Peromyscus maniculatus dorsalis Nelson y Goldman

1931. *Peromyscus maniculatus dorsalis* Nelson y Goldman, Jour. Washington Acad. Sci., 21:535.

localidad típica. Isla Natividad, Baja California [Sur].

Distribución. Conocida solamente de la localidad tipo.

Registros. *BAJA CALIFORNIA SUR*: isla Natividad (Osgood, 1909; Nelson y Goldman, 1931b).

Descripción. Según Nelson y Goldman (1931b), es similar a *P. maniculatus geronimensis,* pero menos amarillento; la parte posterior del lomo pálido; cadera entrepelado con negro. Coloración de la cabeza y parte del lomo gris o castaño amarillento pálido, lo que contrasta con la parte posterior del lomo y la cadera, que son de color amarillo rosado con entrepelado negro dorsal; costados castaños amarillentos; ventralmente blanquecino; patas traseras blancas; parte externa castaño amarillento; pies blancos; orejas obscuras con el borde blanco; cola bicolor, castaño dorsal y blancuzca ventral. El cráneo es similar al de *P. m. geronimensis*, pero los nasales son más anchos; menos adelgazado anteriormente; pared externa del foramen interorbital ancha y el margen anterior redondeado. Al comparar con *P. m. coolidgei* de la península, el cráneo es más grande, robusto y los mismos detalles señalados para *P. m. geronimensis*.

Medidas. Las medidas del tipo (Nelson y Goldman, 1931b) son: longitud total, 177; longitud de la cola, 73; longitud de la pata (piel seca), 22.5; longitud total del cráneo, 26.1; longitud condilobasal, 3.3; anchura zigomática, 23.5; anchura interorbital, 24.2; longitud de los nasales, 9.8; longitud de los dientes maxilares, 4.0.

Comentarios. Osgood (1909) considera los ejemplares de esta isla como *P. m. geronimensis.* La Norma Oficial Mexicana (1994) la considera como amenazada de extinción.

Peromyscus maniculatus dubius J. A. Allen

1898. *Peromyscus dubius* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 10:157.

1909. *Peromyscus maniculatus dubius*, Osgood, N. Amer. Fauna, 28:98.

localidad típica. Isla Todos Santos, Oceáno Pacífico, Baja California.

Distribución. Conocida únicamente en la localidad tipo.

Registros. *BAJA CALIFORNIA*: Isla Todos Santos (J. A. Allen, 1898; Osgood, 1909).

Descripción. Allen (1898) comenta que la coloración es obscura dorsalmente; el pelaje es jaspeado teniendo tonos castaños, amarillo-rojizos, grises y algunos negros; lateralmente es más obscuro y se aprecia una línea lateral; ventralmente es blanco y el color de la piel es grisáceo; patas de color blanco tierroso; cola delgada, bicolor; dorsalmente castaño oscuro, mientras que lateral y ventralmente es blanco tierroso. Según Osgood (1909), el cráneo es grande y robusto, más grande que *P. m. gambeli*; foramen posterior del palatino muy grande; dientes relativamente grandes.

Medidas. Las medidas del tipo y único organismo utilizado por Allen (1898) para la descripción son: longitud total, 175; longitud de la cola, 82; longitud de la pata, 18; longitud de la oreja, 15; longitud total del cráneo, 26; longitud basal, 21.5; anchura zigomática (anterior), 12; anchura mastoidea, 11; anchura interorbital, 3.5; longitud de los nasales, 9.5.

Comentarios. Osgood (1909), en su revisión, sitúa tanto a los organismos de isla Coronados como a los de isla Todos Santos en el grupo *maniculatus* y, por ende, para él son la misma subespecie. Encontró en los distintos topotipos un patrón de coloración similar y una ligera diferencia en el cráneo para los de Coronados (45 organismos). También menciona las diferencias existentes con otras especies insulares como lo es *P. m. catalinae.*

Mellink (1992b) menciona que cuando él colectó en la isla, esta especie era abundante, a pesar de que *Neotoma anthonyi* estaba extinta por la introducción de gatos domésticos y conejos a la

isla, lo que ha modificado considerablemente el hábitat. La Norma Oficial Mexicana (1994) la considera como amenazada de extinción.

Peromyscus maniculatus exiguus J. A. Allen

1898. *Peromyscus exiguus* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 10:157.
1955. *Peromyscus maniculatus exiguus*, Miller y Kellogg, Bull. U. S. Nat. Mus., 205:485.

localidad típica. Isla San Martín, Oceáno Pacífico, Baja California.

Distribución. Unicamente de Isla San Martín.

Registros. *BAJA CALIFORNIA*: Isla San Martín (Allen, 1898; Miller y Kellogg, 1955).

Descripción. Allen (1898) menciona que la coloración es muy similar a *P. clementis*, pero de menor tamaño, y que la cola es relativamente más corta.

Medidas. Del tipo (Allen, 1898) son: longitud total, 154; longitud de la cola, 62; longitud de la pata, 20; longitud de la oreja, 16; longitud total del cráneo, 26.5; longitud basal, 22; anchura mastoidea, 11.5; anchura interorbital, 3.5; longitud de los nasales, 10.

Comentarios. Allen (1898) menciona que A. W. Anthony encontró que los topotipos de *P. clementis* son muy semejantes en coloración, pero existen diferencias marcadas en cuanto al tamaño corporal y de la cola. En su revisión Osgood (1909) sitúa a los organismos de distintas islas (Natividad, San Gerónimo, San Martín) como *P. m. geronimensis*. Nelson y Goldman (1931) describen a esta población como *P. maniculatus martinensis*.

Banks (1964b) menciona que esta subespecie es muy abundante en la isla San Martín, siendo mayormente colectada en una ladera volcánica. Ocho de 11 hembras se encontraron preñadas en abril, con embriones de entre 6 y 18 mm. La Norma Oficial Mexicana (1994) la considera como amenazada de extinción.

Peromyscus maniculatus gambelii (Baird)

1857. *Hesperomys gambelii* Baird, Mamm. N. Am., Pac. R. R. Reports, 8:464.
1909. *Peromyscus maniculatus gambeli* [*sic*], Osgood, N. Amer. Fauna, 28:67.

localidad típica. Monterey, California.

Distribución. Del noroeste de Baja California hasta el estado de Washington (Osgood, 1909).

Registros. *BAJA CALIFORNIA*: Valle de Nochoguero (Mearns, 1896, como *P. texanus medius*). Cañón Salado; Cabo Colnett*; Cañada Carrizo; El Alamo; Encinita*; Ensenada; Cañada Gato; Valle de Guadalupe; Juncolito*; La Huerta; Los Encinos*; Valle Nochoguero*; Límite del Océano Pacífico al Monumento 258; Piñón; Pozo Luciano*; Rancho San Antonio*; Rancho Santo Tomas*; Rancho Viejo*; Rosarito*; San Felipe*; Saños Cedros*; Montañas de San Pedro Mártir; San Quentin [Quintín]*; Santa Eulalia; Santa Rosa*; San Telmo*; San Vicente; Rancho San Ysidro; Valle de Tecate; Trinidad; Ysadora* (Osgood, 1909, menciona además que los ejemplares marcados con * se aproximan a *P. m. sonoriensis*). Vallecitos; Laguna Hansen; Valle de la Trinidad (Calhoun *et al.*, 1988).

Descripción. Según Osgood (1909), es de características similares a *P. m. sonoriensis* pero más pequeño y de coloración similar a *P. m. rufinus*. La coloración dorsal es entre ocrácea y ocrácea amarillenta, mezclada uniformemente con oscuro; costados de coloración similar al lomo; ventralmente de color blanco crema; orejas obscuras, con el borde blancuzco; sin manchas faciales

obscuras; patas blancas; cola bicolor, obscura dorsalmente y clara en la porción ventral. El cráneo es muy similar al de *P. m. sonoriensis*, pero ligeramente mayor; más pequeño que *P. m. rubidus*.

Medidas. La media y el intervalo de diez ejemplares de Baja California (Osgood, 1909) son: longitud total, 170 (160-183); longitud de la cola, 80 (69-86); longitud de la pata, 20.7 (20-21.7). Las medidas craneales del tipo son: longitud total, 25; longitud condilobasal, 19; anchura zigomática, 13; anchura inteorbital, 3.7; longitud de los nasales, 9.8; longitud postpalatal, 8.8; longitud de los dientes maxilares, 3.6.

Comentarios. Osgood (1909) comenta que esta subespecie es muy abundante en su área de distribución y que los ejemplares del noroeste de Baja California son muy similares al tipo de la subespecie. En las áreas de intersección con *P. m. sonoriensis* se pueden encontrar ejemplares de ambas subespecies mezclados, pudiéndose encontrar en la Sierra de San Pedro Mártir.

Peromyscus maniculatus geronimensis Allen

1898. *Peromyscus geronimensis* Allen, Bull. Amer. Mus. Nat. Hist., 10:156.

1909. *Peromyscus maniculatus geronimensis*, Osgood, N. Amer. Fauna, 28:99.

localidad típica. Isla San Gerónimo, Océano Pacífico, Baja California.

Distribución. Conocido únicamente de la localidad tipo.

Registros. *BAJA CALIFORNIA*: isla San Gerónimo (Allen, 1898; Osgood, 1909).

Descripción. La coloración es semejante a *P. texanus*; de tamaño grande para los miembros de este grupo. Dorsalmente la coloración corresponde a una mezcla de tonalidades castaños y amarillo-rojizas pálidas, alternando con tonos negros que, en organismos adultos jóvenes, dan la apariencia de una franja dorsal más obscura; en los costados es más clara, mientras que en el vientre es de tono claro; piel color grisáceo; cola bicolor, dorsalmente obscura, mientras que lateral y ventralmente es más clara.

Medidas. Del tipo dadas por Allen (1898) son: longitud total, 175; longitud de la cola, 83; longitud de la pata, 20; longitud de la oreja, 14; longitud total del cráneo, 25; ancho a la altura del mastoideo, 11; ancho interobital, 3.8; longitud de los nasales, 8.

Comentarios. *Peromyscus m. geronimenesis* es claramente distinguible de los organismos más próximos geográficamente (*P. m. thurberi*), siendo más grande y pálido en coloración. Existe mayor similitud con *P. m. clementis* de Isla San Clemente (Allen, 1898). Osgood (1909) considera que las poblaciones de las islas Natividad y San Martín deben ser consideradas dentro de esta misma subespecie. Nelson y Goldman (1931), en contraposición, consideran a cada población como un taxón diferente.

Banks (1964b) comenta que la población es reducida; para el mes de abril colecta una hembra preñada (15.0) y once sin actividad. La Norma Oficial Mexicana (1994) la considera como amenazada de extinción.

Peromyscus maniculatus hueyi Nelson y Goldman

1932. *Peromyscus maniculatus hueyi*, Nelson y Goldman, Trans. San Diego Soc. Nat. Hist., 7:51.

localidad típica. Pequeña isla en Bahía Gonzaga [isla San Luis Gonzaga], aproximadamente 29° 50' Baja California. Bond (1969) la restringe a 112° 20' LW.

Distribución. Solamente conocida de la localidad tipo.

Registros. *BAJA CALIFORNIA*: Pequeña isla en Bahía Gonzaga, 29° 50' LN, 112° 20' LW. (Nelson y Goldman, 1932; Bond, 1969)

Descripción. Según la descripción original de Nelson y Goldman (1932), la subespecie es muy obscura, similar a *P. m. coolidgei*; el cráneo es ligeramente diferente. La coloración dorsal es gris amarillento combinado con negro, aunque predomina este último en el dorso; mejillas, hombros y costados con menos pelo negro; ventralmente es blanco, incluyendo la barba y los labios; parte externa de las extremidades color amarillo grisáceo o castaño, con las internas blancas; patas blancas; orejas cubiertas con pelos finos color negro y el margen externo blancuzco, cola bicolor. El cráneo es similar a *P. m. coolidgei*, pero con más matices plateados; arco zigomático más adelgazado y menos cuadrado anteriormente; premaxilar más atenuado y menos interdigitado con el frontal; rostro moderadamente robusto. Similar a *P. m. sonoriensis,* pero de cráneo menos robusto.

Medidas. La media y el intervalo del tipo y los cuatro topotipos son: longitud total, 165 (160-170); longitud de la cola, 76 (68-83); longitud de la pata, 21 (20-21). Las medidas craneales del tipo son: longitud total, 25.3; longitud condilobasal, 23.3; anchura zigomática, 12.8; longitud de los nasales, 9.5; longitud del alvéolo de los molares superiores, 4.2.

Comentarios. Nelson y Goldman (1932) comentan que la coloración de estos ejemplares es muy contrastante con el resto de los de la península; los ejemplares fueron colectados el mismo día que el tipo de *P. crinitus pallidissimus*.

Peromyscus maniculatus labecula Elliot

1903. *Peromyscus labecula* Elliot, Field Columb. Mus., Publ. 71, Zool. Ser., 3(8):143.

1909. *Peromyscus maniculatus labecula*, Osgood, N. Amer. Fauna, 28:87.

localidad típica. Ocotlán, Jalisco.

Distribución. Desde Nayarit, hasta el suroeste y el centro sur de México (Osgood, 1909).

Registros. *NAYARIT*: Ojo de Agua, cerca de Amatlán (Osgood, 1909). 8 mi a Ahuacatlán, 1500 m; 1.8 mi (por carretera) NW Coapan, 1560 m; 1.2 mi (por carretera) S El Casco, río Chitle, 60 m; El Refilón, 850 m; Estanzuela, 1380 m; 2 mi E Jalcocotán, 1500 m; 2 mi E San Pedro Lagunillas, lado E del lago, 1300 m; Tepic, 1000 m; 1 mi W Tepic, 792 m; 5 mi W Tepic, 792 m (Carleton *et al.*, 1982).

Descripción. Osgood (1909) menciona que es similar a *P. m. sonoriensis*, *P. m. blandus* y *P. m. fulvus*, pero de tamaño más grande; coloración obscura, negruzca; cráneo grande y más angular. Dorsalmente amarillo marrón mezclado con negro tizne, dando efecto de castaño sucio; lomo más oscuro que los costados; ventralmente blanco; patas blancas; parte interna de las piernas blanco sucio; ancas obscuras; orejas negruzcas; cola bicolor, dorsalmente negruzca y ventralmente blanca. Cráneo más grande, fuerte y anguloso que *P. m. sonoriensis*, *P. m. blandus* y *P m. fulvus*; parte anterior del arco zigomático muy fuerte; caja craneal relativamente pequeña.

Medidas. La media y el intervalo de diez ejemplares de Ocotlán, Jalisco (Osgood, 1909) son: longitud total, 173 (168-182); longitud de la cola, 72 (64-82); longitud de la pata, 22.5 (22-24); longitud de la oreja (en seco), 14.9 (14.5-15.5). Las medidas craneales del tipo son: longitud total, 25.7; longitud condilobasal, 21; anchura interorbital, 3.7; longitud de los nasales, 11; longitud pospalatal, 9.5; longitud de los dientes maxilares, 4.1.

Comentarios. Osgood (1909) menciona que esta subespecie puede ser distinguida fácilmente por su coloración tiznada que la distingue de las demás. Los ejemplares de Tepic son más pequeños,

con los nasales más anchos y dientes molares pequeños, pero considera que, por la variación interna del grupo y por el poco material disponible, por el momento los sitúa dentro de *P. m. labecula*.

Carleton *et al.* (1982) comentan que esta subespecie está restringida al suroeste del Nayarit. Está asociada a selva baja caducifolia en el límite con el bosque de encino; el valle en el que se colectó tiene en la parte baja un río y zona de pasto, *P. m. labecula* se colecta en el área de pastizal, mientras que *P. spicilegus* y *P. pectoralis* ocupan las laderas. Estas son las mismas condiciones en las que Hooper (1955) la colectó en Jalisco. Se tienen registros de hembras lactantes para el mes de enero (Carleton *et al.*, 1982).

Peromyscus maniculatus magdalenae Osgood

1909. *Peromyscus maniculatus magdalenae* Osgood, N. Amer. Fauna, 28:101.

localidad típica. Isla Magdalena, Baja California.

Distribución. Isla Magdalena y parte de la península de Baja California, frente a la isla, Baja California Sur (Osgood, 1909).

Registros. *BAJA CALIFORNIA SUR*: Isla Magdalena; Matancita; San Jorge; Bahía de San Juanico (Osgood, 1909).

Descripción. Según Osgood (1909), es similar a *P. m. geronimensis*, pero más grande y con una cola más larga; coloración más obscura y aleonada; más grande y obscura que *P. m. coolidgei* y *P. m. margaritae*. La coloración dorsal entre ocrácea amarillenta canela con vináceo claro, mezclada con oscuro; cabeza y lados de la cara ligeramente más claros que los costados; párpados oscuros; orejas obscuras con el borde blanquecino; ventralmente blanco crema. Cráneo similar al de *P. m. geronimensis*, pero en promedio menos ancho; arco zigomático diferente en su parte anterior.

Medidas. La media y el intervalo de siete ejemplares (Osgood, 1909) son: longitud total, 184 (175-200); longitud de la cola, 88 (82-96); longitud de la pata, 22.8 (22-23); longitud de la oreja (en seco), 16.6 (15.5-17.8). Las medidas craneales de un ejemplar son: longitud total, 27; longitud condilobasal, 20.8; anchura zigomática, 14; anchura interorbital, 4.2; longitud de los nasales, 10; longitud pospalatal, 9.8; longitud de los dientes maxilares, 4.

Comentarios. Osgood (1909) menciona que la subespecie habita también en la región peninsular frente a la isla Magdalena y que los individuos pueden cruzar a ambos lados durante la marea baja. La Norma Oficial Mexicana (1994) la considera como amenazada de extinción.

Peromyscus maniculatus margaritae Osgood

1909. *Peromyscus maniculatus margaritae* Osgood, N. Amer. Fauna, 28:95.

localidad típica. Isla Santa Margarita, Baja California [Sur].

Distribución. Isla Santa Margarita, Baja California Sur.

Registros. *BAJA CALIFORNIA SUR*: Isla Margarita (Townsend, 1912; Alvarez, 1958).

Descripción. Según Osgood (1909) es muy similar a *P. m. coolidgei*, pero de coloración más palida, con el dorso tonos amarillentos rosáceos pálidos; cráneo más corto y ancho. Dorsalmente, la cabeza y los costados son color rosa amarillento pálido, entremezclado con oscuro; lados de la cara, incluyendo la base de los bigotes, rosas amarillentos; párpados oscuros; las orejas blanquecinas proximal y obscuras distalmente, con manchas conspicuas en la base anterior;

ventralmente, nariz, patas delanteras y traseras blancas; cola bicolor; la línea paravertebral es obscura, y el resto, blanquecino. Es muy similar *P. m. coolidgei*, pero el cráneo y los nasales en particular más cortos y anchos en promedio.

Medidas. La media y el intervalo de diez ejemplares (Osgood, 1909) son: longitud total, 163 (157-168); longitud de la cola, 77 (74-81); longitud de la pata, 21.3 (20-22); longitud de la oreja, 16.5 (14.6-17.5). Las medidas craneales del tipo son: longitud total, 25.7; longitud condilobasal, 19.4; anchura zigomática, 13.2; anchura interorbital, 3.7; longitud de los nasales, 9.6; longitud pospalatal, 9.2; longitud de los dientes maxilares, 3.6.

Comentarios. Osgood (1909) comenta que los ejemplares fueron colectados en una playa arenosa al oeste de la isla. Además menciona, que la coloración es idéntica a *P. niveiventris* de las costas de Florida. La Norma Oficial Mexicana (1994) la considera como amenazada de extinción.

Peromyscus maniculatus sonoriensis (Le Conte)

1853. *Hesp[romys]. sonoriensis* Le Conte, Proc. Acad. Nat. Sci., Philadelphia, 6:413.

1909. *Peromyscus maniculatus sonoriensis*, Osgood, N. Amer. Fauna, 28:89.

localidad típica. Santa Cruz, Sonora.

Distribución. De la parte alta del norte de Sonora y Sierra de San Pedro Mártir, México, hasta Idaho en los Estado Unidos (Hall, 1981).

Registros. *BAJA CALIFORNIA*: Aguaje de las Fresas; Montañas Cocopah; Laguna Hanson; río Hardy, cerca de lago volcano; nacimiento del río Hardy: La Grulla: Poso [Pozo] Vicente; Ojo de agua San Matías; Siete Pozos; Vallecitos (Osgood, 1909). La Grulla (Hall, 1981). Laguna Hanson (Elliot, 1903) *SONORA*: Santa Cruz (LeConte, 1853). Pozo ciénega; Colonia Lerdo; río Colorado, 20 mi S frontera con Los Estados Unidos; Lado opuesto de la desembocadura del río Hardy; Santa Cruz; río Santa Cruz; Sierra de los Patogones (Osgood, 1909). Pozo ciénega (Cockrum, 1961).

Descripción. Según Osgood (1909), es similar a *P. m. nebrascensis*, aunque de tamaño mayor y cola más larga; la coloración de la mayoría de los adultos es ocrácea amarillenta; con manchas blancas conspicuas en la base anterior de las orejas. La coloración del dorso es ocrácea amarillenta clara homogéneamente mezclada con líneas obscuras; los costados pocoo más claros que el lomo; ventralmente de blanco a blanco cremoso; orejas obscuras con el borde blanquecino; mechón de pelo subauricular ocráceo amarillento claro mezclado con oscuro, pero con un mechón de pelo claramente blanco en la base anterior de la oreja; sin anillo de coloración alrededor de los ojos: los párpados pueden ser oscuros; patas y piernas blancas; los tarsos pueden ser blancos, amarillentos o amarillento mezclado con oscuro; cola bicolor, obscura dorsalmente y clara ventralmente. El cráneo es similar al de *P. m. nebrascensis*, pero en promedio ligeramente más grande; también similar a los de *P. m. rufinus*, *P. m. gambeli* y *P. m. blandus*, con referencia a los dos primeros; además, es ligeramente más grande. Los nasales son más pequeños y convexos. Con respecto a *P. arizonae*, la caja craneal es más chica y angosta.

Medidas. La media y el intervalo de diez ejemplares del río Santa Cruz (Osgood, 1909) son: longitud total, 166 (152-176); longitud de la cola, 75 (65-80); longitud de la pata, 20.7 (20-21.5); longitud de la oreja (en seco), 16.4 (15.2-17.7). Las medidas craneales del tipo son: longitud total, 27.3; longitud condilobasal, 20.3; anchura zigomática, 13.4; anchura interorbital, 3.8; longitud de los nasales, 10.8; longitud pospalatal, 9.8; longitud de los dientes maxilares, 4.4.

Comentarios. William y Hawks (1992) mencionan que la descripción de *Hesperomys sonoriensis* (LeConte, 1853) no incluye características craneales que puedan ser utilizadas; comenta también

que en la actualidad el cráneo está completamente roto y faltan partes. Osgood (1909) informó que esta subespecie se relaciona con las zonas relativamente áridas, en especial con la gran planicie norteamericana. En esta subespecie la localidad típica se encuentra en el límite austral de su distribución.

Peromyscus sejugis Burt

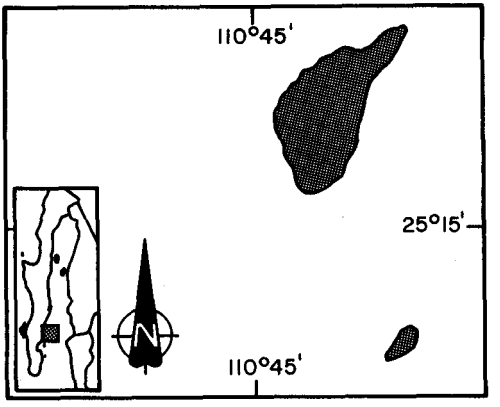
1932. *Peromyscus sejugis* Burt, Trans. San Diego Soc. Nat. Hist., 71:171.

localidad típica. Isla Santa Cruz (25° 17' LN, 110° 43' LW), Golfo de California, Baja California [Sur].

Distribución. Conocidos solamente de las islas Santa Cruz y San Diego, Baja California Sur.

Registros. *BAJA CALIFORNIA SUR*: isla Santa Cruz; isla San Diego (Burt, 1932a).

Descripción. Burt (1932a) comenta que la especie es grisácea con tonos avellana, obscureciéndose hacia el lomo; ventralmente blanco; cola claramente bicolor, con la línea paravertebral obscura (aproximadamente 1.5 mm de ancho en la piel seca); orejas obscuras. Cráneo arqueado antero-posteriormente; rostro grueso; nasales anchos; bula auditiva relativamente pequeña.



Localización de *Peromyscus sejugis*.

Medidas. El promedio de 24 ejemplares examinados por Burt (1932a) son: longitud total, 173; longitud de la cola, 85; longitud de la pata, 22; longitud de la oreja, 16; longitud total del cráneo, 26.3; longitud condilobasal, 23.0; longitud basilar, 20.4; anchura zigomática, 13.1; anchura interorbital, 4.1; longitud de la hilera de dientes maxilares, 3.9.

Comentarios. Burt (1932a) comenta que la población de Santa Cruz se diferencia de la de San Diego en los nasales, así como en la sutura entre el parietal y el frontal. Sin embargo no considera que estas diferencias sean suficientes para asignarlos a subespecies diferentes. Lawlor (1983) considera que la especie tiene su origen en un antecesor del grupo *maniculatus* y Avise *et al.* (1979) determinan que la diferencia genética de *P. sejugis* con *P. maniculatus* es considerable. Hooper y Musser (1964) comentan que el falo de esta especie es muy similar a de *P. maniculatus*.

Para el caso de Santa Cruz la fisiografía de la isla es muy agreste, por lo que se colectó a la especie preferentemente en la base de un cañón, con arena y piedras, con vegetación abundante, siendo en las diferentes épocas en las que se ha incursionado en la isla muy abundante. Para el caso de la isla de San Diego, la colecta se realizó en la planicie de la ladera oeste de la isla, ya que el resto tiene acantilados de muy difícil acceso, pero en el área de colecta ésta fue muy abundante. A pesar de la presncia de gatos en isla Santa Cruz, se considera que las poblaciones todavia tienen buenos números en la zona de cañadas (Alvarez-Castañeda, en prensa). La Norma Oficial Mexicana (1994) la considera como amenazada de extinción.

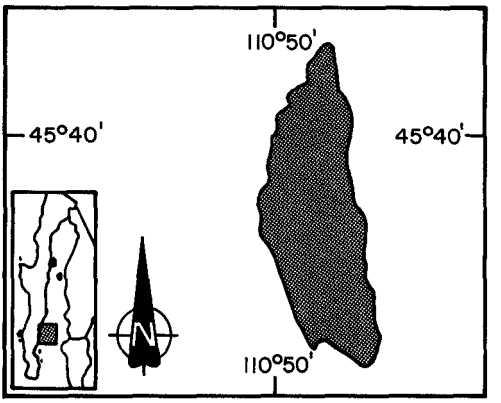
Peromyscus slevini Mailliard

1921. *Peromyscus slevini* Mailliard, Proc. California Acad. Sci., ser. 4, 12:1221.

localidad típica. Isla Santa Catalina, Golfo de California, Baja California.

Distribución. Restringida a isla Santa Catalina, Baja California Sur.

Registros. *BAJA CALIFORNIA SUR*: isla Santa Catalina (Mailliard, 1924; Burt, 1934b).



Localización de *Peromyscus slevini*.

Descripción. Según la descripción original de Mailliard (1924), esta especie es parecida a *Peromyscus californicus* en tamaño, pero poco más grande. La coloración es más pálida que la de *P. californicus*, siendo dorsalmente canela claro con pelos oscuros mezclados; ventralmente blanco con tonos canela claros; cola bicolor; dorso de la cola más oscuro que el lomo y ventralmente blancuzco; pelo corto y orejas pequeñas. Cráneo similar al de *P. californicus*, pero más angosto; interparietal menos extendido lateralmente y el margen anterior forma un ángulo dando apariencia de forma de rombo en la parte anterior; los nasales exceden el margen de los premaxilares; dientes similares a los de *P. californicus*, pero más grandes; forámenes incisivos proporcionalmente grandes; mandíbula fuerte; longitud condilobasilar igual a la de *P. californicus*, pero cráneo más robusto.

Medidas. Del tipo mencionadas por Mailliard (1924) son: longitud total, 225; longitud de la cola vertebral, 120; longitud de la pata, 27; longitud de la oreja, (en seco), 16.5; longitud total del cráneo, 31; longitud basilar, 23; anchura zigomática, 15.6; anchura interorbital, 4.6; longitud de los nasales, 11.5; longitud de los dientes maxilares, 4.9.

Comentarios. Burt (1934b) comenta que *P. slevini* aparentemente no deriva de las poblaciones de *Peromyscus* de tierra firme. Por otra parte, Carleton (1989) considera que no derivó de *P. sejugis*. Posiblemente por su plasticidad y su restringida área de distribución, ha cambiado de tal manera que excede su consanguinidad específica enmascarada por el desarrollo de sus características morfológicas. Hooper (1968) la sitúa tentativamente en el subgénero *Peromyscus*. Sin embargo, Lawlor (1983) y Carleton (1989) consideran que se necesita hacer una revisión crítica de las características de la especie,.corroborándose con el análisis de DNA mitocondrial (Hogans *et al*, 1997).

Sánchez *et al*. (1997) registra dos hembras preñadas para el mes de Julio. La isla es muy escarpada; nosotros intenamos colectar en las zonas planas y en las laderas. La eficiencia fue del 8.0% para el mes de noviembre; se obtuvieron ocho hembras lactantes (Alvarez-Castañeda y Cortés-Calva, en prensa). Posiblemente esta isla sea la mejor conservada de todas las de Baja California Sur en el Golfo de California. La Norma Oficial Mexicana (1994) considera esta especie como amenazada de extinción.

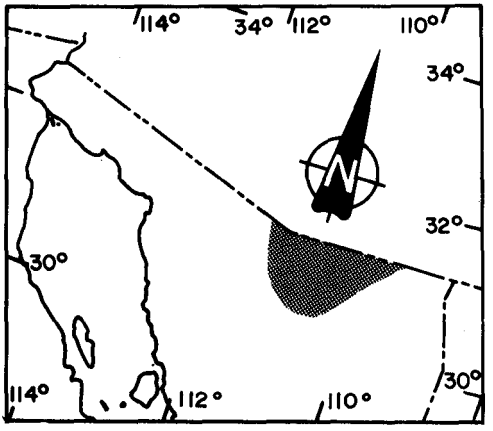
Peromyscus leucopus arizonae J. A. Allen

1984. *Peromyscus americanus arizonae* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 6:321.
1909. *Peromyscus leucopus arizonae*, Osgood N. Amer. Fauna, 28:126.

localidad típica. Fairbank, Condado de Cochise, Arizona.

Distribución. En las partes altas, desde Arizona y Nuevo México, hasta Durango. En el área de estudio, en las partes altas de Sonora.

Registros. *SONORA*: Rancho San Bernardino; Santa Cruz; río Santa Cruz (Osgood, 1909). Saric (Hall, 1981).



Localización de *Peromyscus leucopus arizonae*.

Descripción. Según Osgood (1909), es similar a *P. l. tornillo*, pero ligeramente más oscuro en general. Dorso, cabeza y costados color amarillo marrón uniforme con mezcla de finas líneas obscuras; sin manchas blancas en la base de las orejas; ventralmente crema blancuzco; patas, manos y miembros anteriores blancos; ancas blancas, a excepción de una mancha color marrón; orejas obscuras con el borde blanco; cola bicolor, castaño pálido dorsalmente y blanca ventralmente. El cráneo es grande; caja craneal relativamente ancha y no muy alta; nasales angostos y convexos y más comprimidos dorsalmente; mandíbula relativamente más corta y delgada; protuberancias laterales de los incisivos más prominentes.

Medidas. La media y el intervalo de 10 ejemplares de Arizona (Osgood, 1909) son: longitud total, 186 (178-193); longitud de la cola, 82.0 (78-85); longitud de la pata, 22.6 (22-24); longitud total craneal, 26.8; longitud condilobasal, 20.9; anchura zigomática, 13.5; anchura interorbital, 4; longitud de los nasales, 10.3; longitud postpalatal, 9.6; longitud de los dientes maxilares, 3.9.

Comentarios. Osgood (1909) comenta que esta subespecie en muchas localidades es prácticamente indistinguible de *P. l. tornillo*. Es por esto que es necesario tener series grandes para hacer una buena comparación, no obstante que *P. l. arizonae* es más oscuro. Esta especie se confunde con cierta frecuencia con *P. maniculatus*, ya que en muchos sitios son símpátricas. Sin embargo, se pueden diferenciar por el menor tamaño del foramen de los incisivos de *P. leucopus*, además de que la línea paravertebral de la cola por lo general es más tenue y menos pigmentada. Osgood (1909), además que, en comparación con *P. m. sonoriensis*, *P. l. arizonae* es de mayor tamaño, con la cola más larga y no bicolor y sin manchas blancas en la base de las orejas.

Baker (1960) comenta que la especie se encuentra a elevaciones de 1,000 m en la base de las áreas montañosas, prefiriendo las zonas próximas a los arroyos con pastizales altos o con gran cobertura de arbustos.

Hooper (1958) menciona que el falo es muy similar al de *P. maniculatus* en tamaño, proporciones y configuración. Linzey y Layne (1974) realizan la descripción de los espermatozoides para la especie, dando las siguientes medidas (micrones): longitud de la cabeza,

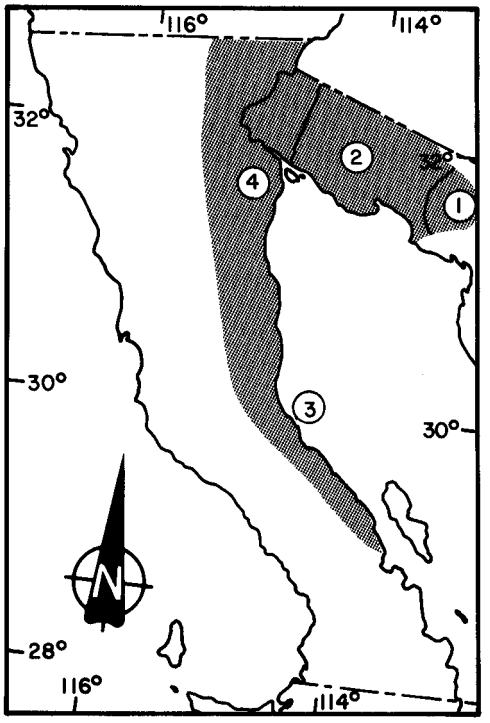
5.3 ±0.24; anchura de la cabeza, 3.4 ±0.16; longitud de la parte media, 16.8 ±0.00; longitud de la cola, 52.7 ±1.21.

Peromyscus crinitus (Merriam)

1891. *Hesperomys crinitus* Merriam, N. Amer. Fauna, 5:53.
1899. *Peromysus crinitus*, Bangs, Proc. New England Zool. Club, 1:67.

localidad típica. Cascadas de Shoshone, lado norte río Snake, condado de Jerome, Idaho.

Distribución. La especie se distribuye desde Oregon y centro oeste de los Estados Unidos, hasta la península de Baja California, por la vertiente del Golfo, al sur de Bahía de los Angeles, y en Sonora hasta el norte de Punta Peñasco (Carleton, 1989).



Localización de *Peromyscus crinitus*:
1. *P. c. delgadilli* 2. *P. c. disparilis*
3. *P. c. pallidissimus* 4. *P. c. stephensi*

Descripción. Según Osgood (1909), la especie es de tamaño medio; la cola más grande que el resto del cuerpo; orejas proporcionalmente grandes; pelaje usualmente largo y laxo; patas peludas aproximadamente hasta la cuarta parte proximal o desnuda en la parte media del calcáneo; cráneo proporcionalmente ancho; caja craneal poco profunda y larga; nasales angostos. En cuanto a la coloración, dorsalmente es de tonalidades ocráceas a amarillo claro mezclado con tonos oscuros; frente, nariz y parte superior de la cara de color gris; la parte interna de las extremidades de color blanco, frecuentemente con una mancha amarilla desvanecida en el pectoral; cola bicolor, obscurecido en la parte dorsal, mientras que por debajo es blanquecina ventralmente; las patas delanteras y traseras son de color blanco. Los organismos juveniles son menos ocráceos y con más tonos grisáceos. El cráneo de estos organismos, muestran una caja cerebral ancha y ligeramente aplanada, mientras que el zigomático comprimido anteriormente; rostro ligeramente deprimido y más o menos redondeado dorsalmente; nasales largos y un poco comprimidos en la parte posterior, ascendiendo las ramas de los premaxilares usualmente atenuados y raramente excede al tamaño de los nasales; bulas auditivas moderadas; dientes molares con tubérculos accesorios entre los ángulos externos muy pequeños e inconspicuos; una vez nacidos los dientes se observa el patrón de esmalte semejante al de *P. eremicus*.

Comentarios. *P. crinitus* es una especie muy distinta a las principales especies confinadas a la región del Great Basin. Externamente se caracteriza por poseer un pelaje suave como en *P.*

eremicus y por el pelo crespo de la cola. Por tal, parece tener más relación con *P. eremicus*, del que puede diferenciarse por el rostro y algunas características del cráneo. En *P. crinitus* el rostro es más elongado, comprimido y redondeado; el arco zigomatico es mucho más comprimido en la región anterior, y el premaxilar no excede la parte posterior de los nasales. El pelaje de *P. crinitus* difiere básicamente en la textura y el entremezclado de las tonalidades ocres, principalmente con predominio en los meses de junio y julio (Osgood, 1909).

Linzey y Layne (1969) hacen un análisis comparativo del tracto reproductor de las especies de *Peromyscus* con el que encuentran que *P. crinitus* tiene las glándulas "prepuciales" ausentes, mientras que las glándulas accesorias son completamente esenciales. La uretra es proporcionalmente corta. Lo que contrasta con las demás especies del género, es pequeña la prostata ventral. Con respecto al falo, Hooper y Musser (1964) consideran, por las características de éste, que debe ser agrupado dentro del grupo *maniculatus*.

La especie se encuentra representada por cinco subespecies, siendo algunas de ellas endémicas a las islas y otras se distribuyen en la región continental.

Peromyscus crinitus delgadilli Benson

1940. *Peromyscus crinitus delgadilli* Benson, Proc. Biol. Soc. Washington, 53:1.

localidad típica. 2 mi S Crater Elegante, Sierra del Pinacate, 34 mi W Sonoita, Sonora.

Distribución. Sierra del Pinacate, Sonora.

Registros. *SONORA*: 2 mi S Crater Elegante, 34 mi Sonoita, Sierra del Pinacate; río Sonoita, 30 mi WSW Sonoita (Benson, 1940).

Descripción. Se caracteriza por su color oscuro, cola obscura unicolor y patas obscuras. El resto de las subespecies conocidas tienen las patas blancas y la cola bicolor o blanca.

Medidas. La media y el intervalo de seis ejemplares dado por Benson (1940) son: longitud total, 182 (173-188); longitud de la cola, 104 (94-115); longitud de la pata, 20 (9-21); longitud de la oreja, 20 (19-21); longitud total del cráneo, 23.7 (23.3-24.3); longitud basilar, 17.5 (17.0-18.0); anchura zigomática 11.3 (11.0-11.7); anchura interorbital, 4.0 (3.8-4.1); longitud de los nasales, 9.1 (8.9-9.2); longitud de los dientes maxilares, 3.4 (3.3-3.5).

Comentarios. Benson (1940) comenta que uno de los ejemplares examinados presenta características de los de la Sierra de Hornaday, por lo que considera que la coloración obscura todavía no es homocigótica. Esta subespecie se restringe al malpaís de la Sierra del Pinacate, aproximadamente una milla cuadrada. La población está rodeada por áreas arenosas donde no se distribuye esta especie (Benson, 1940).

Peromyscus crinitus disparilis Goldman

1932. *Peromyscus crinitus disparilis* Goldman, Proc. Biol. Soc. Washington, 45:90.

localidad típica. Tinajas Altas, 2000 ft, Montes Gila, Condado de Yuma, Arizona.

Distribución. Esta parece estar restringida a el desierto de Altar en Sonora y Arizona.

Registros. *SONORA*: Cerro de La Colla, 6 mi WNW Punta Peñasca [Peñasco] (Benson, 1940).

Descripción. Según Goldman (1932b), es de tamaño pequeño con coloración rosácea amarillenta pálida, similar a *P. c. stephensi*, pero dorsalmente se acentúa más en el lomo, donde se combina con pelos negros; ventralmente y en la parte interna de los miembros es blanco; orejas cubiertas

de pelos muy pequeños de color castaño, del color de la epidermis; parte externa de los miembros amarillenta; patas blancas; cola con el pelo esparcido, castaño dorsal y blancuzca ventralmente. El cráneo es similar a *P. c. stephensi*, pero el foramen interpterigoideo ancho; hilera de dientes maxilares marcadamente grande; los dientes, en lo individual, grandes.

Medidas. Del ejemplar tipo (Goldman, 1932b) son: longitud total, 178; longitud de la cola vertebral, 105; longitud de la pata, 19; longitud total del cráneo, 23.5; longitud condilobasal, 20.5; anchura zigomática, 11.4; anchura interorbital 4.2; longitud de los nasales, 8.8. longitud de los dientes maxilares, 3.4.

Comentarios. Goldman (1932b) comenta que esta subespecie, como el resto de las de *P. crinitus* habita en sustratos rocosos. Esta subespecie se separa de *P. c. stephensi* en el Valle del Colorado por ser más obscura.

Peromyscus crinitus pallidissimus Huey

1931. *Peromyscus crinitus pallidissimus* Huey, Trans. San Diego Soc. Nat. Hist., 6:389.

localidad típica. De una isla pequeña en la Bahía de Gonzaga [Isla San Luis Gonzaga], 29° 50' LN, 114° 20' LW. Baja California.

Distribución. Restringida a la isla "Punta Willard" [isla San Luis Gonzaga] (Huey, 1931b).

Registros. *BAJA CALIFORNIA*: San Felipe; Bahía Gonzaga (Huey, 1931b).

Descripción. En tamaño es similar a *P. crinitus stephensi*, pero es más pálido, y la región ventral es más amarillenta. La caja craneal es ligeramente más plana y las medidas son similares.

Medidas. En la descripción original no se dan medidas de ejemplares y hasta el momento no se tienen de ningún ejemplar. La media y el intervalo de 21 ejemplares depositados en la colección de mamíferos del Centro de Investigaciones Biológicas del Noroeste son: longitud total, 179.5 (190-165); longitud de la cola vertebral, 105.7 (116-96); longitud de la pata, 19.3 (20-18); longitud de la oreja, 18.6 (20-18); longitud total del cráneo, 22.9 (24.0-22.2); anchura zigomática, 11.4 (11.9-10.9); anchura interorbital 3.8 (4.0-3.7); longitud de los nasales, 8.4 (9.3-7.2); anchura de la caja craneal, 10.9 (11.4-7.94); longitud palatal, 8.6 (9.0-8.2); longitud de los dientes maxilares, 3.0 (3.4-2.5); longitud de los dientes mandibulares, 3.1 (3.5-2.8).

Comentarios. Huey (1931b), en la descripción original, menciona que el nombre de la isla, según el mapa por él consultado (U. S. Navy Hydrographic Office Cahrt No. 619), aparece como Punta Willard. Por otra parte Huey (1931b) considera que esta subespecie es la misma que la de San Felipe, Baja California.

Esta especie habita en la misma isla que *P. maniculatus hueyi* y se diferencia por la longitud de la cola que es aproximadamente el 90 % de la longitud del cuerpo; parte dorsal pálida; dos pares de mamas y anchura maxilar menor de 11 mm. La Norma Oficial Mexicana (1994) la considera como amenazada de extinción.

Peromyscus crinitus stephensi Mearns

1892. *Peromyscus stephensi* Mearns, Proc. U. S. Nat. Mus., 19:721.

1909. *Peromyscus crinitus stephensi*, Osgood, N. Amer. Fauna, 28:232.

localidad típica. 3 mi E de las montañas Spring, Condado Imperial, California.

Distribución. En California, Arizona y la vertiente del Golfo de Baja California hasta Bahía de los Angeles.

Registros. *BAJA CALIFORNIA*: Cañón Esperanza; Cocopah; Montañas Signal (Osgood, 1909). El Mayor, Hardy River, 30 ft; San Felipe; Bahía de los Angeles (Lawlor, 1971b).

Descripción. La descripción, según Osgood (1909), es: coloración dorsal ocráceo amarillento pálido, entremezclado con castaño oscuro, excepto en la línea lateral; región facial gris claro; el vientre es blancas o blanco cremoso, ocasionalmente con la mancha pectoral amarillenta. El cráneo es similar al de *P. c. auripectus*, pero más pequeño; arco zigomático comprimido anteriormente; rostro atenuado y molares pequeños.

Medidas. El promedio y el intervalo de diez ejemplares de California (Osgood, 1909) son: longitud total, 170 (161-176); longitud de la cola vertebral, 94 (88-101); longitud de la pata, 20; longitud de la oreja (en seco), 16 (15.3-16.5). Del cráneo del tipo son: longitud total, 23.2; anchura zigomática, 11; anchura interorbital, 4; longitud de los nasales, 8.4; longitud de los dientes maxilares, 3.2.

Comentarios. La especie no es fácil de distinguir de *P. eremicus* con base en la coloración, siendo el factor más importante la cantidad de pelo en la cola. Con respecto al cráneo, con las características mencionadas, es fácil su separación (Osgood, 1909). Lawlor (1971b) no asigna a ninguna subespecie los registros que proporcionó para la península, siendo Hall (1981) quien los refiere a *P. c. stephensi*.

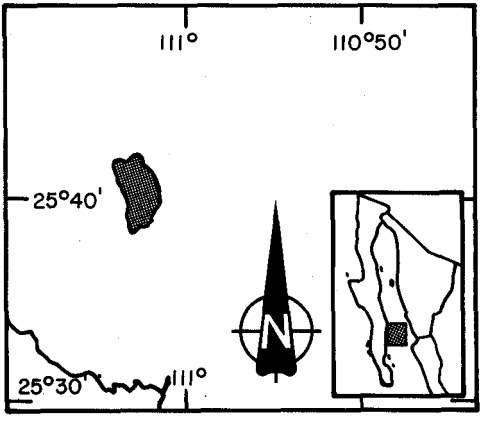
Peromyscus caniceps Burt

1932. *Peromyscus caniceps* Burt, Trans. San Diego Soc. Nat. Hist., 7:174.

localidad típica. Isla Montserrat, Golfo de California, Baja California [Sur].

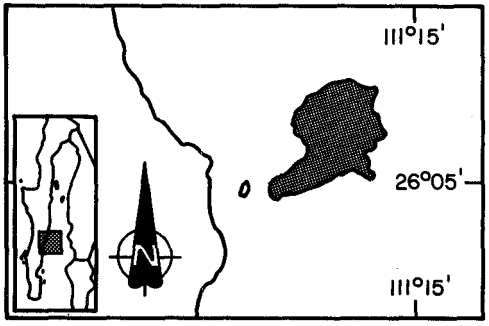
Distribución. Isla Montserrat, Baja California Sur.

Registros. *BAJA CALIFORNIA SUR*: isla Montserrat (Alvarez-Castañeda *et al*, 1998; Burt, 1932a; Avise *et al*., 1974).



Localización de *Peromyscus caniceps*.

Descripción. Burt (1932a) considera que es del tipo de *P. eremicus*. El dorso y los costados son amarillo ocráceo; cabeza grisácea, lo que contrasta con el dorso y los costados; línea lateral indistinguible; ventralmente blanco con amarillento (en algunos ejemplares el amarillo-ocráceo de los costados se continúa ventralmente sin observarse la línea lateral, sólo permaneciendo la garganta y la barba blanca); cola bicolor, obscura dorsal y blanca ventral; orejas obscuras, juveniles grisáceos. Cráneo más angular que en *P. pseudocrinitus*; proceso zigomático del escamoso proyectándose lateralmente por debajo de la caja craneal, disminuyendo anteriormente; primero y segundo molares superiores con cúspides accesorias; bulas auditivas pequeñas; nasales ligeramente más angostos en su porción terminal.



Localización de *Peromyscus pseudocrinitus*.

Medidas. Las medias de 17 ejemplares examinados por Burt (1932a) son: longitud total, 202; longitud de la cola, 112; longitud de la pata, 22; longitud de la oreja, 15.5; longitud total del cráneo, 25.7; longitud condilobasal, 22.9; anchura zigomática, 13.2; anchura interorbital, 4.0; longitud de los nasales, 9.4; longitud de los dientes maxilares, 3.8.

Comentarios. Burt (1932a) menciona que esta especie debe considerarse dentro del grupo *crinitus*, ya que difiere de *P. pseudocrinitus* con la coloración, forma del proceso zigomático, los nasales y los dientes maxilares. Lawlor (1971b) y posteriormente Carleton (1989) la consideran como especie derivada de *P. eva*, por lo que debe estar considerada dentro del grupo *eremicus*. Sin embargo, Hall (1981) la sitúa en el grupo *crinitus*.

Para la colecta de esta especie los que suscriben han colocado más de 1,200 trampas hombre en la isla de 1994 a 1997, en diferentes épocas del año, y solamente se tienen dos ejemplares. Sánchez *et al.* (1997) registra subadultos para el mes de mayo. La Norma Oficial Mexicana (1994) la considera como una especie rara.

Peromyscus pseudocrinitus Burt

1932. *Peromyscus pseudocrinitus* Burt, Trans, San Diego Soc. Nat. Hist., 7:173.

localidad típica. Isla Coronados (26° 06' LN, 111° 18' LW), Golfo de California, Baja California [Sur].

Distribución. Isla Coronados, Baja California Sur.

Registros. *BAJA CALIFORNIA SUR*: isla Coronados (Burt, 1932a; Lawlor, 1971b).

Descripción. Según Burt (1932a), es un *Peromyscus* muy oscuro (el más oscuro de las formas insulares), de cola larga con poco pelo y bicolor en los dos tercios proximales. Dorsalmente, negro plomizo entremezclado con canela; ventralmente blanco. El cráneo es, en general, similar al de *P. crinitus*, pero más grande y con las bulas auditivas relativamente menos infladas; nasales anchos, con la terminación posterior redondeada; premaxilares extendiéndose un poco por detrás de los nasales, cúspides accesorias entre las crestas primarias externas del primero y segundo molares superiores, más prominentes que en *P. crinitus*; interparietal dividido en cuatro.

Medidas. Las medias de seis ejemplares examinados por Burt (1932a) son: longitud total, 194; longitud de la cola, 110; longitud de la pata trasera, 21; longitud de la oreja, 16; longitud total del cráneo, 25.3; longitud condilobasal, 23.0; anchura zigomática, 12.7; anchura interorbital, 12.7; longitud de los nasales, 9.3; longitud de los dientes maxilares, 3.8.

Comentarios. La isla Coronados es una montaña, la cual tiene un sustrato pedregoso con pocas áreas arenosas. Las piedras, en la mayor parte de la isla, son grandes y están pegadas entre sí, no existiendo suelo. Esto permite condiciones de gran cantidad de espacio entre y debajo de las piedras. La pendiente de las laderas es superior a los 50 grados. En la zona sur, existe una barrera

de arena en la que la vegetación es más abundante. La mayor cantidad de ejemplares colectado se encontraron asociados a las zonas arenosas mas que a las pedregosas (Alvarez-Castañeda, 1998).

Lawlor (1971b), con base en el glande, comenta que la especie es muy parecida a *P. eremicus*. La Norma Oficial Mexicana (1994) la considera como amenazada de extinción.

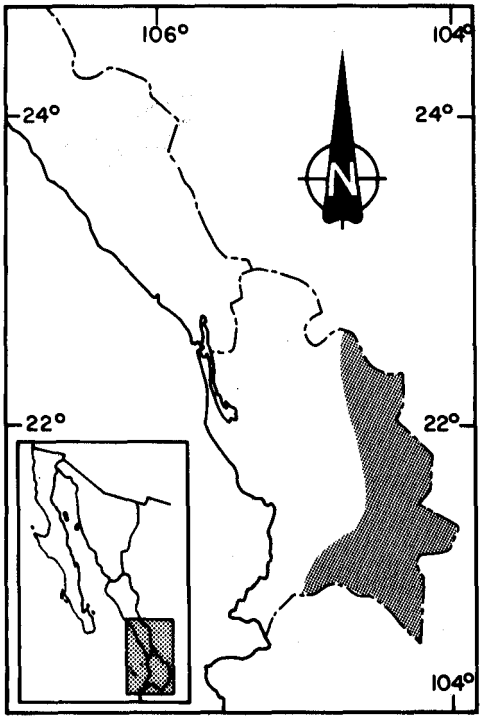
Peromyscus pectoralis pectoralis Osgood

1904. *Peromyscus attwateri pectoralis* Osgood, Proc. Biol. Soc. Washington, 17:59.
1906. *Peromyscus pectoralis pectoralis*, V. Bailey, Proc. Biol. Soc. Washington, 19:57.

localidad típica. Jalpan, Querétaro.

Distribución. La especie se distribuye por la Sierra Madre Occidental y parte del altiplano incluyendo el Eje Volcánico Transversal y parte de San Luis Potosí (Schmidly, 1974). En la región de estudio, sólo en una pequeña parte alta de Nayarit.

Registros. *NAYARIT*: Arroyo de Jiguite, río Grande de Santiago, 100 m; 1.8 mi (por carretera) NW Coapan, 1560 m; Rancho Zapotito, 1100 m (Carleton *et al.*, 1982).



Localización de *Peromyscus pectoralis pectoralis*.

Descripción. Según Osgood (1909), es similar a *P. eremicus* en proporciones y tamaño; de coloración más obscura y vinácea; cola con más pelo; el cráneo y los dientes son diferentes. En características generales es más similar a *P. b. rowleyi* y *P. levipes*, pero con la cola más grande y de tamaño total del cráneo y los dientes más pequeños. Dorsalmente es ocráceo amarillento pálido con entrepelado oscuro, produciendo un efecto general de castaño madera oscuro; lados de la cara, cerca de los ojos, grisáceo, con un anillo oscuro alrededor del ojo; ventralmente blanco con una marcada mancha pectoral ocráceo-amarillenta; orejas castaño obscuras, con el borde blanquecino; patas blancas; cola variable, castaño obscura dorsalmente y blanca, y algunas veces con la región ventral también obscura. Comparándolo con *P. b. rowleyi*, el cráneo es muy parecido, pero en general más pequeño; el rostro es relativamente ancho y robusto; caja craneal menos fuerte; molares notablemente más pequeños. De alguna manera es similar a *P. levipes*, pero más pequeño; región lacrimal menos abultada; premaxilares terminan poco después de los nasales; interparietal relativamente más grande.

Medidas. La media y el intervalo de ocho ejemplares de Chihuahua (Anderson, 1972) son: longitud total, 189.0 (172-198); longitud de la cola, 104.5 (96-110); longitud de la pata, 20.9 (20-22); longitud de la oreja, 18.0 (17-19); longitud occipitonasal, 25.7 (24.7-26.6); anchura

zigomática, 12.8 (12.2-13.3); anchura interorbital, 3.9 (3.8-4.0); anchura de la caja craneal, 11.9 (11.6-12.2); longitud del rostro, 8.2 (7.7-8.6); longitud de los alvéolos maxilares, 3.96 (3.7-4.0).

Comentarios. Osgood (1909) comenta que por el pelo puede ser similar a los ejemplares del grupo *eremicus*, pero por el cráneo es más similar al de *boylii*.

Carleton *et al.* (1982) mencionan que esta subespecie sólo se encuentra en el suroeste de Nayarit, en el mismo hábitat que *P. spicilegus*, en las laderas pedregosas con vegetación y de clima seco. Baker (1960) comenta que, en Durango, esta subespecie habita en las bases de las laderas cubiertas por matorral, en zonas con chaparral y en los bosques de pino piñonero y encino. Es muy poco abundante en las laderas expuestas donde existe soto, lechuguilla y yuca, o donde dominan las plantas xerófitas. Por otro lado, Matson y Baker (1986) la consideran como una especie característica de la zona desértica del altiplano central mexicano.

Con respecto al análisis del falo, Bradley y Schmidly (1989) comentan que el glande es grande (aproximadamente dos quintos de la longitud de la pata trasera); espinas del glande cónicas y delgadas en comparación con las otras especies de grupo *boylii*. El báculo es prácticamente recto, con la punta cartilaginosa, que equivale al 8.1% de la longitud total. Respecto al tracto reproductivo, comparado con *P. boylii*, la glándula ampural es relativamente más chica; la vesicular no es tan curva como en *P. boylii*, y las prostatales, especialmente la ventral media, son más chicas en comparación con *P. boylii* (Linzey y Layne, 1969) .

El cariotipo es 2n=26 y el FN=58; el cromosoma Y es metacéntrico chico y el X es subtelocéntrico grande (Hsu y Arrighi, 1968).

Peromyscus boylii (Baird)

1855. *Hesperomys boylii* Baird, Proc. Acad. Nat. Sci. Philadelphia, 7:335.

1896. *Peromyscus boylii*, Mearns, Proc. U. S. Nat. Hist., 5:335.

localidad típica. Middle Fork, río Americano, cerca del poblado actual de Auburn, California.

Distribución. La especie se distribuye desde el suroeste de los Estados Unidos, la Sierra de Juárez y San Pedro Mártir, en Baja California, y la Sierra Madre Occidental (Carleton, 1989).

Descripción. Según Osgood (1909), la especie se caracteriza por ser de tamaño medio; cola larga, del mismo tamaño que el cuerpo; orejas de tamaño medio. La coloración dorsal es entre castaño y sepia; la parte baja del rostro, los brazos y la línea lateral son de color ocráceo amarillento pálido; anillo alrededor de los ojos delgado y oscuro; orejas similares al dorso, nunca con pelos blancos, pero algunas veces con pelos negros en la base y en el margen superior; ventralmente blanco crema; patas blancas; cola castaño dorsal y blancuzca ventral; cráneo de tamaño medio; rostro deprimido anteriormente; zigomático ancho; región infraorbital débil; caja craneal redondeada y pequeña; bulas auditivas pequeñas.

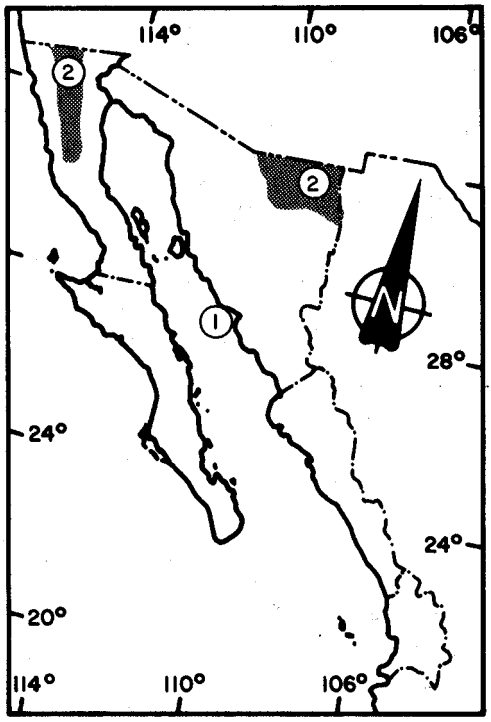
Medidas. El promedio y el intervalo de diez topotipos adultos (Osgood, 1909) son: longitud total, 197 (183-202); longitud de la cola, 103 (92-112); longitud de la pata, 22 (21-23); longitud de la oreja, 16.4 (15.3-17.5). Unicamente las del tipo son: longitud mayor del cráneo, 27.3; longitud basilar, 20.7; anchura zigomática, 13.4; anchura interorbital, 4.2; longitud de los nasales, 9.8; longitud de los dientes maxilares, 4.0.

Comentarios. En la revisión que se realizó para la elaboración del presente capítulo se observó que, según al autor que se consulte, esta especie se escribe de dos maneras: *boylii* (*e.i.* Hall, 1981) y *boylei* (*e.i.* Osgood, 1909). Se revisó la descripción original en la que Baird (1855) describe a

Hesperomys boylii, dedicada al Dr. C. C. Boyle, por lo que en el presente se utilizará el nombre original de la descripción, aunque al parecer Baird tuvo un error en la asignación del nombre.

Este es uno de los complejos específicos que más cambios han tenido en los últimos años, ya que a varias de las que se consideraban como subespecies, en la actualidad se les ha otorgado el rango de especies. La especie se caracteriza por su tamaño moderado dentro del género, cola larga y con pelos, orejas moderadamente largas, siendo notorias pero más chicas que las del complejo *dificilis*. Cráneo de tamaño medio; arco zigomático relativamente débil, principalmente en la parte anterior; caja craneal redondeada (Anderson, 1972). Molares más complejos que los de *P. eremicus*.

Para las zonas de bosque, Baker y Greer (1962) comentan que se le puede encontrar en las zonas abiertas con pasto, además, que el ámbito hogareño es en promedio de 0.14 acres para los machos y de 0.11 para las hembras.



Localización de *Peromyscus boylii*:
1. *P. b. glasselli* 2. *P. b. rowleyi*

Para Chihuahua (Anderson, 1972) se registra actividad reproductiva de abril a septiembre, con una media de 4.1 embriones por hembra preñada. Con respecto al tracto reproductivo, Linzey y Layne (1969) comentan que la glándula ampular es de tamaño promedio; la glándula vesicular es más curva que la típica de *P. leucopus* y la próstata ventral media y distinguiblemente menor que el par lateral.

Linzey y Layne (1974) realizan la descripción de los espermatozoides dando las siguientes medidas (micrones): longitud de la cabeza, 5.5 ± 0.05; anchura de la cabeza, 2.4 ± 0.07; longitud de la parte media, 17.0 ± 0.08; longitud de la cola, 55.1 ± 1.42, con dos subespecie para el noroeste de México.

Peromyscus boylii glasselli Burt

1932. *Peromyscus boylii glasselli* Burt, Tran. San Diego Soc. Nat. Hist., 7:171.

localidad típica. Isla San Pedro Nolasco, 27° 58' LN, 111° 24' LW, Golfo de California, Sonora.

Distribución. Solamente conocida de la localidad típica.

Registros. *SONORA*: isla San Pedro Nolasco (Burt, 1932a; Lawlor, 1971a; Committee for Standardization of Chromosomes of *Peromyscus*, 1977).

Descripción. Burt (1932) considera que es similar a *P. boylii rowleyi* en tamaño; dorsalmente la coloración se oscurece hacia el lomo, pero es más clara que en *P. b. rowleyi*; ventralmente es

blanco, con manchas pectorales y tonos "vináceos-amarillentos"; orejas obscuras, que contrastan con la coloración dorsal. Cráneo similar al de *P. b. rowleyi*, pero diferente en la anchura del rostro, los nasales más puntiagudos en su parte terminal y la caja craneal más redondeada.

Medidas. Las del tipo (Burt, 1932a) son: longitud total, 188; longitud de la cola vertebral, 97; longitud de la pata, 23; longitud de la oreja, 16; longitud total del cráneo, 26.5; longitud condilobasal, 23.6; anchura zigomática, 13.1; anchura interorbital, 4.0; longitud de los nasales, 10.6; longitud de los dientes maxilares, 4.2.

Comentarios. La isla cuenta con mucha vegetación y la mayoría se puede considerar como original. La otra especie de *Peromyscus* presente es P. *pembertoni*, actualmente considerada como extinta.

Peromyscus boylii rowleyi (J. A. Allen)

1893. *Sitomys rowleyi* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 5:76.

1896. *P[eromyscus]. b[oylii]. rowleyi*, Means, Proc. U. S. Nat. Mus., 19:139.

localidad típica. Rancho Nolasco, lado N río San Juan, condado San Juan, aproximadamente 1.5 mi de Four Corners, Utah.

Distribución. Desde el sur de los Estado Unidos, norte de Baja California, por la vertiente este de la Sierra Madre Occidental parte del Altiplano Central, hasta Zacatecas (Hall, 1981). En el área de estudio, en la parte alta de Baja California y Sonora.

Registros. *BAJA CALIFORNIA*: San Antonio; Montañas de San Pedro Mártir (Elliot, 1903). Aguaje de las Fresas; Laguna Hanson; La Grulla; Valle Nachoguero; Palomar; Rancho San Antonio; Paso San Matías; Montañas [Sierra] San Pedro Mártir (Osgood, 1909). 3.9 mi W (por carretera) Vallecitos, Sierra San Pedro Mártir (Janecek, 1990). *NAYARIT*: Ocota Airstrip, 1900 m; Santa Teresa, 2100 m; 13 km SW Santa Teresa, Rancho Viejo, 2100 m (Carleton *et al.*, 1982). *SONORA*: Minas providencia, noroeste de Sonora (Elliot 1903b). Montañas Huasavos; Minas Providencia; Montañas San Luis; Montañas San José; río Santa Cruz; Sierra Patagones (Osgood, 1909). 8 mi NNW San Carlos; 27 mi NW Puerto Peñasco (Sullivan *et al.*, 1991).

Descripción. Las características de la subespecie, según Osgood (1909) y Schmidly *et al.* (1987), son: el dorso es al color castaño madera, constituido por ocre amarillento uniforme con líneas obscuras; costados similares al dorso, a excepción de una línea que no tiene la combinación obscura; la región postorbital es grisácea; alrededor del ojo tiene un anillo negruzco muy delgado; orejas obscuras con el borde blancuzco; ventralmente blanco crema; cola dorsalmente castaño y ventralmente blanca; patas blancas. El cráneo es muy similar al de *P. b. boylii*.

Medidas. La media y el intervalo de 17 ejemplares de las cercanías de Pacheco, Chihuahua (Anderson, 1972) son: longitud total, 194.1 (185-198); longitud de la cola, 106.0 (103-115); longitud de la pata, 21.7 (20-23); longitud de la oreja, 20.8 (18-23); longitud occipitonasal, 27.1 (25.8-28.3); anchura zigomática, 13.1 (12.4-13.7); anchura interorbital, 4.2 (4.0-4.6); longitud de los alvéolos de los dientes maxilares, 4.3 (4.1-4.4).

Comentarios. Osgood (1909) menciona que la subespecie tiene poca variación y que se diferencia de *P. b. boylii* por la coloración más clara. *P. b. rowleyi* se puede diferenciar de *P. spicilegus* por la coloración más pálida de las orejas; tamaño pequeño; borde supraocular ausente o poco marcado (Baker y Greer, 1962; Anderson, 1972). Osgood (1909) comenta que esta especie ocupa el lado este de la Sierra Madre Occidental, mientras que *P. spicilegus* de la parte oriental. Anderson (1972) presenta un análisis detallado para la separación de estas dos especies, aunque las trata como subespecies de *P. boylii*. Carleton *et al.* (1982) no asignan nivel subespecífico al material

por ellos analizado debido a que consideran que es necesaria una evaluación completa del grupo *boylii*.

Jones y Webster (1976) capturan esta subespecie en Zacatecas asociada a pastizales, pastizales con acacia, bosque de juníperos y cercas de piedra.

El báculo y el glande de esta subespecie es el más grande de todas las subespecies de *P. boylii*. El glande equivale aproximadamente la mitad de la longitud de la pata trasera y está cubierto por espinas triangulares. El báculo es curvo dorsoventralmente (Bradley y Schmidly, 1987). Carleton *et al.* (1982) registran para enero hembras lactantes y la presencia de juveniles.

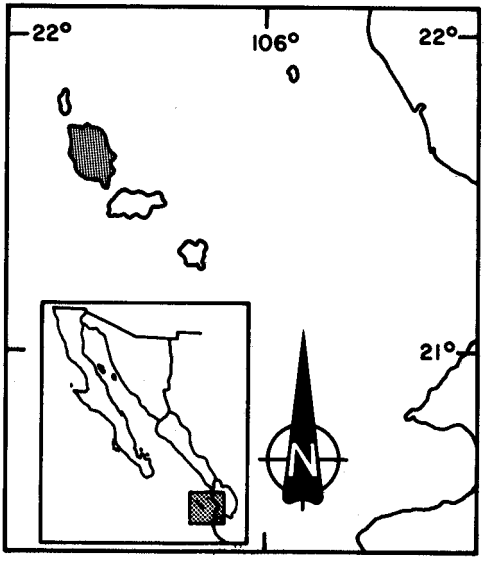
Peromyscus madrensis Merriam

1898. *Peromyscus madrensis* Merriam, Proc. Biol. Soc. Washington, 12:16.

localidad típica. Isla María Madre, islas Tres Marías, Nayarit.

Distribución. Conocida solamente del archipiélago de las islas Marías.

Registros. *NAYARIT*: isla Tres Marías, isla María Cleofas; isla María Madre; isla María Magdalena; isla Juanito (Carleton, 1977; Carleton *et al.*, 1982; Wilson, 1991). Isla María Madre; isla María Magdalena; isla María Cleofas (Merriam, 1898; Osgood, 1909).



Localización de *Peromyscus madrensis*.

Descripción. Osgood (1909) menciona que dorsalmente es ocráceo amarillento oscuro, mezclado con castaño canela, principalmente en el lomo; orejas castaño oscuro; anillo oscuro y angosto alrededor del ojo; ventralmente color crema o blanco amarillento, algunas veces con una mancha ocrácea amarillenta en el pecho; patas blancas; cola prácticamente no bicolor, aunque en algunos ejemplares es obscura dorsal y blancuzca ventralmente. Cráneo similar al de *P. spicilegus*, pero más grande, más elongado; bula auditiva y dientes como en *P. spicilegus*, relativamente pequeños.

Medidas. Las medias y el intervalo de 30 ejemplares de María Cleofa (Carleton *et al.*, 1982) son: longitud total, 225.8 (210-250); longitud de la cola, 114.5 (103-130); longitud de la pata, 25.6 (23-28); longitud de la oreja, 18.2 (17-20); longitud total del cráneo, 29.8 (28.3-31.5); longitud condilobasal, 26.5 (25.4-28.0); anchura zigomática, 15.0 (14.4-15.6); anchura interorbital, 4.6 (4.4-4.9); longitud de los nasales, 11.6 (10.7-12.7); longitud postpalatal, 10.5 (9.7-11.2); longitud alveolar de los dientes maxilares, 4.4 (4.1-4.7).

Comentarios. Osgood (1909) sitúa a esta especie como subespecie de *P. boylii*, pero menciona que tiene características bien marcadas; además, comenta que los cráneos de los ejemplares de María Cleofas y María Magdalena son más grandes que los de María Madre. Carleton (1977) y

Carleton *et al.* (1982) la consideran como una especie diferente, mencionando que la más cercana es *P. spicilegus*.

Nelson (1899) comenta que es la especie más abundante en las tres islas grandes del archipiélago, pero que no se le encuentra en San Juanico, posiblemente por la gran cantidad de cangrejo de tierra. Carleton *et al.* (1982) y Wilson (1991) mencionan que en la María Magdalena sólo lo colectan en las partes altas del interior de la isla. Menciona, además, que a la especie se le puede encontrar asociada a los arroyos que llevan agua, viviendo debajo de oquedades y raíces protectoras, así como de rocas y pequeños troncos. Carleton *et al.* (1982) colectan hembras preñadas y lactantes en marzo.

El cariotipo (Carleton *et al.*, 1982) es 2n = 48, FN = 54, con el cromosoma Y subtelocéntrico y el X subtelocéntrico grande. La Norma Oficial Mexicana (1994) la considera como amenazada de extinción.

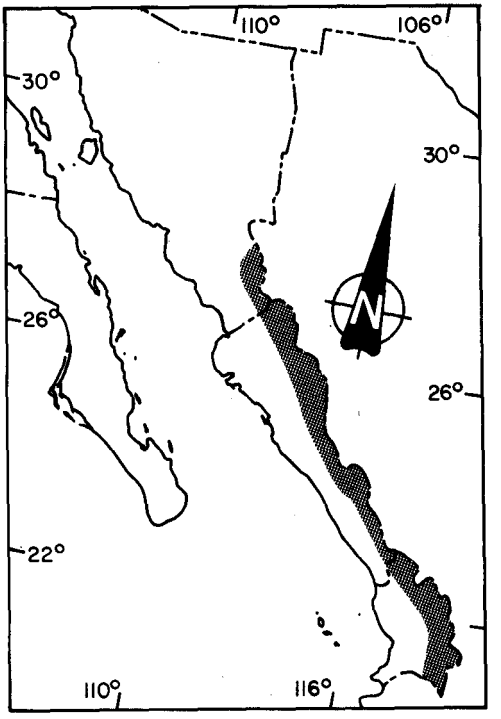
Peromyscus spicilegus J. A. Allen

1897. *Peromyscus spicilegus* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 9:50.

localidad típica. Mineral San Sebastían, Mascota, Jalisco.

Distribución. Por la Sierra Madre Occidental, desde el sur de Sonora hasta las partes altas de Colima (Hall, 1981). En el área de estudio, en Sonora, Sinaloa y Nayarit.

Registros. *NAYARIT*: Jalisco; Pedro Pablo; Santa Teresa (Osgood, 1909). Agua Escondida, 1380 m; 8 mi (por carretera) S Ahuacatlán, 1500 m; Arroyo de Jinguite, río Grande de Santiago, 100 m; Arroyo Taberna, 2 mi WNW Mesa del Nayar, 1200 m; Chacala, 30 m; 1.8 mi (por carretera) NW Coapan, 1560 m; Cucharas, río Acaponeta, 100 m; El Refilón, 850 m; 3.5 mi (por carretera) E El Venado, 100 m; Estanzuela, 1380 m; 10 km N Jala, 1600 m; 2 mi E Jalcocotán, 500 m; Jalisco, 1000 m; 1 km S La Villita, 760 m; Mesa del Nayar, 1300 m; Pedro Pablo, 820 m; 2 mi E San Pedro Lagunillas, lado E del Lago, 1300 m; Rancho Viejo, 13 km SW Santa Teresa, 2100 m; Tempiste, río Ameca, 840 m. (Carleton *et al.*, 1982). Mineral del Tigre (Webb *et al.*, 1981). 5 mi W villa Carranza (Sullivan y Kilpatrick, 1991). *SINALOA*: Plumosa; Sierra de Choix, 50 mi NE Choix (Osgood, 1909). Plumosas; 2 mi SW Santa Lucía, 3750 ft (Baker y Greer, 1962). *SONORA*: Montañas cercanas a Alamos (Osgood, 1909).



Localización de *Peromyscus spicilegus*.

Descripción. Según Osgood (1909), es dorsalmente aleonado, algunas veces ocre rojizo, con pelos de puntas obscuras, repartidos homogéneamente en toda la región dorsal, algunas veces concentrándose en la parte central del lomo, dando la apariencia de una línea; costados igual que el dorso, sin una marcada línea lateral; detrás del anillo oscuro de alrededor de los ojos y la base de la oreja tiene una área grisácea; orejas obscuras con parte del borde ligeramente blanco amarillento; patas blancas; ventralmente crema blancuzco, usualmente con tonos grises, por el color de la base del pelo; cola castaño obscura dorsalmente y blancuzca ventralmente. El cráneo es similar al de *P. b. boylii*, pero más aplanado anteriormente; borde supraorbital anguloso, desde la sutura parietofrontal al lacrimal; aberturas palatinas expandidas lateralmente; fosa interpterigoidea relativamente ancha; bula auditiva pequeña.

Medidas. La media y el intervalo de 29 ejemplares de Ahuacatlán, Nayarit (Carleton *et al.*, 1982) son: longitud total, 196.9 (175-232); longitud de la cola, 97.4 (85-115); longitud de la pata, 21.7 (20-23); longitud de la oreja, 18.6 (17-21); longitud total del cráneo, 27.7 (25.9-30.1); longitud condilobasal, 24.6 (23.0-26.8); anchura mastoidea, 11.7 (11.0-12.4); anchura zigomática, 14.0 (12.6-15.1); anchura interorbital, 4.4 (4.2-4.69); longitud de los nasales, 10.7 (9.5-12.0); longitud del paladar, 4.4 (4,0-4.9); longitud alveolar de los dientes maxilares, 4.5 (4.3-4.8).

Comentarios. Carleton (1989) menciona que Osgood (1909), en su revisión, consideró por error ejemplares de las tierras bajas de Nayarit y Jalisco (*P. boylii spicilegus*) y de la ladera oeste de la Sierra Madre Occidental (*P. boylii rowleyi*). Lo que creó gran confusión en la intergradación de *P. spicilegus* con *P. boylii rowleyi*, fue que no se contó con muestras apropiadas de *P. spicilegus*, ya que se colectó con una mezcla de especies.

Brower *et al.* (1985), mediante análisis estomacales, encontraron que la dieta de esta especie, en Michoacán, esta constituida principalmente por la mariposa monarca. Carleton *et al.* (1982) comentan que es probable que esta subespecie prefiera los hábitats de elevación baja y media, áridos y con las laderas rocosas. Sin embargo, aunque también es común en los bosques de pino-encino del sur del estado, siendo Arroyo Viejo (2,100 m) la localidad de mayor altura donde se le encontró, con bosque de pino. En Zacatecas fue colectada en un valle con un río de características subtropicales y en el ecotono inferior del bosque de pino-encino, siempre en compañía de *P. boylii rowleyi* (Matson y Baker, 1986). Carleton (1977) y Núñez *et al.* (1981) lo colectan en el ecotono entre la vegetación subtropical y el bosque de pino-encino.

Carleton *et al.* (1982) recolectan hembras lactantes en enero, septiembre y octubre, juveniles en febrero y marzo. Núñez *et al.* (1981) encuentran, para la zona de El Tuito en Jalisco, hembras preñadas en el mes de septiembre, y lactantes para octubre y noviembre. Sánchez-Cordero y Villa-Ramírez (1988) realizan un estudio de la variación morfométrica en la misma región de Jalisco, de lo que encuentra que existe mayor robustes craneal y presencia de una mancha blanca en la punta de la cola en las poblaciones que habitan a mayor altitud.

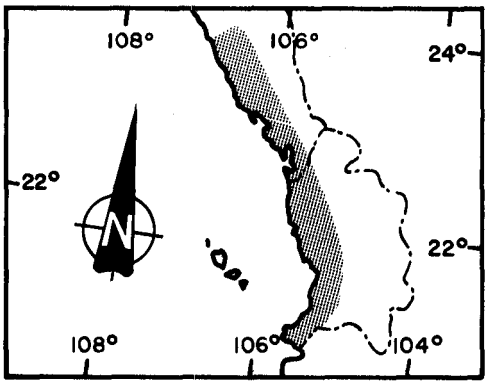
El cariotipo es 2n=48 y el FN=79-84 (Carleton *et al.*, 1982), constituido por tres pares de medianos a grandes con dos brazos, y 18 acrocéntricos de medianos a grandes. El cromosoma Y es metacéntrico de tamaño medio, y el X, submetacéntrico grande (Schmidly y Schoeter, 1974).

Peromyscus simulus Osgood

1904. *Peromyscus spicilegus simulus* Osgood, Proc. Biol. Soc. Washington, 17:64.

1977. *Peromyscus simulus*, Carleton, Occ. Papers Mus. Zool., Univ. Michigan, 675:41.

localidad típica. San Blas, Nayarit.



Localización de *Peromyscus simulus*.

Distribución. Restringido a la costa sur de Sinaloa y Nayarit (Hall, 1981).

Registros. *SINALOA*: Escuinapa; cerca de Mazatlán (Osgood, 1909). 5 mi S Copala, 750 ft; 4 mi E Concordia, carretera 40; 15 mi SE Escuinapa, 300 ft; Mazatlán, 300 ft; 2 mi N Mazatlán; 5 mi NW Mazatlán, carrereta 15: Rosario, 100 ft; 8 mi NNW Rosario; 15 mi N Rosario, Chelo, 300 ft (Carleton, 1973). Chele; Escuinapa (Baker y Greer, 1962). 5 mi NW Mazatlán; 4 mi E Concordia, (carretera 40) (Schmidly y Schoeter, 1974). 5 mi E Concordia; 5 mi SW Copala, 750 ft; 9 mi W Mazatlán; 15 mi S Rosarito, 300 ft (Bradley y Schmidly, 1987). *NAYARIT*: Rosario; San Blas (Osgood, 1909). 10 mi E San Blas (Ingles, 1959). Navarrete, 800 ft; San Blas; 0.5 mi E San Blas, 10 ft; 3.5 mi E San Blas, 100 ft; 2 km E San Blas; 1 mi S San Blas (Carleton, 1973). 2 mi E, 2 mi S San Blas (Schmidly y Schoeter, 1974). 4 km Aticama, 50 m; 4 km N Cuautla, nivel del mar; 1 mi S Cuautla, nivel del mar; Cucharas, río Acaponeta, 100 m; 1.2 mi (por carretera) S El Casco, río Chilte, 60 m; Navarrete, 50 m; Paso de Soquilpa, 8.8 mi E San Blas, 100 m; San Blas; 1.4 mi N (por carretera) Tacote, 15 m; Teponahuaxtla, 50 m (Carleton *et al.*, 1982). 5 mi E Concordia (Sullivan *et al.*, 1991).

Descripción. Osgood (1909) la considera similar a *P. spicilegus*, pero más pequeña y en promedio más clara. La coloración es similar a *P. spicilegus*, pero menos aleonado y más amarillento. El cráneo es similar al de *P. spicilegus*, pero más pequeño y anguloso; nasales y rostro más chicos; parietal angosto y el borde menos desarrollado; los premaxilares no sobrepasan el borde posterior de los nasales; arco zigomático relativamente robusto y cuadrado anteriormente; molares muy pequeños; huesos del paladar cortos.

Medidas. La media y el intervalo de 59 ejemplares de Cuautla, Nayarit (Carleton *et al.*, 1982) son: longitud total, 189.0 (165-238); longitud de la cola, 89.3 (78-102); longitud de la pata, 22.4 (21-24); longitud de la oreja, 17.7 (16-19); longitud total de cráneo, 26.7 (24.7-28.6); longitud condilobasal, 23.8 (22.0-25.1); anchura zigomática, 13.9 (12.8-14.7); anchura interorbital, 4.2 (3.6-4.6); longitud de los nasales, 10.0 (9.0-11.1); longitud postpalatal, 9.5 (8.7-10.2); longitud de los alveolar de los dientes maxilares, 4.0 (3.7-4.5).

Comentarios. Osgood (1909) comenta que esta forma es fácil de diferenciar de las otras del grupo *boylii* pero, a pesar de esto, los mantiene como una subespecie de *P. boylii*. Carleton *et al.* (1982) menciona que el hábitat más común en el que encontraron a esta especie es el bosque tropical de las tierras bajas, siendo muy abundante en la primera noche de colecta (72% de efectividad). También se colectó en selva baja caducifolia.

Según Bradley y Schmidly (1989) el falo es el más pequeño de todas las especies del grupo *boylii*. El glande es de un cuarto de la longitud de la pata trasera, con espinas triangulares grandes y anchas. Báculo grande con respecto a la longitud del glande; ancho en la parte media, y la punta es cartilaginosa pequeña. Carleton *et al.* (1982) obtienen hembras lactantes para septiembre.

El cariotipo de ejemplares de Mazatlán y Concordia está constituido por 17 pares de medianos a grandes de dos brazos, un par de pequeños y uno de acrocéntricos grandes. El cromosoma Y es un metacéntrico de tamaño medio y el X es metacéntrico grande (Schmidly y Schoeter, 1974).

Peromyscus stephani Townsend

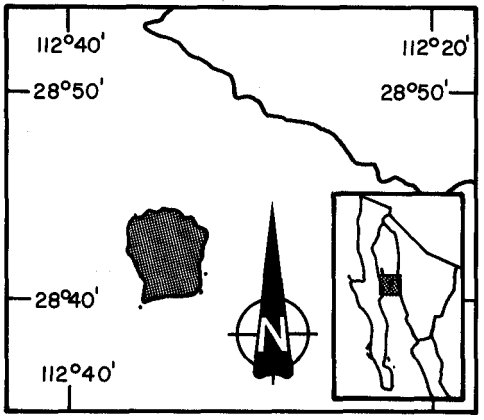
1912. *Peromyscus stephani* Townsend, Bull. Amer. Mus. Nat. Hist., 31:126.

localidad típica. Isla San Esteban, Golfo de California, Baja California.

Distribución. Restringido a la isla de San Esteban, Golfo de California, Baja California.

Registros. *BAJA CALIFORNIA*: isla de San Esteban (Townsend, 1912; Lawlor, 1971a; Bradley y Schmidly, 1987; Gill, 1981).

Descripción. Según Townsend (1912), se caracteriza por tener la cola corta en promedio y las patas traseras muy largas; en coloración es similar a *P. eremicus*. En general es un ejemplar de gran tamaño, en comparación con *P. eremicus*; el cráneo es corto; los nasales son más puntiagudos posteriormente, excediendo los premaxilares a los nasales. En la parte posterior del cráneo los frontales se unen en un ángulo a la altura de la línea media, en lugar de en curva como en *P. eremicus*.



Localización de *Peromyscus stephani*.

Medidas. Townsend (1912) solamente proporciona la longitud total, 195; longitud de la cola, 97; longitud de la pata trasera, 22.

Comentarios. Lawlor (1971a) realiza un análisis comparativo de la morfología, relacionada con la osteología, el pelaje, los órganos sexuales externos y otros caracteres anatómicos, serológicos y citológicos. En este estudio se hace una comparación entre *P. stephani*, *P. guardia*, *P. interparietalis*, *P. eremicus* y *P. boylii*. Hooper y Musser (1964), tentativamente colocaron a esta especie en el grupo *boylii*.

El falo es grande, elongado y similar al de *P. boylii*; el báculo es de longitud media y ancho, con curvatura dorso-ventral y con la punta cartilaginosa (Bradly y Schmidly, 1987). No se ha observado dimorfismo sexual secundario (Gill, 1981). La Norma Oficial Mexicana (1994) la considera como amenazada de extinción.

Peromyscus truei (Shufeldt)

1885. *Hesperomys truei* Shufeldt, Proc. U. S. Nat. Mus., 8:407.

1894. *P*[*eromyscus*]. *truei*, Thomas, Ann. Mag. Nat. Hist., ser. 6, 14:365.

localidad típica. Fort Wingate, Condado de McKinley, Nuevo México.

Distribución. Suroeste de los Estados Unidos, la Sierra de Juárez y San Pedro Mártir en Baja California, y la Sierra de La Laguna en Baja California Sur (Carleton, 1989).

Descripción. Según Osgood (1909), es de tamaño medio; cola de la misma longitud que el cuerpo; pelaje largo y suave; orejas muy largas, del mismo tamaño que las patas traseras; patas con mucho pelo, desde los calcáneos hasta los tubérculos plantales proximales. La coloración dorsal es ocrácea amarillenta con finas líneas obscuras; lados del rostro grises; anillo ocular angosto y oscuro; orejas castaño oscuro con o sin pelos grises; ventralmente blanco crema; patas blancas;

cola ligeramente bicolor; cráneo de tamaño medio; arco zigomático cuadrado y fuerte; nasales anchos y planos; bula auditiva grande.

Comentarios. De los datos que se tienen para la especie (Hoffmeister, 1981), se ha notificado que la reproducción se realiza de mediados de febrero a mediados de noviembre, con un promedio de 3.5 crías por parto.

Linzey y Layne (1969), al revisar el tracto reprodutivo de las especies de *Peromyscus*, comentan que los genitales son muy similares a los de *P. leucopus*. Linzey y Layne (1974) realizan la descripción de los espermatozoides para la especie, dando las siguientes medidas (micrones): longitud de la cabeza, 5.4 ± 0.05; anchura de la cabeza, 2.6 ± 0.07; longitud de la parte media, 16.2 ± 0.08; longitud de la cola, 56.8 ± 0.94.

El cariotipo es 2n=48, constituido por ocho pares de cromosomas con dos brazos y 15 acrocéntricos. El cromosoma Y es una acrocéntrico pequeño y el X es subtelocéntrico (Lee *et al.*, 1972), con dos subespecies para el noroeste de México.

Peromyscus truei lagunae Osgood

1909. *Peromyscus truei lagunae* Osgood, N. Amer. Fauna, 28:172.

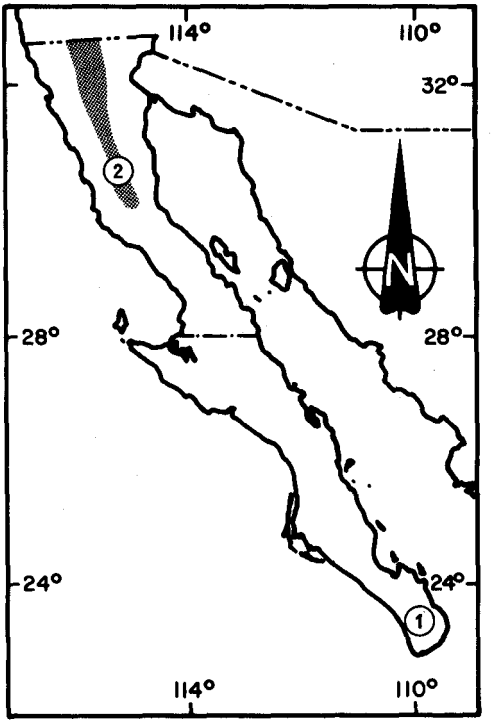
localidad típica. La Laguna, Sierra La Laguna, Baja California [Sur].

Distribución. Restringida a la parte alta de la Sierra de La Laguna, en la región de Los Cabos.

Registros. *BAJA CALIFORNIA SUR*: El Sauz; La Chuparosa; La Laguna; Montaña Miraflores; Sierra [La] Laguna; Montañas [Sierra de la] Victoria (Osgood, 1909).

Descripción. Osgood (1909), en la descripción original, menciona que es de orejas pequeñas; cola relativamente larga; cráneo pequeño y delicado. Dorsalmente es ocráceo amarillento mezclado con líneas obscuras; nariz y región postorbital grisácea; anillo alrededor de los ojos oscuros; cola castaño obscura, ventralmente blanca; patas blancas; ventralmente blanco crema. El cráneo es similar al de *P. t. truei* y *P. t. martirensis*, pero más chico y frágil: rostro y nasales más delgados; arco zigomático comprimido anteriormente; molares y bula auditiva pequeña; interparietal relativamente más grande.

Medidas. La media y el promedio de 10 ejemplares de La Sierra de la Laguna (Osgood, 1909) son: longitud total, 193 (182-210); longitud de la cola, 105 (97-118);



Localización de *Peromyscus truei*:
1. *P. t. lagunae* 2. *P. t. martirensis*

longitud de la pata, 22.4 (21.5-23); longitud de la oreja, 19 (18-19.8). Las craneales del tipo son: longitud total, 27.7; longitud condilobasal, 20.6; anchura zigomática, 13.3; anchura interorbital, 4.1; longitud de los nasales, 10.3; longitud postpalatal, 9.5; longitud de los dientes maxilares, 4.

Comentarios. Osgood (1909) comenta que las diferencias entre *P. t. lagunae* y *P. t. martirensis* no son muy notorias, pero debido al aislamiento geográfico entre las poblaciones, propone sea considerada como subespecie diferente.

Esta subespecie es muy abundante en la zona del bosque de pino y pino-encino de la Sierra de La Laguna, donde pueden ser fácilmente capturados, siendo por mucho el roedor más abundante (Banks, 1967a). Banks (1967a) comenta que esta subespecie es colectada por primera vez por Bryant en 1892, pero los ejemplares son destruidos en el terremoto de San Francisco de 1906, a excepción de uno que se encontraba como préstamo en Washington. Cabe hacer la aclaración de que esta especie, por lo general, se encuentra asociada a alguna especie de *Reithrodontomys*, siendo posiblemente la Sierra de La Laguna el único sitio en que no sea así.

Peromyscus truei martirensis (J. A. Allen)

1893. *Sitomys martirensis* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 5:187.

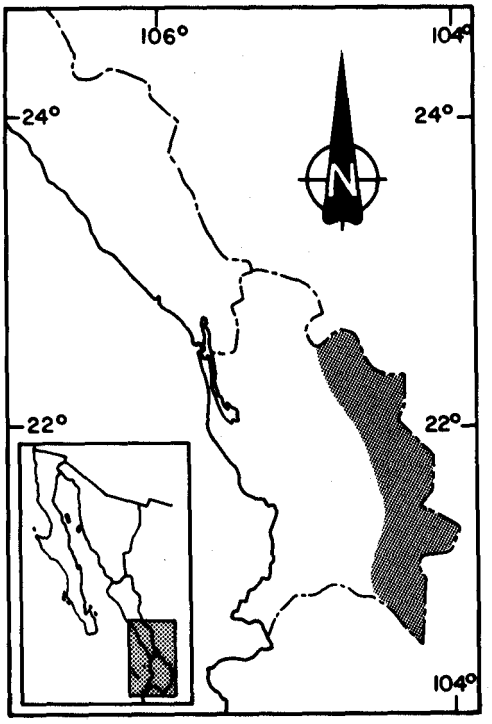
1909. *Peromyscus truei martirensis*, Osgood, N. Amer. Fauna, 28:171.

localidad típica. Sierra San Pedro Mártir, 7,000 ft, Baja California.

Distribución. En la Sierra de San Pedro Mártir, Sierra de Juárez y sur de California.

Registros. *BAJA CALIFORNIA*: Laguna Hanson, 5200 ft; Ojo de Agua San Matías; Piñón; Aguaje de Las Fresas; Vallecitos; Santa Eulalia; Calabozo; Palomar; Agua escondida; Santa Rosa; Rosarito; La Grulla, Sierra de San Pedro Mártir, 7200-7500 ft (Elliot, 1903a). Aguaje de Las Fresas; Agua escondida; El Rayo; montañas de Laguna Hanson; Laguna Hanson, montañas de Laguna Hanson; La Grulla, Montañas [Sierra de] San Pedro Mártir; Parteaguas Rosarito; Ojo de Agua San Matías; Montañas [Sierra de] San Pedro Mártir, 7,000 ft; Santa Eulalia; Santa Rosa; Vallecitos (Osgood, 1909). Laguna Hanson, montañas Sierra Juárez; 2.4 mi W (por carretera) Vallecitos, Sierra de San Pedro Mártir; 1 mi W (por carretera) Vallecitos, Sierra San Pedro Mártir (Janecek, 1990).

Descripción. Allen (1893b) y Osgood (1909) comentan que es muy parecido a *P. t. truei*, pero con la cola considerablemente más larga y bula auditiva en promedio más chica. La coloración es muy similar a la de *P. t. truei*,



Localización de *Peromyscus melanophrys micropus.*

ligeramente más ocrácea amarillenta. Respecto al cráneo, el arco zigomático es ligeramente más comprimido en la porción anterior; bula auditiva en promedio más pequeña, pero más grande que en *P. boylii*.

Medidas. Las de cuatro ejemplares (Allen, 1893b) son: longitud total, 195, longitud de la cola, 102; orejas desde la base, 16; orejas desde la escotadura, 20; pata trasera, 22; longitud del cráneo; 28; longitud basilar, 23.4; ancho zigomático, 12.7.

Comentarios. Osgood (1909) considera que la característica distintiva de esta subespecie es la cola, no pudiéndola separar de *P. t. truei* por la coloración. La subespecie se puede encontrar ampliamente distribuída en los bosques de la Sierra de San Pedro Mártir y la de Juárez, donde es una de las especies más conspicuas.

Peromyscus melanophrys micropus Baker

1952. *Peromyscus melanophrys micropus* Baker, Univ. Kansas Publ., Mus. Nat. Hist., 5:255.

localidad típica. 3 mi N Guadalajara, Jalisco.

Distribución. La parte central de Jalisco y la parte alta de Nayarit (Hall, 1981).

Registros. *NAYARIT*: Arroyo de Jiguite, río Grande de Santiago, 100 m; Mesa del Nayar, 1300 m (Carleton *et al.*, 1982).

Descripción. Según Carleton *et al.* (1982), la especie se distingue por ser dorsalmente amarillenta o rojo pálido, con pelos individuales grises en la base y pálidos en la punta; ventralmente los pelos son grises en la base y blancos en la punta, dando una apariencia grisácea; cola más larga que el cuerpo, con pelos esparcidos en la base y más densos hacia la punta, con un pequeño penacho, siendo la longitud de la cola el carácter que permite separarlos de los demás *Peromyscus*.

Medidas. La media y el intervalo del tipo y cinco topotipos (Baker, 1956) son: longitud total, 264 (253-280); longitud de la cola, 152 (143-160); longitud de la pata, 26 (26-27); longitud basilar, 23.3 (22.8-23.8); anchura interorbital, 4.6 (4.4-4.7); longitud de los nasales, 11.4 (10.8-1.8); longitud de los alvéolos de los dientes maxilares, 4.4 (4.4-4.5).

Comentarios. Carleton *et al.* (1982) mencionan que se les encuentra en las zonas rocosas y áridas del altiplano central, colectándolos en la mesa del Nayar. Para el mes de enero se recolectaron hembras lactantes y un juvenil.

Carleton *et al.* (1982) mencionan que el cariotipo es 2n=23 y el FN=58, con el cromosoma Y de tamaño muy pequeño por lo que no dan su tipo, y el X es telocéntrico grande. El cariotipo de estos ejemplares es muy diferente al de *P. melanophrys consobrinis* de Zacatecas.

Osgoodomys

Osgoodomys banderanus banderadus (J. A. Allen)

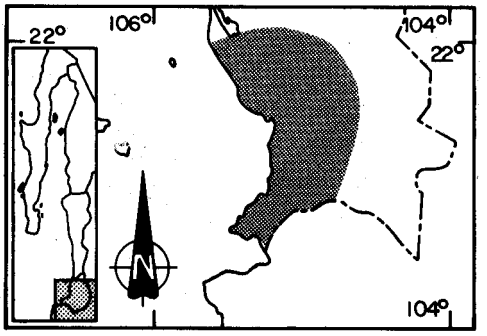
1897. *Peromyscus banderanus* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 9:51.

1980. *Osgoodomys banderanus*, Carleton, Misc. Publ. Mus. Zool., Univ. Michigan, 157:123.

localidad típica. Valle de Banderas, Nayarit.

Distribución. La especie se distribuye en las partes bajas de la costa de Sinaloa hasta Guerrero, incluyendo la depresión del Balsas en Michocán, Guerrero y el suroeste del Estado de México (Carleton, 1989). *O. b. banderadus*, desde la parte media de Michoacán hasta Nayarit.

Registros. *NAYARIT*: Navarrete; Valle de Banderas (Osgood, 1909); 3 mi SE Sayalita (Carleton, 1980).



Localización de *Osgoodomys banderanus banderanus*.

Descripción. Según Osgood (1909), es de tamaño medio; cola aproximadamente de la misma longitud que el cuerpo; orejas de tamaño moderado; pelaje suave y corto. Color ocráceo amarillento lustroso. El cráneo es angosto y elongado; parte posterior de la caja craneal elongada, extendiéndose más de la mitad de la longitud del interparietal, que se continua hasta el plano de inicio de las bulas auditivas; cresta suprauricular bien desarrollada, con la presencia de un canal en su porción interna que va desde la región del lacrimal hasta la sutura parietofrontal; lacrimal desarrollado; los nasales terminan anterad a los conductos del lacrimal; bulas auditivas pequeñas; foramen anterior del paladar pequeño.

Medidas. La media y el intervalo de cinco ejemplares (Osgood, 1909) son: longitud total, 234 (228-245); longitud de la cola, 119 (115-127); longitud de la pata, 35; longitud de la oreja (en seco), 18 (17.2-18.5). Las medidas del cráneo del tipo son: longitud total, 30.6; longitud condilobasal, 23.9; anchura zigomática, 15; anchura interorbital, 5; longitud de los nasales, 12; longitud de los dientes maxilares, 4.2.

Comentarios. Esta especie tiene características únicas que permiten la fácil separación del resto de los *Peromyscus* (Osgood, 1909). Hooper (1958) comenta, entre otras cosas, que el falo es 2/5 la longitud de la pata trasera el glande es pequeño, similar al de *Neotomodon*, quedando la abertura de la uretra en la punta. Hooper y Musser (1964) concluyen, del análisis del falo, que por lo diferente de éste, la especie debe constituir un género diferente del de *Peromyscus*, siendo más similar a *Neotomodon* que a *Peromyscus*.

Linzey y Layne (1974) realizan la descripción de los espermatozoides para la especie, dando las siguientes medidas (micrones): longitud de la cabeza, 5.6 ± 0.08; anchura de la cabeza, 2.7 ± 0.08; longitud de la parte media, 18.0 ± 0.08; longitud de la cola, 56.0 ± 0.99.

López-Forment *et al.* (1971) comentan haber colectado en Jalisco ejemplares de esta especie en zonas con cultivo de maíz y "bules". Núñez *et al.* (1981) lo recolectan asociado a bosques de encino.

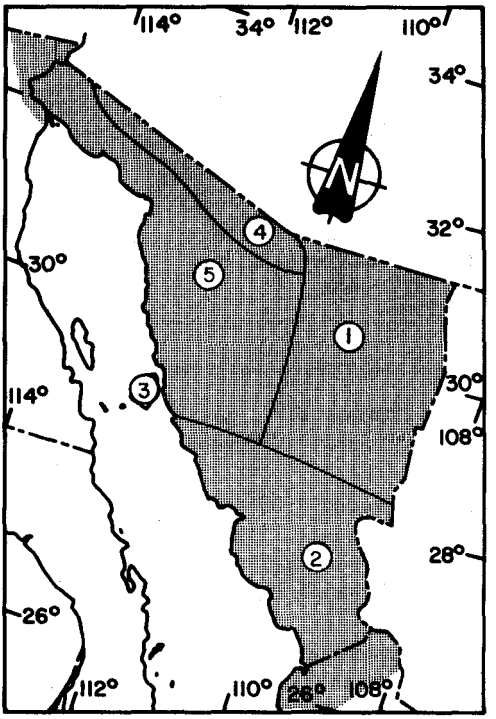
Lee y Elder (1977) mencionan que el cariotipo es 2n=48 y el FN= 52, el cromosoma Y es metacéntrico pequeño, y el X, metacéntrico grande.

Neotoma

Neotoma albigula albigula Hartley

1894. *Neotoma albigula* Hartley, Proc. Acad. Sci., ser 2, 4:157.

localidad típica. Cerca de Fort Lowell, cerca de Tucson, Condado de Pima, Arizona.



Localización de *Neotoma albigula*:
1. *N. a. albigula* 2. *N. a. melanura*
3. *N. a. seri* 4. *N. a. sheldoni*
5. *N. a. venusta*

Distribución. La especie se distribuye desde el sur de Utah y parte de Texas, por todo el altiplano central y la costa de Sonora y parte de Sinaloa (Macedo y Mares, 1988). *N. a. albigula* ocupa gran parte de los Estados Unidos, mientras que en México, se encuentra en la región noroeste extendiéndose hasta el este de Sonora a la altura de Hermosillo.

Registros. *SONORA*: Hermosillo; Magdalena; Nogales; montañas de Patagonia; Pozo de Luis; río San Bernardino (cerca de línea internacional); montañas de San José; Santa Cruz; Sonoyta [Sonoita] (Goldman, 1910). Hermosillo; Santo Domingo (Cockrum, 1961).

Descripción. Las características, según Goldman (1910) y Rogers y Schmidly (1981), son: la parte dorsal con tonalidades ocres y costados del cuerpo de color más claro; dicha coloración varía en los ejemplares. Las extremidades son más obscuras en la parte externa, con tonalidades canelas o vináceas; la región interna del cuerpo y de las patas es blanquecina; dorsalmente la cola es gris, y ventralmente, blanca. La forma del cráneo es muy similar al de *N. l. intermedia,* aunque es más grande; el rostro es mucho más robusto; paladar cóncavo en la parte posterior (convexo en *N. l. intermedia*); reentrante del primer molar superior con ángulo anterointerno poco profundo, como en *N. l. intermedia.*

Medidas. Las de los cuatro ejemplares (Goldman, 1910) son: longitud total 328; longitud de la cola, 152; longitud de la pata, 33.5; longitud condilobasal, 36.3; anchura zigomática, 22.6; anchura interorbital, 5.8; longitud de la hilera de dientes maxilares, 8.0. Anderson (1969) da una muy buena serie de medidas de ejemplares de esta subespecie para Chihuahua.

Comentarios. *Neotoma a. albigula* se traslapa en el centro de Sonora con *N. a. melanura*, subespecie distribuida hacia la ladera sur de la Sierra Madre Occidental. Externamente *N. a. albigula* se asemeja a *N. m. fallax,* y las dos comúnmente tienen traslapamiento en su distribución. La característica distintiva para *N. a. albigula* en cuanto a coloración es el blanco de la garganta y del pecho. Anderson (1969) hace una análisis que permite distinguirla de *N. a. durangae* y *N. micropus* por su menor tamaño y diferencia en el cráneo.

El báculo es ancho en forma de U en corte transversal y tiene una protuberancia en el extremo terminal. Las medidas de 13 ejemplares son: longitud 6.57 (5.80-7.60); diámetro a la base, dorso-ventral, 1.53 (1.25-1.79); lateral, 3.1 (2.82-3.50); diámetro cerca de la parte media, dorso-ventral, 0.60 (0.42-0.73); lateral, 0.61 (0.51-0.73) (Burt y Barkalow, 1942).

Baker (1960) menciona que se alimentan de cactus y que fueron colectados en acantilados asociados a bosques de pino y encino. Por otro lado Taylor *et al.* (1945) encontraron esta especie en áreas con mezquites y cactus. Con respecto al área de estudio no se tienen datos para la reproducción, pero Baker (1956) menciona que para Coahuila es activa durante todo el año. Además se ha registrado actividad reproductiva, en hembras de abril a agosto, para Chihuahua (Anderson, 1972).

Baker y Mascarello (1969), comentan que el cariotipo de la especie es 2N=52 y el FN=58. El cromosoma Y es generalmente grande y submetacéntrico y el X es grande y metacéntrico. Especie con cuatro subespecies para el noroeste de México.

Neotoma albigula melanura Merriam

1894. *Neotoma intermedia melanura* Merriam, Proc. Biol. Soc. Washington, 9:126.

1905. *N.[eotoma]. a[lbigula]. melanura,* Goldman, Proc. Biol. Soc. Washington, 18:29.

localidad típica. Ortiz, Sonora.

Distribución. Se encuentra en la parte sur de Sonora, mientras que en Chihuahua ocurre en la porción suroeste, que colinda con la porción norte de Sinaloa. En la base de la ladera de la Sierra Madre Occidental, en las partes altas y bajas de las zonas árido tropical de Sonora.

Registros. *SINALOA*: 1 mi N Topolobampo, 50 ft (Hall y Genoways, 1970). Rancho Rosalita, 26 mi NE Choix; 18 km NNE Choix; 16 km NNE Choix, 1700 ft; 0.5 mi SE Vaca, 650 ft; 5.5 km NE El Fuerte; 2.5 mi N El Fuerte; 3 mi NE El Fuerte, 200 ft; Kilometro 1672 [cerca del límite con Sonora] en la carretera 15; Kilómetro 1666 en la carretera 15; 3 mi N, 1 mi E San Miguel, 350 ft; 10 mi NW Los Mochis; 1 mi N Topolobampo (Birney y Jones, 1971). *SONORA*: Alamos; Batamotal; Camoa; Guaymas; Ortíz; Presidio (Goldman, 1910). Aduana (cerca de Alamos) (Ingles, 1959 como *Neotoma albigula*). 3 mi N, 1 mi E San Miguel, 350 ft; 2.5 mi N El Fuerte (Jones *et al.*, 1962). Bahía San Carlos, 14 mi NW Guaymas (Cockrum y Bradshaw, 1963). 6 km N Navojoa (Lucas y Loomis, 1968).

Descripción. Según Goldman (1910), el dorso es de tonalidades ocres y rosados oscuros; a lo largo de los costados y en las orejas la coloración es obscura; la cabeza, en su porción media, y las ancas son pálidas; en la interna es blanca pálida; patas blancas; cola dorsalmente obscura (paravertebral) y ventralmente blanquecina.

Medidas. El promedio y el intervalo de 16 adultos (Birney y Jones, 1971) son: longitud total 341.6 (317-363); longitud de la cola, 157.3 (145-169); longitud de la pata, 32.5 (33-37); longitud de la oreja, 27.4 (25-30). Las craneales de 12 adultos son: longitud mayor, 43.9 (41.4-45.6); anchura zigomática 22.2 (20.8-23.1); anchura interorbital 5.8 (5.4-6.0); anchura mastoidea, 17.0 (16.0-18.0); longitud de la hilera de dientes maxilares 8.6 (8.2-9.1).

Comentarios. *N. a. melanura* se diferencia de *N. a. albigula*, por su coloración más obscura y el promedio de las medidas menor, así como la bula auditiva pequeña (Anderson, 1972). Goldman (1910) menciona que los ejemplares de la localidad tipo y los organismos de Batamotal no son típicos, pero muestran una intergradación en coloración y en el tamaño del cráneo respecto a *N. albigula* y una mayor diferenciación de las formas a mayor distancia situadas hacia el sur a lo largo de la ladera este de la Sierra Madre.

Birney y Jones (1971) comentan que es común en las zonas áridas y rocosas del extremo norte de Sinaloa, ocurriendo hasta el río Fuerte en el sur. Los ejemplares fueron capturados cerca de Chollas, en laderas rocosas, paredes rocosas a lo largo de ríos y cercos de piedra.

Se registra actividad reproductiva en hembras para los meses de junio, noviembre y diciembre, y sin actividad para enero, junio y diciembre (Birney y Jones, 1971). Burt y Barkalow (1942) dan las siguientes medidas para el báculo de un ejemplar; longitud, 6.10; diámetro a la base, dorso-ventral, 1.20; lateral, 2.92; diámetro cerca de la parte media, dorso-ventral, 0.44; lateral, 0.70.

Neotoma albigula seri Townsend

1912. *Neotoma albigula seri* Townsend, Bull. Amer. Mus. Nat. Hist., 31:125.

localidad típica. Isla Tiburón, Golfo de California, Sonora.

Distribución. Solamente de isla Tiburón.

Registros. *SONORA*: isla Tiburón (Townsend, 1912). Isla Tiburón, Ensenada del Perro (Baker y Mascarello, 1969).

Descripción. En coloración es similar a *N. a. albigula*. Los dientes son pequeños; la anchura interorbital es angosta y el interparietal es pequeño en comparación con otras *N. albigula* (Townsend, 1912).

Medidas. Según Townsend (1912) son: longitud total, 328; longitud de la cola, 149; longitud de la pata trasera, 34. La media y el intervalo de 21 ejemplares de la colección de mamíferos del Centro de Investigaciones Biológicas del Noroeste son: longitud total, 1328 (357-290); longitud de la cola vertebral, 154 (170-135); longitud de la pata, 35 (38-31); longitud de la oreja, 31 (33-28); longitud total del cráneo, 43.2 (45.4-37.4); anchura zigomática, 22.0 (23.0-19.4); anchura interorbital 5.7 (6.2-5.0); longitud de los nasales, 16.7 (18.7-13.4); anchura de la caja craneal, 17.4 (18.3-16.7) longitud de los dientes maxilares, 7.8 (8.3-7.3); longitud de los dientes mandibulares, 8.0 (8.4-7.6).

Comentarios. No se obtuvo mayor información de la subespecie. La Norma Oficial Mexicana (1994) la considera como una especie amenazada de extinción.

Neotoma albigula sheldoni Goldman

1915. Neotoma albigula sheldoni Goldman, Proc. Biol. Soc. Washington, 28:136.

localidad típica. Papago Tank, Sierra del Pinacate, Sonora

Distribución. Restringida a la zona de la Sierra del Pinacate.

Registros. *SONORA*: Pápago Tank (Goldman, 1915b). Sáric (Hall, 1981).

Descripción. Según Goldman (1915b) es de coloración obscura, diferenciándose de *N. a. albigula* y *N. a. mearnsi* por los tonos vináceos amarillentos del vientre. Dorsalmente son vináceos amarillentos. Los hombros y costados de coloración más intensa, el dorso entrepelado con negro; cabeza grisácea; ventralmente el pelo blanco y completamente blanco en la garganta, la barba y la región inguinal; orejas y bordes orbitales negruzcos; patas blancas; cola bicolor, obscura dorsal y blancuzca ventral. Cráneo similar al de *N. a. albigula.*

Medidas. Las del ejemplar tipo (Goldman, 191b5) son: longitud total, 334; longitud de la cola, 136; longitud de la pata, 32.5; longitud total del cráneo, 44.0; anchura zigomática, 23.1; anchura interorbital, 5.5; longitud de la hilera de dientes maxilares, 8.5.

Comentarios. Goldman (1915b) menciona que el origen de su coloración se debe a su asociación con las regiones de lava de la Sierra del Pinacate.

Neotoma albigula venusta True

1894. *Neotoma venusta* True, Proc. U. S. Nat. Mus., 17:354.

1910. *Neotoma albigula venusta*, Goldman, N. Amer. Fauna, 31:33.

localidad típica. Cañón del Carrizo, condado Imperial, Colorado.

Distribución. Desierto de Altar, cuenca del río Colorado, por la vertiente este y hasta Punta Kino.

Registros. *BAJA CALIFORNIA*: Colonia Lerdo; base este de las montañas Cocopah (Cockrum, 1961). *SONORA*: Bahía de San Carlos (Ingles, 1959 como *Neotoma albigula*). Bahía Choya, 5 mi NW Punta Peñasco (Cockrum y Bradshaw, 1963). Rancho Costa Rica; 9 km N Bahía Kino (Kino Viejo); Hermosillo; 8 mi E Kino 20 ft; 27 mi NW, Puerto Peñasco; 8 mi San Luis, 34 mi NW Caborca 1775 ft (IB-UNAM).

Descripción. Según Goldman (1910), dorsalmente es amarillento rojizo, siendo más clara en las partes laterales del cuerpo, la tonalidad varia en algunos especímenes (claro a oscuro); externamente la coloración de las patas es oscura o rojiza; la parte interna es de color blanco; dorsalmente la cola es castaño grisácea y ventralmente es blanca. Cráneo muy similar al de *N. lepida*, pero largo y rostro mucho más tosco; parte posterior del paladar cóncava (convexo en *N. lepida*); bulas largas; primer molar superior con reentrantes anterointernas poco profundas, como en *N. lepida*; nasales estrechos en la parte posterior.

Medidas. El promedio de cinco ejemplares de Sonora de la colección de mamíferos (IB-UNAM) son: longitud total, 319.0; longitud de la cola, 143.8; longitud de la pata, 32.7; Longitud de la oreja, 29.0; longitud total del cráneo, 48.4; anchura zigomática, 21.7; anchura interorbital, 5.9; anchura del rostro, 7.0; anchura a la altura de los mastoideos, 17.7; longitud de la hilera de dientes maxilares, 8.6; longitud de la hilera de los dientes mandibulares, 8.4.

Comentarios. Esta subespecie es la de distribución más occidental dentro del grupo *albigula* (Goldman, 1910). Las subespecies de *N. albigula* se situaron después de *N. micropus* y antes de *N. lepida* con base en las características del báculo (Burt y Barkalow, 1942).

Hall (1981) menciona casos de hibridación o intergradación entre *N. albigula* y *N. micropus* en el sureste de Colorado. Posible adaptación convergente en ciertas medidas morfológicas en *N. albigula* y *N. micropus* en el este de Coahuila es mencionada en la descripción de *N. micropus*.

Neotoma anthonyi Allen

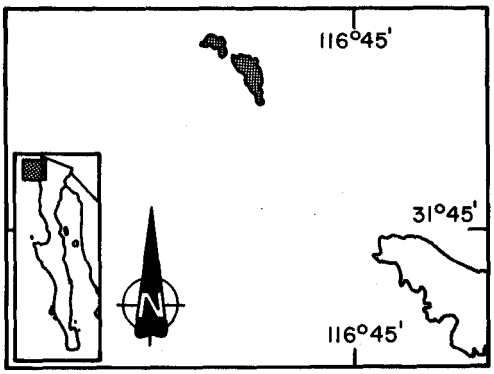
1898. *Neotoma anthonyi* Allen, Bull. Amer. Mus. Nat. Hist., 10:151.

localidad típica. Isla Todos Santos, Baja California.

Distribución. Conocida solamente en la isla Todos Santos.

Descripción. Según Goldman (1910), la coloración es castaño agrisado; costados pálidos, un poco más oscuro en la parte superior de la cabeza y lomo; orejas obscuras; parte interna de las extremidades con tonalidades blanquecinas; de la garganta hasta el vientre presenta tonalidades que van de rojizo pálido a oscuro; patas blancas con tobillos oscuros; cola bicolor, dorsalmente negra y ventralmente de color blanco turbio.

El cráneo es muy similar al de *N. lepida,* pero largo y tosco; nasales anchos; los maxilares y el zigomático robustos; frontales más desarrollados cerca de los lacrimales, elevándose a lo largo de la línea media; los foramenes de los incisivos son prolongados, aunque ligeramente constriñidos cerca de la sutura maxilopremaxilar; fosa interpterigoidea ancha; parte anterior del basiesfenoides



Localización de *Neotoma anthonyi.*

ancha; el preesfenoides se ensancha en la parte posterior en el punto de unión con el basiesfenoides; dentición del tipo de *N. lepida*, pero robusta.

Medidas. El promedio y el intervalo de cuatro organismos (Allen, 1898) son: longitud total, 329 (330-345); longitud de la cola, 139 (132-146); longitud de la pata, 35 (34-36); longitud de la oreja, 24 (23-25); las medidas craneales del tipo son: longitud total del cráneo, 46; anchura zigomática, 25; anchura interorbital, 4.8; anchura del cráneo a la altura del mastoideo, 18.2; longitud de la hilera de dientes maxilares, 8.

Comentarios. Nelson (1922) considera que la especie es muy numerosa en la isla Todos Santos, pero Mellink (1992a; 1992b) la considera actualmente como extinta. Mellink (1992b) realizó cuatro viajes de colecta sin éxito, mas en cambio si a *Peromyscus maniculatus debius* el otro murido endémico de la isla. Menciona además que en la decada de los cincuentas se introdujeron gatos y posteriormente conejos, cuyas poblaciones se incrementaron en los años setentas y después los conejos disminuyeron fuertemente. Con base en esto, Mellink (1992b) considera que la gran población de gatos ejerció presión sobre la población de *Neotoma* hasta que se extinguió. La Norma Oficial Mexicana (1994) y la UICN la considera como especie en peligro.

Neotoma bryanti Merriam

1887. *Neotoma bryanti* Merriam, Amer. Nat., 21:191

localidad típica. Isla Cedros, Baja California.

Distribución. Solamente conocida de la isla Cedros.

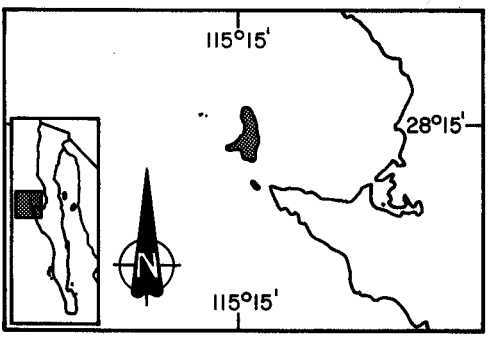
Registros. *BAJA CALIFORNIA*: isla Cedros (Goldman, 1910); Isla Cedros, el paso a Punta Prieta 100 msm. 28° 04' LN 115° 12' LW (CIB).

Descripción. De coloración clara; el dorso pardo, muy asemejado al substrato (Goldman, 1910), con matices claros a lo largo del pecho y laterales, poco más oscuros en la parte superior de la cabeza y las orejas. Ventralmente con tonalidades blancas y cremas, aunque algunos tienen colores rojizos; tobillos poco más oscuros; patas blancas; cola bicolor, obscura en el dorso y agrisada en la parte ventral.

Goldman (1910) menciona que el cráneo es muy similar al de *N. cursoria*, pero un poco más largo y angular; los frontales se extienden a lo ancho abruptamente entre los lacrimales anteriores; superficie superior acanalada; márgenes laterales ligeramente levantados, separados por una línea posterior recta; fosa interpterigoidea estrecha; dentición robusta.

Medidas. Dos hembras de la colección de mamíferos del Centro de Investigaciones Biológicas del Noroeste son: longitud total 351, 369; longitud de la cola, 155, 176; longitud de la pata, 36, 37; longitud de la oreja, 31, 31; longitud total del cráneo, 44.59, - ; anchura zigomática, 23.05, - ; anchura interorbital, 5.84,- ; ancho del rostro, 4.52, -; anchura del cráneo a la altura del mastoideo,

18.43, - ; longitud de la hilera de dientes maxilares, 9.47, - ; longitud de la hilera de dientes mandibulares, 9.01, -.



Localización de *Neotoma bryanti.*

Comentarios. Los cráneos de *N. bryanti* y *N. cursoria* de las costas e islas más sureñas indican una relación estrecha entre estas dos especies (Goldman, 1910), las que se diferencian por la coloración. Allen (1898) hace mención acerca de las descripciones realizadas por Merriam (1887) comenta que el único organismo que se usó estaba en muy malas condiciones, por lo que existió alteración en la coloración original. Debido a esto, Allen (1898) utiliza 18 topotipos para redescribe a la especie. Esta especie tiene parentesco tanto con *N. arenarius* como con el grupo de *N. fuscipes*, especialmente con *N. f. macrotis* (Allen, 1898).

Banks (1964b) considera que la especie es poco abundante, la colecta de sus únicos dos ejemplares fue en la bahía sur. Mellink (1992a) comenta que la especie se encuentra en toda la isla a excepción del extremo sur por la presencia de depredadores domésticos, pero que se le puede encontrar en los pinares, las áreas rocosas, con arbustos grandes dispersos, arroyos anchuras y huertos frutales. Los nidos miden 120 cm de diámetro (Alvarez-Castañeda y Yensen, en prensa).

Burt y Baklalow (1942) dan las siguientes medidas para el báculo de un ejemplar; longitud 21.83; diámetro a la base, dorso-ventral, 1.40; lateral, 2.60; diámetro cerca de la parte media, dorso-ventral, 0.81; lateral, 0.92. La Norma Oficial Mexicana (1994) la considera como una especie amenazada de extinción.

Neotoma bunkeri Burt

1932. *Neotoma bunkeri* Burt, Trans. San Diego Soc. Nat. Hist., 7:181.

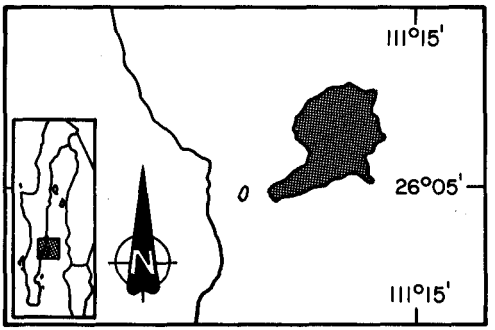
localidad típica. Isla Coronados (26° 06' LN, 111° 18' LW), Golfo de California, Baja California [Sur].

Distribución. Sólo conocida de la isla Coronados, Baja California Sur.

Registros. *BAJA CALIFORNIA SUR*: isla Coronados (Burt, 1932a).

Descripción. Son de tamaño medio; coloración obscura (Goldman, 1910). La coloración es gris profundo en la base, seguido de una banda castaño rojizo a amarillo claro y la punta negra; en general, la apariencia del pelo del cuerpo es gris oscuro; ventralmente es blanca; la cola en la parte superior es de color castaño; debajo el matiz es blanco; el plantar es desnudo en el calcañal. Cráneo similar a *N. fuscipes macrotis*, pero relativamente más corto y el rostro más ancho; foramen interorbital amplio; bulas auditivas ligeramente redondeadas; la caja craneal muy aplanada. El tercer molar superior con cuatro curvas esmaltadas en sitios definidos para el subgénero *Homodontomys*. Pertenece al grupo de *Neotoma fuscipes*, subgénero *Homodontomys* (Goldman, 1910).

Medidas. Organismo tipo (Burt, 1932a) son: longitud total, 390; longitud de la cola, 168; longitud de la pata, 43; longitud oreja, 32; anchura zigomática, 25.3; anchura interorbital, 6.0; longitud de la hilera de dientes maxilares 9.7.



Localización de *Neotoma bunkeri.*

Comentarios. Según Goldman (1910), sus madrigueras se localizan entre rocas de lava y cactus en la isla Coronados. Estos roedores son los únicos miembros insulares del grupo *fuscipes*, que habitan en isla Coronados. Esto indica que el rango del grupo probablemente se extiende más al sur de Baja California. El límite de distribución en la parte sur, dado por Goldman (1910), es cerca de los 30° latitud norte a lo largo de la costa oeste de Baja California. La coloración extrema de *N. bunkeri* es una "adaptación" al hábitat, ya que la coloración del suelo es debida a la lava presente en la isla (Burt, 1932a). La isla es de aproximadamente 6 km y en ella se han colectado ejemplares de *Peromyscus* y *Perognathus*, no encontrándose rastros de *N. bunkeri*, pero cabe la duda de su situación en función de lo rocoso de la isla y, sobretodo, de la fisiografía del lado este, debido a lo escarpado de la pendiente, por consecuencia muy es difícil de colectar.

El hábitat de la isla actualmente está muy alterado, principalmente por la introducción de gatos ferales, a los que se les ha culpado de ser los causante de la extinción de *N. bunkeri* (Smith *et al.*, 1993). Cabe hacer la aclaración que de esta especie solamente se conoce la serie tipo que se encuentra depositada en el Museo de la Sociedad de Historia Natural de San Diego. Actualmente ha sido declarada como extinta por Smith *et al.* (1993), mientras que la Norma Oficial Mexicana (1994) y la UICN consideran que está en peligro de extinción. Mascarello (1978) la considera como coespecífica de *N. lepida.*

Neotoma fuscipes Baird

1858. *Neotoma fuscipes* Baird, Mammals, in Repts. Expl. Surv. . . ., 8(1):495.

localidad típica. Petaluma [condado de Sonoma] California.

Distribución. Desde el río Columbia, por la costa, hasta el norte de Baja California (Carraway y Verts, 1991).

Descripción. Según Carraway y Verts (1991), *Neotoma fuscipes* es de tamaño medio, con la coloración dorsal castaño-grisácea; la oreja con poco pelo y esparcido; ventralmente de apariencia blanco o de color pálido, con la base del pelo gris y la punta blanca; la parte superior de las patas traseras color ollín; cola bicolor dorsalmente con pelo corto negruzco y ventralmente blanco. El tragus es pequeño y tiene doble antitragus. Cranealmente se puede distinguir porque los molares en vista oclusal son planos y constituidos por prismas, con el prisma de en medio del primero y el segundo molar superior, extendiéndose por completo a lo largo del molar.

Comentarios. *Neotoma fuscipes* tiene la cola y las pata trasera más largas que *N. lepida* y las orejas más largas quelas de esta última especie y las de *N. albigula*. *Neotoma fuscipes* se encuentra muy bien estudiada para los Estados Unidos. Carraway y Verts (1991) sintetizan la información al respecto, pero es muy limitado para la península de Baja California.

Carraway y Verts (1991) mencionan que las glándulas del pene de *N. fuscipes* son poco comunes en los neotomidos. El báculo es corto, ancho y simétrico en su línea exterior. El periodo de gestación es de aproximadamente 33 días, con un promedio de 2.6 crías por parto.

El cariotipo es 2n=56 y el FN=82; es considerado por Baker y Mascarello (1969) como radicalmente diferente al de las demás especies de *Neotoma*. El cromosoma X se considera más chico que en las otras especies de *Neotoma*. Especie con dos subespecies para el noroeste de México.

Neotoma fuscipes macrotis Thomas

1893. *Neotoma macrotis* Thomas, Ann. Mag. Nat. Hist., ser. 6, 12:234.

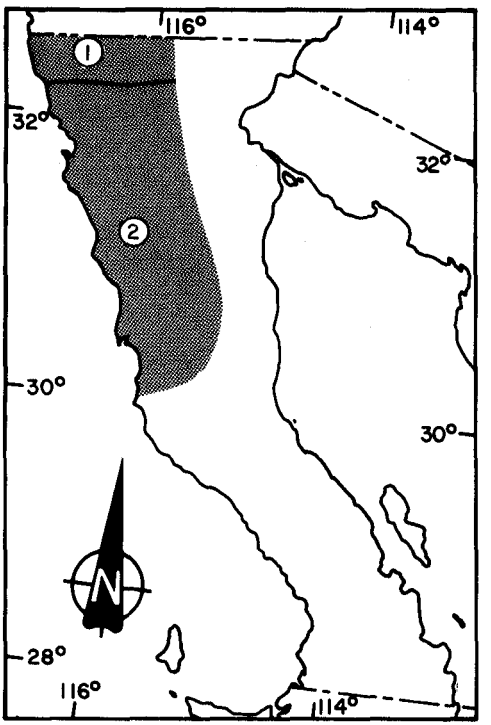
1894. *Neotoma fuscipes macrotis* Merriam, Proc. Acad. Nat. Sci., Philadelphia, 14:246.

localidad típica. San Diego, condado de San Diego, California.

Distribución. Se encuentra a lo largo de la costa suroeste de los Estados Unidos y región noroeste de Baja California hasta la Sierra de Juárez.

Registros. *BAJA CALIFORNIA*: Sierra Juárez; 5 mi S monumento 258, costa oeste (Hall, 1981).

Descripción. Tamaño medio en comparación con *N. floridana* y *N. mexicana*. En cuanto a la coloración ventral, el pelo es blanco en la porción proximal; patas blancas con tonalidades grises; cola bicolor siendo en la región dorsal obscura y en la región ventral blanquecina, al igual que en los costados; orejas largas. Cráneo fuertemente levantado; de perfil el frontal es convexo; borde supraorbital notablemente marcado; foramen anterior del palatino simplemente extendido hacia atrás a nivel de la raíz del m^1; dientes pequeños.



Localización de *Neotoma fuscipes*:
1. *N. f. macrotis* 2. *N. f. martirensis*

Medidas. Las del tipo (Thomas, 1893) son: longitud total, 180; longitud de la cola, 165; longitud de la pata, 33.7; longitud de la oreja, 29; longitud basal, 41.6; anchura máxima, 24.7; longitud de los nasales, 18.4; anchura interorbital, 6; longitud del interparietal, 5; anchura del interparietal, 11; longitud de la serie de molares superiores, 8.4.

Comentarios. Esta subespecie es registrada para México por primera vez por Hall (1981) de una localidad de la Sierra de Juárez a escasos cinco kilómetros de la frontera con los Estados Unidos.

Neotoma fuscipes martirensis Orr

1934. *Neotoma fuscipes martirensis* Orr, Proc. Biol. Soc. Washington, 47:110.

localidad típica. Valladares, 2700 ft, Sierra de San Pedro Mártir, Baja California.

Distribución. Se localiza en la parte norte de la península desde Ensenada hasta El Rosario. Cubriendo un amplio territorio, caracterizado por la Sierra de Juárez, el Valle de Trinidad, Sierra San Miguel.

Registros. *BAJA CALIFORNIA*: San Pedro Mártir, 8200 ft (Allen, 1893). Valladares, 2700 ft; Aguaje del Sauce, 2600 ft; 6 mi NW de Valladares; La Grulla, 7200-7500 ft, Sierra San Pedro Mártir; Vallecitos, 8500 ft, Sierra San Pedro Mártir; San José, latitud 31° N, 2300-2500 ft; Concepción, 6000 ft, San Pedro Mártir; Santo Domingo, 25 ft; Las Cruces, 2600 ft, 20 mi E de Ensenada (Orr, 1934).

Descripción. De acuerdo con la descripción original (Orr, 1934), esta *Neotoma* es de tamaño pequeño; coloración muy similar a *N. f. macrotis,* pero con mayor pigmentación ventral; el cráneo carece de angularidad; rostro no tan arqueado; en vista lateral, la línea externa dorsal de la diástema es relativamente recta; bulas auditivas grandes. En comparación con una serie de topotipos de *N. f. macrotis* y *N. f. martirensis* se observaron algunas diferencias: el tamaño pequeño, la gran pigmentación ventral con bandas terminales de tonalidades rojizas y ocres (vináceo-canela), además de una parte más pequeña y menos angular; rostro poco arqueado; bulas proporcionalmente grandes.

Medidas. El promedio y el intervalo de siete ejemplares examinados (Orr, 1934) son: longitud total, 362.1 (335-390); longitud de la cola, 170.9 (156-190); longitud de la pata, 36 (33-39); longitud basilar, 37.1 (36.1-38.8); anchura zigomática, 23.1 (22.3-24.3); anchura interorbital, 5.6 (5.4-5.8); longitud de los nasales, 17.8 (16.6-19.2); longitud de la hilera de dientes maxilares, 8.6 (8.1-9.1).

Comentarios. Los especímenes de Las Cruces, al este de Ensenada, se asemejan a *N. l. martirensis* (pigmentación ventral, tamaño pequeño, ausencia de angularidad del cráneo y las bulas grandes); sin embargo, el rostro de estos individuos es más elevado y circular, y los incisivos son más curvos, como en los especímenes de San Pedro Mártir (Orr, 1934).

Para los juveniles de la Sierra de Juárez, los caracteres parecen los intermedios entre *N. f. macrotis* y *N. f. martirensis*, pero en coloración se aproximan a los topotipos de *N. f. macrotis* de edad similar. Es por esto que entonces estos organismos fueron colocados tentativamente como *N. f. macrotis* (Orr, 1934).

Neotoma lepida lepida Thomas

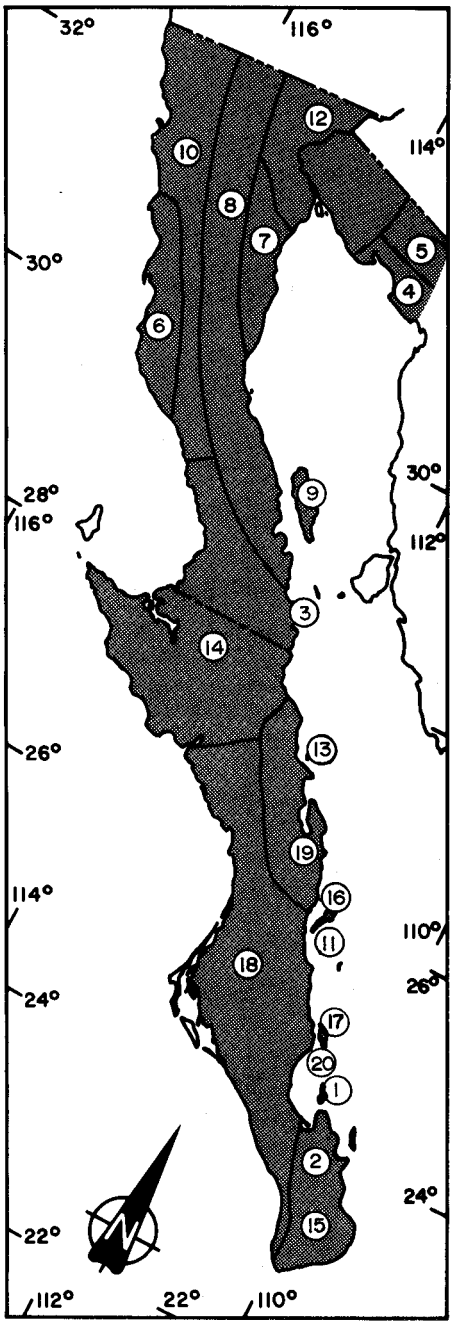
1893. *Neotoma lepida* Thomas, Ann. Mag. Nat. Hist., ser. 6, 12.235.

localidad típica. En algún lugar de "La ruta de Simpson" entre campo Floyd [=Fairfield], Utah y Carson City, Nevada.

Distribución. En México se le encuentra únicamente en la región de la delta del río Colorado.

Registros. *BAJA CALIFORNIA*: Cerro Prieto, cerca del lago volcánico; Sierra Cocopah (Hall, 1981).

Descripción. La parte dorsal es de color amarillento o entre tonalidades ocres, amarillo cremoso y crema, aunque la parte del lomo, la cabeza y las orejas presentan matices más oscuros; en la parte del pecho las tonalidades son claras, los hombros, las partes laterales y la parte intermedia de la cara son de color gris amarillento; las partes internas de las extremidades son de color cremoso (vientre de algunos organismos con tonos rojizos); región basal del pelo plúmbeo, excepto un área pequeña de la garganta, el interior del antebrazo y las regiones pectorales e inguinales, que son blancas; patas blancas, la cola es gris claro, aunque en algunas ocasiones es más obscura en la



parte dorsal que en la ventral. Los organismos jóvenes son oscuros, menos amarillentos que los adultos, categóricamente pálidos como *N. stephensis*; cola ligeramente unicolor. El cráneo en los adultos es muy similar al de *N. stephensis*, siendo de tamaño pequeño; interparietal relativamente pequeño; las hileras de los dientes son cortas y los incisivos, pequeños; ángulo de reentrada anterointernal del primer molar débil o ausente (usualmente ausente), como en los otros miembros del grupo *desertorum* (Goldman, 1910).

Medidas. Promedio de seis ejemplares del Cañón Keam (Goldman, 1910) son: longitud total, 286; longitud de la cola, 136; longitud de la pata, 29; longitud basilar, 324; anchura zigomática, 21.1; anchura interorbital, 5.5; longitud de los nasales, 14.8; longitud de la hilera de dientes maxilares, 7.8.

Comentarios. Especie muy parecida a *N. l stephensi*, pero pequeña; la coloración es pálida (amarillo grisáceo oscuro); cola ligeramente peluda, como en *N. l. stephensi*. Estrecho parentesco externo con *N. l. desertorum*, pero las partes dorsales son de tonos amarillo-amarillo rosado; cola larga peluda, no bicolor. El cráneo es muy parecido a *N. l. stephensis*, pero pequeño, con el interparietal relativamente pequeño; hilera de dientes cortos; primer molar superior con ángulo de entrada anterointerno débil o ausente (usualmente

Distribución de *Neotoma lepida*:

1. *N. l. abbreviata*	2. *N. l. arenacea*
3. *N. l. aridicola*	4. *N. l. aureotunicata*
5. *N. l. bensoni*	6. *N. l. egressa*
7. *N. l. felipensis*	8. *N. l. gilva*
9. *N. l. insularis*	10. *N. l. intermedia*
11. *N. l. latirostra*	12. *N. l. lepida*
13. *N. l. marcosensis*	14. *N. l. molagrandis*
15. *N. l. notia*	16. *N. l. nudicauda*
17. *N. l. perpallida*	18. *N. l. pretiosa*
19. *N. l. ravida*	20. *N. l. vicina*

ausente), como en los otros miembros del grupo *desertorum*.

Burt y Barlalow (1942) dan las siguientes medidas para los baculos de cinco ejemplares de *N. l. lepida*: longitud 11.26 (10.20-12.20); diámetro a la base, dorso-ventral, 1.15 (0.99-1.25); lateral, 1.98 (1.80-2.20); diámetro cerca de la parte media, dorso-ventral, 0.50 (0.45-0.55); lateral, 0.67 (0.61-0.70).

El cariotipo, según Baker y Mascarello (1969), es 2n=52 y el FN=60 a 66. La morfología de los cromosomases es variable, por lo que no hay un cariotipo que se pueda considerar como típico para la especie.Todos los ejemplares analizados presentan un número diploide de 52, pero con varias combinaciones de cromosomas birrámeos o unirrámeos. Estas combinaciones indistintamente con la variación geográfica. Especie con 19 subespecie en la región, muchas de las cuales son endémicas de las islas del Golfo de California.

Neotoma lepida abbreviata Goldman

1909. *Neotoma abbreviata* Goldman, Proc. Biol. Soc. Washington, 22:140.

1932. *Neotoma lepida abbreviata,* Burt, Trans. San Diego Soc. Nat. Hist., 7:182.

localidad típica. Isla San Francisco, Golfo de California, Baja California Sur.

Distribución. Conocida solamente de la isla San Francisco.

Registros. *BAJA CALIFORNIA SUR.* isla San Francisco (Osgood, 1909; Burt, 1932); NE de la Isla San Francisco (CIB).

Descripción. Según la descripción original de Osgood (1909), es de tamaño pequeño; color muy pálido; cola corta semejante al tamaño del cuerpo. Es la especie más pequeña del grupo *lepida*. Parecida a *N. l. intermedia* pero más pequeña y más pálida; cola corta. El dorso es gris oscuro; pecho y laterales con matiz pálido; cabeza y orejas ligeramente más obscuras, debido a lo oscuro del pelo en su porción distal y disposición alternada, lo que crea un efecto agrisado; parte posterior del lomo cubierta por un color amarillo pálido o canela; parte interna de las extremidades blanca, mientras que la basal está cubierto por un color plúmbeo; patas blancas; superficialmente la cola presenta un tono gris y por debajo es blanca. El cráneo es parecido al de *N. l. intermedia*, pero pequeño y más angular; la constricción posterior del frontal es estrecha; bulas auditivas pequeñas, muy circulares; borde posterior del palatino ligeramente emarginado; proceso mastoideo del escamoso en forma de espátula, ancho en la punta; el relieve mastoideo expuesto debajo de la extensión lateral del supraoccipital. Al compar *N. l. abbreviata* con *N. l. perpallida,* el cráneo de *N. l. abbreviata* es definitivamente pequeño; la anchura nasal está redondeada en la parte posterior.

Medidas. Promedios de 15 ejemplares de la colección de mamíferos del Centro de Investigaciones Biológicas del Noroeste son: longitud total, 280; longitud de la cola, 135; longitud de la pata, 30; longitud de la oreja, 31; longitud total del cráneo, 39.3; anchura zigomática, 20.4; anchura interorbital, 5.7; anchura del cráneo a la altura del mastoideo, 15.6; anchura del rostro, 4.6; longitud de la hilera de dientes maxilares, 8.4; longitud de la hilera de dientes mandibulares, 8.1.

Comentarios. Se encontró muy abundante en la isla de San Francisco, principalmente en la ladera norte, donde la efectividad de colecta de la especies fue superior al 10%. El sitio donde se colectó es rocoso, con vegetación arbustiva de menos de 50 cm, con una pendiente de 40 grados y con una serie de riscos. La vegetación dominante está conformada por *Ruelia* sp., *Jatropha* sp. y *Euphorbia* sp. La Norma Oficial Mexicana (1994) la considera como una especie amenazada de extinción.

Neotoma lepida arenacea J. A. Allen

1898. *Neotoma arenacea* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 10:150.

1932. *Neotoma lepida arenacea,* Goldman, Jour. Mamm., 13.65.

localidad típica. San José del Cabo, Baja California [Sur].

Distribución. Localizada en la parte más sureña del estado, desde el Valle de La Paz hasta las región de los cabos, por la vertiente del Golfo, sin incluir las partes altas de la Sierra de La Laguna.

Registros. *BAJA CALIFORNIA SUR*: San José del Cabo; Sierra de La Laguna (Allen, 1898). Miraflores (Townsend, 1912 como *N. intermedia*). Cabo San Lucas (Townsend, 1912). Cabo Pulmo, 5 m; estero San José del Cabo; Kilómetro 17.5 carretera transpeninsular; Ciudad Constitución; kilómetro 16 carretera San Juan de la Costa (CIB).

Descripción. Según Allen (1898), es de coloración dorsal castaño grisáceo; contorno de las orejas de color negro; cuerpo cubierto con tonos amarillo rojizo oscuros a castaños; la parte de la cabeza es un poco más gris; la parte interna de las extremidades es de color blanco, y la piel, de color gris-plomo; la cola es muy poco peluda, castaño indistintamente bicolor, superficialmente ligeramente más obscura que la parte ventral; orejas largas, castaño pálido, provistas de poco pelo. Respecto al cráneo, la región rostral es estrecha; la sección intermaxilar se extiende mucho (3 mm) detrás de los nasales; en el borde lateral de los foramenes frontales tienen un surco agudo o globoso, extendiéndose de la terminación posterior del intermaxilar a los parietales y lo que forma líneas divergentes rectas; foramen infraorbital estrecho, abierto en la parte anterior; la pared externa es estrecha está redondeada en el borde anterosuperior; la serie de los molares es estrecha en la parte posterior, siendo el m^3 estrecho como m^1; con un surco sobre la cara anterointerior del m^1 obsoleto; las bulas de tamaño medio.

Medidas. El promedio y el intervalo de diez ejemplares de la colección de mamíferos del Centro de Investigaciones Biológicas del Noroeste son: longitud total, 341; longitud de la cola, 159; longitud de la pata, 31; longitud de la oreja, 34. Las craneales de un macho y una hembra son: longitud total, 45.65, 43.58; anchura zigomática, 23.25, 21.75; anchura interorbital, 6.25, 5.86; anchura del rostro, 4.87, 4.59; anchura del cráneo a la altura del mastoideo, 17.05, 16.66; longitud de la hilera de dientes maxilares, 8.76, 8.66; longitud de la hilera de dientes mandibulares, 8.22, 8.11.

Comentarios. Unica subespecie de *N. lepida* que está relacionada con la selva baja caducifolia, además de encontrarse en la zona xerófila de la misma península. La abundancia de la subespecie varía mucho en su área de distribución, siendo más frecuente hacia la base de la sierra. Aparentemente ésta muy relacionada con *N. fuscipes macrotus*, pero es más pequeña y mucho más pálida en coloración. La cola es más coloreada y no tan peluda; difiere notablemente en la extensión posterior de los intermaxilares detrás de los nasales; los frontales son de diferente conformación, especialmente en lo aguzado; fosa supraorbital robusta y recta. La dentición y la abertura interorbital son estrechas, pero el palatal está abierto en dos formas.

Neotoma lepida aridicola Huey

1957. *Neotoma lepida aridicola* Huey, Trans. San Diego Soc. Nat. Hist., 12.287

localidad típica. El Barril cerca de los 28° 20' LN, Golfo de California, Baja California.

Distribución. Se conoce en la ladera desértica del Golfo en la región de la bahía de San Francisquito hasta el El Barril, aunque se cree que abarca regiones, tanto más al norte como al sur.

Descripción. El autor señala que esta especie es muy similar en el tamaño del cuerpo a *N. l. felipensis*, la cual habita la costa norte del Golfo cerca de San Felipe, pero la coloración es de tonalidad rojiza firme. El rostro es estrecho y delgado; caja craneal en vista dorsal es redondeada, mientras que en la parte posterior es de forma arqueada o abovedada. La superficie ventral del cráneo de *N. l. aridicola* muestra algunas diferencias sobresalientes en comparación con el de *N. l. felipensis*. Los molares son pequeños y las series del m^1 a m^3 son agudos y adelgazados. El pterigoideo es paralelo como en *N. l. felipensis*, y las bulas auditivas son marcadamente pequeñas y redondeadas. Huey (1957) menciona que se diferencia de *N. l. molagrandis* por el color del pelo el tamaño corporal las bulas auditivas y los dientes molariformes son más pequeños.

Comparándola con *N. l. ravida*, difiere notablemente en la coloración, ya que *N. l. ravid* tiene tonalidades obscuras, mientras que las diferencias en el tamaño del cráneo no son notorias, pero sí en los dientes molariformes y las bulas auditivas. El hábitat que ocupa es diferentes, ya que se asocia a las partes montañosas y de lava.

Medidas. Las medidas del tipo (Huey, 1957) son: longitud total del cuerpo, 325; longitud de la cola, 145; longitud de la pata, 31; longitud de la oreja, 28.

Comentarios. De toda la bibliografía que se revisó, Huey (1957) es el único que da información sobre la subespecie; el resto de las publicaciones hacen referencia sólo a este trabajo. Por esta razón, se considera que es necesario un estudio de esta subespecie.

Neotoma lepida aureotunicata Huey

1937. *Neotoma lepida aureotunicata* Huey, Trans. San Diego Soc. Nat. Hist., 8:349.

localidad típica. Punta Peñascosa [Punta Peñasco], Sonora.

Distribución. Conocida únicamente en la localidad tipo.

Registros. *SONORA*: Punta Peñasco (Huey, 1937).

Descripción. Según la descripción realizada por Huey (1937), son organismos de color amarillo claro en todo el cuerpo; cola bicolor; patas blancas. La serie de molares son ligeramente largos y robustos más que *N. l. flava* o *N. l. auripila*.

Medidas. Las de dos machos y una hembra (Huey, 1937) son: longitud total, 305, 292, 305; longitud de la cola, 141, 141, 155; longitud de la pata, 30, 31, 32; longitud de la oreja, 25, 27, 30; longitud total del cráneo, 39.3, 37.5, 38.9; longitud condilobasal, 37.5, 36.2, 37.0; anchura zigomática, 20.0, 19.6, 20.5; anchura interorbital, 5.0, 5.1, 5.0; longitud de los nasales, 15.2, 14.2, 14.3; longitud de la hilera de molares superiores, 8.2, 8.2, 8.4.

Comentarios. Huey (1937) menciona que la distribución está restringida a un área aislada y lejana a las localidades donde se había reportado de *N. lepida*. Las laderas altas de Arizona y Sonora son el hábitat donde se puede encontrar a estos organismos.

Neotoma lepida bensoni Blossom

1935. *Neotoma lepida bensoni* Blossom, Occas. Pap. Pub. Mus. Zool., Univ. Michigan, 315:1.

localidad típica. Tanque Pápago, Sierra del Pinacate, Sonora.

Distribución. Debido a las características fisiográficas, quedan restringuidos a la Sierra del Pinacate. Su distribución está delimitada al noroeste y noreste por el desierto del Altar y hacia el sur por dunas caminantes (Blossom, 1935).

Registros. *SONORA*: tanque Pápago; cráter Elegante, 41 mi SW Sonoyta [Sonoita] (Blossom, 1935).

Descripción. Según Blossom (1935), es una subespecie pequeña de coloración obscura; orejas grandes y pelo de la cola corto.

Medidas. Las medidas del tipo y dos paratipos (Blossom, 1935) son: longitud total, 284, 277, -; longitud de la cola, 134, 116, -; longitud de la pata, 27, 28, -; longitud de la oreja, 29, 30.6, -; longitud total del cráneo, 37.0, -, 38.1; longitud basilar, 32.9, -, 33.6; anchura zigomática, 19.5, -, 20.3; anchura interorbital, 4.9, -, 4.9; longitud de los nasales, 13.4, - 14.5; longitud de la serie de molares superiores, 7.7, -, 7.6.

Comentarios. Blossom (1935) menciona que todas las poblaciones de las diferentes especies que se encuentran en esta zona de la Sierra del Pinacate son de color oscuro, debido a la presencia del sustrato de origen volcánico. Por esta razón han sido designadas como subespecies diferentes, ya que contrasta con las poblaciones de alrededor, que son claras.

Neotoma lepida egressa Orr

1934. *Neotoma lepida egressa* Orr, Proc. Biol. Soc. Washington, 47:109.

localidad típica. 1 mi E El Rosario, 200 ft, Baja California.

Distribución. En la parte centro oeste del estado de Baja California, desde San Telmo hasta San Quintín, la parte noroeste de la Sierra de San Miguel. Orr (1934) menciona que la distribución es de la región de la costa noroeste de Baja California de la latitud 31° LN hacia el sur hasta Rosario (30° 03' LN).

Registros. *BAJA CALIFORNIA.* Colnett (latitud 31° LN); San Telmo, 600 ft; San Ramón, boca del río Santo Domingo; Santo Domingo, 25 ft; arroyo Nuevo York, 200 ft, 15 mi S Santo Domingo; Socorro 20 mi S San Quintín, 1 mi E Rosario, 200 ft (Orr, 1934).

Descripción. Es grande en tamaño, comparándola con *N. l. intermedia* o *N. l. felipensis*, con variación en coloración a tono pálido; cráneo grande y rostro relativamente largo y delgado; bulas auditivas grandes (Orr, 1934).

Medidas. Orr (1934) proporciona la media y el intervalo de diez organismos de tres localidades (El Rosario, Socorro y San Telmo): longitud total, 344.7 (325-360); longitud de la cola, 157.3 (145-171); longitud de la pata, 34.5 (32-36); longitud basilar, 37.2 (35.7-39); anchura zigomática, 23.4 (22.2-24.4); anchura interorbital, 5.7 (5.4-5.9); longitud de los nasales, 17.4 (16.6-18.7); longitud de la serie de molares superiores, 8.9 (8.4-9.4).

Comentarios. De acuerdo con la descripción original (Orr, 1934), esta subespecie se distingue básicamente por su tamaño y coloración. Se considera como la intergradación, en cuanto a coloración, entre la obscura de la costa del Pacífico (*N. l. intermedia*) y la color pálido del desierto de (*N. l. felipensis*).

Neotoma lepida felipensis Elliot

1903. *Neotoma bella felipensis* Elliot, Field Columb. Mus., Publ. 79, Zool. ser., 3(12):217.

1932. *Neotoma lepida felipensis,* Goldman, Jour. Mamm., 13:64.

localidad típica. San Felipe, Baja California.

Distribución. Desde la cabecera oeste del Golfo de California, en el estado de Baja California hasta antes de las partes altas.

Registros. *BAJA CALIFORNIA*: San Felipe (Elliot, 1903). Palomar; Parral; Cañón Viento (Hall, 1981).

Descripción. Elliot (1903) considera que la coloración es similar a *N. bella* (actualmente *N. l. lepida*); las tonalidades abarcan el crema y el amarillo claro, con negro en las partes superiores del cuerpo; los costados son crema pálido; labios, manos, patas, parte baja e interna de los costados de color blanco; porción basal del pelo plúmbea en la región lateral del cuerpo y parte interna de las extremidades, excepto la barbilla; la parte central del pecho y una línea en la parte baja del abdomen hasta la región anal de color blanco; cola obscura en la parte dorsal y clara en la ventral; orejas castaño pálido.

Medidas. Las dadas por Elliot (1903) son: longitud total, 335; longitud cola, 158; longitud pata, 34; longitud oreja, 34.

Comentarios. En general la apariencia de esta subespecie no difiere mucho de *N. bella* de Palm Spring al sur de California. Según menciona Elliot (1903), es difícil poder hacer una diferenciación de los especímenes, pero se ha observado que los organismos adultos son más largos, con orejas poco más grandes; las patas y la cola difieren de manera similar; en cuanto al cráneo, la disparidad garantiza esta separación.

Burt y Barkalow (1942) dan las siguientes medidas para los báculos de dos individuos; longitud 14.30-15.60; diámetro a la base, dorso-ventral, 1.0-1.3; lateral, 2.1-2.18; diámetro cerca de la parte media, dorso-ventral, 0.64-0.65; lateral, 0.70-0.80.

Neotoma lepida gilva Rhoads

1894. *Neotoma intermedia gilva* Rhoads, Amer. Nat., 28:70.

1932. *Neotoma lepida gilva*, Goldman, Jour. Mamm., 13:63.

localidad típica. Banning, condado de Riverside, California.

Distribución. En México, en la parte alta de la zona montañosa de Baja California, continuándose hasta la región centro oeste del Mar de Cortéz en el estado de Baja California.

Registros. *BAJA CALIFORNIA*. Calamahué; Yubay; pozo San Agustín, 20 mi E San Fernando; Cañón Esperanza, ladera E Sierra de San Pedro Mártir (Hall, 1981). Valle La Puerta, cerca de la línea divisoria; Bahía de los Angeles; 27 m W Paradero, Punta Prieta; 24 km E Paradero, Punta Prieta; 24 km E Paradero, 1 km E (kilómetro 148, carretera Guerrero Negro-Rosario 580 mi) (IB-UNAM). *BAJA CALIFORNIA SUR*: San Bartolomé [Bahía Tortuga] (Townsend, 1912).

Descripción. Según Rhoads (1894) es mucho mas grande que *N. l. intermedia*.

Medidas. La media de ocho ejemplares examinados del Instituto de Biología de la Universidad Nacional Autónoma de México son: longitud total, 277.9; longitud de la cola, 125.5; longitud de la pata, 31.8; longitud de la oreja, 30.3; longitud total del cráneo, 38.8; anchura zigomática, 20.2; anchura interorbital, 5.6; ancho del rostro, 6.2; anchura del cráneo a la altura del mastoideo, 16.8; longitud de la hilera de dientes maxilares, 8.1; longitud de la hilera de dientes mandibulares, 7.9.

Comentarios. Burt y Barkalow (1942) dan las siguientes medidas para el báculo de un ejemplar: longitud 17.05; diámetro a la base, dorso-ventral, 1.32; lateral, 2.50; diámetro cerca de la parte media, dorso-ventral, 0.60; lateral, 0.70.

Neotoma lepida insularis Townsend

1912. *Neotoma insularis* Townsend, Bull. Amer. Mus. Nat. Hist., 31:125.

1932. *Neotoma lepida insularis*, Burt, Trans. San Diego Soc. Nat. Hist., 7.182.

localidad típica. Isla Angel de la Guarda, Baja California.

Distribución. Conocida solamente de la isla Angel de la Guarda.

Descripción. Tamaño similar a *N. l. gilva*, pero de coloración más parda, de tonos grises y amarillentos. Cráneo relativamente corto y ancho, rostro robusto al igual que la dentición, las bulas auditivas son grandes (Townsend, 1912).

Medidas. Townsend (1912) solamente da las siguientes medidas: longitud total, 290; longitud de la cola, 120 y longitud de la pata, 35.

Comentarios. Burt y Barkalow (1942) dan las siguientes medidas para el báculo de un ejemplar: longitud 8.4; diámetro a la base, dorso-ventral, 1.22; lateral, 2.0; diámetro cerca de la parte media, dorso-ventral, 0.58; lateral, 0.76. Esta isla se caracteriza por su fisiografía abrupta y accidentada. En mayo de 1997 los autores del presente capítulo colocaron mas de 1,200 trampas/noche en tres diferentes partes de la isla y no se colectó ningun ejemplar. La Norma Oficial Mexicana (1994) la considera como una especie amenazada de extinción.

Neotoma lepida intermedia Rhoads

1894. *Neotoma intermedia* Rhoads, Amer. Nat., 28:69.

1932. *Neotoma lepida intermedia*, Goldman, Jour. Mamm., 13.64.

localidad típica. Dulzura, condado de San Diego, California.

Distribución. Por la vertiente del Pacífico y la región norte centro de Baja California, a excepción de la zona del Valles de San Telmo a San Quintín.

Registros. *BAJA CALIFORNIA*: Ensenada; El Alamo; Agua San Matias; Aguaje de las Fresas; Vallecitos; La Grulla; San Antonio; Santa Rosa; St [Santa] Eulalia; origen del río San Antonio; división Rosarito; Rosarito; Agua Escondida; San Quentín [Quintín]; montañas de San Pedro Mártir; Palomar; Laguna Hanson; Agua Escondida, Lagunas Hanson (Elliot, 1903). Río Tecate; cúspide del camino de San Matías; San Fernando; rancho San Antonio; W de la Sierra de San Pedro Mártir; 20 mi E de Ensenada (Hall, 1981).

Descripción. Según la descripción original de Rhoads (1894), es de tamaño pequeño; cola delgada, corta y bicolor; orejas grandes; dorso castaño grisáceo, con una línea negra; parte media ventral; lados internos de las patas y los dos primeros tercios de la cola blancos; resto de las partes ventrales color gris amarillento; base de los pelos obscura; el primer tercio de la parte dorsal de la cola negruzca.

Medidas. El promedio de seis ejemplares del Instituto de Biología de la Universidad Nacional Autónoma de México es: longitud total, 281.4; longitud de la cola, 109.2; longitud de la pata, 32.6; longitud de la oreja, 29.4.

Comentarios. Rhoads (1894) menciona que la especie ha sido confundida con *N. mexicana*, diferenciándose por el tamaño de las orejas y el cráneo

Neotoma lepida latirostra Burt

1932. *Neotoma lepida latirostra* Burt, Trans. San Diego Soc. Nat. Hist., 7:180.

localidad típica. Isla Danzante (25° 47' LN, 111° 11' LW), Baja California [Sur].

Registros. *BAJA CALIFORNIA SUR*: isla Danzante (Burt, 1932a). Lado W de la isla Danzante (CIB).

Distribución. Conocida solamente de la Isla Danzante.

Descripción. Burt (1932a) señaló a esta especie ligeramente grande dentro del grupo *lepida*; el rostro es amplio y tosco; dentición robusta; bulas auditivas grandes y redondeadas; cola relativamente corta, en relación con el cuerpo. Coloración similar a la de *N. l. arenacea*, pero distinguiéndose en forma y tamaño de algunas partes del cuerpo, como lo son: cola relativamente corta; espacio interpterigoideo estrecho; puente palatal largo; foraminas de los incisivos cortas; rostro ancho y nasales largos. En comparación con *N. l. perpallida*, el tamaño es mayor; cola relativamente corta y coloración obscura; la dentición esta es robusta; rostro ancho y bulas auditivas largas. Respecto a *N. l. nudicauda*, la diferencia se observa en la coloración obscura, el tamaño mayor, la robustez del rostro y el surco supraorbital, que es ligeramente agudo. El cráneo en la parte superior se eleva abruptamente en *N. l. latirostra*, mientras que en *N. l. nudicauda* está inclinado hacia adelante.

Medidas. El promedio de 11 ejemplares examinados Centro de Investigaciones Biológicas del Noroeste son: longitud total, 347; longitud de la cola, 156; longitud de la pata, 39; longitud de la oreja, 34; longitud total del cráneo, 45.9; anchura zigomática, 23.1; anchura interorbital, 6.3; anchura del cráneo a la altura del mastoideo, 18.0; ancho del rostro, 5.0; longitud de la hilera de dientes maxilares, 8.8; longitud de la hilera de dientes mandibulares, 8.4.

Comentarios. Banks (1964b) comenta que esta subespecie es común en la isla y que ninguna de las hembras colectadas en mayo se encontraron preñadas. En las distintas visitas efectuadas a la isla, la colecta de estos organismos ha sido escasa. Una de las posibles causas es la fisiografía, la cual ha dificultado la zonación de la isla, aun cuando el tipo de hábitat es propicio para la ocurrencia de estos organismos. Característicamente, esta isla es abrupta con poca vegetación; de las especies vegetales dominantes en el área encontramos a *Merremia aurea*, *Synanchum* sp., *Ruellia* sp., *Antiphytum peninsulae*. La Norma Oficial Mexicana (1994) la considera como una especie amenazada de extinción.

Neotoma lepida marcosensis Burt

1932. *Neotoma lepida marcosensis* Burt, Trans. San Diego Soc. Nat. Hist., 7:179.

localidad típica. Isla San Marcos (27° 13' LN, 112° 05' LW), Golfo de California, Baja California [Sur].

Distribución. Conocida únicamente en la localidad tipo.

BAJA CALIFORNIA SUR: isla San Marcos (Burt, 1932a); NE de la isla (CIB).

Descripción. Según Burt (1932), son organismos más o menos oscuros; en la parte dorsal del cuerpo se observa una tonalidad más obscura que a los costados; básicamente el pelaje es de color gris, aunque las puntas se observan amarillo-castaño, en los laterales el pelo es de menor tamaño por lo que el efecto del matizado da apariencia de coloración más clara; ventralmente es clara; a la altura de la garganta se observa agrisada, mientras que en el pecho, un manchón blanquecino a crema; el resto del vientre varía de crema agrisado a amarillo-castaño; las orejas son color castaño-grisáceo; mientras que la cola es castaño obscura, observándose en la parte terminal

blanquecina; las extremidades, hasta el tobillo, presentan el color del resto del cuerpo, mientras que las patas son de tonalidades claras.

Medidas. El intervalo de seis ejemplares de la colección de mamíferos del Centro de Investigaciones Biológicas del Noroeste son: longitud total, 305-380; longitud de la cola, 131-192; longitud de la oreja, 36-41; longitud de la pata, 33-37; longitud total del cráneo, 42.2-47.5; anchura zigomática, 20.9-23.5; anchura interorbital, 5.9-6.7; ancho del rostro, 4.6-5.2; anchura del cráneo a la altura del mastoideo, 17.2-18.1; longitud de la hilera de dientes maxilares, 8.7-9.3; longitud de la hilera de dientes mandibulares, 8.6-9.0.

Comentarios. En 1995, se realizó una visita a la parte noreste de la isla. Se observó que la vegetación predominante es *Euphorbia magdalenae*, *Antiphytum peninsulare* y *Encelia* sp. Con respecto a la fisiografía, encontramos algunos acantilados y cañadas con vegetación arbustiva baja.

Burt y Baklalow (1942, dan las siguientes medidas para el báculo de un ejemplar; longitud 18.55; diámetro a la base, dorso-ventral, 1.56; lateral, 2.40; diámetro cerca de la parte media, dorso-ventral, 0.73; lateral, 0.90. La Norma Oficial Mexicana (1994) la considera como una especie amenazada de extinción.

Neotoma lepida molagrandis Huey

1945. *Neotoma lepida molagrandis* Huey, Trans. San Diego Soc. Nat. Hist., 10:307.

localidad típica. Sitio del viejo pozo cercano a un "banco de arena", 3 mi tierra adentro del desembarcadero de la playa Santo Domingo, cerca de 50 ft, 28° 15' LN, Baja California.

Distribución. La región del desierto de Vizcaíno, continuándose un tercio de la planicie costera de Baja California al norte y hasta Santo Domingo hacia el Sur.

Registros. *BAJA CALIFORNIA*: Sitio del viejo pozo cercano a un "banco de arena," 3 mi tierra adentro del desembarcadero de la playa Santo Domingo (Huey, 1945). Punta Prieta; Misión de Santa Gertrudis; 12 mi E El Arco (Hall, 1981). *BAJA CALIFORNIA SUR*: Bahía Tortuga; Bahía Santa María; (Carleton, 1980, como *N. lepida*). Rancho Miraflores; San Ignacio; tinaja Santa Clara; Sierra Santa Clara (Hall, 1981).

Descripción. Huey (1945) basó la determinación de esta subespecie en el tamaño y color de los organismos del área de costa-llano del noroeste del desierto de Vizcaíno. El los asemeja a *N. l. egressa* del área de San Quintín, con la única diferencia de que la coloración del pelo de *N. l. molagrandis* es ligeramente más pálida. Con respecto a la diferencias craneales, estas están bien delimitadas. Para *N. l. molagrandis*, los molares son robustos; bulas auditivas más largas e infladas; los nasales son ligeramente más anchos; cráneo aguzado y angular, inclinado en la parte posterior y en los arcos zigomáticos. Un carácter más conspicuo es el contorno del foramen infraorbital; éste es largo en *N. l. egressa*, pero comprimido en la parte superior, con las paredes paralelas (similar a *N. l. ravida*). Comparada con *N. l. ravida* del área montañosa del sureste y sur del desierto de Vizcaíno, *N. l. molagrandis* tiene un tamaño mayor y una coloración más firme. Las diferencias craneales están bien marcadas, y el arco zigomático es robusto y muy ancho en la parte posterior; bulas auditivas demasiado elongadas e infladas. Los molares de *N. l. molagrandis* son grandes.

Medidas. Las medidas del tipo (Huey, 1945) son: longitud total, 342; longitud de la cola, 150; longitud de la pata, 35; longitud de la oreja, 30; longitud total del cráneo, 44.4; anchura zigomática, 23.7; anchura interorbital, 5.5; longitud de los nasales, 17.1; longitud del puente palatal, 8.0; longitud de la serie de molares superiores, 8.4.

Comentarios. En el trabajo de Huey (1945) se hace mención acerca de los primeros trabajos realizados con *N. lepida*, que inicialmente era denominada como *N. intermedia*. En dicho trabajo menciona las primeras distribuciones referidas por Goldman, en donde se toma en cuenta únicamente a dos subespecies; sin embargo conforme se realizaron más trabajos, esta distribución fue reduciéndose, de tal manera que resulta de interés ver la distribución de *Neotoma* en función de la Sierra de San Pedro Mártir.

Neotoma lepida notia Nelson y Goldman

1931. *Neotoma intermedia notia* Nelson y Goldman, Proc. Biol. Soc. Washington, 44:108.
1932. *Neotoma lepida notia,* Goldman, Jour. Mamm., 13:65.

localidad típica. La Laguna, 5500 ft, Sierra de la Victoria, Baja California Sur.

Distribución. Conocida solamente de las partes altas de las sierras de Baja California Sur, en la región de los Cabos.

Registros. *BAJA CALIFORNIA SUR*: La Laguna, Sierra de la Victoria; monte Miraflores; Sierra o montaña Victoria (Nelson y Goldman, 1931a).

Descripción. Nelson y Goldman (1931a) describen la coloración de la parte superior del cuerpo con tonalidades de amarillo claro a canelas, tonalidades claras en el pecho y a todo lo largo de los costados, moderadamente obscura en la parte superior de la cabeza y lomo; las partes internas del cuerpo están cubiertas de color blanco, y en la porción basal el color es plúmbeo; las patas son blancas, tobillos agrisados; cola delgada y peluda, confusamente bicolor; en la parte superior es castaño oscuro, mientras que en la parte de abajo es de color gris oscuro. La forma del cráneo es similar al de *N. l. arenacea*, pero más pequeña; rostro pequeño; región frontal plana; surco supraorbital ligeramente obturado; bulas auditivas pequeñas, y la dentición es más bien robusta como en *N. l. arenacea.* Al comparar el cráneo con el de *N. l. intermedia*, éste es similar en tamaño, pero el zigomático es notoriamente más robusto y arqueado en la parte posterior externa; fosa interpterigoidea ancha; dentición robusta.

Medidas. Las medidas del tipo (Nelson y Goldman, 1931a) son: longitud total, 325; longitud de la cola, 150; longitud de la pata, 37; longitud mayor del cráneo, 43.3; longitud condilobasal, 40.8; anchura zigomática, 22.2; anchura interorbital, 5.5; longitud de la hilera de dientes superiores, 8.7.

Comentarios. Banks (1967a) comenta haber encontrado ejemplares de esta subespecie, desde la zona de cactáceas hasta el bosque de pino. Para finales de mayo registra una hembra preñada con un embrión de 50 mm. En excursiones que hemos realizado recientemente se ha observado que la población es abundante en la parte alta de la sierra.

Neotoma lepida nudicauda Goldman

1905. *Neotoma nudicauda* Goldman, Proc. Biol. Soc. Washington, 18:28.
1932. *Neotoma lepida nudicauda,* Burt, Trans. San Diego Soc. Nat. Hist., 7:182.

localidad típica. Isla del Carmen, Golfo de California, Baja California [Sur].

Distribución. Conocida solamente de la isla del Carmen.

Registros. *BAJA CALIFORNIA SUR*: Isla del Carmen (Goldman, 1905; Townsend, 1912).

Descripción. Según Goldman (1905), la parte trasera del cuerpo es de color agrisado oscuro en la parte del pecho y los laterales; el lomo es oscuro el extremo de las orejas es de color negro; la parte interna de las extremidades son blancas; el vientre y los lados tienen coloración plúmbea; orejas

gris-castaños; patas blancas; cola bicolor; un tercio de la circunferencia de la parte superior del cuerpo es de color oscuro; por debajo, las dos terceras partes, blanquecino obscuras. Cráneo similar a *N. arenacea*, pero bulas auditivas grandes; fosa interpterigoidea estrecha; miembros maxilares del zigoma robustos; foramen anterorbital grande; la pared del borde externo proyectada hacia adelante; nasales truncados en la parte posterior, plano de las orbitas; yugal bastante largo; la dentición semejante a la de *N. albigula*; surco supraorbital bien desarrollado y agudo como en *N. arenacea.*

Medidas. Las medidas de tres ejemplares examinados dos del Instituto de Biología de la Universidad Nacional Autónoma de México y uno del Centro de Investigaciones Biológicas del Noroeste son: longitud total, 351, -,336; longitud de la cola, 167, -, 147; longitud de la oreja, 35, -, 33; longitud de la pata, 41, -, 40; longitud total del cráneo, 46.0, 44.8, 44.1; anchura zigomática, 23.7, 22.9, 22.9; anchura interorbital, 5.9, 5.6, 6.4; ancho del rostro, 6.8, 7.4, 5.1; anchura del cráneo a la altura del mastoideo, 18.4, 18.0, 18.0; longitud de la hilera de dientes maxilares, 9.0, 9.1, 9.3; longitud de la hilera de dientes mandibulares, 9.0, 9.1, 8.5

Comentarios. La vegetación presente en esta localidad corresponde a la de matorral, donde predomina *Jatropha cunneata*, *Larrea tridentata*, *Bursera microphyla* y *Lysiloma candida.* Se han realizado colectas en la parte sur y sureste de la isla, pero no se ha tenido éxito, por lo que se considera que la posible merma en la población puede ser atribuible a la presencia de gatos. La Norma Oficial Mexicana (1994) la considera como una especie amenazada de extinción.

Neotoma lepida perpallida Goldman

1909. *Neotoma intermedia perpallida* Goldman, Proc. Biol. Soc. Washington, 22:139.

1932. *Neotoma lepida perpallida,* Goldman, Jour. Mamm., 13:65.

localidad típica. Isla San José, Golfo de California, Baja California [Sur].

Distribución. Conocida solamente de la isla San José.

Registros. *BAJA CALIFORNIA SUR*: isla San José (Goldman, 1909; Townsend, 1912); SE de isla San José (CIB; IB-UNAM).

Descripción. Según Goldman (1909), la parte superior es de coloración gris pardo, pálido como en *N. l. vicina*, ligeramente oscuro en el lomo y negro o castaño oscuro en las orejas; patas y partes bajas del cuerpo blancas; cola dorsalmente obscura y ventralmente gris. Cráneo más parecido al de *N. l. vicina*, que al de *N. l. intermedia* o *N. gilva*, pero un poco largo; las bulas auditivas son ligeramente pequeñas.

Medidas. El intervalos de 12 ejemplares del Sureste Isla San José Centro de Investigaciones Biológicas del Noroeste son: longitud total, 310-375; longitud de la cola, 140-194; longitud de la pata, 35-39; longitud de la oreja, 30-36; longitud total del cráneo, 40.8-45.3; anchura zigomática, 20.7-23.3; anchura interorbital, 5.7-6.5; ancho del rostro, 4.6-5.4; anchura del cráneo a la altura del mastoideo, 16.0-18.6; longitud de la hilera de dientes maxilares, 8.0-9.2; longitud de la hilera de dientes mandibulares, 7.6-8.5.

Comentarios. Los organismos capturados en la porción sureste de la isla mostraron coloración gris claro; se observa una línea dorsal más obscura; el pelaje es más o menos corto y suave, de color gris pálido en la base, y conforme se acerca a la punta, tiene tonalidades cremas a castaño claro; lateralmente se observa una línea que divide la región corporal, siendo la parte ventral blanquecina; el pelo es de color gris perla y en la punta es blanco; las orejas son de color castaño al igual que la cola; las extremidades mantienen este patrón de coloración hasta la región de los

tobillos; las patas son de color gris claro. Muy parecidan a *N. l. vicina*, pero de coloración pálida suave y cola ligeramente larga. Similar en color a *N. l. gilva*, pero en la parte interna del cuerpo es totalmente blancas y la cola en la parte basal amarillo pálido con escaso mechón en la parte terminal. La Norma Oficial Mexicana (1994) la considera como una especie amenazada de extinción.

Neotoma lepida pretiosa Goldman

1909. *Neotoma intermedia pretiosa* Goldman, Proc. Biol. Soc. Washington, 22:139.

1932. *Neotoma lepida pretiosa,* Goldman, Jour. Mamm., 13:64.

localidad típica. Matancita, 100 ft (Soledad), 50 mi al N de Bahía Magdalena, Baja California [Sur].

Distribución. Prácticamente dos tercios de la vertiente de Pacífico de Baja California Sur, desde el área del Conejo hasta Santo Domingo, por el lado del Golfo, desde Loreto hasta la parte norte de La Paz, incluyendo Isla Margarita y Magdalena.

Registros. *BAJA CALIFORNIA SUR*: isla Santa Margarita (Townsend, 1912; Alvarez, 1958). San Jorge, SW de Comondú; Matancita 100 ft. (Soledad), 50 mi N de Bahía Magdalena; isla [Santa] Margarita; isla [Santa] Magdalena (Hall, 1981). Bahía Magdalena; isla Santa Margarita (Carleton, 1980, como *N. lepida*). 18 km W San Ignacio, 150 m; Ligui, 27 km S de Loreto 420 m; El Juncalito, 15 km de Loreto; Bahía Magdalena, Magdalena isla; Pescadero, 6 mi E; Pescadero, 13 mi S; Cuñano (IB-UNAM).

Descripción. Según la descripción original hecha por Goldman (1909), es de tamaño mayor y de color más pálido que *N. l. intermedia.* Similar en tamaño a *N. l. arenacea*, pero difiere en la palidez; cola corta; bulas auditivas grandes. Goldman (1909) describe esta subespecie con una coloración corporal gris pálido, cual se presenta en las partes laterales y en el pecho; en la parte de la cabeza, orejas y región dorsal presenta tonalidades obscuras y amarillentas; en la parte baja del cuerpo y las patas con tonalidades blanquecinas; cola de color oscuro, y en la parte terminal es agrisada. El cráneo es similar al de *N. intermedia* pero mucho más largo y angular; contorno supraorbital muy prominente; dentición robusta.

Medidas. El promedio y el intervalo de 11 ejemplares Centro de Investigaciones Biológicas del Noroeste son: longitud total, 272.9 (320-237); longitud de la cola, 129.1 (183-107); longitud de la pata, 30.7 (33-29); longitud de la oreja, 31.4 (39-27); longitud total del cráneo, 41.1 (45.2-38.2); anchura zigomática, 20.6 (23.9-17.9); anchura interorbital, 5.6 (6.2-5.3); apertura nasal, 6.5 (7.7-5.4); anchura del cráneo a la altura del mastoideo, 16.8 (18.7-15.5); longitud de la hilera de dientes maxilares, 8.4 (9.7-7.5); longitud de la hilera de dientes mandibulares, 8.0 (8.7-6.8).

Comentarios. Banks (1964b) menciona que esta subespecie es muy abundante en los manglares de isla Magdalena. Burt y Barkalow (1942) dan las siguientes medidas para los báculos de 11 ejemplares: longitud 18.01 (17.0-20.2); diámetro a la base, dorso-ventral, 1.53 (1.12-1.79); lateral, 2.5 (2.20-2.79); diámetro cerca de la parte media, dorso-ventral, 0.77 (0.61-0.80); lateral, 0.92 (0.81-1.10).

Neotoma lepida ravida Nelson y Goldman

1931. *Neotoma intermedia ravida* Nelson y Goldman, Proc. Biol. Soc. Washington, 44:107.

1932. *Neotoma lepida ravida,* Goldman, Jour. Mamm., 13:64.

localidad típica. Comondú, 700 ft, Baja California [Sur].

Distribución. Región volcánica y montañosa de la Sierra de La Giganta, desde la zona de Loreto hasta el norte de Santa Rosalía.

Registros. *BAJA CALIFORNIA SUR*: Bahía Agua Verde; Mulege; Bahía Concepción (Townsend, 1912 como *N. intermedia*). Aguaje de la Natividad, 25 mi NW de San Ignacio; Comondú; El Potrero, cerca de Mulege; Paso Hondo, 16 mi N La Purísima; San Ignacio; Sierra de la Giganta (Nelson y Goldman, 1931a). Sierra de La Giganta, 1200 m (Alvarez, 1958).

Descripción. Nelson y Goldman (1931a) señalan que la coloración en la parte superior del cuerpo abarca matices de amarillo a vino, cubriéndose con una mezcla fuerte y bastante uniforme de tonalidades negras; en general se produce efecto oscuro; la parte interna de las extremidades en general es de color blanco; algunas veces la raíz del pelo es de color plúmbeo; en la parte baja del cuello se presenta una banda con matices amarillos y rosáceos; patas de color blanco; tobillos blanquecinos; cola delgada y peluda, negra en la parte superior, mientras que la parte de abajo es de coloración castaño-agrisado, sin línea de límite para la porción dorsal y ventral. El cráneo es muy similar en forma y tamaño al de *N. l. intermedia*, con una estructura ligera; zigomático muy delgado; fosa interpterigoidea comúnmente ancha; bula auditiva proporcionalmente larga y delgada; la dentición es igual. Comparándose con *N. l. pretiosa* y *N. l. arenacea*, el cráneo es mucho más pequeño y ligero.

Medidas. Las del organismo tipo (Nelson y Goldman, 1931a) son: longitud total, 343; longitud de la cola, 172; longitud de la pata, 34; longitud total del cráneo, 41.5; longitud condilobasal, 39.5; anchura zigomática, 21.6; anchura interorbital, 5.4; longitud de la hilera de dientes superiores, 8.

Comentarios. Los estudios realizados por Nelson y Goldman (1931a) demuestran que el intervalo de distribución de *N. l. intermedia* no se extiende demasiado al sur, como se había pensado originalmente. Los especímenes de la parte central son propiamente asignables a *N. l. gilva*, mientras que son de la región volcánica a lo largo del eje de la península, cerca de la latitud de los 28° sur de la Sierra de la Giganta, representa la forma obscura de *N. l. ravida*. El color está asociado con el tipo de suelo en el que habitan. Los especímenes de *N. l. ravida*, que habitan lugares con presencia de lava cercanos a San Ignacio, contrastan fuertemente con éstas de *N. l. gilva* de arenas blanquecinas de San Angel, en desierto del Vizcaíno el 20 mi al oeste. Alvarez (1958) registra, en la Sierra de La Giganta, el límite altitudinal que se tiene para la subespecie.

Neotoma lepida vicina Goldman

1909. *Neotoma intermedia vicina* Goldman, Proc. Biol. Soc. Washington, 22:140.
1932. *Neotoma lepida vicina,* Goldman, Jour. Mamm., 13:65.

localidad típica. Isla Espíritu Santo, Baja California [Sur].

Distribución. Conocida solamente de la Isla Espíritu Santo.

Registros: *BAJA CALIFORNIA SUR*: Isla Espíritu Santo (Goldman, 1909; 1910; Townsend, 1912).

Descripción. Según Goldman (1910), el pelo de la parte superior del cuerpo es de color gris oscuro o pardo oscuro; esta coloración es típica de la partes laterales y el pecho; la cabeza, las orejas y la región dorsal son moderadamente obscuras; patas y partes internas del cuerpo blancas; cola obscura dorsal y gris ventral. Cráneo parecido al de *N. l. perpallida*, diferenciándose de *N. l. arenacea* en el tamaño pequeño, la dentición relativamente robusta y las bulas auditivas un poco más grandes.

Medidas. Las de un ejemplar (Goldman, 1910) son: longitud total, 344; longitud de la cola, 162; longitud de la pata, 34.5; longitud basilar, 35.6; anchura zigomática, 22.8; anchura interorbital, 5.6; longitud de los nasales, 16.4; longitud alveolar de los molares superiores 8.1.

Comentarios. Esta subespecie es muy abundante en la parte norte de la isla, principalmente en las laderas de los cañones, que son muy pedregosas y con muy poca vegetación. Las piedras por lo general son de gran tamaño, permitiendo el fácil movimiento de los roedores por debajo de ellas. Los nidos pueden ser fácilmente observables debajo de piedras o entre éstas. En las partes altas de los cañones existen tres acantilados escalonados de aproximadamente cinco metros cada uno, en donde es frecuente observar los nidos en las oquedades. Se ha observado que esta especie tiene actividad antes del crepúsculo en los días de más calor, cuando las laderas en las que viven ya tienen sombra.

En colectas realizadas en varias ocasiones en las islas se obtuvo que no son muy comunes. Las trampas Sherman han mostrado poca eficiencia. La vegetación predominante en los cañones del norte son *Pachycerius* sp., *Paullinia* sp., *Solanum* sp. y *Ruelia* sp. La Norma Oficial Mexicana (1994) la considera como una especie amenazada de extinción.

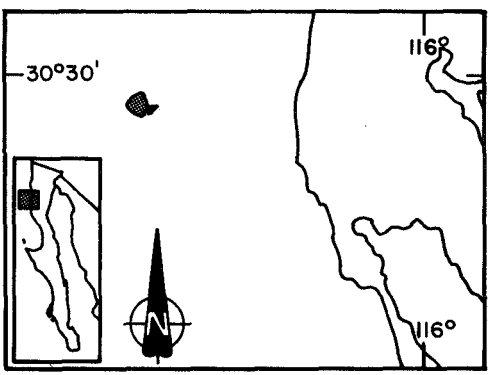
Neotoma martinensis Goldman

1905. *Neotoma martinensis* Goldman, Proc. Biol. Soc. Washington, 18:28.

localidad típica. Isla San Martín, Baja California.

Distribución. Conocida solamente de isla San Martín.

Registros. *BAJA CALIFORNIA*: isla San Martín (Goldman, 1905).



Localización de *Neotoma martinensis*.

Descripción. Según Goldman (1905), la parte posterior del cuerpo es castaño agrisada; en la dorsal se mezcla con matices oscuros de las orejas; algunas veces se extienden en los costados tonalidades amarillentas; la parte interna del cuerpo es clara (blanca a cremosa), aunque basalmente es gris oscuro (plúmbeo); orejas obscuras; costados notoriamente oscuros; las patas en sus porciones laterales son blancas; cola bicolor; en la parte dorsal es castaño oscuro, y en la ventral, gris claro. Cráneo de tamaño medio, ligeramente redondeado; el arco zigomático es alto y arqueado en la parte interior; surco temporal ligeramente desarrollado y muy separado; nasales muy largos, abruptamente angosto en su región posterior; la superficie superior está poco extendida, y exteriormente el surco lateral está bien desarrollado; la bula auditiva puede ser pequeña y en forma de pera; el meato es muy largo y abierto.

Medidas. Las que proporciona Goldman (1905) son: longitud total, 342; longitud de la cola, 167; longitud de la pata, 35.7 (piel seca).

Comentarios. Actualmente se puede considerar como una especie posiblemente extinta (Mellink, 1992a). Este autor además ha menciona que en los sesentas se introdujeron gatos con la intención

de extirpar a esta rata de la isla, no siendo capturada desde 1963 en que Banks trampeo en la isla. La Norma Oficial Mexicana (1994) la considera como una especie amenazada de extinción.

Neotoma mexicana mexicana Baird

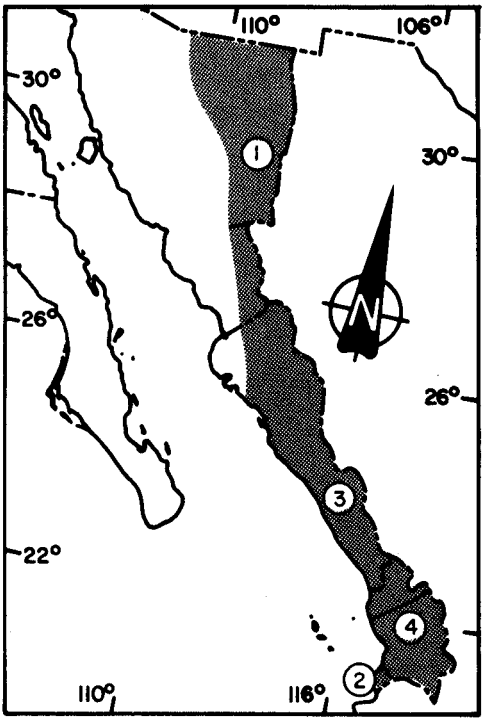
1855. *Neotoma mexicana* Baird, Proc. Acad. Nat. Sci. Philadelphia, 7:333.

localidad típica. A unos metros cerca de Chihuahua.

Distribución. La especie se encuentra desde el norte de Colorado hasta Guatemala y Honduras; en México, principalmente en el altiplano central y las dos sierras madres (Cornely y Baker, 1986). *N. m. mexicana* de la Sierra Madre Occidental habita desde el noroeste de Chihuahua y el noreste de Sonora, hacia el sur y el oeste de Zacatecas (Goldman, 1910).

Registros. *SONORA*: Cuchita; Oposura (Allen, 1895); a unos metros cerca de Chihuahua; Sierra Madre, 7000 ft, cerca de Guadalupe y Calvo, Chihuahua (Baird, 1855; Goldman, 1905). Cuchita (Allen, 1893a). Cuchita; Oposura (Burt, 1938).

Descripción. La coloración es entre amarilla rojiza y canela; dorsalmente es más oscuro, debido al pelaje, que tiene tonos negros en su parte terminal; en el interior de las extremidades las puntas del pelo son blancas, aunque en la parte basal es de color gris; en las axilas la tonalidad es amarillo ocre; patas blancas; cola bicolor con la parte dorsal castaño, mientras que ventralmente es blanquecina a grisácea. Con respecto al cráneo, las bulas son relativamente pequeñas; primer molar con ángulo de reentrada antero-interno.



Localización de *Neotoma mexicana*:
1. *N. m. mexicana* 2. *N. m. eremita*
3. *N. m. sinaloae* 4. *N. m. tenuicauda*

Medidas. Promedio de dos topotipos (Goldman, 1910) son: longitud total, 314; longitud de la cola, 144; longitud de la pata, 33; longitud basilar, 34.8; anchura zigomática. 21.7; anchura interorbital, 5.4; longitud de los nasales, 17.2; longitud de la serie de molares maxilares, 8.5.

Comentarios. La distribución de esta subespecie incluye las partes altas de la Sierra Madre de Sonora, Chihuahua y Zacatecas; a lo largo de la ladera este existe un solapamiento con *N. m. sinaloe*. Se puede distinguir de *N. m. sinaloe* debido a las características del pelo más oscuro y por el tamaño de las bulas auditivas (Goldman, 1910).

Los especímenes de esta especie pueden ser fácilmente distinguibles por lo profundo de la reentrante anterointerna en el primer molar superior, así como por su coloración, tamaño y dimensiones craneales.

Birney y Jones (1971), al revisar las *Neotomas mexicana* del estado de Sinaloa, concluyeron que *N. m. madrensis* no está presente en la región, al contrario de los suponian Baker y Greer (1962). Por otro lado consideran que la gran mayoría de los ejemplares de *N. mexicana* en el estado deben de ser asignados a *N. m. sinaloe* a excepción de tres de la zona de Plomosa, que pueden ser referidos a *N. m. tenuicauda*. Sin embargo consideran que es necesario un mayor revisión de ejemplares de esta última subespecie.

La especie se encuentra principalmente en las zonas rocosas fuera de los cultivos, laderas rocosas y acantilados, así como en las zonas montañosas, en áreas abiertas o arbustivas (Gardner, 1965; Cornely y Baker, 1986; Matson y Baker, 1986). Específicamente para México, han sido colectadas en encinares, pinares (Baker, 1956), zonas con vegetación riparia y vegetación tropical (Hooper, 1955), matorral espinoso (Birney y Jones, 1971), selva baja caducifolia (Davis, 1944) y en bosque mixto asociado a áreas áridas (Davis y Russell, 1954).

Neotoma mexicana no construye los nidos como las demás especies de *Neotoma* (Cornely y Baker, 1986); sus madrigueras se han encontrado en partes protegidas entre rocas, cavidades de árboles o construcciones abandonadas, en ocasiones ocupa nidos vacíos de otras especies.

Anderson (1972, registra para Chihuahua una hembra con cuatro embriones y cinco con dos en los meses de mayo, junio y julio. Burt y Barkalow (1942) comentan que el báculo es muy recto y que la base es poco expandida con forma de U en corte transversal. También reportan las siguientes medidas para dos ejemplares: longitud, 5.38-5.60; diámetro a la base, dorso-ventral, 0.89-1.09; lateral, 1.84-2.21; diámetro cerca de la parte media, dorso-ventral, 0.51-0.55; lateral, 0.61-0.70. Hooper (1960) menciona que las glándulas del pene son similares a las de *N. albigula, N. floridana* y *N. micropus*.

Baker y Mascarello (1969) registran el cariotipo para la especie con 2n=52 y el FN=54. El cromosoma Y es subtelocéntrico de tamaño medio y el X es subtelocéntrico grande. Al analizar poblaciones aisladas en la cima de montañas (cinco subespecies), no encuentran variación en el cromosoma. Existen cuatro subespecies en la región noroeste de México.

Neotoma mexicana eremita Hall

1955. *Neotoma mexicana eremita* Hall, Jour. Washington Acad. Sci., 45:328.

localidad típica. 1 mi S San Francisco, 50 ft, Nayarit.

Distribución. Conocida únicamente de la localidad tipo.

Registros. *NAYARIT*: 1 mi S San Francisco, 50 ft (Hall, 1955).

Descripción. Dentro de la especie, se considera la de cráneo de menor tamaño; la coloración dorsal varía de gris oscuro a tonalidades ocres. Difieren de *N. m. parvidens* y *N. m. eremita* en el tamaño pequeño; dorsalmente es menos ocre e internamente es menos clara; más bien es grisácea. *N. m. eremita* también es menos ocrácea y grande que *N. m. tenuicauda*, que está geográficamente adyacente.

Medidas. Las medidas del tipo (Hall, 1955) son: longitud total, 301; longitud de la cola, 142; longitud de la pata, 30; longitud occipitonasal, 39; longitud basilar, 31.6; anchura zigomática, 19.7; anchura mastoideo, 15; anchura interorbital, 4.8; longitud de los nasales, 15.6; longitud de la hilera de dientes maxilares, 7.2

Comentarios. Existe una estrecha relación entre *N. m. eremita* y *N. m. parvidens* (Hall, 1955).

Neotoma mexicana sinaloae J. A. Allen

1898. *Neotoma sinaloe* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 10:149.
1910. *Neotoma mexicana sinaloe,* Goldman, N. Amer. Fauna, 31:60.

localidad típica. Tatameles, Sinaloa.

Distribución. Al parecer la ocurrencia de estos organismos es en la parte sureste de Sonora y a lo largo de la costa de Sinaloa.

Registros. *SINALOA*: Tatameles [cerca de Rosarito] (Allen, 1898). Mazatlán (Goldman, 1910). Chele (Hooper, 1955). Copala; 5 mi SW Copala (Baker y Greer, 1962). 15 km N, 65 km E Sinaloa, 4700 ft; 12 km N, 50 km E Sinaloa, 6000 ft; 1.5 mi N Badiraguato, 750 ft; 12 mi N Culiacán; 1 mi SE Presa Sanalona, 500 ft; Huitacochi, 8 mi S Novolato; 32 mi SSE Culiacán; 1 mi SE Camino Real, 400 ft; 10 km NE Santa Lucía, 6400 ft; 1 mi E Santa Lucía, 5650 (*ca.* 3650) ft; Pánuco, 2025 ft; 5 mi NW Mazatán (Birney y Jones, 1971). *SONORA*: San Javier; Mira Sol; Camoa (Burt, 1938).

Descripción. Tamaño medio; la coloración es amarillo rojizo, el cual varía un poco, ya que en las puntas tiene tonalidades obscuras; la superficie de la cabeza no presenta la coloración corporal siendo de color agrisado; ventralmente es blanca; la piel es de color plúmbeo; patas blancas; cola crespada, bicolor; la región dorsal es de color castaño, mientras que ventralmente es blanquecina.

Medidas. La media y el intervalo de cinco ejemplares de Sinaloa (Birney y Jones, 1971) son: longitud total, 349.8 (326-360); longitud de la cola, 162.6 (145-170); longitud de la pata, 34.0 (23-37); longitud de la oreja, 26.9 (25-28); longitud total del cráneo, 43.0 (42.0-44.2); anchura zigomática, 22.1 (21.6-22.6); anchura interorbital, 5.4 (5.3-5.5); anchura mastoidea, 13.2 (15.9-17.0); anchura del rostro, 6.8 (6.5-7.1); longitud del rostro, 17.0 (16.4-17.6); longitud de la hilera de dientes maxilares, 76.8 (6.5-7.1).

Comentarios. Muy semejante en coloración *N. m. mexicana*, pero tiene mayor longitud de la cola, dentición más robusta y un surco más profundo en el borde anterointerior de m^1; las bulas son mucho más pequeñas. *N. m. sinaloe* se puede distinguir de *N. m. madrensis* por su tamaño menor; coloración más obscura y bulas auditivas relativamente pequeñas.

Birney y Jones (1971) comentan que la captura de estos ejemplares se realizó en zonas rocosas y que los nidos se han encontrado en hoyos de árboles. Capturaron, además, hembras preñadas en enero y marzo, y juveniles en enero, marzo, abril, junio, agosto y octubre.

Neotoma mexicana tenuicauda Merriam

1892. *Neotoma tenuicauda* Merriam, Proc. Biol. Soc. Washington, 7:169.
1955. *Neotoma mexicana tenuicauda,* Hooper, Occas, Paper Mus. Zool., Univ. Michigan, 565:22.

localidad típica. Ladera N de la Sierra Nevada de Colima, 12,000 ft, Jalisco.

Distribución. El registro más norteño está referido a la ladera de la sierra de Sinaloa, extendiéndose a la zona centro norte y centro occidente.

Registros. *SINALOA*: Plomosas, 2500 ft; 2 mi SW Plomosas, 3050 ft (Birney y Jones, 1971).

Descripción. Dorsalmente presenta una coloración castaño obscura, más o menos cubierto de tonos amarillo rojizos, particularmente en el cuello y los hombros, pasando a tonos oscuros

amarillo-rojizos en los costados y la cadera; la parte interna del cuerpo es de color blanco tierroso en la punta, mientras que basalmente es de color gris, con una mancha salmón en el lado interno de la axila; cola bicolor, dorsal obscura y ventral blanca; los tobillos y las patas son blancas; patas traseras blanquecinas, y fuertemente manchadas a la altura de los metatarsales; dedos blancos. Proporcionalmente los nasales son cortos, no alargándose al plano de los lacrimales; ramificación ascendente del extremo de los premaxilares sobre el plano de los lacrimales; bula auditiva larga para una *Neotoma*; serie de molares estrechos, con forma prismática angular; primer molar superior con triángulo cerrado interno lateral; molares inferiores con curvas largas, transversas y estrechas; el interior con ángulo de reentrada (Merriam, 1892).

Medidas. Las de un ejemplar examinado por Birney y Jones (1971) son: longitud total, 325; longitud de la cola, 151; longitud de la pata, 34; longitud de la oreja, 25; longitud total del cráneo, 42.3; anchura zigomática, 21.9; anchura interorbital, 5.0; anchura mastoidea, 16.2; anchura del rostro, 6.7; longitud alveolar de los dientes maxilares, 8.6.

Comentarios. Merriam (1892) comenta que es una rata pequeña que vive en las hendiduras de las rocas, con una elevación de 12,000 ft, en el norte de la Sierra Nevada de Colima, en la franja superior de Abetos.

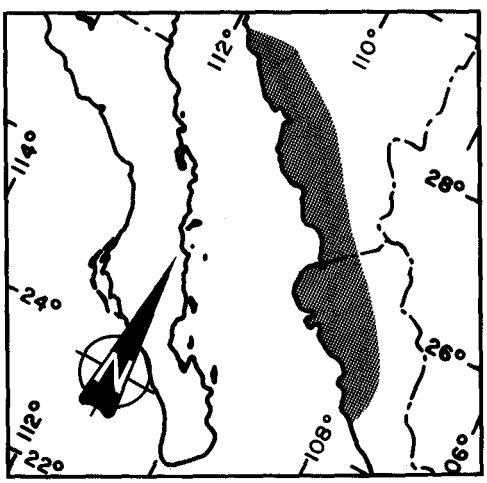
Birney y Jones (1971) asignan los ejemplares de Sinaloa por ellos analizadso tentativamente a *N. m. tenuicauda*, por su similitud con los de esta subespecie de otros estados próximos, pero consideran que el número de muestra (tres ejemplares) no es suficiente para una asignación definitiva.

Neotoma phenax Merriam

1903. *Teanopus phenax* Merriam, Proc. Biol. Soc. Washington, 16:81.
1942. [*Neotoma*] *phenax*, Burt y Barkalow, Jour. Mamm., 23:289.

localidad típica. Camoa, río Mayo, Sonora.

Distribución. A lo largo de la costa sur de Sonora hasta la porción noroeste de Sinaloa.



Localización de *Neotoma phenax*.

Registros. *SONORA*: San José de Guaymas; Guásima (Hooper, 1960). Rancho El Alamito, cerca de Potam y río Yaqui; Camoa, río Mayo; Alamos, 54 km E Navojoa, 1000 ft; 3 mi NNW Bacabachi (Birney y Jones, 1971). *SINALOA*. En la carretera 15, 14 mi W Guamuchil (Loomis y Stephens, 1962). Laguna, 17 km SW Choix, 500 ft; 3 mi E Presa Hidalgo, 500 ft; 6 km E El Fuerte, 400 ft; 35 mi N Los Mochis; 2 mi N San Blas, 50 ft; 8 mi NW El Carrizo, 40 ft; 5 mi WNW El Carrizo; El Carrizo; 1 mi E Sinaloa, 180 ft; 7 mi SW Los Mochis, 20 ft; 15 km SW Los Mochis, 25 ft; 15 mi S. 5 mi E Los Mochis; 16 km SW Topolobampo, 70 ft; Kilómetro 1548 de la carretera 15 (S de San Rafael); Guamúchil, 150 ft; 24 km S Guasave, 20 ft; Rancho Viejo; 4 km Sw Navolato, 20 ft; Huitacochi, 8 mi S Navolato;

40 km SW Culiacán; 2 mi W El Dorado, 20 ft; Kilómetro 1672 en la carretera 15, cerca del límite con Sonora (Baker y Mascarello, 1969). 29.3 km S, 4.2 km W de límite Sonora-Sinaloa, en la carretera 15 (Mascarello *et al.*, 1974).

Descripción. Según Merriam (1903), en cuanto al tamaño y la apariencia, es similar a *Hodomys vetulus*; cola proporcionalmente larga y negra o con borde oscuro; dorsalmente es gris amarillento; ventralmente y en la región anterior es de color claro (blanco-amarillento); en la parte posterior se observa la misma coloración del cuerpo; la parte superior y lateral de la nariz es oscura; pecho gris pálido; la parte externa de las piernas gris oscuro, lo que contrasta con tonalidades blancas; patas superficialmente blanca tierrosas; tobillos oscuros en ambos lados, bordeados en la parte de abajo con tonalidad blanca. Los molares esmalte como en el grupo *albigula*.

Medidas. Del organismo tipo (Merriam, 1903) son: longitud total, 352; longitud de la cola, 172; longitud de la pata, 37.5.

Comentarios. El género de *Teanomus* pasó a ser *Neotoma*. Las características morfológicas de *Hodomys vetulus* son: orejas largas y más o menos desnudas; cola larga y densamente cubierta con pelo corto; patas con pequeños tubérculos; cráneo de manera general parecido a *Neotoma* y *Teonoma*, pero la bula verticalmente es más inflada (Merriam, 1903).

Burt (1938) menciona que se encuentra asociada a los arroyos. Birney y Jones (1971) comentan que esta especie habita en la parte más tropical del estado de Sinaloa, del centro hacia el norte, con un gradiente altitudinal entre los 0 y 500 ft. Los nidos frecuentemente se encuentran en las ramas de los árboles de 1.5 a 6 m de altura, aunque también se les puede encontrar en la base. También comentan que la captura se realiza más fácilmente al desmantelar los nidos, ya que las trampas no son muy efectivas.

Se han reportado hembras preñadas para enero, abril y diciembre, y lactantes para febrero, marzo, abril, agosto y noviembre. La mayoría de las hembras tiene dos crías, aunque para algunas sólo se detectó una (Birney y Jones, 1971; Jones y Genoways, 1978).

Burt y Baklalow (1942) dan las siguientes medidas para el báculo de un ejemplar: longitud 3.61; diámetro a la base, dorso-ventral, 0.81; lateral, 1.51; diámetro cerca de la parte media, dorso-ventral, 0.42; lateral, 0.50.

Baker y Mascarello (1969) registran el cariotipo de la especie con 2n=38 y FN=50. Tiene seis pares de cromosomas grandes de tamaño medio submetacéntricos, uno de tamaño medio subtelocéntrico y once acrocéntricos de medianos a grandes. Los cromosomas sexuales son mayores que cualquiera de los autosomas; el Y es submetacéntrico grande y el X es submetacéntrico muy grande. La Norma Oficial Mexicana (1994) la considera como una especie rara.

Neotoma varia Burt

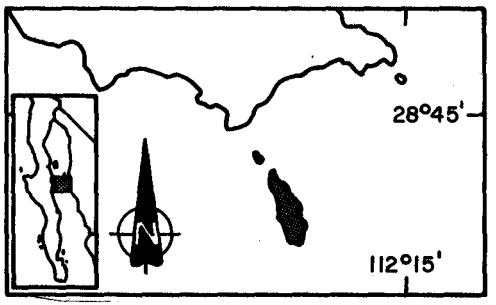
1932. *Neotoma varia* Burt, Trans. San Diego Soc. Nat. Hist., 7:178.

localidad típica. Isla Turner, Golfo de California, Sonora.

Distribución. Conocida únicamente en la localidad tipo.

Registros. *SONORA*: isla Turner (Burt, 1932a).

Descripción. Según Burt (1932a), dentro del grupo *albigula* es una de las *Neotomas* más pequeñas, con rostro robusto y puente palatal corto. Similar en coloración a *N. a. albigula*, aunque las tonalidades rosadas y amarillentas en menor grado, especialmente en las mejillas. Por otra parte,



Localización de *Neotoma varia*.

difiere de *N. a. albigula* relativamente en la robustez del rostro con incisivos muy curvos; hueso pterigoideo ligero y circular; proceso coronoideo poco prominente. Difiere de *N. a. seri*, además de lo señalado anteriormente en *N. a. albigula*, por la coloración pálida en el dorso del cuerpo y de la cola, siendo castaño en lugar de negruzca, y por el tamaño menor de la cola. El cráneo es también más arqueado en la porción anteroposterior que en la superficie dorsal. La principal diferencia entre *N. varia* y *N. a. melanura* y *N. a. sheldoni* corresponde al menor tamaño y a la coloración más clara, así como a la forma de los dientes maxilares en la estructura del último molar superior. En todos los especímenes de *N. a. albigula*, *N. a. seri*, *N. a. melanura* y *N. a. sheldoni* se observó que *N. varia* tiene dos lóbulos con un ángulo de reentrada en lugar de tres lóbulos con ángulo de reentrada. Esta es una condición anormal (Burt, 1932a).

Medidas. De un ejemplar (Burt, 1932a) son: longitud total, 305; longitud de la cola, 140; longitud de la pata, 33; longitud de la oreja, 25; longitud basilar de Hensel, 34.3; anchura zigomática, 22.7; anchura interorbital, 5.9; longitud de los nasales, 16; longitud de la hilera de dientes maxilares, 8.0.

Comentarios. Burt, (1932a) muestreó con 20 trampas y colectó un solo organismo; además, comenta que los nidos de se encuentran entre los cactus y arbustos. Los autores del presente capítulo colocaron más de 400 trampas en la isla de Turner en 1997 y no colectaron ningun ejemplar. En los ochentas Michael Bogan (*com. per.*) también intentó colectar a la especie sin éxito. La Norma Oficial Mexicana (1994) la considera como una especie amenazada de extinción.

Hodomys

Hodomys alleni alleni Merriam

1892. *Neotoma alleni* Merriam, Proc. Biol. Soc. Washington, 7:168.

1973. *Hodomys alleni*, Carleton, Misc. Publ. Mus. Zool., Univ. Michigan, 146:29.

localidad típica. Manzanillo, Colima.

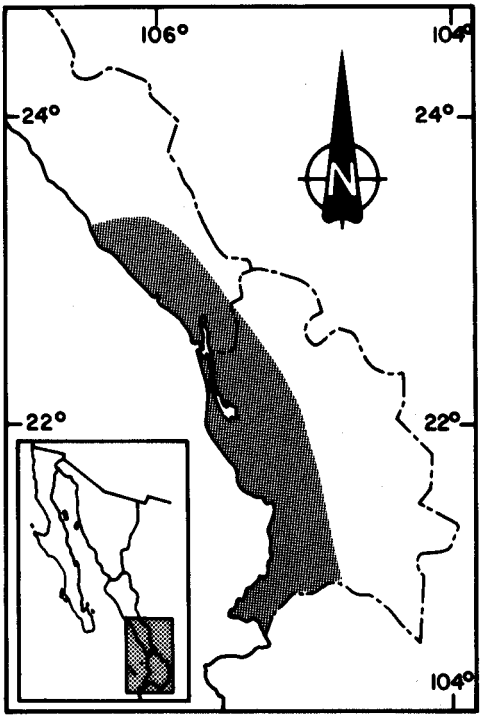
Distribución. Básicamente de distribución occidental; se encuentra a lo largo de la costa, a partir del suroeste de Sinaloa, hasta Michoacán.

Registros. *NAYARIT*: Banderas [Valle Banderas] (Elliot, 1903; Hooper, 1960). Acaponeta (Hall y Kelson, 1959; Genoways y Birney, 1974). *SINALOA*: Rosarito (Goldman, 1938). Isla Palmito de la Virgen, 15 ft; 27 km S Escuinapa; Palmito (cerca de 10 mi NW Teacapán), 20 ft; Isla Palmito del Verde; 8 mi NNW Teacapán 0.5 mi S Concepción (o La Concha), 250 ft (Birney y Jones, 1974).

Descripción. Según Merriam (1892), la parte superior de la cabeza y la base de la cola son ferrugineo aleonado (amarillo ocre); tamaño de la cola corto, igual al de la cabeza y el cuerpo; lados de la cara y la nariz grises; ancas blanquecinas; la punta del pelaje es blanco, y la base es gris; patas blancas con algunas manchas obscuras; cola unicolor blanquecina. El cráneo es de los más grandes del género con marcadas impresiones musculares; superciliar fuertemente acanalado,

continuándose posteriormente a lo largo del medio externo, de los parietales e interparietal al occipucio. Interparietal subcuadrado con un apéndice postero-lateral en cada lado; ranura anterorbital con un tubérculo en la base inferior; bula auditiva pequeña, conectada por un proceso óseo con el proceso amular del pterigoideo; la serie de molares es muy alargada y robusta; los molares posteriores en forma de "S" como en *Xenomys*, pero difieren debido a que muestran un ángulo de reentrada en el lado externo opuesto al hondo pliegue del lado interior.

Medidas. Media e intervalo de ocho ejemplares examinados por Birney y Jones (1971) son: longitud total, 432.4 (417-446); longitud total de la cola, 197.7 (189-206); longitud de la pata, 44.4 (43-45); longitud de la oreja, 31.0 (28-33). Craneales de diez ejemplares: longitud total, 53.2 (50.2-55.8); anchura zigomática, 26.4 (23.9-28.0); anchura interobital, 5.5 (5.2-6.2); anchura mastoidea, 18.5 (17.5-19.1); longitud del rostro, 21.6 (20.4-22.4); anchura del rostro, 8.0 (7.5-8.7); longitud de los dientes maxilares, 11.0 (10.7-11.7).



Localización de *Hodomys alleni alleni*.

Comentarios. Los sitios donde se ha colectado a estos organismos han sido abundantes. Presentan hábitos nocturnos y las madrigueras se localizan entre rocas y arbustos cubiertos de hojas y tallos (Merriam, 1892). Son consideradas como muy abundantes en las áreas con agave o matorral espinoso (Genoways y Birney, 1974).

Birney y Jones (1971) comentan que se encuentra en los sitios con matorral espinoso, ya sea en la porción continental como en las islas Palmito Verde y Palmito de la Virgen. Sus nidos los construyen entre las raíces de los árboles. Con respecto a los datos de reproducción, ellos no colectaron hembras con actividad reproductiva para febrero y junio, aunque sí una lactante para septiembre y juveniles en febrero y agosto. Genoways y Jones (1973) la asocian a la vegetación tropical en una barranca, observando un nido en una de las cuevas que se encontraba en la pared del cañón, con rastros de haber tenido crías recientemente (agosto). También la colectaron sobre cercos de piedra.

Se tienne registros de hembras preñadas para febrero (Genoways y Birney, 1974) y lactantes con dos crías para septiembre (Birney y Jones, 1971). Burt y Barkalow (1942) dan las siguientes medidas para los báculos en dos ejemplares: longitud 6.01-6.80; diámetro a la base, dorso-ventral, 1.0-1.2; lateral, 2.40-3.00; diámetro cerca de la parte media, dorso-ventral, 0.50-0.60; lateral, 0.65-0.75. El báculo es ancho en la base con una depresión ventral cóncava y es dorsalmente cóncavo (Burt y Barkalow, 1942; Burt, 1960). Hooper (1960) realiza una amplia descripción de las glándulas del pene.

Carleton (1973,) al realizar el análisis de la morfología del estómago, encuentra que el de *N. alleni* es diferente de todas las analizadas y, al mismo tiempo, considera que *Hodomys* debe de ser considerado como un género válido. Hooper (1960) y Sprague (1941) concluyen que las glándulas del pene y la estructura del hioides se pueden relacionar con *Xenomys nelsoni.*

El cariotipo de esta especie es considerado diferente al resto de las especise, pero se desconoce el cariotipo de los machos (Genoways y Birney, 1974). El complememto está constituido por 48 cromosomas, un par de subtelocéntricos grandes, uno de submetacéntricos grandes y 22 telocéntricos, algunos de los cuales posiblemente tengan brazos secundarios muy pequeños (Genoways y Birney, 1974).

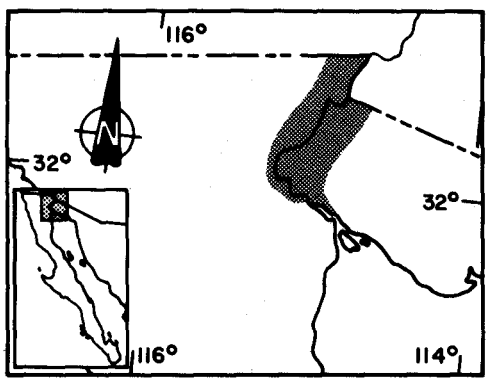
Sigmodon

Sigmodon hispidus eremicus Mearns

1897. *Sigmodon hispidus eremicus* Mearns, Proc. U. S. Nat. Mus., 20:504.

localidad típica. Ciénega (Well), 30 mi S monumento 204, borde de la línea mexicana, sobre el banco E del Río Colorado, Sonora.

Distribución. La especie se encuentra desde el sureste de los Estados Unidos hasta el norte de Sudamérica (Cameron y Spencer, 1981). *Sigmodon hispidus eremicus* está asociado al delta del Río Colorado, en especial a las áreas agrícolas (Huey, 1964).



Localización de *Sigmodon hispidus eremicus.*

Registros. *SONORA*: Lado opuesto a la boca del Río (Hardy river).

Descripción. De manera general la coloración es amarillo; grisácea comúnmente se presenta un bandeo negro y castaño en el pelo, dando la apariencia obscura; en las especies cuya distribución se encuentra el desierto, la coloración es más pálida; en los costados y en la parte trasera del cuerpo, la coloración es ocre; la región interna de las extremidades es blanca, el pelo en la base es gris, mientras que las puntas son blancas; patas color blanco grisáceo; cola escasamente peluda (Mearns, 1897).

Medidas. Las medidas dadas por Mearns (1897) son: longitud total, 280; longitud de la cola, 128; longitud de la pata, 34; longitud de la oreja, 15. Las medidas del cráneo son 20.5 por 35.

Comentarios. Ingles (1959) menciona que los encontró muy abundantes en los zacates altos, entre las yerbas que rodeaban los campos de cultivo, teniendo sus túneles debajo de las plantas de maguey. Huey (1964), comenta que la especie se encuentra asociada a la zona riparia del delta del Río Colorado, que corresponde a la zona agrícola del noreste de Baja California y noroeste de Sonora.

El período de gestación para la especie es de 27 días, con promedio dr 4.3 crías por parto (Cameron y Spencer, 1981); para los ejemplares de noroeste de México no se tiene mayor información.

El cariotipo de *Sigmodon hispidus* es 2n=52 y el FN= 52, siendo 48 acrocéntricos y dos metacéntricos muy pequeños. El cromosoma Y, metacéntrico a submetacéntrico de tamaño medio pequeño, y el X es un subtelocéntrico grande.

Sigmodon arizonae Mearns

1890. *Sigmodon arizonae* Mearns, Bull. Amer. Mus. Nat. Hist., 2:287.

localidad típica. Fort Verde, Condado de Yavapi, Arizona.

Distribución. La especie se distribuye desde Arizona hasta el norte de Jalisco, por la vertiente del Pacífico (Hall, 1981).

Descripción. Es de tamaño grande; pelo híspido y castaño-negruzco; ventralmente plateado o blancuzco con la base negruzca; región ventral de la cola del mismo color que el vientre; dorso de las patas plata gris; cráneo grande; la distancia entre la crestas parietoescamosa de 3.2 o mayor; espina anterior de la placa infraorbial puntiaguda y angosta; borde anterior del foramen magnum angular (Hoffmeister, 1986).

Comentarios. La especie tiene dos subespecies registradas para el noroeste de México.

Sigmodon arizonae cienegae A. B. Howell

1919. *Sigmodon hispidus cienegae* A. B. Howell, Proc. Biol. Soc. Washington, 32:161.
1981. *Sigmodon arizonae cienegae*, Hall, 1981, Mamm. North Amer., 2:741.

localidad típica. Bullock's Ranch, 4 mi E Fort Lowell, Condado de Pima, Arizona.

Distribución. Probablemente tiene una pequeña distribución, quizá referida a las ciénegas del Río Santa Cruz.

Registros. *SONORA*: Granados; Ures; Hermosillo; 2.5 mi W Caborca (Zimmerman, 1970).

Descripción. La coloración es obscura y ligeramente castaño como en *S. h. eremicus*, pero escasamente comparable con especímenes de *S. h. confinis* o *S. arizonae*. El cráneo en comparación con *S. h. confinis*, difiere en que tiene ligeramente más largos los molares; las bulas auditivas son más grandes y globulares; ancho interorbital grande; la caja craneal inflada; rostro corto, en general amplio y robusto. De *S. h. eremicus* se diferencia por tener el ancho interorbital más grande, las bulas grandes y el rostro pequeño y robusto (Howell, 1919).

Medidas. Las medidas del organismo tipo (Howell, 1919) son: longitud total, 307; longitud de la cola, 129.5; longitud de la pata, 35.5.

Comentarios. Zimmerman (1970), al analizar a los individuos de Sonora, los considera como *S. arizonae* sin asignarles ningún nivel subespecífico, y es Hall (1981) quien los considera como *S. a. cienegae*, pero no menciona que haya realizado una revisión de ejemplares, por lo que consideramos que la presencia de esta subespecie en Sonora y México se tiene que corroborar con el estudio de los ejemplares del estado.

Howell (1919) menciona que, de acuerdo con la edad obtenida de los cráneos y de las tallas de los ejemplares, *S. a. cienegae* es más grande que *S. h. confinis*. También hace mención acerca de la conducta de estos organismos, los que define como muy asustadizos.

Sigmodon arizonae major V. Bailey

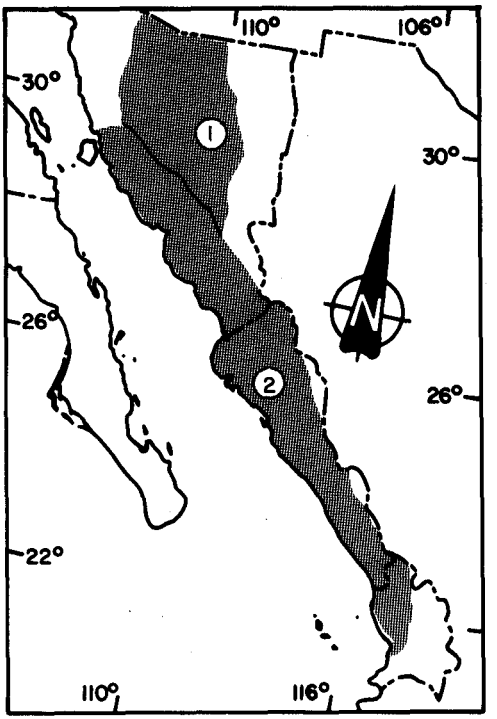
1902. *Sigmodon hispidus major* V. Bailey, Proc. Biol. Soc. Washington, 15:109.
1981. *Sigmodon arizonae major*, Hall, Mamm. North Amer., 2:741.

localidad típica. Sierra de Choix, 50 mi (probablemente 10 o 15 mi) NE Choix, Sinaloa.

Distribución. A lo largo de la costa oeste, a partir de Tepic, Sinaloa hasta el sur de Sonora.

Localidades referidas. *NAYARIT*: 4 mi SE Tepic (Crossin *et al.*, 1973). 2 mi N Ahuacatlán; 3 mi NNW las Varas, 150 ft) 0.5 mi E San Blas. *SINALOA*: localidad tipo; 15 km N, 65 km E Sinaloa (Baker y Greer, 1962). 19.5 km (por la carretera) NE Santa Lucía, 6200 ft. *SONORA*: Alamos (Bailey, 1902); Tecoripa (Hall y Kelson, 1959); 3 mi S Maytorena (Cockrum y Bradshaw, 1963).

Descripción. Según Bailey (1902) la parte superior del cuerpo tonalidades castaño grisáceas; nariz amarillenta; región ventral de tonalidad clara (amarillo a blanco); patas color gris claro; cola obscura en la región dorsal; por debajo es de un gris oscuro. Cráneo macizo y robusto en los adultos; interparietales en forma de bandas amplias y circulares en la parte final; nasales con hendidura posterior; bulas auditivas relativamente grandes y alargadas.



Localización de *Sigmodon arizonae*:
1. *S. a. cienegae* 2. *S. a. major*

Medidas. Del organismo tipo (Bailey, 1902) son: longitud total, 365; longitud de la cola, 156; longitud de la pata, 40.5; longitud basal del cráneo, 36; longitud de los nasales, 16; anchura zigomática, 23.5; anchura mastoidea, 16.4; longitud de los molares superiores, 7.3.

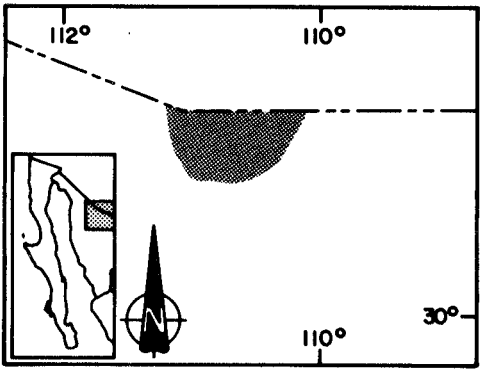
Sigmodon fulviventer minimus Mearns

1894. *Sigmodon minima* Mearns. Proc, U. S. Nat. Mus., 17:130
1962. *Sigmodon fulviventer minimus*, Baker y Greer, Publ. Mus., Michigan State Univ., Biol. Ser., 2:123.

localidad típica. Cerca del monumento 40, 1500 m., condado Hidalgo, Nuevo México, que colinda con la línea divisoria mexicana, 100 mi W del monumento inicial sobre banco oeste del Río Grande.

Distribución. La especie se encuentra desde Arizona y Nuevo México hasta el norte de Michoacán (Hall, 1981). En la Sierra Madre, desde el norte de Durango hasta el sur de Arizona y Nuevo México; en el área de estudio, únicamente al noreste de Sonora (Baker, 1969).

Registros. *SONORA*: río Santa Cruz; río Santa Cruz cerca del monumento 111 (Baker, 1969).



Localización de *Sigmodon fulviventer minimus*.

Descripción. La descripción del organismo tipo (Mearns, 1894) es: cubierto de pelaje abundante y cerdoso; piel de tonalidad obscura (gris plúmbeo) más que en *S. hispidus texianus* o *S. arizonae*; en la región de los lados de la cabeza y cuello el pelaje es cerdoso; orejas, patas y cola con abundante pelo; no existe distinción en color de la cola siendo por lo general uniforme en coloración. La coloración superficial del cuerpo puede ser gris a castaño, donde el pelo puede presentar tonalidades obscuras en la base, siendo en la porción apical de color amarillento; las orejas en la superficie interna presentan denso pelaje grisáceo; la cola de castaño-negruzca, algunas veces más clara en la parte de abajo. Comparativamente con *S. h. texianus*, la caja craneal es alta y angosta; el cráneo es más constriñido entre las órbitas, con nasales cortos; estas bases pueden estar muy cercanas con el borde posterior del foramen de los incisivos; la dentición es mucho más robusta.

Medidas. Del organismo tipo (Mearns, 1894) son: longitud total, 223; longitud de la cola, 94; longitud de la pata, 28; longitud de la oreja, 14.

Comentarios. *S. f. minimus* se diferencia de *S. f. fulviventer*, en que el segundo tiene un cráneo más ancho, largo y rostro más pequeño, además de ser más oscuro (Baker y Greer, 1962). Baker (1969) menciona que es la subespecie más chica de la especie; lo colecta en Chihuahua en áreas abiertas con pastos, siendo en algunas de ellas el pasto muy cerrado. Anderson (1972) lo colectó en Chihuahua en un valle con pastizales naturales y pastoreados, en áreas de cultivo y bosques de pinos y juníperos. Baker (1966), a su vez, en una zona árida con pastos, uñas de gato, juníperos y mezquites.

Sigmodon alleni alleni V. Bailey

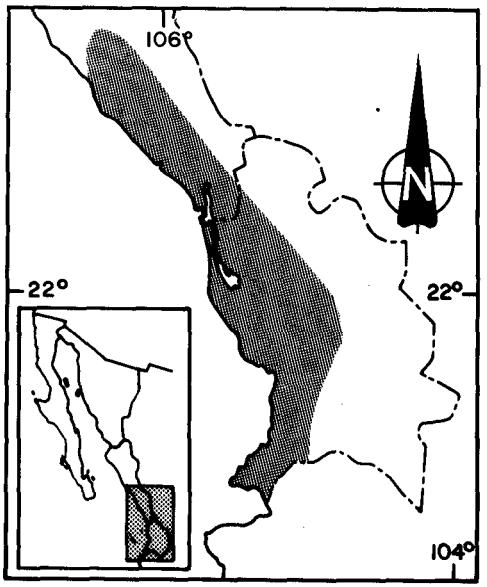
1902. *Sigmodon alleni* V. Bailey, Proc. Biol. Soc. Washington, 15:112.

localidad típica. San Sebastián, Mascota, Jalisco.

Distribución. La especie se distribuye por la costa del Pacífico, desde el sur de Sinaloa hasta Oaxaca, incluyendo parte de la depresión del Balsas (Shump y Baker, 1978). Por la parte de la vertiente del Pacífico, desde el oeste de Jalisco hasta el sur de Sinaloa (Baker, 1969).

Registros. *NAYARIT*: Valle de Banderas; Tepic; San Blas (Bailey, 1902; Baker, 1969). Mineral del Tigre (Webb *et al.*, 1981). *SINALOA*: 2 km E Santa Lucía, 1723 m; Copalá (Baker, 1969).

Descripción. Dorsalmente amarillo castaño; vientre de coloración amarillo o blanquecino; cola obscura en su porción dorsal, mientras que por debajo es de tonalidad castaño; patas castaño-amarillentas. El cráneo similar a *S. berlandieri*, pero con la caja cerebral estrecha; doble contorno convexo del interparietal; molares pequeños; bulas pequeñas y redondeadas (Bailey, 1902).



Localización de *Sigmodon alleni alleni.*

Medidas. El promedio de ocho individuos de la localidad tipo (Bailey, 1902) son: longitud total, 244; longitud de la cola, 112; longitud de la pata, 31.6. Del organismo tipo: longitud basal del cráneo, 29.3; longitud de los nasales, 13; anchura zigomática, 19.3; anchura mastoidea, 13; longitud de los molares superiores, 6.4.

Comentarios. Baker (1969) comenta que la subespecie se diferencia de *S. a. vulcani* por su mayor tamaño coloración más pálida; cráneo más chico y más aplastado; rostro corto, y bulas auditivas menos expandidas. Se colectaron ejemplares desde el nivel del mar hasta los 1,723 metros.

Baker (1969) colecta esta subespecie en el lado del Pacífico de la Sierra Madre Occidental, en la selva baja caducifolia, por debajo del bosque de pino-encino; también en cañones angostos con vegetación secundaria. Núñez *et al.* (1981) capturan ejemplares de esta especie en selva media subperennifolia, bosque de encino; registran hembras preñadas para septiembre y sin actividad para febrero, abril y octubre.

Baker (1971), comenta que *S. alleni* tiene gran interacción con *S. arizonae* por los pastos en Sinaloa, pero que estas dos especies no consumen al azar, sino que son muy selectivas en lo que comen, lo que les ha permitido subsistir.

El cariotipo es 2n=52 y el FN= 64. El cromosoma Y es submetacéntrico y el X es subtelocéntrico.

Microtus

Microtus californicus (Peale)

1848. *Arvicola californica* Peale, Mammalia and Ornithology, *in* U. S. Expl. Exped. . . .8:46.

1897. [*Microtus*] *californicus*, Touessart, Catalogus mammalium. . . p.563.

localidad típica. Cerca de la bahía de San Francisco, probablemente en la cañada de San Francisquito, cerca de Palo Alto, Santa Clara.

Distribución. Desde Oregon, por la vertiente del Pacífico, hasta las partes altas de Baja California.

Descripción. Según Bailey (1900), son ejemplares grandes; las orejas sobrepasan el pelo; el pelo es tupido y de color similar a un ratón de casa; cráneo fuerte y angular; foramen incisivo grande, abierto y ancho posteriormente. La coloracion de verano es: dorsalmente amarilla o color arcilla; la con una línea ligeramente obscura en la parte central del lomo; región ventral amarilla clara o blanca; cola bicolor; dorso castaño oscuro y amarillo ventral; patas castaños; cráneo robusto y angular; nasales largos, con terminación hacia abajo, ensanchándose en los frontales y angostos

en el extremo distal; marca precigomática profunda; proceso postorbital prominente; frontales cóncavos posteriormente; foramenes del incisivo abiertos y redondeados en los dos extremos y usualmente más ancho en la parte posterior que en la media; incisivo fuerte; molares grandes; ángulo posterior del primer molar inferior, normalmente con un ángulo interno; triángulo posterior de segundo molar inferior con un loop interno, suguiendo el loop posterior de *M. pensilvanicus*.

Comentarios. En la región de estudio esta especie presenta tres subespecies.

Microtus californicus aequivocatus Osgood

1928. *Microtus californicus aequivocatus* Osgood, Jour. Mamm., 9:56

localidad típica. San Quintín, Baja California

Distribución. Restringido a las áreas próximas de San Quintín.

Registros. *BAJA CALIFORNIA*: San Quintín (Osgood, 1928). San José; Las Cabras; 1 mi E El Rosario (Huey, 1931a). San José; San Antonio; 1 mi E El Rosario; San Telmo (Hall, 1981).

Descripción. Se caracteriza por su coloración mas rojiza (Osgood, 1928).

Medidas. La media de cinco ejemplares (Huey, 1931a) son: longitud total, 206.2; longitud de la cola, 58.6; longitud de la pata, 24.8; longitud de la oreja, 11.6; longitud condilobasal, 31.7; longitud basilar, 27.9; longitud de los nasales, 9.9; achura zigomática, 18.4; anchura interorbital, 3.8; altura del cráneo al nivel de la bula, 11.4; longitud de los dientes maxilares, 7.3.

Comentarios. Osgood (1928) realiza un analisis de por qué ésta debe de ser considerada como una subespecie diferente de *Microtus californicus huperuthrus*; fuera de esto no se conoce mayor información.

Microtus californicus grinnelli Huey

1931. *Microtus californicus grinnelli* Huey, Trans San Diego Soc. Nat. Hist., 7:47

localidad típica. Sangre de Cristo, Valle San Rafael en la base W Sierra de Juaréz, Baja California 31° 52' LN, 115° 06' LW.

Distribución. Solamente conocida de la localidad tipo.

Registros. *BAJA CALIFORNIA*: Sangre de Cristo, Valle San Rafael en la Base W Sierra de Juaréz; La Grulla near Ensenada (Huey, 1931a).

Descripción. Huey (1931a) hace una comparación con las tres subespecies de la región más que una diagnosis de la especie, por lo que *M. c. grinnelli* se diferencia de *M. c. huperuthrus* en que la primera es más rojiza en lugar de grisácea, en promedio más pequeña, cranealmente es más pequeña con la bula auditiva más globular y la anchura del zigomático menor. Con respecto a *M. i. aequivocatus* es poco más claro y de rojo mós tenúe y de tamaño menor. Cranealmente la bula auditiva es ligeramente más globular y el arco zigomático en menos ancho y menos robusto.

Medidas. La medias de cuatro ejemplares (Huey, 1931a) son: longitud total, 187.7; longitud de la cola, 51.0; longitud de la pata trasera, 24.0; longitud de la oreja, 12.2; longitud condilobasal, 29.7; longitud basilar, 26.0; longitud de los nasales, 9.2; achura zigomática, 17.0; anchura interorbital, 3.4; altura del cráneo al nivel de la bula, 11.0; longitud de los dientes maxilares, 6.7.

Comentarios. Huey (1931a) menciona que las tres subespecies de Baja California presentan los foramenes incisivos muy grandes en comparación con los de California.

Microtus californicus huperuthrus Elliot

1903. *Microtus californicus huperuthrus* Elliot, Field. Columb. Mus. Publ. 74, Zool. Ser., 3:161.

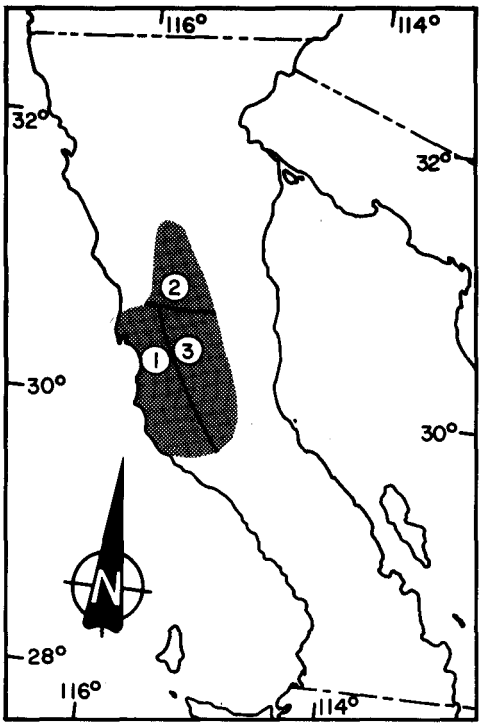
localidad típica. La Grulla, Montes [Sierra de] San Pedro Mártir, Baja California.

Distribución. Restringido a la Sierra de San Pedro Mártir.

Registros. *BAJA CALIFORNIA*: La Grulla, Sierra de San Pedro Mártir (Elliot, 1903a; Huey, 1931a). Concepción; Vallecitos; San Ramón (Hall, 1981).

Descripción. Según Elliot (1903a) es de tamaño grande y de coloración mas rojiza que *M. californicus*, con la pata trasera mas grande y la cola de tamaño similar. La coloración dorsal es castaño obscura o castaño rojizo con oscuro; costados pálidos, mas amarillentos; ventralmente plomizo, lavado con blanco; patas y manos grises.

Medidas. La media de tres ejemplares (Huey, 1931a) son: longitud total, 199.3; longitud de la cola, 53.6; longitud de la pata trasera, 24.6; longitud de la oreja, 11.5; longitud condilobasal, 31.9; longitud basilar, 28.2; longitud de los nasales, 10.4; achura zigomática, 17.9; anchura interorbital, 3.8; altura del cráneo al nivel de la bula, 11.5; longitud de los dientes maxilares, 7.7.



Localización de *Microtus californicus*:
1. *M. c. aequivocatus* 2. *M. c. grinnelli*
3. *M. c. huperuthrus*

Comentarios. Elliot (1903a) menciona que los ejemplares por él examinados no presentan la misma coloración entre sí y que probablemente esto se deba a una diferencia en el periodo en el que se llevaron al cabo las colectas del material. Osgood (1928) comenta que Elliot (1903a) no designa tipo de esta subespecie, pero en el escrito original menciona la localidad tipo como San Quintín. Sin embargo da lo datos de las medidas de un ejemplar de "La Grulla", y al hacer una revisión de la colección del Field Museum, se encuentra que un ejemplar de "La Grulla" tiene la etiqueta roja de tipo, por lo que la localidad tipo, se fija en "La Grulla" en vez de San Quintín. Por lo que los ejemplares de está última localida a ser conocidos como *Microtus californicus aequivocatus* (Osgood, 1928).

Ondatra

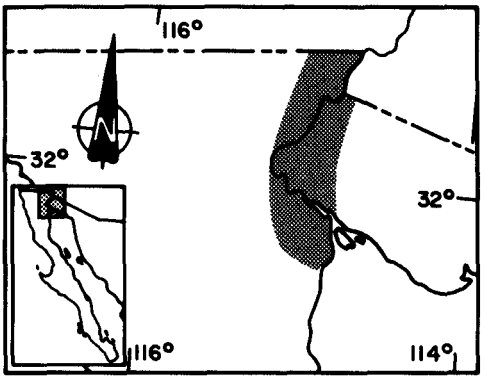
Ondatra zibethicus pallidus (Mearns)

1890. *Fiber zibeticus pallidus* Mearns, Bull. Amer. Mus. Nat. Hist., 2:280.
1912. *Ondatra zibethicus pallidus*, Miller, Bull. U. S. Nat. Mus., 79:322.

localidad típica. Fort Verde, Yavapi Co. Arizona.

Distribución. Por los alrededores del río Colorado, desde California hasta la desenbocadura, incluyendo los canales de irrigación (Howell, 1911).

Localidades referidas. *BAJA CALIFORNIA*: 15 mi S Lago Volcan (Hall, 1981).



Localización de *Ondatra zibethicus pallidus*

Descripción. Según Hoffmeister (1986) se caracteriza por su pequeño tamaño externo y del cráneo; longitud total menor de 500 mm; longitud basal del cráneo usualmente menor de 58.0; cola pequeña. La coloración dorsal es rojiza con entrepelado negruzco, dando apariencia de rojo oscuro; banda media dorsal obscura ausento o poco marcada; parte superior de la cabeza más obscura que la dorsal del lomo; medidas craneales más pequeñas que las de las otras poblaciones; arcos zigomáticos no muy aplastados; rostro débil y ancho; bulas auditivas no notoriamente infladas.

Medidas. Las medidas de once machos y nueve hembras (Hoffmeister, 1986) son: longitud total, 465.1 (425-494); longitud de la cola, 205.2 (170-235); longitud de la pata, 67.5 (59-71); longitud de la oreja, 54.7 (52.3-57.8); anchura zigomática, 36.6 (34.9-38.9); longitud del paladar, 11.91 (10.8-12.8); longitud de los nasales, 18.8 (17.8-20.1); longitud alveolar de los molares superiores, 14.53 (13.9-15.5).

Comentarios. Hoffmeister (1986) considera que *O. z. bernardi* debe ser considerada como sinónimo de *O. z. pallidus*. Los cometarios que se conocen para esta subespecie en territorio Mexicano son mínimos.

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S. T. Alvarez-Castañeda y J. L. Patton (eds.).
Centro de Investigaciones Biológicas del Noroeste, S.C.
1999, pags. 569-574.

FAMILIA CASTORIDAE

Patricia Cortés-Calva

Introducción

Los castores se cuentan entre los animales de piel más valiosa de Norteamérica. En general se encuentran en latitudes nórdicas y en las montañas, pero a lo largo del límite sur de su área de distribución continental, en el extremo norte de México, existen poblaciones locales aclimatadas a vivir en ríos calientes que atraviesan las planicies áridas, se desconoce el porqué esta especie no se distribuye en la Sierra Madre Occidental, aparentemente podría deberse a la disminución del alimento (Leopold, 1990). *C. canadensis,* ha sido introducido en Eurasia y puede que se encuentre fuera de competencia en algunas áreas con *C. fiber* (Lahti y Helminen, 1974).

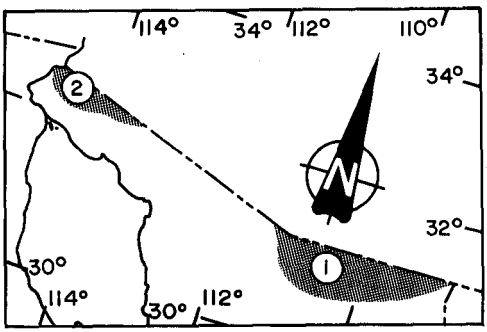
A lo largo del río Colorado y del río Bravo la mayoría de los castores viven en cuevas excavadas en los suelos aluviales sueltos de las riveras, construyen madrigueras con palos y lodo en las pozas formadas detrás de la represas, aunque para los organismos que se distribuyen en México, estos no forman represas, sino tributarios; permanecen en una cámara de habitación de varios metros de diámetro sobre el nivel del agua, ocupada normalmente por varios castores que pueden incluir un par de adultos y una familia de jóvenes. Se mantienen activos durante la mayor parte del invierno por debajo del hielo, alimentándose del tejido del cambio de árboles tales como sauces, álamos, fresnos y encinos (Leopold, 1990). En la actualidad la familia esta representada por sólo dos especies, *Castor canadensis* para Norte América y *Castor fiber*, del norte de Europa y Asia (Jenkins y Busher, 1979).

Castor canadensis Kuhl

1820. *Castor canadensis* Kuhl, 1820:64 Verlag der Hermannschen Buchandlung, Frankfurt am Main, Abt 1. 151 pp.

Localidad típica. Grayson, río San Joaquin, Stanislaus Co., California.

Distribución. Naturalmente *Castor canadensis* ocurre en los extremos, pozas y en los márgenes de los grandes lagos a lo largo de Norte América (Shelton, 1966), a excepción de la tundra, la península de Florida y los desiertos del suroeste. La información que se ha recabado desde los años de 1800s, hace mención acerca de la abundancia de estos animales a lo largo de los ríos Bravo y Colorado, así como a los intensos trampeos a los que eran sometidos alrededor de los años 1940s (Leopold, 1990), pero no se cuenta con información reciente acerca de las poblaciones y su estatus. A estos organismos se les atribuye una gran capacidad de modificar el ambiente mediante, el poder derribar los árboles y la construcción de represas.



Distribución de *Castor canadensis*
1 *C. c. fondator* 2. *C. c. repentinus*

Descripción. *Castor canadensis* se caracteriza por el rostro ancho y profundo, caja cerebral angosta; región basioccipital que muestra una depresión; la dentición sin un crecimiento constante del tipo hipsodonto. La forma externa altamente modificada para la vida acuática, cola y vértebras caudales planas; incisivos muy desarrollados; báculo presente; dentición, i. 1/1, c. 0/0, p. 1/1, m. 3/3 (Jenkins, 1974). Referente al género, por lo general la partes superficiales son de tonalidaes cafés, la cual varía estacionalmente y geográficamente; las regiones internas son de tonos más pálidos, mientras que la cola es oscura al igual que las patas. El cariotipo de *C. canadensis* es (2N=40) Lavrov y Orlov (1973:742).

Comentarios. La unidad fundamental de la poblaciones de castores son las colonias de cuatro a ocho individuos, donde se observa que las hembras son más sedentarias que los machos (Bergerud y Miller, 1977). De los principales depredadores que influyen en las poblaciones se encuentran *Canis lupus* (Voigt *et al.*, 1976); *C. latrans* (Young y Jakson, 1951); *Ursus americanus* (Hakala, 1952). Por estudios llevados a cabo en laboratorio se puede decir que estos organismos son monogamos, conductualmente se comunican através de algunos sonidos, así como el golpeteo con la cola (Hodgdon y Larson, 1973).

De la información generada en el conocimiento de la reproducción de la especie, se ha observado que no existe dimorfismo sexual, sino hasta que las hembras se encuentran lactantes, estas presentan cuatro glándulas mamarias pectorales; la placenta de *C. canadensis* es generalmete de forma sciuromorfa (Fischer, 1971). La madurez sexual se adquiere aproximadamente a 1.5 años de edad (Larson, 1967; Henry y Bookhout, 1969); se reproducen una vez al año (enero y febrero), los nacimientos ocurren en mayo y junio (Bergerud y Miller, 1977), en ocasiones se han encontrado crías a principios de febrero (Miller, 1948) o a finales de noviembre (Thomas, 1943; Cook y Mauton, 1954). El número promedio de camada es de 3-4, influyendo de manera considerable la disponibilidad del alimento y la agresividad del clima invernal. Pearson (1960) y Boyce (1974), señalan que existe una relación positiva entre el tamaño de la camada y el peso de la madre. La lactancia dura en promedio 90 días (Zurowski et al., 1974). Los recién nacidos tienen dientes y ojos parcialmente abiertos (Bradt, 1939; Guenther, 1948). Con respecto a la descripción se tienen algunos trabajos acerca de los Sistemas nervioso, muscular y anatomía interna (Pilleri, 1959; Warner, 1976; Coles, 1970; Currier *et al.*, 1960; McKean y Carlton 1977); reproducción (Provost, 1962; histología del reproductor Conaway, 1958).

Castor canadensis frondator Mearns

1897. *Castor canadensis frondator* Mearns, Proc. U. S. Nat. Mus., 20:502.

Localidad típica. Del río San Pedro, Sonora México, cerca del monumento No. 98 de la línea fronteriza mexicana (Mearns, 1897).

Distribución. Para México la especie se distribuye a lo largo de la frontera con los Estados Unidos, en el delta del río Colorado y ríos del noreste de Sonora, a lo largo del río Bravo, desde Ciudad

Juárez, Chihuahua, hasta su desembocadura, así como los ríos que bajan del norte, en el norte de Coahuila, Nuevo León y Tamaulipas (Leopold, 1990).

Registros. *SONORA*: Río San Pedro y Río Sonora, en el noroeste del estado (Mearns, 1897); río de San Pedro, cerca del monumento # 98 de la línea divisoria con los Estados Unidos de Norte América, aproximadamente 45 Km al NNE de Cananea (Villa-R., 1954); Cañón de Guadalupe (Sierra Madre), cerca de los 5,000 ft arriba de agua salada "above salt water" (Anderson, 1972); Cañon de Guadalupe (Baird, 1859)

Descripción. Según Mearns (1897) esta especie es larga, de mátices pálidos además de diferenciarse por la coloración y ancho de la cola. El dorso es rojizo, cambiando en el pedúnculo caudal a una tonalidad chocolate, y las patas un poco más tostadas, los dedos de color chocolate rojizo. Ventralmente de mátices canela grisáceos, mientras que a los lados del pedúnculo caudal presenta una tonalidad de amarillo aleonado más claro. Los lados son marron madera, debido a que en las puntas del pelo se presenta una coloración marron olivácea. El cráneo de *C. canadensis frondator* difiere de *C. canadensis canadensis* en ser mucho más largo, con los zigomáticos más anchos.

Medidas. Organismo tipo (Mearns, 1897) son: longitud total 1,070; longitud de la cola, 360; longitud de la parte desnuda de la cola, 290; ancho de la parte desnuda de la cola, 125; longitud de la oreja desde la corona, 31; longitud de la oreja de la base anterior, 35; distancia de la punta de la nariz al ojo, 68; de la punta de la nariz a la oreja, 125; de la nariz al occipucio, 165; longitud de la mano con uña, 82; longitud de la pata trasera con uñas, 185. Cráneo 133 por 99.

Comentarios. Algunas anotaciones realizadas por Mearns, 1897, refieren que el castor presenta un patrón de coloración diferente a *C. fiber*, presenta tonalidades marron y oscuras. El examinó 33 cráneos y un gran número de pieles de castores de Arizona y Sonora. En los machos adultos la longitud total alcanzaba 1,130 mientras que la porción escamosa y desnuda de la cola era de 285 por 155. Los machos adultos pesaban 60 pounds [27.21 Kg]; las hembras 40 a 50 pounds [18-22.5 Kg]. El mismo autor refiere que no existe conección entre la ocurrencia de estas dos especies (*Castor fiber* y *C. canadensis*) en sus respectivos intervalos geográficos en zonas no boscosas, por lo que no existe una continuidad en el hábitat.

De las descripciones del cráneo, este se caracteriza por su robustez, así como por presentar una depresión distintiva en la porción basioccipital, así como una hendidura en el canal infraorbital, dorsoventralmente el jugal es ancho, presenta una extensión tubular de la bula cercana al meato auditivo externo. Bond (1956) no encontró dimorfismo sexual en las medidas craneales.

Castor canadiensis repentinus Goldman, 1932.

1932. *Castor canadensis repentinus* Goldman, Jour Mamm., 13:266.

Localidad típica. Bright Angel Creek, 4000 ft., Grand Canyon, Arizona.

Distribución. La distribución para esta especie todavia no se ha delimitado con exactitud, más aún lo mencionado por Goldman (1932) es que se les puede encontrar desde Arizona, en la delta del Río Colorado, desconoce sus límites de distribución

Registros. *SONORA*. Río Colorado, 30 mi al Norte de la boca (Stock, 1970; Baird, 1859); *BAJA CALIFORNIA*: extremo Noreste de Baja California (Huey, 1964).

Descripción. La coloración del dorso es amarillo canela, claro en la región de las ancas y base superior de la cola; los costados poco mas claros que la espalda; los lados del hocico, mejillas, cuello, foramenes y patas delanteras entre amarillo claro-rosado y amarillo canela; las partes

internas de tonalidad pálida amarillo canela, la línea media del abdomen de tonalidad oscura, variando a color avellana en porción anal, mientras que en la base de la cola es de tonalidad parda. Cráneo similar al de *C. c. frondator*, pero el rostro es un poco mas aplanado; nasales alaragados, que se extienden hasta la parte posterior detrás de los premaxilares; premaxilares angostos en la porción posterior; parte anterior de la región frontal ancha; zigomático robusto, el borde inferior fuertemente inclinado en la porción anterior, con un ángulo anterior prominente; jugal prolongado verticalmente al proceso postorbital; cresta lomboide con miníma proyección posterior sobre los condilos, de tal forma que la longitud occipitonasal excede a la longitud condilobasal (inverso a lo observado en *C. c. frondator*); la dentición es idéntica. Existe una similitud con *C. c. baileyi*, pero la caja craneal, rostro y los nasales son categóricamente anchos; el zigomático es mucho más ancho. Comparativamente con *C. c. mexicanus*, los nasales son grandes y angostos, poco inflados; los premaxilares angostos en las parte posterior; jugal poco prolongado verticalmente al proceso postorbital; las bulas suavemente redondeadas, amplias y completamente infladas en la porción anterior.

Medidas. Organismo tipo (Goldman, 1932) son: longitud total 1,132; longitud de la cola vertebral, 453; longitud de la pata, 185. Un topotipo hembra: longitud 1,000; longitud de la cola, 390; longitud de la pata, 176. Cráneo (Tipo): Longitud occipitonasal, 135.4; longitud condilobasal, 136.4; ancho zigomático, 95.5; anchura maxima de los frontales (exactamente detrás de los lacrimales), 41.6; constricción interorbital, 24.6; ancho de la caja cerebral (de la constricción del esquamoso detrás del zigomático), 44.9; longitud de los nasales, 53.9; anchura máxima de los nasales, 24; hilera de los dientes maxilares, 32.7.

Comentarios. Goldman (1932), menciona que *C. c. repentinus*, manifiesta una cercania muy marcada con *C. c. frondator* del sureste de Arizona, pero la elongación de los nasales, además de otras características craneales, ponen de manifiesto un parentesco con *C. c. baileyi* de la planicie interior de la región de Nevada. Los especímenes cercanos a Yuma, Arizona tienen los nasales cortos, y probablemente con grado cercano a *C. c. frondator*, pero el jugal abultado y, otras caracteristicas inclinan la cercanía a *C. c. repentinus*. En la localidad tipo, los castores ocupan el cañon "del angel brillante".

Stock (1970) menciona que un macho de *C. c. repentinus*, fue estudiado en el museo del colegio Dixie del cañon de Magotsu a 30 mi al NW de San Jorge. Respecto a la distribución de esta subespecie se ha señalado por medio de mapas que se distribuyen el suroeste de Utah, a lo largo de los ríos Virginia y Santa Clara extendiéndose en la parte superior del cañon de Beaverdam Durrant (1952). Los especímenes de esta localidad son grandes, con nasales anchos y mastoideos amplios y robustos, lo que coincide con lo señalado por Hall (1946) para *C. c. repentinus*, pero son ligeramente mas grandes, considerando estas partícularidades y a resreva de tener mas ejemplares, estos organismos son considerados dentro de esta subespecie. Huey (1964) menciona la abundancia de estos animales a lo largo del río Colorado, así como en el delta de algunos canales; considerandos como los causantes de perturbación en los canales.

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