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## CURRENT DISTRIBUTIONAL STATUS OF TWO SUBSPECIES OF *SYLVILAGUS BACHMANI* ON THE BAJA CALIFORNIA PENINSULA, MEXICO

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**ABSTRACT.**—We assessed the current distributions for 2 subspecies of the brush rabbit, *Sylvilagus bachmani peninsularis* and *S. b. exiguus*, on the Baja California Peninsula, Mexico. On the basis of field sampling, field notes, and voucher specimens in scientific collections, we demonstrated that (1) both subspecies have been previously recorded in mesic habitats with conditions associated with oases and streams; (2) the 2 subspecies exhibit disjunction in their distributions in the middle and southern portions of the peninsula; (3) habitats are threatened by human activities and desertification, which explains why brush rabbit populations are currently fragmented; and (4) specimens of *S. bachmani* have not been collected or observed in the last 20 years, with effort concentrated mainly in the southernmost part of the peninsula (San Lucas faunal district). We suggest that *S. b. exiguus* be considered threatened, requiring immediate conservation actions, including habitat preservation; and we suggest that the southern form, *S. b. peninsularis*, be considered extinct due to anthropogenic activities.

**RESUMEN.**—Se evaluó la distribución actual de dos subespecies del conejo matorralero *Sylvilagus bachmani* (*S. b. peninsularis* y *S. b. exiguus*) en la península de Baja California, México. Basados en muestreos de campo, notas de campo y ejemplares en las colecciones científicas, demostramos que: (1) ambas subespecies se han registrado previamente en hábitats específicos en condiciones mésicas asociadas a oasis y arroyos; (2) estas dos subespecies exhiben una separación en sus distribuciones en las porciones central y sur de la península; (3) sus hábitats están amenazados por las actividades humanas y la desertificación, lo que explica por qué sus poblaciones están actualmente fragmentadas; y (4) no se han colectado u observado especímenes de *S. bachmani* en los últimos 20 años, principalmente en la parte sur de la península. Sugerimos que el estado actual de la población de ambas subespecies se considere como amenazada, se requieren acciones inmediatas para su conservación, incluyendo sus hábitats. La forma del sur, *S. b. peninsularis*, podría ser considerada como extinta por actividades antropogénicas.

The brush rabbit (*Sylvilagus bachmani*) is represented by 13 nominal subspecies, of which 5 are endemic to the Baja California Peninsula (Hall 1981, Álvarez-Castañeda and Patton 1999): *S. b. howelli* in the mountain ranges of the northern part of the peninsula; *S. b. rosaphagus* in the northwestern coastal plains; *S. b. exiguus* in the Central and Vizcaino deserts; *S. b. peninsularis* in the southern part of the peninsula; and *S. b. cerrosensis* on Cedros Island (Hall 1981, Cervantes et al. 1999).

Brush rabbits occur in areas with dense shrub cover, mostly in chaparral, as well as in oak (*Quercus* spp.) and conifer woodlands or grasslands in California (Williams et al. 2008). The preferred biotopes for brush rabbits are those with amargosa shrubs (*Franseria* sp.) and

predominance of agaves (*Agave* spp.; Álvarez-Castañeda et al. 2008). Brush rabbits establish networks of runways through the vegetation (Chapman 1974) and seem most adapted to uniform habitats (Chapman and Ceballos 1990). Their diet consists mainly of fresh leaves but is opportunist when fruits and seeds are seasonally available (Chapman 1974). Most records are associated with mesic habitats (riparian) or dry-mesic prairie with a high percentage of grass cover.

The main vegetation type in the peninsula comprises plants that have adaptations for desert survival (Wiggins 1980). In the southern half of the peninsula, the mesic areas with dense shrub vegetation are restricted to the oases (Axelrod 1979, Arriaga et al. 1997, León de la Luz et al. 2000). *Sylvilagus bachmani*

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requires a dense plant cover that serves as refuge and protection from raptorial birds and carnivorous mammals (Huey 1940, Wolozyn and Wolozyn 1982, Steenhof and Kochert 1988, Cartron et al. 2004). Such habitat characteristics are rare in the Baja California warm-desert areas (Wiggins 1980).

Brush rabbits are abundant in the United States of America, and in the northern part of their ranges, they have been considered uniformly distributed along the Baja California Peninsula (including all warm deserts; Chapman 1974, Hall 1981, Chapman and Ceballos 1990, Cervantes et al. 1999). An exception to this uniform distribution is in the southern part of the peninsula where *S. b. peninsularis* and *S. b. exiguus* occur. However, there is no detailed information on the current status of the 5 brush rabbit subspecies on the Baja California peninsula (Chapman and Ceballos 1990).

During over 20 years of intensive field work in the southernmost part of the Baja California peninsula (San Lucas faunal district), we have not collected any specimens of *S. bachmani*, including at localities where it was previously recorded, such as Santa Anita and San Lucas (Hall 1981, Cervantes et al. 1999). Therefore, we analyzed collection records for the genus *Sylvilagus* on the Baja California Peninsula to evaluate the current status and distribution of the species.

#### METHODS

We used information on specimens ( $n = 942$ ) housed in the following mammal collections and databases: Centro de Investigaciones Biológicas del Noroeste ( $n = 300$ ; CIB), Mammal Networked Information System ( $n = 461$ ; MaNIS), Unidad de Informática para la Biodiversidad ( $n = 161$ ; UNIBIO) of the Instituto de Biología at the Universidad Nacional Autónoma de México, and the Mammal Collection of the Facultad de Ciencias of the Universidad Autónoma de Baja California ( $n = 20$ ; FC-UABC). All these data were combined into a single data set for analyses, which included generation of a map of localities for the species/subspecies and integration of historical information with data from current fieldwork.

#### RESULTS

During fieldwork in the years 1991–2011 by personnel of the mammal collection of the

Centro de Investigaciones Biológicas del Noroeste (7 field surveys per year on average and observation effort of 10 km per day per survey on average), no specimen of *S. bachmani* was observed or collected on the peninsula south of 28°N. Only the cottontail rabbit, *Sylvilagus audubonii*, was observed or collected in 21 localities south of the same parallel and in 49 other localities throughout the peninsula (Fig. 1).

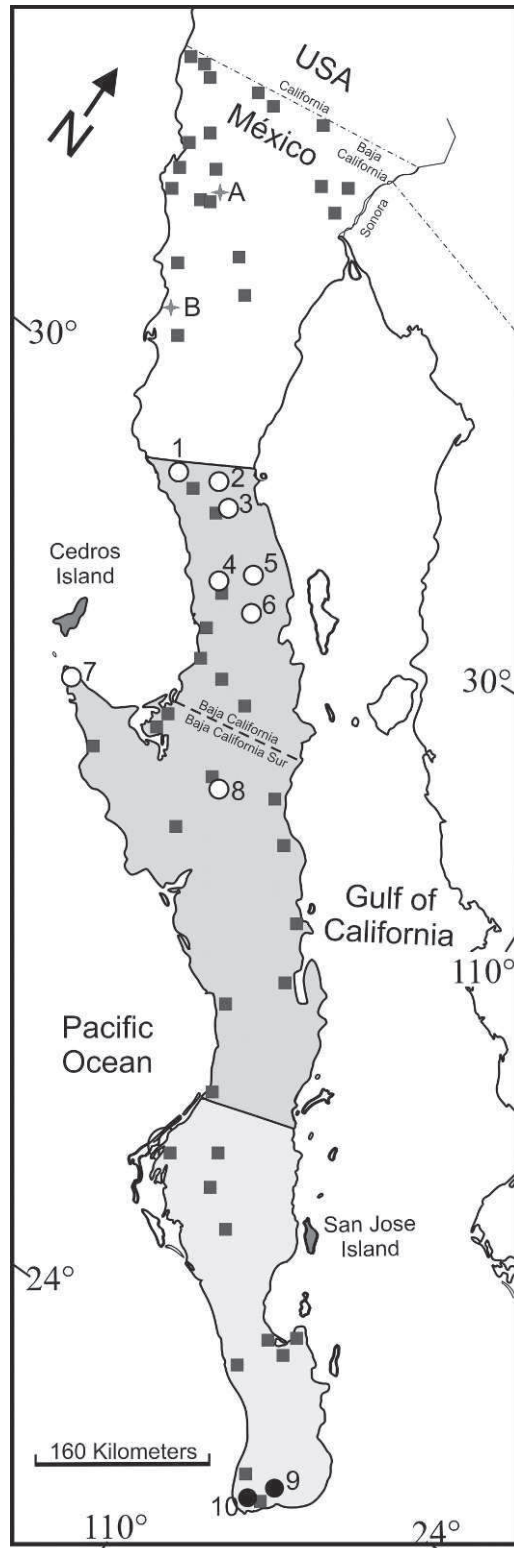
Historically, *S. bachmani* is reported for 9 localities south of 30°N, not including the insular population (Cedros Island; Fig. 1). All these records are associated with mesic vegetation habitats, some of which are oases (Cervantes et al. 1999; unpublished collection data). In all the survey localities associated with desert vegetation, only *S. audubonii* was collected.

The statuses of the 2 southernmost subspecies of *S. bachmani* are as follows:

*Sylvilagus bachmani peninsularis*.—Formerly, the range for this subspecies was from the Magdalena Bay region to the southern peninsula (Hall 1981, Cervantes et al. 1999), but specimens are known only from Santa Anita and Cabo San Lucas, both in the southeasternmost area and 32 km apart. We did not find any specimens of *S. b. peninsularis* in the specific surveys made at these 2 localities. Today, both localities are within the Cabo San Lucas–San José del Cabo suburban area, which has been strongly modified by tourist developments. The last known specimens collected for this southern subspecies were obtained in the first quarter of the 20th century (MaNIS).

*Sylvilagus bachmani exiguus*.—This subspecies ranges from the central desert of the peninsula from about 30°N southward to the general vicinity of Bahía Magdalena, not including the Pacific coastal plain in the northwestern part of its range (Hall 1981, Cervantes et al. 1999). This subspecies has been recorded from only 8 localities (1–8, Fig. 1). All collection localities are characterized by relict mesic vegetation (San Fernando, El Mármol, Cataviña, Punta Prieta, Yubay, San Borja, Punta Eugenia, and San Ignacio).

Many of these sites (e.g., San Fernando, El Mármol, Yubay, San Borja, and Punta Eugenia) exhibit low human impact, and cottontail rabbits are common. Although we have not collected *S. bachmani* at these sites, we expect



that intensive surveys focused on *S. bachmani* will result in new specimen records.

#### DISCUSSION

Modification of native habitat and loss of perennial water bodies in the southern portion of the Baja California Peninsula has altered the distribution of the biota. The fragmentation has a negative influence on ecological processes of plants and animals (Farina 1998). In the southern portion of the cape region in particular, there has been a remarkable fragmentation, resulting in only small, isolated patches of native vegetation (Madriñan 2002). The diversity of animals in the patches is highly influenced by patch size (Forman and Gordon 1986), location of roads and other anthropogenic changes that potentially alter the gene flow of species, and physical characteristics of the environment (Madriñan 2002, Turner 1996, Madriñan et al. 2007).

On the Baja California peninsula this process of habitat loss appears to be one of the causes of extinction of the Baja California rice mouse (*Oryzomys peninsularis*; Álvarez-Castañeda 1994, Álvarez-Castañeda and Cortés-Calva 1999) in the cape region. It is absent from the same localities at which *S. b. peninsularis* was recorded many years ago. In the early 20th century, the Santa Anita area occupied by *S. b. peninsularis* had a permanent stream (Arroyo San José) that extended 13.5 km from the highlands and ended at San José del Cabo (Nelson 1922). At present, the main channel of the Arroyo San José is virtually dry and has water for short periods only after summer tropical storms. The upper drainage basin near Santa Anita now has wells that supply water to the Los Cabos urban area and for irrigation of a few peripheral agricultural areas (Valdez 2006).

Recent study of landscape ecology and transformation of the cape shows rapid change of vegetation structure caused by human activities

Fig. 1. Records for *Sylvilagus bachmani exiguus* (open circles, range in dark gray), *S. b. peninsularis* (solid circles, range in gray), and *S. audubonii* (solid squares) on the Baja California Peninsula, México. (1) San Fernando, (2) El Mármol, (3) Cataviña, (4) Punta Prieta, (5) Yubay, (6) San Borja, (7) Punta Eugenia, (8) San Ignacio, (9) Santa Anita, and (10) Cabo San Lucas. (A) El Alamo, type locality of *S. b. howelli*, (B) Mision de Santo Domingo, type locality of *S. b. rosaphagus*.

(1973–1993). These changes have affected about 13% (= 2500 ha) of the cape's original area and have caused an increase in the patchiness of the habitat (Madriñan 2002). *Sylvilagus bachmani* has not been collected by us in over 20 years of fieldwork in the southern part of the Baja California peninsula, nor has the species been documented in field notes archived in the Mammal Collection of the Centro de Investigaciones Biológicas del Noroeste S.C.

Historically, only 8 specimens of *S. b. peninsularis* are known; 2 collected by D. Coolidge in 1896, 3 by J. Xantus in 1859, 1 by Nelson and Goldman in 1905, and 2 without name of collector and year (MaNIS). All the specimens are housed in the Smithsonian Institution and were collected in the 19th or early 20th century. There are about 922 specimens of lagomorphs collected south of the 28th parallel housed in 11 mammal collections of Mexico and the United States, including the type locality of *S. b. peninsularis* (Santa Anita). It is evident there has been relatively continuous collecting activity in the area during the 20th and early 21st centuries, but no specimens of *S. bachmani* have been collected in the last 100 years for the southern part of the Baja California peninsula.

We conclude that *S. b. peninsularis* has drastically declined because of habitat modification. We believe that the effort made in looking for this subspecies has been sufficient to consider it extinct. *Sylvilagus bachmani cerrosensis* and *S. b. exiguus* are threatened and should be added to national and international lists of protected species.

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#### LITERATURE CITED

- ÁLVAREZ-CASTAÑEDA, S.T. 1994. Current status of the rice rat, *Oryzomys couesi peninsulae*. *Southwestern Naturalist* 39:99–100.
- ÁLVAREZ-CASTAÑEDA, S.T., AND P. CORTÉS-CALVA. 1999. Familia Muridae. Pages 445–570 in S.T. Álvarez-Castañeda and J.L. Patton, editors, Mamíferos del noroeste de México. Centro de Investigaciones Biológicas del Noroeste, S.C., La Paz, Baja California Sur, México.
- ÁLVAREZ-CASTAÑEDA, S.T., AND J.L. PATTON. 1999. Mamíferos del noroeste de México. Centro de Investigaciones Biológicas del Noroeste, S.C., La Paz, Baja California Sur, México.
- ÁLVAREZ-CASTAÑEDA, S.T., E. RIOS, P. CORTÉS-CALVA, N. GONZÁLEZ-RUIZ, AND C.G. SUÁREZ-GRACIDA. 2008. Los Mamíferos de las Reservas de El Valle de los Cirios y El Vizcaíno. Centro de Investigaciones Biológicas del Noroeste, S.C., Comisión Nacional para el Conocimiento y Uso de la Biodiversidad, Distrito Federal, México.
- ARRIAGA, L., S. DÍAZ, R. DOMÍNGUEZ, AND J.L. LEÓN DE LA LUZ. 1997. Composición florística y vegetación. Pages 69–106 in L. Arriaga and R. Rodríguez Estrella, editors, Los Oasis de la Península de Baja California. Centro de Investigaciones Biológicas del Noroeste, S.C., La Paz, Baja California Sur, México.
- AXELROD, D.I. 1979. Age and origin of Sonoran Desert vegetation. *Occasional Papers of the California Academy of Sciences* 132:1–74.
- CARTRON, J.L.E., P.J. POLECHLA JR., AND R.R. COOK. 2004. Prey of nesting Ferruginous Hawks in New Mexico. *Southwestern Naturalist* 49:270–276.
- CERVANTES, F.A., C. LORENZO, AND J. VARGAS. 1999. Familia Leporidae. Pages 199–237 in S.T. Álvarez-Castañeda and J.L. Patton, editors, Mamíferos del noroeste de México. Centro de Investigaciones Biológicas del Noroeste, S.C., La Paz, Baja California Sur, México.
- CHAPMAN, J.A. 1974. *Sylvilagus bachmani*. *Mammalian Species* 34:1–4.
- CHAPMAN, J.A., AND G. CEBALLOS. 1990. The cottontails. Pages 95–110 in J.A. Chapman and J.E.C. Flux, editors, Rabbits, hares and pikas, status survey and conservation action plan. International Union for the Conservation of Nature and Natural Resources, Gland, Switzerland.
- FARINA, A. 1998. Principles and methods in landscape ecology. Chapman and Hall, London, United Kingdom.
- FORMAN, R.T.T., AND M. GORDON. 1986. Landscape ecology. John Wiley & Sons, New York, NY.
- HALL, E.R. 1981. The mammals of North America. Wiley, New York, NY.
- HUEY, L.M. 1940. A new coastal form of brush rabbit from the vicinity of San Quintín, Lower California, Mexico. *Transactions of the San Diego Society of Natural History* 9:221–224.
- LEÓN DE LA LUZ, J.L., N.J. PÉREZ, AND A. BRECEDA. 2000. Vegetation of the lowlands of the Cape Region, Baja California Sur: a transitional xerophitic tropical plant community. *Journal of Vegetation Sciences* 11: 555–564.
- MADRIÑAN, L.F. 2002. Ecología del paisaje y transformación de la región de Cabo San Lucas Baja California Sur, México (1973–1993). Thesis. Uso, Manejo y preservación de los recursos Naturales (Ecología de Zonas Áridas). Centro de Investigaciones Biológicas del Noroeste, S.C., La Paz, Baja California Sur, México.
- MADRIÑAN, L.F., A. ETTER, G.D. BOXALL, AND A. ORTEGA-RUBIO. 2007. Tropical alluvial forest fragmentation in the eastern lowlands of Colombia (1993–1997). *Land Degradation and Development* 18:199–208.

- NELSON, E.W. 1922. Lower California and its natural resources. *Memoirs of the National Academy of Sciences* 16(1):1–194.
- STEENHOF, K., AND M.N. KOCHERT. 1988. Dietary responses of three raptor species to changing prey densities in a natural environment. *Journal of Animal Ecology* 57:37–48.
- TURNER, I.M. 1996. Species loss in fragments of tropical rain forest: a review of the evidence. *Journal of Applied Ecology* 33:200–209.
- VALDEZ, A. 2006. Diagnóstico, servicios ambientales y valoración económica del agua en el corredor turístico-urbano de Los Cabos, BCS. Master's thesis, Universidad Autónoma de Baja California Sur, Baja California Sur, México.
- WIGGINS, I. 1980. *Flora of Baja California*. Stanford University Press, Stanford, CA.
- WILLIAMS, D.F., P.A. KELLY, P. HAMILTON, M.R. LLOYD, E.A. WILLIAMS, AND J.J. YOUNGBLOM. 2008. Recovering the endangered riparian brush rabbit (*Sylvilagus bachmani riparius*): reproduction and growth in confinement and survival after translocation. Pages 349–361 in P.C. Alves, N. Ferrand, and K. Hackländer, editors, *Lagomorph biology: evolution, ecology, and conservation*. Springer-Verlag, Berlin, Germany.
- WOLOZYN, D., AND B.W. WOLOZYN. 1982. *Los mamíferos de la Sierra de La Laguna*. Consejo Nacional de Ciencia y Tecnología, Distrito Federal, México.

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