MAMMALIAN SPECIES No. 796, pp. 1–3, 3 figs.

Leptonycteris curasoae.

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Published 9 August 2006 by the American Society of Mammalogists

Leptonycteris curasoae **Miller, 1900**

Curaçaoan Long-nosed Bat

Leptonycteris curasoae Miller, 1900:126. Type locality "Curacao, West Indies."

Leptonycteris curasoae tarlosti Pirlot, 1965:6. Type locality "El Valle, Isla Margarita, Venezuela."

CONTEXT AND CONTENT. Order Chiroptera, family Phyllostomidae, subfamily Glossophaginae, tribe Glossophagini. *L. curasoae* is monotypic (Simmons 2005).

DIAGNOSIS. *Leptonycteris curasoae* (Fig. 1) is smaller than its congener *L. nivalis* (length of forearm 54–55 mm versus 56.5–59.5 mm). Length of the 3 phalanges of the 3rd finger of *L. curasoae* is on average not greater than the length of the 3rd metacarpal; it is typically greater for *L. nivalis*. Pelage of *L. curasoae* is grayish to brown and darker than the lighter pelage of *L. nivalis*. Uropatagium is sparsely haired with a slight fringe, compared to the nearly naked uropatagium of *L. yerbabuenae*. In addition, *L. curasoae* has a narrower uropatagium with less hair and with a few short hairs along its edge in comparison to *L. nivalis* (Miller 1900). Dentition is relatively heavy compared to *L. yerbabuenae*. Upper incisors lack a median gap, which is often present in *L. yerbabuenae*. Upper incisors are equally spaced in *L. curasoae* and more forward projecting than in *L. nivalis* (Miller 1900). Upper toothrow of *L. curasoae* is shorter with distance from the canine to the last molar usually <9.0 mm.

GENERAL CHARACTERS. *Leptonycteris curasoae* is a medium-sized phyllostomid bat. Its ears are relatively small and broad. Adult pelage of *L. curasoae* is short, dense, and grayish to brown in color (Miller 1900). Ventral surface is slightly paler. Ears and membranes are dark brown.

Third molar is missing but lower incisors are usually present. Molars are elongate and slender with a faint W-pattern (Hall 1981). Lower incisors may appear absent because of wear or they may be entirely lost (Fig. 2).

Measurements (mean and range, in mm) for *L. curasoae* for 4 males and 2 females combined are: length of forearm, 54.7, 54.0–55.3; length of 3rd metacarpal, 48.6, 48.0–49.4; length of 1st phalanx III, 14.7, 14.2–15.5; length of 2nd phalanx III, 23.5, 22.8–23.8; length of 3rd phalanx III, 12.1, 10.5–12.8; length of 3rd digit, 99.1, 97.8–99.9; condylobasal length, 27.4, 27.0–28.0; zygomatic width, 11.4, 11.1–11.8; interorbital width, 5.1, 5.0–5.4; mastoidal width, 11.0, 10.6–11.5; length of palate from alveolus, 15.3, 15.2–15.6; length of maxillary toothrow, 9.6, 9.5–9.7; length of mandible, 19.3, 19.2–19.7 (Fig. 2; Davis and Carter 1962).

DISTRIBUTION. *Leptonycteris curasoae* occurs in northern Colombia and Venezuela and the Caribbean islands of Aruba, Bonaire, Curaçao, and Margarita (Fig. 3; Cuervo-Díaz et al. 1986; Fleming and Nassar 2002). *L. curasoae* travels over a broad range in Venezuelan arid zones, including coastal, midland, and Andean locations, based on an analysis of the distribution of mitochondrial DNA haplotypes (Newton et al. 2003). The seasonal disappearance of this species from Andean sites in Venezuela (May–August) suggests local migrations in northern South America (Soriano et al. 2000; Sosa and Soriano 1993) or altitudinal movements (Herrera 1997).

FOSSIL RECORD. No fossils of *L. curasoae* are known. Subfossil remains occur in guano deposits in the Cueva de Los Murciélagos, Isla de Toas, state of Zulia, Venezuela (Rincón 2001).

FORM AND FUNCTION. Roosting in warm caves and mine shafts during the maternity period provides 2 metabolic benefits: young can divert more energy to growth and development and the daytime maintenance costs for females are low (Arends et al. 1995). The extrusible tongue is long with lengthened tongue papillae to facilitate nectar feeding (Howell and Hodgkin 1976; Koopman 1981). Dental formula is i 2/2, c 1/1, p 2/3, m 2/2, total 30 (Hoffmeister 1957).

These cactophilic bats are well adapted to exploit cactus nectar, pollen, and fruit as food sources (Simmons and Wetterer 2002). Curaçaoan long-nosed bats flew an average of 27.2 km to their foraging sites at a mean air speed of 8.2 m/s (Sahley et al. 1993). In addition to wide wingspans, large wing areas, low aspect ratios, and high wing loading (Norberg and Rayner 1987), *L. curasoae* has a long and narrow rostrum, relatively short ears, and a small nose leaf, characters that facilitate probing into flower corollas in search of nectar. *L. curasoae* has a moderately long tongue with papillae that terminate in a hook. The papillae collectively act as a "mop" to aid in removal of nectar from flowers (Howell and Hodgkin 1976).

ONTOGENY AND REPRODUCTION. In northern Venezuela, females are seasonally monoestrous (Martino et al. 1998; Petit 1997; Wilson 1973). Copulation occurred late during November–early December (Martino et al. 1998). A pregnancy peak occurred in May and a lactation peak in June in northern Venezuela (Martino et al. 1998). The highest frequency of juveniles was in July. Lactation lasts ca. 2 months (Jenness and Studier 1976; Martino et al. 1998).

ECOLOGY. *Leptonycteris curasoae* lives in semiarid and arid habitats subject to annual fluctuations in temperature, rainfall, or both. In northern Venezuela variations in temperature and photoperiod are slight; seasonal changes in this area are driven by rainfall (Martino et al. 1998). In northern South America, *L. curasoae* is associated with thorn forest, spiny scrublands, cardon cactus forests, and tropical dry forests.

Typically, *L. curasoae* roosts in caves with varying environmental conditions, but seems to prefer caves that are hot (>30°C) and humid because they trap metabolic heat and moisture produced by thousands of conspecific and other bat species (Arends et al. 1995; Martino et al. 1998). Females gain several physiological benefits from roosting in warm, densely populated caves and mines, including lower energy expenditure during the day, reduced evap-

FIG. 1. Photograph of an adult *Leptonycteris curasoae* from Venezuela. Used with permission of the photographer, P. Soriano.

FIG. 2. Dorsal, ventral, and lateral views of cranium and lateral view of mandible of an adult male *Leptonycteris curasoae* (U.S. National Museum of Natural History [USNM] 455160) from Caserio Boro, 10 km N El Tocuyo, Lara, Venezuela. Greatest skull length is 26.9 mm.

orative water loss, low thermoregulation costs, and increased growth rates of young (Arends et al. 1995; Fleming and Nassar 2002). Piedra Honda Cave, Paraguaná, Venezuela, is a typical maternity cave. Annual temperature inside the cave averages 30°C and relative humidity averages 84% (Martino et al. 1998). *L. curasoae* co-occurs in large numbers with up to 3 species of mormoopid bats in Venezuela (Bonaccorso et al. 1992). Suitable day roosts must be within foraging range of sufficient food resources.

The diet of *L. curasoae* overlaps significantly with that of *Glossophaga longirostris* in semiarid shrub habitat in Venezuela (Petit 1997; Sosa and Soriano 1993). However, interspecific competition is low because *L. curasoae* only occurred in the study area when food availability was highest.

Nectar, pollen, and fruit dominate the diet of *L. curasoae*. Some stomachs from Curaçaoan long-nosed bats have contained insects that may have been consumed coincidental to nectar feeding (Sosa and Soriano 1993). Much of the pollen taken is probably ingested when Curaçaoan long-nosed bats groom their fur after nectar feeding. Nectar and pollen form the bulk of the diet but some fruit (Cactaceae, Myrtaceae, and Sapotaceae) may be consumed, especially when females are lactating (Fleming and Nassar 2002).

Leptonycteris curasoae plays an important role in the pollination of Cactaceae and Agavaceae and in the dispersal of cactus seeds (Nassar et al. 1997; Petit 1997; Sosa and Soriano 1993). Columnar cacti are critical for the survival and reproduction of *L. curasoae* on Curaçao (Petit 1997). Cactus pollen was identified in diet samples year-round; roughly 90% of the samples contained cactus products and 43% of the samples contained cactus products exclusively. Only when *Agave* and *Ceiba pentandra* are flowering

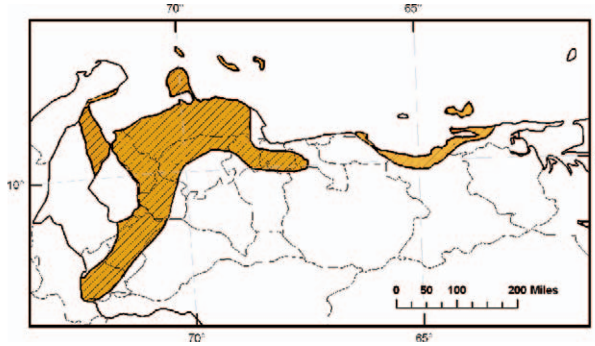

FIG. 3. Geographic distribution of *Leptonycteris curasoae*.

at the beginning of the dry season could *L. curasoae* survive without eating cactus products (Petit 1997).

In northern Venezuela, the general diet composition is similar to that reported in other areas (Martino et al. 2002). Pollen from Cactaceae and Bombacaceae dominated the bat diet (100% of samples), followed by Caricaceae (67%) and Agavaceae (22%—Martino et al. 2002). Pollen composition in the diet varies seasonally, related to the flowering pattern of the plants in the area. Females during lactation ingest more pollen and fruits to help supply nutritional (i.e., nitrogen, protein, and essential amino acids) and energetic needs (Martino et al. 2002). *L. curasoae* depends on cacti and agave as its main food sources in Venezuelan arid environments (Nassar et al. 2003). In northern Venezuela, *L. curasoae* eats pollen from Cactaceae and Agavaceae as well as fruits from columnar cacti (*Cereus repandus* and *Stenocereus griseus*—Sosa and Soriano 1993). *L. curasoae* feeds opportunistically and may migrate locally seeking flowering agave and columnar cacti (Sosa and Soriano 1993). *L. curasoae* digested 71.3% of pollen grains of columnar cacti ingested in Venezuela (Muñoz-Romo et al. 2005).

Leptonycteris curasoae lives up to 10 years (Tuttle and Stevenson 1982). Barn owls (Debrot et al. 2001) prey on *L. curasoae* on Curaçao, and a giant centipede, *Scolopendra gigantea*, ate Curaçaoan long-nosed bats in the Paraguana Peninsula, Venezuela (Molinari et al. 2005).

BEHAVIOR. *Leptonycteris curasoae* hangs from its large claws when resting. In caves with thousands of individuals, they are highly gregarious and roost in densely packed clusters. *L. curasoae* is an agile flier and its flight is usually rapid and direct. It sometimes hovers in front of an inflorescence (Nassar et al. 1997).

GENETICS. Gene flow among populations of *L. curasoae* distributed over a range of distances is high (Wilkinson and Fleming 1996). Identical haplotypes in *L. curasoae* were shared over a broad range in Venezuelan arid zones, including coastal, inland, and Andean locations (Newton et al. 2003).

CONSERVATION STATUS. Curaçaoan long-nosed bats might be more vulnerable to extinction than other bats because of their specialized feeding behavior. Habitat destruction and the resulting decline or disappearance of plants, especially agave and columnar cacti that serve as nectar, pollen, and fruit sources, are important conservation concerns (Petit 1997). The Biological Reserve of Piedra Honda Cave was created in 1988 to protect this important resting and maternity roost in northwestern Venezuela. *L. curasoae* is considered a vulnerable species in the Red Book of Venezuelan Fauna (Rodríguez and Rojas-Suárez 1999).

REMARKS. Miller named *L. curasoae* in 1900, and it remained a little-known South American and Caribbean endemic until 1988, when Arita and Humphrey lumped *L. yerbabuenae* with it. Koopman (1994) was the 1st to recognize *curasoae*, *nivalis*, and *yerbabuenae* as separate species. Although Pirlot (1965) described *L. c. tarlosti* as a separate subspecies from the mainland, Margarita, and Aruba, Smith and Genoways (1974) believed that the populations of *L. curasoae* of northern South America and adjacent islands are undifferentiated and little evidence exists to consider these populations a distinct subspecies. (That arrangement was followed by Simmons 2005).

Mitochondrial DNA suggests that the 3 *Leptonycteris* species shared a common ancestor ca. 1 million years ago and that *L.*

curasoae and *L. yerbabuenae* separated ca. 540,000 years ago (Wilkinson and Fleming 1996). Climatic events during the late Pliocene and Pleistocene, the uplift of the Mexican plateau in the late Pliocene, and the uplift and the formation of the Sierra Madre Mountains facilitated divergence. A temporary, arid or semiarid, dispersal corridor linking Mexico and northern South America during at least 1 Pleistocene glacial advance explains the range of *L. curasoae* (Wilkinson and Fleming 1996). The distribution of columnar cacti may have influenced the evolution of *L. curasoae* (Simmons and Wetterer 2002)

The name *Leptonycteris* is from the Greek *leptos*, meaning slender, and *nycteris*, meaning bat, in reference to the slender rostrum of this genus (Hensley and Wilkins 1988). The specific epithet *curasoae* refers to the type locality, the island of Curaçao.

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