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Nyctinomops laticaudatus.

By Rafael Avila-Flores, José Juan Flores-Martínez, and Jorge Ortega

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Nyctinomops laticaudatus (É. Geoffroy St.-Hilaire, 1805)

Broad-tailed Bat

Molossus laticaudatus É. Geoffroy St.-Hilaire, 1805:156. Type locality "Asunción, Paraguay."
Nyctinomops laticaudatus Miller, 1902:393. First use of current name combination.

CONTEXT AND CONTENT. Order Chiroptera, suborder Microchiroptera, family Molossidae, genus *Nyctinomops*. *N. laticaudatus* has 5 subspecies:

N. l. europs (H. Allen, 1889:558). Type locality "Corumbá, Mato Grosso, Brazil."
N. l. ferrugineus Goodwin, 1954:2. Type locality "8 mi. N (= Cueva del Abra, 10 km NNE) Antiguo Morelos, Tamaulipas."
N. l. laticaudatus (É. Geoffroy St.-Hilaire, 1805:156), see above (*caecus* Rengger, *espiritosantensis* Ruschi, and *gracilis* Dobson are synonyms).
N. l. macarenensis Barriga-Bonilla, 1965:249. Type locality "right side of Río Guayabero (= alto Río Guaviare), La Angostura [= Primera Angostura (1)]. Departamento del Meta, Colombia."
N. l. yucatanicus Miller, 1902:393. Type locality "Chichén-Itzá, Yucatán."

DIAGNOSIS. *Nyctinomops laticaudatus* (Fig. 1) differs from *Tadarida brasiliensis* in 2nd phalanx of 4th digit being shorter, measuring <5 mm; rostrum is narrow and deeply notched on anterior palate; metaloph and paraloph of upper molars are convergent, and metaloph is parallel with postprotocrista (Freeman 1981; Legendre 1984; Wilkins 1989). *N. laticaudatus* differs from *N. aurispinosus* and *N. macrotis* in being smaller overall and having a proportionately smaller braincase and smaller teeth but having a larger interorbital constriction. Posterointernal cingula of m1 and m2 is quadrangular in shape (Jones and Arroyo-Cabrales 1990; López-González 1998; Milner et al. 1990). *N. femorosaccus* is larger and has a shorter thumb, has fine hairs in uropatagium membrane and closer and more rugose ears (Freeman 1981; Kumirai and Jones 1990).

GENERAL CHARACTERS. The broad-tailed bat is dark chocolate brown dorsally, with a lighter venter (Fig. 1). Upperparts are deep brown, and base of hair is white. Hairs of abdomen are bister with pinkish buff in tips (Hall 1981; Shamel 1931). Dorsally, behind base of humerus, fur abruptly narrows inward, extending down to base of tail (López-González 1998). Single dorsal hairs are wide in 1st portion of distal one-third, tapering gently and evenly in both directions from this point up to the straight base. Cuticula is highly pigmented along length of hair, with a lighter zone at proximal end of distal one-third. Cortex is lightly pigmented, with no distinguishable bands, and is absent in distal one-third of hair (van Staaden and Jones 1997). Wing membranes are entirely naked and semitransparent. Second phalanx of 4th digit is less than one-fourth length of 1st phalanx (Freeman 1981; López-González 1998). Ears are large, rounded, with upper edges joining on forehead. Tragus is small, quadrate, with straight upper margins ca. 1 mm in length. Antitragus is more elongate than elevate, up to 4 mm long. Femur and basal part of tibia on ventral surface are concealed by fold of skin extending from pubis to lower one-third of tibia; hind foot and lower part of tibia are visible. Muzzle is pointed and upturned. Upper lip is deeply wrinkled with vertical folds that overhang lower lip. Nostrils are raised on diminutive tubes that are backed by a hard ridge. Mandible of *Nyctinomops* is prolonged and delicate compared with several molossids (Freeman 1981). Skull strong; sagittal crest is poorly to moderately developed. Coronoid process is low and basisphenoid pits are deep. Anterior border of palate is emarginated (Fig. 2). The p1 touches the canine as well as the large p2; m3 has a complete commissure (Husson 1962; López-González 1998). Premaxillaries are separated in front by a very narrow space; upper incisors are simple and nearly parallel; m3 is minute (Goodwin and Greenhall 1961). Dental formula is i 1/2, c 1/1, p 2/2, m 3/3, total 30 (Villa-R. 1967).

Considering geographic and sexual variation, averages (±*SD*, *n*) of several morphometric measures (in mm) are: total length, 102 (±5.0, 26—Alvarez and Ramírez-Pulido 1972; Barquez and Ojeda 1975; Barriga-Bonilla 1965; Goodwin 1942, 1954; Hall 1981; Husson 1962; Jones and Alvarez 1962; Mares et al. 1981a; Myers and Wetzel 1983; Nuñez-Garduño et al. 1981; Sánchez-Hernández 1978; Sánchez-Hernández and Romero 1995; Villa-R. 1960); length of tail, 40.16 (±3.61, 25—Alvarez and Ramírez-Pulido 1972; Barquez and Ojeda 1975; Barriga-Bonilla 1965; Goodwin 1942, 1954; Hall 1981; Husson 1962; Jones and Alvarez 1962; Mares et al. 1981a; Myers and Wetzel 1983; Nuñez-Garduño et al. 1981; Sánchez-Hernández 1978; Sánchez-Hernández and Romero 1995; Villa-R. 1960); length of ear, 17.96 (±2.13, 20—Barquez and Ojeda 1975; Barriga-Bonilla 1965; Goodwin 1954; Jones and Alvarez 1962; Mares et al. 1981a; Sánchez-Hernández 1978; Sánchez-Hernández and Romero 1995; Villa-R. 1960); length of hind foot, 10.03 (±2.65, 25—Alvarez and Ramírez-Pulido 1972; Barriga-Bonilla 1965; Goodwin 1942, 1954; Hall 1981; Jones and Alvarez 1962; Mares et al. 1981a; Sánchez-Hernández 1978; Sánchez-Hernández and Romero 1995; Villa-R. 1960); length of fore-

FIG. 1. *Nyctinomops laticaudatus* from the Mayan Ruins of Uxmal, Yucatan, Mexico. Photograph courtesy of Jens Rydell.

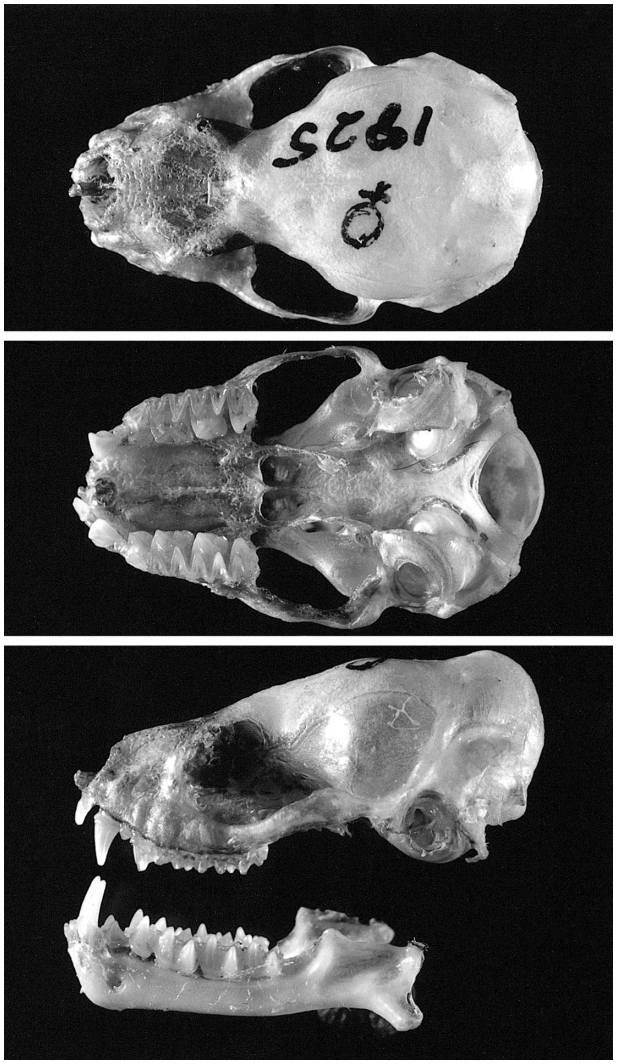

FIG. 2. Dorsal, ventral, and lateral views of cranium and lateral view of mandible of an adult female *Nyctinomops laticaudatus* (IBUNAM 1825 [Instituto de Biología, Universidad Nacional Autonoma de Mexico]) from Uxmal, Yucatan, Mexico. Greatest length of cranium is 23.3 mm. Photographs by José Antonio Hernández Gómez.

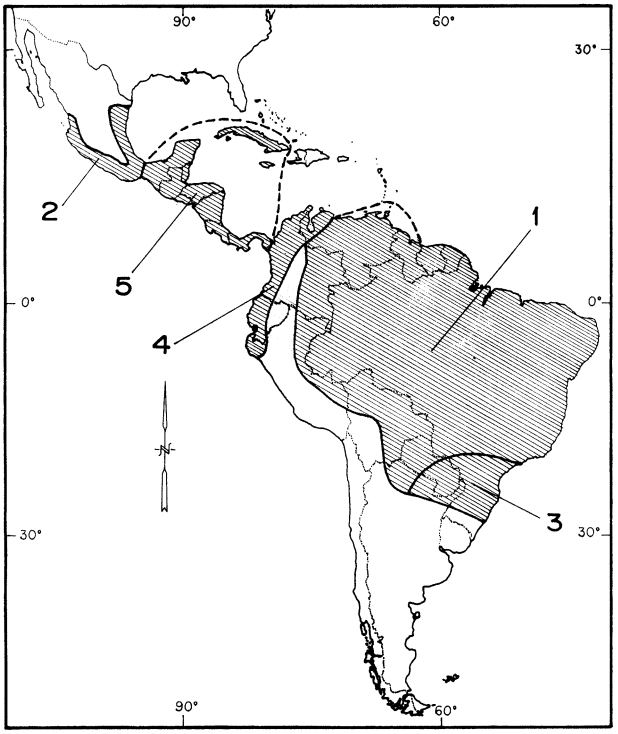

FIG. 3. Geographic distribution of *Nyctinomops laticaudatus* (modified from Barquez et al. 1999; Hall 1981; Koopman 1982): 1, *N. l. europs*; 2, *N. l. ferrugineus*; 3, *N. l. laticaudatus*; 4, *N. l. macarenensis*; 5, *N. l. yucatanicus*.

arm, 43.05 (±1.62, 36—Alvarez and Ramírez-Pulido 1972; Barquez and Ojeda 1975; Barriga-Bonilla 1965; Bowles et al. 1990; Goodwin 1942, 1954; Goodwin and Greenhall 1961; Hall 1981; Husson 1962; Jones and Alvarez 1962; Mares et al. 1981a; Sánchez-Hernández 1978; Sánchez-Hernández and Romero 1995; Silva-Taboada and Koopman 1964; Villa-R. 1960; Zortéa and Taddei 1995); length of metacarpal III, 42.51 (±1.39, 12—Barriga-Bonilla 1965; Zortéa and Taddei 1995); length of metacarpal IV, 42.15 (±1.48, 12—Barriga-Bonilla 1965; Zortéa and Taddei 1995); length of metacarpal V, 24.42 (±0.95, 10—Barriga-Bonilla 1965); length of phalanx 1, d III, 18.34 (±0.83, 12—Barriga-Bonilla 1965; Zortéa and Taddei 1995); length of phalanx 1, d IV, 16.14 (±0.74, 9—Barriga-Bonilla 1965); length of phalanx 2, d III, 15.79 (±1.02, 12—Barriga-Bonilla 1965; Zortéa and Taddei 1995); length of phalanx 2, d IV, 2.87 (±0.60, 10—Barriga-Bonilla 1965); length of phalanx 2, d V, 3.36 (±0.35, 10—Barriga-Bonilla 1965); length of phalanx 3, d III, 5.42 (±0.73, 10—Barriga-Bonilla 1965); greatest length of skull, 18.2 (±0.61, 35—Alvarez and Ramírez-Pulido 1972; Barquez and Ojeda 1975; Goodwin 1942, 1954; Goodwin and Greenhall 1961; Hall 1981; Jones and Alvarez 1962; Polaco et al. 1992; Sánchez-Hernández 1978; Sánchez-Hernández and Romero 1995; Silva-Taboada and Koopman 1964; Zortéa and Taddei 1995); breadth of braincase, 8.67 (±0.16, 8—Alvarez and Ramírez-Pulido 1972; Barquez and Ojeda 1975; Goodwin 1954; Polaco et al. 1992; Sánchez-Hernández 1978; Zortéa and Taddei 1995); zygomatic breadth, 9.96 (±0.42, 31—Alvarez and Ramírez-Pulido 1972; Barquez and Ojeda 1975; Goodwin 1942, 1954; Goodwin and Greenhall 1961; Hall 1981; Jones and Alvarez 1962; Polaco et al. 1992; Sánchez-Hernández 1978; Zortéa and Taddei 1995); interorbital constriction, 3.63 (±0.18, 24—Alvarez and Ramírez-Pulido 1972; Barquez and Ojeda 1975; Goodwin 1942, 1954; Goodwin and Greenhall 1961; Jones and Alvarez 1962); postorbital constriction, 3.69 (±0.05, 8—Barquez and Ojeda 1975; Polaco et al. 1992; Sánchez-Hernández 1978; Zortéa and Taddei 1995); basilar length, 14.75 (±0.35, 2—Barquez and Ojeda 1975; Goodwin 1954); condylobasal length, 16.82 (±0.50, 7—Barquez and Ojeda 1975; Polaco et al. 1992; Silva-Taboada and Koopman 1964; Zortéa and Taddei 1995); length of palate, 6.8 (1—Barquez and Ojeda 1975); mastoid breadth, 9.81 (±0.38, 20—Alvarez and Ramírez-Pulido 1972; Barquez and Ojeda 1975; Jones and Alvarez 1962; Zortéa and Taddei 1995); length of maxillary toothrow, 6.44 (±0.29, 33—Alvarez and Ramírez-Pulido 1972; Goodwin 1942, 1954; Goodwin and Greenhall 1961; Hall 1981; Jones and Alvarez 1962; Polaco et al. 1992; Sánchez-Hernández 1978; Zortéa and Taddei 1995); length of mandibular toothrow, 12.26 (±0.55, 3—Barquez and Ojeda 1975; Zortéa and Taddei 1995); breadth across upper molars, 7.16 (±0.32, 22—Alvarez and Ramírez-Pulido 1972; Goodwin 1954; Jones and Alvarez 1962; Zortéa and Taddei 1995); body mass (g), 11.33 (±2.20, 6—Bowles et al. 1990; Goodwin and Greenhall 1961; Mares et al. 1981a; Sánchez-Hernández 1978).

Bipolar clinal variation was detected for subspecies of *N. laticaudatus*: subspecies at the range extremes (*N. l. ferrugineus* in the north and *N. l. laticaudatus* in the south) are larger than subspecies from Central America, northern South America, and the Amazon Basin (Silva-Taboada and Koopman 1964). Subspecific variation is evident in areas of sympatry, e.g., northern Colombia (Barriga-Bonilla 1965) and Chaco Boreal and eastern areas of Paraguay (Myers and Wetzel 1983).

DISTRIBUTION. *Nyctinomops laticaudatus* is widely distributed in tropical and subtropical America from sea level to 1,700 m, but mainly below 500 m (Fig. 3). Broad-tailed bats occur in the

coastal plains of northwestern (Nayarit) and northeastern (Nuevo León and Tamaulipas) Mexico, the areas of the northernmost records, southward to Yucatan Peninsula and Central America and thence to South America up to Rio Grande do Sul in Brazil (Hall 1981; Jones et al. 1973; McCarthy et al. 1993; Polaco et al. 1992; Sánchez-Hernández and Gaviño 1987; Silva and Souza 1980; Wilson et al. 1985). In the West Indies, it occurs in Cuba (Silva-Taboada and Koopman 1964) and Trinidad (Goodwin and Greenhall 1961). To the east of the Andes, in South America, its range includes eastern Colombia, Venezuela, Guianas, Surinam, Brazil, the eastern portions of Peru and Bolivia, Paraguay, and the northern end of Argentina. To the west of the Andes, *N. laticaudatus* is distributed from northwestern Venezuela and western Colombia to northwestern Peru (Ascorra et al. 1996; Barquez et al. 1999; Graham and Barkley 1984; Mares et al. 1981a, 1981b; Silva and Souza 1980; Taddei and Garutti 1981; Vaccaro 1992).

FOSSIL RECORD. Cranial, mandibular, and postcranial fossil remains have been recorded from pre-Columbian, Holocene, and Pleistocene deposits in Loltun cave, Yucatan (Alvarez 1982; Arroyo-Cabrales and Alvarez 1990; Hatt et al. 1953). Also, fossil remains have been found in sediments from the Recent in Cueva de Quebrada Honda, Venezuela (Linares 1968), and from the late Pleistocene in Cueva del Abra, Tamaulipas (Dalquest and Roth 1970). Some subfossil remains were found in the natural well of Chichen-Itza, Yucatan (Arroyo-Cabrales and Alvarez 1990).

FORM AND FUNCTION. Cylindrical glans penis is ca. 2.0 mm long and 1.0 mm wide at its base. Dome-shaped urethral cap in which the glans ends is continuous with shaft of glans along its dorsal surface but is ventrally separated from shaft by a deep cleft leading to urinary meatus. Shaft is sparsely covered with small, proximally recurved spines 15–30 μm long, which are absent from urethral cap and from rim of urinary meatus surrounding the cap. Corpora cavernosa extends length of shaft and terminates in a small baculum near urinary meatus (Ryan 1991). Base of baculum is swollen at dorsal or ventral portion (or both), whereas distal end can be shortened, notched, or even hooked. Bacular greatest length (mm) averages 0.62 (0.57–0.65, $n = 5$), and greatest breadth at base averages 0.15 mm (0.12–0.17, $n = 5$—Brown 1967). Corpus spongiosum is restricted to a narrow tube surrounding urethra, and neither corpus spongiosum nor the accessory cavernous tissue invade the thin, nonvascular prepuce. *N. laticaudatus* has only small amounts of accessory cavernous tissue in body of glans penis.

ONTOGENY AND REPRODUCTION. Female broad-tailed bats are seasonally monoestrus during the rainy season (Silva-Taboada 1979). In the Yucatan Peninsula, southern Mexico, pregnancy is between April and late June whereas lactation occurs from the second half of July to August (Bowles 1973; Bowles et al. 1990; Jones et al. 1973). In northeast Mexico (Tamaulipas), 27 pregnant and 5 lactating females were caught during 19–23 June (Alvarez 1963). In Honduras, 1 female in advanced pregnancy was collected on 18 March (McCarthy et al. 1993). In Cuba, 50 pregnant females were captured between June and July, whereas 19 lactating females were captured on the same dates (Silva-Taboada 1979). Thus, parturition is synchronous between late June and early July, at least in the northern range of the species (Bowles et al. 1990; Silva-Taboada 1979). In South America (Bolivia), 1 female was taken in September with a single embryo (Anderson 1997). Nonreproductive females have been captured in March (Guatemala—Jones 1966), April (western Mexico and central Brazil—Mares et al. 1989; Sánchez-Hernández 1978), July, October (Peru—Graham 1987), November (western Mexico—Sánchez-Hernández and Gaviño 1987) and December (Yucatan Peninsula—Jones et al. 1973).

Pregnant females carry a single embryo each (Alvarez 1963; Anderson 1997; Baud 1981; Bowles 1973; Bowles et al. 1990; Jones et al. 1973; Silva-Taboada 1979). Fifteen early embryos from Yucatan taken in April averaged 9.2 mm (range 5–12 mm) in crown–rump length (Jones et al. 1973), and 1 in mid-May had a length of 2 mm (Bowles 1973). Terminal embryos from Yucatan ($n = 9$) and Tamaulipas ($n = 27$) collected from mid- to late June (1961) were 25–30 mm in crown–rump length (Alvarez 1963; Bowles et al. 1990), whereas those from Cuba ($n = 40$) collected in early July (1966) were 19–28 mm in length and weighed 2.2–3.9 g (Silva-Taboada 1979). A large fetus (26 mm crown–rump length) was taken in Honduras in middle March (McCarthy et al. 1993). The heaviest late-term embryo from Cuba was 3.1 g (29.1% of mother's weight). Its body was naked, with many bristles on its muzzle and feet. Its only conspicuous teeth were upper and lower incisors and canines. A newborn from Cuba weighed 2.8 g (26.3% of mother's weight) and was morphologically indistinguishable from late-term embryos. Infants open their eyes and move their ears a few hours after birth and are capable of quickly moving themselves over flat surfaces (Silva-Taboada 1979).

ECOLOGY. *Nyctinomops laticaudatus* occupies diverse tropical and subtropical habitats. It roosts or forages in tropical evergreen forest (Handley 1976; Jones et al. 1973; Murie 1935; Ryan 1960), subtropical moist forest (Mares et al. 1981a), cloud forest (Dalquest and Roth 1970), tropical deciduous forest (Alvarez 1963; Jones et al. 1973; Nuñez-Garduño et al. 1981), xerophyllous scrub (Jones et al. 1973), xerophyllous savannah or cerrado vegetation (Mares et al. 1989), swampy chacoan vegetation of palms with low brush (Barquez et al. 1999), subtropical thorn forest with mangrove and coconut trees (Best and Kennedy 1984), and temperate pine–oak forest (Martínez-Coronel and Vidal-López 1999). It has also been captured in disturbed (Mares et al. 1981b) and urban areas (Bowles et al. 1990; dos Reis et al. 1993; Jones et al. 1973).

The broad-tailed bat uses a variety of day roosts. Cave use has been recorded only in northeastern Mexico (Alvarez 1963; Dalquest and Roth 1970; Polaco et al. 1992; Villa-R. 1960). In Cueva del Abra, Tamaulipas, this bat has been observed near the cave entrance, in a faintly lighted area. Individuals were roosting within the rifts, channels, and winding hollows among stalactites formed in walls, at heights from 6 to at least 30 m (Villa-R. 1960). The broad-tailed bat commonly roosts within hollows and crevices in modern man-made structures (Handley 1966, 1976; Jones 1966; Murie 1935; Ryan 1960; Silva-Taboada 1979), in Mayan ruins (Bowles et al. 1990; Jones et al. 1973; Málaga and Villa-R. 1956), in crevices between tightly packed dead leaves of *Copernicia vespertilionum* palms in Cuba (Silva-Taboada and Koopman 1964), between rocks (Handley 1976), and within cracks of rocky cliffs bordering shores of Pacific coasts (Sánchez-Hernández and Gaviño 1987) and Venezuelan rivers (Linares 1987). Group size of roosting bats ranges between 150 and 1,000 individuals (Bowles et al. 1990; Jones 1966; Málaga and Villa-R. 1956; Murie 1935; Ryan 1960; Silva-Taboada and Koopman 1964), although "thousands" of bats were observed in 1 cave (Villa-R. 1960). Individuals have been observed tightly grouped within roosts, in contact with each other (Ryan 1960; Silva-Taboada 1979). They are usually visible when roosting and make audible chirps, but if disturbed, they retreat backward, deep into narrow crevices (Reid 1997). Other species present in the same roosting places are *Artibeus jamaicensis*, *Artibeus lituratus*, *Desmodus rotundus*, *Eumops glaucinus*, *Mormopterus minutus*, *Myotis nigricans*, *Natalus stramineus*, *Nyctinomops aurispinosus*, *N. femorosaccus*, *Pteronotus parnelli*, and *Tadarida brasiliensis* (Alvarez 1963; Dalquest and Roth 1970; Reddell and Mitchell 1971; Silva-Taboada 1979; Villa-R. 1960).

Nyctinomops laticaudatus may form resident colonies throughout the year, in some cases in stable numbers, although population dynamics are complex, and phylopatry is low. In the Mayan ruins of Uxmal, Yucatan, a group of 200 bats was banded in March 1955. When the complete colony (270 females and 280 males) was captured and banded 3 months later, it contained only 17 of the previously banded bats (less than 10%). In November of the same year, the colony had 520 individuals, many of them young. Again, only a small proportion of the bats previously marked in July was recaptured (Málaga and Villa-R. 1956). A large resident colony is also known at Cueva del Abra, Tamaulipas (Dalquest and Roth 1970; Villa-R. 1960).

Digestive tracts of *N. laticaudatus* from 11 adult specimens collected in Cuba contained abundant remains of coleopterans (some of the genus *Copelatus*) and some remains of lepidopterans (Silva-Taboada 1979).

Nyctinomops laticaudatus was captured in flight by barn owls (*Tyto alba*), and bone remains have been found in owl pellets (Alvarez 1963; Arroyo-Cabrales and Alvarez 1990; Dalquest and Roth 1970; Massoia et al. 1989). Stygian owls (*Asio stygius*) also prey on broad-tailed bats (Motta Junior and Taddei 1992), and small

sparrow hawks pursued broad-tailed bats that were released outside a roost in daylight after human manipulation (Málaga and Villa-R. 1956). In Cuba, snakes (genus *Epicrates*) climb palms and prey on roosting bats (Silva-Taboada 1979).

Nyctinomops laticaudatus hosts several species of flea (Siphonaptera: *Hormopsylla kyriophylla*, *Ptilopsylla leptina stubbei*, and *Rothschildopsylla noctilionis*—Morales-Muciño and Llorente-Bousquets 1985), mites (Acarina: *Chiroptonyssus robustipes*, *C. venezolanus*, *Ewingana yaguajayensis*, and *Notoedres lasionycteris minimus*—Silva-Taboada 1979), and chiggers (Acarina: *Hooperella yucatanica*, *Tecomatlana yucatanica*—Loomis 1969). Endoparasites from *N. laticaudatus* include trematodes (*Limatulum solitarium*, *Ochoterenatrema diminutum*, *O. pricei*, *Postorchigenes cubensis*, and *Urotrema scabridum*), cestodes (*Vampirolepis decipiens*), and nematodes (*Anoplostrongylus paradoxus*, *Litomosoides guiterasi*, *L. chandleri*, *Physaloptera*, and *Physocephalus sexalatus*—Silva-Taboada 1979).

Nyctinomops laticaudatus may be infected with rabies. A record of rabies is from a female in Guarulhos, Brazil, that was unable to fly and was taken from a window cornice in the morning in March 1991 (Uieda 1996). A female from Sao Paulo, Brazil, tested negative for 24 *Leptospira interrogans* and 5 *L. biflexa* serotypes (Gimenes-Bosco et al. 1998).

GENETICS. FN = 58 and 2n = 48, but variation occurs in the fundamental number (FN = 64—Morielle-Versute et al. 1996). Autosomes include 1 pair of large metacentrics, 3 pairs of medium-sized submetacentrics, 1 pair of medium-sized subtelocentrics, and 1 pair of small subtelocentrics as well as 17 pairs of acrocentrics. The X chromosome is a medium-sized submetacentric, and the Y chromosome is a small acrocentric (Warner et al. 1974). The nucleolus organizer region of chromosome 5 is located in the terminal area (Morielle-Versute et al. 1996).

CONSERVATION STATUS. *Nyctinomops laticaudatus* is rare or uncommon throughout most of its geographic range, as is confirmed by the records from several countries being few (Barquez et al. 1999; Barquez and Ojeda 1992; Handley 1966; Mares et al. 1981a, 1981b; McCarthy et al. 1993; Silva-Taboada 1979; Willig 1983). However, it is relatively common in some areas, especially within the Yucatan Peninsula (Bowles et al. 1990; Jones et al. 1973).

REMARKS. The broad-tailed bat was identified in the earlier literature as *Tadarida laticaudata* (Freeman 1981; Kumirai and Jones 1990). Several authors considered *Nyctinomus* E. Geoffroy St.-Hilaire the generic name for free-tailed bats. We followed the taxonomic status proposed by Freeman (1981), where *Nyctinomops* represents a particular genus. *Nyctinomops* comes from the Latin word for night feeder animal. The species name *laticaudatus* is derived from the Latin *latis* (ample) and *cauda* (tail). The authors appreciate the comments of Patricia W. Freeman and Renato Gregorin that were made on an earlier draft.

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RAFAEL AVILA-FLORES, JOSÉ JUAN FLORES-MARTÍNEZ, AND JORGE ORTEGA, INSTITUTO DE ECOLOGIA, UNAM, APDO. POSTAL 70-275, CIRCUITO EXTERIOR JUNTO A JARDÍN BOTÁNICO, 04510 MÉXICO, D.F., MEXICO.