MAMMALIAN SPECIES 844:1–8

Anoura caudifer (Chiroptera: Phyllostomidae)

MONIK OPREA, LUDMILLA M. S. AGUILIAR, AND DON E. WILSON

Division of Mammals, MRC 108, National Museum of Natural History, Smithsonian Institution, Washington, DC 20013-7012, USA; opream@si.edu (MO); wilsond@si.edu (DEW)
EMBRAPA Cerrados, BR 020 Km 18, Planaltina, Distrito Federal, 73310-970, Brazil; ludmilla@cpac.embrapa.br (LMSA)

Abstract: *Anoura caudifer* (É. Geoffroy Saint-Hilaire, 1818) is a phyllostomid commonly called the tailed tailless bat. This is a relatively small species with an elongated muzzle, a long and protractile tongue, and generally dark brown pelage; it is 1 of 8 species in the genus *Anoura*. It occurs in Colombia, Venezuela, Guyana, French Guiana, Suriname, Brazil, Ecuador, Peru, Bolivia, and northwestern Argentina. This species is a habitat generalist occurring in mesic tropical forests from sea level to 1,500 m elevation. It is frequently captured in many locations along its geographical distribution and it is not considered of special conservation concern. DOI: 10.1644/844.1.

Key words: Chiroptera, Glossophaginae, nectar-feeding bat, Neotropics, phyllostomid, tailed tailless bat

Published 25 November 2009 by the American Society of Mammalogists
Synonymy completed 15 August 2009

www.mammalogy.org

Anoura caudifer (É. Geoffroy Saint-Hilaire, 1818)
Tailed Tailless Bat

Glossophaga caudifer É. Geoffroy Saint-Hilaire, 1818:418, pl. 17. Type locality "Rio de Janeiro," Rio de Janeiro, Brazil.

Glossophaga ecaudata É. Geoffroy Saint-Hilaire, 1818:418, pl. 18. Type locality unknown.

Glossoph[*aga*]. *caudifera* J. B. Fischer, 1829:139. Incorrect subsequent spelling of *Glossophaga caudifer* É. Geoffroy Saint-Hilaire.

Lonchoglossa caudifera W. Peters, 1868:364. Name combination and incorrect subsequent spelling of *Glossophaga caudifer* É. Geoffroy Saint-Hilaire.

[*Lonchoglossa*] *ecaudata*: Trouessart, 1897:158. Name combination.

Anoura caudifera Cabrera, 1958:74. First use of current name combination and incorrect subsequent spelling of *Glossophaga caudifer* É. Geoffroy Saint-Hilaire.

Lonchoglossa caudifer: Husson, 1962:136. Name combination.

Anoura (*Lonchoglossa*) *caudifer*: Tamsitt and Valdivieso, 1966:230. Name combination.

A[*noura*]. *caudira* Alberico and Orejuela, 1982:34. Incorrect subsequent spelling of *Glossophaga caudifer* É. Geoffroy Saint-Hilaire.

Anoura caudifera Handley, 1984:513. Incorrect subsequent spelling of *Glossophaga caudifer* É. Geoffroy Saint-Hilaire (see "Nomenclatural Notes").

CONTEXT AND CONTENT. Order Chiroptera, suborder Microchiroptera, family Phyllostomidae, subfamily Glossophaginae, tribe Glossophagini (Baker et al. 1989; Simmons 2005). The genus *Anoura* contains 8 species (Mantilla-Meluk and Baker 2006): *A. aequatoris* Lönnberg, 1921; *A. cadenai* Mantilla-Meluk and Baker, 2006; *A. caudifer* (É. Geoffroy Saint-Hilaire, 1818); *A. cultrata* Handley, 1960; *A. fistulata* Muchhala et al., 2005; *A. geoffroyi* Gray, 1838; *A. latidens*

Fig. 1.—An adult *Anoura caudifer* from Parque Estadual Intervales, São Paulo, Brazil. Used with permission of the photographer M. A. R. Mello.

Handley, 1984; and *A. luismanueli* Molinari, 1994. *A. caudifer* is monotypic (Barquez et al. 1999; Simmons 2005).

NOMENCLATURAL NOTES. Some authors, such as Handley (1984), spelled the species name "*caudifera*," arguing that the genus is a feminine substantive, and that the specific epithet should agree with it, resulting in the name *Anoura* "*caudifera*." But, according to Simmons (2005) and to Article 31.2.2 of *The International Code of Zoological Nomenclature* (International Commission on Zoological Nomenclature 1999), the correct spelling is *caudifer*. Following the *Code*, if the author does not indicate if the name is an adjective or a substantive, it should be treated as a noun in apposition, and the original spelling maintained.

DIAGNOSIS

This species usually has a tiny tail, distinguishing it from *Anoura geoffroyi* (Geoffroy's tailless bat), *A. cadenai* (Cadena's tailless bat), and *A. latidens* (broad-toothed tailless bat), which lack a tail (Eisenberg and Redford 1999). It has a small but well-developed calcar, whereas the calcar of *A. geoffroyi* is rudimentary (Nowak 1999). In *A. caudifer* the interfemoral membrane is semicircular in shape, wide, and sparsely haired, whereas in *A. geoffroyi* the interfemoral membrane is triangular in shape and reduced to a narrow, densely furred band (Tamsitt and Nagorsen 1982). *A. caudifer* is slightly smaller than *A. geoffroyi* (Eisenberg and Redford 1999), but it has a longer rostrum (Albuja-V. 1983). The cranium of these 2 species is also similar, but in *A. caudifer* it is shorter and has a slightly larger zygomatic arch (Albuja-V. 1983).

Anoura fistulata (long-lipped bat) is about 10% larger than *A. caudifer* (Muchhala et al. 2005) in almost all measurements. Measurements on specimens in the field showed that the tongue in *A. fistulata* is more than twice as long as that of *A. caudifer* (6–8 cm versus 3 cm). Another useful character to distinguish *A. caudifer* from *A. fistulata* is the shorter palatal spine and longer tail in *A. caudifer* (Muchhala et al. 2005). The interfemoral membrane of *A. luismanueli* (Luis Manuel's tailless bat) is moderately haired dorsally and densely furred medially on the ventral surface, in contrast with the virtually naked interfemoral membrane of *A. caudifer* (Molinari 1994).

Anoura cultrata (Handley's tailless bat) differs from *A. caudifer* in having an enlarged and bladelike 1st lower premolar and a larger upper canine that has a distinctive longitudinal sulcus on the anterior face (Handley 1984). It is perhaps not surprising that *A. caudifer* most closely resembles *A. aequatoris* (equatorial tailless bat), because the 2 were long thought to be conspecific. Mantilla-Meluk and Baker (2006) used discriminant analyses to separate the 2. The slightly smaller *A. aequatoris* has an interfemoral membrane that is quite well furred in comparison to the almost naked membrane of *A. caudifer* (Mantilla-Meluk and Baker 2006:9, figure 4b).

GENERAL CHARACTERS

Anoura caudifer is a relatively small species, with total length between 47 and 70 mm, tail varying from 3 to 6 mm, forearm between 34 and 39 mm, and mass ranging from 8.5 to 13.0 g (Koopman 1994; Molinari 1994; Muchhala et al. 2005; Simmons and Wetterer 2002; Solmsen 1998; Taddei 1975). The muzzle is elongated, and the upper border at the height of the eyes is notably convex (Fig. 1). The tongue is long and protractile. The nose leaf is small but well defined, taller than wide, and attached to the upper lip. The upper lip is smooth, lacking wrinkles or papillae. A deep furrow divides the lower lip medially, with 2 thick callosities on each side. The ears are short, separated, and rounded; the antitragus is absent and the tragus is normal, short, and without crenulations (Barquez et al. 1999).

The skull is elongated, but length of the rostrum is smaller than length of the braincase, and the rostrum widens in the area of the canines (Fig. 2). Postorbital constriction is insignificant. Zygomatic arches are thin and the middle portion is frequently cartilaginous in young individuals; in mature specimens the arches are ossified and complete. A sagittal crest is absent; a slight lambdoidal crest is present. Tympanic bullae are small. Basiophenoidal pits are present but shallow (Barquez et al. 1999).

Pelage is dense and silky, extending along both the dorsal and ventral sides, over part of the plagiopatagium, propatagium, and one-half of the forearm. Color is generally dark brown; the dorsal hairs are gray at the base and the ventral hairs are uncolored. Areas behind the ears, back of the neck, and anterior one-half of the back are paler or reddish in some specimens. Membranes are dark brown to black (Barquez et al. 1999). Descriptions of pelage color in species of the *A. caudifer* group are usually superficial, but apparently, color is highly variable in this species. Tamsitt and Valdivieso (1966) observed that the occurrence of light and dark individuals of *A. caudifer* varied in local populations and did not reflect geographic trends.

The uropatagium is semicircular and bordered by a fringe of sparse hairs. The tail is usually present but can be absent in some specimens (Simmons and Voss 1998; Williams and Genoways 1980). The tail is small, included in the uropatagium, and generally extends to its border. The calcar is small, slightly shorter than the length of the foot (Albuja-V. 1999). The thumb is short and thin, and its nail is short.

Means and ranges (mm; rounded to tenths) of external characters for 9 males and 12 females (in parentheses) collected from different localities in Ecuador (Albuja-V. 1999) were: total length, 52.8, 50.0–58.0 (58.4, 50.0–68.0); length of ear, 13.4, 12.0–17.0 (12.1, 8.0–17.0); length of forearm, 37.7, 35.0–36.4 (36.3, 32.9–38.1); length of hind

Fig. 2.—Dorsal, ventral, and lateral views of the skull and lateral view of mandible of an adult male *Anoura caudifer* (USNM [United States National Museum] 49931) from Zaragoza 25 km S, 22 km W, at La Tirana, Colombia. Photo by Lauren E. Helgen.

foot, 9.25, 7.0–12.0 (9.2, 8.0–11.0); length of tail, 4.9, 3.5–7.0 (5.5, 4.0–10.0). Means and ranges (mm) for the same males and females (in parentheses) cited above for length of skull were: 21.8, 20.8–23.8 (21.6, 20.8–22.1).

Although geographic variation is slight in this species, there is some indication that animals from Argentina average slightly larger than those from Ecuador. Means and ranges (mm) of external characters for 8 specimens (no determination on sex) in Argentina were: total length, 59.0, 56.0–62.4; length of tail, 4.7, 4.5–5.0 length of ear, 12.9, 11.0–15.5; length of forearm, 38.1, 36.0–39.0; length of hind foot, 9.2, 8.0–10.0. Means and ranges (mm; rounded to tenths) for cranial and dental measurements for the same specimens cited above were: length of skull, 22.9, 22.7–23.9;

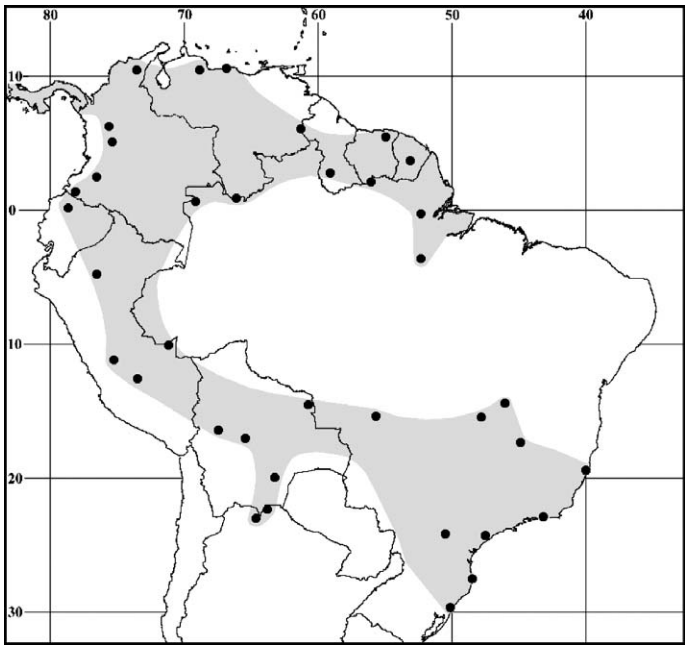

Fig. 3.—Geographic distribution of *Anoura caudifer*, with dots indicating marginal localities. Map used with permission of A. L. Gardner (2007).

condylobasal length, 22.1, 21.7–23.0; length of maxillary toothrow, 8.3, 8.2–8.5; width across canines, 4.1, 3.8–4.3; width across molars, 5.8, 5.7–6.2; width of postorbital constriction, 4.6, 4.4–4.9; zygomatic width, 9.9, 9.6–10.2; width of braincase, 9.0, 8.8–9.4; length of palate, 11.8, 11.5–12.4; width of mastoid 9.2, 9.1–9.3; length of mandibular toothrow, 8.9, 8.8–9.1; length of mandible, 16.7, 16.2–17.3 (Barquez et al. 1999).

In contrast to those from Argentina, *A. caudifer* from Brazil averaged slightly smaller than those from Ecuador. Means and ranges (mm; rounded to tenths) of the forearm for 4 males and 3 females (in parentheses) collected at State Park of Pedra Branca, Rio de Janeiro, Brazil (Dias et al. 2002) were: 36.2, 35.5–37.5 (35.8, 35.3–36.4). Means and ranges (mm) for cranial and dental measurements for the same males and females (in parentheses) cited above were: length of skull, 22.7, 22.6–23.1 (22.8, 22.5–23.1); length of maxillary toothrow, 8.3, 8.3–8.6 (8.4, 8.1–8.7); width across canines, 4.0, 3.6–4.2 (3.9, 3.7–4.1); width across molars, 4.9, 4.1–5.2 (5.1, 5.0–5.3); postorbital width, 4.5, 4.0–4.8 (4.6, 4.6–4.7); zygomatic width, 9.3, 8.8–9.8 (9.3, 9.2–9.4); width of braincase, 8.6, 8.1–8.9 (8.5, 8.4–8.6); length of palate, 12.2, 12.0–12.4 (12.3, 11.9–12.8).

DISTRIBUTION

Anoura caudifer occurs in Colombia, Venezuela, Guyana, French Guiana, Suriname, Brazil, Ecuador, Peru, Bolivia, and northwestern Argentina (Fig. 3; Simmons

2005). In Brazil it is recorded in the states of Acre, Amapá, Amazonas, Bahia, Distrito Federal, Espírito Santo, Mato Grosso, Mato Grosso do Sul, Minas Gerais, Pará, Paraná, Rio de Janeiro, Rio Grande do Sul, Santa Catarina, and São Paulo (Nogueira et al. 2007). In Ecuador, it inhabits low and medium elevations on both sides of the Andes (Albuja-V. 1999). There are records in Argentina from Salta and Jujuy provinces (Barquez et al. 1999). On the eastern and western slopes of the Andes *A. caudifer* is less abundant than *A. geoffroyi* at higher elevations (Muchhala et al. 2005). This species is a habitat generalist occurring in mesic tropical forests from sea level to 1,500 m elevation (Eisenberg 1989).

FOSSIL RECORD

There is a specimen of *Anoura caudifer* from the Quaternary Period in Minas Gerais, Brazil (Czaplewski and Cartelle 1998). This specimen was documented by Winge (1893) from caves near Lagoa Santa, and the nomenclature was updated by de Paula-Couto (1946).

FORM AND FUNCTION

Form.—Members of the genus *Anoura* have the 3rd largest brains in the subfamily Glossophaginae (Baron et al. 1996), with many of the fundamental, telencephalon, and brainstem parts large. Within the genus, although *A. caudifer* and *A. geoffroyi* have similar brains, the brain of *A. caudifer* is smaller (Baron et al. 1996). The vomeronasal organ of *A. caudifer* is asymmetrical (right vomeronasal organ, 3.72 mm; left vomeronasal organ, 3.97 mm) in anteroposterior length (Bhatnagar and Smith 2007). The lumen is crescentric or nearly round. The ratio between the vomeronasal neuroepithelium and the receptor-free epithelium is estimated to be 3:1. The vomeronasal organ retains a cartilaginous capsule anteriorly, which becomes partially ossified posteriorly, before ending as a small remnant next to the palate. The nasal septum is thick and contains glands that also are observed in the lateral nasal wall. A huge blood sinus is present lateral to the receptor-free epithelium. The vomeronasal neuroepithelium is approximately 38 mm in height, whereas the nonciliated receptor-free epithelium is approximately 12 mm. Large vomeronasal nerve fascicles are seen under the vomeronasal neuroepithelium (Bhatnagar and Smith 2007).

The dental formula is i 2/0, c 1/1, p 3/3, m 3/3, total 32 (Phillips 1971). The I1 and I2 are small, paired, and separated by a wide space; I1 is smaller than I2. Premolars are laterally compressed and increase in size from the 2nd to the 4th; P2 is reduced and separated from the canine and P3 by a small space; P3 is separated from P2 and P4; and P4 is in contact at its posterior border with M1 (Barquez et al. 1999). All premolars are triangular in lateral view except for P2; the central cusp is elevated and sharp, and the anterior and posterior cusps are smaller. The molars have a strong depression similar to that in the genus *Glossophaga*, although more laterally compressed. The absence of lower incisors, a diagnostic dental trait, provides a space through which the tongue extends during feeding (Barquez et al. 1999). Lower premolars are thin; p2 is almost in contact with the canine, but separated from p3 by a small space. No gaps separate the remaining premolars and molars. The paraconid is much smaller than the rest of the cusps. The coronoid process of the mandible is not well developed, and is about the same height as the mandibular condyle (Barquez et al. 1999). The canines are not exceptionally enlarged, the premolars are not reduced, and the 1st lower premolar (p2) is no larger than other premolars (Nagorsen and Tamsitt 1981).

Function.—*Anoura caudifer* has the highest value for basal metabolism, 178%, reported for glossophagine bats (McNab 1969). This species, both in laboratory experiments and in cave roosts, remains homeothermic at cool ambient temperatures (McNab 1969). Thus, while remaining homeothermic, *A. caudifer* may require a higher basal metabolism, given the differential between ambient and body temperatures (Arends et al. 1995). For *A. caudifer* to remain in energy balance, it requires about 4 h of foraging time, 800 floral visits, and in-flight commuting of about 50 km every night (Helversen and Reyer 1984). Using doubly labeled water injections, Helversen and Reyer (1984) also calculated a daily energy expenditure of 310% the basal rate or 12.4 kcal/day. The basal metabolic rate was calculated for 7 specimens of *A. caudifer* (average body mass = 11.3 g), at 28.1 ml O_2/h (Cruz-Neto et al. 2001).

ONTOGENY AND REPRODUCTION

Reproductive individuals tend to be captured in the months of August–November, but an asynchronous reproductive cycle was predicted for *Anoura caudifer* (Wilson 1979). In Argentina, a juvenile captured in Itaú, Salta Province, in October had deciduous teeth and was just beginning to fly. A 2nd individual from nearby Piquirenda Viejo was slightly more developed in mid-November, but the last molars had not erupted completely. At about the same time, in Río Pescado, a pregnant female was found with a well-developed fetus. This species may have a long reproductive period in Argentina, with births occurring from September through November (Barquez et al. 1999). In Ecuador, during September 1968, 2 reproductive males were recorded in Río Saloya, and on August 1997 at Río Lliquino, a female was found with a 15-mm-long embryo (Albuja-V. 1999).

Anoura caudifer appears to be reproductive at different times in different parts of its range. Seasonal polyestry was suggested for *A. caudifer* (Taddei 1976; Trajano 1985). In a study carried out in the Cerrado biome in Brazil, Zortéa

(2003) found that the only 3 pregnant females of *A. caudifer* he collected were captured in the rainy season. However, these data are not sufficient to define precisely the reproductive cycle of *A. caudifer* in this region. Zortéa (2003) recorded a female lactating in October, and 1 postlactating at the end of May, suggesting that this species may have more than 1 annual birth peak. Three nonreproductive females were recorded at the end of the dry season. Of the 3 males collected, only 1 was reproductive.

ECOLOGY

Population characteristics.—The habitat specificity and elevational range required by *Anoura caudifer*, a species primarily associated with higher elevations, results in a smaller distribution than implied in range maps. Such habitat specificity often results in geographically isolated populations having reduced gene flow with contiguous population units, thus promoting differentiation. This is the case with *A. geoffroyi*, which has a similar distribution (Griffiths and Gardner, 2007). However, when morphological variation was investigated among samples from different localities across the entire distribution, geographic structure was difficult to determine (Mantilla-Meluk and Baker 2006). This would seem to confirm the slight amount of variation in measurements in the studies listed above under ''General Characters.''

Space use.—*Anoura caudifer* is found in primary forest and lightly disturbed forests; in humid areas, especially above streams (Albuja-V. 1999). In French Guiana, colonies were found ranging in size from a few up to 100 individuals, some being nursing colonies and others being harems. In all these colonies, *A. caudifer* was found to be in association with Seba's short-tailed bat (*Carollia perspicillata*) and the common big-eared bat (*Micronycteris microtis*—Brosset and Charles-Dominique 1990).

Caves, tunnels, and tree holes are known shelters for *A. caudifer*. In caves, they live in association with other species such as *A. geoffroyi*, *A. cultrata*, *C. perspicillata* (as well as other species of *Carollia*), and the common mustached bat (*Pteronotus parnellii*—Lemke and Tamsitt 1979). A specimen from Argentina was captured almost at ground level, in a net located at the side of a river in an open area, along with several specimens of the little yellow-shouldered bat (*Sturnira lilium*—Barquez et al. 1999). *A. caudifer* had the lowest capture rates, and females tended to outnumber males (10 females and 3 males) in an ecological study in a Cerrado region in Brazil (Zortéa 2003).

In Brazil, *A. caudifer* seems to occur in all biomes (Marinho-Filho and Sazima 1998), but there is no published record for the Caatinga (Oliveira et al. 2003). This species is commonly reported in surveys, and occurs in areas of primary and secondary forests (Brosset et al. 1996; Reis and Peracchi 1987), banana plantations associated with forest areas (Esbérard et al. 1996; Peracchi and Albuquerque 1971), pasture lands (Coimbra et al. 1982), and urban and rural areas (Bredt and Uieda 1996). It roosts in caves (Esbérard et al. 2005), rock crevices (Peracchi and Albuquerque 1971), holes in fallen trees (Reis and Peracchi 1987), and a variety of man-made structures (Esbérard et al. 1996; Marques 1985). This is 1 of the most common species captured in surveys done in karst areas (Esbérard et al. 2005; Trajano 1985).

Diet.—*Anoura caudifer* feeds on nectar from a large variety of plants, including the families Fabaceae (Sazima 1976), Passifloraceae and Campanulaceae (Sazima and Sazima 1987), Bombacaceae (Fischer et al. 1992), Bromeliaceae (Sazima et al. 1995), Marcgraviaceae (Sazima and Sazima 1980), Myrtaceae (Teixeira and Peracchi, 1996), Lythraceae, Malvaceae, and Rubiaceae (Sazima et al. 1999). In Ecuador, *A. caudifer* prefers small flowers, whereas *A. geoffroyi* prefers larger flowers (Muchhala and Jarrín-V. 2002). The diet of *A. caudifer* also includes pollen, fruits, and insects (Teixeira and Peracchi 1996; Zortéa 2003). Sazima (1976) captured this species visiting flowers of the orchid tree (*Bauhinia rufa*) and observed that stomachs contained pollen and fragments of insects of the orders Thysanoptera, Hymenoptera, Coleoptera, and Lepidoptera.

Diseases and parasites.—Ectoparasites of *Anoura caudifer* include species of Labidocarpidae (Venezuela), Streblidae (Brazil and Colombia), Trombiculidae (Venezuela), and Spinturnicidae (Venezuela—Webb and Loomis 1977). The streblid *Trichobius tiptoni* was recorded for *A. caudifer* by Komeno and Linhares (1999), and *Strebla carvalhoi* by Graciolli (2003) in Brazil. *Trypanosoma vespertilionis* and *Trypanosoma* (*megadermae*-type) were listed as protozoan parasites for *A. caudifer* (Ubelaker et al. 1977). *Litomosoides brasiliensis* (Nematoda: Filariidae) was listed by Mourão et al. (2002), from Amapá, Brazil.

Interspecific interactions.—In Brazil and Ecuador *Anoura caudifer* may be sympatric with 2 other nectarivorous bats, Pallas's long-tongued bat (*Glossophaga soricina*) and *A. geoffroyi*, with which it may compete (Baumgarten and Vieira 1994; Zortéa 2003). *A. caudifer* has been found roosting with other bat species including *A. cultrata* and *A. geoffroyi* (Tamsitt and Nagorsen 1982). In the Andes, *A. caudifer*, *A. geoffroyi*, and *A. cultrata* are sympatric, and have been found in the same roost in Colombia (Nagorsen and Tamsitt 1981). Ecological overlap among the 3 species probably occurs in areas of sympatry and the size differences between *A. caudifer* and *A. geoffroyi* may be related to undetermined differences in resource utilization (Nagorsen and Tamsitt 1981). *A. caudifer* also may be found coinhabiting caves with the common vampire bat (*Desmodus rotundus*), hairy-legged vampire bat (*Diphylla ecaudata*), fringe-lipped bat (*Trachops cirrhosus*), little big-eared bat (*Micronycteris megalotis*), southern golden bat (*Mimon bennettii*), common sword-nose bat (*Lonchorhina aurita*), *G. soricina*, black myotis (*Myotis nigricans*), black mastiff

bat (*Molossus rufus*), lesser dog-like bat (*Peropteryx macrotis*), greater dog-like bat (*Peropteryx kappleri*), and greater spear-nosed bat (*Phyllostomus hastatus*—Ruschi 1953).

HUSBANDRY

Laboratories maintained between 21°C and 28°C and with a relative humidity between 55% and 92% proved satisfactory for housing *Anoura caudifer* (Rasweiler and de Bonilla 1972; Rasweiler and Ishiyama 1973). Greenhall (1976) pointed out the lack of information on the importance of ventilation and circulation of air in laboratories housing bats. Bats in poorly ventilated laboratories appear restless. Illumination is automatically controlled in many laboratories and 13 h of light and 11 h of darkness were found to be satisfactory for *A. caudifer* (Rasweiler and de Bonilla 1972). In captivity, this species accepts bananas, mangoes, and sugar water with vitamins and proteins (Ruschi 1953). Diets were successfully formulated for the long-term maintenance of large numbers of *A. caudifer* (Rasweiler 1973; Rasweiler and de Bonilla 1972).

Although a number of bats have bred and raised young in captivity, there is little published information for phyllostomids (Greenhall 1976). Many captive colonies are initiated with wild-caught individuals and, unfortunately, females in advanced pregnancy either abort or die shortly after being placed in captivity. Rasweiler and de Bonilla (1972) found that *A. caudifer* could be kept in captivity for prolonged periods with low mortality rates.

BEHAVIOR

Anoura caudifer can be found in colonies from 5 to 15 individuals, in caves or in the foliage of certain trees such as *Mangifera indica* and plants in the genera *Livistona* and *Attalea* (Ruschi 1953). The activity pattern of *A. caudifer* was analyzed in a fragment of Atlantic Forest in Brazil. The bats became active 1 h after sunset and were no longer captured 6 h later, with a peak of capture in the 4th hour after sunset (Aguiar and Marinho-Filho 2004). There was no statistically significant difference in the frequency of captures between the dry and rainy seasons (Aguiar and Marinho-Filho 2004). Trajano (1996) captured and marked some specimens of *A. caudifer* in a karst region in southeastern Brazil, with a view toward observing the movements of this species. The results showed that *A. caudifer* was not recaptured, a fact that suggested a great degree of nomadism according to Trajano (1996), but perhaps indicates the normal wariness bats show once captured.

GENETICS

Anoura caudifer has a diploid number (2n) of 30 and a fundamental number (FN) of 56 (Baker 1973; Baker and Hsu 1970; Hsu et al. 1968). Because karyotypes of *A. caudifer* and *A. geoffroyi* (Baker 1979) are identical with those of *A. cultrata*, Nagorsen and Tamsitt (1981) concluded that the karyotype is conservative in species of *Anoura*. The G-banded karyotype of *A. caudifer* was examined by Haiduk and Baker (1982) and found to be identical to that of *A. geoffroyi*. Examination of their data suggested that the relationship between the genus *Anoura* and the remaining glossophagines was not resolvable because this genus is characterized by an autapomorphic karyotype. The autapomorphic condition is the result of a high rate of chromosomal evolution and the karyotype of *Anoura* requires a minimum of 30 rearrangements to so radically reorganize its banding pattern (Haiduk and Baker 1982).

CONSERVATION

In the Neotropics, the control of common vampire bats is a serious threat to bats in general if conducted by inexperienced persons. Populations of insectivorous, frugivorous, and nectar-feeding bats have been lost, presumably as a consequence of misdirected campaigns aimed at vampire bats (Arita and Prado 1999; Villa-R. 1967). *Anoura caudifer*, like other bats, is vulnerable to roost disturbance and habitat destruction. It is frequently captured in many locations along its broad geographical distribution but insufficient data about population sizes are available. Therefore, it remains data deficient for most of its distribution and is not considered threatened by the International Union for Conservation of Nature and Natural Resources (International Union for Conservation of Nature and Natural Resources 2007).

LITERATURE CITED

Aguiar, L. M. S., and J. Marinho-Filho. 2004. Activity patterns of nine phyllostomid bat species in a fragment of the Atlantic Forest in southeastern Brazil. Revista Brasileira de Zoologia 21:385–390.

Alberico, M. S., and J. E. Orejuela. 1982. Diversidad específica de dos comunidades de murciélagos en Nariño, Colombia. Cespedesia, Supplement 3(41–42):31–40.

Albuja-V., L. 1999. Murcielagos del Ecuador. 2nd ed. Cicetronic Compania, Limitada, Quito, Ecuador.

Arends, A., F. J. Bonaccorso, and M. Genoud. 1995. Basal rates of metabolism of nectarivorous bats (Phyllostomidae) from a semiarid thorn forest in Venezuela. Journal of Mammalogy 76:947–956.

Arita, H. T., and K. S. Prado. 1999. Conservation biology of nectar-feeding bats in Mexico. Journal of Mammalogy 80:31–41.

Baker, R. J. 1973. Comparative cytogenetics of the New World leaf-nosed bats (Phyllostomatidae). Periodicum Biologicum 75:37–45.

Baker, R. J. 1979. Karyology. Pp. 107–155 in Biology of bats of the New World family Phyllostomatidae. Part III (R. J. Baker, J. K. Jones, Jr., and D. C. Carter, eds.). Special Publications, The Museum, Texas Tech University 16:1–441.

Baker, R. J., C. S. Hood, and R. L. Honeycutt. 1989. Phylogenetic relationships and classification of the higher categories of the New World bat family Phyllostomidae. Systematic Zoology 38: 228–238.

Baker, R. J., and T. C. Hsu. 1970. Further studies on the sex-chromosome systems of the American leaf-nosed bats (Chiroptera, Phyllostomatidae). Cytogenetics 9:131–138.

BARON, G., H. STEPHAN, AND H. D. FRAHM. 1996. Comparative neurobiology in Chiroptera. Birkhauser, Basel, Switzerland.

BARQUEZ, R. M., M. A. MARES, AND J. K. BRAUN. 1999. The bats of Argentina. Special Publications, The Museum, Texas Tech University 42:1–275.

BAUMGARTEN, J. E., AND E. M. VIEIRA. 1994. Reproductive seasonality and development of *Anoura geoffroyi* (Chiroptera: Phyllostomidae) in central Brazil. Mammalia 58:415–422.

BHATNAGAR, K. P., AND T. D. SMITH. 2007. Light microscopic and ultrastructural observations on the vomeronasal organ of *Anoura* (Chiroptera: Phyllostomidae). The Anatomical Record: Advances in Integrative Anatomy and Evolutionary Biology 290:1341–1354.

BREDT, A., AND W. UIEDA. 1996. Bats from urban and rural environments of the Distrito Federal, midwestern Brazil. Chiroptera Neotropical 2:54–57.

BROSSET, A., AND P. CHARLES-DOMINIQUE. 1990. The bats from French Guiana: a taxonomic, faunistic and ecological approach. Mammalia 54:509–560.

BROSSET, A., P. CHARLES-DOMINIQUE, A. COCKLE, J. F. COSSON, AND D. MASSON. 1996. Bat communities and deforestation in French Guiana. Canadian Journal of Zoology 74:1974–1982.

CABRERA, A. 1958. Catálogo de los mamíferos de América del Sur. Revista del Museo de Argentino de Ciencias Naturales ''Bernardino Rivadavia,'' Ciencias Zoológicas 4(1):xvi + iv + 1–308 [Dated 1957; published 27 March 1958, see notice on p. 308.]

COIMBRA, C. A. E., JR., M. M. BORGES, D. Q. GUERRA, AND D. Q. MELO. 1982. Contribuição a zoogeografia e ecologia de morcegos em região de Cerrado do Brasil Central. Boletim Técnico da Revista Brasil Florestal 7:34–38.

CRUZ-NETO, A. P., T. GARLAND, JR., AND A. S. ABE. 2001. Diet, phylogeny, and basal metabolic rate in phyllostomid bats. Zoology 104:49–58.

CZAPLEWSKI, N. J., AND C. CARTELLE. 1998. Pleistocene bats from cave deposits in Bahia, Brazil. Journal of Mammalogy 79:784–803.

DE PAULA-COUTO, C. 1946. Atualização da nomenclatura genérica e específica usada por Herluf Winge, em ''E Museo Lundii.'' Estudos Brasileiros de Geologia 1:59–80.

DIAS, D., A. L. PERACCHI, AND S. S. SILVA. 2002. Quirópteros do Parque Estadual da Pedra Branca, Rio de Janeiro, Brasil (Mammalia, Chiroptera). Revista Brasileira de Zoologia 19:113–140.

EISENBERG, J. F. 1989. Mammals of the Neotropics. Vol. 1. The northern Neotropics: Panama, Colombia, Venezuela, Guyana, Suriname, French Guiana. University of Chicago Press, Chicago, Illinois.

EISENBERG, J. F., AND K. F. REDFORD. 1999. Mammals of the Neotropics. Vol. 3. The central Neotropics: Ecuador, Peru, Bolivia, Brazil. University of Chicago Press, Chicago, Illinois.

ESBÉRARD, C. E. L., A. S. CHAGAS, M. B. SILVA, AND E. M. L. COSTA. 1996. Levantamento de Chiroptera na Reserva Biologica de Araras, Petrópolis/RJ. I—Riqueza de espécies. Revista Científica do Instituto de Pesquisas Gonzaga da Gama Filho 2:67–83.

ESBÉRARD, C. E. L., J. A. MOTTA, AND C. PERIGO. 2005. Morcegos cavernícolas da Área de Proteção Ambiental (APA) Nascentes do Rio Vermelho, Goiás. Revista Brasileira de Zoociências 7: 311–325.

FISCHER, E. A., F. A. JIMENEZ, AND M. SAZIMA. 1992. Polinização por morcegos em duas espécies de *Bombacaceae* na Estação Ecológica de Juréia, São Paulo. Revista Brasileira de Botânica 15:67–72.

FISCHER, J. B. 1829. Synopsis mammalium. J. G. Cottae, Stuttgart, Germany.

GARDNER, A. L. 2007. Mammals of South America. Vol. 1. Marsupials, xenarthrans, shrews, and bats. University of Chicago Press, Chicago, Illinois.

GEOFFROY SAINT-HILAIRE, É. 1818. Sur de nouvelles chauve-souris, sous le nom de Glossophages. Mémoirs de Muséum d'Histoire Naturelle (Paris) 4:411–418.

GRACIOLLI, G. 2003. A new species of *Strebla* Wiedemann, 1824 (Diptera, Streblidae, Streblinae) on *Anoura caudifer* (E. Geoffroy, 1818) (Chiroptera, Phyllostomidae, Glossophaginae). Revista Brasileira de Entomologia 47:435–436.

GRAY, J. E. 1838. A revision of the genera of bats (Vespertilionidae), and the description of some new genera and species. Magazine of Zoology and Botany 2:483–505.

GREENHALL, A. M. 1976. Care in captivity. Pp. 89–131 in Biology of bats of the New World family Phyllostomatidae. Part I (R. J. Baker, J. K. Jones, Jr., and D. C. Carter, eds.). Special Publications, The Museum, Texas Tech University 10:1–218.

GRIFFITHS, T. A., AND A. L. GARDNER. 2007. Subfamily Glossophaginae Bonaparte, 1845. Pp. 224–244 in Mammals of South America (A. L. Gardner, ed.). Vol. 1. University of Chicago Press, Chicago, Illinois.

HAIDUK, M. W., AND R. J. BAKER. 1982. Cladistic analysis of G-banded chromosomes of nectar-feeding bats (Glossophaginae: Phyllostomidae). Systematic Zoology 31:252–265.

HANDLEY, C. O., JR. 1960. Descriptions of new bats from Panama. Proceedings of the United States National Museum 112:459–479.

HANDLEY, C. O., JR. 1984. New species of mammals from northern South America: a long-tongued bat, genus *Anoura* Gray. Proceedings of the Biological Society of Washington 97:513–521.

HELVERSEN, V., AND H. U. REYER. 1984. Nectar intake and energy expenditure in a flower visiting bat. Oecologia 63:178–184.

HSU, T. C., R. J. BAKER, AND T. UTAKOJI. 1968. The multiple sex chromosome system of American leaf-nosed bats (Chiroptera, Phyllostomidae). Cytogenetics 7:27–38.

HUSSON, A. M. 1962. The bats of Suriname. Zoologische Verhandelingen/Uitgegeven Door het Rijksmuseum van Natuurlijke Historie te Leiden 58:1–282.

INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE. 1999. International code of zoological nomenclature. 4th ed. International Trust for Zoological Nomenclature, London, United Kingdom.

INTERNATIONAL UNION FOR CONSERVATION OF NATURE AND NATURAL RESOURCES. 2007. The IUCN Red list of threatened species. www.iucnredlist.org, accessed 29 January 2008.

KOMENO, C. A., AND A. X. LINHARES. 1999. Batflies parasitic on some phyllostomid bats in southern Brazil: parasitism rates and host–parasite relationships. Memórias do Instituto Oswaldo Cruz, Rio de Janeiro 94:151–156.

KOOPMAN, K. F. 1994. Chiropteran systematics. Pp. 81–82 in Handbuch der Zoologie (J. Niethammer, H. Schliemann, and D. Starck, eds.). Walter de Gruyter, Berlin, Germany.

LEMKE, T. O., AND J. R. TAMSITT. 1979. *Anoura cultrata* (Chiroptera: Phyllostomatidae) from Colombia. Mammalia 43:579–581.

LÖNNBERG, E. 1921. A second contribution to the mammalogy of Ecuador with some remarks on *Caenolestes*. Arkiv för Zoologi 14: 1–104.

MANTILLA-MELUK, H., AND R. J. BAKER. 2006. Systematics of small *Anoura* (Chiroptera: Phyllostomidae) from Colombia, with description of a new species. Occasional Papers, Museum of Texas Tech University 261:1–18.

MARINHO-FILHO, J. S., AND I. SAZIMA. 1998. Brazilian bats and conservation biology: a first survey. Pp. 282–294 in Bat biology and conservation (T. H. Kunz and P. A. Racey, eds.). Smithsonian Institution, Washington, D.C.

MARQUES, S. A. 1985. Novos registros de morcegos do Parque Nacional da Amazônia (Tapajós), com observação do período de atividade noturna e reprodução. Boletim do Museu Paraense Emilio Goeldi, Série Zoologia 2:71–83.

MCNAB, B. K. 1969. The economics of temperature regulation in neotropical bats. Comparative Biochemistry and Physiology 31: 227–268.

MOLINARI, J. 1994. A new species of *Anoura* (Mammalia Chiroptera Phyllostomidae) from the Andes of northern South America. Tropical Zoology 7:73–86.

MOURÃO, E. D., L. S. AVILLA, AND H. LENT. 2002. Redescrição de *Litomosoides brasiliensis* Almeida, 1936 (Nematoda: Filariidae) parasito de *Anoura caudifera* (Chiroptera: Phyllostomidae). Memórias do Instituto Oswaldo Cruz 97:495–499.

MUCHHALA, N., AND P. JARRÍN-V. 2002. Flower visitation by bats in cloud forests of western Ecuador. Biotropica 34:387–395.

MUCHHALA, N., P. MENA V., AND L. ALBUJA-V. 2005. A new species of *Anoura* (Chiroptera: Phyllostomidae) from the Ecuadorian Andes. Journal of Mammalogy 86:457–461.

NAGORSEN, D., AND J. R. TAMSITT. 1981. Systematics of *Anoura cultrata*, *A. brevirostrum*, and *A. werckleae*. Journal of Mammalogy 62:82–100.

NOGUEIRA, M. R., D. DIAS, AND A. L. PERACCHI. 2007. Subfamilia Glossophaginae. Pp. 46–48 in Morcegos do Brasil (N. R. Reis, A. L. Peracchi, W. A. Pedro, and I. P. Lima, eds.). Editora Universidade Estadual de Londrina, Londrina, Brasil.

NOWAK, R. M. 1999. Walker's mammals of the world. 6th ed. Johns Hopkins University Press, Baltimore, Maryland.

OLIVEIRA, J. A., P. R. GONÇALVES, AND C. R. BONVICINO. 2003. Mamíferos da caatinga. Pp. 275–334 in Ecologia e conservação da caatinga (I. R. Leal, J. M. C. Silva, and M. Tabarelli, eds.). EDUFPE, Recife, Brazil.

PERACCHI, A. L., AND S. T. ALBUQUERQUE. 1971. Lista provisória dos quiropteros dos estados do Rio de Janeiro e Guanabara, Brasil (Mammalia, Chiroptera). Revista Brasileira de Biologia 31: 405–413.

PETERS, W. 1868. Über die zu den Glossophagæ gehörigen Flederthiere un über eine neue Art der Gattung Colëura. Monatsberichte Königliche Preussische Akademie der Wissenschaften zu Berlin 1869:361–368.

PHILLIPS, C. J. 1971. The dentition of glossophagine bats: development, morphological characteristics, variation, pathology, and evolution. Miscellaneous Publications of the Museum of Natural History, University of Kansas 54:1–138.

RASWEILER, J. J., IV. 1973. Care and management of the longed-tonged bat, *Glossophaga soricina* (Chiroptera: Phillostomatidae), in the laboratory, with observations on estivation induced by food deprivation. Journal of Mammalogy 54:391–404.

RASWEILER, J. J., IV., AND H. DE BONILLA. 1972. Laboratory maintainence methods for some nectarivorous and frugivorous phyllostomatid bats. Laboratory Animal Science 22:658–663.

RASWEILER, J. J., IV., AND V. ISHIYAMA. 1973. Maintaining frugivorous phyllostomatid bats in the laboratory: *Phyllostomus*, *Artibeus* and *Sturnira*. Laboratory Animal Science 23:56–61.

REIS, N. R., AND A. L. PERACCHI. 1987. Quiropteros da região de Manaus, Amazonas, Brasil (Mammalia, Chiroptera). Boletim do Museu Paraense Emílio Goeldi, Serie Zoologia 3:161–182.

RUSCHI, A. 1953. Morcegos do Espírito Santo. Descrição das espécies *Lonchoglossa caudifera* e *Lonchoglossa ecaudata* com algumas observações biológicas a respeito. Boletim do Museu de Biologia Mello Leitão 18:1–7.

SAZIMA, I. 1976. Observations on the feeding habits of phyllostomid bats (*Carollia*, *Anoura*, and *Vampyrops*) in southeastern Brazil. Journal of Mammalogy 57:381–382.

SAZIMA, M., S. BUZATO, AND I. SAZIMA. 1995. Bat pollination of *Vriesea* in southeastern Brazil. Bromelia 2:29–37.

SAZIMA, M., S. BUZATO, AND I. SAZIMA. 1999. Bat-pollinated flower assemblages and bat visitors at 2 Atlantic Forest sites in Brasil. Annals of Botany 83:705–712.

SAZIMA, M., AND I. SAZIMA. 1980. Bats visits to *Marcgravia myriostigma* Tr. et Planch. (Marcgraviaceae) in southeastern Brazil. Flora 169: 84–88.

SAZIMA, M., AND I. SAZIMA. 1987. Additional observations on *Passiflora mucronata*, the bat-pollinated passion flower. Ciência e Cultura 39:310–312.

SIMMONS, N. B. 2005. Order Chiroptera. Pp. 312–529 in Mammal species of the world: a taxonomic and geographic reference (D. E. Wilson and D. M. Reeder, eds.). 3rd ed. Johns Hopkins University Press, Baltimore, Maryland.

SIMMONS, N. B., AND R. S. VOSS. 1998. The mammals of Paracou, French Guiana: a neotropical lowland rainforest fauna. Part 1. Bats. Bulletin of the American Museum of Natural History 237: 1–219.

SIMMONS, N. B., AND A. L. WETTERER. 2002. Phylogeny and convergence in cactophilic bats. Pp. 87–121 in Evolution, ecology, and conservation of columnar cacti and their mutualists (T. H. Flemming and A. Valiente-Banuet, eds.). University of Arizona Press, Tucson.

SOLMSEN, E.-H. 1998. New World nectar-feeding bats: biology, morphology and craniometric approach to systematics. Zoologisches Forschungsinstitut und Museum Alexander König, Bonn, Germany.

TADDEI, V. A. 1975. Phillostomidae (Chiroptera) do norte-ocidental do estado de São Paulo. II—Glossophaginae, Carolliinae, Sturnirinae. Ciência e Cultura 27:723–734.

TADDEI, V. A. 1976. The reproduction of some Phyllostomidae (Chiroptera) from the northwestern region of the state of São Paulo. Boletim de Zoologia da Universidade de São Paulo 1: 313–330.

TAMSITT, J. R., AND D. NAGORSEN. 1982. *Anoura cultrata*. Mammalian Species 179:1–5.

TAMSITT, J. R., AND D. VALDIVIESO. 1966. Taxonomic comments on *Anoura caudifer*, *Artibeus lituratus*, and *Molossus molossus*. Journal of Mammalogy 47:230–238.

TEIXEIRA, S. C., AND A. L. PERACCHI. 1996. Morcegos do Parque Estadual da Serra da Tiririca, Rio de Janeiro, Brasil (Mammalia, Chiroptera). Revista Brasileira de Zoologia 13:61–66.

TRAJANO, E. 1985. Ecologia de populações de morcegos cavernícolas em uma região cárstica do sudeste do Brasil. Revista Brasileira de Zoologia 2:255–320.

TRAJANO, E. 1996. Movements of cave bats in southeastern Brazil, with emphasis on the population ecology of the common vampire bat, *Desmodus rotundus* (Chiroptera). Biotropica 28:121–129.

TROUESSART, E.-L. 1897. Catalogus mammalium tam viventium quam fossilium. Fasciculus I. Primates, Prosimiae, Chiroptera, Insectivora. R. Friedländer & Sohn, Berlin, Germany.

UBELAKER, J. E., R. D. SPECIAN, AND D. W. DUSZYNSKI. 1977. Endoparasites. Pp. 7–56 in Biology of bats of the New World family Phyllostomatidae. Part II (R. J. Baker, J. K. Jones, Jr., and D. C. Carter, eds.). Special Publications, The Museum, Texas Tech University 13:1–364.

VILLA-R., B. 1967. Los murcielagos de Mexico. Universidad Nacional Autonoma de Mexico, Mexico City, Mexico.

WEBB, J. P., JR., AND R. B. LOOMIS. 1977. Ectoparasites. Pp. 57–119 in Biology of bats of the New World family Phyllostomatidae. Part II (R. J. Baker, J. K. Jones, Jr., and D. C. Carter, eds.). Special Publications, The Museum, Texas Tech University 13:1–364.

WILLIAMS, S. L., AND H. H. GENOWAYS. 1980. Results of the Alcoa Foundation—Suriname expeditions. II. Additional records of bats (Mammalia: Chiroptera) from Suriname. Annals of Carnegie Museum of Natural History 49:213–236.

WILSON, D. E. 1979. Reproductive patterns. Pp. 317–378 in Biology of bats of the New World family Phyllostomidae. Part III (R. J. Baker, J. K. Jones, Jr., and D. C. Carter, eds.). Special Publications, The Museum, Texas Tech University 16:1–441.

WINGE, H. 1893. Jordfundne og nulevende Flagermus (Chiroptera) fra Lagoa Santa, Minas Geraes, Brasilien: med udsigt over Flagermusenes indbyrdes Slaegstkab. E Museo Lundii 2:1–92.

ZORTÉA, M. 2003. Reproductive patterns and feeding habits of three nectarivorous bats (Phyllostomidae: Glossophaginae) from the Brazilian Cerrado. Brazilian Journal of Biology 63:159–168.

Associate editors of this account were PAMELA OWEN and ERIC RICKART. PAUL VELAZCO reviewed the synonymy. Editor was MEREDITH J. HAMILTON.