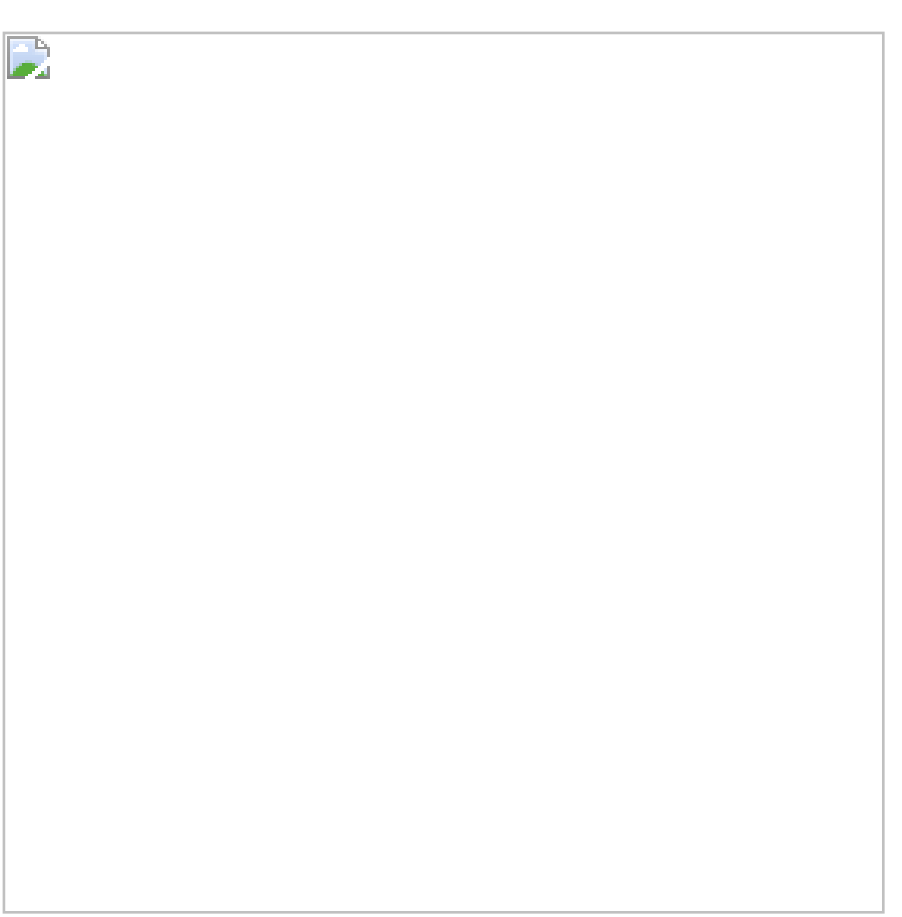

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A New Amazonian Species of *Micronycteris* (Chiroptera: Phyllostomidae) with Notes on the Roosting Behavior of Sympatric Congeners

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ABSTRACT

Micronycteris sensu stricto is a diverse group of small to medium-sized phyllostomid bats characterized by large rounded pinnae that are connected at the base by an interauricular band of skin. Eight species are currently recognized, including three with dark venters (*hirsuta*, *megalotis*, *microtis*) and five with pale venters (*brosseti*, *sanborni*, *schmidtorum*, *minuta*, *homezi*). As many as seven species can occur sympatrically at Amazonian localities. In this paper we describe a new dark-bellied species from the lowlands of northeastern Peru and document its diagnostic external and craniodental characters. We also summarize information about diurnal roosting habitats for the new species and its Amazonian congeners, and we emphasize the importance of nonconventional collecting methods for future studies of phyllostomine diversity in Neotropical rainforests.

INTRODUCTION

The genus *Micronycteris* Gray has traditionally included a heterogeneous array of small to medium-sized phyllostomines that shared little in common other than a short tail and a V-shaped pair of dermal pads on the chin (Sanborn, 1949; Koopman, 1993; Simmons, 1996). Simmons and Voss (1998) and Wetterer et al. (2000) concluded that this assemblage was not monophyletic, and argued

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that the subgenera of *Micronycteris* recognized by Simmons (1996) should be elevated to generic rank in order to achieve a phylogenetic classification. This change resulted in the recognition of four genera in addition to *Micronycteris* (sensu stricto): *Glyphonycteris* Thomas, *Lampronycteris* Sanborn, *Neonycteris* Sanborn, and *Trinycteris* Sanborn. So restricted, *Micronycteris* now includes eight species: *hirsuta* Peters, *megalotis* Gray, *microtis* Miller, *brosseti* Simmons and Voss, *sanborni* Simmons, *schmidtorum* Sanborn, *minuta* Gervais, and *homezi* Pirlot. Although no phylogenetic study to date has included all of these species, recent analyses of morphological data (Simmons, 1996; Wetterer et al., 2000) and DNA sequences (Baker et al., 2000) from various subsets of congeneric taxa suggest that *Micronycteris* (sensu stricto) is monophyletic.

As members of the phyllostomid subfamily Phyllostominae, species of *Micronycteris* are characterized by a moderately long rostrum and a well-developed nose leaf. Simmons and Voss (1998: 62) provided an emended diagnosis of the genus based on additional characters:

> Dorsal fur bicolored (the hairs brown with white bases); pinnae large, rounded distally, connected by notched band of skin (interauricular band) across crown of head; ventral edge of narial horseshoe defined by thick ridge; chin with pair of dermal pads arranged in a ''V'' with no central papilla; third metacarpal shortest, fifth longest; first and second phalanges of wing digit III subequal in length; first and second phalanges of wing digit IV either subequal or second phalanx shorter than first; rostrum and anterior orbital region not inflated; basisphenoid pits shallow; dental formula I 2/2, C 1/1, P 2/3, M 3/3 × 2 = 34; height of upper canine greater than or equal to twice height of inner upper incisor; outer upper incisor in normal position between inner incisor and canine, not excluded from occlusion with lower incisors; P3 not molariform, lingual cingulum and cusp absent; lingual cingulum of P4 with concave outline and raised edge, lingual cusp small or absent; lower incisors bifid; lower premolars aligned in row on mandible, none excluded from toothrow.

Although rarely captured in large numbers, species of *Micronycteris* constitute a large fraction of the gleaning-insectivorous bat fauna of Neotropical moist forests, where many species can occur sympatrically. Simmons and Voss (1998) recorded seven species of *Micronycteris* in a rainforested study area with a 3-km sampling radius at Paracou, French Guiana, and geographic range data suggest that similar numbers of congeners could coexist at most Amazonian localities. Several well-sampled local faunas include both dark-bellied species (*hirsuta*, *megalotis*, *microtis*) and pale-bellied forms (*brosseti*, *sanborni*, *schmidtorum*, *minuta*, *homezi*), but the ecobehavioral significance (if any) of this chromatic distinction is unknown. In fact, very little is known about the natural history of *Micronycteris* species, in large part because they are not commonly captured by mistnetting (the preferred bat-collecting method of most Neotropical mammalogists; Voss and Emmons, 1996).

In 1998 and 1999 we initiated a collaborative faunal inventory and ethnobiological research project on the Río Gálvez in the Amazonian lowlands of northeastern Peru. Among other voucher material collected to date, this project resulted in the preservation of 47 specimens representing 5 species of *Micronycteris*. One of those species is an undescribed dark-bellied form superficially resembling *M. megalotis* and *M. microtis*, but substantially larger than either of those taxa and differing from other known congeners by a unique combination of qualitative traits. We describe this new species below, document its diagnostic morphological attributes, and summarize our preliminary natural history observations in a comparative context.

METHODS

Study Site and Collection Methods

All known specimens of our new species and much of our comparative material was collected at Nuevo San Juan (73°9′50″W, 5°14′50″S; 150 m above sea level), a Matses Indian village on the right (SE) bank of the Río Gálvez in Departamento Loreto, Peru (fig. 1). Estimates of average annual rainfall (2900 mm) and average annual temperature (25.9°C) are available from Jenaro Herrera (the nearest weather station; Marengo, 1983), which is ca. 100 km WNW of Nuevo San Juan. The Gálvez is a mixed-water river (dark but turbid), with a narrow floodplain that rarely extends more than 0.5 km on either side. Local habitats surrounding Nuevo San Juan can be broadly characterized as pri-

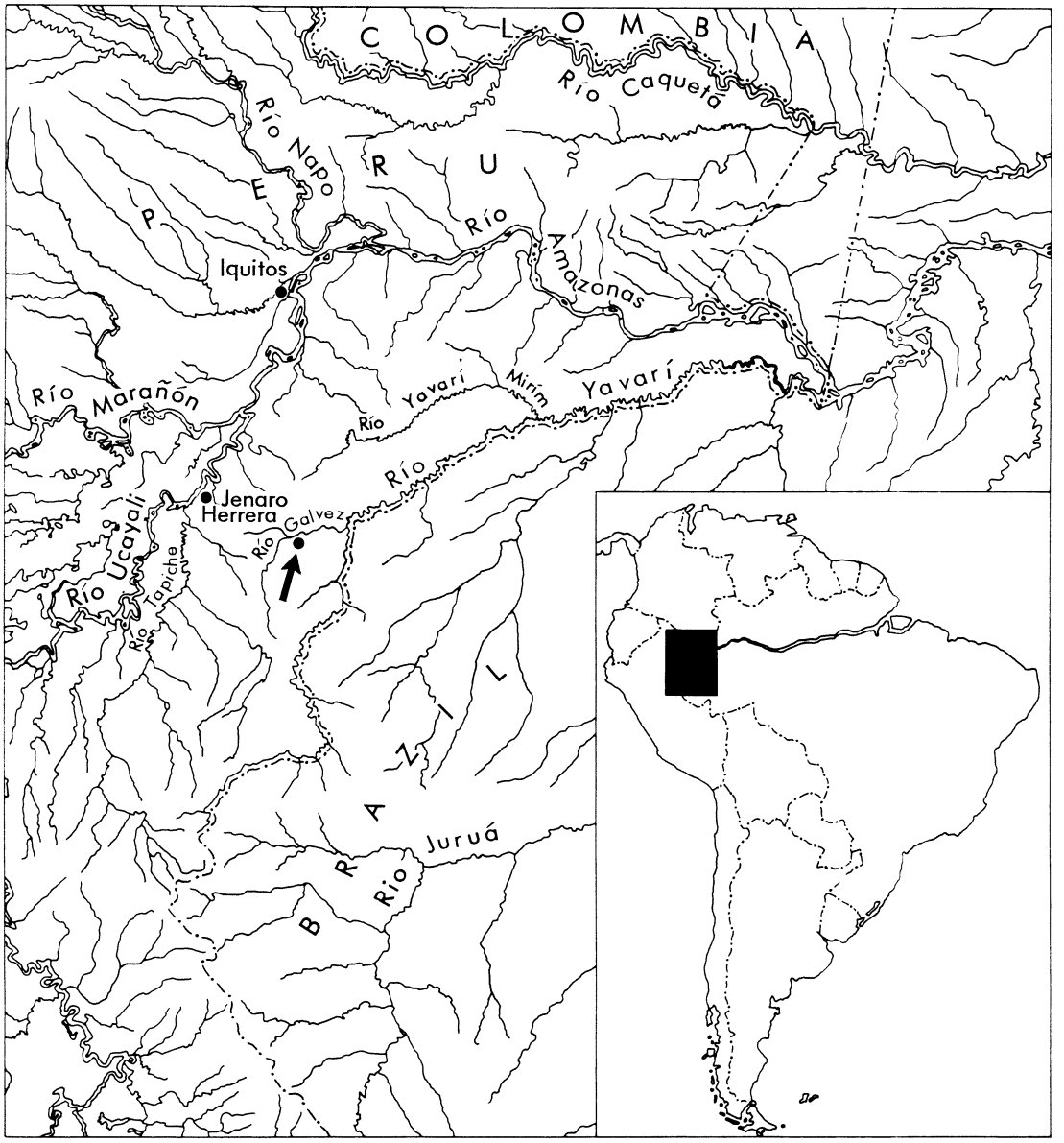

Fig. 1. The Amazonian lowlands of northeastern Peru (Departamento Loreto), showing the location of our study site at Nuevo San Juan on the right (SE) bank of the Río Gálvez (see text for map coordinates).

mary rainforest, with the exception of small gaps caused by windfalls and by active and abandoned swiddens (0.5–2.0 ha agricultural plots) that have been cleared since the village was established in 1984. More detailed descriptions of the vegetation and topography at this site were provided by Fleck and Harder (2000).

From May to July of 1998, Voss sampled the bat fauna within a 3-km radius of Nuevo San Juan by ground-level mistnetting and by searching for roosts (see Voss and Emmons [1996] and Simmons and Voss [1998] for relevant descriptions of both methods). Local habitats sampled by mistnetting included gardens and clearings around Matses houses,

secondary growth (abandoned swiddens), well-drained primary forest, *aguajales* (*Mauritia flexuosa* palm swamps), and river beaches. Under the forest canopy, mistnets were usually deployed in linear (tandem) arrays along existing trails or in specially cut net lanes, but right-angled or other configurations were sometimes used. Nets were opened just before dark (often when it was still light enough to read), and were tended continuously until they were closed (usually before midnight). The equipment used consisted of 2.6 × 6 m nets woven from 70 denier (d) thread, and 2.6 × 12 m nets of 50 d thread; all nets had a mesh size of about 36 mm.

Bat roosts were located with and without the involvement of Matses volunteer helpers in our 1998 field season, but Voss collected all specimens (usually by shooting) and recorded data (roost location, habitat, etc.) himself. From September to November of 1999, however, five Matses men were paid salaries to look for bat roosts. For the first month (September) of our 1999 field season, the Matses did not collect bats or record data themselves, but returned to the village to lead Fleck to roosts where he shot specimens and took notes. Subsequently, Matses assistants both collected specimens and recorded data themselves, and then brought the specimens to Fleck, who identified, cataloged, and preserved them. Matses collectors recorded their observations in field notebooks, which Fleck later translated and transcribed.

Measurements and Abbreviations

All measurements reported herein are from adult individuals with closed epiphyses. The first five measurements listed below were taken from skin tags or other records made by the collector, but the other dimensions were measured by Simmons using digital calipers. Linear measurements of external and craniodental dimensions are reported in millimeters (mm); weights are reported in grams (g). Measurements are defined as follows:

Total length: Distance from the tip of the snout to the tip of the last caudal vertebra.

Tail length: Measured from the point of dorsal flexure of the tail with the sacrum to the tip of the last caudal vertebra.

Hindfoot length: From the anterior edge of the base of the calcar to the tip of the claw of the longest toe.

Ear length: From the notch to the fleshy tip of the pinna.

Forearm length: From the elbow (tip of olecranon process) to the wrist (including the carpals), measured with the wing at least partially folded.

Thumb length: From the metacarpal-phalangeal joint to the tip of the claw of the thumb.

Tibia length: From the proximal end of the tibia to the posterior base of the calcar.

Greatest length of skull: From the posteriormost point on the occiput to the anteriormost point on the premaxillae (excluding the incisors).

Condylo-incisive length: From the posteriormost point on the occipital condyles to the anteriormost point on the upper incisors.

Postorbital breadth: Least breadth across the frontals posterior to the postorbital bulges.

Zygomatic breadth: Greatest breadth across the zygomatic arches.

Braincase breadth: Greatest breadth of the globular part of the braincase.

Mastoid breadth: Greatest cranial breadth across the mastoid region.

Maxillary toothrow length: From the anteriormost edge of the canine crown to the posteriormost edge of the crown of M3.

Breadth across molars: Greatest breadth across the outer edges of the crowns of the upper molars.

To confirm taxonomic identifications we compared our voucher material from Nuevo San Juan with types, original descriptions, and comparative series from other localities. We indicate museums in which vouchers and other specimens are preserved using the following institutional acronyms: AMNH, American Museum of Natural History (New York); BMNH, British Museum of Natural History (London); CM, Carnegie Museum (Pittsburgh); FMNH, Field Museum of Natural History (Chicago); MNHN, Muséum National d'Histoire Naturelle (Paris); MUSM, Museo de Historia Natural de la Universidad Nacional Mayor de San Marcos (Lima); TTU, The Museum, Texas Tech University (Lubbock); USNM, National Museum of Natural History (Washington, DC).

SYSTEMATICS

FAMILY PHYLLOSTOMIDAE GRAY, 1825

SUBFAMILY PHYLLOSTOMINAE GRAY, 1825

GENUS *MICRONYCTERIS* GRAY, 1866

Micronycteris matses, new species

Figures 2, 3

TYPE MATERIAL: The holotype (MUSM 15231), an adult male preserved in alcohol with the skull removed and cleaned, was collected at Nuevo San Juan by David W. Fleck (original number: DWF 782) on 9 November 1999. Seven paratypes include two additional males (AMNH 272814, 273133) and five females (MUSM 15229; AMNH 273043, 273044, 273095, 273196), all of which were likewise collected at Nuevo San Juan, between 27 June 1998 and 9 November 1999.

DISTRIBUTION: Currently known only from the type locality (fig. 1), but perhaps widely distributed in Amazonia. Because few bats appear to be restricted by the riverine boundaries that limit the ranges of many nonvolant Amazonian mammals (Voss et al., 2001), it seems likely that the known distribution of *Micronycteris matses* is just an artifact of inadequate collecting, perhaps exacerbated by elusive roosting and foraging behavior.

ETYMOLOGY: For the Matses, a Panoan-speaking indigenous population living along the Río Yavarí and its tributaries in northeastern Peru and western Brazil, treated as a noun standing in apposition to the generic name.

DIAGNOSIS: A medium-sized species of *Micronycteris* (forearm 37.5–39.5 mm; weight 8–14 g) with dark-brown dorsal and ventral fur; dorsal hairs bicolored, 7–8 mm long in shoulder region, with white base comprising one-fourth or less of each hair; fur on outside of medial third of pinna short ($\leq$ 3 mm) and dense; pinnae large with rounded tips, connected across crown of head by low interauricular band with shallow midline notch; thumb small (9.5–11 mm); second phalanx of wing digit IV shorter than first; calcar longer than foot; mastoid breadth less than zygomatic breadth; crown height of upper incisors not reduced; no gap present between outer upper incisor and canine; P3 and P4 subequal in anteroposterior length, height of P3 equal to or slightly less than that of P4; P4 with small lingual heel and variably developed lingual cusp; M1 narrower than M2; no noticeable gap between posterior edge of cingulum of M2 and anterolingual edge of M3 when toothrow seen in occlusal view; lower incisors small and bilobed, not markedly hypsodont, crown height one and one-half to two times crown width; lower premolar dentition with p2 largest in anteroposterior length and height, p3 smallest in both dimensions; coronoid process high, upper margin of ascending process with steep slope (25–30°).

Of the characters listed above, five are particularly useful for field identification of *Micronycteris matses*: size (forearm 37.5–39.5 mm; weight 8–14 g); ventral fur color (dark brown, similar to dorsal fur); length of the fur on the leading edge of the pinna (short, $\leq$ 3 mm); morphology of the interauricular band (low, with shallow midline notch); and morphology of the lower incisor crowns (not markedly hypsodont). Within the genus *Micronycteris*, this combination of traits is unique to *M. matses*.

MEASUREMENTS: Dimensions of each specimen in the type series of *Micronycteris matses* are provided in table 1, and metrical comparisons with representative series of other dark-bellied congeners are summarized in table 2.

DESCRIPTION AND COMPARISON: *Micronycteris matses* is a medium-sized member of the genus, smaller than *hirsuta* but larger than *microtis* and *megalotis* (tables 1–3). From all other dark-bellied congeners, *matses* can be unambiguously distinguished on the basis of forearm length, greatest length of skull, condylo-incisive length, postorbital breadth, mastoid breadth, zygomatic breadth, maxillary toothrow length, and breadth across molars. Additionally, *matses* can be distinguished from *hirsuta* on the basis of total length, tibia length, and thumb length; from *microtis* on the basis of weight and total length; and from *megalotis* on the basis of weight, hindfoot length, and tibia length. *Micronycteris matses* is larger than all pale-bellied congeners (*brosseti*, *schmidtorum*, *homezi*, *minuta*, *sanborni*; see measurements summarized by Simmons [1996] and Simmons and Voss [1998]) in most anatomical dimensions.

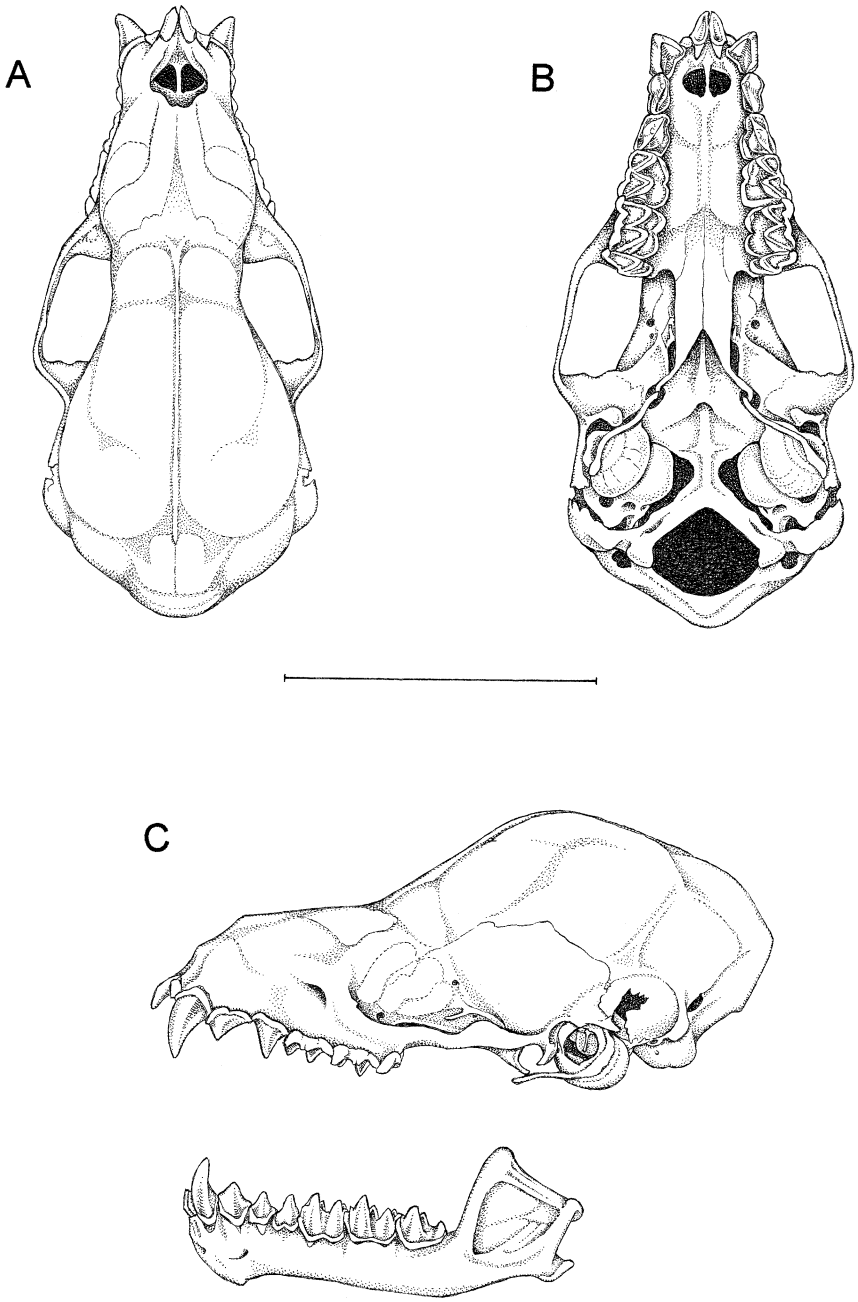

Fig. 2. Dorsal (**A**), ventral (**B**), and lateral (**C**) views of the skull of the holotype of *Micronycteris matses* (MUSM 15231). Scale bar = 10 mm.

As in all *Micronycteris*, the dorsal pelage of *matses* is composed of bicolored hairs with white bases and brown tips. In the upper back region, the white base comprises no more than one-fourth of the length of each hair. This is comparable to the pattern seen in *hirsuta*, but differs from that seen in most other species. The white bases comprise between one-fourth and one-half of each hair on the upper back in *microtis*, *megalotis*,

TABLE 1
Measurements[a] of the Type Series of *Micronycteris matses*

	Holotype MUSM 15231	Paratype AMNH 272814	Paratype AMNH 273133	Paratype MUSM 15229	Paratype AMNH 273043	Paratype AMNH 273044	Paratype AMNH 273045	Paratype AMNH 273196
Sex	male	male	male	female	female	female	female	female
Weight	10.7	8.6	10.2	14.0[b]	10.4	12.2	10.1	11.5
Total length	68.0	69.0	66.0	68.0	69.0	67.0	66.0	67.0
Tail length	15.0	16.0	14.0	13.0	17.0	17.0	14.0	14.0
Hind foot length	11.0	12.0	11.0	11.0	12.0	12.0	11.0	11.0
Ear length	23.0	21.5	23.0	23.0	22.0	22.0	22.0	23.0
Forearm length	38.8	38.5	38.8	37.7	39.1	39.4	39.1	38.8
Tibia length	18.2	17.7	18.1	16.9	17.9	18.3	17.9	18.0
Thumb length	9.7	9.5	9.9	9.8	10.2	10.8	9.8	10.0
Greatest length of skull	20.36	20.07	20.40	20.04	20.30	20.94	20.11	20.44
Condyloincisive length	18.56	18.23	18.53	18.33	18.48	18.75	18.28	18.30
Postorbital breadth	4.41	4.39	4.38	4.60	4.32	4.61	4.62	4.49
Braincase breadth	8.12	8.11	8.18	8.38	7.95	8.09	—	8.16
Mastoid breadth	9.41	9.20	9.63	9.49	9.04	9.45	9.28	9.39
Zygomatic breadth	9.96	9.78	10.17	9.95	9.92	10.12	10.08	10.15
Maxillary toothrow length	8.05	8.02	7.98	7.74	7.90	7.98	7.87	7.88
Breadth across molars	6.69	6.79	6.79	6.65	6.59	6.44	6.59	6.71

[a] Weight is given in grams; all other measurements are recorded in millimeters. See text for a description of measurement methods.
[b] Pregnant.

brosseti, *schmidtorum*, and *homezi*, and are even more extensive in *minuta* (comprising one-half to two-thirds of each hair) and *sanborni* (two-thirds to three-fourths of each hair). The length of the dorsal fur over the upper back in *matses* is approximately 7–8 mm, comparable to that of *microtis*, *brosseti*, and *homezi*. In contrast, *minuta* and *sanborni* have shorter fur over the shoulders (5–7 mm), whereas *megalotis*, *schmidtorum*, and *hirsuta* have longer fur (8–11 mm in the former two species, 11–14 mm in the latter).

The ventral fur of *matses* (including that covering the neck and throat) is brown, approximately the same shade as the dorsal fur. This is the same pattern seen in *megalotis*, *microtis*, and *hirsuta*. By contrast, the ventral fur of *brosseti*, *schmidtorum*, *homezi*, and *minuta* is gray or buff (paler than the dorsal fur), and the ventral fur of *sanborni* is bright white.

The fur on the leading edge of the medial third of each pinna is short ($\leq$ 3 mm) and dense in *matses*, similar to the condition seen in *microtis*, *minuta*, *hirsuta*, *brosseti*, and *sanborni*. By contrast, the auricular fur of *megalotis*, *schmidtorum*, and *homezi* is much longer (5–8 mm). As in all other species of *Micronycteris*, the ears of *matses* are connected across the crown of the head by an interauricular band of skin. In *matses*, this band is low and nearly horizontal in profile, and is marked at the midline by a shallow notch; a similar condition is seen in all other dark-bellied congeners. This morphology contrasts sharply with the interauricular band seen in most pale-bellied species (i.e., *schmidtorum*, *minuta*, *sanborni*, and *homezi*), which is higher and divided by a deep median notch into two roughly triangular flaps.

The second phalanx of wing digit IV is shorter than the first in *matses*, as it is also in *megalotis*, *microtis*, *hirsuta*, *brosseti*, *schmidtorum*, and *homezi*. By contrast, the first and second phalanges of digit IV are subequal in *minuta* and *sanborni*.

The calcar is distinctly longer than the hind foot in *matses*, as it is in most other species of *Micronycteris*. In contrast, the calcar is approximately equal in length to the hind foot in *sanborni*, and is markedly shorter than the foot in *minuta* and *homezi*.

As noted by Simmons (1996), cranial morphology is remarkably similar in all species of *Micronycteris*. Like other members of the genus, *matses* has a relatively long rostrum,

TABLE 2
Summary of Measurements[a] of Dark-Bellied Species of *Micronycteris*

	Micronycteris matses		*Micronycteris hirsuta*	
Number/Sex	5 females	3 males	13 females	18 males
Weight	11.6 (10.1–14.0) 5	9.8 (8.6–10.7) 3	15.0 (12.0–18.4) 10	12.6 (10.3–16.5) 12
Total length	67.4 (66.0–69.0) 5	67.6 (66.0–69.0) 3	76.0 (70.0–84.0) 8	76.7 (72.0–81.0) 10
Tail length	15.0 (13.0–17.0) 5	15.0 (14.0–16.0) 3	14.6 (11.0–19.0) 9	15.3 (13.0–19.0) 11
Hind foot length	11.4 (11.0–12.0) 5	11.3 (11.0–12.0) 3	13.9 (13.0–18.0) 9	13.3 (12.0–15.0) 10
Ear length	22.4 (22.0–23.0) 5	22.5 (21.5–23.0) 3	25.2 (24.0–26.0) 9	24.6 (24.0–26.0) 10
Forearm length	38.8 (37.7–39.4) 5	38.7 (38.5–38.8) 3	43.7 (41.0–45.0) 12	43.6 (41.0–46.0) 18
Tibia length	17.8 (16.9–18.3) 5	18.0 (17.7–18.2) 3	20.9 (19.3–22.7) 7	19.7 (18.8–22.6) 10
Thumb length	10.1 (9.8–10.8) 5	9.7 (9.5–9.9) 3	12.6 (11.7–13.6) 8	12.3 (11.2–13.7) 14
Greatest length of skull	20.37 (20.04–20.94) 5	20.28 (20.07–20.40) 3	23.22 (22.83–23.57) 4	23.20 (22.75–23.74) 4
Condyloincisive length	18.43 (18.28–18.75) 5	18.44 (18.23–18.56) 3	20.88 (20.64–21.37) 8	20.82 (19.89–21.40) 9
Postorbital breadth	4.53 (4.32–4.62) 5	4.39 (4.38–4.41) 3	4.94 (4.72–5.09) 7	4.95 (4.75–5.16) 11
Braincase breadth	8.15 (7.95–8.38) 4	8.14 (8.12–8.18) 3	8.65 (8.46–8.87) 7	8.67 (8.43–8.91) 10
Mastoid breadth	9.33 (9.04–9.49) 5	9.41 (9.20–9.63) 3	10.22 (9.99–10.49) 4	10.26 (10.03–10.64) 4
Zygomatic breadth	10.04 (9.92–10.15) 5	9.97 (9.78–10.17) 3	11.62 (11.24–12.10) 8	11.65 (11.34–12.00) 10
Maxillary toothrow length	7.85 (7.74–7.98) 5	8.02 (7.98–8.05) 3	9.06 (8.89–9.36) 8	9.16 (8.97–9.52) 12
Breadth across molars	6.60 (6.44–6.71) 5	6.76 (6.69–6.79) 3	7.32 (7.17–7.59) 4	7.32 (7.23–7.45) 4

	Micronycteris microtis		*Micronycteris megalotis*	
Number/Sex	22 females	27 males	14 females	20 males
Weight	6.7 (5.1–9.3) 20	6.4 (5.0–7.5) 23	5.6 (5.2–6.3) 6	5.6 (5.0–6.3) 7
Total length	60.5 (55.0–65.0) 21	59.7 (54.0–64.0) 27	61.0 (55.0–66.0) 9	59.0 (56.0–63.0) 14
Tail length	12.8 (11.0–15.0) 20	12.9 (10.0–17.0) 27	13.6 (10.0–15.0) 9	13.1 (10.0–16.0) 14
Hind foot length	10.4 (9.0–11.0) 22	10.5 (9.0–12.0) 26	9.1 (8.0–10.0) 8	9.7 (8.8–10.0) 14
Ear length	20.6 (19.0–22.0) 20	20.5 (19.0–21.0) 23	22.0 (21.0–23.0) 6	22.3 (21.0–23.0) 10
Forearm length	34.6 (33.4–35.7) 20	34.3 (32.5–36.6) 26	34.3 (33.2–36.0) 9	33.9 (31.9–35.6) 14
Tibia length	15.2 (12.8–17.7) 20	15.0 (12.7–17.0) 24	13.8 (13.3–14.6) 7	13.8 (12.1–17.4) 12
Thumb length	8.7 (8.1–9.6) 21	8.9 (7.8–9.8) 26	8.9 (8.2–9.7) 13	8.7 (8.6–9.4) 18
Greatest length of skull	17.81 (17.09–18.40) 11	17.92 (17.23–18.49) 11	17.97 (17.50–18.55) 4	18.09 (17.68–18.46) 5
Condyloincisive length	16.02 (15.40–16.73) 13	16.03 (15.55–16.50) 14	16.07 (15.54–16.94) 10	15.90 (15.54–16.38) 12
Postorbital breadth	4.05 (3.88–4.18) 13	3.99 (3.84–4.14) 15	3.89 (3.69–4.12) 14	3.76 (3.54–3.98) 16
Braincase breadth	7.40 (7.14–7.69) 12	7.48 (7.19–7.66) 15	7.59 (7.26–8.30) 12	7.46 (7.12–7.82) 15
Mastoid breadth	8.36 (8.19–8.56) 10	8.32 (8.02–8.50) 11	8.33 (8.08–8.54) 3	8.22 (8.13–8.46) 5
Zygomatic breadth	8.77 (8.34–9.19) 13	8.68 (8.44–8.90) 15	8.78 (8.53–9.19) 12	8.45 (8.08–8.76) 12
Maxillary toothrow length	6.73 (6.33–7.16) 13	6.74 (6.45–7.25) 15	6.76 (6.49–7.10) 14	6.64 (6.32–7.15) 18
Breadth across molars	5.80 (5.52–6.12) 11	5.80 (5.64–6.05) 11	5.74 (5.39–5.87) 4	5.73 (5.64–5.80) 5

[a] Summary statistics (mean, observed range, and sample size) of measurements for each species and sex. Weight is given in grams; all other measurements are recorded in millimeters. See text for a description of measurement methods. With the exception of *matses*, the measurements presented for each species reflect variation across several localities in South America; see appendix 1 for a list of specimens and localities.

no anteorbital inflation, a large braincase, and shallow basisphenoid pits (fig. 2). Mastoid breadth is less than zygomatic breadth in *matses*, as it is in most other *Micronycteris* species. By contrast, mastoid breadth is greater than zygomatic breadth in *sanborni*, *minuta*, and *homezi*.

Like all other congeneric species, *Micronycteris matses* has a dental formula of I 2/2, C 1/1, P 2/3, M 3/3 × 2 = 34. The crown height of the upper incisors is not reduced, and no gap is present between the outer upper incisor and the canine. In this respect *matses* resembles most other species of *Micronycteris*, the contrasting morphology being seen only in *sanborni* (in which crown height of I2 is reduced and a gap is present between this tooth and the canine; Simmons, 1996).

Although differences in the upper premo-

lar dentition are subtle, variation in this region provides an important means of distinguishing species of *Micronycteris* (see Simmons, 1996). In *matses*, P3 and P4 are subequal in length (anteroposterior dimension), and the height (dorsoventral dimension) of P3 is either equal to or very slightly less than that of P4 (fig. 2). This is similar to the condition seen in most other congeners, but P3 is noticeably smaller than P4 in both length and height in *minuta* and *sanborni*.

The degree of development of the posterolingual heel and lingual cusp on P4 varies among and within species of *Micronycteris*. The lingual heel of P4 in *matses* is similar in outline and proportions to the homologous structures seen in *megalotis*, *microtis*, *brosseti*, *schmidtorum*, and *homezi*. By contrast, the lingual heel is proportionately smaller in *hirsuta* and *minuta*, and larger in *sanborni* (see illustrations in Simmons [1996] and Simmons and Voss [1998]). The lingual cusp of P4, which is formed from the raised edge of the heel, is variably developed in *matses*, as it is likewise in *microtis* and *megalotis*. The lingual cusp is present and tapers to a sharp point (which typically bears a wear facet) in most individuals, but is poorly developed (or lacking entirely) in others. By contrast, the lingual cusp is never well developed and always lacks a sharp point in *brosseti*, *homezi*, *minuta*, and *sanborni*, and it is entirely lacking in many specimens of *schmidtorum*. The lingual cusp of P4 in *hirsuta* is located farther posteriorly than in the other species; typically well developed, it tapers to a blunt point that is not marked by a wear facet.

The first upper molar is noticeably narrower than M2 in *matses*, as it is in most other species of *Micronycteris*. Uniquely, however, the lingual portion of M1 is expanded so that M1 and M2 are subequal in width in *sanborni*, which also differs from all other congeners in having a large gap between the posterior edge of the cingulum of M2 and the anterolingual edge of M3 when the toothrow is observed in occlusal view.

As in most other species of *Micronycteris*, the lower incisors of *matses* are small and bilobed, with the height of the anterior face of each incisor crown between one and one-half to two times the width of the crown. This differs markedly from the condition observed in *hirsuta*, which has uniquely hypsodont lower incisors crowns, the heights of which are roughly three times their widths (fig. 3).

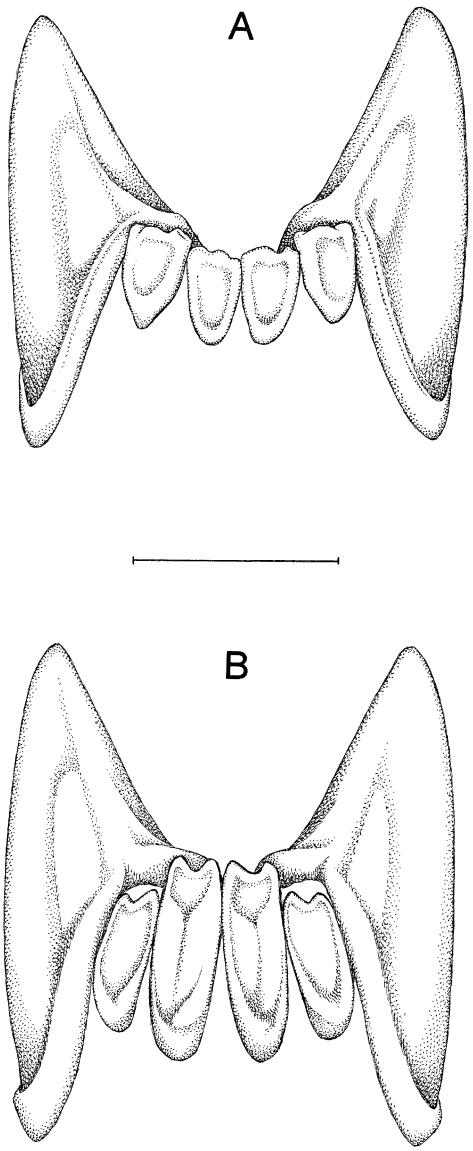

Fig. 3. Anterior views of the lower dentition of *Micronycteris matses* (**A,** MUSM 15231) and *M. hirsuta* (**B,** AMNH 273153, male). Note the hypsodont lower molars in *hirsuta*, a unique morphological trait (within *Micronycteris*) that can be used in conjunction with size and other characters for field identification. Scale bar = 1 mm.

TABLE 3
Summary of Principal Diagnostic Characters for Dark-Bellied Amazonian Species of *Micronycteris*[a]

M. hirsuta	*M. matses*	*M. megalotis*	*M. microtis*
Weight = 12.0–18.4 g	Weight = 8.6–14.0 g	Weight = 5.0–6.3 g	Weight = 5.0–9.3 g
Forearm length = 41.0–46.0 mm	Forearm length = 37.7–39.4 mm	Forearm length = 31.9–36.0 mm	Forearm length = 32.5–36.6 mm
Length of dorsal fur = 11–14 mm	Length of dorsal fur = 7–8 mm	Length of dorsal fur = 8–11 mm	Length of dorsal fur = 7–8 mm
White base of dorsal pelage comprises less than 1/4 of total hair length	White base of dorsal pelage comprises less than 1/4 of total hair length	White base of dorsal pelage comprises 1/4 to 1/2 of total hair length	White base of dorsal pelage comprises 1/4 to 1/2 of total hair length
Fur on leading edge of medial third of pinna short (≤3 mm)	Fur on leading edge of medial third of pinna short (≤3 mm)	Fur on leading edge of medial third of pinna long (5–8 mm)	Fur on leading edge of medial third of pinna short (≤3 mm)
Lower incisors hypsodont, crown height approximately 3× crown width	Lower incisors not hypsodont, crown height ≤2× crown width	Lower incisors not hypsodont, crown height ≤2× crown width	Lower incisors not hypsodont, crown height ≤2× crown width

[a] All dark-bellied species of *Micronycteris* share the following traits: dark brown or reddish brown ventral fur that is similar in color to the dorsal fur; pinnae connected across crown of head by a low interauricular band with a shallow midline notch; second phalanx of wing digit IV shorter than first phalanx; calcar longer than foot; mastoid breadth greater than zygomatic breadth; crown height of upper incisors not reduced, no gap present between outer upper incisors and canine; P3 and P4 subequal in length and height; P3 either equal to or very slightly smaller than P4; M1 width < M2 width.

The lower premolar dentition of *matses* most closely resembles that of *hirsuta*. In both of these species, p2 is the largest premolar in both anteroposterior length and dorsoventral height, p3 is the smallest in both dimensions, and p4 is intermediate (fig. 2). By contrast, p3 is relatively larger (approximately the same size as p4) in both *microtis* and *megalotis*; in these taxa, p2 is often slightly larger than either p3 or p4, although there is some within-species variation in this trait (all three lower premolars are subequal in some individuals). In *brosseti* and *schmidtorum*, p2 and p4 are subequal in length and in height, whereas p3 is slightly smaller in both dimensions. In *minuta*, *sanborni*, and *homezi*, p3 is further reduced relative to p2 and p4, which are large and subequal.

The coronoid process in *Micronycteris matses* is high, and the upper margin of the ascending process has a steep slope (25–30°), similar to the mandibular morphology of *megalotis*, *microtis*, *brosseti*, and *schmidtorum*. By contrast, the coronoid process is comparatively low and the upper margin of the ascending ramus has a shallow slope (16–18°) in *minuta*, *sanborni*, and *homezi*.

NATURAL HISTORY

Of the eight known specimens of *Micronycteris matses*, one was caught in a ground-level mistnet at dusk (18:00 hrs) in well-drained primary rainforest on 27 June 1998. The remaining seven specimens were all taken from diurnal roosts as described in the following abstracts from Fleck's 1999 fieldnotes (numbers refer to entries in a catalog of bat roosts):

Roost 31. A deep armadillo burrow in the side of a stream headwater gully on a hillside in primary forest ca. 2 km from the village. Six bats were collected from this roost on 4 September 1999, including one adult female *Peropteryx* cf. *macrotis* (AMNH 273042), two adult female *Micronycteris matses* (AMNH 273043, 273044), and three adult female *Carollia brevicauda* (AMNH 273045, 273046; MUSM 15160). No bats were seen exiting the hole, but it is possible that some escaped by flying deeper inside.

Roost 55. Another deep hole (probably an armadillo burrow) in the side of a stream headwater gully in primary hillside forest near the village. Five bats were

TABLE 4

Captures of *Micronycteris* spp. by Mistnetting and by Searching for Roosts at Two Amazonian Rainforest Inventory Sites[a]

	Captured in mistnets	Captured at roosts	Total
	Nuevo San Juan[b]		
hirsuta	0	5	5
matses	1	7	8
megalotis	0	2	2
microtis	1	27	28
minuta	0	4	4
	Paracou[c]		
brosseti	1	7	8
hirsuta	3	6	9
homezi	1	0	1
megalotis	8	3	11
microtis	3	17	20
minuta	6	0	6
schmidtorum	2	0	2
GRAND TOTALS	26	78	104

[a] Table entries are numbers of captured bats, which are not necessarily equivalent to independent sampling events.

[b] Nuevo San Juan is in the Departamento Loreto, Peru (see text).

[c] Paracou is in northern French Guiana (see Simmons and Voss, 1998; Voss et al., 2001).

TABLE 5

Roosts Inhabited by *Micronycteris matses* and Sympatric Amazonian Congeners[a]

	Cavities in standing trees	Hollow logs	Holes in ground	Other	Total
brosseti[b]	1	—	—	—	1
hirsuta	4	—	1	—	5
matses	—	—	4	—	4
megalotis	2	—	—	—	2
microtis	2	10	5	2[c]	19
minuta	1	—	—	—	1
TOTALS	10	10	10	2	32

[a] Table entries are numbers of roosts found at Nuevo San Juan (Peru) and Paracou (French Guiana). Both localities include extensive tracts of primary rainforest, and both localities lack caves or other rocky substrate suitable as shelter for bats. Roosts found in man-made structures (e.g., culverts under roads) are not tabulated.

[b] Although *Micronycteris brosseti* and *M. matses* have yet to be recorded in sympatry, both are known from the Ucayali-Yavarí interfluve.

[c] "Other" roosts in which *Micronycteris microtis* were found include a cavity in the buttressed roots of a tree (at Paracou) and inside a wide crack in the trunk of a recently felled tree (at Nuevo San Juan).

observed hanging together from the roof of this tunnel on 16 September 1999, of which only one (an adult female *Micronycteris matses*, AMNH 273095) was collected.

Roost 95. Described by the Matses collector as "a hole in the ground that one could stand in", in a stream headwater gully in primary floodplain forest (seasonally inundated by the Gálvez, but dry at the time of collection). Many bats were observed to inhabit this roost on 6 October 1999, of which only two could be collected; both were *Micronycteris matses*, one an adult male (AMNH 273133), the other an adult female (MUSM 15229).

Roost 161. A hole eroded in the side of a stream headwater gully in primary upland (unflooded) forest. About seven bats were observed in this roost on 9 November 1999, of which four were shot. All of the shot bats appeared to be conspecific, but two (an unsexed adult and a juvenile) were too damaged to preserve as specimens. The voucher material from this roost therefore consists of just two individuals, one adult female *Micronycteris matses* (AMNH 273196) and the adult male holotype (MUSM 15231).

Several aspects of these scant field data are noteworthy. First, our capture records for *Micronycteris matses* (one in mistnets, seven at roosts) are similar to the pattern we recorded for other congeneric species at Nuevo San Juan and elsewhere in Amazonia (table 4). In general, species of *Micronycteris* are more commonly encountered by searching for diurnal roosts than by mistnetting, a fact that perhaps accounts for the small numbers of these bats routinely taken by inventory workers who rely principally on the latter method to sample Neotropical chiropteran faunas. The adoption of intensive roost-searching protocols by future inventory projects will doubtless result in more captures of *M. matses*, which is perhaps widely distributed in Amazonia.

Second, the four roosts found to be occupied by *Micronycteris matses* at Nuevo San Juan were all essentially similar (holes in the ground), and unlike those typically used by most other congeneric species (table 5). All of the roosts occupied by *M. matses* were probably excavated (or enlarged) by the giant long-nosed armadillo (*Dasypus kappleri*), an important game species esteemed by the Matses, who identify stream headwater gullies as a favored site for burrow construction

(Fleck and Harder, 2000). By contrast, no other *Micronycteris* species used this type of roost exclusively at Nuevo San Juan, and none used such refugia at Paracou, another Amazonian locality where we found many *Micronycteris* roosts. Roosts typically inhabited by other congeneric species are rotted cavities in logs or standing trees, but *M. microtis* was sometimes found in holes in the ground (usually armadillo burrows) at Nuevo San Juan.

Lastly, we note that *Micronycteris matses* occupies the conspicuous size hiatus remarked by Simmons and Voss (1998: 65), which previously distinguished *M. hirsuta* from all of its diminutive congeners. The size spectrum of Amazonian *Micronycteris* now appears to consist of a more evenly graded series of taxa, each of which perhaps exploits some distinctive range of trophic (or other) resources. How (or if) sympatric *Micronycteris* species differ from one another by partitioning one or more crucial niche dimensions, however, is a topic that remains to be addressed by future field studies.

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APPENDIX 1

SPECIMENS EXAMINED

The following list summarizes the taxa and specimens examined for this report. Specimens measured for tables 1 and 2 are indicated with asterisks.

Micronycteris brosseti—**Peru**: Loreto, Puerto Indiana, Río Amazonas near mouth of Río Napo (AMNH 73495, 73496, 73498, 73499); Loreto, Jenaro Herrera (MUSM 5528); Loreto, Río Yavarí Mirím, Quebrada Esperanza (FMNH 89100, 89101, 89102). **French Guiana**: Paracou, near Sinnamary (AMNH 266032, 266033, 266034, 266035, 266038, 267419; MNHN 1995.1032 [holotype], 1995.1031). **Brazil**: São Paulo, Rio Juquiá, Barra (FMNH 92997).

Micronycteris matses—**Peru**: Loreto, Río Gálvez, Nuevo San Juan (AMNH 272814, 273043, 273044, 273095, 273133, 273196; MUSM 15229, 15231 [holotype]).

Micronycteris hirsuta—**Colombia**: Cauca, Río Saijá (FMNH *90328, *90329); Antioquia, La Frijolera (AMNH *36783); Magdalena, 2 km W Río Don Diego (AMNH 255705); Magdalena, Bonda (AMNH *14573). **Peru**: Pasco, Oxapampa, San Juan (AMNH *230114, *230115, *230116); Madre de Dios, left bank Río Palotoa, 12 km from mouth (FMNH *138857). **Trinidad and Tobago**: ''Brickfield'' (FMNH *62034); Caroni Parish, Cunupia Ward, Regis Road near Village of Cunupia (AMNH 175615); Fort Reid, Waller Field (AMNH 175609); St. George Parish, Port of Spain, 21 Queens Park (AMNH 76287); St. George Parish, St. Ann's Ward, Old Santa Cruz Road (FMNH *54979); St. Patrick Parish, Cedros Ward, Granville (AMNH 175606, 176623); St. Patrick Parish, Charuma Ward, St. John (AMNH *179958); St. Patrick Parish, La Brea Ward, La Brea, Granys Trace (AMNH *179957, *182698); St. Patrick Parish, Siparia Ward, Fyzabad, Leaseholds (AMNH *179955, *180032, *180033). **French Guiana**: Paracou, near Sinnamary (AMNH *267093, *267094, *267096, *267857, *267858, *267860; MNHN *1995.800, *1995.801, *1995.802); **Brazil**: Pará, Rio Tapajos, Aramanaí (AMNH *94534, *94560).

Micronycteris homezi—**French Guiana**: Paracou, near Sinnamary (AMNH 267414).

Micronycteris megalotis—**Colombia**: Cundinamarca, Mesitas del Colegio (AMNH *207775, *207776, *207778). **Peru**: Huánuco, Puerto Márquez, near Montealegre (AMNH *67234, *67235); Junín, Tarma, 2 km NW San Ramón (AMNH *230117); Loreto, Río Amazonas, Puerto Indiana (AMNH *73497, *73500); Loreto, Río Yavarí Mirím, Quebrada Esperanza (FMNH *89097, *89098, *89099); Napo, San José Abajo (AMNH *68009, *68010, *68011, *68012, *68013). **Trinidad and Tobago**: St. George Co., Maracas (TTU *23759). **Surinam**: Brokopondo, 1.5 km W Rudi Kappelvliegveld (CM *63575). **French Guiana**: Paracou, near Sinnamary (AMNH *266020, *267090, *267091, *267092, *267862, *267864; MNHN *1995.803). **Brazil**: [no additional information] (BMNH *not registered [holotype]; BMNH 42.8.17.8 [holotype of *Phyllostoma elongata* Gray, 1842]); Pernambuco, Fazenda Pomonha, 21 km SSW Exu (CM *98912); Pernambuco, Serrote Gamba, 19 km SSW Exu (CM *98911); Pará, Rio Tocantins, Ilha do Taiuna (AMNH *97206, *97219).

Micronycteris microtis—**Colombia**: Cundinamarca, Mesitas del Colegio (AMNH *207778). **French Guiana**: Paracou, near Sinnamary (AMNH *266024, *266025, *266027, *266029, *266030, *266038, *267097,*267866, *267867, *267868, *267869, *267870, *267872, *267873; MNHN *1995.805, *1995.806, *1995.807, 1995.809, 1995.810, 1995.811, 1995.812). **Brazil**: Amazonas, Yucali (= Iucali), Rio Negro (AMNH *79423); Amazonas, Rio Waupes (= Rio Uaupes), Tahulpunta (= Taúa; AMNH *78648, *78649); Pará, Rio Tocantins, Ilha do Taiuna (AMNH *94554, *97218).

Micronycteris minuta—**Colombia**: Magdalena, Bonda (AMNH 15131 [holotype of *M. hypoleuca*]; Putumayo, Río Mecaya (FMNH 72158, 72160, 72161, 72162, 72285). **Ecuador**: Napo, San Jose de Payamino (FMNH 124666, 124667, 124668); ''Oriente'', San José (AMNH 64004, 64005, 64006, 64007, 64008). **Peru**: Cuzco, Río Mapitunari, 12°39′S, 73°42′W (AMNH 283221); Loreto, Boca Curaray (AMNH 71614, 71615, 71616, 71617, 71618, 71621, 71628, 71629, 71630, 71631); Madre de Dios, Hacienda Amazonia (FMNH 138856); Madre de Dios, Río Manu, Pakitza (MUSM 6797, 6798, 6799, 6800, 6801, 6802); Pasco, Oxapampa, San Pablo (AMNH 230119, 230120). **Trinidad and Tobago**: Caroni Parish, Montserrat Ward, Freeport, Arena Road (AMNH 175597); Mayaro Parish, Piexrville (AMNH 183295); St. Andrew Parish, Valencia Ward, Cumaca (AMNH 175592, 175593); St. Patrick Parish, La Brea Ward, Point Fortin, Lot 10, Parrylands (AMNH 183168, 183169); St. Patrick Parish, Siparia Ward, Rochard-Douglas Road (AMNH 175595). **French Guiana**: Paracou, near Sinnamary (AMNH 267098, 267412, 267413, 267415, 267874, 267875; MNHN 1995.813, 1995.814). **Brazil**: Amazonas, Rio Madeira, Rosarinho (AMMH 92408, 92409, 92410, 92411, 92689, 92690, 92691, 92692, 92693, 92694, 92695, 92696, 92697, 92698, 92846); Mato Grosso do Sul, Rio Paraguai, Fazenda Acurizal (AMNH 237910, 244471); Pará, Lago Jauari, livramento Rio Amazonas (FMNH 42431, 42432); Pará, Belém, Mocambo (FMNH 126207, 126208); Pará, Belém, Utinga (FMNH 126206).

Micronycteris sanborni—**Brazil**: Ceará, Sitio Luanda, Itaitera, 4 km S Crato (USNM 555702 [holotype]); Ceará, 4 km SE Novo Olinda, KM

19 on Route CE96 (CM 98913); Pernambuco, Serrote das Lajes, 17 km S Exu (CM 98917); Pernambuco, 21 km SSW Exu, Fazenda Pomonha (CM 98914, 98915, 98916).

Micronycteris schmidtorum—**Belize**: Corozal District, Patchakan Village (FMNH 108762, 108763); Orange Walk District, Albion, 1.3 km W San Antonio, Río Hondo (FMNH 106766); Toledo District, 1.8 km NNW Quebrada de Oro at Bladen Branch River (AMNH 256821). **Guatemala**: Izabal, Bobas (FMNH 41559 [holotype], 41960); Santa Rosa, 2 km N Chiquimulilla (AMNH *243753). **Honduras**: Copan (FMNH 47583). **Colombia**: Vichada, Maipures, Río Orinoco (BMNH 99.9.11.24). **Peru**: Madre de Dios, Río Manu, Pakitza (MUSM 6803). **Venezuela**: Lara, Tocuyo, Río Tocuyo (AMNH 130715, 130716, 130717, 130718, 130719, 130720, 130725). **French Guiana**: Paracou, near Sinnamary (AMNH 267853; MNHN 1995.818). **Brazil**: Pará, Belém, Mocambo/Embrapa (FMNH 126204; 126205); Pernambuco, Estação Ecológica do Tapacura, São Lourenço da Mata (USNM 555703); Pernambuco, Fazenda Alto do Ferreira, 5 km SW Exu (CM 98908, 98909); Pernambuco, Fazenda Cantarena, 4.5 km NNE Exu (CM 98910).

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