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SMALL MAMMALS OF THE MAYO RIVER BASIN IN NORTHERN PERU, WITH THE DESCRIPTION OF A NEW SPECIES OF *STURNIRA* (CHIROPTERA: PHYLLOSTOMIDAE)

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ABSTRACT

We present the results of an inventory of small mammals in the Mayo River basin, one of the least-studied regions of the Central Andes in Peru. We conducted inventories at three locations in May 2007. We collected 47 species of small mammals in the study area: five marsupials, 31 bats, and 11 rodents. A new species of *Sturnira* was encountered and is described. The new species, which was previously confused with *S. lilium*, occurs east of the Andes in Colombia, Ecuador, Peru, Bolivia, Venezuela, the Guianas, and Brazil, with an isolated record on the western slope of the Andes in Peru. Additionally, we report the presence of *Anoura geoffroyi* in Peru, *Carollia* sp. sensu Solari and Baker (2006) south of the Marañon River, and extend the elevational range of *Neacomys spinosus* and *Oligoryzomys destructor*. Our results highlight the need to conduct additional inventories to increase our understanding of the biodiversity of this rich and increasingly impacted region.

INTRODUCTION

Peru has the fifth most mammal species of any country in the world, second only to Brazil in the New World (Ramírez-Chaves et al., 2016). This high diversity can be attributed to the juxtaposition in Peru of several Neotropical regions, including Andean slopes, Amazonia, the Altiplano, and the arid Pacific coast. This diverse group of regions supports a rich and heterogeneous mammal fauna, with endemic species occurring in each one of these regions (Pacheco et al., 2009).

The eastern versant of the Central Andes is one of the major centers of endemism in the Andes (Patterson et al., 2012). Several inventories have been conducted in the central and southern regions of the Central Andes (e.g., Emmons et al., 2001; Solari et al., 2006; Pacheco et al., 2013); however, few inventories have focused on the northern Central Andes in Peru (e.g., Leo and Romo R., 1992; Butchart et al., 1995; Leo, 1995).

The Mayo River, a tributary of the Huallaga River, runs from west to east and flows entirely within the department of San Martín, Peru (fig. 1), crossing several habitats including montane cloud forest, premontane cloud forest, and lowland rainforest. The Mayo River basin extends for roughly 10 million km^2, with 91% of that area in the department of San Martín and the remaining 9% in the department of Amazonas (SENAMHI, 2009). The basin includes highlands >3,400 m above sea level as well as lowlands to 200 m, and its natural habitats are vital for watershed protection and for carbon sequestration. Two protected areas are present in the Mayo River basin, the Área de conservación regional Cordillera Escalera (ACRCE) and the Bosque de Protección Alto Mayo (BPAM) (fig. 1). Both are part of the Abiseo-Condor-Kutuku Conservation Corridor, established to safeguard a system that supports high numbers of endemic plant and animal species. But despite these protections, the region is under continuing threats: insufficient funds for protected area management, construction of a national highway that crossed the region in 1975, and the resulting high rates of migration and settlement of people from the Andes into lowland areas. As a result, even BPAM has suffered exceptionally high rates of deforestation (Parks Watch, 2003; Gonzales Inca and Llanos López, 2015) and unprotected areas are almost entirely given over to agriculture.

Given its geographic position, the Mayo River region potentially supports a full range of mammalian diversity. Despite the documented presence of endemic species that serve as global flagships, such as the yellow-tailed woolly monkey (*Lagothrix flavicauda*) and the Río Mayo titi (*Callicebus oenanthe*), few studies have documented its mammalian diversity (e.g., von Tschudi, 1844; Miller, 1913; Osgood, 1913, 1914; Thomas, 1924, 1927; DeLuycker, 2007). In this article, we present the results of a mammal inventory conducted at the end of the rainy season (May) in four localities in the Mayo River basin.

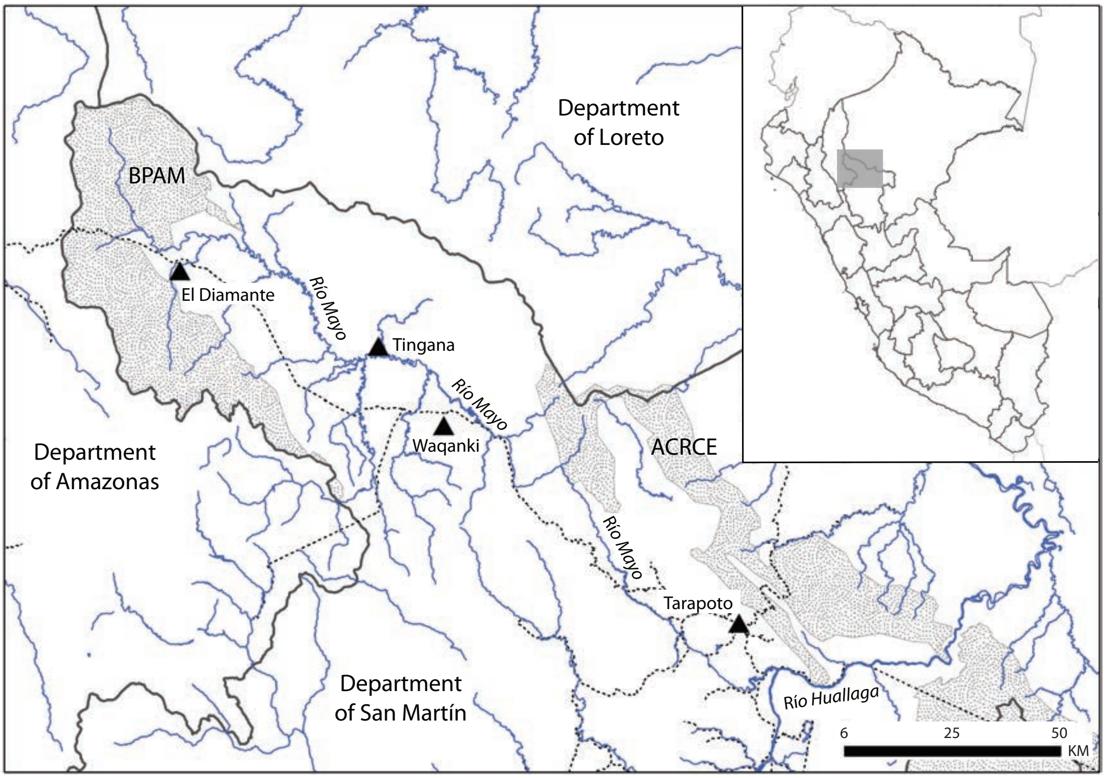

FIG. 1. Map of the Mayo River basin indicating the position of the four sampling localities (see Material and Methods for geographic coordinates and other information). Abbreviations: **ACRCE,** Área de conservación regional Cordillera Escalera; **BPAM,** Bosque de Protección Alto Mayo.

MATERIAL AND METHODS

Field Sites

The collections and observation reported below were obtained from four localities within the Mayo River basin (fig. 1). Fieldwork was carried out 1–25 May, 2007. Below the four localities are listed, as well as their inclusive inventory dates, habitats present, and mist-net and trap effort.

Waqanki (2–10 May 2007): An orchid farm located 3 km south of Moyobamba, 970 m, 06° 04′ 30.2″ S, 76° 58′ 33.5″ W (6.075100 S, 76.976000 W). The Waqanki center is part of the Área de Conservación Municipal Mishquiyacu-Rumiyacu y Almendra. This site is situated in a disturbed premontane forest drained by a stream, surrounding grasslands, and a farm house. Our total sampling effort consisted of 81 net nights and 1458 trap nights.

El Diamante (10–16 May 2007): Rioja, Pardo Miguel, Naranjos, Caserio El Diamante, 1078 m, 05° 45′ 12.1″ S, 77° 31′ 34.0″ W (5.753400 S, 77.526100 W). This site sampled active coffee plantations. Our total sampling effort consisted of 30 net nights and 375 trap nights.

Tingana (17–24 May 2007): 1 hr 45 min by road and boat from Moyobamba, 815 m, 05° 54′ 38.4″ S, 77° 06′ 43.3″ W (5.910700 S, 77.112000 W). Located on the Río Avisado, Tingana is part of the Área de Conservación Municipal Asociación Hídrica Aguajal Renacal del Alto Mayo. This site was covered primarily by seasonally flooded forest (dominated by *Coussapoa trinervia* and *Ficus trigona*) and agricultural fields. Our total sampling effort consisted of 56 net nights and 1100 trap nights.

Tarapoto (1 May 2007): City center, 335 m, 06° 29′ 16″ S, 76° 21′ 34″ W (6.487778 S, 76.359444 W). Tarapoto is the largest city of the department of San Martín. We only had one incidental capture in this locality, a *Lonchophylla handleyi* that was captured by hand.

A meteorological station near the *El Diamante* locality registered a stable temperature throughout the year (2007) with an average minimum temperature of 18.3° C and a maximum of 28.7° C. The months with higher precipitation in 2007 were January, March, April, and September through December, when it rained an average of 4.1 to 11.4 mm monthly. In May the average precipitation was 3.2 mm (SENAMHI portal).

Specimens and Abbreviations

Marsupial and Rodent Trapping and Measurements: We used standard trapping equipment (Voss and Emmons, 1996; Voss et al., 2001; Hice and Velazco, 2012) to sample the local fauna of small marsupials and rodents near ground level during our field seasons. Each trap station included three different trap types: one single-spring Victor snap-type rat trap, one Museum Special back-break trap, and one standard (LFA) folding Sherman live trap. In each locality sampled, the number of stations in each line transect varied based on the availability of trails. Trap stations were placed along trails at 10–15 m intervals. A mixture of peanut butter, oatmeal, and vanilla extract was used as bait for all traps. Additionally, a shotgun was used to collect mammals that were observed in trees (*Didelphis* and *Coendou*).

Vouchers specimens were prepared as either standard stuffed skins with accompanying skulls and partial skeletons, as skins and skulls with bodies in fluid (fixed in 10% formalin and transferred to 70% ethanol), or as fluid specimens; skulls were later removed and cleaned from some of these. The collection totals 357 specimens (marsupial, rodents, and bats) and was divided equally between the Field Museum of Natural History, Chicago, Illinois (FMNH), and the Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima, Peru (MUSM).

External measurements for marsupials and rodents were taken from dead individuals prior to specimen preparation, as follows:

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

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

Hind-foot length (HF): From proximal margin of calcaneus to tip of the claw of the longest toe.

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

Cranial measurements were taken with digital calipers to the nearest 0.1. Different sets of measurements were taken for marsupials and rodents. Our quantitative comparisons of marsupial crania are based on the following measurements:

Condylobasal length (CBL): From the posteriormost point on the occipital condyles to the anteriormost point of the premaxillae.

Nasal breadth (NB): Measured across the junction of the nasal, frontal, and maxillary bones on each side.

Least interorbital breadth (LIB): Measured at the narrowest point across the frontals between the orbits.

Least postorbital breadth (LPB): Measured at the narrowest point across the frontals behind the orbits.

Palatal breadth (PB): Measured across the labial extremes of the crowns of the last molars.

Palatal length (PL): Measured in the midline from the anteriormost point of the premaxillae to the end of the palate.

Zygomatic breadth (ZB): Greatest breadth across the zygomatic arches.

Maxillary toothrow length (MTR): From the anteriormost edge of the canine to the posteriormost edge of the crown of M4.

Length of molars (LM): From the anteriormost edge of M1 crown to the posteriormost edge of the crown of M4.

Quantitative comparisons of rodent crania are based on the following measurements:

Condyloincisive length (CIL): From the posteriormost point on the occipital condyles to the anteriormost point on the upper incisors.

Length of diastema (LD): From the crown of the first cheektooth to the lesser curvature of the incisor on the same side.

Maxillary toothrow length (MTR): From the anteriormost edge of P4 crown to the posteriormost edge of the crown of M3 (except as noted in some tables, where the alveolar equivalent was measured).

Length of molars (LM): From the anteriormost edge of M1 crown to the posteriormost edge of the crown of M3.

Breadth of M1 (BM1): Greatest crown breadth of the first maxillary molar.

Length of incisive foramen (LIF): Greatest anterior-posterior dimension of one incisive foramen.

Breadth of incisive foramina (BIF): Greatest transverse dimension across both incisive foramina.

Breadth of palatal bridge (BPB): Measured between the protocones of the right and left first maxillary molars.

Breadth of zygomatic plate (BZP): Least distance between anterior and posterior edges of the zygomatic plate.

Length of rostrum (LR): From the tip of one nasal bone to the posterior margin of the zygomatic notch on the same side.

Length of nasals (LN): Greatest anterior-posterior dimension of one nasal bone.

Least interorbital breadth (LIB): Least distance across the frontal bones between the orbital fossae.

Braincase breadth (BB): Greatest breadth of the globular part of the braincase above and slightly behind the squamosal zygomatic processes.

Zygomatic breadth (ZB): Greatest breadth across the zygomatic arches.

Zygomatic length (ZL): From the posterior margin of the infraorbital foramen to the posterolateral corner of the zygomatic arch.

Bat Capture and Measurements: We used mist nets of different lengths (6, 9, and 12 m) set at ground level to capture bats at three localities. The number of mist nets set in each locality varied based on the availability of suitable flyways but averaged approximately eight mist nets per night. Voucher specimens of bats were prepared following the same method described for marsupials and rodents.

External measurements for bats were taken from dead individuals prior to specimen preparation, as follows:

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

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

Hind-foot length (HF): From the anterior edge of the base of the calcar to the tip of the claw of the longest toe.

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

Forearm length (FA): From the elbow (tip of the olecranon process) to the wrist (including the carpals). This measurement is made with the wing at least partially folded.

Cranial measurements of bats were taken with digital calipers to the nearest 0.1. Our quantitative comparisons of bat crania are based on the following measurements:

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

Condyloincisive length (CIL): From the posteriormost point on the occipital condyles to the anteriormost point on the upper incisors.

Condylocanine length (CCL): From the posteriormost point on the occipital condyles to the anteriormost point on the upper canines.

Lacrimal breadth (LB): Greatest breadth across the lacrimal (= anteorbital) ridges, when present and well defined.

Postorbital breadth (POB): Least breadth across the frontals posterior to the postorbital processes or bulges.

Zygomatic breadth (ZB): Greatest breadth across the zygomatic arches.

Braincase breadth (BCB): Greatest breadth of the globular part of the braincase.

Mastoid breadth (MB): Greatest cranial breadth across the mastoid region.

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

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

Breadth across canines (BC): Greatest breadth across the outer edges of the crowns of the upper canines.

Dentary length (DENL): Distance from midpoint of condyle to the anteriormost point of dentary.

Mandibular toothrow length (MANDL): Distance from anteriormost surface of the lower canine to the posteriormost surface of m3.

We follow Dávalos et al. (2014; MorphoBank project 891, http://dx.doi.org/10.7934/P891) in assigning homology for bat premolars. When three upper premolars are present (e.g., *Anoura*), the first upper premolar corresponds to P1, the second to P4, and the third one to P5. If only two are present (e.g., *Lophostoma*) these correspond to P4 and P5 and if only one is present (e.g., *Desmodus*) it corresponds to P5. The lower premolar homologies are not as straightforward as those of the upper premolars. When three lower premolars are present (e.g., *Glossophaga*, *Thyroptera*) these correspond to p1, p4 and p5, but if only two are present in some cases they apparently correspond to p1 and p5 (e.g., *Artibeus*, *Sturnira*, *Uroderma*) whereas in other cases they correspond to p4 and p5 (e.g., *Carollia, Desmodus*).

Additional comparative voucher material used in the description of the new species of *Sturnira* is housed in the following museums: American Museum of Natural History, New York (AMNH); the Natural History Museum, London (formerly the British Museum of Natural History, London; BMNH); Carnegie Museum of Natural History, Pittsburgh, (CM); Field Museum of Natural History, Chicago (FMNH); Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima (MUSM); Royal Ontario Museum, Toronto, Ontario (ROM); Museum of Texas Tech University, Lubbock, Texas (TTU), and the Bavarian State Collection of Zoology, Munich (ZSM).

SPECIES ACCOUNTS

Order Didelphimorphia Gill, 1872

Family Didelphidae Gray, 1821

The higher-level taxonomy of this family has changed dramatically from earlier treatments (e.g., Gardner, 2008a) due to the work of Voss and Jansa (2009). Based on strongly supported molecular and morphological analyses, they recognized four subfamilies in Didelphidae: Caluromyinae (for *Caluromys* and *Caluromysiops*), Glironiinae (*Glironia*), Hyladelphinae (*Hyladelphys*), and Didelphinae. Additionally, they recognized four tribes in Didelphinae: Didelphini (for *Chironectes*, *Didelphis*, *Lutreolina*, and *Philander*), Marmosini (*Marmosa*, *Monodelphis*, and *Tlacuatzin*), Metachirini (*Metachirus*), and Thylamyini (*Chacodelphys*, *Cryptonanus*, *Gracilinanus*, *Lestodelphys*, *Marmosops*, and *Thylamys*). Another taxonomic change suggested by Voss and Jansa (2009) is the recognition of the genus *Micoureus* as a subgenus of *Marmosa*.

Subfamily Didelphinae Gray, 1821

Members of this subfamily are characterized by their lack of an anterior cutting edge on the third upper premolar (Voss and Jansa, 2009). All five species of didelphids recorded at the three sampled localities belong to this subfamily.

Tribe Didelphini Gray, 1821

Didelphis marsupialis Linnaeus, 1758

Voucher Material: **Waqanki**: 1 adult male (FMNH 203508); **Tingana**: 1 adult female (MUSM 39246); see table 1 for measurements.

Identification: We consulted descriptions and measurements of *Didelphis marsupialis* provided by Gardner (1973), Patton et al. (2000), Voss et al. (2001), Lemos and Cerqueira (2002), Cerqueira and Tribe (2008), and Hice and Velazco (2012). Our Mayo River basin specimens exhibit all the diagnostic characteristics of this species (e.g., ears entirely black, lack of facial markings, jugal embracing the squamosal zygomatic process both above and below) and fall within the range of measurements previously reported for *Didelphis marsupialis* (table 1).

Remarks: Our two individuals were shot, MUSM 39246 at 06:00 hours in an agricultural field and FMNH 203508 at 22:00 hours in a tree overhanging a chicken coop.

Tribe Marmosini Hershkovitz, 1992

Marmosa (*Micoureus*) *regina* Thomas, 1898

Voucher Material: **Waqanki**: 1 adult male (FMNH 203510); see table 1 for measurements.

Identification: The systematics and taxonomy of this subgenus is still confused and future taxonomic changes will probably be necessary due to the high molecular diversity in this group (e.g., de la Sancha et al., 2011). We consulted the descriptions and measurements of *Marmosa* (*Micoureus*) *regina* provided by Hice and Velazco (2012), Patton et al. (2000), and Voss and Jansa (2009). Our single specimen conforms in all respects to the morphology previously described for *Marmosa regina* (e.g., dense but short fur, base of the tail covered with fur [< 20 mm], palatine fenestrae absent).

Remarks: Our single specimen was caught in a Victor rat trap in a forest.

Tribe Thylamyini Hershkovitz, 1992

Marmosops (*Marmosops*) *caucae* (Thomas, 1900)

Voucher Material: **Tingana**: 1 adult female (FMNH 203324), 2 juvenile males (FMNH 203326; MUSM 39248); see table 2 for measurements.

Identification: We follow Díaz-Nieto et al. (2011) and Díaz-Nieto et al. (2016) in recognizing *M. caucae* as a species distinct from *M. impavidus*. Our specimens conform in all respects to the morphology and measurements described by Díaz-Nieto et al. (2011) for *M. caucae* (e.g., interdigital pad 4 and hypothenar pad of hind foot in contact, two antebrachial vibrissae, palatine fenestrae present, subsquamosal foramen constricted anteroposteriorly, absence of accessory cusps on the upper canine).

Remarks: The adult female was caught in a Victor rat trap in an agricultural field. The two adult males were caught in Victor rat traps in a *renacal* (flooded forest of *Coussapoa trinervia*).

Marmosops (*Marmosops*) *noctivagus* (Tschudi, 1845)

Voucher Material: **El Diamante**: 1 adult male (MUSM 39249); see table 2 for measurements.

Identification: We consulted the descriptions and measurements of *Marmosops noctiva-*

TABLE 1

External and craniodental measurements (mm) and weights (g) of *Didelphis marsupialis* and *Marmosa regina*

	Didelphis marsupialis		*Marmosa regina*
	FMNH 203508 ♂	MUSM 39246 ♀	FMNH 203510 ♂
W	1840	1270	107.5
TTL	840	814	418
TL	431	415	238
HF	61	57	27
EL	54	49	26
CBL	105.5	–	42.1
NB	16.1	13.3	6.3
LIB	20.7	19.5	8.2
LPB	12.6	–	7.8
PB	32.2	28.6	14.0
PL	64.6	–	23.0
ZB	56.5	–	24.3
MTR	42.6	42.8	17.4
LM	19.6	20.5	9.0

gus provided by Hice and Velazco (2012), Gardner and Creighton (2008), Patton et al. (2000), Díaz-Nieto (2012), and Díaz-Nieto et al. (2016). Our specimen conforms in all respects to previous descriptions of *Marmosops noctivagus*: dorsal pelage dark brown to reddish brown, broad ventral band of white self-colored hairs, presence of lateral carpal tubercles, absence of medial carpal tubercles, supraorbital region distinctly beaded with elevated lateral ridges extending posteriorly onto parietals (lateral ridges are parallel), maxillary fenestra absent, and upper canines without accessory cusps.

Remarks: Caught in a Victor rat trap in an ecotone between farmland and secondary forest.

Marmosops (*Sciophanes*) *bishopi* (Pine, 1981)

Voucher Material: **El Diamante**: 2 adult males (FMNH 203328; MUSM 39247); see table 2 for measurements.

Identification: We consulted the descriptions and measurements of *Marmosops bishopi* provided by Hice and Velazco (2012), Gardner and Creighton (2008), Voss et al. (2001), Díaz-Nieto (2012), Díaz-Nieto et al. (2016), and Díaz-Nieto and Voss (2016). Our specimens conform in all respects to previous descriptions of *Marmosops bishopi*. They have a continuous band of self-colored ventral white hairs, bladelike lateral carpal tubercles, single posterior accessory cusps on the upper canines (anterior accessory cusp absent), and absence of palatal vacuities, all of which are diagnostic characteristics for this species according to Díaz-Nieto and Voss (2016).

Remarks: Both specimens were caught in Victor rat traps in an ecotone between banana/coffee plantations and secondary forest.

Order Chiroptera Blumenbach, 1779

Family Emballonuridae Gervais, 1856

This pantropical family currently comprises 14 extant genera and 54 species, 22 of which are Neotropical. Emballonurids are characterized by long, soft fur, lack of facial ornamentation, unusu-

TABLE 2

External and craniodental measurements (mm) and weights (g) of *Marmosops bishopi*, *M. neblina*, and *M. noctivagus*

	Marmosops bishopi		*M. caucae*			*M. noctivagus*
	FMNH 203328 ♂	MUSM 39247 ♂	FMNH 203324 ♀	FMNH 203326 ♂	MUSM 39248 ♂	MUSM 39249 ♂
W	23	28	31	14	14	25
TTL	247	254	253	194	197	241
TL	136	143	148	112	109	139
HF	17	17	18	15	14	15
EL	16	20	18	19	18	18
CBL	28.6	29.1	30.5	24.7	24.8	29.6
NB	3.4	3.5	3.7	3.4	3.4	3.6
LIB	5.7	5.9	5.6	5.3	5.3	5.9
LPB	6.1	5.9	6.0	5.9	6.0	7.0
PB	8.5	8.8	9.7	7.9	8.1	11.5
PL	16.0	16.3	17.5	14.0	14.2	17.1
ZB	14.5	15.1	16.0	13.3	13.6	16.2
MTR	11.8	11.7	12.4	9.2	10.2	12.5
LM	6.4	5.8	6.3	5.2	4.8	5.9

ally long, thin postorbital processes, and presence of a broad uropatagium from which the tip of the tail emerges dorsally roughly halfway along the length of the membrane (Emmons and Feer, 1997; Simmons and Voss, 1998; Hood and Gardner, 2008; Reid, 2009). Most Neotropical species have glandular wing sacs or pouches located in the propatagium near the elbow (Emmons and Feer, 1997; Reid, 2009). In this study, a single species was recorded at one locality.

Peropteryx kappleri Peters, 1867

Voucher Material: **El Diamante**: 3 adult males (FMNH 203512; MUSM 39109, 39110); see table 3 for measurements.

Identification: We consulted the descriptions and measurements of *Peropteryx kappleri* provided by Sanborn (1937), Goodwin and Greenhall (1961), Husson (1962, 1978), Jones and Hood (1993), Simmons and Voss (1998), and Lim et al. (2010). Two subspecies are currently recognized: *P. k. kappleri* (Central America to Ecuador, Venezuela, Guianas, and southeastern Brazil) and *P. k. intermedius* (southern Peru) (Hood and Gardner, 2008). Our specimens conform in all respects to previous descriptions of the nominate subspecies: brown wings, ears not connected by a band of skin, lateral pterygoid pits small and shallow, and posterior border of the mesopterygoid extension level with the anterior border of the basisphenoid and lateral pterygoid pits, and a posterior cusp present on the anterior upper premolar. Our Mayo River basin voucher material is also encompassed by the range of measurements reported for the nominate subspecies.

Family Phyllostomidae Gray, 1825

The Neotropical family Phyllostomidae is the most ecologically diverse family within Mammalia, containing species variously specialized for insectivory, carnivory, omnivory, nectarivory, palynivory, frugivory, and even sanguivory. Phyl-

TABLE 3

External and craniodental measurements (mm) and weights (g) of *Peropteryx kappleri* (3 males)

W	7.7 (7.0–8.2) 3
TTL	74.7 (67.0–81.0) 3
TL	13.8 (13.0–15.0) 3
HF	10.3 (9.0–11.0) 3
EL	17.3 (16.0–19.0) 3
FA	50.7 (50.0–51.1) 3
GLS	16.7 (16.4–17.0) 3
CIL	16.1 (16.0–16.2) 3
CCL	15.6 (15.5–15.7) 3
LB	6.0 (5.8–6.3) 3
POB	3.1 (3.0–3.2) 3
ZB	10.3 (9.9–10.7) 3
BCB	7.7 (7.6–7.8) 3
MB	8.6 (8.5–8.6) 3
MTR	7.0 (6.9–7.1) 3
BM	7.9 (7.7–8.0) 3
BC	4.5 (4.4–4.6) 3

lostomids are characterized by having a noseleaf or other narial structures, a humerus with a well-developed trochiter, a digit II with a well-developed metacarpal and a small phalanx, a digit III with three completely ossified phalanges, a friction lock on the digits of the feet, a fibula that is proximally cartilaginous, a well-developed tragus, and oviductal folds limited to the extramural oviduct (Simmons and Voss, 1998; Gardner, 2008b).

Subfamily Carolliinae Miller, 1924

Seven species are currently recognized in this monogeneric subfamily, but perhaps two undescribed species have been identified (Solari and Baker, 2006; Velazco, 2013). Velazco (2013) noted that *C. brevicauda* and *C. perspicillata* exhibit the lowest pairwise cytochrome *b* divergence among all the species pairs of the genus, suggesting the possibility that *brevicauda* and *perspicillata* should be synonymized. However, making a nomenclatural decision affecting two of the most studied mammal species in the Neotropics requires analyses of additional markers. We recorded four species, one of them unnamed, at the three sampled localities.

Carollia benkeithi Solari and Baker, 2006

Voucher Material: **El Diamante**: 2 adult males (FMNH 203352; MUSM 39140), 2 adult females (MUSM 39141, 39142); **Waqanki**: 1 adult female (FMNH 203546), 7 adult males (MUSM 39136–39138; FMNH 203348, 203350, 203544); see table 4 for measurements.

Identification: Descriptions and measurements of *Carollia benkeithi* were provided by Solari and Baker (2006) and McLellan and Koopman (2008). No subspecies are currently recognized in *C. benkeithi* (McLellan and Koopman, 2008). Our specimens conform in all respects to previous descriptions of *C. benkeithi*: lateral rim of basisphenoid pits discontinues 3–4 mm anterior to posterolateral margin of basisphenoid, well-developed anterior cingulum of the second upper premolar, second upper premolar oriented in line with the axis of the skull creating an obtuse angle between the margins of the second premolar and

TABLE 4

External and craniodental measurements (mm) and weights (g) of *Carollia benkeithi* and *C. brevicauda*

	Carollia benkeithi		*Carollia brevicauda*	
	9 males	3 females	7 males	17 females
W	10.7 (10.0–12.0) 9	11.5 (11.0–12.0) 3	15.6 (13.5–18.0) 7	14.3 (10.8–16.5) 17
TTL	64.8 (60.0–67.0) 9	63.7 (62.0–65.0) 3	69.3 (61.0–76.0) 7	68.0 (62.0–75.0) 17
TL	9.6 (7.0–12.0) 9	10.2 (9.5–11.0) 3	7.7 (6.0–9.0) 7	9.2 (7.0–13.0) 17
HF	10.9 (9.0–13.0) 9	10.3 (10.0–11.0) 3	12.7 (12.0–15.0) 7	12.5 (10.0–15.0) 17
EL	16.0 (14.0–18.0) 9	17.3 (17.0–18.0) 3	19.3 (16.0–21.0) 7	19.4 (17.0–21.0) 17
FA	36.0 (32.0–38.0) 9	36.7 (36.0–37.0) 3	40.6 (38.0–42.0) 7	40.8 (39.0–43.0) 17
GLS	19.0 (18.3–19.6) 6	18.7 (18.2–19.0) 3	21.7 (21.3–22.0) 6	21.2 (20.2–22.1) 16
CIL	17.7 (17.3–18.4) 6	17.4 (16.9–17.7) 3	20.3 (19.7–20.5) 6	20.0 (19.3–20.7) 15
CCL	17.2 (16.6–18.0) 6	16.7 (16.4–17.0) 3	19.6 (19.0–19.8) 6	19.3 (18.6–20.0) 16
LB	5.3 (5.0–5.7) 6	5.3 (5.2–5.3) 3	6.2 (6.0–6.5) 6	5.9 (5.6–6.2) 16
POB	5.2 (5.0–5.6) 6	5.4 (5.2–5.6) 3	5.5 (5.4–5.8) 6	5.5 (5.2–5.8) 16
BCB	8.7 (8.5–8.9) 6	8.7 (8.5–8.9) 3	9.6 (9.5–9.8) 6	9.5 (9.2–9.8) 16
MB	9.9 (9.6–10.2) 6	9.8 (9.7–10.0) 3	11.2 (11.0–11.4) 6	10.9 (10.4–11.4) 16
MTR	6.2 (5.9–6.5) 6	6.1 (5.9–6.2) 3	6.9 (6.8–7.1) 6	6.9 (6.5–7.5) 15
BM	6.9 (6.5–7.5) 6	6.9 (6.7–7.1) 3	8.0 (7.8–8.2) 6	7.8 (7.4–8.2) 16
BC	4.3 (4.1–4.4) 6	4.2 (4.0–4.4) 3	4.9 (4.8–5.0) 6	4.7 (4.3–4.9) 15

first molar, and second upper premolar usually not in contact with first upper molar (McLellan and Koopman, 2008). Our Mayo River basin voucher material falls within the range of measurements reported for the species (Solari and Baker, 2006). Velazco (2013) identified the Mayo River basin voucher material as *C. benkeithi*.

Remarks: The two females (MUSM 39141–39142) collected at El Diamante were lactating.

Carollia brevicauda (Schinz, 1821)

Voucher Material: **El Diamante**: 9 adult females (FMNH 203356, 203358, 203554, 203556, 203558; MUSM 39145, 39148, 39149, 39151), 4 males (FMNH 203360; MUSM 39146, 39147, 39150); **Tingana**: 4 adult females (FMNH 203362, 203364; MUSM 39153, 39154), 1 adult male (MUSM 39152); **Waqanki**: 4 adult females (FMNH 203354, 203548, 203552; MUSM 39143), 2 adult males (FMNH 203550; MUSM 39144); see table 4 for measurements.

Identification: We consulted the descriptions and measurements of Pine (1972), Brosset and Charles-Dominique (1990), and McLellan and Koopman (2008). No subspecies are currently recognized in *Carollia brevicauda* (McLellan and Koopman, 2008; Velazco, 2013). Our specimens conform in all respects to previous descriptions of *C. brevicauda*: forearm length ranging from 36 mm to 41 mm; fur long, thick, and fluffy; forearm, tibia, and toes hairy; outer lower incisors not obscured by cingula of canines when lower jaw viewed in dorsal view; labial outline of upper toothrow evenly curved, without a distinct notch; crown of first lower incisor triangular in outline; and trigonid of m1 distinctly narrower than talonid (Pine, 1972; McLellan and Koopman, 2008). Velazco (2013) identified the Mayo River basin voucher material as *C. brevicauda*.

Remarks: The wing tips of one male (MUSM 39146) and entire pinnae of one female (FMNH 203358) specimen were white. Twenty-one individuals were captured and released, 9 in the Waqanki and 12 in El Diamante localities. Of the released individuals, two females were pregnant (El Diamante) and two others were lactating (one from each locality).

Carollia perspicillata (Linnaeus, 1758)

Voucher Material: **El Diamante**: 8 adult females (FMNH 203374, 203380, 203570; MUSM 39162, 39164, 39165, 39166, 39169), 6 adult males (FMNH 203376, 203378, 203572; MUSM 39163, 39167, 39168); **Tingana**: 12 adult females (FMNH 203382, 203384, 203386, 203388, 203390, 203392, 203396; MUSM 39170, 39171, 39174, 39177, 39178), 7 adult males (FMNH 203394, 203574, 203576; MUSM 39172, 39173, 39175, 39176); **Waqanki**: 9 adult females (FMNH 203368, 203370, 203372, 203560, 203566; MUSM 39155, 39156, 39157, 39160), 7 adult males (FMNH 203366, 203562, 203564, 203568; MUSM 39158, 39159, 39161); see table 5 for measurements.

Identification: Descriptions and measurements of *Carollia perspicillata* were provided by Pine (1972), Goodwin and Greenhall (1961), Husson (1962, 1978), Brosset and Charles-Dominique (1990), Cloutier and Thomas (1992), and McLellan and Koopman (2008). We follow Velazco (2013) in not recognizing subspecies in *C. perspicillata.* Our Mayo River basin specimens exhibit all the diagnostic characteristics of the species (e.g., forearm longer than 39 mm; fur relatively short, sparse, and coarse; forearm and toes naked or only sparsely haired; half or more of the outer lower incisors obscured by cingula of canines, when lower jaw viewed from directly above; V-shaped lower jaw, with straight rami; maxillary toothrow length more than 7.4 mm) and its measurements fall within the ranges reported for *C. perspicillata.* Velazco (2013) identified the Mayo River basin voucher material as *C. perspicillata.*

Remarks: Four females collected by us were lactating (FMNH 203377, 203388, 203390; MUSM 39177). Sixty individuals were captured and released, 36 from the El Diamante, four from the Tingana, and 20 from the Waqanki localities. Of the released individuals, one female was pregnant (El Diamante) and two others were lactating (one from each, El Diamante and Waqanki localities).

Carollia sp.

Voucher Material: **El Diamante**: 1 adult female (FMNH 203398); see table 5 for measurements.

Identification: This unnamed *Carollia* species was first recognized by Solari and Baker (2006) based on specimens from eastern Ecuador and northeastern Peru. We were unable to find any discrete morphological characteristic that would distinguish this unnamed species from *C. benkeithi* or *C. castanea*. Based on the analysis of cytochrome *b* sequences, Velazco (2013) identified our specimen from El Diamante as a member of this unnamed taxon.

Remarks: Our only specimen of *Carollia* sp. was lactating. We continue to treat this as an unnamed taxon pending a more thorough revision of the genus.

Subfamily Desmodontinae Wagner, 1840

Three monotypic genera are recognized in this subfamily (Kwon and Gardner, 2008); two of these were recorded in the sampled localities.

Desmodus rotundus
(É. Geoffroy St.-Hilaire, 1810)

Voucher Material: **El Diamante**: 2 adult females (FMNH 203336; MUSM 39183), 8 adult males (FMNH 203332, 203334, 203516, 203518, 203520; MUSM 39184, 39185, 39186); **Tingana**: 1 adult female (MUSM 39187); **Waqanki**: 4 adult females (FMNH 203330, 203514; MUSM 39180, 30182), 1 adult male (MUSM 39181); see table 6 for measurements.

TABLE 5
External and craniodental measurements (mm) and weights (g) of *Carollia perspicillata* and *C.* sp. nov.

	Carollia perspicillata		*Carollia* sp. nov.
	20 males	29 females	FMNH 203398 ♀
W	16.6 (13.0–18.0) 19	15.4 (11.0–20.0) 25	38.5
TTL	73.0 (66.0–79.0) 20	72.2 (63.0–84.0) 29	61.0
TL	9.0 (7.0–14.0) 20	9.3 (6.0–13.0) 29	9.0
HF	12.3 (11.0–14.0) 20	13.1 (11.0–19.0) 29	13.0
EL	19.5 (18.0–21.0) 20	19.8 (17.0–22.0) 29	18.5
FA	43.2 (39.0–47.0) 20	43.2 (41.0–46.0) 29	37.5
GLS	22.1 (20.9–23.3) 19	21.9 (21.0–22.9) 25	19.2
CIL	20.9 (19.8–21.6) 19	20.7 (19.8–21.2) 25	18.0
CCL	20.2 (19.0–20.9) 19	20.0 (19.1–20.6) 25	17.4
LB	5.9 (5.6–6.1) 19	5.9 (5.6–6.3) 25	5.4
POB	5.6 (5.1–5.9) 19	5.5 (5.2–5.8) 25	5.4
BCB	9.5 (9.1–10.0) 19	9.4 (9.0–9.8) 25	8.9
MB	11.0 (10.5–11.6) 19	10.9 (10.4–11.4) 25	9.9
MTR	7.6 (7.3–7.9) 19	7.5 (6.7–8.1) 25	6.5
BM	7.8 (7.1–8.3) 19	7.8 (7.2–8.3) 25	6.9
BC	5.0 (4.6–5.4) 19	4.8 (4.4–5.1) 25	4.3

Identification: Descriptions and measurements of *Desmodus rotundus* have been provided by Goodwin and Greenhall (1961), Husson (1962), Swanepoel and Genoways (1979), Greenhall et al. (1983), and Simmons and Voss (1998). Currently two subspecies are recognized: *D. r. murinus* (northwestern Mexico southward to northern and western Colombia, and from the Pacific lowlands and western slopes of the Andes in Ecuador and Peru) and *D. r. rotundus* (Trinidad, Venezuela, Guianas, Amazon basin of Colombia, Ecuador, Peru, Brazil, and Bolivia, south through Paraguay and Uruguay into Chile and northern Argentina) (Kwon and Gardner, 2008). Our specimens conform in all respects to previous descriptions of *D. rotundus*: thumb greatly elongated, longer than hind foot, and with the presence of two basal pads; ventral sulcus present on tongue; inner lower incisors bicuspidate; and one upper molar on each side (Goodwin and Greenhall, 1961; Kwon and Gardner, 2008; Cirranello et al., 2016). Our Mayo River basin voucher material belongs to the nominate subspecies.

Remarks: One female (FMNH 203336) that we collected was lactating.

Diphylla ecaudata Spix, 1823

Voucher Material: **El Diamante**: 1 adult female (MUSM 39188), 2 adult males (FMNH 203522; MUSM 39189); see table 6 for measurements.

Identification: Descriptions and measurements of *Diphylla ecaudata* have been provided by Swanepoel and Genoways (1979), Greenhall et al. (1984), and Kwon and Gardner (2008). Currently two subspecies are recognized: *D. e. centralis* (southern United States southward through eastern Mexico and Central America) and *D. e. ecaudata* (Venezuela, Colombia, Ecuador, Peru, Bolivia, and Brazil, excluding the central Amazon

TABLE 6

External and craniodental measurements (mm) and weights (g) of *Desmodus rotundus* and *Diphylla ecaudata*

	Desmodus rotundus		*Diphylla ecaudata*		
	9 males	7 females	FMNH 203522 ♂	MUSM 39189 ♂	MUSM 39188 ♀
W	31.7 (24.0–36.0) 9	39.4 (37.0–45.5) 7	27.5	29.0	25.0
TTL	81.9 (78.0–85.0) 9	90.6 (86.0–95.0) 7	85.0	83.0	86.0
HF	17.0 (15.0–19.0) 9	16.6 (14.0–20.0) 7	14.0	13.0	17.0
EL	18.8 (17.0–20.0) 9	18.9 (16.0–20.0) 7	13.0	13.0	17.0
FA	61.9 (60.0–64.0) 9	65.3 (65.0–67.0) 7	54.0	53.0	53.0
GLS	22.8 (22.2–23.6) 8	23.3 (22.8–24.0) 5	20.9	20.8	21.0
CIL	22.3 (21.7–23.0) 8	22.9 (22.5–23.2) 5	20.6	20.0	20.0
CCL	20.1 (19.5–20.8) 8	20.7 (20.4–21.0) 5	18.7	18.2	18.2
LB	6.4 (5.9–6.7) 8	6.5 (6.4–6.6) 5	6.2	6.5	6.3
POB	5.5 (5.2–5.9) 8	5.6 (5.2–5.9) 5	6.8	6.6	6.8
ZB	12.3 (11.7–13.0) 8	12.5 (12.1–12.8) 5	12.9	12.1	12.5
BCB	12.3 (12.0–12.6) 8	12.6 (12.1–13.5) 5	11.2	11.4	11.2
MB	12.4 (12.1–12.8) 8	12.8 (12.6–13.2) 5	12.0	11.8	11.9
MTR	3.7 (3.5–3.8) 8	3.7 (3.4–3.8) 5	3.3	3.8	3.6
BM	6.1 (5.6–6.4) 8	6.6 (6.4–6.9) 5	5.7	5.8	5.6
BC	6.1 (5.8–6.4) 8	6.3 (6.0–6.4) 5	5.2	5.3	5.3

basin) (Greenhall et al., 1984; Kwon and Gardner, 2008). Our Mayo River basin specimens exhibit the diagnostic characteristics of the species: thumb small (usually less than 13 mm), lacking basal pads; uropatagium well furred; occlusal margin of lower inner incisors with four lobes, of lower outer incisors with three lobes; two upper incisors and two lower molars on each side (Kwon and Gardner, 2008; Cirranello et al., 2016). Our Mayo River basin voucher material represents the nominate subspecies.

Remarks: Our female (MUSM 39188) was lactating.

Subfamily Glossophaginae Bonaparte, 1845

A total of 14 genera and 35 species are currently recognized in this subfamily (Simmons, 2005; Griffiths and Gardner, 2008a; Nogueira et al., 2012). We recorded three species at the three sampled localities.

Anoura caudifer (É. Geoffroy St.-Hilaire, 1818)

Voucher Material: **Tingana**: 2 adult males (FMNH 203340; MUSM 39113); **Waqanki**: 4 adult females (FMNH 203338, 203526; MUSM 39111, 39112), 1 adult male (FMNH 203524); see table 7 for measurements.

Identification: Descriptions and measurements of *Anoura caudifer* have been provided by Husson (1962), Handley (1984), Molinari (1994), Simmons and Voss (1998), Mantilla-Meluk and Baker (2006), Brosset and Charles-Dominique (1990), and Pacheco et al. (2018). No subspecies are currently recognized in *A. caudifer* (Griffiths and Gardner, 2008a). Our Mayo River basin specimens exhibit the diagnostic characteristics of the species: well-developed calcar, slightly smaller than the foot; presence of a short tail; lower lip protruding less than 3 mm beyond upper lip; skull with keel along midline of mesopterygoid fossa that is not flattened posteriorly and usually extends onto septum between basisphenoid pits; and upper last premolar lacking medial internal cusp. Our vouchers fall within the range of measurements reported for *A. caudifer*.

Remarks: Two females (FMNH 203338, 203526) that we collected were pregnant, each with a single embryo (crown-rump length [CRL] = 20 mm).

Anoura geoffroyi Gray, 1838

Voucher Material: **Waqanki**: 2 adult females (FMNH 203530; MUSM 39114), 2 adult males (FMNH 203528; MUSM 39115); see table 7 for measurements.

Identification: The review of the *Anoura geoffroyi* species complex by Mantilla-Meluk and Baker (2010) elevated the two nonnominal subspecies of *A. geoffroyi* to species rank: *A. peruana* (Tschudi, 1844) and *A. lasiopyga* (Peters, 1868). Based on the distributions provided by Mantilla-Meluk and Baker (2010), two *Anoura* species occur in Peru: *A. peruana* from the middle to high elevations of the Andes from Bolivia to Colombia, and *A. geoffroyi* from middle and low elevations of the eastern versant of the Andes from Brazil to northern South America, including the island of Trinidad. However, Pacheco et al. (2018) suggested that Mantilla-Meluk and Baker (2010) erroneously removed *A. geoffroyi* from the list of species present in Peru. Our Mayo River basin voucher material conforms with previous descriptions of *A. geoffroyi*, sharing the diagnostic characteristics of the species with specimens from Brazil (e.g., AMNH 78288, 78296; see below) and hence confirming presence of this species in Peru.

Descriptions and measurements of *Anoura geoffroyi* have been reported by Griffiths and Gardner (2008a) and Mantilla-Meluk and Baker (2010). No subspecies are currently recognized in *A. geoffroyi* sensu stricto (Mantilla-Meluk and Baker, 2010). The Mayo River basin specimens exhibit the diagnostic characteristics of the species: narrow uropatagium with a fringe of hair; lack of tail; zygomatic arches present; medial internal cusp of P5 prominently protruding from narrow base of tooth; upper and lower last two premolars narrow; and first lower premolar approximately the same size and shape as other lower premolars (Griffiths and Gardner, 2008a; Mantilla-Meluk and Baker, 2010).

Glossophaga soricina (Pallas, 1766)

Voucher Material: **El Diamante**: 1 adult female (MUSM 39193); **Tingana**: 1 adult male (FMNH 203536); **Waqanki**: 6 adult males (FMNH 203342, 203532, 203534; MUSM 39190–39192); see table 7 for measurements.

Identification: Descriptions and measurements of *Glossophaga soricina* have been provided by Goodwin and Greenhall (1961), Husson (1962), Alvarez et al. (1991), Webster (1993), Simmons and Voss (1998), and Griffiths and Gardner (2008a). Currently five subspecies are recognized: *G. s. antillarum* (Jamaica), *G. s. handleyi* (northern Mexico southward to northern and western Colombia), *G. s. mutica* (Tres Marías Islands, Mexico), *G. s. soricina* (eastern Colombia, Ecuador, and Peru; Venezuela, Trinidad, Guyana, Suriname, French Guiana, Brazil, northern Bolivia, eastern Paraguay, and northern Argentina), and *G. s. valens* (western Ecuador and Peru, and eastward into the upper Marañon River of the Department of Amazonas, Peru) (Alvarez et al., 1991; Webster, 1993). *G. soricina* is easily distinguished from other species of the genus by craniodental features including: mandibular symphyseal ridge well developed; upper inner incisors large and procumbent, extending anteriorly well beyond upper outer incisors; M1 with well-developed parastyle; lower incisors crowded, usually in contact with each other and canines; and m1 and m2 with well-developed mesostyles (Alvarez et al., 1991; Webster, 1993; Griffiths and Gard-

TABLE 7

External and craniodental measurements (mm) and weights (g) of *Anoura caudifer*, *A. geoffroyi*, and *Glossophaga soricina*

	Anoura caudifer		*Anoura geoffroyi*		*Glossophaga soricina*	
	3 males	4 females	2 males[a]	2 females[b]	7 males	MUSM 39193 ♀
W	10.0 (10.0–10.0) 3	9.7 (8.6–10.5) 3	9.4, 15.2	14.5, 14.0	7.8 (7.0–8.5) 7	8.0
TTL	68.3 (65.0–71.0) 3	67.5 (64.0–70.0) 4	64.0, 64.0	69.0, 67.0	59.9 (54.0–64.0) 7	65.0
TL	4.0 (3.0–5.0) 3	4.5 (4.0–6.0) 4	–	–	5.9 (4.0–7.0) 7	5.0
HF	10.7 (10.0–12.0) 3	9.8 (8.0–11.0) 4	10.0, 11.5	11.0, 11.0	9.9 (8.0–11.0) 7	9.0
EL	14.0 (13.0–15.0) 3	13.9 (13.0–14.5) 4	16.0, 15.0	15.0, 16.0	13.1 (12.0–14.0) 7	15.0
FA	37.2 (35.5–38.0) 3	36.0 (36.0–36.0) 4	42.0, 42.0	45.0, 44.0	33.8 (32.0–36.0) 7	36.0
GLS	21.8 (21.6–22.0) 3	21.9 (21.5–22.4) 4	23.0, 23.4	24.1, 23.6	19.3 (18.6–19.6) 6	19.4
CIL	21.7 (21.3–22.1) 3	21.7 (21.4–22.0) 3	22.9, 23.5	24.1, 23.6	19.1 (18.5–19.5) 5	19.7
CCL	21.1 (20.7–21.5) 3	21.2 (20.9–21.4) 3	22.2, 22.9	23.5, 22.8	18.1 (17.7–18.6) 6	18.8
LB	4.4 (4.2–4.6) 3	4.4 (4.3–4.6) 4	4.7, 4.7	4.7, 4.5	3.8 (3.7–4.0) 6	4.1
POB	4.5 (4.5–4.6) 3	4.6 (4.6–4.8) 4	5.0, 4.9	4.7, 4.7	4.5 (4.3–4.6) 6	4.7
ZB	9.5, 9.8	9.7 (9.5–9.8) 3	–, 10.5	10.4, 10.4	9.0 (8.8–9.3) 6	8.9
BCB	8.8 (8.7–8.9) 3	9.0 (8.7–9.1) 4	9.6, 9.7	9.4, 9.7	8.5 (8.3–8.8) 6	8.5
MB	9.4 (9.1–9.6) 3	9.3 (9.2–9.4) 4	10.1, 9.9	10.1, 9.7	8.7 (8.4–9.1) 6	8.7
MTR	8.3 (7.9–8.6) 3	8.4 (8.3–8.4) 3	9.0, 9.0	9.8, 9.0	6.8 (6.6–7.1) 6	7.3
BM	5.7 (5.6–6.0) 3	5.7 (5.7–5.8) 3	6.1, 5.9	6.1, 6.0	5.2 (5.1–5.4) 6	5.4
BC	4.3 (4.1–4.5) 3	4.1 (4.0–4.2) 3	4.3, 4.4	4.5, 4.3	3.6 (3.5–3.8) 6	3.6

[a] FMNH 203528, MUSM 39115.

[b] MUSM 39114, FMNH 203530.

TABLE 8

External and craniodental measurements (mm) and weights (g) of *Lionycteris spurrelli* and *Lonchophylla handleyi*

	Lionycteris spurrelli			*Lonchophylla handleyi*
	MUSM 39195 ♂	FMNH 203538 ♂	5 females	FMNH 203346 ♂
W	5.5	–	6.4 (5.5–7.0) 5	15.5
TTL	53.0	59.0	59.6 (56.0–63.0) 5	81.0
TL	8.0	5.0	6.6 (6.0–8.0) 5	5.0
HF	9.0	9.0	10.4 (9.0–12.0) 5	12.0
EL	11.0	12.0	11.4 (8.0–13.0) 5	16.0
FA	33.0	34.0	35.2 (35.0–36.0) 5	42.0
GLS	18.1	18.9	19.1 (18.7–19.6) 5	25.2
CIL	17.4	18.6	18.8 (18.4–19.4) 5	25.6
CCL	17.1	17.8	18.0 (17.8–18.5) 5	24.5
LB	3.3	3.7	3.8 (3.7–4.0) 5	4.7
POB	3.7	4.0	4.1 (3.9–4.3) 5	5.2
BCB	7.9	8.2	8.1 (7.9–8.5) 5	10.0
MB	8.1	8.3	8.4 (8.2–8.6) 5	11.0
MTR	6.0	6.3	6.4 (6.3–6.6) 5	10.1
BM	–	4.9	5.1 (4.9–5.3) 5	6.1
BC	2.8	3.1	3.2 (3.0–3.4) 5	3.9

ner, 2008a). Our Mayo River basin voucher material belongs to the nominate subspecies.

Subfamily Lonchophyllinae Griffiths, 1982

Twenty species are recognized in the five genera of this subfamily (Velazco et al., 2017). We recorded two species in the sampled localities.

Lionycteris spurrelli Thomas, 1913

Voucher Material: **El Diamante**: 5 adult females (FMNH 203344, 203540; MUSM 39194, 39196, 39197), 1 adult male (FMNH 203538), 1 juvenile male (MUSM 39195); see table 8 for measurements.

Identification: Descriptions and measurements of *Lionycteris spurrelli* have been provided by Phillips (1971), Carter and Dolan (1978), Swanepoel and Genoways (1979), Williams and Genoways (1980), Koopman (1993), Zortéa et al. (1998), Gregorin and Ditchfield (2005), Woodman and Timm (2006), and Woodman (2007). No subspecies are currently recognized in *L. spurrelli* (Griffiths and Gardner, 2008b). Our specimens conform in all respects with previous descriptions of this species and exhibit the diagnostic characteristics of *L. spurrelli*: base of dorsal pelage darker than tips; GLS <21 mm; rostrum shorter than braincase; upper premolars not conspicuously elongated; well-developed lingual cusps present on both upper premolars; p4 and p5 short and broad; and main cusps of p4 and p5 high and narrow (Woodman and Timm, 2006; Griffiths and Gardner, 2008b). Our vouchers fall within the range of measurements reported for *L. spurrelli*.

Remarks: Two females (MUSM 39196, 39197) that we collected were lactating.

Lonchophylla handleyi Hill, 1980

Voucher Material: **Tarapoto**: 1 subadult male (FMNH 203346); see table 8 for measurements.

Identification: Descriptions and measurements of *Lonchophylla handleyi* have been provided by Gardner (1976), Bowles et al. (1979), Hill (1980), Solari et al. (1999), Dávalos (2004), Woodman and Timm (2006), Woodman (2007), Dávalos and Corthals (2008), and Mantilla-Meluk et al. (2010). No subspecies are currently recognized in *L. handleyi* (Griffiths and Gardner, 2008b). Our specimen conforms in almost all respects to previous descriptions and exhibits the diagnostic characteristics of *L. handleyi*: fringe of hairs on the uropatagium; moderately inflated postorbital region; postorbital processes absent; posterior margin of infraorbital foramen located above the posterior root of P5; and weakly developed posterolingual cusp of P5 (Woodman and Timm, 2006; Griffiths and Gardner, 2008b). Because our specimen is a subadult, its measurements fall at the lower end or just outside the ranges previously reported for *L. handleyi.*

Subfamily Phyllostominae Gray, 1825

The subfamily Phyllostominae currently includes 22 species grouped into 10 genera (Baker et al., 2016; Cirranello et al., 2016). We recorded a single species at the sampled localities.

Lophostoma silvicolum d'Orbigny, 1836

Voucher Material: **Waqanki**: 1 adult male (FMNH 203542); see table 9 for measurements.

Identification: Descriptions and measurements of *Lophostoma silvicolum* have been provided by Swanepoel and Genoways (1979), Baker et al. (2004), Velazco and Cadenillas (2011), and Velazco and Gardner (2012). Currently three subspecies are recognized: *L. s. centralis* (eastern Honduras to Costa Rica), *L. s. laephotis* (Guianas to the lower Amazon basin of Brazil), and *L. s. silvicolum* (Panama through South America east of the Andes, in Bolivia, Brazil, Colombia, Ecuador, Paraguay, Peru, and Venezuela) (Williams and Genoways, 2008; Velazco and Cadenillas, 2011). *L. silvicolum* is distinguished from other species in the genus by the following combination of characteristics: large size (FA >45 mm, GLS > 4 mm); brown to gray ventral fur; strong indentation present on the lingual cingulum of the upper canine; and M1 hypocone moderately to well developed (Velazco and Gardner, 2012).

Velazco and Cadenillas (2011) analyzed cytochrome *b* sequences from all *Lophostoma* species, including our specimen (FMNH 203542). The specimens of *L. silvicolum* recovered from different localities throughout its range grouped into three clades. One of these clades was sister to *L. evotis* and contained specimens from Panama, Venezuela, eastern Ecuador, and eastern Peru (Mayo River basin). However, after reviewing more than 250 specimens of *L. silvicolum* throughout its entire distribution, Velazco and Cadenillas (2011) could not find a clear morphological or morphometric pattern that matched either the three molecular clades or the traditionally recognized subspecies. Before resolving this problem by making a taxonomic decision to either recognize the three subspecies as full species or, alternatively, lump the three subspecies and *L. evotis* together into one species, we believe that it is necessary to analyze nuclear and additional mitochondrial markers. Accordingly, here we simply refer our specimen to *L. silvicolum* as traditionally recognized. Our specimen conforms with previous descriptions and exhibits all the diagnostic characteristic of the species, and its measurements fall within the range previously documented for the species.

Subfamily Rhinophyllinae Baker, Solari, Cirranello, and Simmons, 2016

The lone genus recognized in this subfamily contains three species (McLellan and Koopman, 2008; Baker et al., 2016; Cirranello et al., 2016).

TABLE 9

External and craniodental measurements (mm) and weights (g) of *Lophostoma silvicolum* and *Rhinophylla pumilio*

	Lophostoma silvicolum	*Rhinophylla pumilio*	
	FMNH 203542 ♂	4 males	10 females
W	25.0	9.2 (8.5–10.0) 4	9.6 (8.2–11.0) 10
TTL	104.0	52.0 (49.0–55.0) 4	52.2 (49.0–55.0) 10
TL	21.0	--	--
HF	15.0	8.0 (5.0–11.0) 4	9.5 (8.0–11.0) 10
EL	37.0	15.0 (14.0–16.0) 4	16.1 (15.0–17.0) 10
FA	57.0	34.3 (33.0–35.0) 4	35.0 (34.0–36.0) 9
GLS	26.7	18.2 (17.8–18.4) 4	18.2 (17.5–18.7) 10
CIL	23.7	16.9 (16.7–17.2) 4	17.0 (16.4–17.6) 10
CCL	23.1	16.2 (16.0–16.4) 4	16.2 (15.7–16.7) 10
LB	6.2	4.9 (4.8–5.0) 4	4.8 (4.7–5.1) 10
POB	4.0	5.4 (5.2–5.5) 4	5.3 (5.1–5.5) 10
ZB	12.9	--	--
BCB	11.0	8.3 (8.2–8.4) 4	8.2 (8.0–8.4) 10
MB	13.6	9.2 (9.1–9.2) 4	9.2 (8.9–9.4) 10
MTR	9.7	5.1 (5.1–5.2) 4	5.2 (4.9–5.5) 10
BM	8.7	6.5 (6.3–6.7) 4	6.5 (5.8–6.9) 10
BC	6.2	4.7 (4.6–4.8) 4	4.7 (4.5–5.0) 10

One species was recorded in two of the three sampled localities.

Rhinophylla pumilio Peters, 1865

Voucher Material: **Tingana**: 6 adult females (FMNH 203402, 203404, 203406; MUSM 39219–39221), 2 adult males (MUSM 39218, 39222); **Waqanki**: 4 adult females (FMNH 203400, 203580; MUSM 39216, 39217), 2 adult males (FMNH 203578; MUSM 39215); see table 9 for measurements.

Identification: Descriptions and measurements of *Rhinophylla pumilio* have been provided by Swanepoel and Genoways (1979), Anderson (1997), Simmons and Voss (1998), Rinehart and Kunz (2006), and McLellan and Koopman (2008). No subspecies are currently recognized in *R. pumilio* (McLellan and Koopman, 2008). Our specimens conform in all respects to previous descriptions and show the characteristics described for the species: margin of uropatagium naked; upper inner incisors relatively broad and with three or four well-defined lobes; and gap absent between upper incisor and canine. Measurements of our vouchers fall within the ranges reported for *R. pumilio*.

Remarks: Two females (FMNH 203400, 203404) that we collected were lactating.

Subfamily Stenodermatinae Gervais, 1856

Ninety-eight species grouped into 19 genera are currently recognized in the subfamily Stenodermatinae (Simmons, 2005; Taddei and Lim, 2010;

TABLE 10

External and craniodental measurements (mm) and weights (g) of *Artibeus lituratus*, *A. obscurus*, and *A. planirostris*

	Artibeus lituratus		*Artibeus obscurus*		*Artibeus planirostris*	
	10 males	8 females	4 males	2 females[a]	FMNH 203434 ♂	5 females
W	67.3 (60.0–76.0) 8	69.0 (54.0–82.0) 8	33.5 (30.0–35.0) 4	34.0, 32.0	60.0	56.0 (46.0–72.0) 5
TTL	99.6 (95.0–105.0) 8	97.6 (90.0–101.0) 8	80.3 (77.0–83.0) 4	93.0, 78.0	99.0	94.4 (93.0–95.0) 5
HF	17.4 (15.0–20.0) 8	16.8 (12.0–20.0) 8	15.3 (13.0–17.0) 4	13.0, 15.0	15.0	17.8 (15.0–21.0) 5
EL	22.4 (21.0–24.0) 8	22.8 (21.0–25.0) 8	21.4 (19.0–23.0) 4	21.0, 22.5	23.0	24.7 (24.0–26.0) 5
FA	72.9 (71.0–75.0) 7	72.6 (68.0–78.0) 8	60.3 (58.0–64.0) 4	61.0, 59.0	71.0	68.8 (65.0–74.0) 5
GLS	31.3 (30.4–32.1) 10	31.0 (29.8–32.0) 8	27.8 (27.7–27.9) 4	26.7, 26.8	32.2	30.5 (29.2–31.5) 5
CIL	28.1 (27.5–28.9) 10	28.1 (27.3–28.9) 8	24.8 (24.3–25.5) 4	24.4, 24.3	28.7	28.1 (27.2–28.8) 5
CCL	27.3 (26.8–28.1) 10	27.4 (26.8–28.2) 8	24.2 (23.7–25.0) 4	23.8, 23.7	28.0	27.3 (26.4–27.8) 5
LB	7.9 (7.1–8.6) 10	7.8 (7.1–8.3) 8	7.2 (6.9–7.6) 4	7.0, 6.8	9.2	9.0 (8.8–9.6) 5
POB	6.8 (6.3–7.1) 10	6.8 (6.4–7.2) 8	6.4 (6.1–6.8) 4	6.4, 6.5	8.0	7.8 (7.4–8.3) 5
ZB	18.8 (17.3–19.7) 10	18.9 (18.0–19.4) 8	16.8 (16.7–17.2) 4	16.1, 15.3	20.9	19.2 (18.3–20.3) 5
BCB	13.7 (13.1–14.3) 10	13.4 (13.0–13.9) 8	12.2 (11.9–12.4) 4	11.9, 11.3	14.1	13.4 (13.0–13.9) 5
MB	17.1 (16.0–17.8) 9	16.7 (16.1–17.1) 8	14.5 (14.2–15.1) 4	14.0, 13.8	17.0	16.8 (16.1–17.8) 5
MTR	11.2 (10.8–11.6) 10	11.2 (10.8–11.7) 8	10.2 (9.8–10.5) 4	9.5, 9.3	11.9	11.5 (10.8–11.8) 5
BM	13.6 (13.0–14.3) 10	13.7 (13.1–14.3) 8	12.5 (12.2–12.8) 4	11.9, 11.8	14.6	14.1 (13.9–14.4) 5
BC	8.9 (8.5–9.6) 10	8.9 (8.5–9.2) 8	8.0 (7.8–8.2) 4	7.5, 7.9	9.2	8.8 (8.1–9.1) 5

[a] MUSM 39130, FMNH 203604.

TABLE 11

External and craniodental measurements (mm) and weights (g) of *Artibeus anderseni* and *A. glaucus*

	Artibeus anderseni		*Artibeus glaucus*	
	2 males[a]	3 females	4 males	3 females
W	9.0, 11.0	11.0 (9.4–12.0) 3	10.8 (10.0–12.0) 3	11.7 (11.0–12.0) 3
TTL	52.0, 54.0	54.0 (50.0–58.0) 3	57.3 (54.0–61.0) 4	55.3 (51.0–58.0) 3
HF	10.0, 10.0	10.2 (9.0–11.5) 3	9.8 (9.0–11.0) 4	10.3 (9.0–12.0) 3
EL	14.0, 16.0	15.2 (14.0–16.0) 3	14.8 (13.0–16.0) 4	(16) 3
FA	35.0, 38.0	39.3 (39.0–40.0) 3	40.5 (39.0–42.0) 4	42.2 (42.0–42.5) 3
GLS	17.7, 18.6	18.6 (18.1–19.0) 3	19.5 (19.2–19.9) 4	19.9 (19.5–20.3) 3
CIL	16.2, 16.8	16.8 (16.6–17.3) 3	17.8 (17.5–18.0) 4	18.2 (17.9–18.5) 3
CCL	15.8, 16.4	16.6 (16.2–17.1) 3	17.4 (17.1–17.8) 4	17.8 (17.5–18.1) 3
LB	4.6, 5.0	5.1 (4.9–5.5) 3	5.8 (5.4–6.0) 4	5.8 (5.7–6.0) 3
POB	4.6, 4.9	4.8 (4.7–5.0) 3	5.3 (5.2–5.3) 4	5.1 (5.0–5.2) 3
ZB	10.8, 11.5	11.3 (11.2–11.5) 3	11.3 (11.1–11.7) 4	11.5 (11.3–11.7) 3
BCB	8.1, 8.9	8.7 (8.5–9.0) 3	9.0 (8.7–9.2) 4	8.9 (8.7–9.1) 3
MB	9.2, 9.8	9.8 (9.6–10.1) 3	10.1 (10.0–10.3) 4	10.2 (10.1–10.3) 3
MTR	5.6, 5.8	5.8 (5.7–6.1) 3	6.5 (6.4–6.6) 4	6.3 (6.0–6.5) 3
BM	7.8, 8.1	8.1 (7.9–8.2) 3	8.3 (8.1–8.4) 4	8.3 (7.9–8.6) 3
BC	5.3, 5.0	5.1 (5.0–5.2) 3	5.4 (5.3–5.8) 4	5.4 (5.2–5.6) 3

[a] FMNH 203438, MUSM 39118.

Velazco et al., 2010; Mantilla-Meluk, 2014; Tavares et al., 2014; Velazco and Lim, 2014; Baker et al., 2016; Cirranello et al., 2016; Molinari et al., 2017). We recorded 14 species at the sampled localities, including an undescribed species of *Sturnira*.

Artibeus Leach, 1821

The genus *Artibeus* currently includes 23 species grouped into two subgenera (*Artibeus* and *Dermanura*) (Hoofer et al., 2008; Redondo et al., 2008; Solari et al., 2009; Cirranello et al., 2016). For decades there has been controversy regarding whether three genera (*Artibeus*, *Dermanura*, and *Koopmania*), two genera (*Artibeus* and *Dermanura*), or only one genus (*Artibeus*) should be recognized to group these species. Recently Cirranello et al. (2016) and Baker et al. (2016) advocate for the recognition of a single genus with two subgenera (*Artibeus* and *Dermanura*) as the most reasonable classification scheme for these taxa. Five *Artibeus* species were recorded at the three sampled localities.

Artibeus (*Artibeus*) *lituratus* (Olfers, 1818)

VOUCHER MATERIAL: **El Diamante**: 1 adult female (MUSM 39125); **Tingana**: 4 adult females (FMNH 203426, 203600, 203602; MUSM 39126), 6 adult males (FMNH 203428, 203430, 203598; MUSM 39127–39129); **Waqanki**: 3 adult females (FMNH 203424; MUSM 39123, 39124), 4 adult males (FMNH 203422, 203594, 203596; MUSM 39122); see table 10 for measurements.

IDENTIFICATION: We consulted descriptions and measurements of *Artibeus lituratus* provided by Goodwin and Greenhall (1961), Swanepoel and Genoways (1979), Davis (1984), Koepcke and Kraft (1984), Handley (1987), Brosset and Charles-Dominique (1990), Marques-Aguiar (1994), Anderson (1997), Simmons and Voss (1998), Rui et al. (1999), and Marchan-Rivadeneira et al. (2012). Currently, two subspecies are recognized: *A. l. lituratus* (south of the Orinoco basin in Venezuela, east through the Guianas and southward, east of the Andes in Colombia, Ecuador, Brazil, Peru, and Bolivia into Paraguay and northern Argentina) and *A. l. palmarum* (southeastern Mexico south to northern and western Colombia, northern Venezuela, Trinidad and Tobago, and Lesser Antilles) (Marques-Aguiar, 2008; Larsen et al., 2013). Our Mayo River basin specimens exhibit the diagnostic characteristics of the species: large size (FA >63); brown dorsal and ventral pelage; ventral pelage without silver frosting; well-defined white facial stripes; dorsal surface of uropatagium furred; M1 with weakly developed hypocone; and M3 absent (Marques-Aguiar, 2008; Larsen et al., 2013). Measurements of the Mayo River specimens fall within the ranges reported for the nominate subspecies.

Remarks: One female (MUSM 39124) that we collected was lactating.

Artibeus (*Artibeus*) *obscurus* (Schinz, 1821)

Voucher Material: **Tingana**: 2 adult females (FMNH 203604; MUSM 39130), 4 adult males (FMNH 203432; MUSM 39131–39133); see table 10 for measurements.

Identification: We consulted descriptions and measurements of *Artibeus obscurus* (under the name *A. fuliginosus* in earlier publications) provided by Koepcke and Kraft (1984), Handley (1987), Brosset and Charles-Dominique (1990), Lim and Wilson (1993), Marques-Aguiar (1994), Simmons and Voss (1998), Haynes and Lee (2004), and Lim et al. (2005). No subspecies are currently recognized in *A. obscurus* (Marques-Aguiar, 2008). Our Mayo River basin specimens exhibit the diagnostic characteristics of the species: medium size (FA 55–69 mm); dorsal pelage blackish and long (8–10 mm); facial stripes pale or obsolete; M3 variably present (Haynes and Lee, 2004; Marques-Aguiar, 2008). Measurements of our specimens fall within the ranges reported for the species.

Artibeus (*Artibeus*) *planirostris* (Spix, 1823)

Voucher Material: **El Diamante**: 2 adult females (FMNH 203608; MUSM 39135); **Tingana**: 1 adult female (FMNH 203436); **Waqanki**: 2 adult females (FMNH 203606; MUSM 39134), 1 adult male (FMNH 203434); see table 10 for measurements.

Identification: We consulted descriptions and measurements of *Artibeus planirostris* provided by Husson (1962, 1978), Patten (1971), Handley (1987), Brosset and Charles-Dominique (1990), Lim and Wilson (1993), Lim (1997), Hollis (2005), and Lim et al. (2005). Currently three subspecies are recognized: *A. p. fallax* (Venezuela [south and east of the Orinoco river]), Trinidad, Grenada, Guyana, Surinam, French Guiana, and the lower Amazon basin of Brazil), *A. p. hercules* (southeastern Colombia and the eastern lowlands of Ecuador, Peru, and Bolivia), and *A. p. planirostris* (southern Bolivia, northern Argentina, Paraguay, and eastern and southern Brazil) (Marques-Aguiar, 2008). The only major morphological difference recognized among subspecies is that *A. p. hercules* tends to be larger than the other subspecies (Hollis, 2005). Based on distribution, the voucher material from Mayo River basin should correspond to the subspecies *A. p. hercules*. However, measurements of our material span the published variation of size for the entire species, and hence do not conform to published characteristics of the subspecies. We therefore recommend against formally recognizing subspecies in *Artibeus planirostris* until truly diagnostic characters can be found, including additional data from molecular markers.

Subgenus Dermanura Gervais, 1856

Small-sized *Artibeus* (*Dermanura*) species are difficult to unequivocally identify based solely on external morphology (Simmons and

TABLE 12
External and craniodental measurements (mm) and weights (g) of *Chiroderma trinitatum* and *Mesophylla macconnelli*

	Chiroderma trinitatum	*Mesophylla macconnelli*	
	MUSM 39179 ♂	FMNH 203618 ♂	MUSM 39198 ♂
W	12.0	5.5	6.4
TTL	60.0	48.0	49.0
HF	10.0	8.0	9.0
EL	15.0	14.0	14.0
FA	42.0	31.0	31.0
GLS	21.3	17.9	17.4
CIL	19.8	16.1	15.9
CCL	19.2	15.7	15.4
LB	5.7	4.3	4.3
POB	5.4	4.4	4.4
ZB	13.1	10.4	10.1
BCB	9.8	8.1	7.7
MB	11.0	9.3	8.8
MTR	7.1	6.0	6.0
BM	9.6	7.3	7.0
BC	4.8	4.2	4.1

Voss, 1998). The majority of the external characteristics proposed to differentiate species of *Dermanura* are highly variable within and among species (e.g., see discussion in Simmons and Voss, 1998). In order to positively identify all our voucher specimens of the subgenus *Dermanura*, we sequenced a fragment of the mitochondrial cytochrome *b* gene and compared it with the sequences published by Solari et al. (2009). The molecular analysis of our sequences grouped our specimens into two species: *A. anderseni* and *A. glaucus*.

Artibeus (*Dermanura*) *anderseni* Osgood, 1916

Voucher Material: **Tingana**: 2 adult males (FMNH 203438; MUSM 39118); **Waqanki**: 3 adult females (FMNH 203610; MUSM 39116, 39117); see table 11 for measurements.

Identification: We consulted descriptions and measurements of *Artibeus anderseni* provided by Webster and Jones (1980), Anderson (1997), and Rocha et al. (2018). No subspecies are currently recognized (Marques-Aguiar, 2008). Our Mayo River basin voucher specimens exhibit the diagnostic characteristics of the species: uropatagium sparsely haired; rostrum elevated (tilted up); weakly developed impression of the optic nerve in the orbit; maxillary toothrow nearly parallel; caniniform P5; broad talon on M1; and presence of two lower molars (Marques-Aguiar, 2008; Díaz et al., 2016; Rocha et al., 2018). Measurements of our specimens fall within the ranges previously reported for the species.

Remarks: One female (MUSM 39116) that we collected was lactating.

Artibeus (*Dermanura*) *glaucus* Thomas, 1893

Voucher Material: **El Diamante**: 1 adult female (FMNH 203616), 2 adult males (FMNH 203614; MUSM 39120); **Tingana**: 1 adult female (MUSM 39121); **Waqanki**: 1 adult female (FMNH 203612), 2 adult males (FMNH 203440; MUSM 39119); see table 11 for measurements.

Identification: We consulted descriptions and measurements of *Artibeus glaucus* provided by Andersen (1908), Davis (1970), Carter and Dolan (1978), Swanepoel and Genoways (1979), Anderson (1997), Lim et al. (2008), and Ortega et al. (2015). No subspecies are currently recognized in *A. glaucus* (Lim et al., 2008). Our Mayo River basin specimens exhibit the diagnostic characteristics of the species: dark gray to blackish dorsal pelage; dark ears; V-shaped posterior margin of uropatagium; rostrum not elevated with a concavity present dorsally; U-shaped posterior border of the hard palate; mesopterygoid fossa not constricted posteriorly on basicranium; well-developed angular process reaching the level of the condyloid process; and presence of three lower molars (Marques-Aguiar, 2008; Díaz et al., 2016). Measurements of our specimens fall within the range reported for the species.

Remarks: One female (FMNH 203616) that we collected was lactating.

Chiroderma trinitatum Goodwin, 1958

Voucher Material: **Waqanki**: 1 adult male (MUSM 39179); see table 12 for measurements.

Identification: We consulted descriptions and measurements of *Chiroderma trinitatum* provided by Goodwin (1958), Goodwin and Greenhall (1961), Baker and Genoways (1976), Gardner (1976), Carter and Dolan (1978), Genoways and Williams (1979), Swanepoel and Genoways (1979), Brosset and Charles-Dominique (1990), Anderson (1997), Simmons and Voss (1998), Lim et al. (2005), Taddei and Lim (2010), Garbino et al. (2012), Tello et al. (2014), and Rocha et al. (2016). Two subspecies are currently recognized: *C. t . gorgasi* (Panama south to western Colombia and northwestern Ecuador) and *C. t. trinitatum* (Trinidad, eastern Colombia, Ecuador, and Peru, and Venezuela, the Guianas, Brazil, and northern Bolivia) (Gardner, 2008c). Our Mayo River basin specimen exhibits the diagnostic characteristics of the nominate subspecies: small size (FA <42.5 mm, GLS <23 mm); dorsal stripe arising between the shoulders and extending across the head; muzzle short and broad; furred legs; uropatagium partially furred, lack of a conspicuous fringe of hair on its trailing edge; skull lacking nasal bones; and upper inner incisors that converge along their distal third, contacting each other at the tips (Simmons and Voss, 1998; Gardner, 2008c; Garbino et al., 2012). Measurements of our specimen fall within the range reported for the species.

Mesophylla macconnelli Thomas, 1901

Voucher Material: **Tingana**: 1 adult male (FMNH 203618); **Waqanki**: 1 adult male (MUSM 39198); see table 12 for measurements.

Identification: We consulted descriptions and measurements of *Mesophylla macconnelli* provided by Goodwin and Greenhall (1962), Ceballos Bendezú (1968), Starrett and Casebeer (1968), Carter and Dolan (1978), Swanepoel and Genoways (1979), Brosset and Charles-Dominique (1990), Anderson (1997), and Simmons and Voss (1998). No subspecies are currently recognized in *M. macconnelli* (Arroyo-Cabrales, 2008a). Our Mayo River basin specimens exhibit the diagnostic characteristics of the species: small size (FA 28–34 mm); ears and noseleaf yellow in live specimens, but paler in museum specimens; small accessory noseleaflike structure present behind the noseleaf; skull short with a relatively narrow rostrum; palate extending well behind the last molars; upper inner incisors long, convergent, and usually with weakly bifid tips; m2 lacking a posterior cuspulid; and minute m3 (Arroyo-Cabrales, 2008a). Measurements of our specimens fall within the range reported for the species.

Platyrrhinus incarum (Thomas, 1912)

Voucher Material: **Waqanki**: 4 adult females (FMNH 203624, 203626; MUSM 39199, 39200), 7 adult males (FMNH 203442, 203620, 203622; MUSM 39201–39204); see table 13 for measurements.

Identification: We consulted descriptions and measurements of *Platyrrhinus incarum* provided by Anderson (1997), Velazco et al. (2010), and Velazco and Lim (2014). No subspecies are currently recognized in *P. incarum* (Velazco et al., 2010). Velazco et al. (2010) identified all the material from Mayo River basin as *P. incarum*. Our Mayo River basin specimens exhibit the diagnostic characteristics of the species: small size (FA 35–40 mm); poorly developed (almost imperceptible) paraoccipital processes; barely perceptible fossa on the squamosal root of the zygomatic arch; two stylar cuspules on the posterior cristid of P4; M1 protocone well developed; stylar cuspule present on lingual face of the paracone of M2; and m2 hypoconid present (Velazco et al., 2010). Measurements of our specimens fall within the range previously reported for the species.

Platyrrhinus infuscus (Peters, 1880)

Voucher Material: **El Diamante**: 5 adult females (FMNH 203452, 203634, 203638; MUSM 39213, 39214), 5 adult males (FMNH 203450, 203454, 203636; MUSM 39211, 39212); **Waqanki**: 4 adult females (FMNH 203630, 203632; MUSM 39206, 39209), 8 adult males (FMNH 203444, 203446, 203448, 203628; MUSM 39205, 39207, 39208, 39210); see table 13 for measurements.

Identification: We consulted descriptions and measurements of *Platyrrhinus infuscus* provided by Cabrera (1958), Gardner and Carter (1972), Swanepoel and Genoways (1979), Velazco (2005), and Velazco and Gardner (2009). No subspecies are currently recognized in *P. infuscus* (Gardner, 2008d). Our Mayo River basin specimens exhibit the diagnostic characteristics of the species: larger size (FA >54 mm); dark brown dorsal pelage; facial and dorsal stripes inconspicuous; short, sparse hair on the upper surface of feet; posterolabial cuspulid present on p5; M1 parastyle present; and m1 metaconid well developed (Velazco, 2005; Gardner, 2008d). Measurements of our specimens fall within the range reported for the species.

Sturnira Gray, 1842

The genus *Sturnira* currently includes 23 described species and one unnamed form, making it the most speciose phyllostomid genus (Velazco and Patterson, 2013; Velazco and Patterson, 2014; Molinari et al., 2017). A multilocus phylogenetic analysis of the genus by Velazco and Patterson (2013) identified three unnamed taxa. Two of these were subsequently described by Velazco and Patterson (2014) as *S. bakeri* and *S. burtonlimi*. The third, "*S*[*turnira*]. new species 3," long confused with and considered part of *S. lilium*, is described below. It is one of the most widely distributed species in the genus. Three *Sturnira* species were recorded at the three sampled localities.

Sturnira giannae, new species

Gianna's Yellow-Shouldered Bat

Murciélago de Charreteras de Gianna

Sturnira lilium: Dobson 1878: 540 (part).
Sturnira lilium lilium: Cabrera 1958: 78 (part).
S[*turnira*]. new species 3: Velazco and Patterson 2013: 687.

Holotype: The holotype (AMNH 268545; fig. 2, table 14), an adult male specimen preserved in

TABLE 13

External and craniodental measurements (mm) and weights (g) of *Platyrrhinus incarum*, *P. infuscus*, and *Sturnira oporaphilum*

	Platyrrhinus incarum		*Platyrrhinus infuscus*		*Sturnira oporaphilum*
	7 males	4 females	13 males	9 females	MUSM 39230 ♂
W	12.1 (11.1–13.0) 7	14.3 (12.6–15.6) 3	37.0 (31.5–43.0) 12	38.3 (30.0–42.0) 8	16.4
TTL	57.7 (54.0–62.0) 7	61.3 (57.0–66.0) 4	87.5 (82.0–91.0) 13	85.9 (81.0–90.0) 9	70.0
HF	10.6 (9.0–12.0) 7	10.8 (10.0–11.0) 4	14.1 (12.0–16.0) 13	15.0 (10.0–18.0) 9	11.0
EL	15.6 (15.0–17.0) 7	15.8 (15.0–17.0) 4	20.7 (18.0–23.0) 13	21.7 (17.0–23.0) 9	18.0
FA	37.7 (36.0–39.0) 7	39.3 (38.0–40.0) 4	57.3 (55.0–60.0) 13	59.0 (57.0–61.0) 9	44.0
GLS	20.7 (20.0–21.1) 7	20.8 (20.6–21.0) 4	29.7 (28.9–30.8) 11	29.4 (27.9–30.2) 9	22.8
CIL	18.9 (18.4–19.4) 7	19.1 (18.9–19.3) 4	27.5 (26.8–28.7) 11	27.4 (26.2–28.4) 9	21.4
CCL	18.5 (18.0–18.9) 7	18.7 (18.4–18.9) 4	26.8 (26.3–27.9) 11	26.9 (25.6–27.9) 9	20.6
LB	5.4 (5.2–5.8) 7	5.5 (5.4–5.5) 4	7.3 (6.6–7.7) 11	7.3 (7.0–7.7) 9	––
POB	5.3 (5.0–5.5) 7	5.4 (5.3–5.7) 4	6.8 (6.5–7.0) 11	6.7 (6.3–7.0) 9	6.0
ZB	11.9 (11.7–12.2) 7	12.3 (12.1–12.8) 3	17.8 (17.3–18.4) 11	17.6 (16.5–18.2) 9	13.4
BCB	9.2 (8.8–9.5) 7	9.3 (9.2–9.3) 4	12.5 (12.1–12.8) 11	12.3 (12.0–12.7) 9	10.3
MB	10.3 (10.1–10.5) 7	10.8 (10.4–11.2) 4	14.8 (14.2–15.3) 11	14.7 (14.1–15.2) 9	12.3
MTR	7.2 (6.9–7.5) 7	7.3 (7.3–7.4) 4	11.6 (11.2–11.9) 11	11.6 (11.1–11.9) 9	6.9
BM	8.5 (8.2–8.7) 7	8.7 (8.4–8.9) 4	13.3 (12.7–13.7) 11	13.2 (12.4–13.8) 9	7.8
BC	5.0 (4.8–5.2) 7	5.2 (5.0–5.3) 4	8.0 (7.7–8.2) 11	7.7 (7.4–8.5) 9	6.3

alcohol with the skull removed and cleaned, was collected by Nancy B. Simmons (original field number 846) on 8 October 1994 at Paracou (5°17′N, 53°55′W, 210 m), near Sinnamary, Cayenne, French Guiana. The body and skull are in good condition. Frozen tissues are deposited at the Ambrose Monell Cryo Collection at the American Museum of Natural History (AMCC 110416).

Paratypes: An adult female (FMNH 203582) caught by Paúl M. Velazco (original field number PMV 2295) collected on 2 May 2007 at the Waqanki locality. An adult female (MUSM 13260) caught by Robert S. Voss (original field number RSV 2365) collected on 5 July 1998 at Nuevo San Juan (73°9′50″W, 5°14′50″S; 150 m above sea level), a Matses village on the right (SE) bank of the Río Gálvez in the Peruvian department of Loreto. Frozen tissues are deposited at the Ambrose Monell Cryo Collection of the American Museum of Natural History (AMCC 109783). An adult male (MUSM 39228) caught by Richard Cadenillas (original field number RCO 965) collected on 14 May 2007 at El Diamante locality (table 14). Frozen tissues of FMNH 203582 and MUSM 39228 are deposited at the Field Museum of Natural History.

Distribution: Eastern slopes of the Andes and adjacent Amazonian lowlands from Colombia to northern Bolivia. Lowlands of southern Venezuela, the Guianas, and Brazilian Amazon (fig. 3; appendix). One specimen of *Sturnira giannae* (FMNH 128845) was collected at a locality (fig. 3: 19) on the western slope of the Andes in the department of Cajamarca, Peru. This record could result from populations of *S. giannae* using the Huancabamba Depression, which features the lowest montane passes in the

TABLE 14

External and craniodental measurements (mm) and weights (g) of the type series of *Sturnira giannae*

	Holotype AMNH 268545 ♂	Paratype FMNH 203582 ♀	Paratype MUSM 13260 ♀	Paratype MUSM 39228 ♂
W	25.3	14.0	18.0	22.0
TTL	73.0	67.0	65.0	73.0
HF	15.0	13.0	13.0	12.0
EL	17.0	16.0	17.0	14.0
FA	45.0	45.0	45.0	44.0
GLS	22.7	22.6	22.3	22.2
CIL	21.2	21.3	20.6	21.2
CCL	20.4	20.4	19.9	20.5
POB	6.1	5.8	5.5	6.1
ZB	14.4	14.0	13.2	13.9
BCB	10.5	10.4	9.8	10.3
MB	12.7	12.2	11.5	11.9
MTR	6.6	6.8	6.8	6.8
BM	8.1	8.1	8.2	8.3
DENL	15.2	14.8	14.6	15.0
MANDL	7.5	7.8	7.6	7.7

Andes between Venezuela and Chile, as a corridor to cross the Andes.

Etymology: The epithet *giannae*, a feminine noun in the genitive case, is proposed in dedication to the daughter of the first author, Gianna C. Velazco Kline.

Diagnosis: Dorsal fur short and bicolored with pale brown bases (80% of length) and dark brown tips. Ventral fur short and monocolored. Shoulder glands (epaulettes) present in both sexes, but variable in the degree of development. Trailing edge of the uropatagium covered by short hairs. Sphenorbital fissure small. Zygomatic arches do not converge anteriorly. Anterior process of glenoid fossa well developed. Upper inner incisor (I1) bicuspidate and slender. First and second lower incisors (i1 and i2) tricuspidate and subequal in height. Paraconid present and well developed in m1 but absent in m2. Metaconids and entoconids of m1, m2, and m3 well defined and separated by a deep notch.

Description: *Sturnira giannae* is a medium-sized yellow-shouldered bat (FA 43.0–47.0 mm; GLS 21.7–24.2 mm; CIL 20.1–21.8 mm; fig. 4, tables 14–15) with a slender rostrum and a globular braincase (fig. 2). The dorsal pelage is brown to reddish brown (fig. 4). Dorsal hairs are bicolored with a long, pale brown base (approximately 80% of the length of each hair), and a short, dark-brown terminal band (approximately 20% of each hair). The ventral pelage is brown to reddish brown (fig. 4). Ventral hairs are monocolored and vary from gray to pale brown. The fur is short, ~5–6 mm long between the shoulders and 4 mm on the chest. Shoulder glands (epaulettes) are present in both sexes with varying degrees of definition: weakly defined in some specimens (e.g., FMNH 203588) and strongly so in others (MUSM

FIG. 2. Dorsal, ventral, and lateral views of the cranium and lateral view of the mandible of *Sturnira giannae* (AMNH 268545, holotype). Scale bar = 5 mm.

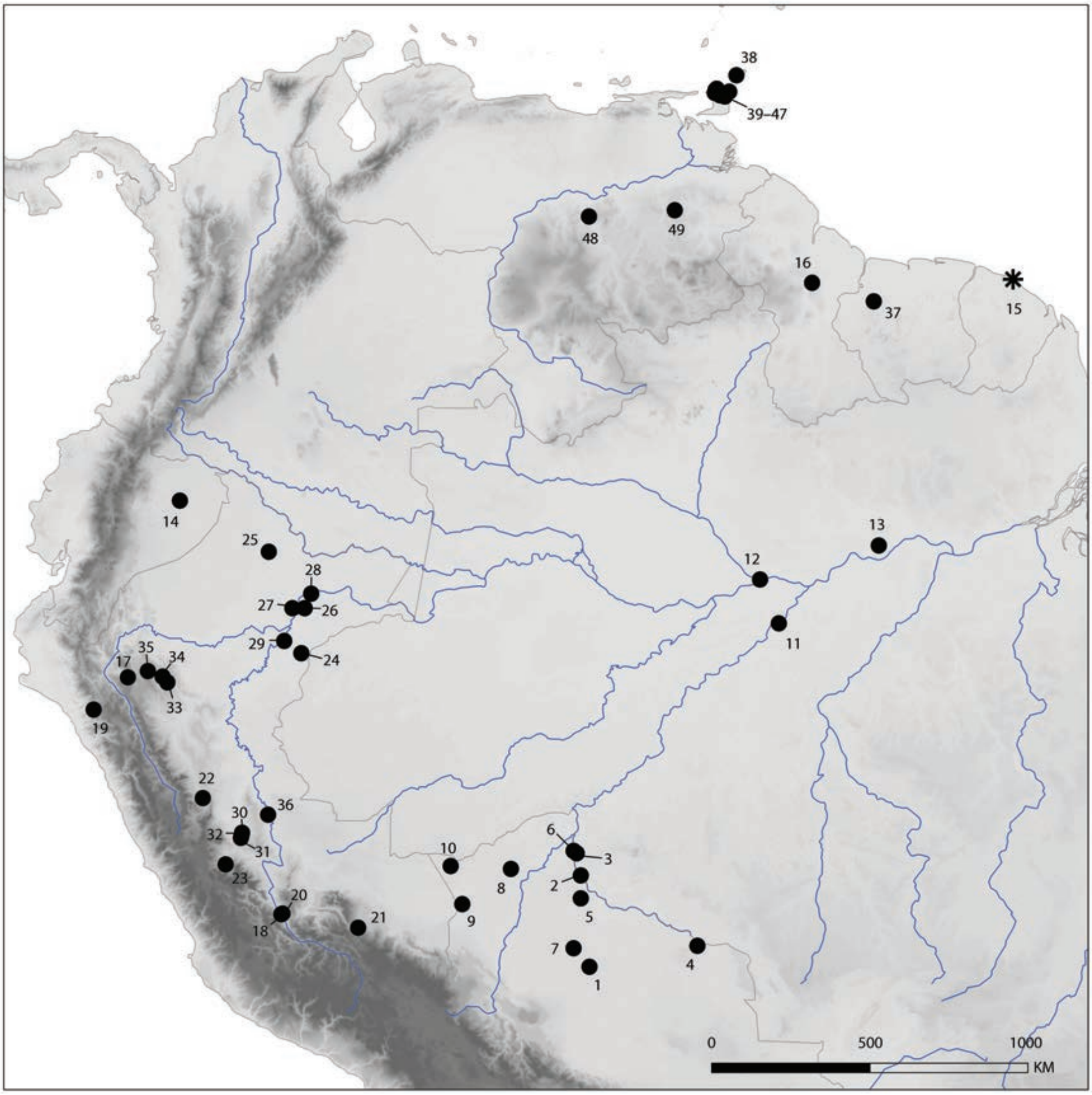

FIG. 3. Map showing selected collecting localities of *Sturnira giannae* as listed in the appendix. The type locality is marked by an asterisk.

FIG. 4. Photographs of **A,** an adult male (ROM F63353) and **B,** an adult female (ROM 117574) *Sturnira giannae* captured at the Estación Biológica "José Álvarez Alonso," Reserva Nacional Allpahuayo-Mishana, Loreto, Peru, and Blanche Marie Vallen, Sipaliwini, Suriname, respectively. The two specimens illustrate the two extremes of the fur color variation in the species, with some specimens exhibiting brown fur (A) while others are much more reddish (B). Photographs by Marco Tschapka (A) and Alex Borisenko (B).

FIG. 5. Dorsal views of the uropatagium and legs in **A,** *Sturnira giannae* (FMNH 203590) and **B,** *S. lilium* (AMNH 205180) illustrating taxonomic differences in the degree of hairiness. In *S. giannae*, the trailing edge of the uropatagium is covered by short hairs (4–6 mm) and the dorsal surfaces of the tibia and feet are sparsely covered with long hairs. In *S. lilium*, the uropatagium is covered by long hairs (7–9 mm) and the tibia and feet are densely covered with long hairs.

TABLE 15

External and craniodental measurements (mm) and weights (g) of *Sturnira giannae* and *S. tildae*

	Sturnira giannae		*Sturnira tildae*	
	15 males[a]	14 females[b]	5 males[c]	2 females[d]
W	20.0 (19.0–25.3) 9	19.3 (17.0–24.0) 13	20.3 (17.0–24.5) 5	23.0, 15.0
TTL	65.8 (60.0–73.0) 11	64.9 (60.0–71.0) 14	70.6 (67.0–74.0) 5	66.0, 61.0
HF	12.8 (11.0–15.0) 11	12.7 (11.0–14.0) 14	12.6 (11.0–14.0) 5	15.0, 14.0
EL	16.0 (14.0–17.0) 11	16.2 (15.0–17.0) 14	17.5 (16.0–19.0) 5	18.0, 16.0
FA	44.8 (43.0–47.0) 14	43.8 (41.0–45.0) 14	45.8 (45.0–47.0) 5	46.0, 45.0
GLS	22.8 (22.1–24.2) 14	22.2 (21.7–22.9) 13	22.6 (22.2–23.4) 5	22.4, 22.1
CIL	21.2 (20.7–21.8) 14	20.8 (20.1–21.3) 13	21.5 (21.2–21.8) 5	21.2, 20.9
CCL	20.4 (20.0–21.0) 14	20.0 (19.3–20.6) 13	20.8 (20.4–21.2) 5	20.4, 20.2
POB	6.0 (5.8–6.4) 14	5.8 (5.4–6.2) 13	6.0 (5.7–6.3) 5	6.2, 6.0
ZB	14.1 (13.5–15.2) 13	13.5 (13.0–13.9) 11	13.7 (13.5–14.2) 5	13.9, 13.0
BCB	10.4 (10.1–10.9) 14	10.2 (9.8–11.0) 13	10.3 (10.1–10.5) 5	10.4, 10.2
MB	12.4 (11.8–12.8) 14	12.0 (11.5–12.9) 13	12.1 (11.6–12.3) 5	12.3, 12.1
MTR	6.7 (6.5–7.2) 14	6.7 (6.4–7.1) 13	6.7 (6.5–6.9) 5	6.9. 6.5
BM	8.2 (7.8–8.6) 14	8.1 (7.7–8.4) 14	8.1 (7.7–8.3) 5	8.4, 8.1
DENL	15.3 (15.0–16.0) 8	14.7 (14.2–15.1) 8	14.3 (13.9–14.4) 4	–, 13.8
MANDL	7.8 (7.5–8.6) 8	7.6 (7.3–7.9) 8	7.1 (7.0–7.3) 4	–, 7.1

[a] Summary statistics (mean, observed range in parentheses, and sample size) for measurements of AMNH 268545; FMNH 87058, 128825, 203412, 203416, 203586, 203590; MUSM 5925, 21266, 39225, 39226, 39228; ROM 103552, 105875, 107936.

[b] Summary statistics (mean, observed range in parentheses, and sample size) for measurements of FMNH 203408, 203410, 203414, 203420, 203582, 203584, 203588; MUSM 5922, 5924, 13260, 39223, 39224, 39227, 39229.

[c] Summary statistics (mean, observed range in parentheses, and sample size) for measurements of FMNH 203592; MUSM 39231–39233, 39235.

[d] FMNH 203418; MUSM 39234.

39228). The trailing edge of the uropatagium is covered by short hairs (5.0 mm) (fig. 5A). The proximal portion of the forearm (roughly 50% of the shaft just distal to the elbow) is densely furred with short hairs. The dorsal surfaces of the tibia and feet are sparsely covered with long hairs. The III and IV metacarpals are subequal in length, but shorter than the V metacarpal.

The skull of *Sturnira giannae* has a globular braincase with a slender rostrum and well-developed sagittal crest (smaller in females but still well developed). Postorbital processes moderately developed (fig. 2). The posterior border of hard palate shows intraspecific variation, some individuals with a U-shaped border while in others it is V-shaped. The basisphenoid pits are divided by a narrow midline septum (fig. 2). The sphenorbital fissure is oval or circular, but always small. The zygomatic arches do not converge anteriorly. The anterior process of the glenoid fossa is well developed (fig. 2).

Sturnira giannae has a dental formula of I2/2, C1/1, P2/2, M3/3 = 32 teeth. The upper inner incisor (I1) is bicuspidate, with these cusps noticeable only in younger individuals without pronounced tooth wear (fig. 6A). The I1 is orthodont, slender, and at least twice the height of I2. P4 is shorter anteroposteriorly than P5, and the crown height of P4 is slightly less than that of P5. P5 has a small distal cusp. The anteroposterior and labiolingual lengths of M1 exceed those of M2. The protocones of P5, M1, and M2 are tall and well developed. The paracones of M1 and M2 are slightly shorter than corresponding metacones on the same teeth. The M3 is ovoid in shape and has one lingual and one or two labial cones (cusps). If two labial cones are present, they are divided by a shallow notch. The first and second lower incisors (i1 and i2) are tricuspidate and subequal in height. The lower canine covers less than 25% of the occlusal area of i2. The lower canine shafts are slightly oriented outward. The lower canine is less than 2× the height of p1. The anteroposterior length of p5 exceeds that of p1. The p1 is slightly higher than p5. The protoconid, hypoconid, metaconid, and entoconid are present on m1 and m2. The paraconid is present and well developed on m1 but absent on m2. The lingual cuspids (metaconid and entoconid) on m1 and m2 are long anteroposteriorly. The metaconids and entoconids of m1, m2, and m3 are well defined and separated by a deep notch (fig. 7A). In some individuals, the metaconids of m2 is divided into two cusps (e.g., MUSM 5922, 39228). The protoconid is the tallest cuspid on m1 and the entoconid is the lowest. All the four cuspids present on m2 are subequal in height. The m3 is small with only the protoconid, metaconid, and entoconid present. All three cuspids of m3 are subequal in height.

Comparisons: *Sturnira giannae* was compared with all the species of the *lilium* complex (*S. angeli*, *S. bakeri*, *S. lilium*, *S. luisi*, *S. parvidens*, and *S. paulsoni*) (Velazco and Patterson, 2013) and with other species of the genus that occur in sympatry with it (e.g., *S. magna*, *S. oporaphilum*, *S. sorianoi*, and *S. tildae*). External and craniodental measurements for *S. giannae* and the compared species are provided in tables 14–16 (*S. lilium* and *S. tildae*); other relevant sources of measurement data are de la Torre (1966: in text—*S. angeli* and *S. magna*), de la Torre and Schwartz (1966: in text—*S. paulsoni*), Jones and Phillips (1976: table 1—*S. angeli* and *S. paulsoni*), Molinari et al. (2017: table 3—*S. oporaphilum*), Sánchez-Hernández et al. (2005: table 2—*S. sorianoi*), Simmons and Voss (1998: table 45—*S. tildae*), Tamsitt et al. (1986: table 1—*S. magna*), Velazco and Patterson (2014: tables 1–2—*S. bakeri*, *S. luisi*, *S. oporaphilum*, and *S. parvidens*), Kwiecinski et al. (2018: table 1—*S. paulsoni paulsoni*), and Pedersen et al. (2018: table 1--*S. paulsoni luciae*).

Size serves to distinguish some but not all *Sturnira* species. *Sturnira giannae* can be easily distinguished from *S. magna* by the latter's longer forearm and longer greatest length of skull (Tamsitt et al., 1986: table 1) and from *S. parvidens* by that bat's shorter forearm and shorter greatest length of skull (Velazco and Patterson, 2014: table 2). *Sturnira giannae*, *S. angeli*, *S. bakeri*, *S. lilium*, *S. luisi*, *S. oporaphilum*, *S. paulsoni*, *S. sorianoi*, and *S. tildae* overlap somewhat in size but are unambiguously distinguished by pelage and craniodental characteristics (tables 15–17).

Externally, the dorsal fur between the shoulders of *S. giannae*, *S. luisi*, and *S. parvidens* is short (4.0–6.0 mm) whereas it is long (>8 mm) in *S. angeli*, *S. lilium*, *S. magna*, *S. sorianoi*, *S. oporaphilum*, and *S. tildae*. Individual dorsal hairs are bicolored in *S. giannae*, *S. lilium*, *S. luisi*, and *S. parvidens* whereas they are 4-colored in *S. angeli*, *S. magna*, *S. sorianoi*, *S. oporaphilum*, and *S. tildae*. The overall appearance of the dorsal pelage is brown to reddish brown in *S. giannae* and *S. tildae*, whereas it is pale brown in *S. angeli*, *S. lilium*, *S. luisi*, *S. magna*, and *S. oporaphilum*, slightly reddish in *S. parvidens*, and pale gray in *S. sorianoi*. Ventrally the hairs are short (3–5 mm) and monocolored in *S. giannae* and *S. tildae*, whereas they are long (6–8 mm) and monocolored in *S. lilium*, short (4.0–6.0 mm) and bicolored in *S. luisi*, short (3–5 mm) and tricolored in *S. parvidens*, long (6–8 mm) and tricolored in *S. angeli*, *S. sorianoi*, and *S. oporaphilum*, and short (3–5 mm) and 4-colored in *S. magna*. The ventral fur is pale brown to reddish brown in *S. giannae*, whereas is pale brown in *S. angeli*, *S. lilium*, *S. magna*, *S. sorianoi*, *S. oporaphilum*, and *S. tildae*, dark gray in *S. luisi*, and reddish in *S. parvidens*. Shoulder glands (epaulettes) are weakly to strongly developed in specimens of *S. giannae,* whereas epaulettes are weakly defined in *S.*

FIG. 6. Anterior views of the upper incisors and canines in **A,** *Sturnira giannae* (MUSM 13260) and **B,** *S. lilium* (AMNH 185320) illustrating taxonomic differences in the number of cuspids of the upper inner incisor (I1). In *S. giannae* the I1 is bicuspidate while in *S. lilium* I1 is unicuspidate.

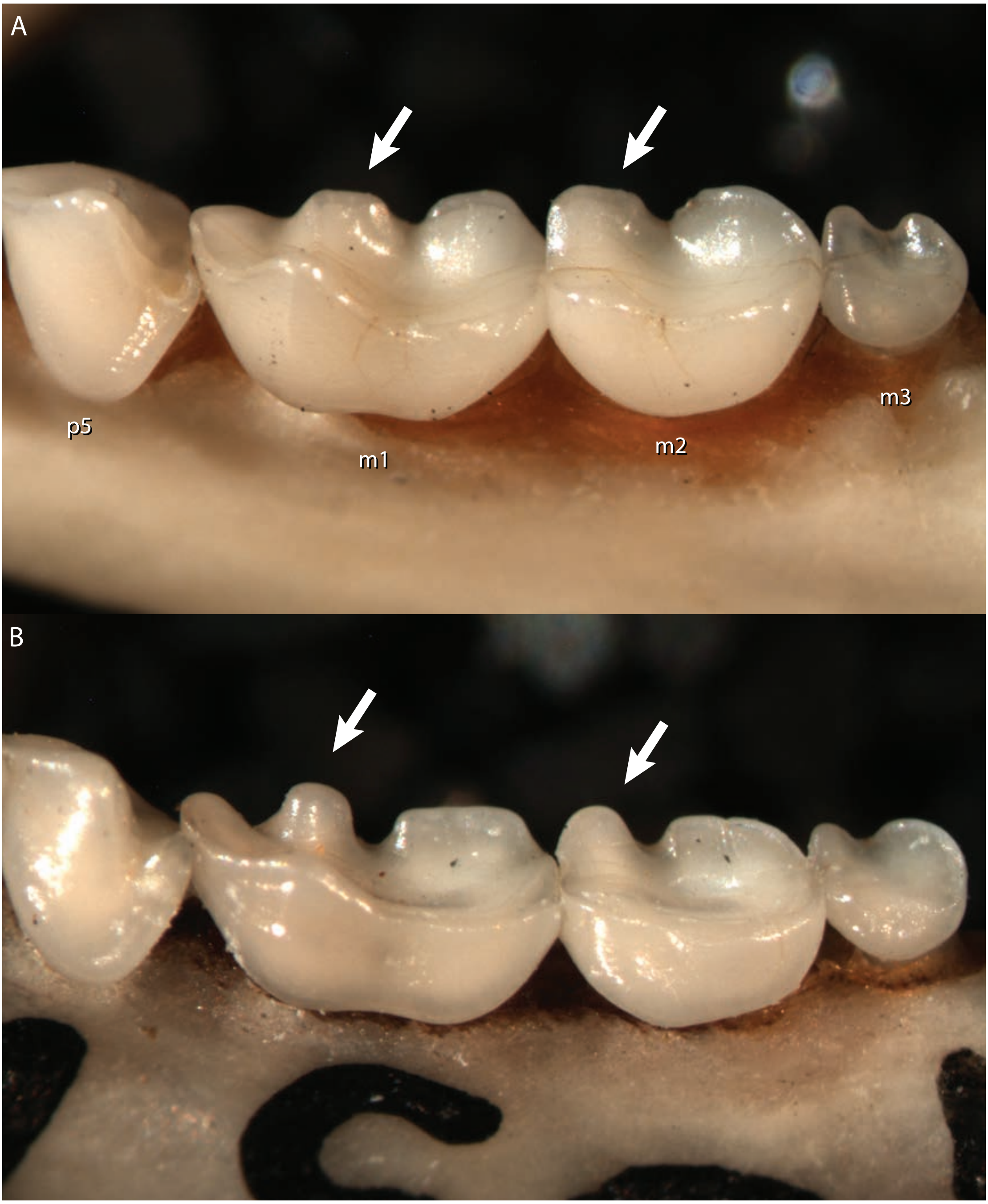

FIG. 7. Dorsolateral views of the left mandibular toothrows in **A,** *Sturnira giannae* (AMNH 268545) and **B,** *S. lilium* (AMNH 205180), illustrating taxonomic differences in the shape of the metaconids of m1 and m2. In *S. giannae*, the metaconids of m1 and m2 are longer mesiodistally (arrows). In *S. lilium*, however, the metaconids of m1 and m2 are shorter mesiodistally (arrows).

sorianoi and *S. oporaphilum* and more conspicuous in *S. angeli*, *S. lilium*, *S. luisi*, *S. magna*, *S. parvidens*, and *S. tildae*. The trailing edge of the uropatagium is covered by short hairs (4–6 mm) in *S. giannae*, *S. luisi*, *S. oporaphilum*, *S. parvidens*, and *S. tildae*, whereas the uropatagium is covered by long hairs (7–9 mm) in *S. angeli*, *S. lilium*, *S. magna*, and *S. sorianoi* (fig. 5). The proximal portion of the forearm (roughly 50% of the shaft just proximal to the elbow) is densely furred with short hairs in *S. giannae*, *S. angeli*, *S. parvidens*, and *S. tildae*, whereas it is sparsely furred with short hairs in *S. luisi* and *S. oporaphilum* and sparsely furred with long hairs in *S. lilium*, *S. magna*, and *S. sorianoi*. The dorsal surfaces of the tibia and feet are sparsely covered with long hairs in *S. giannae*, *S. angeli*, *S. magna*, *S. sorianoi*, *S. oporaphilum*, and *S. tildae*, whereas the tibia and feet are densely covered with long hairs in *S. lilium*, the tibia is sparsely covered with long hairs and the feet are densely covered with long hairs in *S. parvidens*, and the tibia is sparsely covered with short hairs and the feet are densely covered with short hairs in *S. luisi*. Metacarpal IV is subequal to metacarpal III in *S. giannae*, *S. angeli*, *S. lilium*, *S. luisi*, *S. magna*, *S. sorianoi*, and *S. oporaphilum*, whereas metacarpal IV is shorter than metacarpal III in *S. parvidens* and longer than metacarpal III in *S. tildae*.

Cranially, the sagittal crest is well developed in *S. giannae*, *S. lilium*, *S. magna*, *S. paulsoni*, and *S. tildae*, whereas it is weakly developed in *S. angeli*, *S. sorianoi*, and *S. oporaphilum*. The postorbital processes are moderately developed in *S. giannae*, *S. oporaphilum*, *S. paulsoni*, and *S. tildae*, whereas they are well developed in *S. angeli*, *S. magna*, and *S. sorianoi*. The postorbital processes of *S. lilium* vary from moderately developed to well developed. The basisphenoid pits are divided by a narrow midline septum in *S. giannae*, *S. lilium*, *S. luisi*, *S. magna*, *S. parvidens*, and *S. tildae*, whereas the midline septum is broader in *S. angeli*, *S. oporaphilum*, *S. paulsoni*, and *S. sorianoi*. The sphenorbital fissure is small in *S. giannae* and *S. magna*, whereas it is large in *S. angeli*, *S. lilium*, *S. oporaphilum*, and *S. sorianoi*. Some specimens of *S. tildae* and *S. paulsoni* present a small sphenorbital fissure whereas in others it is large. The zygomatic arches do not converge anteriorly in *S. giannae*, *S. lilium*, *S. magna*, *S. oporaphilum*, *S. sorianoi*, and *S. tildae*, whereas they are bowed outward in *S. angeli*, *S. luisi*, *S. paulsoni*, and *S. parvidens*. The anterior process of the glenoid fossa is well developed in *S. giannae*, *S. magna*, *S. luisi*, and *S. parvidens*, whereas it is weakly developed in *S. paulsoni*, *S. sorianoi*, and *S. tildae*, and absent in *S. angeli*. Some specimens of *S. lilium* and *S. oporaphilum* lack the anterior process of the glenoid fossa while in others it is weakly developed.

Dentally, I1 is bicuspidate in *S. giannae*, *S. angeli*, *S. luisi*, *S. magna*, *S. parvidens*, *S. sorianoi*, and *S. tildae*, whereas it is unicuspidate in *S. lilium*, *S. oporaphilum*, and *S. paulsoni* (fig. 6). The I1 is orthodont and slender in *S. giannae*, *S. angeli*, *S. lilium*, and *S. paulsoni*, whereas this tooth is orthodont and broad in *S. oporaphilum*, *S. sorianoi*, and *S. tildae*, and proodont and broad in *S. magna*. The protocones of P5, M1, and M2 are tall and well developed in *S. giannae*, *S. oporaphilum*, and *S. sorianoi*, whereas they are low and weakly developed in *S. angeli* and *S. magna*. These protocones are well developed in some specimens of *S. lilium* (AMNH 185320), whereas in others they are low and weakly developed (AMNH 205180, 256984). In *Sturnira paulsoni* and *S. tildae*, the protocones of M1 and M2 are tall and well developed but on P5, the protocone is low and weakly developed. The i1 and i2 are tricuspidate in *S. giannae*, *S. angeli*, *S. lilium*, *S. luisi*, *S. magna*, *S. paulsoni*, *S. parvidens*, *S. sorianoi*, and *S. tildae*, whereas they are bicuspidate in *S. oporaphilum*. The metaconids and entoconids of m1 and m2 are well defined and separated by a deep notch in *S. giannae*, *S. lilium*, *S. luisi*, *S. paulsoni*, and *S. parvidens*, whereas they are well defined but separated by a shallow notch in *S. angeli* and *S. tildae*, and poorly defined and not separated by a notch in *S. magna*, *S. oporaphilum*, and *S. sorianoi*. The metaconids of m1 and m2 are well defined and long mesiodistally in *S. giannae* and *S. angeli*, whereas they are well defined and short mesiodistally in *S. lilium*, *S. tildae*, and *S. paulsoni*, and poorly defined

TABLE 16

External and craniodental measurements (mm) and weights (g) of *Sturnira lilium*

	Sturnira lilium	
	11 males[a]	4 females[b]
W	21.5 (19.0–28) 4	20.0
TTL	65.9 (55.0–70.0) 11	65.3 (60.0–69.0) 4
HF	13.7 (11.0–16.0) 11	14.8 (12.0–17.0) 4
EL	17.3 (14.0–20.0) 10	16.7 (15.0–18.0) 3
FA	42.3 (39.8–44.9) 11	41.7 (40.6–43.4) 4
GLS	22.5 (21.2–22.9) 11	22.1 (21.7–22.9) 4
CIL	20.8 (20.0–21.4) 11	20.4 (20.0–20.9) 4
CCL	20.1 (19.4–20.7) 11	19.6 (19.3–20.0) 4
POB	6.1 (5.5–6.4) 11	5.9 (5.7–6.1) 4
ZB	14.1 (13.6–14.5) 9	13.4 (13.1–13.8) 4
BCB	10.5 (10.1–10.7) 11	10.3 (10.1–10.6) 4
MB	12.3 (11.8–12.8) 11	11.8 (11.2–12.3) 4
MTR	6.9 (6.7–7.1) 10	6.6 (6.5–6.7) 4
BM	8.3 (8.0–8.7) 10	8.0 (7.8–8.1) 4
DENL	15.0 (14.2–15.5) 11	14.6 (14.2–15.0) 4
MANDL	7.9 (7.5–8.2) 11	7.4 (7.4–7.6) 4

[a] Summary statistics (mean, observed range in parentheses, and sample size) for measurements of AMNH 23802, 23803, 185321, 186949, 205178, 205179, 205181, 217542, 234280, 256984, 268400.

[b] Summary statistics (mean, observed range in parentheses, and sample size) for measurements of AMNH 185320, 205177, 205180, 217541.

in *S. magna*, *S. oporaphilum*, and *S. sorianoi* (fig. 7). The metaconid and entoconid of m3 are separated by a deep notch in *S. giannae*, *S. lilium*, and *S. paulsoni* (when m3 is present), whereas these cusps are separated by a weak notch in *S. angeli* and *S. magna* and not separated in *S. oporaphilum* (fig. 7). Some specimens of *S. sorianoi* and *S. tildae* present the metaconid and entoconid of m3 separated by a weak notch while in others they are not separated.

Natural History: Natural history information on *S. giannae* has been previously reported under the name *Sturnira lilium*, where it is mixed with reports from *S. angeli*, *S. lilium* sensu stricto, *S. parvidens*, and *S. paulsoni*. We discriminate the information of *S. giannae* from published records of *S. angeli*, *S. lilium* sensu stricto, *S. parvidens*, and *S. paulsoni*, all previously considered subspecies of *S. lilium* sensu lato (Velazco and Patterson, 2013), by considering only reports from the lower Orinoco and the Amazon basins as belonging to *S. giannae*. This species may occur in a wide variety of forested habitats, excluding only very dry forests and those above 2000 m elevation (Handley, 1976). Its documented roosting sites include dense foliage, tree holes, caves, and culverts (Linares, 1998) as well as buildings (Goodwin and Greenhall, 1961). *S. giannae* is a frugivorous bat that has been reported to feed on at least 41 plant species representing 20 genera in 14 families: *Cyathula prostrata* (Amaranthaceae); *Rollinia exsucca* (Annonaceae); *Couma utilis* (Apocynaceae); *Anthurium trinerve*, *Philodendron grandifolium*, *Ph. squamiferum*, *Ph.* sp. (Araceae); *Carica papaya*, *Jacaratia digitata* (Caricaceae); *Cecropia distachya*, *Ce. ficifolia*, *Ce.*

TABLE 17

Morphological differences among *Sturnira giannae*, *S. lilium*, *S. oporaphilum*, and *S. tildae*

Character	*S. giannae*	*S. lilium*	*S. oporaphilum*	*S. tildae*
Dorsal fur length	Short	Long	Long	Long
Dorsal fur bands	Bicolored	Bicolored	Tetracolored	Tetracolored
Ventral fur length	Short	Long	Long	Short
Ventral fur bands	Monocolored	Monocolored	Tricolored	Monocolored
Hairs on the trailing edge of the uropatagium	Short	Long	Short	Short
Proximal portion of the forearm	Densely furred with short hairs	Sparsely furred with long hairs	Sparsely furred with short hairs	Densely furred with short hairs
Dorsal surfaces of the tibia and feet	Sparsely covered with long hairs	Densely covered with long hairs	Sparsely covered with long hairs	Sparsely covered with long hairs
Metacarpal III and IV	Met III = IV	Met III = IV	Met III = IV	Met III < IV
Sagittal crest	Well developed	Well developed	Weakly developed	Well developed
Sphenorbital fissure	Small	Large	Large	Small or large
Anterior process of the glenoid fossa	Well developed	Weakly developed or absent	Weakly developed or absent	Weakly developed
Upper inner incisors	Bicuspidate and slender	Unicuspidate and slender	Unicuspidate and broad	Bicuspidate and broad
Lower incisors	Tricuspidate	Tricuspidate	bicuspidate	Tricuspidate
Metaconids and entoconids of m1 and m2	Well defined and separated by a deep notch	Well defined and separated by a deep notch	Poorly defined and are not separated by a notch	Well defined but separated by a shallow notch
Metaconids of m1 and m2	Well defined and broad mesiodistally	Well defined and slender mesiodistally	Poorly defined	Well defined and slender mesiodistally
Metaconid and entoconid of m3	Separated by a deep notch	Separated by a deep notch	Not separated	Separated by a weak notch or not separated

obtusa (Cecropiaceae); *Clusia* sp., *Vismia guianensis*, *Vismia* sp. (Clusiaceae); *Muntingia calabura* (Elaeocarpaceae); *Banara guianensis* (Flacourtiaceae); *Poraqueiba sericea* (Icacinaceae); *Byrsonima* sp. (Malpiguiaceae); *Ficus panurensis*, *F. paraensis* (Moraceae); *Piper aduncum*, *Pi. bartlingianum*, *Pi. hostmannianum*; *Pi.* sp. (Piperaceae); *Coffea* sp. (Rubiaceae); *Markea longiflora*, *Solanum asperum*, *So. caavurana*, *So. confine*, *So. coriaceum*, *So. grandiflorum*, *So. lanceolatum*, *So. leucocarpon*, *So. paniculatum*, *So. rugosum*, *So. schlechtendalianum*, *So. subinerme*, *So. torvum*, *So*. sp. (Solanaceae); *Celtis schippii* (Ulmaceae) (dos Reis and Guillaumet, 1983; de Foresta et al., 1984; Charles-Dominique, 1986, 1993; Foster et al., 1986; dos Reis and Peracchi, 1987; Maas et al., 1992; Gorchov et al., 1995; Charles-Dominique and Cockle, 2001; Lobova et al., 2003, 2009; Lobova and Mori, 2004).

Lactating females have been reported in the months of May, June, and November in Peru (Hice et al., 2004) and pregnant females in the months of March, July, August, October, and November in Peru (Tuttle, 1970; Hice et al., 2004) and in June, July, and August in French Guiana (Brosset and Dubost, 1967). Both pregnant and lactating females were reported in December and January in Pará and Amazonas, Brazil (Marques-Aguiar, 1985).

Wenzel (1976) reported three species of streblid flies occurring on *Sturnira giannae* in Venezuela (*Aspidoptera falcata*, *Trichobius lionycteridis*, and *Trichobius parasparsus*). The dermatophytic fungi *Exophiala* (*Wangiella*) *dermatitidis* was isolated from the lung of one individual collected in a secondary forest in Manaus, Brazil (Reiss and Mok, 1979). The bacteria *Bartonella* and *Leptospira* were found in the single individual tested and in three of 38 individuals tested, respectively (Matthias et al., 2005; Bai et al., 2012). One of 43 *Sturnira giannae* near the type locality tested positive for rabies virus (de Thoisy et al., 2016).

Remarks: The synonymy of *Sturnira lilium* sensu lato includes several junior synonyms, one nomen nudum, and unavailable names. The majority of those are undoubtedly assignable to *S. lilium* sensu stricto (e.g., *Phyllostoma spiculatum* Lichtenstein, 1823; *Phyllostoma excisum* Wagner, 1842; *Phyllostoma albescens* Wagner, 1847; *Phyllostoma chrysosema* Natterer, 1883, in Pelzeln, 1883).

A specific type locality was not mentioned in the original description of five junior synonyms of *Sturnira lilium*. *Phyllostoma vampyrus* was described by Schinz (1845) from "America tropicali," but to our knowledge a holotype was not designated. The holotype of *Nyctiplanus rotundatus*, which was described by Gray (1849) with only "Brazils" as the type locality, is now lost (Carter and Dolan, 1978). *Phyllostoma fumarium* Wagner, 1847 was described based on a single specimen. Its label was lost while the specimen was being prepared as a study skin (with partial skull inside) and had been removed from its original fluid condition. Wagner (1847) remembered that the specimen was from Brazil but did not recall a specific locality within Brazil. Photographs of the holotype (ZSM 58) clearly show that the trailing edge of the uropatagium and the tibia and feet are densely covered by long hairs characteristic of *S. lilium*. For that reason, we recommend continued assignment of *Phyllostoma fumarium* Wagner, 1847, as a junior synonym of *Sturnira lilium* (Geoffoy St.-Hilaire, 1810). *Sturnira spectrum* Gray, 1842, was also described based on a specimen from Brazil. The label does not specify sex or a specific locality. Photographs of the holotype (BMNH 42.12.2.4), a dry study skin with a partial skull (only the rostrum is preserved) revealed two diagnostic characteristics of *S. lilium*: the trailing edge of the uropatagium and the tibia and feet are densely covered by long hairs and the inner upper incisors are unicuspidate. Therefore, we recommend that *Sturnira spectrum* Gray, 1842, should likewise be regarded as a junior synonym of *Sturnira lilium* (Geoffoy St.-Hilaire, 1810). The name *Phyllostoma chrysocomos* Wagner, 1855 should also be assigned to *Sturnira lilium* (Geoffoy St.-Hilaire, 1810) as a junior synonym because it is a renaming of *Sturnira spectrum* Gray, 1842.

Sturnira oporaphilum (Tschudi, 1844)

Voucher Material: **Waqanki**: 1 adult male (MUSM 39230); see table 13 for measurements.

Identification: We consulted descriptions and measurements of *Sturnira oporaphilum* provided by Carter and Dolan (1978), Anderson (1997), Velazco and Patterson (2014), and Molinari et al. (2017). No subspecies are currently recognized in *S. oporaphilum* (Velazco and Patterson, 2014; Molinari et al., 2017). Our specimen exhibits the diagnostic characteristics of *S. oporaphilum*: medium size (FA 42–47 mm); shoulder glands (epaulettes) present but weakly defined; metacarpals III and IV subequal in length, but shorter than metacarpal V; upper inner incisors orthodont; lower incisors bicuspidate; and metaconids and entoconids of m1 and m2 poorly defined, forming a continuous sloping ridge (Gardner, 2008e). Measurements of our specimens fall within the range of measurements previously reported for the species.

Sturnira tildae de la Torre, 1959

VOUCHER MATERIAL: **Tingana**: 1 adult male (MUSM 39235); **Waqanki**: 2 adult females (FMNH 203418; MUSM 39234), 4 adult males (FMNH 203592; MUSM 39231–39233); see table 15 for measurements.

IDENTIFICATION: We consulted descriptions and measurements of *Sturnira tildae* provided by de la Torre (1959), Goodwin and Greenhall (1961), Hill (1964), Marinkelle and Cadena (1971), Husson (1978), Genoways and Williams (1979), Swanepoel and Genoways (1979), Brosset and Charles-Dominique (1990), Anderson (1997), Simmons and Voss (1998), and Lim et al. (2005). No subspecies are currently recognized in *S. tildae* (Gardner, 2008e). Our specimens conform in all respects to previous descriptions of *S. tildae* and exhibit the diagnostic characteristics of the species: medium size (FA 43–51 mm, GLS 24–26 mm); shoulder glands (epaulettes) present and well defined; metacarpal III shorter than metacarpal V; tips of inner upper incisors broad and weakly bicuspidate with lobes of equal size; metaconids and entoconids of m1, m2, and m3 well defined and separated by a notch; and paraconulids not present on m1 and m2 (Gardner, 2008e). Measurements of our specimens fall within the range of measurements previously reported for the species.

Key to the Species of *Sturnira* That Occur in Sympatry with *S. giannae* (modified from Gardner, 2008e)

1. Lingual cuspids (metaconid and entoconid) of m1 and m2 poorly defined, usually forming a continuous sloping ridge......................2
1′. Lingual cuspids (metaconid and entoconid) of m1 and m2 well defined and separated by a notch..4
2. Forearm longer than 51 mm; greatest length of skull more than 27 mm….*Sturnira magna*
2′. Forearm shorter than 50 mm; greatest length of skull less than 27 mm…..................3
3. Forearm 41–44 mm; upper inner incisor bicuspidate; lower incisors tricuspidate......................................*Sturnira sorianoi*
3′. Forearm 42–47 mm; upper inner incisor; lower incisors bicuspidate ....*Sturnira oporaphilum*
4. Forearm 43–51 mm; greatest length of skull 22–26 mm; tips of inner upper incisors broad and weakly bicuspidate; metaconid and entoconid of m1 and m2 separated by a shallow notch; dorsal fur 4-colored ....*Sturnira tildae*
4′. Forearm 41–48 mm; greatest length of skull 21–25 mm; tips of inner upper incisors slender and weakly bicuspidate; metaconid and entoconid of m1 and m2 separated by a deep notch; dorsal fur bicolored..*Sturnira giannae*

Uroderma bilobatum Peters, 1866

VOUCHER MATERIAL: **Tingana**: 4 adult females (FMNH 203460; MUSM 39238, 39240, 39241), 6 adult males (FMNH 203456, 203458, 203462, 203640; MUSM 39237, 39239); **Waqanki**: 1 adult female (MUSM 39236); see table 18 for measurements.

IDENTIFICATION: The latest taxonomic review of the *Uroderma bilobatum* species complex was by Mantilla-Meluk (2014). He recognized four species in this complex: the nominate species *U. bilobatum*, a newly described taxon (*U. bakeri*), and two species formerly treated as subspecies (*U. convexum* and *U. davisi*). Currently, *Uroderma bilobatum* is thought to be restricted to east of the Andes (Mantilla-Meluk, 2014), and it can be distinguished from the other species of the genus by the following combination of characteristics: dark color, prominent facial stripes, yellowish ear margin (becoming pale yellow to white on dry museum skins), dorsum of uropatagium nearly naked, rostrum not elevated with a dorsal convexity present dorsally, interorbital constriction not swollen, junction of the nasal and maxillae forms

TABLE 18
External and craniodental measurements (mm) and weights (g) of *Uroderma bilobatum*, *Vampyressa thyone*, and *Thyroptera tricolor*

	Uroderma bilobatum		*Vampyressa thyone*	*Thyroptera tricolor*
	6 males	5 females	2 males[a]	FMNH 203644 ♀
W	17.3 (15.5–19.0) 6	18.5 (14.4–22.0) 5	8.0, 7.0	4.0
TTL	65.3 (62.0–68.0) 6	66.2 (64.0–71.0) 5	54.0, 47.0	74.0
TL	--	--	–, –	28.0
HF	12.0 (10.0–14.0) 6	11.2 (10.0–13.0) 5	8.0, 10.0	5.0
EL	17.8 (16.0–18.5) 6	17.5 (15.0–19.0) 5	13.0, 14.5	11.0
FA	44.8 (42.0–47.0) 6	44.4 (42.5–45.5) 5	32.0, 32.0	37.0
GLS	23.7 (22.7–24.1) 6	23.5 (22.7–24.3) 5	18.4, 17.5	13.3
CIL	21.9 (21.4–22.4) 6	21.7 (20.7–22.4) 5	17.3, 16.3	13.3
CCL	21.3 (20.8–21.7) 6	21.1 (20.3–21.8) 5	16.7, 15.8	--
LB	6.1 (5.7–6.4) 6	6.1 (5.8–6.5) 5	5.0, 5.0	--
POB	5.4 (5.1–5.8) 6	5.5 (5.2–5.7) 5	4.9, 4.6	2.7
ZB	13.4 (12.8–13.7) 6	13.5 (12.4–14.2) 5	11.0, 10.5	7.5
BCB	9.9 (9.6–10.1) 6	9.7 (9.4–10.1) 5	8.4, 8.3	7.4
MB	11.4 (11.0–11.7) 6	11.2 (10.8–11.4) 5	9.2, 9.1	7.0
MTR	8.4 (8.2–8.5) 6	8.4 (8.2–8.5) 5	6.2, 5.8	5.6
BM	9.3 (9.0–9.5) 6	9.6 (8.8–10.0) 5	7.8, 7.9	5.4
BC	5.8 (5.5–6.0) 6	5.8 (5.5–6.0) 5	4.4, 4.5	3.1

[a] FMNH 203642; MUSM 39242.

an obtuse angle in lateral view, and the edge of the maxillae (that forms the eye socket) forms a rim. Additional measurements were provided by Goodwin and Greenhall (1961), Husson (1962, 1978), Davis (1968), Carter and Dolan (1978), Swanepoel and Genoways (1979), Brosset and Charles-Dominique (1990), Anderson (1997), Simmons and Voss (1998), and Lim et al. (2005). Three subspecies are recognized: *U. b. bilobatum* (lowlands east of the Andes in Venezuela, Colombia, Ecuador, Peru and Bolivia, east through the Guianas, and south to Brazilian Amazonia and eastern Brazil), *U. b. thomasi* (eastern piedmonts of the Andes in Ecuador, Peru, and Bolivia), and *U. b. trinitatum* (Trinidad). Based on distribution and range of measurements, our Mayo River basin voucher material should correspond to *U. b. thomasi*.

REMARKS: One female (MUSM 39236) that we collected was lactating.

Vampyressa thyone (Thomas, 1909)

VOUCHER MATERIAL: **El Diamante**: 2 adult males (FMNH 203642; MUSM 39242); see table 18 for measurements.

IDENTIFICATION: We consulted descriptions and measurements of *Vampyressa thyone* provided by Goodwin (1963), Ceballos Bendezú (1968), Anderson (1997), Lim et al. (2003), and Tavares et al. (2014). No subspecies are currently recognized in *V. thyone* (Arroyo-Cabrales, 2008b). Our Mayo River basin specimens exhibit the diagnostic characteristics of the species: small size (FA <34 mm; GLS <19 mm); facial stripes weak and dorsal stripe lacking; uropatagium narrow and sparsely haired; rostrum shorter than braincase; hard palate extends well behind the molars; upper inner incisors long, separated basally and converging at the bifid tips; first upper premolar smaller than the second; first lower premolar caniniform and smaller than the second premolar (Arroyo-Cabrales, 2008b). Measurements of our specimens fall within the range of measurements reported for the species.

Family Thyropteridae Miller, 1907

The Neotropical family Thyropteridae includes five species characterized by small size, the presence of a circular disk on the sole of each foot, and an oval or circular disk attached by a short pedicle to the base of each thumb (Velazco et al., 2014). One species was recorded at one locality.

Thyroptera tricolor Spix, 1823

Voucher Material: **Tingana**: 1 adult female (FMNH 203644); see table 18 for measurements.

Identification: We consulted descriptions and measurements of *Thyroptera tricolor* provided by Wilson and Findley (1977), Pine (1993), Solari et al. (2004), Bezerra et al. (2005), Lim et al. (2005), Gregorin et al. (2006), and Velazco et al. (2014). Three subspecies are currently recognized in *T. tricolor*: *T. t. albiventer* (southern Mexico southward to lowland Colombia and Ecuador), *T. t. juquiaensis* (known only from the type locality in the state of São Paulo, Brazil), and *T. t. tricolor* (Amazon basin of Brazil and Peru, and the Guianan Shield of Guyana, French Guiana, Surinam, and Venezuela) (Wilson and Findley, 1977; Wilson, 2008a). Velazco et al. (2014) identified our Mayo River basin specimen as *T. tricolor*. This specimen exhibits most of the diagnostic characteristics of the species: unicolored whitish ventral pelage; proximal portion of the forearm sparsely haired; circular adhesive disk on the thumb; calcar with two lappets that project posterolaterally from the shaft of the calcar; I2 mesial cusp larger than the distal cusp; both cusps on I2 obliquely arranged relative to the long axis of the toothrow; P1 circular in occlusal view; i3 with two faintly developed accessory cusps on each side (Velazco et al., 2014). One of the diagnostic characteristics of the family Thyropteridae is the lack of postorbital processes, which is seen in all known species (Wilson, 2008a). However our specimen possesses well-marked postorbital processes on both sides of the skull. The presence of postorbital processes in our specimen could be the result of individual variation or might be indicative of a new species, but without a more comprehensive study that includes molecular data, we continue to identify this individual as a member of the nominate subspecies. With the exception of its postorbital processes, our specimen conforms to previous descriptions of the nominate subspecies and its measurements fall within the range of size variation previously documented.

Family Vespertilionidae Gray, 1821

Vespertilionidae is the most speciose family in Chiroptera, with a nearly cosmopolitan distribution except in the Arctic and Antarctica. Vespertilionids are characterized by the reduction of the second digit of the wing to the metacarpal and a single small phalanx and the presence of a long tail, reaching the edge of the uropatagium (Koopman, 1994). Two species of *Myotis* were recorded in one locality during our study.

Myotis caucensis Allen, 1914

Voucher Material: **Waqanki**: 1 adult female (FMNH 203646), 2 adult males (MUSM 39243, 39244); see table 19 for measurements.

Identification: *Myotis* is the most diverse and widely distributed bat genus with 126 species recognized (Burgin et al., 2018). The taxonomy and systematics of the genus, especially in the

New World, is confused and controversial (e.g., LaVal, 1973; Moratelli and de Oliveira, 2011; Moratelli et al., 2011a,b, 2013; Moratelli and Wilson, 2011; Larsen et al., 2012; Mantilla-Meluk and Muñoz-Garay, 2014). Recently, several studies have attempted to clarify the taxonomy of the *Myotis nigricans* species complex (Larsen et al., 2012; Moratelli et al., 2013; Moratelli and Wilson, 2014). One of the results of these revisions was the recognition of *Myotis caucensis* as a valid species where previously it had been regarded as a junior synonym of *Myotis nigricans osculatii* (Wilson, 2008b; Moratelli et al., 2013). *M. caucensis* occurs along the intermontane valleys of the Andes in Colombia, eastern Ecuador, and Peru and the adjacent Amazon lowlands across an elevational range from ca. 200 to 2600 m (LaVal, 1973; Moratelli et al., 2013). No subspecies are currently recognized in *M. caucensis* (Moratelli et al., 2013). Our Mayo River basin voucher specimens exhibit the diagnostic characteristics of the species: medium-size (FA 36.0–38.5 mm); dorsal pelage silky and unicolored; a fringe of hairs lacking along the trailing edge of the uropatagium; sagittal crest absent; and frontals not steeply sloping (Moratelli et al., 2013). Measurements of our specimens fall within the range of measurements reported for the species.

Myotis riparius Handley, 1960

Voucher Material: **Waqanki**: 2 adult females (FMNH 203650; MUSM 39245); see table 19 for measurements.

Identification: We consulted descriptions and measurements of *Myotis riparius* provided by Handley (1960), LaVal (1973), Simmons and Voss (1998), Brosset and Charles-Dominique (1990), López-González et al. (2001), Moratelli et al. (2013), and Novaes et al. (2017). No subspecies are currently recognized in *M. riparius* (Novaes et al., 2017). Our Mayo River basin voucher specimens exhibit the diagnostic characteristics of the species: fur long and woolly; dorsal pelage unicolored; plagiopatagium attached to the foot at the level of the base of the toes; a fringe of hairs lacking along the trailing edge of uropatagium; sagittal and lambdoidal crests present; and occipital region flattened posteriorly (Novaes et al., 2017). Measurements of the Mayo River specimens fall within the range of measurements reported for the species.

Remarks: One female (MUSM 39245) that we collected was lactating.

Order Rodentia Bowdich, 1821

Family Cricetidae Fischer, 1817

The cricetid rodents are one of the largest and most successful radiations in mammals. The family is the second largest in Mammalia, second only to murids, comprising 765 species grouped into 142 genera (Pardiñas et al., 2017). Five subfamilies are currently recognized within the family, with only three of those occurring in the New World: Neotominae, Sigmodontinae, and Tylomyinae (Pardiñas et al., 2017).

Subfamily Sigmodontinae Wagner, 1843

The sigmodontines are the most diverse subfamily of cricetids, with a distribution spanning southern North America to Cape Horn. They occupy a great variety of habitats across an elevational range from sea level to 5000 m (D'Elía and Pardiñas, 2015; Maestri and Patterson, 2016; Pardiñas et al., 2017).

Tribe Akodontini Vorontsov, 1959

Akodon aerosus Thomas, 1913

Voucher Material: **El Diamante**: 1 adult female (MUSM 39253); **Tingana**: 1 adult female (MUSM 39254), 2 adult males (FMNH 203654; MUSM 39255); **Waqanki**: 5 adult females (FMNH 203466, 203464, 203652; MUSM 39251, 39252), 1 adult male (MUSM 39250); see table 20 for measurements.

TABLE 19

External and craniodental measurements (mm) and weights (g) of *Myotis caucensis* and *M. riparius*

	Myotis caucensis			*Myotis riparius*	
	MUSM 39243 ♂	MUSM 39244 ♂	FMNH 203646 ♀	MUSM 39245 ♀	FMNH 203650 ♀
W	4.8	4.8	6.0	5.8	7.0
TTL	83.0	84.0	83.0	80.0	93.0
TL	38.0	37.0	35.0	38.0	44.0
HF	7.0	9.0	8.0	8.0	7.0
EL	12.0	14.0	13.0	11.0	12.0
FA	36.0	38.0	37.0	37.0	38.0
GLS	13.2	13.0	12.7	13.2	13.1
CIL	13.3	13.4	12.9	13.8	14.0
CCL	12.5	12.6	12.3	12.9	13.1
POB	3.5	3.6	3.6	3.5	3.6
ZB	8.4	–	8.2	9.0	9.5
BCB	6.6	6.5	6.2	6.5	6.9
MB	7.0	7.0	6.7	7.4	7.5
MTR	5.1	5.3	5.0	5.5	5.4
BM	5.4	5.5	5.5	5.7	6.2
BC	3.6	3.6	3.5	3.9	4.2

Identification: We consulted descriptions and measurements of *Akodon aerosus* provided by Myers (1990), Anderson (1997), Jiménez et al. (2013), Pardiñas et al. (2015), and Pardiñas and Cuéllar Soto (2017). No subspecies are currently recognized in *A. aerosus* (Pardiñas and Cuéllar Soto, 2017). Our Mayo River basin voucher specimens present the diagnostic characteristics of the species: dorsal pelage dark brown, dense, and short; ventral pelage slightly paler than dorsum; ears, forefeet, hind feet, and tail blackish brown; rostrum short and broad; supraorbital ridges smooth and nonbeaded; incisive foramina long, widely open, and with smoothly rounded edges; and broad mesopterygoid fossa (Pardiñas et al., 2015; Pardiñas and Cuéllar Soto, 2017). Measurements of our specimen fall within the range of measurements reported for the species.

Remarks: All of the Mayo River basin specimens were captured either in grassy fields or cultivated areas. A new species of laelapinae mite, *Androlaelaps aerosus*, was described by Lareschi and Velazco (2013) based on mites present on *Akodon aerosus* specimens from the Tingana and Waqanki localities.

Tribe Oryzomyini Vorontsov, 1959

Euryoryzomys macconnelli (Thomas, 1910)

Voucher Material: **El Diamante**: 2 adult males (FMNH 203468, 203656); see table 21 for measurements.

Identification: We consulted descriptions and measurements of *Euryoryzomys macconnelli* provided by Patton et al. (2000, as *Oryzomys macconnelli*), Voss et al. (2001, as *Oryzomys macconnelli*), Weksler et al. (2006), Weksler and Percequillo (2011), Percequillo (2015a), and Prado et al. (2017a). No subspecies are currently recognized in *E. macconnelli* (Percequillo, 2015a; Prado et al., 2017a). *Euryoryzomys macconnelli* is distinguished from other species in the genus by the following combina-

TABLE 20

External and craniodental measurements (mm) and weights (g) of *Akodon aerosus*

	3 males	7 females
W	35.0, 37.0	39.4 (20.0–52.0) 7
TTL	170.7 (163.0–180.0) 3	181.3 (170.0–192.0) 6
TL	64.0 (61.0–66.0) 3	64.0 (49–76) 6
HF	24.3 (24.0–25.0) 3	23.3 (21.0–25.0) 6
EL	(15) 2	16.0 (15.0–18.0) 6
CIL	25.3 (25.0–25.5) 3	25.7 (24.6–27.0) 5
LD	7.0 (6.8–7.3) 3	7.0 (6.1–7.5) 7
LM	4.6 (4.4–4.8) 3	4.5 (4.2–4.7) 7
BM1	1.3 (1.3–1.4) 3	1.3 (1.2–1.5) 7
LIF	5.9 (5.7–6.1) 3	6.2 (5.3–6.7) 7
BIF	2.3 (2.2–2.4) 3	2.5 (2.3–2.7) 7
BPB	2.9 (2.8–3.0) 3	3.0 (2.7–3.1) 7
BZP	2.4 (2.3–2.5) 3	2.4 (2.0–2.6) 7
LN	10.1 (9.4–10.6) 3	10.6 (9.5–11.4) 7
LIB	5.4 (5.4–5.5) 3	5.5 (5.2–5.7) 7
BB	13.1 (12.9–13.2) 3	12.8 (12.5–13.1) 5
ZB	14.3 (14.2–14.5) 3	14.3 (14.0–14.8) 6

tions of characteristics: medium size; fur dense, lax, and long; dorsal pelage reddish brown; skull lacking alisphenoid strut; and lower first molar with an ectolophid (Percequillo, 2015a). Our voucher material conforms to previous descriptions of the species, and measurements fall within the range of size variation previously documented for *E. macconnelli.*

Remarks: Both of our specimens were captured in a small coffee plantation. Lareschi and Velazco (2013) reported the mites *Androlaelaps fahrenholzi* and *Gigantolaelaps oudemansi* type I from our specimens.

Holochilus sciureus Wagner, 1842

Voucher Material: **Waqanki**: 1 adult female (MUSM 39257); see table 21 for measurements.

Identification: We consulted descriptions and measurements of *Holochilus sciureus* provided by Anderson (1997), Patton et al. (2000), Hice and Velazco (2012), Gonçalves et al. (2015), and Prado et al. (2017b). No subspecies are currently recognized in *H. sciureus* (Prado et al., 2017b). *H. sciureus* is characterized by the following characteristics: small size, head and body length 123–193 mm, tail length 115–178 mm; dorsal fur yellowish brown, usually mixed with black; sides are paler; ventral pelage whitish; supraorbital crests well developed; incisors opisthodont; and molars tetralophodont (Gonçalves et al., 2015; Prado et al., 2017b). Our specimen conforms to previous descriptions of the species, and measurements fall within the range of size variation previously documented.

Remarks: Our single specimen was captured in a grassland. Lareschi and Velazco (2013)

TABLE 21

External and craniodental measurements (mm) and weights (g) of *Euryoryzomys macconnelli* and *Holochilus sciureuss*

	Euryoryzomys macconnelli		*Holochilus sciureus*
	FMNH 203468 ♂	FMNH 203656 ♂	MUSM 39257 ♀
W	62.0	48.0	109.0
TTL	255.0	254.0	288.0
TL	126.0	123.0	138.0
HF	32.0	32.0	35.0
EL	21.0	19.0	16.0
CIL	28.7	26.5	33.5
LD	8.1	7.1	10.9
LM	4.8	4.8	6.9
BM1	1.5	1.5	2.2
LIF	5.2	4.2	7.3
BIF	2.5	2.2	2.6
BPB	3.0	2.6	2.9
BZP	3.3	3.0	4.2
LR	--	--	11.6
LN	--	--	14.1
LIB	5.2	5.3	4.1
BB	--	--	14.3
ZB	16.5	15.0	19.4
ZL	--	--	15.6

reported the mite *Gigantolaelaps mattogrossensis* from our specimen.

Hylaeamys perenensis (Allen, 1901)

Voucher Material: **El Diamante**: 2 adult females (FMNH 203474; MUSM 39258), 2 juvenile females (FMNH 203478; MUSM 39262), 6 adult males (FMNH 203472, 203480, 203658; MUSM 39259, 39260, 39261), 1 juvenile male (FMNH 203476); **Tingana**: 10 adult females (FMNH 203484, 203488, 203662, 203664; MUSM 39256, 39264, 39271, 39272, 39274, 39276), 1 juvenile female (FMNH 203482), 13 adult males (FMNH 203486, 203490, 203492, 203494, 203668; MUSM 39263, 39266–39270, 39273, 39277), 7 juvenile males (FMNH 203496, 203660, 203666, 203670, 203678; MUSM 39265, 39275); **Waqanki**: 1 juvenile male (FMNH 203470); see table 22 for measurements.

Identification: We consulted descriptions and measurements of *Hylaeamys perenensis* provided by Patton et al. (2000, as *Oryzomys perenensis*), Weksler et al. (2006), Weksler and Percequillo (2011), Hice and Velazco (2012), Percequillo (2015b), and Brito and Pardiñas (2017a). No subspecies are currently recognized in *H. perenensis* (Percequillo, 2015b; Brito and Pardiñas, 2017a). *H. perenensis* is distinguished from other species in the genus by the following combination of characteristics: medium size (head and body length 81–169 mm; tail 94–154 mm); tail shorter than head and body length; hind feet with medium-sized hypothenar pads; skull large and robust; incisive foramina long, narrow, teardrop shaped (length 3.6–6.0 mm; width 1.5–2.9 mm); roof of mesopterygoid fossa completely ossified; and M2 without a mesofossette and with long paraflexus (Percequillo, 2015b; Brito and Pardiñas, 2017a). Our specimens conform to previous descriptions of the species, and their measurements fall within the range of size variation previously documented.

Remarks: In the Mayo River basin, *Hylaeamys perenensis* was commonly captured in cultivated areas and flooded forests; it was less commonly captured in a coffee plantation and near a small stream. One pregnant female was recorded at the Tingana location. Lareschi and Velazco (2013) reported the mite *Gigantolaelaps oudemansi* type I from our specimens.

Hylaeamys yunganus (Thomas, 1902)

Voucher Material: **El Diamante**: 2 adult males (MUSM 39278, 39279), 1 juvenile male (FMNH 203498); **Tingana**: 1 adult male (FMNH 203500); see table 22 for measurements.

Identification: We consulted descriptions and measurements of *Hylaeamys yunganus* provided by Anderson (1997, as *Oryzomys yunganus*), Musser et al. (1998, as *Oryzomys yunganus*), Patton et al. (2000, as *Oryzomys yunganus*), Voss et al. (2001, as *Oryzomys yunganus*), Weksler et al. (2006), Weksler and Percequillo (2011), Hice and Velazco (2012), Percequillo (2015b), and Brito and Pardiñas (2017b). No subspecies are currently recognized in *Hylaeamys yunganus* (Percequillo, 2015b; Brito and Pardiñas, 2017b). Our Mayo River basin specimens exhibit the diagnostic characteristics of the species: tail shorter than head and body length; dorsal fur dense and velvety; claws sparsely covered by ungual tufts; hind feet lacking hypothenar pads; posterior margins of dentary shallowly concave between condyloid and angular processes; M2 with a distinct mesofossette and short paraflexus; and m2 with a conspicuous entoflexid (Percequillo, 2015b; Brito and Pardiñas, 2017b). Measurements of our specimens fall within the range of measurements reported for the species.

Remarks: All our specimens were captured in cultivated areas. Lareschi and Velazco (2013) reported the mites *Androlaelaps fahrenholzi* and *Gigantolaelaps oudemansi* type I from our specimens.

Neacomys spinosus (Thomas, 1882)

Voucher Material: **Waqanki**: 1 adult female (MUSM 39280), 1 adult male (FMNH 203672); see table 23 for measurements.

Identification: *Neacomys spinosus* was considered the most widespread species of *Neacomys* (e.g., Patton et al., 2000; Hice and Velazco, 2012; Weksler and Bonvicino, 2015a) until the taxonomy and systematics of the species was reviewed and its limits were reassessed by Hurtado and Pacheco (2017). The latter authors restricted the distribution of *N. spinosus* to montane cloud forests of the Peruvian departments of Amazonas, San Martín, and Huánuco across an elevational range that extends from 1127 to 2100 m. *Neacomys spinosus* is distinguished from other congeneric species by the following combination of characteristics: dorsal fur reddish; ventral fur pale white with gray bases; carpal vibrissae short; carpal and metatarsal patches always present; tail long; supraorbital beads moderately developed; alisphenoid strut present; condylar process large and slim; procingulum of M1 anteriorly flattened; posteroloph short; and protoflexus in M1 deep (Hurtado and Pacheco, 2017). Our specimens conform to this emended description of the species, and measurements fall within the range of size variation previously documented.

Remarks: At Mayo River basin, *Neacomys spinosus* was captured near a small stream. Our specimens were captured at the Waqanki locality that is at an elevation of 970 m, somewhat lower than the minimum elevation (1127 m) previously reported for the species by Hurtado and Pacheco (2017). Lareschi and Velazco (2013) reported the

TABLE 22

External and craniodental measurements (mm) and weights (g) of *Hylaeamys perenensis* and *H. yunganus*

	Hylaeamys perenensis		*H. yunganus*
	19 males	12 females	3 males
W	69.3 (52.0–96.0) 19	62.8 (41.0–85.0) 11	55.3 (40.0–80.0) 3
TTL	254.5 (225.0–283.0) 17	284.4 (215.0–273.0) 12	240.7 (225.0–267.0) 3
TL	115.6 (98.0–131.0) 17	111.3 (96.0–120.0) 12	116.0 (106.0–121.0) 3
HF	30.6 (28.0–33.0) 19	29.9 (28.0–32.0) 12	28.7 (28.0–30.0) 3
EL	20.6 (18.0–22.0) 19	20.8 (20.0–23.0) 12	19.3 (18.0–20.0) 3
CIL	29.8 (27.6–32.1) 17	29.2 (27.4–30.9) 11	28.4 (27.0–30.9) 3
LD	8.7 (8.0–9.9) 19	8.5 (7.7–9.8) 12	8.0 (7.4–9.1) 3
LM	5.0 (4.7–5.3) 19	4.9 (4.6–5.1) 12	5.1 (5.1–5.2) 3
BM1	1.5 (1.4–1.7) 19	1.5 (1.4–1.6) 12	1.5 (1.4–1.6) 3
LIF	4.5 (4.1–5.0) 19	4.5 (4.1–4.9) 12	4.7 (4.5–4.9) 3
BIF	2.3 (2.0–2.6) 19	2.2 (1.9–2.4) 12	2.1 (1.9–2.3) 3
BPB	3.2 (2.8–4.2) 19	3.1 (2.8–3.5) 12	2.9 (2.7–3.1) 3
BZP	3.9 (3.4–4.5) 19	4.0 (3.4–4.6) 12	3.7 (3.4–3.9) 3
LN	12.4 (11.0–13.7) 19	12.3 (11.2–13.9) 12	12.2 (11.5–12.8) 3
LIB	5.2 (4.9–5.6) 19	5.2 (5.0–5.5) 12	5.4 (5.3–5.7) 3
BB	13.5 (12.8–14.2) 17	13.4 (12.6–13.9) 12	13.4 (13.0–13.6) 3
ZB	17.0 (15.7–18.7) 19	16.3 (13.8–17.6) 12	16.3 (15.6–17.4) 3

mites *Gigantolaelaps intermedia*, *Laelaps boultoni*, and *Laelaps neacomydis* from our specimens.

Nectomys rattus (Pelzeln, 1883)

Voucher Material: **El Diamante**: 1 adult female (MUSM 39281); see table 23 for measurements.

Identification: We consulted descriptions and measurements of *Nectomys rattus* provided by Hershkovitz (1944, as *Nectomys squamipes melanius*), Voss et al. (2001, as *Nectomys melanius*), Bonvicino and Weksler (2015), and Chiquito et al. (2017). No subspecies are currently recognized in *Nectomys rattus* (Bonvicino and Weksler, 2015; Chiquito et al., 2017). *Nectomys rattus* is distinguished from other species in the genus by the following combination of characteristics: dorsal fur grayish brown; venter fur pale gray; hind feet lacking hypothenar pads; forefeet with distinct rudiment of thumb with nail; tail scaly but moderately haired; lacrimals contacting the maxillary bone; interparietal much wider than long; and dorsolateral exposition of the exoccipital reduced (Bonvicino and Weksler, 2015; Chiquito et al., 2017). Our specimen conforms to previous descriptions of the species, and its measurements fall within the range of size variation previously documented.

Remarks: Our single specimen was captured in a cultivated area. Lareschi and Velazco (2013) reported the mite *Gigantolaelaps goyanensis* from our specimen.

TABLE 23

External and craniodental measurements (mm) and weights (g) of *Neacomys spinosus*, *Nectomys rattus*, and *Oecomys bicolor*

	Neacomys spinosus		*Nectomys rattus*	*Oecomys bicolor*	
	MUSM 39280 ♀	FMNH 203672 ♂	MUSM 39281 ♀	FMNH 203502 ♂	FMNH 203674 ♂
W	10.6	21.5	108.0	26.9	30.0
TTL	142.0	173.0	302.0	195.0	205.0
TL	72.0	80.0	156.0	104.0	110.0
HF	21.0	22.0	44.0	21.0	21.0
EL	15.0	15.0	18.0	16.0	14.0
CIL	17.9	20.7	33.7	--	24.4
LD	4.8	6.0	9.3	6.5	7.1
LM	3.2	3.3	7.4	3.8	4.0
BM1	1.1	1.2	2.1	1.3	1.2
LIF	3.0	3.9	5.8	4.3	4.6
BIF	1.7	1.7	2.8	1.9	2.0
BPB	2.1	2.3	2.9	2.4	2.4
BZP	1.8	2.0	3.6	2.3	2.4
LR	6.0	7.3	--	--	--
LIB	4.3	4.3	6.6	4.7	4.8
BB	10.6	10.8	--	--	--
ZB	11.1	11.8	19.8	13.9	13.9

Oecomys bicolor (Tomes, 1860)

Voucher Material: **Tingana**: 2 adult males (FMNH 203502, 203674); see table 23 for measurements.

Identification: We consulted descriptions and measurements of *Oecomys bicolor* provided by Anderson (1997), Patton et al. (2000), Voss et al. (2001), Carleton et al. (2009), Hice and Velazco (2012), Carleton and Musser (2015), Ruelas and Pardiñas (2017), and Suárez-Villota et al. (2018). No subspecies are currently recognized in *O. bicolor* (Carleton and Musser, 2015; Ruelas and Pardiñas, 2017). *Oecomys bicolor* is distinguished from other congeneric species by the following combination of characteristics: dorsal fur ranging from orange brown to rufous brown; ventral pelage uniformly white; tail (105%–112% of head-body length) unicolored with a moderately penciled tip; skull robust, with short rostrum, narrow interorbit with finely beaded supraorbital ledges, and relatively inflated braincase; zygomatic arches slightly narrower rostrally and divergent toward braincase; bony palate with a pair of prominent posterolateral palatal pits; carotid circulatory pattern complete (sphenofrontal foramen and squamosoalisphenoid groove present, stapedial foramen small but present); and ectotympanic bullae small, exposing much of medial periotic (Carleton and Musser, 2015; Ruelas and Pardiñas, 2017). Our specimens conform to previous descriptions of the species, and their measurements fall within the range of size variation previously documented.

Remarks: Our specimens were captured in a flooded forest. Lareschi and Velazco (2013) reported the mites *Androlaelaps fahrenholzi*, *Gigantolaelaps tiptoni*, and *Laelaps furmani* from our specimens.

Oligoryzomys destructor (Tschudi, 1844)

Voucher Material: **El Diamante**: 1 adult male (FMNH 203504); **Tingana**: 2 adult males (MUSM 39285, 39286); see table 24 for measurements.

Identification: We consulted descriptions and measurements of *Oligoryzomys destructor* provided by Anderson (1997), Weksler and Bonvicino (2015b), Pardiñas (2017a), and Hurtado and D'Elía (2019). Currently two subspecies are recognized: *O. d. destructor* (eastern slope of the Andes [between 1600 and 3600 m] from southern Marañon River to southern Peru) and *O. d. spodiurus* (western slope of the Andes [between 1200 and 2900 m] from northern Ecuador to northern Marañon River in Peru) (Hurtado and D'Elía, 2019). *Oligoryzomys destructor* is characterized by the following characteristics: upper body reddish brown, interspersed with numerous black hairs and some gray ones with light tips; ventral fur pale yellow with a gray base; transition between ventral and dorsal coloration well defined; tail markedly bicolored; tail longer than head and body length; dorsal surfaces of feet covered by short silver-gray hair, with hairs of nail base very long; internal ear surfaces with short, pale brown hair, external surface covered with longer, blackish hairs; eight mammae present; opening of stapedial foramen large (carotid circulation pattern 2); zygomatic notch deep; interorbital constriction narrower than external breadth across molar rows; posterior borders of incisive foramina reach the anterior borders of M1; anterior border of mesopterygoid fossa curved; and short and thin coronoid process (Weksler and Bonvicino, 2015b; Pardiñas, 2017a; Hurtado and D'Elía, 2019). Our specimen conforms to previous descriptions of the nominate subspecies, and measurements fall within the range of size variation previously documented.

Remarks: At Mayo River basin, two of our specimens of *Oligoryzomys destructor* were captured at the Tingana locality which lies at an elevation of 815 m, far lower than the lowest elevation (1600 m) reported by Hurtado and D'Elía (2019) for the nominal subspecies. All three specimens were captured in cultivated areas. Lareschi and Velazco (2013) reported the mites *Gigantolaelaps tiptoni* and *Mysolaelaps parvispinosus* from our specimens.

Oligoryzomys microtis (Allen, 1916)

Voucher Material: **El Diamante**: 3 adult females (MUSM 39283, 39284; FMNH 203506); **Tingana**: 1 adult male (FMNH 203676); **Waqanki**: 1 adult female (MUSM 39282); see table 24 for measurements.

Identification: We consulted descriptions and measurements of *Oligoryzomys microtis* provided by Olds and Anderson (1987; as *Oryzomys microtis*), Anderson (1997), Patton et al. (2000), Voss et al. (2001), Hice and Velazco (2012), Weksler and Bonvicino (2015b), and Pardiñas (2017b). No subspecies are currently recognized in *O. microtis* (Weksler and Bonvicino, 2015b; Pardiñas, 2017b). *Oligoryzomys microtis* is characterized by the following characteristics: dorsal fur dull yellowish brown, finely lined with black-tipped hairs; ventral fur white; upper surfaces of feet thinly covered with light buffy brown hairs; ears small, brownish, and nearly naked; eight mammae; stapedial foramen with large opening, indicating carotid circulation pattern 2 (Weksler and Bonvicino, 2015b; Pardiñas, 2017b). Our specimens conform to previous descriptions of the species, and measurements fall within the range of size variation previously documented.

Remarks: The specimen collected at the Tingana location was caught at the edge of a *renacal* (flooded forest of *Coussapoa trinervia*). All the other specimens were caught in cultivated areas. Lareschi and Velazco (2013) reported the mite *Laelaps paulistanensis* from our specimens.

TABLE 24

External and craniodental measurements (mm) and weights (g) of *Oligoryzomys destructor* and *O. microtis*

	Oligoryzomys destructor	*O. microtis*	
	3 males	FMNH 203676 ♂	4 females
W	23.5 (15.5–30.5) 3	24.0	17.5 (16.0–20.0) 4
TTL	185.0 (170.0–195.0) 3	204.0	175.8 (165.0–188.0) 4
TL	98.3 (90.0–105.0) 3	107.0	98.3 (91.0–106.0) 4
HF	22.0 (21.0–23.0) 3	22.0	21.5 (21.0–22.0) 4
EL	13.3 (12.0–14.0) 3	16.0	13.5 (12.0–15.0) 4
CIL	21.2 (19.5–22.4) 3	21.3	19.7 (19.2–20.0) 4
LD	5.9 (5.1–6.5) 3	5.8	5.3 (5.1–5.5) 4
LM	3.4 (3.3–3.4) 3	3.3	3.3 (3.1–3.4) 4
BM1	(1.0) 3	1.0	1.0 (0.9–1.1) 4
LIF	4.0 (3.8–4.2) 3	3.9	3.7 (3.4–3.8) 4
BIF	1.7 (1.6–1.7) 3	1.6	1.8 (1.6–1.9) 4
BPB	2.3 (2.2–2.4) 3	2.1	2.2 (2.1–2.4) 4
BZP	2.2 (2.0–2.3) 3	2.0	2.0 (1.9–2.2) 4
LR	7.2 (6.5–7.6) 3	7.3	6.6 (6.3–6.9) 4
LIB	3.8 (3.7–3.9) 3	3.7	3.7 (3.6–3.8) 4
BB	10.7 (10.4–10.9) 3	10.4	10.5 (10.4–10.7) 4
ZB	12.5 (12.0–12.8) 3	12.3	11.6 (11.3–11.9) 4

Family Erethizontidae Bonaparte, 1845

The New World porcupines in the family Erethizontidae are medium-to-large sized nocturnal, arboreal, herbivorous rodents that have their bodies covered with spines used for defense (Barthelmess, 2016). Currently, the family comprises 17 species that are grouped into three genera, two of these monotypic (*Chaetomys* and *Erethizon*) (Voss, 2015; Barthelmess, 2016). The third, *Coendou*, contains most of the diversity and its species are distributed in Central and South America (Barthelmess, 2016).

Coendou bicolor (Tschudi, 1844)

Voucher Material: **Waqanki**: 1 subadult of unknown sex (MUSM 39287); see table 25 for measurements.

Identification: Description and measurements of *Coendou bicolor* have been provided by Anderson (1997), Voss (2011, 2015), and Barthelmess (2016). No subspecies are currently recognized in *C. bicolor* (Voss, 2015; Barthelmess, 2016). Our Mayo River basin specimen is a subadult, and all measurements of this individual fall outside or at the lower end of the range of variation previously reported for the species. Nonetheless, our specimen exhibits all the diagnostic characteristics of the species (e.g., quills uniformly bicolored and abruptly shorter on lower back and rump than on shoulders and upper back; frontal sinuses inflated; and roof of external auditory meatus smooth) (Voss, 2015; Barthelmess, 2016). Based on the analysis of cytochrome *b* sequences, Voss et al. (2013) confirmed the identification our specimen as *Coendou bicolor*.

TABLE 25
External and craniodental measurements (mm) and weight (g) of *Coendou bicolor*

	MUSM 39287
W	1270
TTL	670
TL	320
HF	69
EL	20
CIL	69.0
LD	17.4
MTR	17.4
LM	14.2
BM1	4.7
LIF	6.0
BIF	3.6
BPB	4.6
LN	20.9
BB	35.5
ZB	47.7
ZL	27.9

Remarks: Our specimen was shot at night (22:15 hr) while it was feeding on a tree above a stream. Nava et al. (2010) identified *Amblyomma longirostre* ticks collected from our specimen. These ticks represent the first record of this ectoparasite in Peru (Nava et al., 2010).

DISCUSSION

The eastern versant of the Central Andes of Peru is one of the major centers of endemism in the Neotropics. However, its mammalian diversity remains poorly studied. Most recent studies have focused on its global flagship primates, the yellow-tailed woolly monkey (*Lagothrix flavicauda*) and the Río Mayo titi (*Callicebus oenanthe*) (e.g., DeLuycker, 2006, 2007; Shanee et al., 2007a, b; Aldrich et al., 2008; Bóveda-Penalba et al., 2009; Buckingham and Shanee, 2009; Vermeer et al., 2011). Our inventory focused mainly on three localities along the Mayo River basin that exhibited different degrees of anthropogenic disturbances, ranging from highly disturbed (El Diamante) to more moderate disturbance (Tingana). Because our fieldwork was performed during the end of the rainy season, we were unable to assess the mammal diversity during the dry or at the start of the rainy season. Ideally, inventories should be conducted on at least four occasions, including two wet and two dry season samples per year, over at least two years. Despite the high rate of deforestation in the region, the diversity of mammals remains high in the Mayo River basin. In our three-week long inventory, we collected 47 mammal species: five marsupials, 31 bats, and 11 rodents. Had we supplemented our sampling methods for nonvolant mammals with camera traps and diurnal and nocturnal transects, which effectively document medium-sized and larger mammals, a number of additional species would likely have been added. Likewise for bats, the inclusion of harp traps and canopy nets in our inventory would likely have added additional species.

All of our marsupial specimens were either shot (*Didelphis*) or captured with Victor snap traps (*Marmosa* and *Marmosops*). They were captured in a variety of habitats ranging from chicken coops (*Didelphis*) and farmlands to secondary and flooded forests.

Most of the Mayo River bat records are relevant to ongoing studies of bat taxonomy and biogeography in the region. Our single record of *Carollia* sp. sensu Solari and Baker (2006) is the southernmost record of this undescribed species, otherwise known to occur in Ecuador and Peru north of the Amazon and Marañon Rivers. This undescribed species is sister to *C. benkeithi*, but in spite of the large cyt-*b* divergence between these two taxa (7%), we were unable to find discrete morphological characteristics that would help discriminate between these two taxa. Likewise, no differences between *C. benkeithi* and the new species were found in geometric morphometric analyses by Ruelas and López (2018) involving the shape of the skull and mandible.

Recently, Pacheco et al. (2018) questioned the presence of *Anoura geoffroyi* in Peru based on their interpretation of the revision of the *Anoura geoffroyi* complex by Mantilla-Meluk and Baker (2010). However, we captured four individuals that exhibit all the diagnostic characteristics of *A. geoffroyi*, confirming the presence of that species in Peru. Earlier records document another species of the *Anoura geoffroyi* complex, *Anoura peruana*, at mid to high elevations in the Andes. *A. geoffroyi* is present at low to middle elevations east of the Andes.

In the past decade, bats of the genus *Sturnira* have been the focus of numerous systematic and taxonomic revisions, and several species had been described based on their results (e.g., Martínez-Arias et al., 2010; Jarrín-V and Kunz, 2011; Jarrín-V and Clare, 2013; Velazco and Patterson, 2013, 2014; Hernández-Canchola and León-Paniagua, 2017; Molinari et al., 2017). One of the most widespread and widely studied species of the genus, *S. lilium*, was recently reviewed and split into seven taxa, two of them undescribed (Velazco and Patterson, 2013). One of these species, designated "*Sturnira* new species 2," was later described as *Sturnira bakeri* (Velazco and Patterson, 2014) and this trans-Andean form is sister to the Central American species *Sturnira parvidens* (Hernández-Canchola and León-Paniagua, 2017). The other, "*Sturnira* new species 3," is described here as *Sturnira giannae* and has the widest distribution in the genus. Although we now have a better understanding of the taxonomy and systematics of the *S. lilium* complex, several issues still need attention, including the role of the Huancabamba Depression in the diversification and genetic diversity of *S. giannae*. Another remaining issue is the reapportionment to the newly delimited species of all the natural history and other information (e.g., fossils, karyotypes, ectoparasites, endoparasites, etc.) reported under the name *Sturnira lilium* (sensu lato).

Our single specimen of *Thyroptera tricolor* exhibits a postorbital process, a characteristic absent in any known species of the genus. The presence of this process could represent individual variation or signal an undescribed species. Although only five species are extant (Velazco et al., 2014), thyropterids have a remarkable fossil record that dates back to the Miocene of Colombia and documents evolutionary stasis in dental dimensions (Czaplewski, 1996, 1997; Czaplewski et al., 2003; Reyes-Amaya et al., 2016). A comprehensive study that incorporates both these fossils and molecular data from specimens taken from both versants of the Andes is necessary to unravel the systematics of this charismatic widespread species.

Neacomys spinosus and *Oligoryzomys destructor* were collected in the Mayo River basin below the lowest elevations reported for their elevational ranges. We collected *Neacomys spinosus* at 970 m which is lower than the 1127 m previously reported by Hurtado and Pacheco (2017) as the lower limit of the elevational range for the species. We captured *Oligoryzomys destructor* at two localities at 815 m and 1078 m, both of which are far lower than the lower limit reported for the species of 1600 m by Hurtado and D'Elía (2019). These expansions of the elevational range of these two species are evidence of the incomplete knowledge of small mammals in the area.

The high rate of anthropogenic disturbances in the Mayo River basin threatens the biodiversity of one the most diverse regions in the Andes, home to endemic species like *Neacomys spinosus*, *Lagothrix flavicauda*, and *Callicebus oenanthe*. The rich small-mammal diversity documented by our survey highlights the need to conduct additional inventories to document its composition and to develop monitoring programs to ensure its continued persistence in the face of development.

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APPENDIX

SELECTED COLLECTING LOCALITIES FOR *STURNIRA GIANNAE*

Below we list all specimens of *Sturnira giannae* that we personally examined along with their respective localities. Names of the largest administrative unit (department, state, etc.) within each country are italicized, and geographic coordinates are provided.

BOLIVIA

Beni, Cercado, ca. 4 kilometers from Tijamuchi River mouth (14.166667 S, 64.966667 W; AMNH 210732).

Beni, General José Ballivian, ca. 5 kilometers southwest of Buena Hora (11.566667 S, 65.216667 W; AMNH 210723).

Beni, General José Ballivian, ca. 8 kilometers north of Santa Cruz (10.933333 S, 65.333333 W; AMNH 210730).

Beni, Iténez, ca. 1 kilometer below Paragua River mouth, Remansos (13.566667 S, 61.900000 W; AMNH 209424).

Beni, Mamoré, Mamoré River, opposite Cascajal (12.216667 S, 65.216667 W; AMNH 210724).

Beni, Vaca Diez, ca. 5 kilometers south of Guayaramerin, Mamoré River (10.866667 S, 65.416667 W; AMNH 209418).

Beni, Yacuma, ca. 2 kilometers from Yacuma River mouth (13.633333 S, 65.416667 W; AMNH 210733).

Pando, Abuna, Bella Vista (11.383333 S, 67.200000 W; AMNH 262473)

Pando, Manuripi, Madre de Díos River, Gargantua Island (12.383333 S, 68.583333 W; AMNH 262483).

Pando, Nicolas Suarez, Nareuda River (11.302222 S, 68.916667 W; AMNH 248862, 248873).

BRAZIL

Amazonas, Borba, Madeira River (4.400000 S, 59.583333 W; AMNH 92200, 92227).

Amazonas, Manaus, Igarapé Cacao Pereira, Negro River (3.150000 S, 60.116667 W; AMNH 91467–91469).

Pará, Faro, Amazon River, north bank, Serra do Espelho (2.183333 S, 56.733333 W; AMNH 93896, 93897).

ECUADOR

Orellana, Parque Nacional Yasuní, Estación Científica Onkone Gare, 38 km S Pompeya Sur (0.910000 S, 76.616000 W; ROM 105875).

FRENCH GUIANA

Cayenne, Sinnamary, Paracou (5.383300 N, 52.916700 W; AMNH 266207, 266210, 266236, 268545).

GUYANA

Upper Demerara-Berbice, Mabura Hill (5.283333 N, 58.633333 W; ROM 103552).

PERU

Amazonas, Luya, Río Utcubamba, 11 km by road NW Pedro Ruíz (5.933333 S, 78.100000 W; FMNH 128825).

Ayacucho, La Mar, Hacienda Luisiana on Apurimac River (12.666667 S, 73.733333 W; AMNH 208063, 208064).

Cajamarca, Santa Cruz, Río Zaña, 2 km N Monte Seco (6.850000 S, 79.066700 W; FMNH 128845).

Cuzco, La Convención, Cordillera Vilcabamba, Mapitunari River (12.650000 S, 73.700000 W; AMNH 233541).

Cuzco, Paucartambo, San Pedro (13.054667 S, 71.546233 W; FMNH 172153).

Huánuco, Leoncio Prado, 9 km S, 2 km E Tingo María (9.366700 S, 75.966700 W; TTU 46270).

Junín, Chanchamayo, 2 miles northeast of San Ramon (11.250000 S, 75.316667 W; AMNH 230526, 230529, 230545, 230546).

Loreto, Alto Amazonas, Gálvez River, Nuevo San Juan (5.250800 S, 73.163300 W; MUSM 13260).

Loreto, Maynas, Curaray River (2.363333 S, 74.090556 W; AMNH 71691–71695).

Loreto, Maynas, Estación Biológica Isla Muyuy (3.966667 S, 73.066667 W; MUSM 21266).

Loreto, Reserva Nacional Allpahuayo-Mishana, Estación Biológica "José Álvarez Alonso" (3.966667 S, 73.416667 W; ROM F63353).

Loreto, Maynas, Río Maniti, Santa Cecilia (3.555500 S, 72.883300 W; FMNH 87058).

Loreto, Requena, Jenaro Herrera, Centro de Investigaciones Jenaro Herrera (4.898600 S, 73.650300 W; MUSM 5922, 5924, 5925).

Pasco, Oxapampa, Nevati Mission (10.350000 S, 74.850000 W; AMNH 230558).

Pasco, Oxapampa, San Juan (10.500000 S, 74.883333 W; AMNH 230567, 230568).

Pasco, Oxapampa, San Pablo (10.450000 S, 74.866667 W; AMNH 230582).

San Martín, Moyobamba, Área de Conservación Municipal Mishquiyacu-Rumiyacu y Almendra, Orquidiario Waqanki (6.075100 S, 76.976000 W; FMNH 203408, 203410, 203412, 203416, 203582, 203584, 203586, 203590; MUSM 39223–39227).

San Martín, Moyobamba, Área de Conservación Municipal Asociación Hídrica Aguajal Renacal del Alto Mayo, Tingana (5.910700 S, 77.112000 W; FMNH 203420; MUSM 39229).

San Martín, Rioja, Pardo Miguel, Naranjos, Caserio El Diamante (5.753400 S, 77.526100 W; FMNH 203414, 203588; MUSM 39228).

Ucayali, Atalaya, Tahuania, Shahuaya (9.841100 S, 74.105368 W; AMNH 230535–230537).

SURINAME

Sipaliwini, Blanche Marie Vallen (4.756110 N, 56.879440 W; ROM 117574, 117642).

TRINIDAD AND TOBAGO

Tobago, Saint Patrick, Grange (11.183300 N, 60.783300 W; TTU 44085).

Trinidad, Saint Andrew, Balandra (10.721552 N, 60.991014 W; AMNH 204710).

Trinidad, Saint Andrew, Sangre Grande, Rio Grande Forest (10.583333 N, 61.116667 W; AMNH 204717).

Trinidad, Saint George, Arima, 5 mi N (10.706100 N, 61.283300 W; TTU 44090).

Trinidad, Saint George, Simla Research Center, 4 mi N Arima (10.691500 N, 61.283300 W; TTU 44092).

Trinidad, Saint George, Churchill Roosevelt Highway, 15.75 mile mark (10.618246 N, 61.255255 W; AMNH 179953).

Trinidad, Saint George, La Fillette (10.800000 N, 61.350000 W; AMNH 204712).

Trinidad, Saint George, Las Cuevas (10.766667 N, 61.383333 W; AMNH 204723).

Trinidad, Saint George, Maracas (10.683333 N, 61.400000 W; AMNH 204726).

Trinidad, Saint George, Maracas, Waterfalls Road (10.721198 N, 61.409138 W; AMNH 178652).

VENEZUELA

Bolívar, 3 km E of Puerto Caballo del Caura (7.166700 N, 64.983300 W; ROM 107936).

Bolívar, 8 km S 5 km E El Manteco (7.349900 N, 62.541100 W; CM 78567).

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On the cover: A male specimen of *Sturnira giannae* ROM F63353 photographed at the Reserva Nacional Allpahuayo-Mishana, Loreto, Peru, by Marco Tschapka.