



Bats (Mammalia, Chiroptera) from a bamboo-dominated forest in the southwestern Brazilian Amazon, with the first records of *Glyphonhycteris sylvestris* Thomas, 1896 and *Phylloderma stenops* Peters, 1865 from Acre state

Rair Sousa Verde^{1*}, Sidney Ferreira Oliveira², Andressa Oliveira Menezes¹, Felipe Gonçalves¹, Luana Alencar¹, Thiago Martins Silva¹, Armando Muniz Calouro², Henrique Augusto Mews², Elder Ferreira Morato²

1 Programa de Pós-Graduação em Ecologia e Manejo de Recursos Naturais, Universidade Federal do Acre, Rio Branco, AC, Brazil

• RSV: rair.verde@gmail.com  <https://orcid.org/0000-0003-2275-4324>

2 Centro de Ciências Biológicas da Natureza, Universidade Federal do Acre, Rio Branco, Acre, Brazil

* Corresponding author

Abstract

There are only a few published bat surveys from the southwestern Brazilian Amazon, but recent studies have reported additional bats species in the region. We provide the first list of bat species from Floresta Estadual do Antimary (Antimary State Forest) and record for the first time *Glyphonhycteris sylvestris* Thomas, 1896 and *Phylloderma stenops* Peters, 1865 in the state of Acre, increasing to 64 the number of species known from this state. Our survey enlarges the known geographic range of *G. sylvestris* in Brazilian territory and improves the inventory of bat species in a poorly sampled region of the Amazon.

Keywords

Amazonia, chiropteran diversity, distribution

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Introduction

The Neotropical region harbors the greatest species richness of mammals in the world (Burgin et al. 2018). Efforts toward recognizing and recording the biodiversity of mammals have been historically heterogeneous in various Brazilian regions. Biodiversity surveys are usually focused in areas close to urban centers, which concentrate research institutions and along roads and navigable

rivers (Boakes et al. 2010; Oliveira et al. 2016). The Amazon region, given its large area and difficulty of access, represents an enormous knowledge gap in the diversity and distribution of bat species (Bernard et al. 2011).

In Brazil, the order Chiroptera is represented by nine families, 68 genera, and 181 species (Garbino et al. 2020), with records of 160 species in the Amazon biome

(López-Baucells et al. 2016). According to Bernard et al. (2011), 59 bat species occur in the state of Acre, but five species were recently recorded: *Gardnerycteris crenulatum* (É. Geoffroy, 1803), *Lasiurus blossevillii* (Lesson, 1826), *Lophostoma brasiliense* Peters, 1866, *Micronycteris microtis* Miller, 1898, and *Saccopteryx canescens* Thomas, 1901 (Calouro et al. 2010; Verde et al. 2017, 2018).

In the southwestern Amazon, bamboo species of the genus *Guadua* (Bambusoideae: Poaceae) have ecological characteristics that influence the structure and dynamics of forests (Silveira 2005). About 161,500 km² of the southeastern Amazon region is occupied by forest with a high density of bamboo (Carvalho et al. 2013) infer the life-cycle length and describe spatial and temporal patterns of flowering of sarmentose bamboos (*Guadua* spp, which, once established, changes succession and forest dynamics and functions as a biotic filter. *Guadua* species have a life cycle of about 29–32 years (Silveira 2005; Carvalho et al. 2013), with opportunistic growth and a high capacity to occupy altered areas, which give the bamboo a significant competitive advantage (Silveira 2005). These factors, plus the uncommon life cycle of synchronized mortality after fruiting, directly affect the vegetation dynamics, appearance, vegetation structure,

and composition of tree species of the forest (Silveira 2005). Open forests dominated by *Guadua* are called “tabocais” and, although uncommon in the Amazon, cover large areas in the southwestern Amazon (Silveira 2005). Floresta Estadual do Antimary (FEA; Antimary State Forest is located in the center of the distribution of *Guadua* bamboo species in the Amazon (McMichael et al. 2014), and in Acre this is most protected areas are within the distribution of *Guadua* species.

Although there are over 10 protected areas in Acre, including integral and sustainable-use protected areas, bats have only ever been surveyed in Serra do Divisor National Park (Nogueira et al. 1999). Thus, there remains gaps in the knowledge of the real diversity and distribution of these mammals in the state. Therefore, this is the first Chiroptera survey carried out in the FEA, northeastern Acre state, and expands efforts to catalog the bat fauna in one of the less sampled areas of the Amazon.

Methods

Study site. We conducted a bat survey in the FEA (Fig. 1) located in the southwestern Brazilian Amazon, in northeastern Acre. The FEA encompasses the municipalities of Bujari and Sena Madureira, bordering to the

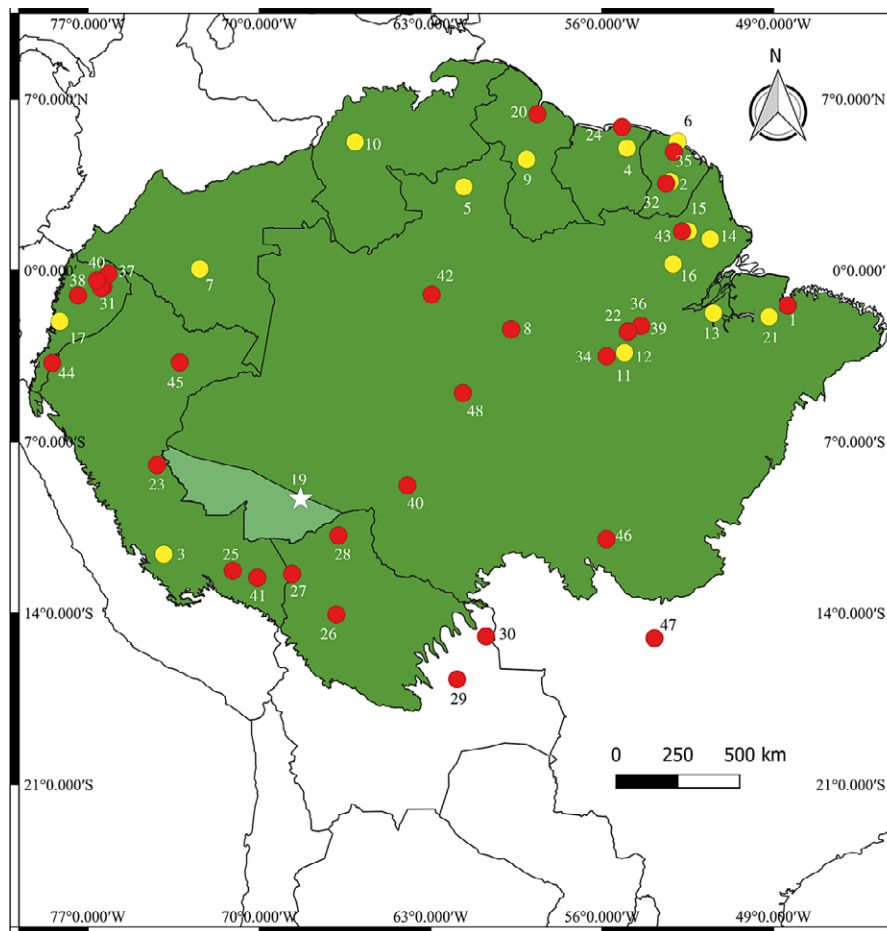


Figure 1. Location of the Floresta Estadual do Antimary (star in the state of Acre (light green) and Brazil, with records of *Glyphoncteris sylvestris* (yellow dots) and *Phylloderma stenops* (red dots) in the Amazon (green), including the new records for the state of Acre (star). See Tables 1 and 2 for localities.

Table 2. Records of *Glyphoncteris sylvestris* in the Amazon. The numbers in the leftmost column refer to the numbers in Figure 1.

Number	Locality	Latitude	Longitude	Reference
1	Guamá, Pará, Brazil	01°26'S	048°25'W	Handley 1967
2	Saül, French Guiana	03°38'N	053°13'W	Brosset and Dubost 1968
3	Cordillera Vilcabamba, Cuzco, Peru	11°35'S	073°54'W	Koopman 1978
4	Brokopondo, Brownsweag, Suriname	05°00'N	054°59'W	Williams and Genoways 1980
5	Ilha de Maracá, Roraima, Brazil	03°25'N	061°39'W	Robinson 1998
6	Paracou, Sinnamary, French Guiana	05°16'N	052°55'W	Simmons and Voss 1998
7	Estación Puerto Abeja, Caquetá, Colombia	00°04'N	072°26'W	Montenegro and Romero-Ruiz 2000
8	80 km N of Manaus, Amazonas, Brazil	02°24'S	059°43'W	Bernard 2001a
9	Iwokrama Forest, Potaro-Siparuni, Guyana	04°32'N	059°05'W	Lim and Engstrom 2001
10	San Juan de Manapiare, Amazonas, Venezuela	05°15'N	066°05'W	Lim and Engstrom 2001
11	Alter do Chão, Pará, Brazil	02°30'S	054°57'W	Bernard and Fenton 2002
12	FLONA Tapajós, Pará, Brazil	03°20'S	045°57'W	Castro-Arellano et al. 2007
13	Estação Científica Ferreira Penna, Pará, Brazil	01°44'S	051°27'W	Marques-Aguiar et al. 2009
14	FLONA do Amapá, Amapá, Brazil	01°17'N	051°35'W	Martins et al. 2011
15	Montanhas do Tumucumaque, Amapá, Brazil	01°36'N	052°29'W	Martins et al. 2011
16	Rio Iratapuru, Amapá, Brazil	00°16'N	053°06'W	Martins et al. 2011
17	Sangay National Park, Morona Santiago, Ecuador	02°05'S	078°09'W	Tirira et al. 2016
19	Floresta Estadual do Antimary, Acre, Brazil	09°31'S	068°23'W	Present study

Table 3. Records of *Phylloderma stenops* in the Amazon. The numbers in the leftmost column refer to the numbers in Figure 1.

Number	Localities	Latitude	Longitude	References
20	Cuyuni-Mazaruni, Bartica Grove, Guyana	06°54'N	058°37'W	Hill 1965
21	Parque Estadual Utinga, Pará, Brazil	01°26'S	048°25'W	Handley 1967
22	Santarém, Pará, Brazil	02°15'S	054°24'W	Jeanne 1970
23	Departamento de Loreto, Iquitos, Perú	03°45'S	073°15'W	Davis and Dixon 1976
24	Coronie, Totness, Suriname	05°53'N	056°19'W	Genoways and Williams 1979
25	Departamento de Madre de Dios, Parque Nacional de Manú, Perú	11°55'S	071°15'W	Ascorra et al. 1991
26	Departamento de Beni, Bolivia	—	—	Anderson 1997
27	Departamento de Pando, Chive, Bolivia	—	—	Anderson 1997
28	Departamento de Pando, Bolivia	—	—	Anderson 1997
29	Provincia de Sara, Santa Cruz, Bolivia	—	—	Anderson 1997
30	Departamento de Santa Cruz, Totaisal, Bolivia	—	—	Anderson 1997
31	Provincia Francisco Orellana, Pompeya Sur, Ecuador	00°40'S	076°22'W	Reid et al. 2000
32	Les Eaux Claires, Saül, French Guiana	03°37'S	052°12'W	Simmons et al. 2000
33	80 km N of Manaus, Amazonas, Brazil	02°24'S	059°43'W	Bernard 2001a
34	Alter do Chão, Amazon National Park, Pará, Brazil	02°24'S	054°42'W	Bernard 2001b
35	Saint-Eugène station, French Guiana	04°51' N	053°04' W	Pons and Cosson 2002
36	Alter do Chão, Pará, Brazil	02°30'S	054°57'W	Bernard and Fenton 2002
37	Provincia Francisco Orellana, Yasuni National Park, Ecuador	00°42'S	076°28'W	Trujillo and Albuja 2005
38	Sucumbios, Limoncocha Biological Reserve, Ecuador	00°24'S	076°38'W	Trujillo and Albuja 2005
39	FLONA Tapajós, Pará, Brazil	03°21'S	045°57'W	Castro-Arellano et al. 2007
40	Sucumbios, Cuyabeno Wildlife Reserve, Ecuador	00°07'S	075°09'W	Tirira 2007
41	Departamento de Madre de Dios, Perú	12°32'S	070°04'W	Bravo et al. 2008
42	Barcelos, Amazonas, Brazil	00°58'S	062°57'W	Moratelli et al. 2010
43	Montanhas do Tumucumaque, Amapá, Brazil	01°36'N	052°29'W	Martins et al. 2011
44	Zamora Chinchipe, Tigre River, Ecuador	03°46'S	078°27'W	Brito and Arguero 2012
45	Departamento de Ucayali, Perú	07°56'S	074°10'W	Fernández-Arellano and Torres-Vásquez 2013
46	Nova Canaã do Norte e Itaúba, Mato Grosso, Brazil	10°58'S	055°45'W	Miranda et al. 2015
47	Mato Grosso, Brazil	15°00'S	053°51'W	Oliveira et al. 2015
48	Between the Purus and Madeira Rivers, Amazonas, Brazil	—	—	Marciente et al. 2015
49	Porto Velho, Rondônia, Brazil	—	—	Tavares et al. 2017
19	Floresta Estadual do Antimary, Acre, Brazil.	09°31'S	068°23'W	Present study

northeast with the state of Amazonas and to the south with the Antimary River. It has an area of 76,832 ha and is comprised of a mosaic of dense forest and open forest with bamboo, including species of the genus *Guadua*, and/or palm trees (Funtac 2012). The predominant vegetation at the two sampling sites is dense rainforest is the

forest dominated by bamboo and palm trees. The annual air temperature in the region ranges from 22 to 33 °C and annual rainfall from 1,600 to 2,750 mm. The climate is Am according to the Köppen classification system (Alvares et al. 2013), and there is an increased rainy period from November to April and drier from May to October.

Field surveys. We captured bats in a total of nine sampling nights in June 2016 and March 2017 during four and five nights, respectively. Each night we used eight Ecotone® mist nets (12 × 3 m, 19 mm mesh size) placed at ground level. The nets were left open for 6 h and inspected every 15 min. The final sampling effort was 15,552 m² · h following Straube and Bianconi (2002).

Identification and voucher specimens. We identified the bats in the field using the identification keys by Gardner (2007) and Díaz et al. (2016). The species caught were classified into five guilds according to Schnitzler and Kalko (1998) and Simmons and Voss (1998): glean-ing frugivore, glean-ing insectivore, aerial insectivore, glean-ing carnivore, and glean-ing omnivore. We kept the bats in cotton bags for morphometric for identification and aging by observing the ossification of epiphyses of the third metacarpus (Kunz and Anthony 1982; Kunz and Robson 1995). We released the bats where they were captured. We euthanized a few voucher specimens of each species by the intramuscular injection of 100 g/kg of ketamine hydrochloride combined with 1% acepromazine at the ratio of 9:1. These specimens were then identified in laboratory using external, cranial, and dental characteristics. We fixed the specimens in 10% formalin for storage in a 70% alcohol solution and deposit in the Laboratório de Ecologia dos Mamíferos (LEM) of the Universidade Federal do Acre. The captures and specimen collections were authorized by SISBIO (Sistema de autorização do Instituto Chico Mendes de Conservação da Biodiversidade) (authorization number 56970).

To confirm the identification of our specimens, we measured the external body, skull, and teeth: weight (in grams), forearm length; total length, the distance between the tip of the muzzle to the tip of the last tail vertebra; tibia length, distance from the proximal tip of the tibia to the posterior base of the calcaneus; ear length, from the notch to the tip of the auricle; tail length, distance from the dorsal tail flexure with the sacrum to the tip of the last tail vertebra; skull maximum length, from the proximal point on the occipital to the distal point over the premaxilla (excluding the incisors); zygomatic width, the largest distance between the zygomatic arches. All biometrics were measured using digital calipers with 0.01 mm precision.

Data analysis. The capture rate was calculated by dividing the number of captures by the total sampling effort (individuals/m² · h · net). Richness was estimated according to the Jackknife 1 method (Colwell and Coddington 1994) using PAST v. 3.0 (Hammer et al. 2001). We also built the species accumulation curve based on the sample randomization using the vegan package (Oksanen et al. 2011) in R v. 3.0.3 program (R Core Team 2015).

Results

Assemblage structure. We captured 99 individuals belonging to 19 species, 15 genera, and two families. The

gleaning frugivores were predominant ($N = 72$, species = 11), followed by insectivores ($N = 23$, species = 5), omnivores ($N = 3$, species = 2) and carnivores ($N = 1$, species = 1) (Table X). Total capture index was 0.006 ind · m² · h · net. The result of the Jackknife 1 richness estimator indicated that the local assemblage hosts 24 ± 1.88 species, which indicates that our sampling represented 79% of the potential richness in the locality. Likewise, the accumulation curve did not reach an asymptote, indicating that more species can be recorded with additional sampling efforts (Fig. 2).

Order Chiroptera

Family Phyllostomidae

Carollia perspicillata (Linnaeus, 1758)

Figure 3E

Materials examined. BRAZIL • 9 adult ♀, 6 adult ♂; Acre, municipality of Sena Madureira, Floresta Estadual do Antimary; 09°18'41.19"S, 068°17'34.58"W; alt. 200 m a.s.l.; Jun. 2016; R.S. Verde leg.; collected with mist nets; voucher: LEM-1153 (Fig. 3E).

Identification. Lower jaw tending to be V-shaped, with straight rami. Short pelage with bands with contrasting colors and a light band greater than the dark one. Forearm ranged from 38 mm to 44 mm. Cingula of canine hiding the outer mandibular incisors. Conspicuous hair on the forearm and toes; by intermediaries in the tibia.

Carollia brevicauda (Schinz, 1921)

Figure 3D

Materials examined. BRAZIL • 1 adult ♀, 2 adult ♂; Acre, municipality of Sena Madureira, Antimary State Forest; 09°18'41.19"S, 068°17'34.58"W; 200 m a.s.l.; Jun.

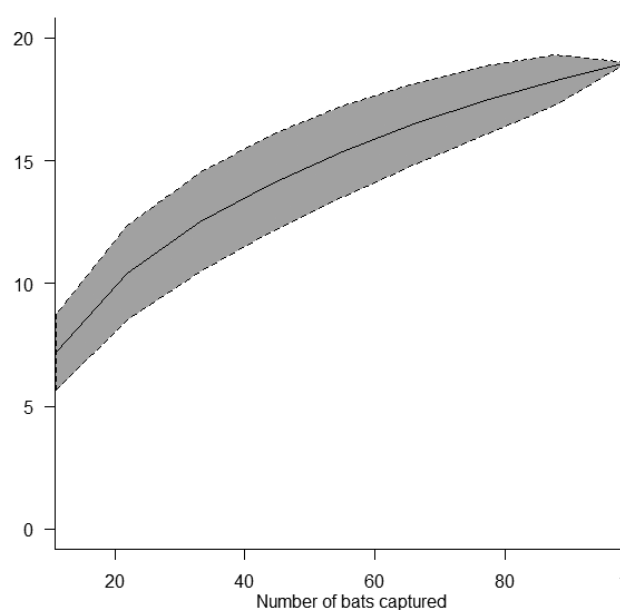


Figure 2. Species accumulation curve as a function of the number of individuals captured in the bat assemblage in Antimary State. The area (gray) represents the 95% confidence interval.

Table 3. List of species, number of individuals captured and capture rate (ind · m² · h · net) of bats in the Floresta Estadual do Antimary, Acre, Brazilian Amazon: gleaning frugivore (GF), gleaning insectivore (GI), aerial insectivore (AI), gleaning carnivore (GC) and gleaning omnivore (GO). * New records for the state of Acre.

Taxa	Guild	No. of individuals captured	Voucher	Capture rate
Phyllostomidae				
Carollinae				
<i>Carollia perspicillata</i> (Linnaeus, 1758)	GF	15	LEM-1153	0.00096
<i>Carollia brevicauda</i> (Schinz, 1821)	GF	3	LEM-1154	0.00019
Rhinophyllinae				
<i>Rhinophylla fischeriae</i> Carter, 1966	GF	6	LEM-1155	0.00038
<i>Rhinophylla pumilio</i> Peters, 1865	GF	15	LEM-1156	0.00096
Phyllostominae				
<i>Lophostoma silvicolium</i> d'Orbigny, 1836	GI	9	LEM-1157	0.00057
<i>Phylloderma stenops</i> Peters, 1865*	GO	1	LEM-1158	0.00006
<i>Phyllostomus elongatus</i> (É. Geoffroy, 1810)	GO	2	LEM-1159	0.00012
<i>Tonatia maresi</i> Williams, Willig e Reid, 1995	GI	10	LEM-1160	0.00064
<i>Trachops cirrhosus</i> (Spix, 1823)	GC	1	LEM-1161	0.00006
Glyphoncterinae				
<i>Glyphoncteris sylvestris</i> Thomas, 1896*	GI	1	LEM-1162	0.00006
<i>Trinycteris nicefori</i> (Sanborn, 1949)	GI	2	LEM-1163	0.00012
Stenodermatinae				
<i>Artibeus planirostris</i> (Spix, 1823)	GF	8	LEM-1164	0.00051
<i>Artibeus lituratus</i> (Olfers, 1818)	GF	15	LEM-1165	0.00096
<i>Artibeus obscurus</i> (Schinz, 1821)	GF	3	LEM-1166	0.00019
<i>Dermanura cinerea</i> Gervais, 1856	GF	2	LEM-1167	0.00012
<i>Platyrrhinus brachycephalus</i> (Thomas, 1912)	GF	1	LEM-1168	0.00006
<i>Platyrrhinus incarum</i> (Thomas, 1912)	GF	1	LEM-1169	0.00006
<i>Uroderma bilobatum</i> Peters, 1866	GF	2	LEM-1170	0.00012
<i>Vampyressa thuyone</i> Thomas, 1909	GF	1	LEM-1266	0.00006
Thyropteridae				
<i>Tyroptera tricolor</i> Spix, 1823	AI	1	LEM-1171	0.00006
Total		99		0.00600

2016; R.S. Verde leg.; collected with mist nets; voucher: LEM-1154 (Fig. 3D).

Identification. Cuspids of first lower molar as well developed as those of second (checked with magnification after removal of the skull); lower second premolar of the same height as first lower molar; branches of the jaw in ventral view forming a “U”. Short pelage with bands with contrasting colors and a light band greater than the dark one. Forearm ranged from 36 mm to 42 mm. Cingula of canine not hiding the external mandibular incisors. Conspicuous pelage on the forearm and toes.

Rhinophylla fischeriae Carter, 1966

Figure 3K

Materials examined. BRAZIL • 4 adult ♀, 2 adult ♂; Acre, municipality of Sena Madureira, Floresta Estadual do Antimary; 09°18'41.19"S, 068°17'34.58"W; 200 m a.s.l.; Jun. 2016; R.S. Verde leg.; collected with mist nets; voucher: LEM-1155 (Fig. 3K).

Identification. Coloration reddish brown; uropatagium normal, not reduced; heel greater than 4 mm; space between upper and canine incisor; small space between the incisor and the canine (seen with magnification after removal of the skull); forearm length 28–31 mm.

Rhinophylla pumilio Peters, 1865

Figure 3L

Materials examined. BRAZIL • 4 adult ♀, 11 adult ♂; Acre, municipality of Sena Madureira, Floresta Estadual do Antimary; 09°18'41.19"S, 068°17'34.58"W; 200 m a.s.l.; Jun. 2016; R.S. Verde leg.; collected with mist nets; voucher: LEM-1156 (Fig. 3L).

Identification. Uropatagium border hairless; upper central incisor with marked side cingula and no space between upper incisor and canine (seen with magnification after removal of the skull); forearm 28–32 mm.

Lophostoma silvicolium d'Orbigny, 1836

Figure 3G

Materials examined. BRAZIL • 2 adult ♀, 2 adult ♂; Acre, municipality of Sena Madureira, Floresta Estadual do Antimary; 09°18'41.19"S, 068°17'34.58"W; 200 m a.s.l.; Jun. 2016; R.S. Verde leg.; collected with mist nets; voucher: LEM-1157 (Fig. 3G).

Identification. One pair of lower incisors; skin band between ears with a deep notch; labial cingula on the upper and lower canines.

Phylloderma stenops Peters, 1865

Figure 3S

Materials examined. BRAZIL • 1 adult ♂; Acre, municipality of Sena Madureira, Floresta Estadual do Antimary; 09°18'41.19"S, 068°17'34.58"W; 200 m a.s.l.; Mar.

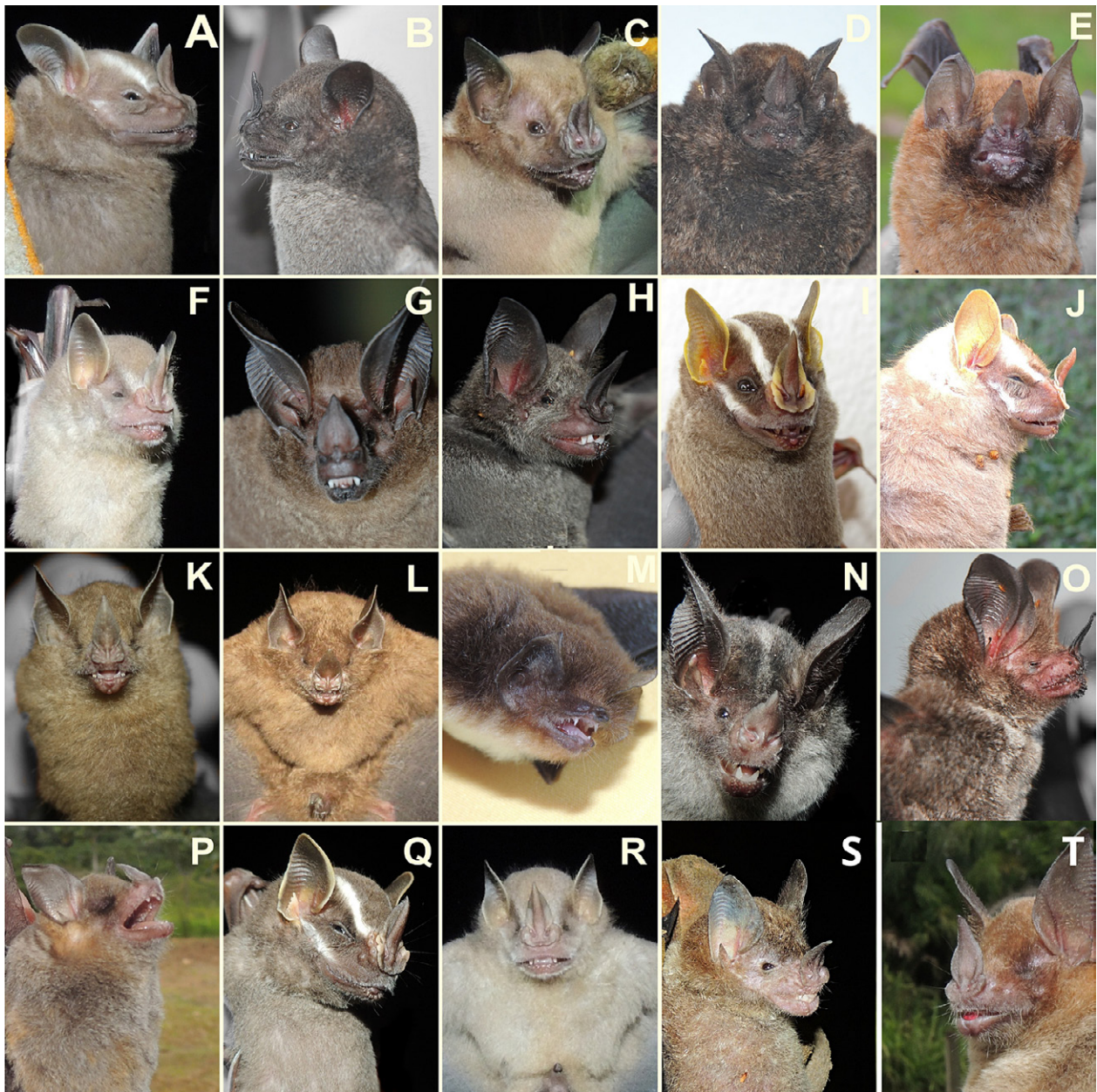


Figure 3. Bats in the Floresta Estadual do Antimary, Acre, southwestern Brazilian Amazon. **A.** *Artibeus lituratus*. **B.** *Artibeus obscurus*. **C.** *Artibeus planirostris*. **D.** *Carollia perspicillata*. **E.** *Carollia brevicauda*. **F.** *Dermanura cinerea*. **G.** *Lophostoma silvicola*. **H.** *Phyllostomus elongatus*. **I.** *Platyrrhinus brachycephalus*. **J.** *Platyrrhinus incarum*. **K.** *Rhinophylla fischerae*. **L.** *Rhinophylla pumilio*. **M.** *Thyroptera tricolor*. **N.** *Tonatia maresi*. **O.** *Trachops cirrhosus*. **P.** *Trinycteris nicefori*. **Q.** *Uroderma bilobatum*. **R.** *Vampyressa thyone*. **S.** *Phylloderma stenops*. **T.** *Glyphonycteris sylvestris*.

2017; R.S. Verde leg.; collected with mist nets; voucher: LEM-1158 (Fig. 3S).

Identification. Nasal leaf with smooth edges and horse-shoe cast with upper lip; first superior premolar separated from third premolar, and second premolar not displaced from lingual face. Measurements: total length 95.2 mm; tail length 11.8 mm; hind foot length 27.7 mm; ear length 24.5 mm; forearm length 74.1 mm; tragus 9.2 mm.

***Phyllostomus elongatus* (É. Geoffroy, 1810)**

Figure 3H

Materials examined. BRAZIL • 2 adult ♂; Acre, municipality of Sena Madureira, Floresta Estadual do Antimary; 09°18'41.19"S, 068°17'34.58"W; 200 m a.s.l.; Jun.

2016; R.S. Verde leg.; collected with mist nets; voucher: LEM-1159 (Fig. 3H).

Identification. Forearm 63–65 mm long; tibia longer than 23 mm; greatest length of skull more than 29 mm; lower incisors trifid.

***Tonatia maresi* Williams, Willig & Reid, 1995**

Figure 3N

Materials examined. BRAZIL • 4 adult ♀, 6 adult ♂; Acre, municipality of Sena Madureira, Floresta Estadual do Antimary; 09°18'41.19"S, 068°17'34.58"W; 200 m a.s.l.; Jun. 2016; R.S. Verde leg.; collected with mist nets; voucher: LEM-1160 (Fig. 3N).

Identification. Skin around mouth, nose leaf, and warts

of lower lip darkly colored; posterior edge of cranium with blunt vertex due to a poorly developed sagittal process; canine and first lower premolar separated by a diastema; clinoid process poorly developed or absent.

***Trachops cirrhosus* (Spix, 1823)**

Figure 3O

Materials examined. BRAZIL • 1 adult ♂; Acre, municipality of Sena Madureira, Floresta Estadual do Antimary; 09°18'41.19"S, 068°17'34.58"W; 200 m a.s.l.; Mar. 2017; R.S. Verde leg.; collected with mist nets; voucher: LEM-1161 (Fig. 3O).

Identification. Papilla-like protuberances present on chin and lips; nose-leaf with finely serrated margins; tail extends to the middle of the interfemoral membrane; calcar about equal in length to foot.

***Glyphoncteris sylvestris* Thomas, 1896**

Figure 3T

Materials examined. BRAZIL • 1 adult ♂; Acre, municipality of Sena Madureira, Floresta Estadual do Antimary; 09°18'41.19"S, 068°17'34.58"W; 200 m a.s.l.; Mar. 2017; R.S. Verde leg.; collected with mist nets; voucher: LEM-1162 (Fig. 3T).

Identification. Dorsal hair tricolored; greatest length of skull less than 25 mm; two pairs of upper incisors, outer incisor hidden by cingulum of canine; lower incisors normal (not anteriorly-posteriorly long and transversely narrow). Morphological characteristics (external, cranial and dental) observed in the collected specimen allowed the correct identification. Measurements (in mm) obtained from the collected male: forearm length 39.9, third metacarpal 36.6, fourth metacarpal 35.3, fifth metacarpal 38.2, total skull length 19.8, basal condyle length 18.2, series of upper teeth 8, length of mandible 12.8, series of lower teeth series 8.3, zygomatic width 9.7, cranial cavity width 8.2.

Comments. Our record expands the distribution of *G. sylvestris* by nearly 650 km northwest of the nearest Amazon record (Tirira et al. 2016).

***Trinycteris nicefori* (Sanborn, 1949)**

Figure 3P

Materials examined. BRAZIL • 4 adult ♀; Acre, municipality of Sena Madureira, Floresta Estadual do Antimary; 09°18'41.19"S, 068°17'34.58"W; 200 m a.s.l.; Jun. 2016; R.S. Verde leg.; collected with mist nets; voucher: LEM-1163 (Fig. 3P).

Identification. Forearm 39.6 mm; dorsal pelage four-banded; pale basal band narrow and inconspicuous; pale median dorsal stripe usually evident on the lower back; upper incisors wide and spatulate; lower lip Y-shaped; brown dorsal hair; first upper premolar small, smaller than the second premolar.

***Artibeus cinereus* Gervais, 1856**

Figure 3F

Materials examined. BRAZIL • 1 adult ♀; Acre, muni-

cipality of Sena Madureira, Floresta Estadual do Antimary; 09°18'41.19"S, 068°17'34.58"W; 200 m a.s.l.; Jun. 2016; R.S. Verde leg.; collected with mist nets; voucher: LEM-1167.

Identification. Forearm 38–40 mm; dorsal hair bicolored; molars 2/2; interfemoral membrane appearing practically hairless (Fig. 3F).

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

Figure 3C

Materials examined. BRAZIL • 4 adult ♀, 4 adult ♂; Acre, municipality of Sena Madureira, Floresta Estadual do Antimary; 09°18'41.19"S, 068°17'34.58"W; 200 m a.s.l.; Jun. 2016; R.S. Verde leg.; collected with mist nets; voucher: LEM-1164 (Fig. 3C).

Identification. Forearm 63–69 mm; facial lines not evident; molars 3/3; tip of the pale wing; nasal leaf with free lower edge.

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

Figure 3A

Materials examined. BRAZIL • 7 adult ♀, 8 adult ♂; Acre, municipality of Sena Madureira, Floresta Estadual do Antimary; 09°18'41.19"S, 068°17'34.58"W; 200 m a.s.l.; Jun. 2016; R.S. Verde leg.; collected with mist nets; voucher: LEM-1165 (Fig. 3A).

Identification. Forearm 69–74 mm; facial stripes prominent and well defined; molars 2/3; tragus and lower margin of ears pale.

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

Figure 3B

Materials examined. BRAZIL • 1 adult ♀, 2 adult ♂; Acre, municipality of Sena Madureira, Floresta Estadual do Antimary; 09°18'41.19"S, 068°17'34.58"W; 200 m a.s.l.; Jun. 2016; R.S. Verde leg.; collected with mist nets; voucher: LEM-1166 (Fig. 3B).

Identification. Forearm 55–59 mm; fur long and blackish; tubercles on lower lip small, usually 3 or 4 on each side of chin.

***Platyrrhinus brachycephalus* (Thomas, 1912)**

Figure 3I

Materials examined. BRAZIL • 1 adult ♂; Acre, municipality of Sena Madureira, Floresta Estadual do Antimary; 09°18'41.19"S, 068°17'34.58"W; 200 m a.s.l.; Mar. 2016; R.S. Verde leg.; collected with mist nets; voucher: LEM-1168 (Fig. 3I).

Identification. Anterolingual cristid of fourth lower premolar with two well-developed accessory cusplids; forearm 43 mm; venter tricolor; facial stripes inconspicuous.

***Platyrrhinus incarum* (Thomas, 1912)**

Figure 3J

Materials examined. BRAZIL • 1 adult ♀; Acre, municipality of Sena Madureira, Floresta Estadual do Antimary; 09°18'41.19"S, 068°17'34.58"W; 200 m a.s.l.; Jun.

2016; R.S. Verde leg.; collected with mist nets; voucher: LEM-1169 (Fig. 3J).

Identification. Anterior border of main cusp of last premolar with 1 or 2 major cusps; ventral hair bicolor; lateral borders of proximal half of nasal leaf and horseshoe white.

***Uroderma bilobatum* Peters, 1866**

Figure 3Q

Materials examined. BRAZIL • 2 adult ♀; Acre, municipality of Sena Madureira, Floresta Estadual do Antimary; 09°18'41.19"S, 068°17'34.58"W; 200 m a.s.l.; Jun. 2016; R.S. Verde leg.; collected with mist nets; hair color, forearm size and dentition; voucher: LEM-1170 (Fig. 3Q).

Identification. ventral pelage dark; facial stripes prominent; ear margin yellowish in life; interfemoral membrane nearly naked; rostrum shallow; forearm 43–45 mm.

***Vampyressa thylene* Thomas, 1909**

Figure 3R

Materials examined. BRAZIL • 1 adult ♀; Acre, municipality of Sena Madureira, Floresta Estadual do Antimary; 09°18'41.19"S, 068°17'34.58"W; 200 m a.s.l.; Jun. 2016; R.S. Verde leg.; collected with mist nets; voucher: LEM-1266 (Fig. 3R).

Identification. Small size, forearm 32.7 mm; maximum length of skull 18.5 mm; zygomatic breadth 10.4 mm; mandibular tooththrow 6.1 mm; dorsal stripe absent.

Family Thyropteridae

***Thyroptera tricolor* Spix, 1823**

Figure 3M

Materials examined. BRAZIL • 1 adult ♀; Acre, municipality of Sena Madureira, Floresta Estadual do Antimary; 09°18'41.19"S, 068°17'34.58"W; 200 m a.s.l.; Jun. 2016; R.S. Verde leg.; collected with mist nets; voucher: LEM-1171 (Fig. 3M).

Identification. Forearm 36.8 mm; ventral pelage solid white or pale gray; interfemoral membrane appearing nearly naked; inner upper incisor bifid.

Discussion

The most common species in our study belonged to the genus *Carollia*. *A. lituratus*, *R. pumilio* and *T. maresi* were moderately abundant. The frugivorous guild was most prevalent and represented 72% of the species captured. Other studies in the Amazon also reported the abundance of individuals of the genus *Carollia* (e.g. Bernard and Fenton 2007; Presley et al. 2009; Bobrowiec and Gribel 2010; Bobrowiec 2012; Tavares et al. 2017), which is often associated plants of the genus *Piper* on which it feeds. Insectivores amounted to 22.8% of the individuals caught, and omnivores and carnivores accounted for less than 3%. The presence of species which are usually less often caught in mist nets, such as *P. stenops*, *G.*

sylvestris, and *T. nicefori*, shows that our study area is probably well-conserved.

Of the species that we newly report from Acre, *P. stenops* is widely distributed, occurring from Mexico to southeastern Brazil, and in Andes at elevations up to 2,900 m (Gardner 2007). In Brazil, there are records in the Amazon, Atlantic Forest, and Cerrado (Esbérard and Faria 2006; Bernard et al. 2011). This is an omnivorous species that feeds on fruits (Annonaceae, Cucurbitaceae, Myrtaceae, Urticaceae, among others) and insects, including social wasps (Jeanne 1970; Giannini and Kalko 2004). Despite its wide distribution, *P. stenops* is relatively poorly sampled using mist nets (Bomfim et al. 2017). Consequently, there are still many gaps in its known distribution. Esbérard and Bergallo (2005) captured this species at locations highly rich in bat species, and Bomfim et al. (2017) captured it in a relatively small fragment of Atlantic Forest with the use of nets in the canopy (Even in primary forests, only a few individuals have been captured, which suggests that this species probably has a low natural density (Clarke and Downie 2001), or it is possible that it uses the canopy and, therefore, is less likely to be captured in mist nets at ground level.

Overall, *G. sylvestris* is widely distributed in the Neotropical region, but its records are occasional and dispersed, with a low capture rate (Williams and Genoways 2008; Zortéa and Alho 2008). There are records in western Mexico, Trinidad, Panama, Colombia, Venezuela, Peru, Suriname, French Guiana, southeastern Brazil, and Argentina (Gardner 2007; Morales-Martinez and Suarez-Castro 2014; Sánchez et al. 2019), and recently in Ecuador (Tirira et al. 2016) and the Brazilian Cerrado (Felix et al. 2016). This species forages mainly for fruits and insects and inhabits humid, deciduous forests (Goodwin and Greenhall 1961; Williams and Genoways 2008). It especially occurs in primary forests but only occasionally in secondary forests and clearings (Ochoa and Velazco 2008; Tirira et al. 2016).

Where *Guadua* bamboo occurs in mature forests, the changes in the dynamics, appearance, and structure of the forest (Silveira 2005) is as they would be in secondary forests (Carvalho et al. 2013). These changes to forests caused by bamboo, as well as the life cycle of *Guadua*, which is estimated as 28 years (Carvalho et al. 2013), are important for understanding how bat assemblages persist in these environments over time. Our study is one of the first on bat diversity within a bamboo-dominated forest in the southwestern Amazon region.

In the state of Acre, the sampling of chiroptero fauna is concentrated in the extreme west. The first studies were carried out by Taddei et al. (1990) and Nogueira et al. (1999), who reported 56 species, including the first records of *Sturnira magna* de la Torre, 1966 and *Pro-mops centralis* Thomas, 1915 in Brazil. An increase sampling effort in the eastern portion of Acre has also increased the number of species known from the state (Marciente and Calouro 2009; Calouro et al. 2010; Verde

et al. 2017; Santos et al. 2018; Verde et al. 2018; Pedroza et al. 2019; Silva et al. 2020). However, there still exists unexplored areas and probably some additional species w yet recorded.

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Authors' Contributions

RSV and AMC designed of the study, provided materials for the fieldwork, captured the bats, and identified the bats in the laboratory. SFO, AOM, FG, LA, TMS, and EFM collected, sorted identified, and prepared voucher specimens, and wrote the first draft of the manuscript. RSV, AMC, and HAM did the analysis and wrote the final draft of the manuscript.

References

- Alvares CA, Stape JL, Sentelhas PCMG, Leonardo J, Sparovek G (2013) Köppen's climate classification map for Brazil. *Meteorologische Zeitschrift* 22 (6): 711–728. <https://doi.org/10.1127/0941-2948/2013/0507>
- Anderson S (1997) Mammals of Bolivia, taxonomy and distribution. *Bulletin of the American Museum of Natural History* 231 (1): 1–652.
- Ascorra CF, Wilson DE, Romo M (1991) Lista anotada de los quirópteros del Parque Nacional Manu, Perú. *Publicaciones del Museo de Historia Natural. Universidad Nacional Mayor de San Marcos* 42 (1): 1–14.
- Bernard E (2001a) Vertical stratification of bat communities in primary forests of Central Amazon, Brazil. *Journal of Tropical Ecology* 17 (1): 115–126. <https://doi.org/10.1017/S0266467401001079>
- Bernard E (2001b) Species list of bats (Mammalia, Chiroptera) of Santarém area, Pará state, Brazil. *Revista Brasileira de Zoologia* 18 (2): 455–463. <https://doi.org/10.1590/S0101-81752001000200016>
- Bernard E, Fenton MB (2002) Species diversity of bats (Mammalia: Chiroptera) in forest fragments, primary forests, and savannas in Central Amazonia, Brazil. *Canadian Journal of Zoology* 80 (6): 1124–1140. <https://doi.org/10.1139/z02-094>
- Bernard E, Fenton MB (2007) Bats in a fragmented landscape: species composition, diversity and habitat interactions in savannas of Santarém, Central Amazonia, Brazil. *Biological Conservation* 34 (3): 332–343. <https://doi.org/10.1016/j.biocon.2006.07.021>
- Bernard E, Tavares VC, Sampaio E (2011) Compilação atualizada das espécies de morcegos (Chiroptera) para a Amazônia brasileira. *Biota Neotropica* 11 (1): 35–46.
- Boakes EH, McGowan PJK, Fuller RA, Chang-qing D, Clark NE, O'Connor K, Mace GM (2010) Distorted views of biodiversity: spatial and temporal bias in species occurrence data. *PLoS Biology* 8 (6): e1000385. <https://doi.org/10.1371/journal.pbio.1000385>
- Bobrowiec PED (2012) A Chiroptera preliminary survey in the middle Madeira River region of central Amazonia, Brazil. *Mammalia* 76 (3): 277–283. <https://doi.org/10.1515/mammalia-2011-0065>
- Bobrowiec PED, Gribel R (2010) Effects of different secondary vegetation types on bat community composition in central Amazonia, Brazil. *Animal Conservation* 13 (2): 204–216. <https://doi.org/10.1111/j.1469-1795.2009.00322.x>
- Bomfim SS, Silvestre SM, Criscuolo AR, Hamsi IC, Ruiz-Esparza JM, Rocha PA, Ferrari SF (2017) *Phylloderma stenops* Peters, 1865 (Chiroptera, Phyllostomidae): first record for the state of Sergipe, Brazil. *Oecologia Australis* 21 (2): 213–218. <https://doi.org/10.4257/oeco.2017.2102.13>
- Bravo A, Harms KE, Stevens RD, Emmons LH (2008) Collpas: activity hotspots for frugivorous bats (Phyllostomidae) in the Peruvian Amazon. *Biotropica* 40 (2): 203–210. <https://doi.org/10.1111/j.1744-7429.2007.00362.x>
- Brito J, Arguero A (2012) Nuevos datos sobre la distribución de *Scolomys ucayalensis* (Rondentia: Cricetidae) y *Phylloderma stenops* (Chiroptera: Phyllostomidae) en Ecuador. *Mastozoología Neotropical* 19 (1): 293–298
- Brosset A, Dubost G (1968) Chiroptères de la Guyane française. *Mammalia* 31 (1): 583–594.
- Burgin CJ, Colella JP, Kahn PL, Upham NS (2018) How many species of mammals are there? *Journal of Mammalogy* 99 (1): 1–11. <https://doi.org/10.1093/jmammal/gyx147>
- Calouro AM, Santos FGA, Faustino SF, Souza SF, Lague BM, Marciente R, Santos GJL, Cunha AO (2010) Riqueza e abundância de morcegos capturados na borda e no interior de um fragmento florestal do estado do Acre, Brasil. *Biotemas* 23 (4): 109–117. <https://doi.org/10.5007/2175-7925.2010v23n4p109>
- Carvalho AL, Nelson BW, Bianchini MC, Plagnol D, Kuplich TM, Daly DC (2013) Bamboo-dominated forests of the southwest Amazon: Detection, spatial extent, life cycle length and flowering waves. *PLoS ONE* 8 (1): 1–13. <https://doi.org/10.1371/journal.pone.0054852>
- Castro-Arellano I, Presley SJ, Saldanha LN, Willig MR, Wunderle JM Jr. (2007) Effects of reduced impact logging on bat biodiversity in terra firme forest of lowland Amazonia. *Biological Conservation* 138 (2): 269–285. <https://doi.org/10.1016/j.biocon.2007.04.025>
- Clarke FM, Downie JR (2001) A bat (Chiroptera) survey of mora rain-forest in Trinidad's Victoria-Mayaro Forest Reserve. *Biodiversity and Conservation* 10 (5): 725–736. <https://doi.org/10.1023/A:1016617127925>
- Colwell RK, Coddington JA (1994) Estimating terrestrial biodiversity through extrapolation. *Philosophical Transactions of the Royal Society of London, Series B: Biological Sciences* 345 (1311): 101–118. <https://doi.org/10.1098/rstb.1994.0091>
- Davis WB, Dixon JR (1976) Activity of bats in a small village clearing near Iquitos, Peru. *Journal of Mammalogy* 57 (4): 747–749. <http://www.jstor.org/stable/1379444>
- Díaz MM, Solari S, Aguirre LF, Aguiar LMS, Barquez RM (2016) Clave de identificación de los murciélagos de Sudamérica. *Publicación Especial No. 2. Programa de Conservación de los Murciélagos de Argentina, Tucumán, Argentina*, 160 pp.
- Esbérard CEL, Bergallo HG (2005) Coletar morcegos por seis ou doze horas a cada noite? *Revista Brasileira de Zoologia* 22 (1): 1095–1098.
- Esbérard CEL, Faria D (2006) New records of *Phylloderma stenops* Peters, 1865 in the Atlantic Forest, Brazil (Chiroptera, Phyllostomidae). *Biota Neotropica* 6 (2): 1–5. <http://doi.org/10.1590/S1676-06032006000200026>
- Felix S, Novaes RLM, Souza RF, Avilla LS (2016) Bat assemblage in a karstic area from northern Brazil: seven new occurrences for Tocantins state, including the first record of *Glyphoncteris sylvestris* Thomas, 1896 for the Cerrado. *Check List* 12 (6): 1999. <https://doi.org/10.15560/12.6.1999>
- Fernández-Arellano GJ, Torres-Vásquez MI (2013) Lista actualizada de quirópteros de los Departamentos de Loreto, Ucayali y Madre de Dios (Perú). *Barbastella* 6 (1): 73–88. <http://doi.org/10.14709/BarbJ.6.1.2013.10>

- Funtac (Fundação de Tecnologia do Estado do Acre) (2012) Mapeamento da degradação florestal na Amazônia brasileira. <http://www.obt.inpe.br/degrad/>. Accessed on: 2012-06-10.
- Garbino GST, Gregorin R, Lima IP, Loureiro L, Moras LM, Moratelli R, Nogueira MR, Pavan AC, Tavares VC, Peracchi AL (2020) Updated checklist of Brazilian bats: versão 2020. Comitê da Lista de Morcegos do Brasil—CLMB. Sociedade Brasileira para o Estudo de Quirópteros. <https://www.sbeq.net/lista-de-especies>. Accessed on: 2020-11-10.
- Gardner AL (2007) Mammals of South America. Volume 1: marsupials, xenarthrans, shrews, and bats. The University of Chicago Press, Chicago, USA, 690 pp. <https://doi.org/10.7208/chicago/9780226282428.001.0001>
- Genoways HH, Williams SL (1979) Records of bats (Mammalia: Chiroptera) from Suriname. *Annals of Carnegie Museum* 48 (1): 323–335.
- Giannini NP, Kalko EKV (2004) Trophic structure in a large assemblage of phyllostomid bats in Panama. *Oikos* 105 (2): 209–220. <http://doi.org/10.1111/j.0030-1299.2004.12690.x>
- Goodwin GG, Greenhall AM (1961) A review of the bats of Trinidad and Tobago: descriptions, rabies infection, and ecology. *Bulletin of the American Museum of Natural History* 122 (1): 187–302.
- Hammer Ø, Harper DAT, Ryan PD (2001) PAST: Paleontological statistics software package for education and data analysis. *Palaeontologia Electronica* 4 (1): 1–9.
- Handley CO (1967) Bats of the canopy of an Amazonian forest. *Atas do Simpósio sobre a biota Amazônica* 5 (1): 211–215.
- Hill JE (1965) Notes on bats from British Guiana, with the description of a new genus and species of Phyllostomidae. *Mammalia* 28 (4): 553–572. <https://doi.org/10.1515/mamm.1964.28.4.553>
- Jeanne RL (1970) Note on a bat (*Phylloderma stenops*) preying upon the brood of a social wasp. *Journal of Mammalogy* 51 (1): 624–625.
- Koopman KF (1978) Zoogeography of Peruvian bats with special emphasis on the role of the Andes. *American Museum Novitates* 265 (1): 1–33.
- Kunz TH, Anthony EL (1982) Age estimation and post-natal growth in the bat *Myotis lucifugus*. *Journal of Mammalogy* 63 (1): 23–32.
- Kunz TH, Robson SK (1995) Postnatal growth and development in the Mexican free-tailed bat (*Tadarida brasiliensis mexicana*): birth size, growth rates, and age estimation. *Journal of Mammalogy* 76 (3): 769–783. <http://doi.org/10.2307/1382746>
- Lim BK, Engstrom MD (2001) Species diversity of bats (Mammalia: Chiroptera) in Iwokrama Forest, Guyana, and the Guianan subregion: implications for conservation. *Biodiversity and Conservation* 10 (4): 613–657. <http://doi.org/10.1023/A:1016660123189>
- López-Baucells A, Rocha R, Bobrowiec P, Bernard E, Palmeirim J, Meyer C (2016) Field guide to Amazonian bats. Editora INPA, Manaus, Brazil, 168 pp.
- Marciente R, Calouro AM (2009) Mammalia, Chiroptera, Phyllostomidae, *Lamproncyteris brachyotis* (Dobson, 1879): first record in Acre, Brazil. *Check List* 5 (4): 886–889. <http://doi.org/10.15560/5.4.886>
- Marciente R, Bobrowiec PED, Magnusson WE (2015) Ground-vegetation clutter affects phyllostomid bat assemblage structure in lowland Amazonian forest. *PloS ONE* 10 (6): 1–16. <http://doi.org/10.1371/journal.pone.0129560>
- Marques-Aguiar S, Aguiar MVD, Aguiar GFS, Saldanha LN, Rocha MMB, Silva Jr. JS (2009) Morcegos (Mammalia: Chiroptera) da Estação Científica Ferreira Penna. In: Lisboa PLB (Ed.) *Caxiuanã: desafios para a conservação de uma Floresta Nacional na Amazônia*. Museu Paraense Emílio Goeldi, Belém, Brazil, 649–671.
- Martins ACM, Bernard E, Gregorin R, Silva WAS (2011) Filling data gaps on the diversity and distribution of Amazonian bats (Chiroptera): the case of Amapá, easternmost Brazil. *Zoologia* 28 (2): 177–185. <http://doi.org/10.1590/S1984-46702011000200004>
- McMichael CH, Palace MW, Golightly M (2014) Bamboo-dominated forests and pre-Columbian earthwork formations in south-western Amazonia. *Journal of Biogeography* 41 (9): 1733–1745. <https://doi.org/10.1111/jbi.12325>
- Miranda JM, Zago L, Carvalho F, Rubio MB, Bernardi IP (2015) Morcegos (Mammalia: Chiroptera) da região do Médio Rio Teles Pires, Sul da Amazônia, Brasil. *Acta Amazonica* 45 (1): 89–100. <http://doi.org/10.1590/1809-4392201400583>
- Montenegro OL, Romero-Ruiz M (2000) Murciélagos del sector sur de la serranía de Chiribiquete, Caquetá, Colombia. *Revista de la Academia Colombiana de Ciencias Exactas, Físicas y Naturales* 23 (1): 641–649.
- Morales-Martínez DM, Suárez-Castro AF (2014) New records for *Glyphonycteris* Thomas, 1896 (Chiroptera: Phyllostomidae) from Colombia [with erratum]. *Check List* 10 (3): 639–644. <http://doi.org/10.15560/10.3.639>
- Moratelli R, Dias D, Bonvicino CR (2010) Estrutura e análise zoogeográfica de uma taxocenose de morcegos no norte do Estado do Amazonas, Brasil. *Chiroptera Neotropical* 16 (1): 661–671.
- Nogueira MR, Pol A, Peracchi AL (1999) New records of bats from Brazil with a list of additional species for the chiropteran fauna of the state of Acre, western Amazon basin. *Mammalia* 63 (3): 363–367. <https://doi.org/10.1515/mamm.1999.63.3.363>
- Ochoa J, Velazco P (2008) *Glyphonycteris daviesi*. The IUCN Red List of threatened species. <http://www.iucnredlist.org>. Accessed on: 2017-02-04.
- Oksanen J, Blanchet FG, Wagner RK, Legendre P, Minchin PR, O'Hara RB, Simpson GL, Solymos P, Stevens MHH, Wagner H (2011) Vegan: Community ecology package <http://cran.r-project.org/web/packages/vegan/index.html>. Accessed on: 2017-05-20.
- Oliveira SLD, Souza LAS, Silva HK, Faria KDC (2015) Spatial configuration of the occurrence of bat species (Mammalia: Chiroptera) in eastern Mato Grosso, Brazil. *Biota Neotropica* 15 (1): 1–8. <http://doi.org/10.1590/1676-06032014012214>
- Oliveira U, Paglia AP, Brescovit AD, Carvalho CJB, Silva DP, Rezende DT, Leite FSF, Batista JAN, Barbosa JPPP, Stehmann JR, Ascher JS, Vasconcelos MF, De Marco P, Löwenberg-Neto P, Dias PG, Ferro VG, Santos AJ (2016) The strong influence of collection bias on biodiversity knowledge shortfalls of Brazilian terrestrial biodiversity. *Diversity and Distributions* 22 (12): 1232–1244. <http://doi.org/10.1111/ddi.12489>
- Pons JM, Cosson JF (2002) Use of forest fragments by animalivorous bats in French Guiana. *Revue d'Écologie* 57 (1): 117–130.
- R, development core team (2015) R: a language and environment for statistical computing <http://www.R-project.org/>. Accessed on: 2017-05-20.
- Pedroza D, Verde RS, Guilherme E (2019) Birds and bats captured in a managed forest in Southwestern Brazilian Amazonia: results and recommendations from a short-term study. *Brazilian Journal of Biological Sciences* 6 (12): 283–295. <https://doi.org/10.21472/bjbs.061226>
- Presley SJ, Willig MR, Castro-Arellano I, Weaver SC (2009) Effects of habitat conversion on temporal activity patterns of phyllostomid bats in lowland Amazonian rain forest. *Journal of Mammalogy* 90 (1): 210–221. <https://doi.org/10.1644/08-mamm-a-089.1>
- Reid FA, Engstrom MD, Lim BK (2000) Noteworthy records of bats from Ecuador. *Acta Chiropterologica* 2 (1): 37–51.
- Robinson F (1998) The bats of the Ilha de Maracá. In: Milliken W, Ratte JA (Eds.) *Maracá: the biodiversity and environment of an Amazonian rainforest*. John Wiley & Sons, Chichester, UK, 165–187.
- Sánchez MS, Labaroni CA, Castellanos FX (2019) First record of *Glyphonycteris sylvestris* Thomas, 1896 (Chiroptera: Phyllostomidae: Glyphonycterinae) for Argentina, with comments on its karyotype. *Mastozoologia Neotropical* 26 (2): 1–10.
- Santos FC, Lisboa CV, Xavier SC, Dario MA, Verde RS, Calouro AM, Roque ALR, Jansen AM (2018) *Trypanosoma* sp. diversity in Amazonian bats (Chiroptera; Mammalia) from Acre state, Brazil. *Parasitology* 145 (6): 828–837. <https://doi.org/10.1017/S003182017001834>

- Schnitzler HU, Kalko EKV (1998) How echolocating bats search and find food. In: Kunz TH, Racey PA (Eds.) Bat biology and conservation. Smithsonian Institution Press, Washington, DC, USA, 183–196.
- Silva RC, Silveira M, Verde RS (2020) Vertical stratification of phyllostomid bats assemblage (Chiroptera, Phyllostomidae) in a forest fragment in Brazilian southwestern Amazon. *Neotropical Biology and Conservation* 15 (2): 107–120. <https://doi.org/10.3897/neotropical.15.e47641>
- Silveira M (2005) A floresta aberta com bambu no sudoeste da Amazônia: padrões e processos em múltiplas escalas. Editora Universidade Federal do Acre, Rio Branco, Brazil, 157 pp.
- Simmons NB, Voss RS (1998) The mammals of Paracou, French Guiana: a Neotropical lowland rainforest fauna Part 1. Bats. *Bulletin of the American Museum of Natural History* 237 (1): 1–219.
- Simmons NB, Voss RS, Peckham HC (2000) The bat fauna of the Saül region, French Guiana. *Acta Chiropterologica* 2 (1): 23–36.
- Straube FC, Bianconi GV (2002) Sobre a grandeza e a unidade utilizada para estimar esforço de captura com utilização de redes-de-neblina. *Chiroptera Neotropical* 8 (1): 150–152.
- Taddei V, Rezende IM, Camora D (1990) Notas sobre uma coleta de morcegos de Cruzeiro do Sul, Rio Juruá, Estado do Acre (Mammalia, Chiroptera). *Boletim do Museum Paraense Emilio Goeldi Zoologia* 6 (1): 75–88.
- Tavares VC, Nobre CC, Palmuti CFS, Nogueira EPP, Gomes JD, Marcos MH, Silva RF, Farias SG, Bobrowiec PED (2017) The bat fauna from southwestern Brazil and its affinities with the fauna of western Amazon. *Acta Chiropterologica* 19 (1): 93–106. <https://doi.org/10.3161/15081109ACC2017.19.1.007>
- Tirira DG, Camacho MA, Tinoco N, Solórzano MF, Burneo SF (2016) Genus *Glyphoncycteris* Thomas, 1896 (Mammalia: Chiroptera) in Ecuador: first confirmed record of *G. sylvestris* Thomas, 1896 and a geographical review to *G. daviesi* (Hill, 1965). *Check List* 12 (5): 1965. <https://doi.org/10.15560/12.5.1965>
- Tirira D (2007) Guía de campo de los mamíferos del Ecuador. Publicación especial sobre los mamíferos del Ecuador 6. Ediciones Murciélagos Blanco, Quito, Peru, 576 pp.
- Trujillo GF, Albuja L (2005) Nuevos registros de *Phylloderma stenops* (Chiroptera: Phyllostomidae) y *Lasiurus borealis* (Chiroptera: Vespertilionidae) para el Ecuador. *Politécnica* 26 (1): 45–53.
- Verde RS, Santos FCB, Silva RC, Calouro AM (2017) First record of *Lasiurus blossevillii* Lesson & Garnot, 1826 (Chiroptera: Vespertilionidae) in the state of Acre, southwest of the Amazon, Brazil. *Oecologia Australis* 21 (2): 191–196. <http://doi.org/10.4257/oeco.2017.2102.09>
- Verde RS, Silva RC, Calouro AM (2018). Activity patterns of frugivorous phyllostomid bats in an urban fragment in southwest Amazonia, Brazil. *Iheringia, Série Zoologia* 108 (1): e2018016. <http://doi.org/10.1590/1678-4766e2018016>
- Williams SL, Genoways HH (1980) Results of the Alcoa Foundation-Suriname Expeditions. II. Additional records of bats (Mammalia: Chiroptera) from Suriname. *Annals of Carnegie Museum* 49 (1): 213–236.
- Williams SL, Genoways HH (2008) Subfamily Phyllostominae. In: Gardner AL (Eds.) *Mammals of South America. Volume 1: marsupials, xenarthrans, shrews, and bats*. The University of Chicago Press, Chicago, USA, 255–299.
- Zortéa M, Alho CJR (2008) Bat diversity of a Cerrado habitat in central Brazil. *Biodiversity and Conservation* 17 (4): 791–805. <https://doi.org/10.1007/s10531-008-9318-3>