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A new species of broad-nosed bat *Platyrrhinus* Saussure, 1860 (Chiroptera: Phyllostomidae) from the Guianan Shield

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Abstract

A new species of broad-nosed bat *Platyrrhinus* Saussure, 1860 (Chiroptera: Phyllostomidae: Stenodermatinae) from the Guianan Shield is described based on molecular and morphological data. Previously confused with *P. helleri* and *P. recifinus*, the new taxon is currently known from only Guyana and Suriname and is most closely related to *P. recifinus* from eastern Brazil and not to the two sympatric species (*P. fusciventris* and *P. incarum*) also recently recognized as distinct from *P. helleri*. Morphometrically the new taxon overlaps with the smaller species of the genus (*P. angustirostris*, *P. brachycephalus*, *P. fusciventris*, *P. helleri*, *P. incarum*, and *P. matapalensis*), but forms a different cluster from the larger *P. recifinus*. Morphologically the new taxon is distinguished from its congeners by a combination of external and cranio-dental characteristics. *Platyrrhinus* now includes 21 species making it the most speciose genus in the Neotropical family Phyllostomidae.

Key words: Guianan Shield, Phyllostomidae, Phylogeny, *Platyrrhinus*, Neotropics, systematics

Introduction

The genus *Platyrrhinus* Saussure, 1860, belongs to the Neotropical bat family Phyllostomidae that ranges from southwestern United States to Paraguay. It includes more than 160 species, the most diverse family of bats in the Neotropics, which together exhibits more variation in morphological features and feeding ecology than any other family-level group of mammals (Simmons 2005; Gardner 2008a; Baker *et al.* 2012). Phyllostomid bats exploit an unusually diverse array of feeding habits including sanguivory, insectivory, carnivory, omnivory, nectarivory, polinivory, and frugivory (Wetterer *et al.* 2000; Baker *et al.* 2012).

Platyrrhinus includes at least 20 species of frugivorous bats endemic to the Neotropics (Velazco *et al.* 2010). The combined geographic ranges of these species extends from southern Mexico into Paraguay and northern Argentina (Velazco & Patterson 2008; Velazco *et al.* 2010). Species of *Platyrrhinus* occur primarily in tropical lowland and montane forest from sea level to at least 2,550 m (Gardner 2008b; Velazco *et al.* 2010).

Platyrrhinus is diagnosed from other genera of the subfamily Stenodermatinae by a combination of three characters: two accessory cusps on the posterior face of P4 (Velazco 2005, figure 12), presence of three upper molars, and presence of a fringe of hair along the trailing margin of the uropatagium. Although other genera also have these characters, no other genera possess all three at the same time (Lim 1993).

During recent years, the use of morphometric, morphological, and molecular techniques to study *Platyrrhinus* has enormously improved our knowledge of its taxonomy and phylogenetic relationships (Velazco & Solari 2003; Velazco 2005; Velazco & Patterson 2008; Velazco & Gardner 2009; Velazco *et al.* 2010). But still some taxa remain undescribed.

The *Platyrrhinus helleri* species complex was reviewed by Velazco (2005), Velazco and Patterson (2008), and Velazco *et al.* (2010). They found that this once widespread species, occurring from Oaxaca and Veracruz (Mexico) to Peru, Bolivia, amazonian Brazil, northern South America, and Trinidad, was a composite of at least five species:

P. angustirostris, *P. fusciventris*, *P. helleri*, *P. incarum*, and *P. matapalensis*. After these revisions six species of *Platyrrhinus* are known to occur on the Guianan Shield including: *P. angustirostris*, *P. aurarius*, *P. brachycephalus*, *P. fusciventris*, *P. incarum*, and *P. lineatus* (Gardner 2008b; Velazco & Gardner 2009; Velazco *et al.* 2010).

While reviewing the systematics, taxonomy, and population structure of *Platyrrhinus*, Velazco (2009) found that a population of the *P. helleri* species complex from Guyana and Suriname was grouped as a sister clade to individuals of the Brazilian endemic *P. recifinus*. Based on this result that was supported solely by DNA data and not on the examination of specimens, Tavares and Velazco (2010) erroneously extended the distribution of *P. recifinus* into the Guianan Shield. This population of small *Platyrrhinus* did not correspond to any of the species recognized by Velazco *et al.* (2010), but its relationship to *P. recifinus* was subsequently recovered by Clare *et al.* (2011). Herein, we formally describe this population of small *Platyrrhinus* from Guyana and Suriname as a new species.

Material and methods

We reassessed the phylogenetic relationships of the unnamed taxon through the analyses of sequence variation of five molecular markers, and then specimens were morphologically assessed to describe it as a new species. The examined specimens and tissues used for this study are deposited in the following institutions:

AMNH	American Museum of Natural History, New York, USA.
BMNH	The Natural History Museum, London, UK (formerly British Museum of Natural History)
FMNH	Field Museum of Natural History, Chicago, Illinois, USA.
LSUMZ	Museum of Natural Science, Louisiana State University, Baton Rouge, Louisiana, USA.
MUSM	Museo de Historia Natural de la Universidad Nacional Mayor de San Marcos, Lima, Peru.
MVZ	Museum of Vertebrate Zoology, University of California, Berkeley, California, USA.
ROM (F)	Royal Ontario Museum, Toronto, Ontario, Canada.
TTU (TK)	Museum of Texas Tech University, Lubbock, Texas, USA.
USNM	National Museum of Natural History (formerly the U.S. National Museum), Smithsonian Institution, Washington, D.C., USA.

Molecular analyses. We generated new sequences from two mitochondrial genes, *Cytb* and ND2, one regulatory region, D-loop (hypervariable region I- HVRI section), and two nuclear genes, RAG1 and RAG2, following the protocols described by Velazco and Patterson (2013) for specimens of the new species, along with *P. recifinus*, *P. brachycephalus*, and the five species in the *P. helleri* complex, with *Vampyrodes caraccioli* as the outgroup taxon. These sequences were analyzed together with those used by Velazco and Patterson (2008) and Velazco *et al.* (2010). All sequences produced in this study have been deposited in GenBank with Accession Nos. KJ576924–KJ576996 (Table 1). DNA sequences were aligned by eye using Sequencher™ 4.1.2. Apparent heterozygosities in the nuclear sequences were coded using the IUPAC ambiguity codes. After exclusions and trimming, the *Cytb* gene data set contained 1140 characters, ND2 had 1044 characters, D-loop had 413 characters, RAG1 had 1072 characters, and RAG2 had 731 characters for a total of 4400 nucleotide characters. The different loci were concatenated in a single matrix using SequenceMatrix 1.7.8 (Vaidya *et al.* 2011). In the single matrix, each locus was run under a separate model of nucleotide substitution selected using the Corrected Akaike Information Criterion (AICc) as suggested by jModelTest 2.1.1 (Guindon & Gascuel 2003; Darriba *et al.* 2012): *Cytb* (TrN+ Γ), ND2 (HKY+I+ Γ), D-loop (HKY+I+ Γ), RAG1 (K80+I), and RAG2 (TPM1uf).

Maximum likelihood analyses (ML) were conducted using Garli 2.0 (Zwickl 2006). ML searches were performed using different models of nucleotide substitution and parameters as suggested by the AICc in jModeltest. We performed five runs, each with 50,000 generations of a mutation-selection-reproduction cycle. A starting tree was generated through stepwise addition. Bootstrap support values were computed from 1000 replicates; replicates were used to calculate a majority-rule consensus tree in PAUP* v 4.0b10 (Swofford 2002) to assess clade support.

Bayesian analyses (BA) were used to estimate a phylogeny employing different models of molecular evolution for each locus. Bayesian inference analysis was conducted using MrBayes v. 3.1.2 (Huelsenbeck & Ronquist

2001), with random starting trees without constraints, four simultaneous Markov chains were run for 20 million generations, trees were sampled every 1000 generations, stationarity was assessed by examining the standard deviation of split frequencies and plotting the $-\ln L$ per generation using Tracer v. 1.5 (Rambaut & Drummond 2007), and trees generated before stationarity were discarded as “burn-in.”

Morphological analyses. We reviewed external and osteological characters based on, but not restricted to, those defined by Velazco (2005), Velazco and Gardner (2009), and Velazco *et al.* (2010). The dental homology nomenclature for the premolars follows that of Velazco (2005): 1st upper premolar (P3), 2nd upper premolar (P4), 1st lower premolar (p2), 2nd lower premolar (p4). All linear measurements are in millimeters and weights (mass) in grams. Standard external measurements (TL, total length; HF, hind foot length; E, ear length) are those recorded on the specimen labels. One external and 11 craniodental measurements were taken with a digital caliper and recorded to the nearest 0.01 as follows:

Forearm length (FA): Distance from the elbow (tip of the olecranon process) to the wrist (including the carpals).

This measurement was made with the wing at least partially folded.

Greatest length of skull (GLS): Distance from the posteriormost point on the occiput to the anteriormost point on the premaxilla (excluding the incisors).

Condylolincisive length (CIL): Distance between a line connecting the posteriormost margins of the occipital condyles and the anteriormost point on the upper incisors.

Condyllocanine length (CCL): Distance between a line connecting the posteriormost margins of the occipital condyles and a line connecting the anteriormost surface of the upper canines.

Braincase breadth (BB): Greatest breadth of the braincase, excluding mastoid and paraoccipital processes.

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

Postorbital breadth (PB): Least breadth at the postorbital constriction.

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

Maxillary toothrow length (MTRL): Distance from the anteriormost surface of the upper canine to the posteriormost surface of the crown of M3.

Width at M2 (M2–M2): Greatest width of palate across labial margins of the alveoli of M2s.

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

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

All measurements, except GLS because it was not available for more than a few specimens, were log-transformed to achieve normalization for statistical analyses. We evaluated differences between species by principal component analysis (PCA) using a correlation matrix of 76 specimens of *P. angustirostris*, 45 of *P. brachycephalus*, 46 of *P. fusciventris*, 84 of *P. helleri*, 70 of *P. incarum*, 5 of *P. matapalensis*, 5 of the new species, and 11 of *P. recifinus* (Appendix). Components with eigenvalues greater than 1 were retained (Guttman 1954; Jackson 1993). Principal component scores were plotted to visualize species groups in morphospace. Analyses were performed using SPSS for Windows, version 16.

Results

Molecular analysis. Maximum likelihood and Bayesian inference analyses of the combined mitochondrial and nuclear genes produced similar, strongly supported topologies (Fig. 1). As in Velazco *et al.* (2010: fig. 2), *P. brachycephalus* was recovered as sister to the other species, which were grouped into three clades: (1) *P. helleri* and *P. matapalensis* sister to the other two clades; (2) *P. recifinus* and the new species; and (3) *P. incarum* sister to *P. angustirostris* and *P. fusciventris*.

The average *Cytb* pairwise distance between the new species and the other species range from 9.6% (new species vs *incarum*) to 2% (new species vs *recifinus*) (Table 2).

TABLE 1. Species, tissue collection number, and GenBank Accession Numbers for the *Platyrrhinus* and *Vampyroides* samples used in this study.

Species	Voucher number	Sample ID number	GenBank Accession Numbers				
			<i>Cytb</i>	ND2	D-loop	RAG1	RAG2
<i>Platyrrhinus angustirostris</i>	FMNH 129150	BDP 2654	FJ154142	FJ154208	FJ154274	KJ576960	FJ154340
<i>Platyrrhinus angustirostris</i>	FMNH 129154	BDP 2677	FJ154143	FJ154209	FJ154275	KJ576961	FJ154341
<i>Platyrrhinus angustirostris</i>	ROM 105127	F 37435	GQ184737	GQ184755	GQ184746	KJ576962	GQ184764
<i>Platyrrhinus angustirostris</i>	ROM 105964	F 40216	GQ184738	GQ184756	GQ184747	KJ576963	GQ184765
<i>Platyrrhinus brachycephalus</i>	FMNH 174745	UPE 150	FJ154130	FJ154196	FJ154262	KJ576964	FJ154328
<i>Platyrrhinus brachycephalus</i>	FMNH 174746	SS 2111	FJ154131	FJ154197	FJ154263	KJ576965	FJ154329
<i>Platyrrhinus brachycephalus</i>	FMNH 174748	UPE 157	FJ154132	FJ154198	FJ154264	KJ576966	FJ154330
<i>Platyrrhinus fusciventris</i>	AMNH 267555	AMCC 110496	GQ184739	GQ184757	GQ184748	KJ576967	GQ184766
<i>Platyrrhinus fusciventris</i>	ROM 112611	F 45313	GQ184740	GQ184758	GQ184749	KJ576968	GQ184767
<i>Platyrrhinus fusciventris</i>	ROM 114089	F 41164	GQ184741	GQ184759	GQ184750	KJ576969	GQ184768
<i>Platyrrhinus fusciventris</i>	USNM 560805	ALG 14596	GQ184742	GQ184760	GQ184751	KJ576970	GQ184769
<i>Platyrrhinus helleri</i>	LSUMZ 536		FJ154140	FJ154206	FJ154272	KJ576971	FJ154338
<i>Platyrrhinus helleri</i>	LSUMZ 537		FJ154141	FJ154207	FJ154273	KJ576972	FJ154339
<i>Platyrrhinus helleri</i>	ROM 108325	F 45313	KJ576924	KJ576933	KJ576942	KJ576973	KJ576951
<i>Platyrrhinus helleri</i>	ROM 99614	F 41164	KJ576925	KJ576934	KJ576943	KJ576974	KJ576952
<i>Platyrrhinus incarum</i>	FMNH 129156	BDP 2993	FJ154144	FJ154210	FJ154276	KJ576975	FJ154342
<i>Platyrrhinus incarum</i>	FMNH 174765	BDP 3989	FJ154145	FJ154211	FJ154277	KJ576976	FJ154343
<i>Platyrrhinus incarum</i>	FMNH 174766	BDP 4101	FJ154146	FJ154212	FJ154278	KJ576977	FJ154344
<i>Platyrrhinus incarum</i>	MUSM 13241	AMCC 109794	FJ154147	FJ154213	FJ154279	KJ576978	FJ154345
<i>Platyrrhinus incarum</i>	MUSM 13389	LLW 456	GQ184734	GQ184752	GQ184743	KJ576979	GQ184761
<i>Platyrrhinus incarum</i>	USNM 584494	LHE 1600	GQ184735	GQ184753	GQ184744	KJ576980	GQ184762
<i>Platyrrhinus incarum</i>	USNM	AVE 12	GQ184736	GQ184754	GQ184745	KJ576981	GQ184763
<i>Platyrrhinus matapalensis</i>	TTU 103556	TK134723	FJ154165	FJ154231	FJ154297	KJ576982	FJ154363
<i>Platyrrhinus matapalensis</i>	TTU 103559	TK134726	FJ154166	FJ154232	FJ154298	KJ576983	FJ154364
<i>Platyrrhinus matapalensis</i>	TTU 102706	TK135094	FJ154167	FJ154233	FJ154299	KJ576984	FJ154365
<i>Platyrrhinus matapalensis</i>	TTU 103799	TK135295	FJ154168	FJ154234	FJ154300	KJ576985	FJ154366
<i>Platyrrhinus recifinus</i>	MVZ 185604	AD 215	KJ576926	KJ576935	KJ576944	KJ576986	KJ576953
<i>Platyrrhinus recifinus</i>	MVZ 185605	AD 216	FJ154174	FJ154240	FJ154306	KJ576987	FJ154372
<i>Platyrrhinus recifinus</i>	MVZ 185606	AD 225	FJ154175	FJ154241	FJ154307	KJ576988	FJ154373
<i>Platyrrhinus recifinus</i>	MVZ 185610	AD 229	FJ154176	FJ154242	FJ154308	KJ576989	FJ154373
<i>Platyrrhinus recifinus</i>	MVZ 185901	AD 462	KJ576927	KJ576936	KJ576945	KJ576990	KJ576954
<i>Platyrrhinus guianensis</i>	ROM 108487	F 43467	KJ576928	KJ576937	KJ576946	KJ576991	KJ576955
<i>Platyrrhinus guianensis</i>	ROM 113465	F50445	KJ576929	KJ576938	KJ576947	KJ576992	KJ576956
<i>Platyrrhinus guianensis</i>	ROM 113991	F 41066	KJ576930	KJ576939	KJ576948	KJ576993	KJ576957
<i>Platyrrhinus guianensis</i>	ROM 114070	F 41145	KJ576931	KJ576940	KJ576949	KJ576994	KJ576958
<i>Platyrrhinus guianensis</i>	ROM 114195	F 41270	KJ576932	KJ576941	KJ576950	KJ576995	KJ576959
<i>Vampyroides caraccioli</i>	FMNH 174915	BDP 3987	FJ154184	FJ154250	FJ154316	KJ576996	FJ154382

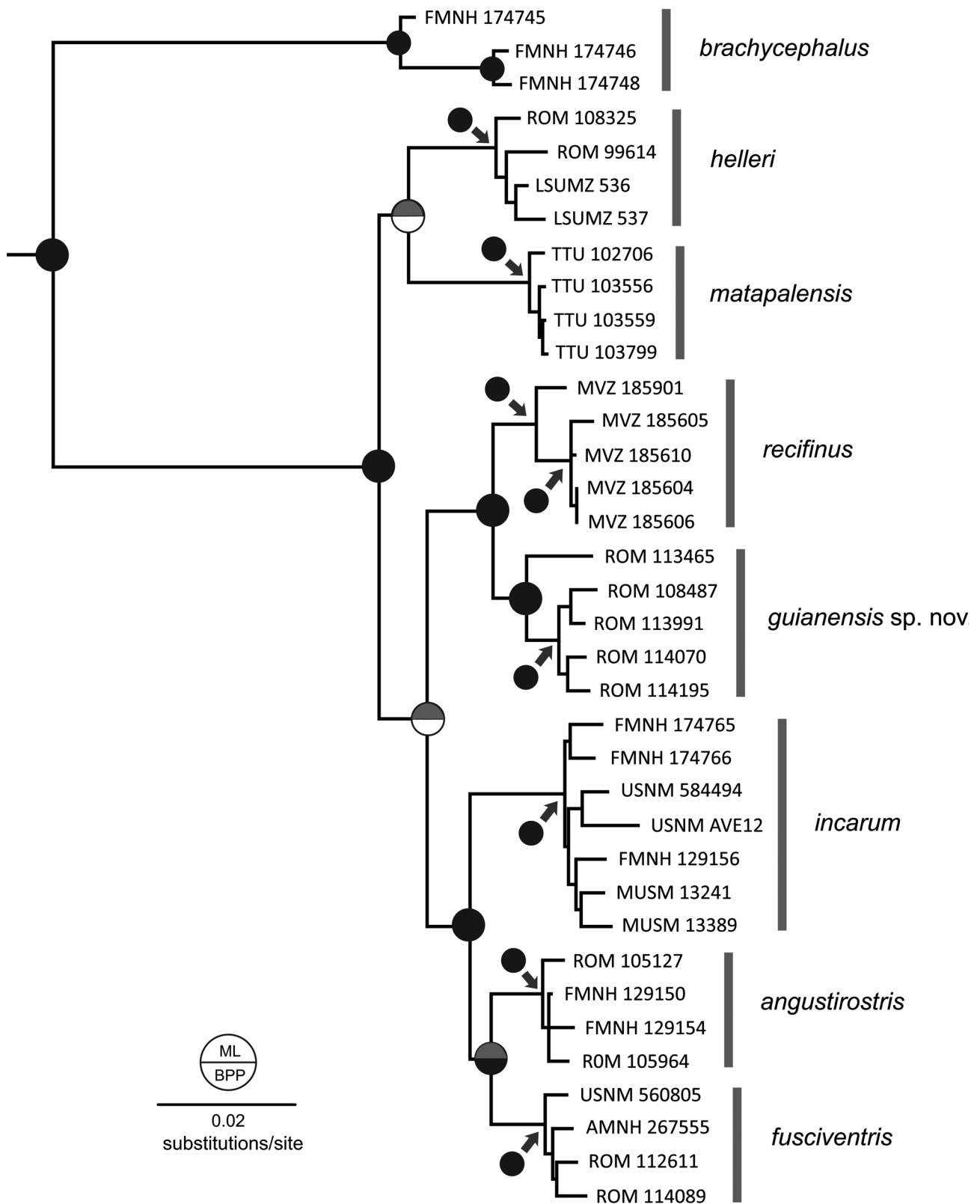


FIGURE 1. Combined mtDNA and nDNA maximum likelihood (ML) phylogram for the *Platyrrhinus helleri* species complex and other closely related taxa. Support statistics from the ML analysis and Bayesian analysis are indicated at each resolved node. For the ML analysis, gray indicates bootstrap frequencies between 50% and 75%, and black indicates bootstrap frequencies > 75%. For the BA, white indicates posterior probabilities < 0.95, whereas black indicates posterior probabilities > 0.95.

TABLE 2. Pair-wise uncorrected percentage of *Cytb* sequence divergence ($\bar{x} \pm SD$) among some *Platyrrhinus* species.

	1	2	3	4
1— <i>Platyrrhinus angustirostris</i>	0.04 ± 0.05			
2— <i>Platyrrhinus brachycephalus</i>	9.41 ± 0.21	1.11 ± 0.81		
3— <i>Platyrrhinus fusciventris</i>	2.04 ± 0.08	9.40 ± 0.33	0.26 ± 0.17	
4— <i>Platyrrhinus helleri</i>	3.66 ± 0.11	9.22 ± 0.27	3.64 ± 0.12	0.26 ± 0.06
5— <i>Platyrrhinus incarum</i>	2.68 ± 0.21	9.64 ± 0.43	3.05 ± 0.29	4.23 ± 0.30
6— <i>Platyrrhinus matapalensis</i>	3.88 ± 0.10	9.38 ± 0.31	3.77 ± 0.11	2.98 ± 0.14
7— <i>Platyrrhinus recifinus</i>	3.55 ± 0.27	9.54 ± 0.48	3.70 ± 0.27	4.04 ± 0.28
8— <i>Platyrrhinus guianensis</i>	3.09 ± 0.19	9.28 ± 0.32	3.32 ± 0.26	3.84 ± 0.22

TABLE 2. (Continued)

	5	6	7	8
1— <i>Platyrrhinus angustirostris</i>				
2— <i>Platyrrhinus brachycephalus</i>				
3— <i>Platyrrhinus fusciventris</i>				
4— <i>Platyrrhinus helleri</i>				
5— <i>Platyrrhinus incarum</i>	1.66 ± 0.33			
6— <i>Platyrrhinus matapalensis</i>	4.09 ± 0.30	0.18 ± 0.11		
7— <i>Platyrrhinus recifinus</i>	4.21 ± 0.32	3.65 ± 0.22	0.65 ± 0.56	
8— <i>Platyrrhinus guianensis</i>	3.75 ± 0.27	3.32 ± 0.21	2.03 ± 0.27	0.84 ± 0.38

Morphological analyses. The principal component analysis comparing all the species extracted two components that accounted for 61.9% and 12.9% of the variation. The PCA plot showed that the new species overlaps completely with the smaller species of the genus (*P. angustirostris*, *P. brachycephalus*, *P. fusciventris*, *P. helleri*, *P. incarum*, and *P. matapalensis*), reflecting size and shape similarities (Fig. 2; Table 3). The only species that did not group with the smaller species and the new species was *P. recifinus*, which plotted at the higher end of PC1 reflecting its larger size.

TABLE 3. Factor loadings for the first two factors extracted from the correlation matrix from a principal component analysis (PCA) of 11 variables comparing *Platyrrhinus angustirostris*, *P. brachycephalus*, *P. fusciventris*, *P. guianensis*, *P. helleri*, *P. incarum*, *P. matapalensis*, and *P. recifinus*.

Measurements	PC1	PC2
FA	0.56	0.46
CIL	0.87	-0.39
CCL	0.84	-0.39
BB	0.76	0.49
ZB	0.72	0.44
PB	0.70	0.34
MB	0.88	0.08
MTRL	0.80	-0.27
M2-M2	0.88	0.15
DENL	0.87	-0.20
MANDL	0.72	-0.45
Eigenvalues	6.8	1.4
Proportion of variation	61.9%	12.9%

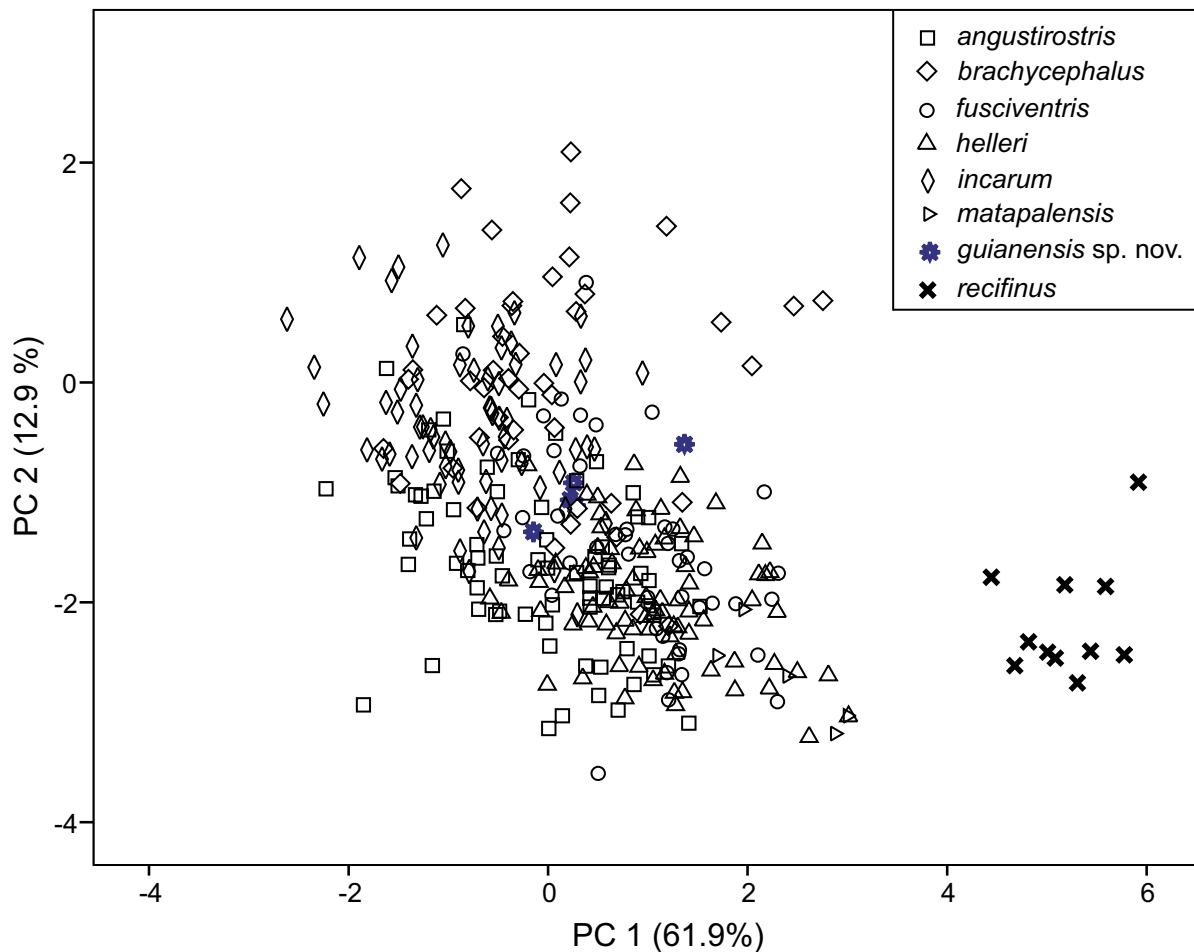


FIGURE 2. Principal components analysis of the *Platyrrhinus helleri* species complex and other closely related taxa showing dispersion of scores along the first and second axes. PC1 represents a size axis (with larger specimens appearing toward the right side of the plot) and PC2 portrays a difference in shape.

In the context of other genetic distances separating valid species of phyllostomids ($[C_{ytb} \geq 2\%]$ — Velazco & Patterson 2008; Velazco *et al.* 2010; Larsen *et al.* 2011; Velazco & Patterson 2013), the genetic distances found between the new taxon and *Platyrrhinus recifinus* (sister species) along with the morphological distinctiveness warrant the description of this taxon as a new species.

Systematics

Family Phyllostomidae Gray, 1825

Subfamily Stenodermatinae Gervais, 1856

Genus *Platyrrhinus* Saussure, 1860

Platyrrhinus guianensis new species

Guianan Broad-nosed Bat

Figures 4–7

P[*latyrrhinus*]. *helleri*: Lim, 1993:162 (part)

Platyrrhinus helleri: Smith and Kerry, 1996:932 (part)

Platyrrhinus helleri: Lim and Engstrom, 2000:121
P[latyrrhinus]. helleri: Lim and Engstrom, 2001a:632 (part)
Platyrrhinus helleri: Lim and Engstrom, 2001b:664 (part)
Platyrrhinus helleri: Engstrom and Lim, 2002:364 (part)
Platyrrhinus helleri: Lim and Norman, 2002:54
P[latyrrhinus]. helleri: Lim *et al.*, 2002:1239 (part)
Platyrrhinus helleri: Lim and Engstrom, 2005:77 (part)
Platyrrhinus helleri: Lim *et al.*, 2005a:244 (part)
Platyrrhinus helleri: Lim *et al.*, 2005b:87 (part)
Platyrrhinus helleri: Clare *et al.*, 2007:187 (part)
Platyrrhinus helleri: Borisenko *et al.*, 2008:475 (part)
Platyrrhinus helleri: Lim, 2009:45 (part)
P[latyrrhinus]. recifinus: Velazco, 2009:259 (part)
Platyrrhinus recifinus: Tavares and Velazco, 2010:119 (part)
Platyrrhinus helleri: Clare *et al.*, 2011:8 (part)
Platyrrhinus helleri: Clare, 2011:4 (part)
Platyrrhinus helleri: Lim, 2012: 253 (part)
Platyrrhinus helleri: Lim and Tavares, 2012:115 (part)

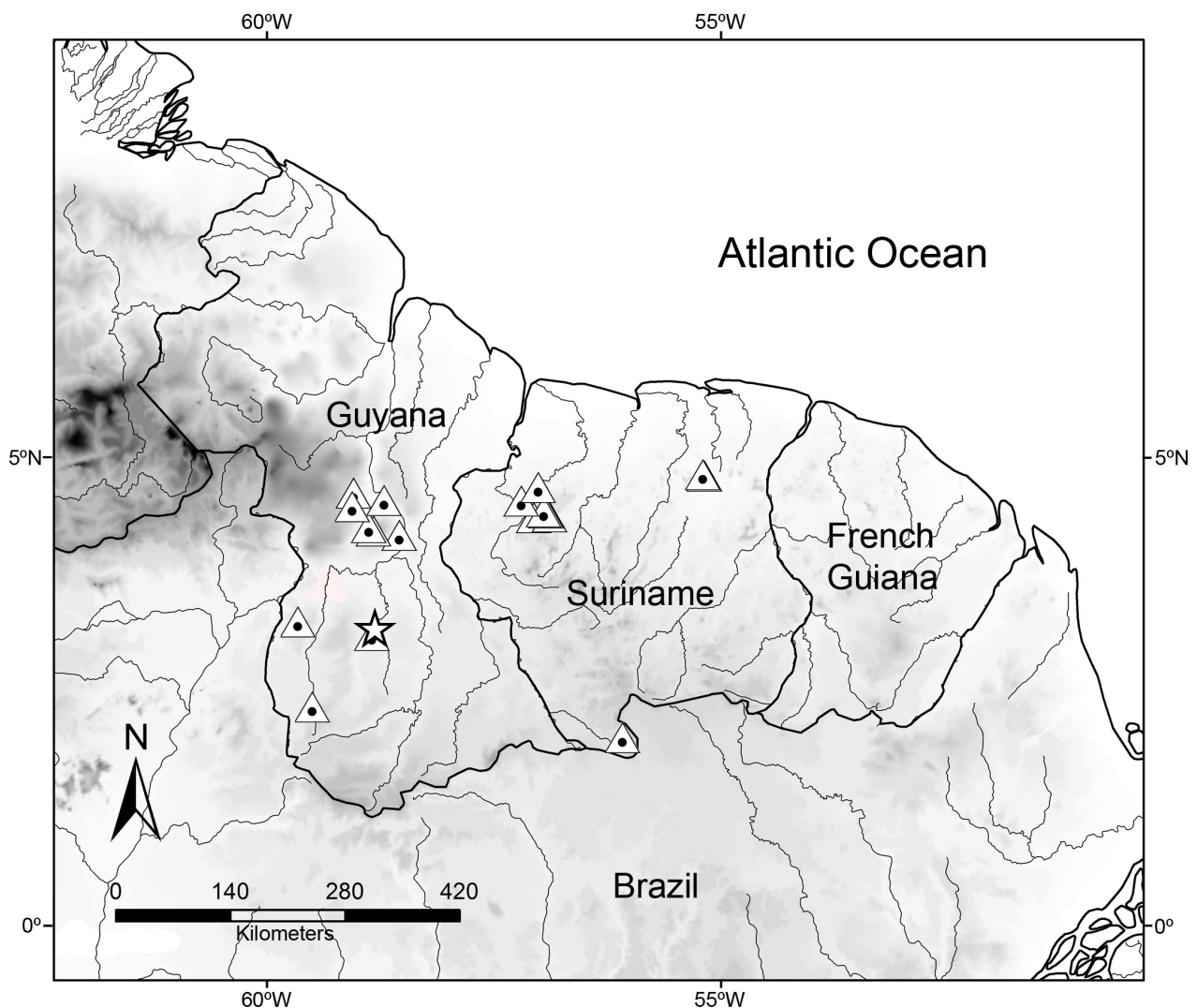


FIGURE 3. Map showing collecting localities of *Platyrrhinus guianensis* as listed in the Appendix. The type locality is represented by a star.

Holotype. Dried skin, skull and skeleton of an adult pregnant female, Royal Ontario Museum (ROM) number 113465, obtained 20 September 2001 by Burton K. Lim and Zacharias Norman (original field number F50445).

The skin, skull, and skeleton are in good condition. Frozen tissues are deposited at the Royal Ontario Museum (F50445).

Type locality. Pobawau Creek mouth, 100 m; Upper Takutu-Upper Essequibo; Guyana, 3°16'3.1"N, 58°46'42.7"W (Fig. 3).

Paratypes. The skin, skull, and skeleton of an adult male (ROM 108487) caught on 8 October 1997 at 38 mi Camp, 35 km SW Kurupukari, 100 m, Iwokrama Forest, Potaro-Siparuni, Guyana, 4°22'W, 58°51'W; one skin and skull of an adult male (ROM 114070) caught on 16 April 2002 and one skin, skull, and skeleton of an adult pregnant female (ROM 113991) caught on 13 April 2002 at Brownsberg Nature Park headquarters, 500 m, Brokopondo, Suriname, 4°57'N, 55°11'W; and the skin and skull of an adult male (ROM 114195) caught on 21 April 2002 at Km 2.4 Wittie Kreek trail, 300 m, Brownsberg Nature Park, Brokopondo, Suriname, 4°56'N, 55°10'W. The holotype and 4 paratypes, along with 31 other specimens from the known distributional range, are listed in Appendix 1 (Fig. 3). Measurements of each specimen of the type series of *P. guianensis* are provided in Table 4.

TABLE 4. Measurements of the type series of *Platyrrhinus guianensis* sp. nov. (in mm)

Character	Holotype ROM 113465 ♀	Paratype ROM 113991 ♀	Paratype ROM 108487 ♂	Paratype ROM 114070 ♂	Paratype ROM 114195 ♂
Greatest length of skull	22.0	21.0	21.9	21.5	21.2
Condylolincisive length	20.0	19.2	19.9	19.7	19.1
Condyllocanine length	19.5	18.8	19.3	19.2	18.6
Braincase breadth	9.4	8.9	8.9	9.0	9.1
Zygomatic breadth	12.7	12.0	12.2	12.0	12.3
Postorbital breadth	5.4	5.1	5.3	5.5	5.1
Mastoid breadth	11.0	10.5	10.4	10.5	10.5
Maxillary tooththrow length	7.9	7.6	7.4	7.6	7.7
Width at M2	9.1	8.9	8.9	8.5	8.8
Dentary length	14.5	13.9	14.2	14.3	14.3
Mandibular tooththrow length	8.3	8.2	8.2	8.1	8.6
Forearm length	40.0	38.0	39.0	39.0	39.0
Total length	59.0	56.0	59.0	58.0	54.0
Hind foot length	12.0	12.0	12.0	10.0	11.0
Ear length	16.0	17.0	16.0	16.0	17.0
Weight in grams	15.0	13.0	12.0	13.0	13.0

Distribution. *Platyrrhinus guianensis* is known from Guyana and Suriname (Fig. 3).

Etymology. The species name is derived from the Latin description of its endemic distribution in the Guiana region of South America.

Diagnosis. *Platyrrhinus guianensis* is distinguished from its congeners by a combination of external and craniodental characteristics. The ventral fur is dark gray; ventral fur unicolor; dorsal stripe wide and brilliant white; fringe of hair along margin of uropatagium long, conspicuously dense, and pale yellow. The skull of *P. guianensis* lacks a fossa on the squamosal root of the zygomatic arch. Dentally, two styler cuspules are present on the posterior cristid of P4; and one stylid cuspulid on the anterior cristid of p4.

Description. *Platyrrhinus guianensis* is a small *Platyrrhinus* (FA 37–41 mm) distinguished from its sister species *P. recifinus* by its smaller size and shorter skull (Table 5; Velazco & Gardner 2009, Table 2–4 and 7). However, measurements of *P. guianensis* overlap with *P. angustirostris*, *P. brachycephalus*, *P. fusciventris*, *P. helleri*, *P. incarum*, and *P. matapalensis* (Tables 4–5). Dorsal fur mostly dark brown, but paler on the upper dorsum; dorsal fur is bicolored with darker tips; facial stripes wide and white; dorsal stripe brilliant white; ventral fur dark gray, individual hairs unicolor; pinnae have well-marked fold lines; tragus and anterior and posterior rims of

pinnae bright yellow (Fig. 4); lateral borders of the proximal half of the noseleaf and borders of the horseshoe yellow; inferior border of the horseshoe completely free of upper lip; posterior margin of uroptagium has the shape of an inverted 'U'; hair on upper surface of feet brown, long and dense (Fig. 5); fringe of hair along the trailing margin of uroptagium long, conspicuously dense, and pale yellow; metacarpal III longer than metacarpal V.



FIGURE 4. Photograph of an adult female *Platyrrhinus guianensis* captured at Bakhuis, Sipaliwini, Suriname on 31 January 2006 (ROM 117503). Photograph by Alex Borisenko.

Rostrum is slender; has a well developed anterior notch in the nasals; postorbital processes moderately developed; paraoccipital processes poorly developed; two infraorbital foramina present; posterior border of hard palate 'V'-shaped (Fig. 6); fossa on the squamosal root of the zygomatic arch absent; and paraoccipital and paracondylar processes poorly developed.

Upper inner incisors bilobed and convergent, not in contact, and tips extend below level of cingula of upper canines; upper outer incisors monolobate; two stylar cuspules on posterior cristid of P4; hypoconal basin fossa of P4 shallow; M1 parastyle present; M1 mesostyle absent; M1 metacone divided in two cones; M1 metacone labial cingulum present; stylar cuspule absent on lingual cingulum of M1 metacone; sulcus on posterior cristid of paracone joined to cingulum of lingual face of metacone on M1; M1 metastyle present; M1 protocone well developed; M2 parastyle present; labial cingulum present on M2 paracone; stylar cuspule on lingual face of M2 paracone absent; M2 metastyle present; stylar cuspule absent on lingual face of M2 metacone; lingual cingulum of the M2 metacone not extending to the paracone; developed M2 hypoconal basin; M3 minute; labial and lingual cingulids on p4; one stylid cuspid on anterior cristid of p4; two stylid cuspid on posterior cristid of p4; m1 paraconid poorly developed; labial and lingual cingulids present on m1; stylid cuspid present on anterior cristid of m1 protoconid; m1 metaconid well developed; m2 hypoconid absent; stylid cuspid between the metaconid and protoconid poorly developed on m2; labial and lingual cingulids present on m2.

TABLE 5. Selected measurements of *Platyrrhinus* species.

Character	<i>Platyrrhinus angustirostris</i>	<i>Platyrrhinus brachycephalus</i>	<i>Platyrrhinus fusciventris</i>	<i>Platyrrhinus helleri</i>	<i>Platyrrhinus incarum</i>	<i>Platyrrhinus matapalensis</i>	<i>Platyrrhinus recifinus</i>
GLS	20.8 ± 0.2 (20.6–21.0) 3	21.1 ± 0.5 (20.4–22.1) 42	21.7 ± 0.4 (21.2–22.0) 3	21.6 ± 0.6 (20.6–22.7) 84	21.0 ± 0.4 (20.1–21.7) 25	22.4 (22.0–22.8) 2	23.4 (23.4–23.4) 2
CIL	19.6 ± 0.5 (18.4–20.5) 76	19.1 ± 0.5 (18.3–20.3) 44	19.9 ± 0.6 (18.6–20.9) 46	20.1 ± 0.4 (19.1–21.3) 84	19.0 ± 0.4 (18.1–19.9) 70	20.7 ± 0.5 (20.1–21.3) 5	22.2 ± 0.3 (21.7–22.6) 11
CCL	19.1 ± 0.5 (17.9–20.2) 76	18.7 ± 0.5 (17.8–19.9) 44	19.5 ± 0.6 (18.4–20.7) 46	19.6 ± 0.4 (18.7–20.8) 84	18.6 ± 0.4 (17.8–19.4) 70	20.2 ± 0.5 (19.6–20.8) 5	21.6 ± 0.3 (21.0–22.1) 11
BB	9.2 ± 0.2 (8.4–9.8) 76	9.3 ± 0.3 (8.9–9.9) 44	9.4 ± 0.2 (8.9–10.2) 46	9.3 ± 0.2 (8.9–9.8) 84	9.2 ± 0.2 (8.7–10.0) 70	9.5 ± 0.2 (9.4–9.8) 5	10.4 ± 0.2 (10.1–10.8) 11
ZB	12.0 ± 0.4 (11.2–12.8) 76	12.3 ± 0.5 (11.5–13.6) 35	12.5 ± 0.3 (11.6–13.1) 46	12.4 ± 0.3 (11.6–13.1) 84	12.1 ± 0.4 (11.2–13.1) 70	12.9 ± 0.3 (12.6–13.1) 3	14.1 ± 0.3 (13.6–14.5) 11
PB	5.3 ± 0.2 (4.9–5.7) 76	5.4 ± 0.2 (4.9–6.2) 45	5.4 ± 0.17 (5.0–5.7) 46	5.4 ± 0.2 (5.0–5.9) 84	5.3 ± 0.1 (5.0–5.6) 70	5.5 ± 0.1 (5.4–5.7) 5	5.7 ± 0.2 (5.5–6.1) 11
MB	9.8 ± 0.3 (9.2–10.5) 76	10.7 ± 0.3 (10.0–11.4) 44	10.0 ± 0.3 (9.5–10.8) 46	10.0 ± 0.2 (9.4–10.7) 84	9.8 ± 0.2 (9.3–10.4) 70	10.9 ± 0.3 (10.5–11.3) 5	11.7 ± 0.4 (11.0–12.4) 11
MTRL	7.7 ± 0.3 (7.0–8.1) 76	7.4 ± 0.3 (6.9–7.9) 38	7.8 ± 0.3 (7.1–8.5) 46	8.0 ± 0.2 (7.4–8.7) 84	7.4 ± 0.2 (6.9–7.9) 70	8.4 ± 0.2 (8.1–8.6) 5	8.9 ± 0.2 (8.6–9.4) 11
M2-M2	8.6 ± 0.3 (8.1–9.3) 76	8.8 ± 0.4 (8.1–9.7) 45	9.0 ± 0.3 (8.5–9.7) 46	9.0 ± 0.2 (8.3–9.8) 84	8.6 ± 0.3 (8.1–9.2) 70	9.2 ± 0.2 (9.0–9.5) 5	10.3 ± 0.3 (9.9–10.7) 11
DENL	14.3 ± 0.5 (13.3–15.3) 76	14.4 ± 0.4 (13.4–15.1) 44	14.6 ± 0.5 (13.5–15.5) 46	14.8 ± 0.4 (14.0–15.9) 84	13.8 ± 0.4 (13.0–14.4) 70	15.3 (15.3) 2	16.4 ± 0.3 (16.0–16.8) 5
MANDL	8.3 ± 0.3 (7.7–9.0) 76	8.2 ± 0.3 (7.3–8.8) 43	8.5 ± 0.3 (8.1–9.0) 46	8.7 ± 0.2 (8.3–9.3) 84	8.0 ± 0.3 (6.9–8.7) 70	9.2 (9.1–9.4) 2	9.6 ± 0.1 (9.6–9.8) 5
FA	37.3 ± 1.0 (34.7–39.2) 76	37.7 ± 1.8 (33.9–42.0) 34	38.3 ± 1.0 (35.4–40.1) 46	38.5 ± 1.1 (36.0–41.3) 84	37.2 ± 1.0 (35.0–40.0) 70	38.2 ± 1.1 (37.0–39.6) 5	42.4 ± 0.7 (41.0–43.5) 10



FIGURE 5. Dorsal view of the legs of an adult female *Platyrrhinus guianensis* captured at Bakhuis, Sipaliwini, Suriname on 31 January 2006 (ROM 117503). Note the presence of long and dense fur over the surface of legs and uropatagium and the long, highly dense, and conspicuously pale fringe of hair along the edge of the uropatagium. Photograph by Alex Borisenko.

Comparisons. *Platyrrhinus guianensis* can be confused with *P. angustirostris*, *P. brachycephalus*, *P. fusciventris*, *P. helleri*, *P. incarum*, and *P. matapalensis* because their external and cranial measurements overlap (Table 3–4). But it can be easily distinguished from *P. brachycephalus* and *P. matapalensis* by the presence of one accessory cuspid on the anterolingual cristid of p4 (Fig. 7) (cuspid lacking in *P. matapalensis* and two accessory cuspids present in *P. brachycephalus*; Velazco 2005, fig. 27). Therefore, the following comparisons focus on differentiating *P. guianensis* from *P. angustirostris*, *P. fusciventris*, *P. helleri*, and *P. incarum*.

Externally, ventral fur is dark gray in *P. guianensis* and *P. angustirostris* (brownish gray in *P. incarum*; pale gray in *P. helleri*; brown in *P. fusciventris*); ventral fur unicolored in *P. guianensis*, *P. angustirostris*, *P. fusciventris*, and *P. helleri* (bicolored in *P. incarum*); dorsal stripe wide and brilliant white in *P. guianensis* and *P. helleri* (conspicuous but narrow in *P. angustirostris*, *P. fusciventris*, and *P. incarum*); tragus and anterior and posterior rims of pinnae bright yellow in *P. guianensis*, *P. fusciventris*, and *P. helleri* (whitish in *P. angustirostris* and *P. incarum*); lateral borders of the proximal half of the noseleaf and borders of the horseshoe yellow in *P. guianensis*, *P. fusciventris*, and *P. helleri* (whitish in *P. angustirostris* and *P. incarum*); posterior margin of uropatagium with a shape of an inverted ‘U’ in *P. guianensis*, *P. angustirostris*, and *P. incarum* (‘V’ shaped in *P. fusciventris* and *P. helleri*); fringe of hair along margin of uropatagium long, conspicuously dense, and pale yellow in *P. guianensis* (long, dense, and pale brown in *P. helleri*; long, dense, and whitish in *P. fusciventris* and *P. incarum*; short, dense, and pale brown in *P. angustirostris*); hair on the upper surface of feet brown, long and dense in *P. guianensis*, *P. angustirostris*, and *P. incarum* (short and intermediate in density in *P. fusciventris* and *P. helleri*); metacarpal III longer than metacarpal V in *P. guianensis*, *P. angustirostris*, and *P. incarum* (metacarpals III and V subequal in *P. fusciventris* and *P. helleri*).

Cranially, there is a ‘V’-shaped posterior border of the hard palate in *P. guianensis*, *P. angustirostris*, *P. helleri*, and *P. incarum* (‘V’- or ‘U’-shaped in *P. fusciventris*); fossa on the squamosal root of the zygomatic arch absent in *P. guianensis*, *P. helleri*, and *P. incarum* (shallow in *P. angustirostris* and *P. fusciventris*).



FIGURE 6. Dorsal (A) and ventral (B) views of the skull of *Platyrrhinus guianensis* (ROM 113465 [holotype]; female) from Upper Takutu-Upper Essequibo, Guyana. Dorsal (C) and ventral (D) views of the skull of *Platyrrhinus recifinus* (ROM 111103; female) from São Paulo, Brazil. Scale bar = 5 mm.

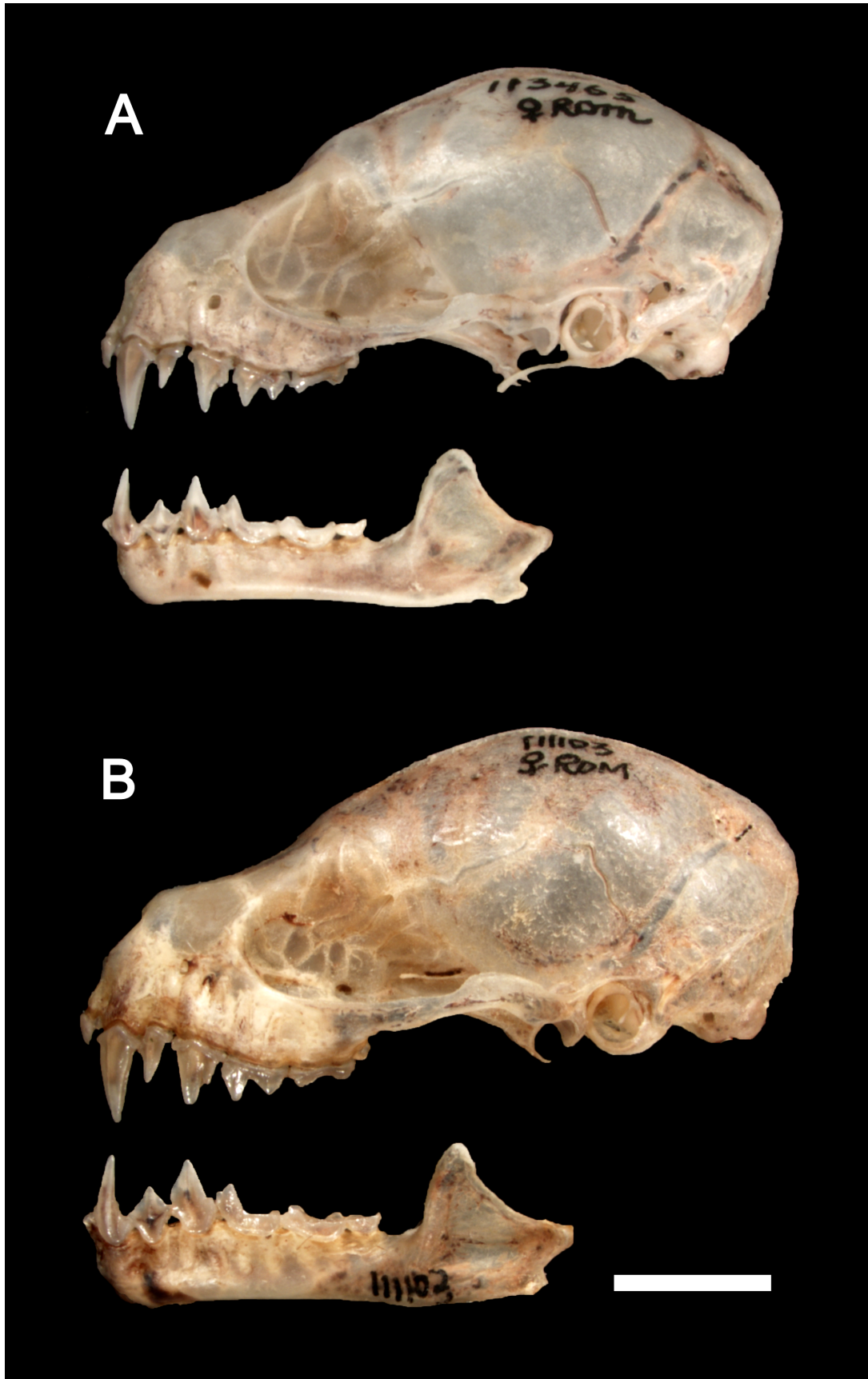


FIGURE 7. Lateral views of the skull and lower jaw of (A) *Platyrrhinus guianensis* (ROM 113465 [holotype]; female). Lateral views of the skull and lower jaw of (B) *Platyrrhinus recifinus* (ROM 111103; female). Scale bar = 5 mm.

Dentally, there are two stylar cuspules on posterior cristid of P4 in *P. guianensis*, *P. fusciventris*, *P. helleri*, and *P. incarum* (three in *P. angustirostris*); stylar cuspule on lingual face of M2 paracone absent in *P. guianensis*, *P. angustirostris*, and *P. fusciventris* (one stylar cuspule in *P. helleri* and *P. incarum*); M3 minute in *P. guianensis* and *P. incarum* (larger in *P. helleri*, *P. angustirostris*, and *P. fusciventris*); one stylid cuspid on the anterior cristid of p4 in *P. guianensis*, *P. fusciventris*, and *P. helleri* (one or two in *P. incarum* and *P. angustirostris*); tall m2 protoconid in *P. guianensis*, *P. angustirostris*, *P. fusciventris*, *P. incarum* (Fig. 7) (shorter in *P. helleri*); hypoconid lacking on m2 in *P. guianensis*, *P. angustirostris*, *P. fusciventris*, and *P. helleri* (poorly developed in *P. incarum*); poorly developed stylid cuspid between the metaconid and protoconid on m2 in *P. guianensis*, *P. fusciventris*, and *P. helleri* (well developed in *P. incarum* and *P. angustirostris*).

Natural history. *Platyrrhinus guianensis* has been documented from an elevational range of 60 to 500 m and is found primarily in rainforest (n=33), but 3 individuals were netted in savanna. Of the 36 specimens examined, 16 are males and 20 females. Testes size (length by width in mm) ranged from 3 by 2 to 5 by 4. From 12 January to 9 February 2006, 8 of 10 females were pregnant with crown-rump (CR) measurements ranging from 4 to 13 mm. A female was pregnant on 13 April 2002 and another on 27 July 2009 with CR of 13 mm and 4 mm, respectively. Three females were pregnant on 20 and 21 September 2001 with CR ranging from 18 to 21 mm. A non-pregnant female was collected on 24 October 1997. A female had an embryo with CR of 26 mm collected on 31 October 2005. Two non-pregnant lactating females were caught on 8 and 11 November 1999 and one non-pregnant female was caught on 19 November 1997.

Discussion

With the description of *Platyrrhinus guianensis*, there are 21 species of *Platyrrhinus*, which is the most speciose genus in the family Phyllostomidae. This taxon also represents the sixth known species of bat endemic to the Guiana Region of South America defined as including Guyana, Suriname, French Guiana, and the southeastern states of Venezuela (Amazonas, Bolivar, and Delta Amacuro) (Lim 2012; Lim & Tavares 2012).

Platyrrhinus guianensis corresponds to the phylogenetic species clade PS2 of the *P. helleri* species complex first reported by Clare *et al.* (2007). Velazco and Patterson (2008) assigned *P. incarum* (then treated as a junior synonym of *P. helleri*) to the clade corresponding to PS1 and Velazco *et al.* (2010) described a new species, *P. fusciventris*, for the clade corresponding to PS3. These taxa were previously identified by DNA barcoding as divergent lineages (Clare *et al.* 2007; Borisenko *et al.* 2008; Clare 2011; Clare *et al.* 2011).

All three of these recently recognized species occur in sympatry at Iwokrama Forest in Guyana, and Brownsberg Nature Park, Bakhuis Mountains, and Iconja Landing in Suriname. During 21 small mammal biodiversity surveys conducted by the Royal Ontario Museum in the Guianas from 1990 to 2010, 36 specimens of *P. guianensis* were collected, indicating similar relative abundance to *P. incarum* (35 specimens), but less than half compared to the 80 specimens taken of *P. fusciventris*.

The new species is restricted to the lowlands of the eastern Guianas but occurs in montane areas up to 500 m in elevation, including the Brownsberg and Bakhuis Mountains in Suriname and the Iwokrama and Kanuku Mountains in Guyana. *Platyrrhinus fusciventris* is more widely distributed up to an altitude of 800 m in the Guiana highlands of western Guyana and southern Venezuela. However, it has not been recorded in the vicinity of the three highest table-topped mountains (tepui) in Guyana that reach over 1,500 m in elevation. As with *P. guianensis*, *P. incarum* does not occur in the Guiana highlands but is found in lowland regions.

Although *P. guianensis*, *P. fusciventris*, and *P. incarum* are sympatric in the Guianas and were previously considered synonymous with the more widely distributed *P. helleri*, none are sister species to each other. This is an example of cryptic species, which contribute to the underestimation of bat diversity, especially in tropical areas. There is a pressing scientific need to continue the collection of museum specimens to properly document both spatial and temporal biodiversity, particularly in a world experiencing unprecedented environmental change.

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APPENDIX

Specimens examined in this study of *P. angustirostris*, *P. brachycephalus*, *P. fusciventris*, *P. guianensis*, *P. helleri*, *P. incarum*, *P. matapalensis*, and *P. recifinus* with their respective localities. See Materials and Methods for abbreviations. Individuals marked with an asterisk were used only in the molecular analyses. All known specimens of *P. guianensis* are listed.

Platyrrhinus angustirostris (79)

COLOMBIA: **Antioquia**: Buenos Aires, 24 km S, 22 km W Zaragoza (USNM 499443–499444); La Tirana, 25 km S, 22 km W Zaragoza (USNM 499445–499448; 499451, 499453–499454); Aljibes, 26 km S, 22 km W Zaragoza (USNM 499449–499450). **Meta**: Finca Buque, Villavicencio (USNM 507188–507189). ECUADOR: **Orellana**: Parque Nacional Yasuní, 66 km S of Pompeya Sur (ROM 105964*); Parque Nacional Yasuní, Onkone Gare, 38 km S of Pompeya Sur (ROM 105127*). PERU: **Amazonas**: Bongara, San Carlos, Río Utcubamba, entre Churuja y Pedro Ruiz (FMNH 129150 [Holotype]); Luya, Río Utcubamba, 11 km by rd NW Pedro Ruiz (FMNH 129152–129153, 129154*). VENEZUELA: **Apure**: Nulita, 29 km SSW Santo Domingo, Selvas de San Camilo (USNM 440595–440605). **Barinas**: Altamira (USNM 440536–440542, 440544, 440593–440594); Altamira, 2 km SW Altamira (USNM 440545–440552). **Bolívar**: Río Supamo, 50 km SE El Manteco (USNM 387076); El Manaco, Km 74, 59 km SE El Dorado (USNM 387079–387081, 387083–387090); Hato San José, 20 km W La Paragua (USNM 405028). **Falcón**: Urama, Km 40, 19 km NW Urama (USNM 372132–372141); Río Socopo, 80 km NW Carora (USNM 440525). **Guarico**: Río Orituco, 10 km N Altagracia (USNM 387091). **Sucre**: Ensenada Cauranta, 9 km NE Güiria (USNM 408407); Manacal, 26 km ESE Carúpano (USNM 408408, 408412–408414, 408416).

Platyrrhinus brachycephalus (48)

BOLIVIA: **El Beni**: Itenez, Buenavista (FMNH 115012); Mamore, San Joaquin (FMNH 96092, 115016–115018); Vaca Diez, La Esperanza (FMNH 115003, 115005). COLOMBIA: **Arauca**: Río Arauca (FMNH 92326). **Meta**: La Macarena Parque, Refugio (FMNH 58739); Villavicencio, Finca El Buque (FMNH 121261). ECUADOR: **Napo**: Marian (FMNH 124990); San Jose de Payamino (FMNH 124991–124992); Zancudo (FMNH 124985–124986). PERU: **Cuzco**: Paucartambo, Consuelo, km 165, 17 km by road W of Pilcopata (FMNH 123920, 123923); Quispicanchi, Collpa de San Lorenzo (FMNH 93580, 93582–93585); Quispicanchi, Huajyumbé (FMNH 84381). **Huánuco**: Leoncio Prado, Tingo Maria, Río Azul (FMNH 98008). **Loreto**: Alto Amazonas, Río Morona, Quebrada Pushaga (FMNH 89091); Alto Amazonas, Yurimaguas (FMNH 19651); Río Samiria, Base Atun (FMNH 122874–122876, 122878); Río Tigre, 1 km above Río Tigrillo (FMNH 122880); Mariscal Ramon Castilla, Río Amazonas, mouth of Río Peruato (FMNH 89096); Mariscal Ramon Castilla, Río Yavari Mirim, Quebrada Esperanza (FMNH 89095); Maynas, Río Nanay, Santa Luisa (FMNH 87074). **Madre de Dios**: Manu, Alto Río Madre de Dios, Hacienda Amazonia (FMNH 125930, 125938, 139639); Manu, Maskoitania, 13.4 km NNW Atalaya, left bank Río Alto Madre de Dios (FMNH 174745*, 174746*, 174748*); Manu, Río Palotoa, left bank, 12 km upstream from mouth (FMNH 139581, 139584–139585, 139587). **Ucayali**: Coronel Portillo, Pucallpa (FMNH 64316–64317); Coronel Portillo, Yarinacocha (FMNH 98009). VENEZUELA: **Tachira**: San Juan de Colon (FMNH 21117).

Platyrrhinus fusciventris (50)

BRAZIL: **Amapa**: Serra do Navio, Río Amapari (USNM 392308–392309). **Amazonas**: Manaus, W of Lago Janauacá (USNM 531072); Manaus, Manacapuru, Km 20 (USNM 554777); Manaus, Reserva Ecológica (USNM 555973); Tefé (USNM 531075). **Pará**: Município de Vitória do Xingu, left Bank Rio Xingu (MPEG 39265); Belém, Fazenda Velha (USNM 361707–361708); Belém, Mocambo/Embrapa (FMNH 126601, 126603, 126606); Belém, Station A, Ian (USNM 361704–361706); Belém, Utinga (USNM 361709–361710). **Roraima**: Ilha Maracá (USNM 531071). ECUADOR: **Pastaza**: Mera (USNM 548165, 548168–548172); Yosa (USNM 548166–548167). FRENCH GUIANA: **Cayenne**: Sinnamary, Paracou (AMNH 267555*). GUYANA: **Barima-Waini**: North West District, Baramita (USNM 582326). **Demerara-Mahaica**: Ceiba Biological Station (ROM 112611*). **Upper Demerara-Berbice**: Dubulay Ranch (USNM 582325). SURINAME: **Brokopondo**: Brownsberg Nature Park, Jeep Trail (ROM 114089*). TRINIDAD AND TOBAGO: **Trinidad**: (346599); Saint Andrew, Turure Ward, Plum Mitán (USNM 346590); Saint David, Toco Ward, Grande Riviere (USNM 346592, 346595). VENEZUELA: **Amazonas**: Belén, 56 km NNW Esmeralda, Cano Essa (USNM 405030–405031, 405033); Belén, 56 km NNW Esmeralda, Río Cunucunuma (USNM 405032); Capibara, 106 km SW Esmeralda, Brazo Casiquiare (USNM 408418–408420); Cerro de la Neblina, Base Camp (USNM 560805*, 560806 [Holotype]); Río Mavaca, 108 km SSE Esmeralda (USNM 405036, 405584); Tamatama, Río Orinoco (USNM 405037–405038, 545345–545346).

Platyrrhinus guianensis (36)

GUYANA: **Potaro-Siparuni**: Iwokrama Forest, 38 Mile Camp, 35 km SW of Kurupukari (ROM 108487); Iwokrama Forest, Gorge Camp, 40 Km SSW of Kurupukari, (ROM 108890); Iwokrama Forest, Field Station (ROM 111955, 112058); Iwokrama Forest, Kabukalli Landing (ROM 111676); Iwokrama Forest, Pakatau Falls, Siparuni River (ROM 109295); Iwokrama Forest, “S” Falls, 50 km WSW of Kurupukari (ROM 109133). **Upper Takutu-Upper Essequibo**: 2 km W of Unabaiton, Rupununi River (ROM 119262); Cacique Mountain, Kwitaro River (ROM 113584); Kuma River, Kanuku Mountains, 10 km SE of Lethem (ROM 97878); Pobawau Creek mouth (ROM 113465 [Holotype], 113491–113492). SURINAME: **Brokopondo**: Brownsberg Nature Park, Headquarters (ROM 113991, 114070); Brownsberg Nature Park, Km 2.4, Wittie Kreek trail (ROM 114195). **Sipaliwini**: Bakhuis, Area 8 Camp (ROM 117398, 117469, 117503–117504); Bakhuis, Area 8 Recon Fly Camp (ROM 117459); Bakhuis, Transect 7 (ROM 117049, ROM 117109); Bakhuis, Transect 9 (ROM

116892, 116903); Bakhuis, Transect 13 (ROM 117190, 117205–117206, 117209, 117225, 117258); Blanche Marie Vallen (ROM 117575, 117643, 117648, 117655); Iconja Landing, Sipaliwini River (ROM 120343).

Platyrhinus helleri (88)

BELIZE: **Stan Creek District**: Cockscomb Basin Wildlife Sanctuary, at confluence of Cockscomb Branch and Mexican Branch (USNM 583032–583034). COLOMBIA: **Valle del Cauca**: Buenaventura, Río Zabaletas, across from Village of Zabaletas, 29 km SE Buenaventura (USNM 483632–483640). COSTA RICA: **Limón**: Barra del Tortuguero, Caño Palma Biological Station, 7km NNW of Tortuguero (ROM 108325*). **Puntarenas**: Quepos, Manuel Antonio National Park (USNM 566449). EL SALVADOR: **Ahuachapan**: La Fineana, Hacienda Los Imposibles (USNM 543123). GUATEMALA: **Petén**: Biotope Cerro Cahui, El Remate (ROM 99614*); Flores Municipality, Tikal National Park, 60 km N Flores (USNM 564895–564896). MEXICO: **Chiapas**: Ococingo Municipality, Ejido “La Gloria,” Río Lagartos (USNM 554856). **Oaxaca**: “Montebello,” 24 mi W Matías Romero (USNM 332746); 11.7 mi S Palomares (USNM 554278). PANAMA: **Bocas del Toro**: Almirante (USNM 315487–315494, 315497–315498). **Chiriquí**: Cuesta de Piedra (USNM 331641–331645); Guabala (USNM 331627–331633); Tole (USNM 331634–331635). **Coclé**: Ola (USNM 331636–331639); 2 mi E Río Hato (USNM 331625–331626); Santa Clara (USNM 331624). **Darién**: Cana (LSUMZ 536*, 537*); Tacarcuna, Village Camp (USNM 309646–309654, 309657–309658). **Los Santos**: Cerro Hoya (USNM 323421–323423). **Veraguas**: 6 mi W Soná (USNM 331640). VENEZUELA: **Miranda**: 1 km S Río Chico (USNM 387099–387103, 387105–387108); 7 km E Río Chico, near Puerto Tuy (USNM 387109); Biringo (USNM 440518–440521); Parque Nacional Guatopo, 21 km NW Altagracia (USNM 387092–387094). **Trujillo**: 23 km N Valera, near Agua Viva (USNM 370406); 25 km NW Valera, near Agua Santa (USNM 370405).

Platyrhinus incarum (74)

BOLIVIA: **Cochabamba**: Puerto San Francisco, 38 km from Villa Tunari on Matamoho River (USNM 461044). **El Beni**: Iténez, Buenavista (FMNH 115001, 115009–115011); Mamoré, San Joaquín (FMNH 115007–115008, 115019). **Santa Cruz**: Velasco Province, Parque Nacional Kempff Mercado, El Refugio Huanchaca (USNM 584494–584495, AVE12*). BRAZIL: **Mato Grosso**: Serra do Roncador, 264 km N Xavantina (USNM 393696–393702). **Rondônia**: Pôrto Velho (USNM 562583); Pôrto Velho, 19 km da Cidade (USNM 554774). COLOMBIA: **Amazonas**: Puerto Nariño, approx. 50 km N Leticia (USNM 483642). ECUADOR: **Sucumbíos**: Cooperativa Nueva Esmeralda, Km 61 on Lago Agrio-Quito Hwy (USNM 522425); Limoncocha (USNM 528340). PERU: **Amazonas**: Luya, Río Utcubamba, 11 km by rd NW Pedro Ruiz (FMNH 129156*). **Cuzco**: La Convención, Echarate, a 2 km SO de C.N. Tangoshiari (MUSM 13389*); La Convención, Echarate, Camisea, Armihuari (USNM 582846–582848); La Convención, Echarate, Camisea, San Martín (USNM 582849–582850); La Convención, Ridge Camp (USNM 588025–588026); Paucartambo, Consuelo, km 165, 17 km by road W of Pilcopata (FMNH 174766*); Quispicanchi, Collpa de San Lorenzo (FMNH 93586–93587). **Loreto**: Río Gálvez, Nuevo San Juan (MUSM 13241). **Madre de Dios**: Manu, Alto Río Madre de Dios, Hacienda Amazonia (FMNH 125951, 139631); Manu, Quebrada Aguas Calientes, left bank Río Alto Madre de Dios, 2.75 km E Shintuya (FMNH 170122, 170125, 170127–170129, 170133–170134); Manu, Maskoitania, 13.4 km NNW Atalaya, left bank Río Alto Madre de Dios (FMNH 174765); Manu, left bank Río Palotoa, 12 km upstream from mouth (FMNH 139648); Río Tambopata, 30 km above mouth (USNM 530915–530917); Tambopata, Tambopata, Explorer's Inn Lodge (USNM 562236–562239). **Pasco**: Oxapampa, San Juan (USNM 364409–364411, 364413). **San Martín**: Moyobamba, Área de Conservación Municipal Mishquiyacu Rumiyacu-Almendra, Orquidiario Waqanki (FMNH 203442, 203620, 203622, 203624, 203626; MUSM 38200, 39199, 39201–39204). **Ucayali**: 59 km W Pucallpa (USNM 461254); 59 km SW Pucallpa (USNM 499095–499097, 499099).

Platyrhinus matapalensis (9)

ECUADOR: **Guayas**: Reserva Ecológica Manglares-Churute, Cerro Cimalon (TTU 103556*, 103559*). **El Oro**: Quebrada Seca, Fuerte Militar Arenillas, 7.1 km W and 12.5 km S of the Militar Base (TTU 102706*). **Loja**: Puyando, Bosque Petrificado-Sector Las Pailas, Quebrada Los Chirimoyos (TTU 103799*). PERU: **Tumbes**: Zarumilla, Z.R. Tumbes, Quebrada Los Naranjos, Campo Verde (MUSM 10725–10726); Zarumilla, Matapalo (FMNH 81079 [Holotype], 81080–81081).

Platyrhinus recifinus (12)

BRAZIL: **Minas Gerais**: APA Coqueiral (CMUFLA 113, 114). **Pernambuco**: Pernambuco [Recife] (BMNH 81.2.16.4 [Holotype]). **São Paulo**: Caetetus Ecological Station (ROM 111103, 111106); Ilha de São Sebastião, Parque Estadual de Ilhabela (MVZ 185604, 185605*, 185606, 185609–185611); Município de Salesópolis, Estação Biológica de Boraceia, Museu Zoologia da USP (MVZ 185901).