

First record of *Vampyroides caraccioli* (Thomas, 1889) (Chiroptera: Phyllostomidae) for the state of Paraná, and range extension to southern region of Brazil

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ABSTRACT: The present note reports the first record of *Vampyroides caraccioli* in Paraná state, southern Brazil, based on an adult male specimen collected in the “Reserva Particular do Patrimônio Natural Salto Morato”, on the north coast of the state, extending 301 km in the known austral distribution of the species.

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Until recently, the genus *Vampyroides* Thomas, 1900 was regarded as monospecific, containing only *Vampyroides caraccioli* (Thomas, 1889) (Gardner 2008; Velazco *et al.* 2010; Peracchi *et al.* 2011). However, the systematics of *V. caraccioli* is quite controversial, and some authors considered the species monotypic (*e.g.*, Zortéa 2007; Peracchi *et al.* 2011), while others recognized two subspecies (*e.g.*, Willis *et al.* 1990; Simmons 2005; Gardner 2008; Velazco *et al.* 2010) or even two distinct species (Cabrera 1958). In the most recent review, Velazco and Simmons (2011) recognized two species for the genus, *V. caraccioli* and *V. major* Allen, 1908, based on morphological and molecular data. *Vampyroides major* occurs from southern Mexico to north-western South America, in western Colombia and Ecuador. *Vampyroides caraccioli* occurs in South America, east of Colombia, Ecuador, Peru, northern of Bolivia, Trinidad, Tobago, Venezuela, Guyana, Suriname, Guyana, and Brazil (Velazco and Simmons 2011). Both species can be considered medium-sized, with forearm ranging from 46.8 to 57.3 mm and weighing 25.2 to 34 g (Willis *et al.* 1990; Zortéa 2007; Gardner 2008), and *V. caraccioli* is smaller when compared to *V. major* (Velazco and Simmons 2011).

In Brazil, *V. caraccioli* have been reported for the Amazonian (Martins *et al.* 2006; Peracchi *et al.* 2011), Pantanal (Alho *et al.* 2011), and Atlantic Forest biomes (Faria 2006; Lourenço *et al.* 2010), with its southern known distribution limit at the northern coast of São Paulo (Velazco *et al.* 2010). This species is associated to rainforests (Willis *et al.* 1990), occurring at various altitudes, but more frequently at elevations below 600 m (Willis *et al.* 1990; Zortéa 2007).

Little is known about the biology and ecology of *V. caraccioli*. Lim and Engstrom (2001) included this species in the canopy frugivores guild, but Rex *et al.* (2008)

mentioned that the species has a foraging height of only 10 meters, which does not correspond to the forest canopy. *Vampyroides caraccioli* consumes mainly fruits of Moraceae (*Ficus* spp.) (Willis *et al.* 1990; Giannini and Kalko 2004; Lobova *et al.* 2009) and roosts in small clusters of two to four individuals under palm leaves (Willis *et al.* 1990; Peracchi *et al.* 2011). Regarding the conservation status, the species is not classified in any of the threat categories, both globally (Miller *et al.* 2008) and nationally (Chiarello *et al.* 2008). The goal in the present study is to report the first record of *V. caraccioli* for the state of Paraná, extending its austral distribution.

The record reported here was obtained during a study of vertical stratification in a bat assemblage from the state of Paraná, southern Brazil. This study was carried out from September 2013 to January 2014, and each forest stratum (understory, sub-canopy, and canopy) was sampled with six mist nets each night, opened for six hours after the twilight. The permission to perform the sampling was granted by the Instituto Chico Mendes de Conservação da Biodiversidade—ICMBio, under the number 36103-13. So far, 28 nights of sampling were performed, which generated a sampling effort of 22,276.8 m².h for each stratum, calculated according to Straube and Bianconi (2002). This effort resulted in 383 captures of 21 other species, as follows: *Anoura caudifer* (É. Geoffroy, 1818); *Anoura geoffroyi* Gray, 1838; *Artibeus fimbriatus* Gray, 1838; *Artibeus lituratus* (Olfers, 1818); *Artibeus obscurus* (Schinz, 1821); *Carollia perspicillata* (Linnaeus, 1758); *Chiroderma doriae* (Thomas, 1891); *Dermanura cinerea* Gervais, 1856; *Desmodus rotundus* (É. Geoffroy, 1810); *Eptesicus brasiliensis* (Desmarest, 1819); *Lamproncycteris brachyotis* (Dobson, 1879); *Myotis nigricans* (Schinz, 1821); *Myotis riparius* Handley, 1960; *Myotis ruber* (É. Geoffroy, 1806); *Platyrrhinus recifinus* (Thomas, 1901);

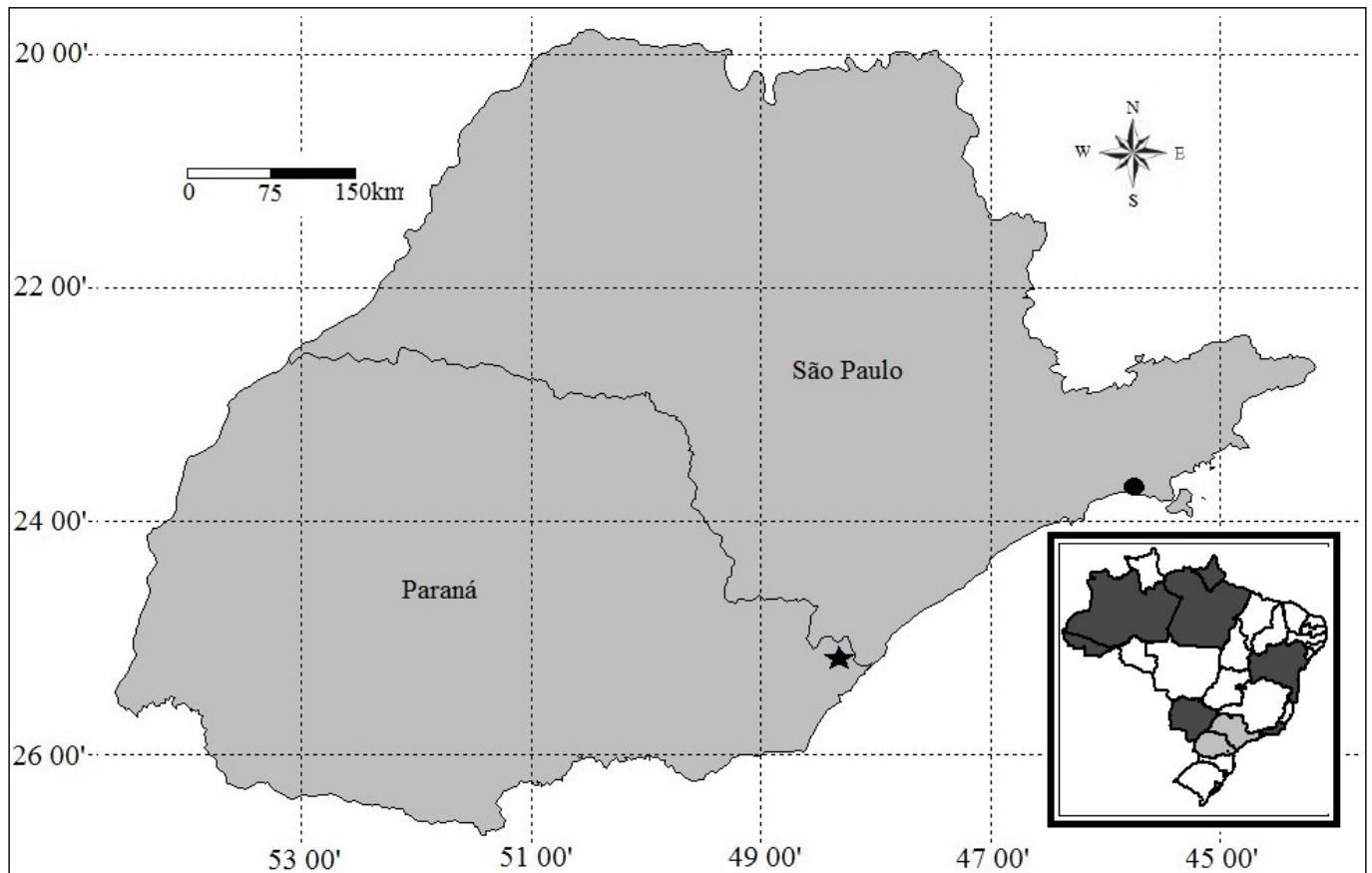


FIGURE 1. Map showing locality records of *Vampyroides caraccioli* in the states of São Paulo (□) (Velazco *et al.* 2010) and Paraná (★) (present study). The Brazilian map highlights the localization of these states (light gray) and shows others (dark gray) with confirmed records based on Velazco *et al.* (2010) and Alho *et al.* (2011).

Pygoderma bilabiatum (Wagner, 1843); *Sturnira lilium* (É. Geoffroy, 1810); *Sturnira tildae* de la Torre, 1959; *Trachops cirrhosus* (Spix, 1823); and *Vampyressa pusilla* (Wagner, 1843).

The study area is located in the municipality of Guaraqueçaba, northern coast of Paraná state (25°09'98" S and 48°17'90" W), being inserted in the Reserve Natural Salto Morato (RNSM), at an average altitude of 60 m above the sea level (Figure 1). The RNSM occupies a total area of 2,340 ha and is inserted into a large continuous forest that corresponds to the Environmental Protection Area of Guaraqueçaba, covering an area of 282,444 ha (Straube and Urben-Filho 2005). According to phytogeographical criteria, the study area falls within the Atlantic Forest Biome, in the sub-formation Dense Tropical Rain Forest Submontane (Veloso *et al.* 1992). According to Koeppen climate classification, the region's climate is type Cfa. According to data obtained in the Salto Morato's weather station, the average monthly rainfall is around 80 mm and average monthly temperature of 20.6°C.

On 25 November 2013, at 00:12 h, an adult male *V. caraccioli* was captured (Figures 2 and 3) in a mist-net installed at the understory level. This individual was collected and incorporated into the mammal collection of Universidade Federal do Paraná—UFPR, under the number DZUP-CCMZ 1956. Morphological measurements of the collected specimen were obtained with a caliper (Table 1), following the description of Velazco and Simmons (2011). Taxonomic identification was based in Lim and Engstrom (2001), Gardner (2008), Aguirre *et al.* (2009), and Velazco and Simmons (2011). At the genus level, the following



FIGURE 2. *Vampyroides caraccioli*, male, (DZUP-CCMZ 1956) from an Atlantic Forest fragment in the state of Paraná, southern Brazil. Photo: Fernando Carvalho.

diagnostic characters were observed: (1) presence of facial and dorsal stripes; (2) dorsal stripe beginning at head; (3) incisors 2/2; (4) molars 2/3; (5) height of first incisor much less than height of first molar; (6) second upper molar equal in size or smaller than first; (7) presence of nasal bones, and (8) greatest length of skull > 24 mm. At the species level, the following diagnostic characters were observed: (1) general size smaller than described for *V. major* (Table 1); (2) third metacarpal greater than the fifth metacarpal; (3) inverted U-shaped posterior margin of the uropatagium, with (4) dense and short hair (< 2 mm) along the trailing edge; (5) parietal foramina well separated from nuchal crest; (6) low developed groove present between occipital condyle and paracondylar process; (7)

paraoccipital processes well developed; (8) I1 broad and bilobed; (9) M1 postentoconule absent; (10) lower incisors robust and bilobed; (11) lingual accessory cuspule present on p4; (12) cuspule on m1 and m2 paracristid absent.

Vampyroides caraccioli had its first record in the Atlantic Forest biome obtained in the state of Bahia (Faria 2006), and Velazco *et al.* 2010 expanded its known distribution southward to São Paulo. With the present record, the first for the state of Paraná, we

extend in 301 km this southern limit.

Vampyroides caraccioli has a disjunct distribution, occurring in Amazonia and Atlantic Forest, with no record in the dry diagonal of South America (Caatinga and Cerrado) (Gardner 2008; Velazco *et al.* 2010; Velazco and Simmons 2011). This disjunct distribution is in agreement with the postulated association of *V. caraccioli* to rainforests (Willis *et al.* 1990), and it could reflect a vicariance event, although molecular analyzes by Velazco and Simmons

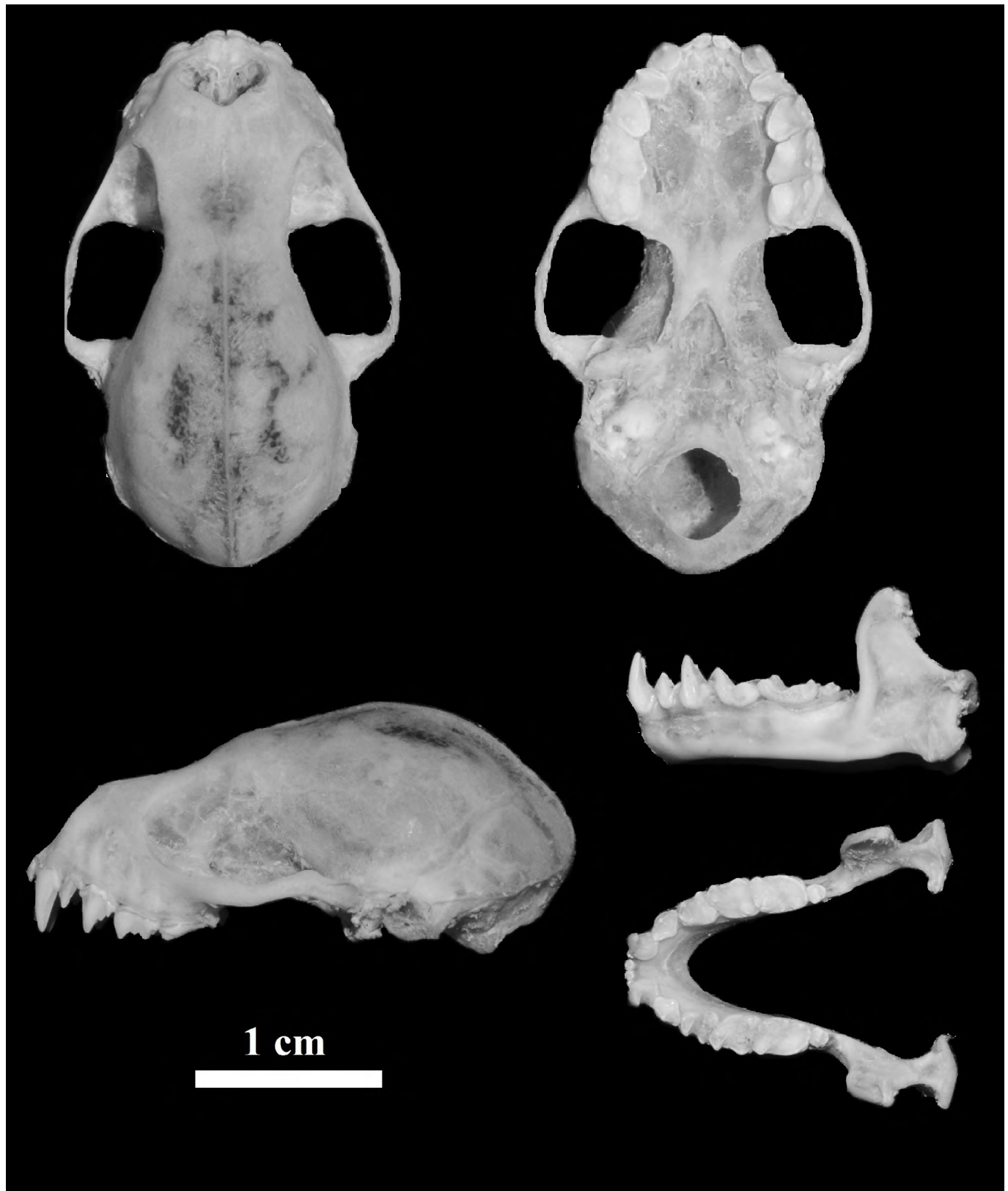


FIGURE 3. Dorsal, ventral, and lateral views of the skull and also dorsal and lateral views of the mandible of *Vampyroides caraccioli* (DZUP-CCMZ 1956).

TABLE 1. Measurements (in mm) of specimens of *Vampyroides caraccioli* from the states of Paraná, southern Brazil (present study), and São Paulo, southeastern Brazil (Velazco *et al.* 2010), and data (min.–max.) for *V. caraccioli* and *V. major* from several localities (Velazco and Simmons 2011).

Character*	<i>V. caraccioli</i>				<i>V. major</i>	
	Present study	Velazco <i>et al.</i> (2010)	Velazco and Simmons (2011)*		Velazco and Simmons (2011)*	
	(N = 1)	(N = 1)	(N = 55)		(N = 212)	
	♂	♀	♀	♂	♀	♂
FA	53.9	54.03	47.28–55.98	48.79–53.96	52.06–58.64	51.36–56.93
GLS	29.1	28.3	25.22–27.97	24.14–27.56	26.65–28.96	26.26–29.06
CIL	25.1	25.83	22.54–25.40	22.99–25.34	23.88–26.14	23.71–26.52
CCL	24.6	25.17	21.98–24.98	22.58–24.66	23.39–25.53	23.09–25.71
BB	11.9	10.98	10.88–11.91	10.90–11.94	11.24–12.70	11.09–12.65
ZB	18.3	17.79	15.92–17.89	15.76–17.62	16.87–18.48	16.33–18.47
PB	6.2	6.55	5.87–6.79	5.99–6.69	6.20–7.35	6.33–7.28
C-C	6.9	6.7	6.13–7.08	6.26–6.96	6.58–7.67	6.35–7.47
PL	13.1	14.14	12.25–14.39	12.99–14.46	13.68–15.51	13.54–15.44
MTRL	10	10.37	9.23–10.25	9.34–9.94	9.78–10.91	9.68–10.78
MLTRL	8.3	8.88	7.71–8.77	7.55–8.43	8.14–9.07	7.98–9.04
M1-M1	12.5	12.26	10.78–12.28	10.64–12.22	11.60–12.94	10.97–12.79
M2-M2	12.8	12.71	11.23–12.37	11.17–12.37	11.93–13.32	10.95–13.14
MB	12.9	—	11.78–13.24	11.57–12.80	12.33–13.53	12.20–13.63
COH	8.6	—	7.13–8.28	7.28–8.23	7.27–8.55	6.90–8.41
DENL	19.1	19.32	16.91–19.10	17.12–19.07	18.28–19.81	17.49–19.89
MANDL	11.1	11.45	10.04–11.27	10.06–11.27	11.07–12.14	10.86–12.06

FA = Forearm length; GLS = Greatest length of skull; CIL = Condylolincisive length; CCL = Condylolcanine length; BB = Braincase breadth; ZB = Zygomatic breadth; PB = Postorbital breadth; C-C = Palatal width at canines; PL = Palatal length; MTRL = Maxillary tooththrow length; MLTRL = Molariform tooththrow length; M1-M1 = Width at M1; M2-M2 = Width at M2; MB = Mastoid breadth; COH = Coronoid height; DENL = Dentary length; MANDL = Mandibular tooththrow length.

(2011) suggest that the two populations belong to the same species. Given the rarity/low abundance of *V. caraccioli* in both Amazonia and Atlantic Forest (Lim and Engstrom 2001; Martins *et al.* 2006; Lourenço *et al.* 2011), however, it is still possible that the species actually occurs in the dry diagonal.

In the Atlantic Forest, *V. caraccioli* has been recorded mostly in large forest fragments, such as the Una Biological Reserve, in Bahia (11,400 ha; Faria 2006), Serra do Mar State Park, in São Paulo (315,999 ha; Velazco *et al.* 2010), and Area of Environmental Protection Guaraqueçaba (288,444 ha; present study). These data may indicate that, unlike other Stenodermatinae, which are abundant in fragmented environments, *V. caraccioli* does not have great ecological plasticity, which could explain its low abundance in the Atlantic Forest environments. However, this hypothesis should be analyzed with caution, since the other species of the genus, *V. major*, can be considered locally abundant (Estrada and Coates-Estrada 2002). Furthermore, several species are rare when near the limit of their geographic distribution, which may explain the low abundance of *V. caraccioli*, at least in southern Brazil.

Some measurements of the specimen sampled in Paraná state (GLS, ZB, M1-M1, M2-M2, and COH—see Table 1) showed larger values than the recorded range for the species throughout its distribution, and GLS and COH were higher even when compared to the variation observed in *V. major* (Velazco and Simmons 2011—see table 1). Although we examined only a single specimen, these data may indicate that *V. caraccioli* shows a clinal variation in size, as observed in other species (*e.g.*, Bornholdt *et al.* 2008; Tavares and Velazco 2010; Garbino 2011; Moratelli

and Oliveira 2011). Studies examining a larger number of specimens are necessary to confirm or rule out this hypothesis (Scultori *et al.* 2009b).

According to Miretzki (2003), the coastal region of the state of Paraná, which includes the area of the present study, has a low priority for conducting inventories. Recent studies in the region, however, have revealed a series of records relevant to the knowledge of the bat fauna of Paraná (Scultori *et al.* 2009a, 2009b, 2009c; Passos *et al.* 2010). Overall, despite increasing knowledge about the distribution and occurrence of species, no Brazilian biome can be considered as satisfactorily sampled in relation to the bat fauna (Bernard *et al.* 2011). Baseline studies are still important in the country, even in areas considered to be of low priority, as in the present study. At least 69 bat species can be now recognized as having confirmed records in the state of Paraná (Bianconi *et al.* 2009; Scultori *et al.* 2009b; Passos *et al.* 2010, Moratelli *et al.* 2011).

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