New records of *Lophostoma brasiliense* Peters, 1867 (Chiroptera, Phyllostomidae) from São Paulo and Mato Grosso do Sul, Brazil

Guilherme S.T. Garbino¹, Viviane Filgueiras², André L.A. Lima², Fernanda D. Abra³,⁴, Paula R. Prist⁴,⁵, Paul F. Colas-Rosas⁶

¹ Departamento de Biologia Animal, Universidade Federal de Viçosa, Viçosa, Brazil • guilherme.garbino@ufv.br • https://orcid.org/0000-0003-1701-5930
² Instituto de Biociências, Universidade Federal de Mato Grosso do Sul, Campo Grande, Brazil • VF: vivi_filgueiras@hotmail.com • AL: andrylima@hotmail.com
³ Center for Conservation and Sustainability, Smithsonian Conservation Biology Institute, Washington, DC, USA • fernanda@viafauna.com • https://orcid.org/0000-0001-8102-7974
⁴ ViaFAUNA Estudos Ambientais, São Paulo, Brazil • paula.prist@viafauna.com • https://orcid.org/0000-0003-2809-0434
⁵ Departamento de Ecologia, Universidade de São Paulo, São Paulo, Brazil
⁶ Biophilium Consultoria Ambiental, Atibaia, Brazil • paul@biophilium.com.br • https://orcid.org/0000-0003-4487-7114

* Corresponding author

**Abstract**

We report on new occurrence records of *Lophostoma brasiliense* Peters, 1867 (Chiroptera, Phyllostomidae) from the states of São Paulo and Mato Grosso do Sul, southeastern Brazil. Specimens from São Paulo were mist-netted in an area originally covered by the Atlantic Forest and Cerrado ecosystems of which only small and isolated fragments remain, while the specimens from Mato Grosso do Sul came from a well-preserved Cerrado area. The new records confirm the presence of *L. brasiliense* in the Brazilian state of São Paulo and clarify the southern edge of the species’ range.

**Keywords**

Atlantic Forest, Cerrado, fragmented landscape, highway underpasses, Pygmy Round-eared Bat

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**Introduction**

The Pygmy Round-eared Bat, *Lophostoma brasiliense* Peters, 1867 (Phyllostomidae, Phyllostominae), is distributed from southern Mexico to central Paraguay and southeastern Brazil (Hall 1981; Williams and Genoways 2008). Throughout its range it inhabits primary and secondary evergreen and deciduous forests, where it uses active termite nests as day roosts (Goodwin and Greenhall 1961; Handley 1966, 1976; Carmignotto et al. 2012). Although *L. brasiliense* may be commonly captured in areas central to its distribution, such as the Amazon (Handley 1976; Simmons and Voss 1998; Tavares et al. 2017), only a few specimens are known from the southern limits of its range (López-González et al. 1998; Mangolin et al. 2007).
Along the southern part of the distribution of *L. brasiliense*, there are records from Paraguay (López-González et al. 1998) and the Brazilian states of Rio de Janeiro (Ávila-Pires and Gouvêa 1977), Mato Grosso do Sul (Bordignon 2006; Fischer et al. 2015), and Minas Gerais (Tavares et al. 2010). Although *L. brasiliense* has not been recorded in the state of São Paulo, its presence is expected as there are near records in the adjacent states of Rio de Janeiro, Minas Gerais, and Mato Grosso do Sul (Vivo et al. 2011; Garbino 2016).

In this report, we present new records of *L. brasiliense* for the Brazilian states of São Paulo and Mato Grosso do Sul. Our data fill a distribution gap and clarify the southern limits of the distribution of the species.

**Methods**

**Study area.** The specimens reported here were collected in areas originally covered by forested habitats of the Atlantic Forest (localities 4 and 8 in Fig. 1) and Cerrado (locality 5 in Fig. 1) ecosystems. However, these areas are currently dominated by pasture and sugarcane plantations and most of the native forest remnants are small (<100 ha) and isolated (Ribeiro et al. 2009; Rezende 2014). Climate in the area corresponds to Aw in the Köppen classification, with a rainy season during the summer (September to March) and a dry season in the winter (April to August) (Rocha and Tommaselli 2012; Homem et al. 2020).

**Data collection.** Our new records are based on four specimens mist netted by us between 2012 and 2020 in São Paulo state, and two museum specimens from Mato Grosso do Sul state collected in 1992. Analyzed specimens are deposited in the collections of the Escola Superior de Agricultura Luiz de Queiroz (LMUSP), Piracicaba; Museu de Zoologia da Universidade de São Paulo (MZUSP), São Paulo; and Universidade Federal de Mato Grosso do Sul (ZUFMS), Campo Grande.

The specimen from Caiuá (LMUSP 512), São Paulo state, was mist netted near the entrance of a culvert passing under highway SP-270. On 11 October 2020, one mist net was set at each of the two openings of the culvert and both were kept open from 18:00 to 23:00. The fieldwork that resulted in its capture was part of a study assessing the use of highway underpasses by bats, structures known to be used by several non-volant mammals in the neotropics (Abra et al. 2020). Three individuals were mist netted in different localities in the Reserva Particular do Patrimônio Natural (RPPN) Foz do Aguapeí, a privately owned protected area of 14,000 ha in western São Paulo state.

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**Figure 1.** A. Southern part of the distribution of *Lophostoma brasiliense*, showing the southernmost known records (dots), the new records (stars) presented herein, and part of the International Union for Conservation of Nature (IUCN) polygon for the taxon (Sampaio et al. 2016). MS = Mato Grosso do Sul state, PR = Paraná state, SP = São Paulo state. B. Detail of the area where the new records of *L. brasiliense* were made. The Paraná River is in light blue and the native vegetation remnants are in light green. Numbers correspond to the localities in Table 1.
Table 1. Southernmost localities of Lophostoma brasiliense for Brazil. The “Locality number” field correspond to localities in Figure 1.

<table>
<thead>
<tr>
<th>Locality no.</th>
<th>Locality</th>
<th>State/department</th>
<th>Country</th>
<th>Coordinates</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>Presidente Hayes</td>
<td>Paraguay</td>
<td>21°29‘5, 03°14‘W</td>
<td>Lopéz-González et al. 1998</td>
</tr>
<tr>
<td>2</td>
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<td>Rio de Janeiro</td>
<td>Brazil</td>
<td>22°23‘, 04°13‘W</td>
<td>Ávila-Pires and Gouveia 1977</td>
</tr>
<tr>
<td>3</td>
<td>Restinga de Jurubatiba, Quimíama</td>
<td>Rio de Janeiro</td>
<td>Brazil</td>
<td>22°06‘24‘, 04°17‘20‘W</td>
<td>Mangoin et al. 2007</td>
</tr>
<tr>
<td>4</td>
<td>SP-270 highway, Caíuá</td>
<td>São Paulo</td>
<td>Brazil</td>
<td>21°51‘34.38‘, 05°17‘54.69‘W</td>
<td>This study</td>
</tr>
<tr>
<td>5</td>
<td>Fazenda Barma, Brasiliândia</td>
<td>Mato Grosso do Sul</td>
<td>Brazil</td>
<td>21°37‘5, 05°20‘W</td>
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</tr>
<tr>
<td>6</td>
<td>Paracatu de Tobias, Miracema</td>
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<td>Brazil</td>
<td>21°29‘16.26‘, 04°02‘03.66‘W</td>
<td>Mangoin et al. 2007</td>
</tr>
<tr>
<td>7</td>
<td>Poços de Caldas</td>
<td>Minas Gerais</td>
<td>Brazil</td>
<td>20°08‘, 04°10‘W</td>
<td>Tavares et al. 2010</td>
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<tr>
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<td>RPPN Foz do Aguapeí</td>
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<td>Brazil</td>
<td>21°04‘, 05°44‘W</td>
<td>This study</td>
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<td>9</td>
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<td>Mato Grosso do Sul</td>
<td>Brazil</td>
<td>20°59‘3, 05°17‘W</td>
<td>Homem et al. 2020</td>
</tr>
<tr>
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<td>Brazil</td>
<td>20°23‘, 04°33‘W</td>
<td>Tavares et al. 2010</td>
</tr>
<tr>
<td>11</td>
<td>Mariana</td>
<td>Minas Gerais</td>
<td>Brazil</td>
<td>20°22‘5, 05°34‘W</td>
<td>Tavares et al. 2010</td>
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<tr>
<td>12</td>
<td>Linhares</td>
<td>Espírito Santo</td>
<td>Brazil</td>
<td>19°35‘, 04°30‘W</td>
<td>Persch and Albuquerque 1993</td>
</tr>
<tr>
<td>13</td>
<td>Fazenda Lagoinha, Fazenda Vale do Sol, Inocência</td>
<td>Mato Grosso do Sul</td>
<td>Brazil</td>
<td>19°17‘0, 05°19‘06‘W</td>
<td>Bordignon 2006</td>
</tr>
<tr>
<td>14</td>
<td>Concórdia da Barra</td>
<td>Espírito Santo</td>
<td>Brazil</td>
<td>18°35‘, 03°45‘W</td>
<td>Rusche 1953</td>
</tr>
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<td>15</td>
<td>São José</td>
<td>Cochabamba</td>
<td>Bolivia</td>
<td>17°36‘, 06°09‘W</td>
<td>Anderson 1997</td>
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<tr>
<td>16</td>
<td>Fazenda Brejo, Brasiliândia de Minas</td>
<td>Minas Gerais</td>
<td>Brazil</td>
<td>17°02‘, 05°30‘W</td>
<td>Tavares et al. 2010</td>
</tr>
<tr>
<td>17</td>
<td>RPPN Sertão Pantanal</td>
<td>Mato Grosso</td>
<td>Brazil</td>
<td>16°30‘, 05°35‘W</td>
<td>Escalante-Tavares &amp; Pessiá 2005</td>
</tr>
<tr>
<td>18</td>
<td>Estação Ecológica da Serra das Araras</td>
<td>Mato Grosso</td>
<td>Brazil</td>
<td>15°19‘, 05°01‘W</td>
<td>Gonzales and Grogoren 2004</td>
</tr>
<tr>
<td>19</td>
<td>Estação Biológica Beni</td>
<td>Beni</td>
<td>Bolivia</td>
<td>14°57‘, 06°01‘W</td>
<td>Anderson 1997</td>
</tr>
<tr>
<td>20</td>
<td>Salvador</td>
<td>Bahia</td>
<td>Brazil</td>
<td>12°59‘, 03°31‘W</td>
<td>Peters 1867</td>
</tr>
<tr>
<td>21</td>
<td>Sucupira</td>
<td>Tocantins</td>
<td>Brazil</td>
<td>11°58‘5, 04°35‘W</td>
<td>Nunes et al. 2005</td>
</tr>
<tr>
<td>22</td>
<td>Estação Ecológica da Serra Geral</td>
<td>Tocantins</td>
<td>Brazil</td>
<td>10°40‘5, 04°52‘W</td>
<td>Gregorin et al. 2011</td>
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</table>

Sampling in this area took place in 10 field expeditions between January 2011 and December 2012, using 10–12 mist nets which were kept open from 18:00 to 00:00. The final sampling effort was 68,982 m² h, following Straube and Bianconi (2006). Of the three captured individuals, two were collected (ZUFMS 2212, 2213) and an adult female was released. We also revised and included two specimens from Fazenda Barma, in Brasiliândia, Mato Grosso do Sul state, that were collected in 1992 (MZUSP 28625 • Brasiliândia, Fazenda Barma; 21°35′S, 052°07′W, ca. 300 m a.s.l.; 18.XI.1992; J.L.Silva Filho leg.; 1 adult ♀, taxidermied skin with separated skull, MZUSP 28626 • São Paulo • Castilho, RPPN Foz do Aguapei; 21°05′14.5″S, 051°45′55″W; alt. 263 m a.s.l.; 13.III.2012; A.L.A. Lima leg.; 1 adult ♀, specimen in alcohol, ZUFMS 2212 • Paulicéia, RPPN Foz do Aguapei; 21°09′00.5″S, 051°48′12.4″W; alt. 259 m a.s.l.; 14.III.2012; A.L.A. Lima leg.; 1 adult ♀, specimen in alcohol, ZUFMS 2213 • RPPN Foz do Aguapei; 21°07′06″S, 051°45′44″W; alt. 265 m a.s.l.; 11.IV.2012 A.L.A. Lima obs.; 1 adult ♀, individual was released (Fig. 2A) • Catuá, km 632 of SP-270 highway; 21°51′34″S, 051°57′54″W; alt. ca. 320 m a.s.l.; 11.X.2020; G.S.T. Garbino, V.J.A. Pereira leg.; 1 adult ♀, taxidermied skin with separated skull and partial skeleton (Fig. 2B), GTG74; LMUSP 512.

Identification. Lophostoma brasiliense is the smallest species of the genus, with a forearm length of 34–40.5 mm and greatest length of skull of 18.7–21.6 mm (Williams and Genoways 2008; Solari et al. 2019). Dorsal hairs are bicolor, with a large pale buff base (approximately ¼ of the hair length) and dark brown tip. The vent is brown, of a slightly paler tone than the dorsum, and does not contrast with it. Ears are long and round.

The examined specimens had the diagnostic characters of L. brasiliense, such as brown dorsal and ventral pelage, long round ears (Fig. 2), one pair of lower incisors, and a visible sagittal crest (Fig. 3). Forearm and cranial measures were also within the variation range known for the taxon (Table 2). The released animal from RPPN Foz do Aguapei had a 40 mm long forearm.

Results

New records. BRAZIL – Mato Grosso do Sul • Brasiliândia, Fazenda Barma; 21°35′S, 052°07′W; alt. ca. 300 m above sea level; 18.XI.1992; J.L.Silva Filho leg.; 1 adult ♀, taxidermied skin with separated skull, MZUSP 28625 • Brasiliândia, Fazenda Barma; 21°35′S, 052°07′W, ca. 300 m a.s.l.; 18.XI.1992; J.L.Silva Filho leg.; 1 adult ♀, taxidermied skin with separated skull, MZUSP 28626 – São Paulo • Castilho, RPPN Foz do Aguapei; 21°05′14.5″S, 051°45′55″W; alt. 263 m a.s.l.; 13.III.2012; A.L.A. Lima leg.; 1 adult ♀, specimen in alcohol, ZUFMS 2212 • Paulicéia, RPPN Foz do Aguapei; 21°09′00.5″S, 051°48′12.4″W; alt. 259 m a.s.l.; 14.III.2012; A.L.A. Lima leg.; 1 adult ♀, specimen in alcohol, ZUFMS 2213 • RPPN Foz do Aguapei; 21°07′06″S, 051°45′44″W; alt. 265 m a.s.l.; 11.IV.2012 A.L.A. Lima obs.; 1 adult ♀, individual was released (Fig. 2A) • Catuá, km 632 of SP-270 highway; 21°51′34″S, 051°57′54″W; alt. ca. 320 m a.s.l.; 11.X.2020; G.S.T. Garbino, V.J.A. Pereira leg.; 1 adult ♀, taxidermied skin with separated skull and partial skeleton (Fig. 2B), GTG74; LMUSP 512.

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Lophostoma brasiliense may be confused with big-eared bats (genus *Micronycteris* Gray, 1866), from which it can be distinguished by having two lower incisors (four in *Micronycteris*), a well-developed sagittal crest, round warts on the chin (V-shaped pads in *Micronycteris*), free ears (ears connected by a band of skin in *Micronycteris*), and a more robust external appearance (Albuja 1999; York et al. 2019). Species of *Lophostoma* may be externally similar to species of *Tonatia* Gray, 1827, and some large members of the former genus may show overlap in forearm length with species of *Tonatia*. However, *L. brasiliense* is much smaller than known species of *Tonatia*, which have a forearm measuring between 51 and 62 mm (Williams and Genoways, 2008). Behaviorally, species of *Lophostoma* show a typical “ear curling” behavior (Fig. 2) which is absent in species of both *Tonatia* and *Micronycteris* (Williams and Genoways 2008).

Remarks

In the RPPN Foz do Aguapei, 11 other bat species were captured: *Artibeus lituratus* (Olfers, 1818); *Artibeus planirostris* (Spix, 1823); *Carollia perspicillata* (Linnaeus, 1758); *Chirolcherma doriae* Thomas, 1891; *Desmodus rotundus* (Geoffroy, 1810); *Glossophaga soricina* (Pallas, 1766); *Phyllostomus discolor* Wagner, 1843; *Phyllostomus hastatus* (Pallas, 1767); *Platyrhinus incarum* (Thomas, 1912); *Platyrhinus lineatus* (Geoffroy, 1810); and *Sturnira lilium* (Geoffroy, 1810). In the SP-270 highway culvert in Caiuá we also sampled *Carollia perspicillata; Lasiurus ega* (Gervais, 1856); *Noctilio leporinus* (Linnaeus, 1758); *Platyrhinus lineatus; Sturnira lilium*; and an unidentified species of *Myotis*.

Discussion

Our new records fill a distribution gap for *Lophostoma brasiliense* in South America, confirming the presence of the species in the Brazilian state of São Paulo.
Table 2. Forearm length and standard cranial measurements (in mm) of *Lophostoma brasiliense* from São Paulo and Mato Grosso do Sul, southeastern Brazil. Data from Velazco and Cadenillas (2011) are the mean and range of measurements of 78 specimens from Central and South America. GLS = greatest length of skull; PB = post orbital breadth; ZB = zygomatic breadth; BB = braincase breadth; C–C = distance across upper canines; MTRL = maxillary toothrow length; MANDL = mandibular toothrow length; DENL = dentary length.

<table>
<thead>
<tr>
<th>Voucher</th>
<th>Locality</th>
<th>Sex</th>
<th>Forearm length</th>
<th>GLS</th>
<th>PB</th>
<th>ZB</th>
<th>BB</th>
<th>C–C</th>
<th>MTRL</th>
<th>MANDL</th>
<th>DENL</th>
</tr>
</thead>
<tbody>
<tr>
<td>LMUSP 512</td>
<td>Caítu</td>
<td>M</td>
<td>40</td>
<td>20.54</td>
<td>3.25</td>
<td>10.27</td>
<td>6.88</td>
<td>3.94</td>
<td>7.32</td>
<td>6.78</td>
<td>12.81</td>
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<tr>
<td>MZUSP 28625</td>
<td>Brasiliândia</td>
<td>M</td>
<td>MZUSP 28625</td>
<td>18.34</td>
<td>3.58</td>
<td>broken</td>
<td>7.94</td>
<td>3.74</td>
<td>6.85</td>
<td>6.35</td>
<td>12.26</td>
</tr>
<tr>
<td>MZUSP 28626</td>
<td>Caítu</td>
<td>F</td>
<td>38.23</td>
<td>19.67</td>
<td>3.22</td>
<td>9.74</td>
<td>8.11</td>
<td>3.74</td>
<td>7.02</td>
<td>6.56</td>
<td>12.71</td>
</tr>
<tr>
<td>ZUFMS 2212</td>
<td>Castilho</td>
<td>M</td>
<td>40.5</td>
<td>20</td>
<td>3.2</td>
<td>9.5</td>
<td>8.1</td>
<td>3.7</td>
<td>7.7</td>
<td>12.6</td>
<td></td>
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<tr>
<td>ZUFMS 2273</td>
<td>Poaúica</td>
<td>F</td>
<td>38.5</td>
<td>-</td>
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</tbody>
</table>

Velazco and Cadenillas 2011 Central and South America M, F 35.2 (30.1–39.6) 20 (18.2–21.8) (BP = post orbital breadth; BB = braincase breadth; C–C = distance across upper canines; MTRL = maxillary toothrow length; MANDL = mandibular toothrow length; DENL = dentary length.

With the new record, there are now 81 species of bats confirmed to occur in the state of São Paulo (Garbino 2016; Cláudio et al. 2020). The western region of São Paulo is one of the least known areas of the state in terms of mammal diversity, and new findings are still being made in the region (Garbino 2016; Prist et al. 2020). The fact that there are only a few protected areas and remaining fragments in western São Paulo should make this region a priority area in future assessments (Rezende 2014).

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Authors’ Contributions
GSTG collected the data and wrote an initial draft of the paper. PFCR and VF, collected the data and revised the manuscript. FDA and PRP provided field logistics and revised several versions of the manuscript. ALAL collected the data.

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Vivo M de, Carmignotto AP, Gregorin R, Hingst-Zaheer E, Lack-