

# High richness of non-volant mammals in a seasonal forest fragment in southeastern Brazil

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**Abstract.** The seasonal forest formations of the Atlantic Forest are a threatened and poorly known habitat. We present here a list of the non-volant mammals occurring in a 515-ha forest fragment known as Santa Maria and located in the Brazilian state of São Paulo. Our surveys are based on live trap captures, camera traps, and active searches for footprints, as well as secondary data. We list 29 species of non-volant mammals in the fragment, recorded between 1996 and 2021. One species found in the fragment, *Leontopithecus chrysopygus*, is globally endangered. Two species are classified as “vulnerable” in the global red list: *Myrmecophaga tridactyla*, and *Tapirus terrestris*. One species, *Panthera onca*, is classified as “critically endangered” in São Paulo state. The red howler, *Alouatta guariba*, was not recorded after 1999 and has probably been extirpated in the fragment. We show that the number of non-volant mammal species in Santa Maria fragment is high, in relation to its size. The fragment is also in a strategic position, between the Morro do Diabo state park and the Black Lion Tamarin Ecological station, the two largest protected areas in the region. Considering its high mammal richness and its possible role as stepping stone for the local fauna, we recommend that the fragment become a protected area.

**Keywords.** Atlantic Forest; Camera traps; Canopy traps; Live traps; Mammalia.

## INTRODUCTION

The Atlantic Forest, a South American forest ranging from northeastern Brazil to northern Argentina and eastern Paraguay, is known for its elevated biodiversity and endemism (Mittermeier *et al.*, 2011). It is also a highly threatened ecosystem, as only 28% of its original forest cover remains (Rezende *et al.*, 2018; Ribeiro *et al.*, 2009). If we consider the two main vegetal formations in the Atlantic Forest, the Dense Ombrophilous Forest and the Seasonal Semideciduous Forest,

the latter has been much more devastated than the former, and in the state of São Paulo, only 6.4 % of its original cover remains (São Paulo, 2014).

The westernmost portion of São Paulo state, known as Pontal do Paranapanema or just Pontal, shelters the largest remnants of the Seasonal Semideciduous Forest of the state. Nearly 40,000 ha of this type of forest are inside protected areas such as the Morro do Diabo State Park (MDSP) with approximately 33,800 ha and the Black Lion Tamarin Ecological Station with approximately 6,700 ha, distributed in four sep-

arated fragments (Faria & Pires, 2006; Valladares-Pádua, 2007). Besides these two large protected areas, there are in Pontal two private-owned forest remnants that harbor important portions of this endangered ecosystem: the Santa Mônica and Santa Maria fragments, each with an area of approximately 500 ha (Ditt *et al.*, 1999).

Previous studies on the mammal fauna of the Pontal region have focused on the Morro do Diabo State Park and the Black Lion Tamarin Ecological Station, while the smaller fragments have received comparatively less attention (*e.g.*, Faria & Pires, 2006; Valladares-Pádua, 2007). While some publications have provided a partial list of the mammals in some of the medium-sized fragments (*e.g.*, Cullen *et al.*, 2000), most of these data are in unpublished reports and dissertations (*e.g.*, Ditt *et al.*, 1999; Rocha, 2004; Tófoli, 2006).

The aim of this paper is to report the non-volant mammal species recorded in one of these areas, the Santa Maria fragment, and discuss its relevance for the conservation of the mammal fauna of the region and its associated ecosystem.

## MATERIAL AND METHODS

### Study area

The Santa Maria forest fragment (hereafter SMA) is located in the municipality of Presidente Epitácio, in the westernmost region of São Paulo state, southeastern Brazil (22°14'S, 52°18'W, 289-344 m a.s.l.) (Fig. 1). The region is known as Pontal do Paranapanema, because in this area the Paranapanema river falls into the larger Paraná River. With an area of 515 ha, SMA is the sixth largest fragment of the Pontal do Paranapanema, and the largest one that is not located inside a protected area.

The predominating vegetation type at the study site is classified as Seasonal Semideciduous Forest (Olson *et al.*, 2001; Veloso *et al.*, 1992) and it includes shade-dependent tree species such as the peroba-rosa (*Aspidosperma polyneuron*), guaritá (*Astronium graveolens*), jequitibá (*Cariniana* sp.), and jatobá (*Hymenaea* sp.), as well as generalist species that occur in open and forested habitats, such as copaiba (*Copaifera langsdorffii*), ipê-tabaco (*Zeyheria tuberculosa*) and *Tabebuia* sp. (Fig. 2). The Seasonal Semideciduous Forest of the western state of São Paulo is also characterized by the conspicuous presence of arboreal cacti, known locally as mandacaru (*Cereus hildmannianus*).

There are also several plant species in SMA that are exploited as food source by the non-volant mammals of the area. The jerivá palm, *Syagrus romanzoffiana*, a species known to produce a large amount of fruit constantly during the year (Begnini *et al.*, 2013; Keuroghlian & Eaton, 2008), is a conspicuous palm in the fragment (Fig. 2). Other fruit trees include the araçá (*Psidium* sp.) and figs (*Ficus* spp.). Fruits of ground bromeliads, such as caraguatá (*Bromelia* sp.) and the roots of *Smilax* spp. are also consumed by terrestrial mammals in the area.

The SW border of the trapezoidal SMA is dominated by the exotic grass *Brachiaria* sp.; in the SE and NE, sugarcane plantation is the predominant land use (Figs. 1, 2). The NE border is limited by the country road SPV-035, a paved highway that connects Presidente Epitácio to the district of Planalto do Sul (Teodoro Sampaio municipality). A small creek, Ribeirão da Água Sumida, passes through the SE and SW borders of the fragment and falls into the large Rio Paraná (Figs. 1, 2).

### Data collection

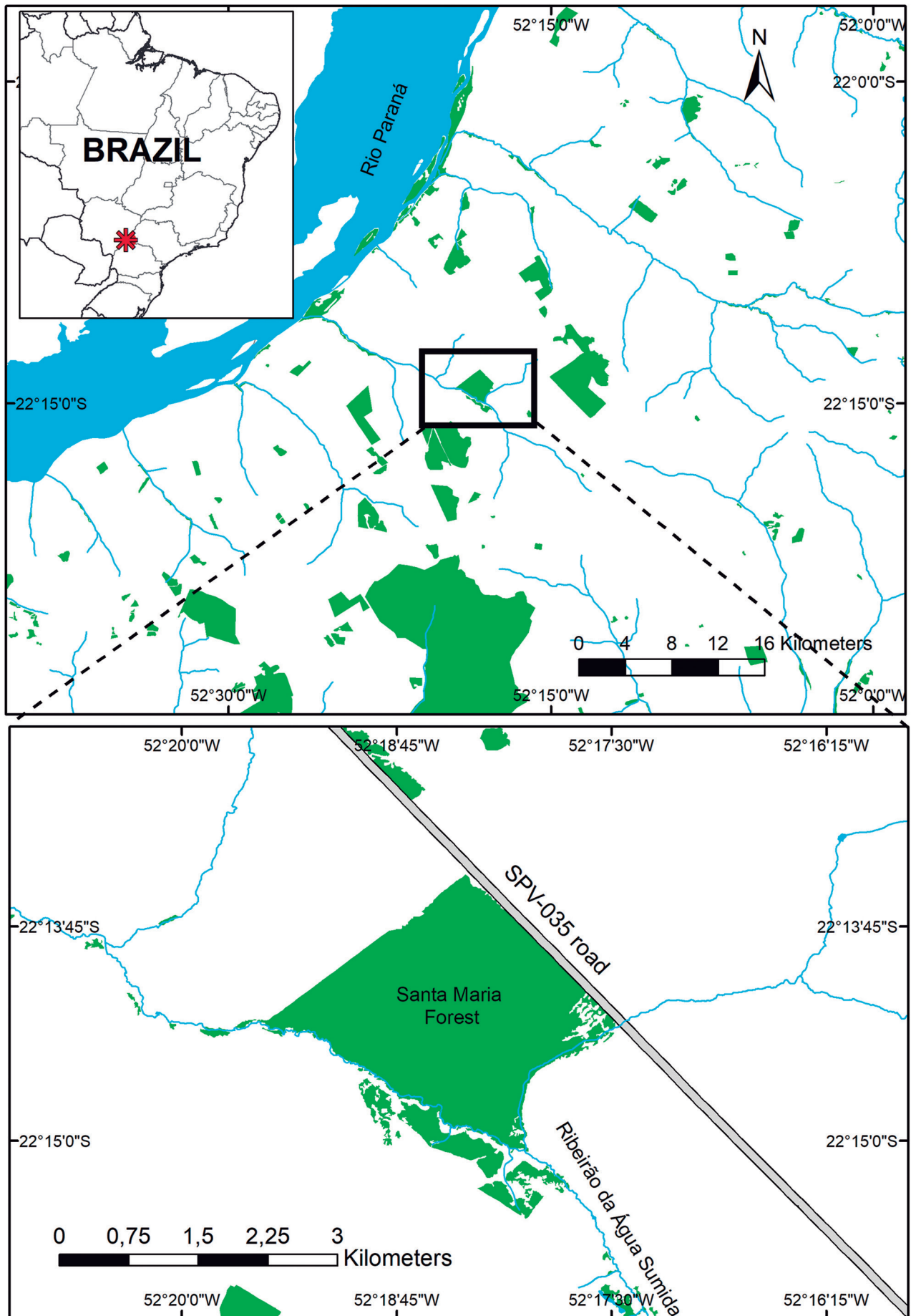
Our records of non-volant mammals are based on voucher specimens (small mammals traps), camera trap data, track records, direct sightings, and secondary data.

Small mammal traps were set up from January 2002 to December 2003. Sample was carried out in three trails, each 300 m long and parallel to each other (Rocha, 2004). Each of the trails had 12 sampling points. In each point, two live traps, one Tomahawk (44 × 20.5 × 21.5 cm) and one Sherman (23 × 9 × 8 cm) were set. Sampling effort totaled 1,924 trap nights and capture rate was 5.25%. To confirm the taxonomic identity of the small mammals, vouchers were collected and are deposited in the mammal collection of the Escola Superior de Agricultura Luiz de Queiroz (LMUSP), Universidade de São Paulo, Piracicaba, São Paulo.

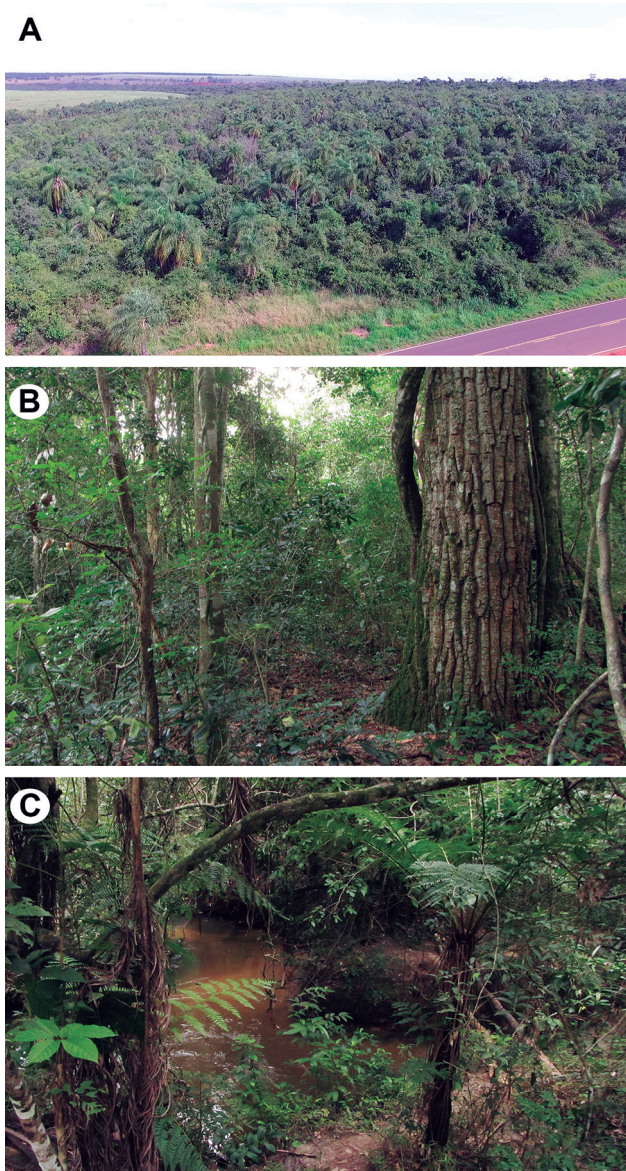
Three Bushnell Trophy Cam camera traps were set from 7<sup>th</sup> December 2014 to 3<sup>rd</sup> February 2015, totaling 174 camera-days of sampling effort. Their placement was aimed at maximizing the sampled area (Table 1). The camera traps were not baited and were set on video mode (20 sec). Between 14<sup>th</sup> February and 25<sup>th</sup> February 2019, two Bushnell Trophy Cam camera traps were installed near the border of the fragment (Table 1), totaling 18 camera-days. We also installed seven camera traps in the canopy, which were set between 3 to 5 m high (Table 1). The camera traps set above ground were originally part of a management action to monitor artificial shelters carried out by the Black Lion Tamarin Conservation Program/IPÊ. The first canopy camera traps were installed on 5 November 2020 and, as of 28 August 2021, are still in the fragment. Licenses to capture and handle the animals

**Table 1.** Coordinates and relative height to which the camera traps were placed in the Santa Maria fragment, Presidente Epitácio, Brazil.

Position	Coordinates	Date
Canopy	22°14'20"S, 52°19'21"W	Jan. 2021 – present
Canopy	22°14'17"S, 52°19'11"W	Jan. 2021 – present
Canopy	22°14'41"S, 52°18'12"W	Nov. 2020 – present
Canopy	22°14'17"S, 52°19'23"W	Jan. 2021 – present
Canopy	22°14'45"S, 52°18'04"W	Nov. 2020 – present
Canopy	22°14'43"S, 52°18'23"W	Nov. 2020 – present
Canopy	22°14'18"S, 52°19'15"W	Jan. 2021 – present
Ground level	22°14'31"S, 52°18'29"W	Dec. 2014 – Feb. 2015
Ground level	22°14'17"S, 52°17'55"W	Dec. 2014 – Feb. 2015
Ground level	22°13'59"S, 52°18'25"W	Dec. 2014 – Feb. 2015
Ground level	22°14'27"S, 52°17'41"W	Feb. 2019
Ground level	22°14'26"S, 52°17'43"W	Feb. 2019



**Figure 1.** Santa Maria forest fragment and its location in Pontal do Paranapanema, São Paulo, southeastern Brazil. Note the small creek (Ribeirão Água Sumida) that passes on its southern edges and the SPV-035 road along its northeastern edge. Green are native forest remnants and blue are the rivers and creeks.



**Figure 2.** (A) Aerial view of the Santa Maria fragment (Presidente Epitácio, Brazil), taken from its northeastern edge. On the foreground is the SPV-035 road. Note the conspicuous jervipalms (*Syagrus romanzoffiana*) in the forest; (B) Trail on the northeastern part of the Santa Maria fragment (note a large *Aspidosperma polyneuron* on the right). (C) Trail on the southwestern border of the fragment, note the Água Sumida creek and the tree ferns.

were provided by the Brazilian Federal Agency Instituto Chico Mendes de Biodiversidade (ICMBio), under the numbers 41275 and 67046.

Mammal tracks on dirt paths surrounding the fragment were recorded *ad libitum* during incursions in the fragment for monitoring black lion tamarins from 2014 to 2015. Several species of mammals were opportunistically recorded while we were walking along a main trail of approximately 2,400 m long as part of our fieldwork with the lion tamarins.

Besides primary data, we used secondary data from IPÊ —Instituto de Pesquisas Ecológicas database (Ditt *et al.*, 1999) and from the ATLANTIC-CAMTRAPS Datapaper (Lima *et al.*, 2017). Searches in Google Scholar using “mammals” AND “Paranapanema” and “mamíferos” AND “Paranapanema” did not yield records for the Santa

Maria fragment. We identified the photos and videos of the camera traps following Emmons & Feer (1998). The tracks were identified according to Becker & Dalponte (2013). The taxonomic arrangement follows the latest checklist of Brazilian mammals (Abreu-Jr. *et al.*, 2021). Due to taxonomic uncertainties regarding the species of cottontails in western São Paulo, where both *Sylvilagus minensis* and *S. paraguensis* could occur, we refer to the taxon in SMA as *Sylvilagus* sp. (Silva *et al.*, 2019). We consider the red brocket in the area to be *Mazama rufa* instead of *M. americana*, following Peres *et al.* (2021).

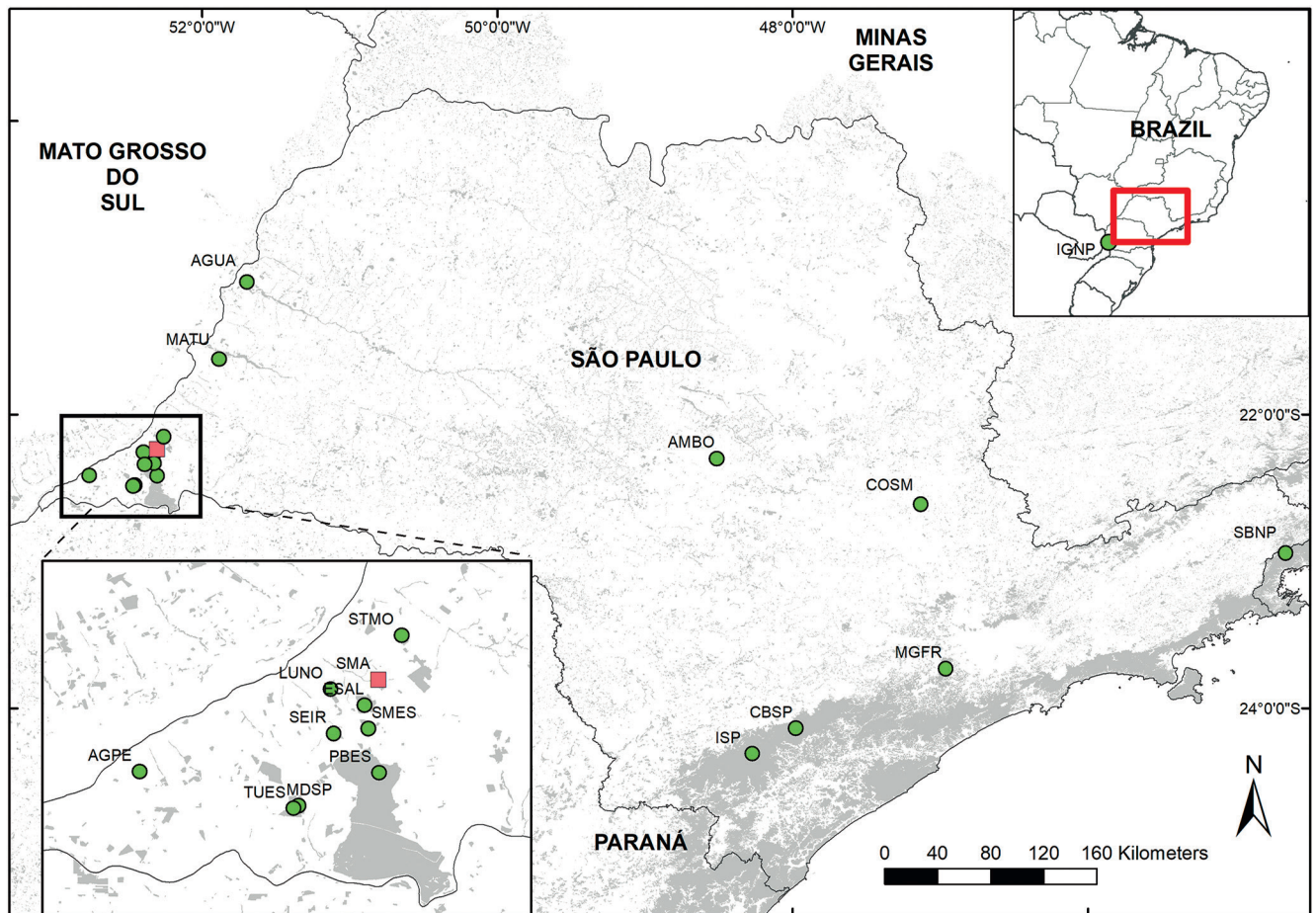
### Data analysis

To verify which Atlantic Forest fragments, including protected and non-protected areas, from the same region were similar to SMA, we carried out a hierarchical cluster analysis using Euclidean distance. The community of medium and large mammals of SMA was compared with the ones from other 18 Atlantic Forest remnants (Fig. 3). Among these localities used in the comparison, we chose 11 Atlantic Forest fragments from the same broad region in western São Paulo (Ditt *et al.*, 1999; Faria & Pires, 2006, 2010; Lima *et al.*, 2017). We also compared with four other localities of seasonal Atlantic Forest: the Iguazu National Park (Silva, 2014), Amadeu Botelho Private Nature Reserve (Reale *et al.*, 2014), Cosmópolis Forest (Magioli *et al.*, 2014), and Morro Grande Forest Reserve (Negrão & Valladares-Pádua, 2006). The mammal community was also compared with three humid Atlantic Forest areas, the Carlos Botelho State Park (Brocardo *et al.*, 2012), Intervalles State Park (de Vivo & Gregorin, 2001), and Serra da Bocaina National Park (Delciellos *et al.*, 2012). The localities to be compared were chosen to represent both the lowland seasonal and the humid montane formations of the Atlantic Forest. We selected montane localities in the Serra do Mar forest continuum of São Paulo and Rio de Janeiro and seasonal forest localities of São Paulo and Paraná states. Bearing in mind that differences in sampling methods and effort can insert biases the cluster analysis, we chose studies that used similar methodologies, *i.e.*, active search for tracks, camera traps, and transects. For this analysis, we excluded small rodents (Cricetidae and Echimyidae) and marsupials (every genus except *Didelphis*).

To assess the richness of non-volant mammals in SMA relative to its area and to the neighboring forest fragments, we carried out a linear regression of species richness according to the fragment area for 14 fragments in western São Paulo state. For this, we included all non-volant mammals documented by us plus the species recorded by Ditt *et al.* (1999). All analyses were made in the R software (R Core Team, 2020).

### RESULTS

A total of 29 species of non-volant mammals belonging to nine orders and 17 families were sampled (Table 2).



**Figure 3.** Locations of the 18 medium and large mammal inventories (green dots) that were compared to the mammal community of Santa Maria forest fragment (red square). Atlantic Forest remnants (*sensu* Ribeiro *et al.*, 2009), are in light gray. AGPE = Água do Peão (Ditt *et al.*, 1999); AGUA = Aguapeí State Park (Faria & Pires, 2010); AMBO = Amadeu Botelho Private Nature Reserve (Reale *et al.*, 2014); CBSP = Carlos Botelho State Park (Brocardo *et al.*, 2012); COSM = Matão de Cosmópolis (Magioli *et al.*, 2014); ESAL = Estrela da Alcídia Água Sumida (Ditt *et al.*, 1999); ISP = Intervalles State Park (de Vivo & Gregorin, 2001); LUNO = Lua Nova (Ditt *et al.*, 1999); MATU = Maturi (Ditt *et al.*, 1999); MDS = Morro do Diabo State Park (Faria & Pires, 2006); MGFR = Morro Grande Forest Reserve (Negrão & Valladares-Pádua, 2006); PBES = Ponte Branca (Black Lion Tamarin Ecological Station) (Valladares-Pádua, 2007); SBNP = Serra da Bocaina National Park (Delciellos *et al.*, 2012); SEIR = Seis R (Ditt *et al.*, 1999); SMES = Santa Maria Água Sumida (Black Lion Tamarin Ecological Station) (Valladares-Pádua, 2007); SMA = Santa Maria Forest (this study); STMO = Santa Mônica (Ditt *et al.*, 1999); TUES = Tucano (Black Lion Tamarin Ecological Station) (Valladares-Pádua, 2007).

We recorded nine species that are threatened in the state of São Paulo (SMA, 2018) and seven that are under some threat category in the Brazilian red list (MMA, 2014) (Table 2). A total of three species are globally threatened (IUCN, 2021) (Table 2). One species, the red howler monkey (*Alouatta guariba*) was last recorded in 1996–1998 surveys and has possibly been extirpated from the fragment. The jaguar (*Panthera onca*) is classified as “Critically Endangered” in São Paulo state (SMA, 2018) and the black lion tamarin (*Leontopithecus chrysopygus*) is classified as “Endangered” at local (SMA, 2018), national (MMA, 2014) and global levels (Rezende *et al.*, 2020).

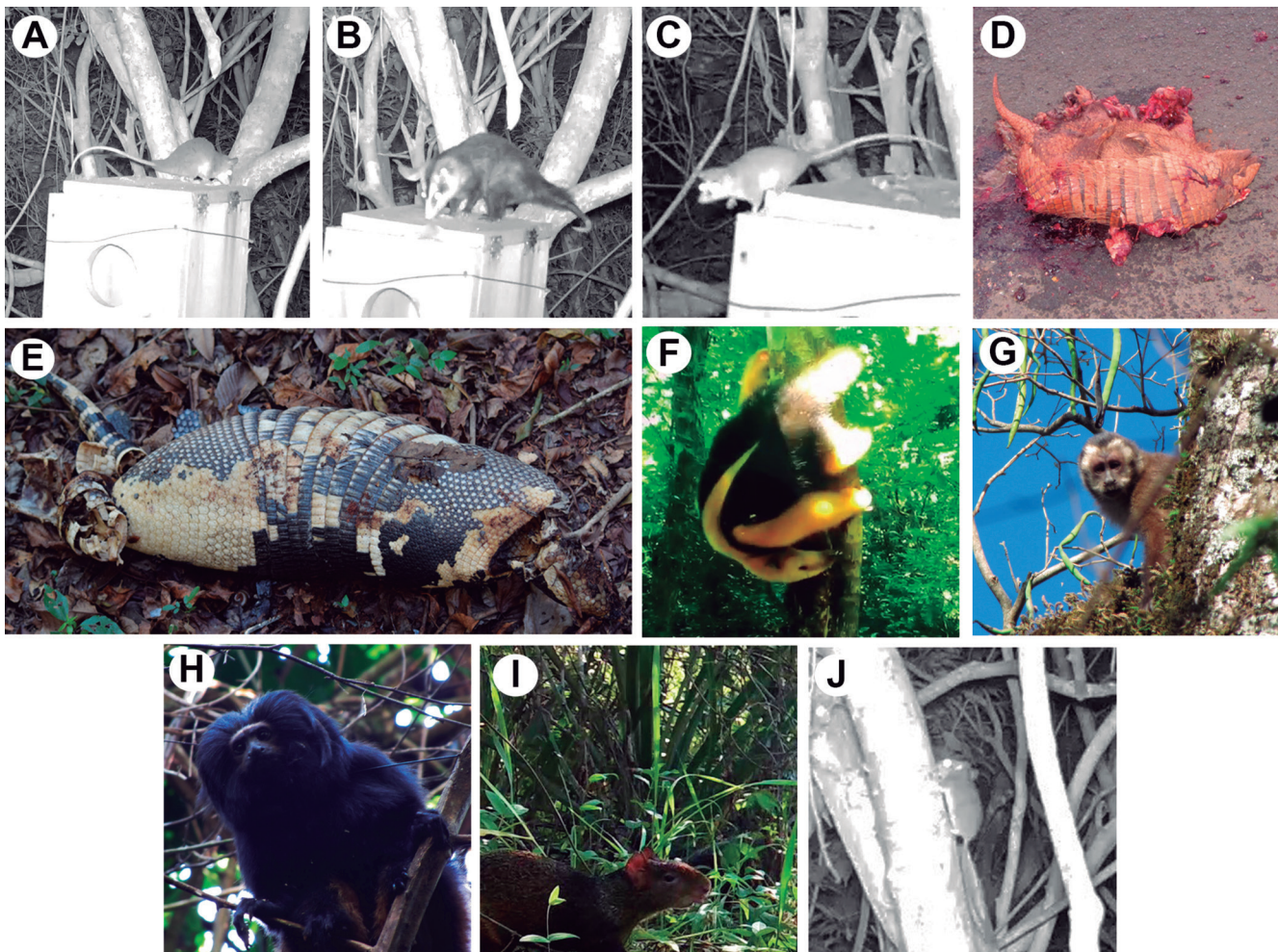
The two small marsupials, *Marmosa paraguayana* and *Gracilinanus microtarsus*, the lesser anteater (*Tamandua tetradactyla*), and one primate (*L. chrysopygus*) were recorded only in camera traps placed in the canopy (Table 2, Fig. 4). The maned wolf (*Chrysocyon brachyurus*), the crab-eating fox (*Cerdocyon thous*), and the six-banded armadillo (*Euphractus sexcinctus*) were only recorded in the dirt paths bordering the forest fragment or on the paved SPV-035 road (Fig. 5). The three marsupials

(*Didelphis albiventris*, *M. paraguayana*, *G. microtarsus*), the arboreal rat (*Oecomys cleberi*), and a single individual of capuchin monkey (*Sapajus nigritus*) and coati (*Nasua nasua*) were sampled in live traps (Table 2).

Hierarchical cluster analysis indicates that the SMA is more similar to the Ponte Branca (1,300 ha) and Tucano (2,115 ha) fragments, both part of the Black Lion Tamarin Ecological Station and 2.5 and 4-fold larger than SMA, respectively (Fig. 6). Every fragment of western São Paulo, except for Aguapeí State Park, grouped together (Fig. 6). The SMA contains more species of mammals than any fragment of similar size in western São Paulo, *i.e.*, the Água do Peão, Santa Mônica, Seis R, and Lua Nova fragments (Fig. 7).

## DISCUSSION

With 29 species recorded, the Santa Maria forest fragment harbors an unexpectedly high richness of non-volant mammals, despite its relatively small size (515 ha;



**Figure 4.** Didelphidae, Xenarthra, Primates and Rodentia recorded in Santa Maria fragment. (A) *Marmosa paraguayana*; (B) *Didelphis albiventris*; (C) *Gracilinanus microtarsus*; (D) *Euphractus sexinctus*; (E) *Dasyus novemcinctus* (preyed); (F) *Tamandua tetradactyla*; (G) *Sapajus nigritus*; (H) *Leontopithecus chrysopygus*; (I) *Dasyprocta azarae*; (J) *Oecomys cleberi*.

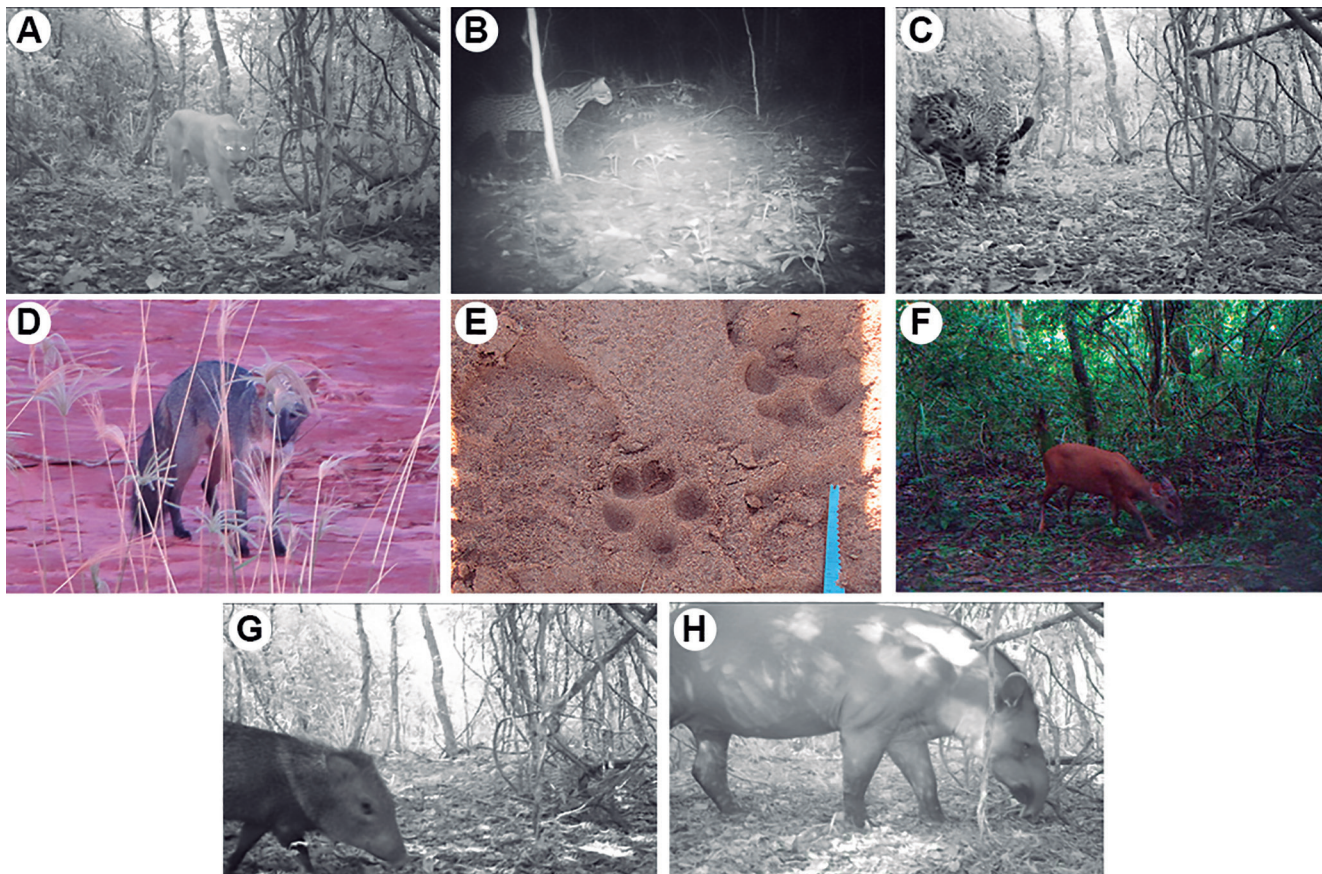
Fig. 7). Besides a high number of species, we recorded also several medium and large-sized mammals that are rare to be detected in the region, such as *Panthera onca*, *Myrmecophaga tridactyla*, and *Tapirus terrestris*. The SMA is also one of the four fragments in the Pontal do Paranapanema where there are confirmed records of *L. chrysopygus*, the others being the Morro do Diabo State Park (33,800 ha), Ponte Branca (1,306 ha) and Santa Mônica (483 ha) (Garbino et al., 2016). The high species richness of SMA may be explained by its proximity to the large Morro do Diabo State Park and by its position at the border between the Atlantic Forest and Cerrado ecosystems.

Because our list is based on sampling efforts carried out along more than 20 years that used distinct methodologies, it was not possible to estimate the species richness in the fragment. However, when compared to what is known for the region (Ditt et al., 1999; Faria & Pires, 2006), we consider our list to be fairly complete. Still, some species, such as the Neotropical otter (*Lontra longicaudis*) and the naked-tailed armadillo (*Cabassous tatouay*) may be recorded in the remnant. We did not record the white-lipped peccary, *Tayassu pecari*. This species used to be relatively common in the Pontal do Paranapanema region (Cullen et al., 2000) but has be-

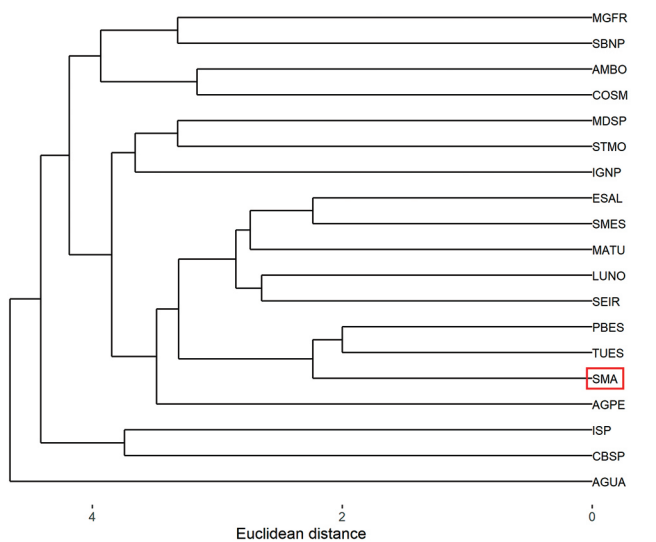
come extremely rare, with the last confirmed sightings around 2008 and it has possibly been extirpated in the area (Fernando Lima, pers. com.). Field searches carried out by us (GSTG and GCR) between 2014 and 2015, in the three largest fragments of the region, i.e., the Morro do Diabo State Park, Tucano and Ponte Branca, also yielded no records of white-lipped peccaries.

Records of muroid rodents were also scarce, with only *Oecomys cleberi* recorded (Table 2). Although specimens of *O. cleberi* were collected in Santa Maria approximately 20 years ago, the taxonomic status of the species was ascertained only recently (Rocha et al., 2012). Recent data, including specimens collected by us in other fragments of the region (Brandão et al., in review), suggest that *O. cleberi* is relatively common in Pontal. Nonetheless, we highlight that pitfall traps were not used by us or in previous studies (Rocha, 2004), which could hamper a proper evaluation of the local diversity of small rodents and marsupials.

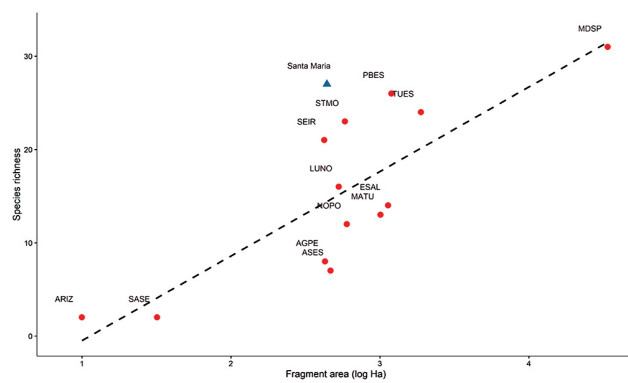
Biogeographically, the mammal fauna in SMA has a mixture of Atlantic Forest and Cerrado taxa, which also can be explained by its geographic position, at the border between the two ecosystems. Typical Atlantic Forest taxa include *Coendou spinosus*, *Alouatta guariba*, and *Leontopithecus chrysopygus*, whereas *Chrysocyon*



**Figure 5.** Carnivora, Artiodactyla, and Perissodactyla recorded in Santa Maria fragment. (A) *Puma concolor*; (B) *Leopardus pardalis*; (C) *Panthera onca*; (D) *Cerdocyon thous*; (E) *Chrysocyon brachyurus*; (F) *Mazama rufa*; (G) *Dicotyles tajacu*; (H) *Tapirus terrestris*.



**Figure 6.** Cluster analysis of medium and large mammal communities' similarity between 19 Atlantic Forest remnants in São Paulo, southeastern Brazil (including a single remnant in Paraná, Brazil). AGPE = Água do Peão; AGUA = Aguapeí State Park; AMBO = Amadeu Botelho Private Nature Reserve; CBSP = Carlos Botelho State Park; COSM = Matão de Cosmópolis; ESAL = Estrela da Alcídia Água Sumida; ISP = Intervalles State Park; LUNO = Lua Nova; MATU = Maturi; MDSP = Morro do Diabo State Park; MGFR = Morro Grande Forest Reserve; PBES = Ponte Branca (Black Lion Tamarin Ecological Station); SBNP = Serra da Bocaina National Park; SEIR = Seis R; SMES = Santa Maria Água Sumida (Black Lion Tamarin Ecological Station); SMA = Santa Maria Forest; STMO = Santa Mônica; TUES = Tucano (Black Lion Tamarin Ecological Station).



**Figure 7.** Scatterplot of non-volant mammal species richness according to fragment area in 14 Atlantic Forest fragments of Pontal do Paranapanema, São Paulo, Southeastern Brazil. The study site, Santa Maria is represented by a blue triangle. AGPE = Água do Peão; ARIZ = Fazenda Arizona; ASES = Água Sumida (Black Lion Tamarin Ecological Station); ESAL = Estrela da Alcídia; LUNO = Lua Nova; MATU = Maturi; MDSP = Morro do Diabo State Park; NOPO = Nova Pontal; PBES = Ponte Branca (Black Lion Tamarin Ecological Station); SASE = São Sebastião; SEIR = Seis R; STMO = Santa Mônica; TUES = Tucano (Black Lion Tamarin Ecological Station).

*brachyurus*, *Didelphis albiventris*, and *Oecomys cleberi* are examples of Cerrado species (Brandão & Hingst-Zaher, 2021; Carmignotto et al., 2012). The ecotonal nature of the mammalian community in the fragment may explain its high species diversity, as has been shown in other studies carried out in areas with Atlantic Forest and Cerrado influences (Cáceres et al., 2007; Hannibal, 2014).

**Table 2.** Non-volant mammals recorded in the Santa Maria fragment (Presidente Epitácio, Brazil) from 1996 to 2020. Threat status were obtained from the global (IUCN, 2021), Brazilian (MMA, 2014), and São Paulo state (SMA, 2018) red lists.

Taxon	Type of record						Threat status			Year of last record	Source		
	Camera (ground)	Camera (canopy)	Capture	Sighting	Footprint	Vocalization	Remains	Brazil (MMA 2014)				São Paulo (SMA 2018)	
								Global (IUCN 2021)	LC				LC
Didelphimorphia													
Didelphidae													
<i>Didelphis albiventris</i> Lund, 1840	x	x	x				x	LC	LC	LC	2019	Rocha (2004), Lima et al. (2017), this study	
<i>Gracilinanus microtarsus</i> (Wagner, 1842)		x	x					LC	LC	LC	2021	Rocha (2004), this study	
<i>Marmosa paraguayana</i> (Tate, 1831)		x	x					LC	LC	LC	2021	Rocha (2004), this study	
Cingulata													
Dasyproctidae													
<i>Dasyprocta novemcinctus</i> Linnaeus, 1758	x			x			x	LC	LC	LC	2019	Ditt et al. (1999), this study	
<i>Euphractus sexcinctus</i> (Linnaeus, 1758)							x	LC	LC	LC	2015	Ditt et al. (1999), this study	
Pilosa													
Myrmecophagidae													
<i>Myrmecophaga tridactyla</i> Linnaeus, 1758	x							VU	VU	VU	?	Lima et al. (2017)	
<i>Tamandua tetradactyla</i> (Linnaeus, 1758)							x	LC	LC	LC	2019	Ditt et al. (1999), this study	
Primates													
Atelidae													
<i>Alouatta guariba</i> (Humboldt, 1812)*				x				LC	VU	EN	1996-1998	Ditt et al. (1999)	
Cebidae													
<i>Sapajus nigritus</i> (Goldfuss, 1809)	x	x	x	x			x	NT	NT	NT	2019	This study	
<i>Leontopithecus chrysopygus</i> (Milne-Edwards, 1823)		x	x	x			x	EN	EN	EN	2020	Ditt et al. (1999), this study	
Rodentia													
Sciuridae													
<i>Guemlinguetus brasiliensis</i> (Gmelin, 1788)							x	LC	LC	LC	2015	This study	
Cricetidae													
<i>Oecomys cleberi</i> Locks, 1981		x	x					DD	LC	—	2017	This study	
Caviidae													
<i>Cavia</i> sp.								LC	LC	LC	1996-1998	Ditt et al. (1999)	
<i>Dasyprocta azarae</i> Lichtenstein, 1823	x		x	x			x	DD	DD	LC	2019	Ditt et al. (1999), this study	
<i>Hydrochoerus hydrochaeris</i> (Linnaeus, 1766)				x				LC	LC	LC	2019	Ditt et al. (1999), this study	
Erethizontidae													
<i>Coendou spinosus</i> (Cuvier, 1823)							x	LC	LC	LC	1996-1998	Ditt et al. (1999)	
Lagomorpha													
Leporidae													
<i>Syrrhaptes</i> sp.	x			x				LC	LC	LC	2015	Ditt et al. (1999), Lima et al. (2017), this study	
Perissodactyla													
Tapiridae													
<i>Tapirus terrestris</i> (Linnaeus, 1758)	x						x	VU	VU	EN	2019	Ditt et al. (1999), Lima et al. (2017), this study	
Artiodactyla													
Tayassuidae													
<i>Dicotyles tajacu</i> (Linnaeus, 1758)	x						x	LC	LC	NT	2015	This study	



Taxon	Type of record						Threat status			Year of last record	Source
	Camera (ground)	Camera (canopy)	Capture	Sighting	Footprint	Vocalization	Remains	Global (IUCN 2021)	Brazil (MMA 2014)		
Cervidae <i>Mazama rufa</i> (Illiger, 1815) <i>Mazama</i> sp.	x				x			DD	DD	EN	2015 This study Ditt et al. (1999), this study
Carnivora Canidae <i>Cerdocyon thous</i> (Linnaeus, 1766) <i>Chrysocyon brachyurus</i> (Illiger, 1815)				x x	x x			LC NT	LC VU	LC VU	2015 2015 Ditt et al. (1999), this study This study
Mustelidae <i>Eira barbara</i> (Linnaeus, 1758) <i>Galictis cuja</i> (Molina, 1782)				x	x			LC LC	LC LC	LC LC	2015 1996-1998 Ditt et al. (1999), this study Ditt et al. (1999)
Procyonidae <i>Nasua nasua</i> (Linnaeus, 1766) <i>Procyon cancrivorus</i> Cuvier, 1798			x	x	x			LC LC	LC LC	LC LC	2015 1996-1998 Ditt et al. (1999), Rocha (2004), this study Ditt et al. (1999)
Felidae <i>Puma concolor</i> (Linnaeus, 1771) <i>Panthera onca</i> (Linnaeus, 1758) <i>Leopardus pardalis</i> (Linnaeus, 1758) <i>Leopardus</i> sp.	x x x			x x	x x			LC NT LC	VU VU LC	VU CR VU	2015 2015 2015 This study This study Ditt et al. (1999), this study Ditt et al. (1999), this study

\* Possibly extirpated in the fragment.

Due to its strategic position, between two fragments of the Black Lion Tamarin Ecological Station with areas of over 1,000 ha, *i.e.*, Água Sumida (1,199 ha) and the homonymous Santa Maria (2,057 ha), and distancing only 12 km of the large remnant of seasonal Atlantic Forest of the Morro do Diabo State Park, the SMA is an important stepping-stone for the local fauna. Also, considering the presence of endangered species, we recommend that the area integrates landscape connectivity plans along with the other fragments. The restoration of forest corridors between these forest remnants, which are less than 4 km apart (in a straight line) from each other, has the potential to establish an area of over 45,000 ha of continuous forest in the region. This can be very significant from the perspective of population viability of the threatened species that live in this fragment. We also recommend that the area be given the necessary attention by government authorities and be turned into a protected area, to ensure the protection and perpetuity of the fauna and flora of the fragment.

### CONCLUSIONS

The high mammal richness and strategic location of the Santa Maria fragment makes it a priority area to be considered in the conservation of the fauna of Pontal do Paranapanema. We show that the fragment harbors endangered species and that some taxa have been extirpated from the fragment. Therefore, increasing its connectivity with neighboring areas is crucial. Future studies investigating mammalian diversity in the area, including bats and non-volant species, will also give a more complete picture of the mammal community in Santa Maria.

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