Oecologia Australis
19(1): 232-243, 2015
10.4257/oeco.2015.1901.15

MEDIUM TO LARGE-SIZED MAMMALS OF THE AUGUSTO RUSCHI BIOLOGICAL RESERVE, SÃO PAULO STATE, BRAZIL

Larissa Fornitano[1,3], Thaís Angeli[1], Rômulo Theodoro Costa[1], Natalie Olifiers[2] and Rita de Cassia Bianchi[1]*

[1]Universidade Estadual Paulista "Júlio de Mesquita Filho", Departamento de Biologia Aplicada à Agropecuária, Laboratório de Ecologia de Mamíferos. Via de Acesso Professor Paulo Donato Castellane, s/n, Faculdade de Ciências Agrárias e Veterinária de Jaboticabal, Jaboticabal, SP, Brasil. CEP: 14884-900.
[2]Fundação Oswaldo Cruz, Instituto Oswaldo Cruz, Laboratório de Biologia e Parasitologia de Mamíferos Silvestres Reservatórios. Avenida Brasil, 4365, Rio de Janeiro, RJ, Brasil. CEP: 21040-900.
[3]Programa de Pós Graduação em Biologia Animal, UNESP, São José do Rio Preto
E-mails: larissafornitano@yahoo.com.br, thais.angeli@hotmail.com, romulothcosta@gmail.com, natolifiers@gmail.com, rc_bianchi@yahoo.com.br

ABSTRACT
Although São Paulo state presents two biodiversity hotspots – the *Cerrado* and the Atlantic Forest – it currently retains only 13% of its native vegetation, which is divided into 8,300 fragments harboring as a whole at least 220 mammal species. This study aims to survey mammalian species of medium to large size in a protected area of São Paulo, the Augusto Ruschi Biological Reserve, which is composed of five forest fragments. We used 562 camera-trap-nights, footprint surveys, and opportunistic visualizations to record species. Species richness was estimated by the presence/absence of animals at the camera-trap station and using the first-order Jackknife estimator. The estimated species richness was 10.99 (± 1.4 standard deviation), but species richness reached 16 species when other types of records were considered. The species richness of medium and large-sized mammals in the area is considerably high, with four species that are vulnerable to extinction. However, the recorded species are not fully protected due to the presence of anthropogenic activities. Based on our results, we recommend specific management actions to enhance species conservation in the reserve.
Keywords: camera-trap; fragment; species richness.

INTRODUCTION

Species surveys are important components of conservation programs, as minimum knowledge about which species occur in a given location is the first step toward conservation actions (Santos 2003). In protected areas, particularly, the lack of surveys is a problem for the implementation of management plans. Despite the importance of species inventories, natural habitats have been lost before we know what species they harbored.

Human activities are the main reason for habitat loss and fragmentation of natural habitats (Dean 1996, Pires *et al.* 2006, Paglia *et al.* 2006). Habitat fragmentation tends to diminish the necessary resources for the most specialized species, thereby causing a decrease in population abundances, in some cases leading to local species extinction (Kronka *et al.* 2005, Paglia *et*

al. 2006). The damage caused to natural communities vary by taxon (Olifiers and Cerqueira 2006); however, mammals of medium to large size are usually highly affected, particularly if they require relatively large areas of native vegetation to sustain their populations (Chiarello 1999, Rodrigues and Bononi 2008).

The São Paulo state has two ecosystems considered biodiversity hotspots - the Atlantic Forest and the *Cerrado* - that have gone through intense loss of their original habitats especially in recent decades; with only 13% of its original vegetation cover (Kronka *et al.* 2005), the remainder of territory is now occupied mainly by sugar cane and eucalyptus plantations as well as livestock. The state has now 12% of Atlantic Forest and 1% of *Cerrado* fragmented into 8,300 remnants, of which only 25% is legally protected (Rodrigues and Bononi 2008, Kronka *et al.* 2005). These areas harbor approximately 220 species of mammals, representing 36% of the species found in Brazil, with representatives of all orders of mammals present in the country (Bressan *et al.* 2009). São Paulo state is home to 38 mammal species considered endangered (17% of the São Paulo state species) and 58 species with limited knowledge, classified as "data deficient" according to the IUCN criteria (Bressan *et al.* 2009).

Although the São Paulo state harbors a very diverse fauna and displays the largest number of threatened species in Brazil, there are no management plans and fauna surveys for much of its remaining forests, including protected areas (Galindo-Leal *et al.* 2005, Rodrigues and Bononi 2008). In this context, the aim of this study was to survey for the first time the species of medium to large-sized mammals of the Augusto Ruschi Biological Reserve (ARBR) - a fragmented, protected area in the northeast region of São Paulo. Similarities in species composition between fragments are discussed. We conclude by proposing specific management actions to conserve species in the reserve.

MATERIAL AND METHODS

Study site

The Augusto Ruschi Biological Reserve (ARBR) is located in the municipality of Sertãozinho, northeast of São Paulo state (21º10'33"S / 48º05'16"W). It was created in 1985 and has a total area of 757 ha divided into five forest fragments ranging from 55.07 ha to 189.21 ha, 300-1000 m apart from each other (Figure 1). The ARBR is part of "Instituto de Zootecnia de São Paulo" and consists of pasture and forest fragments of seasonal semi-deciduous forest of *Cerrado*. In addition to pasture, the area is surrounded by sugar cane plantations and crossed by the highway Atilio Balbo (SP-333), which connects the cities of Ribeirão Preto and Jaboticabal. The ARBR is relatively isolated, with larger forest fragments being located at around 35 km kilometers from it. However, one of the ABBR fragments is connected to a strip of Gallery Forest that accompanies the Mogi Guaçu river, which passes nearby the reserve. There is not an official mammal inventory for the reserve

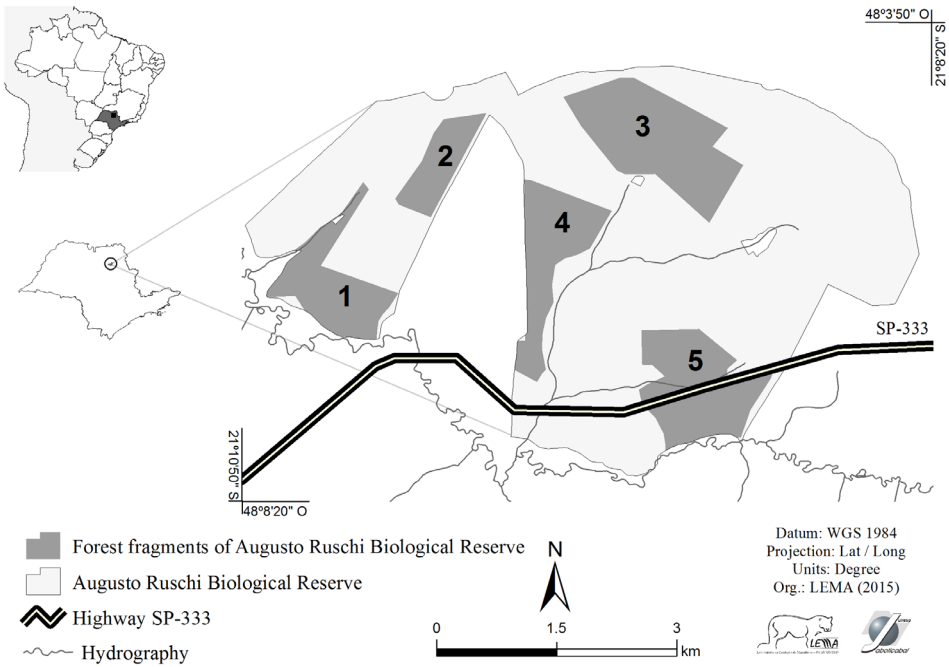

Figure 1. Map of the Augusto Ruschi Biological Reserve, with its location in the São Paulo state, Brazil.

(Brasil 1985), and a management plan has not been prepared.

Data collection

Digital camera traps (Scoutguard ® SG550) were placed every 500 m in the five fragments comprising the reserve from October 2012 to May 2013, with a sampling effort of 562 trap-nights (Table 1). The fragments were sampled one at a time, and the number of sampling points in each fragment varied from two to six. The cameras were baited with bobcat urine (*Lynx rufus*, BobcatPee®), banana, and bacon and programmed to capture images every 10 seconds, when activated. Inspections occurred weekly for the replacement of batteries and renewal of baits. The roads between the fragments were searched for the presence of mammal footprints and other signs. Footprints were photographed and identified using field guides (Becker and Dalponte 1999, Borges and Tomas 2008).

Data analysis

Species richness was estimated by the presence/absence of animals at the camera-trap stations and using the first-order Jackknife estimator with the software EstimateS 9 (Colwell 2013). The results were used in a species rarefaction curve for the entire area and for each fragment. A relative abundance index for each species was calculated

by dividing the number of independent records (pictures of the same species at least 30 minutes apart from each other) by the sampling effort (number of trap-nights) (Kasper *et al.* 2007).

To evaluate the similarity on species composition between fragments, we performed a cluster analysis using a dissimilarity matrix based on the Jaccard index (Krebs 1999) and Ward's method of linkage.

RESULTS

Nine species of wild mammals were recorded in camera traps, but species richness reached 16 species of 7 orders, 12 families and 16 genera when other records (footprints, direct observations and roadkilled animals) were considered. Domestic dogs (*Canis familiaris*, Linnaeus, 1758) were also recorded in the reserve (Table 2). The species with the highest number of records in camera traps was the nine-banded armadillo (*Dasypus novemcinctus*) with 49 records, followed by the white-eared opossum (*Didelphis albiventris*) with 48 records (Table 2). The species with the lowest number of records in camera traps were the capybara (*Hydrochoerus hydrochaeris*) and the greater naked-tailed armadillo (*Cabassous tatouay*), with only one record each.

The estimated species richness (using only data from camera traps) was 10.99 (± 1.4 SD). The appropriateness of the methodology and sampling effort used for the species record was evidenced by the rarefaction curve that

Table 1. Relative abundance of species (divided by sampling effort), fragment size, sampling effort in trap-nights and estimated species richness in each fragment of the Augusto Ruschi Biological Reserve, Sertãozinho, São Paulo, from October 2012 to May 2013. Frag. = sampled fragment within the reserve.

Species	Area				
	Frag. 1	**Frag. 2**	**Frag. 3**	**Frag. 4**	**Frag. 5**
Dasypus novemcinctus	0.037	0.091	0.127	0.011	0.015
Dasyprocta azarae	0.074	0.182	0.057	0.022	0.077
Didelphis albiventris	0.037	0.091	0.067	0.101	0.000
Puma concolor	0.000	0.018	0.003	0.022	0.015
Tamandua tetradactyla	0.019	0.036	0.003	0.011	0.000
Sapajus nigritus	0.000	0.000	0.000	0.045	0.000
Hydrochoerus hydrochaeris	0.000	0.000	0.000	0.011	0.000
Myrmecophaga tridactyla	0.000	0.018	0.000	0.000	0.015
Cabassous tatouay	0.000	0.000	0.003	0.000	0.000
Estimated richness	4.98	8.91	8.95	9.91	6.93
Sampling effort	54	55	299	89	65
Fragment size (ha)	166.19	55.07	189.21	128.48	163.82

Table 2. Mammalian species of medium and large size recorded in the Augusto Ruschi Biological Reserve, Sertãozinho, SP, from October 2012 to May 2013. CT = camera trap, F = footprints, DV = direct visualization, Photographic records = number of photographic records.

Taxon	Record type	Photographic records
Order Cingulata, Family Dasypodidae		
*Dasypus novemcinctus (*Linnaeus, 1958)	CT, F	47
Cabassous tatouay (Desmarest, 1804)	CT	1
Order Didelphimorphia, Family Didelphidae		
Didelphis albiventris (Lund, 1840)	CT	46
Order Rodentia, Family Dasyproctidae		
Dasyprocta azarae (Lichtenstein, 1823)	CT	37
Order Rodentia, Family Caviidae		
Hydrochoerus hydrochaeris (Linnaeus, 1766)	CT, F	2
Order Rodentia, Family Erethizontidae		
Coendou prehensilis (Linnaeus, 1758)	DV	-
Order Carnivora, Family Felidae		
Puma concolor (Linnaeus, 1771) [1, 2]	CT, F	5
Leopardus sp.	F	-
Order Carnivora, Family Canidae		
Cerdocyon thous (Linnaeus, 1776)	F	-
Chrysocyon brachyurus (Illiger, 1815) [1, 2]	F	-
Order Carnivora, Family Mustelidae		
Galictis sp.	DV	-
Order Pilosa, Family Myrmecophagidae		
Tamandua tetradactyla (Linnaeus, 1758)	CT	4
Myrmecophaga tridactyla (Linnaeus, 1758) [1, 2, 3]	CT	2
Order Primates, Family Cebidae		
Sapajus nigritus (Goldfuss, 1809)	CT, DV	4
Order Primates, Family Atelidae		
Alouatta caraya (Humboldt, 1812) [1]	DV	-
Order Artiodactyla, Family Cervidae		
Mazama sp.	F	-

[1] the Red List of São Paulo state (Bressan *et al.* 2009); [2] the Brazilian Red List (Ministério do Meio Ambiente 2014); [3] the IUCN Red List (IUCN, 2014).

reached an asymptote (Figure 2), even though an asymptote was not reached for three of the rarefaction curves for the fragments (Figure 3).

Similarity in species composition between fragments varied from 0.33 (fragments 1 and 5) to 0.71 (fragments 2 and 3) (Figure 4). Fragments 2 and 3 were the most similar in terms of species composition due to the presence of 5 species in common while differing by one species only (Table 1). Fragment 1 was then grouped to fragment 2 and 3 cluster because it had 4 species, with all of them present in both fragments 2 and 3 (Figure 4, Table 1). Fragment 4 was grouped to the previous cluster because it showed up to 5 species (out of 7) in common with the fragments in that cluster, whereas it had only 3 species in common with fragment 5; this later fragment was the most dissimilar one, mainly due to the absence of *Didelphis albiventris* and *Tamandua tetradactyla* and the presence of *Myrmecophaga tridactyla* (Figure 4; Table 1).

DISCUSSION

The frequent records of some species such as the armadillo and the white-eared opossum are an indication of the high degree of disturbance in the area, since these species are habitat and diet generalists and adapt well to regions where carnivore fauna is modified or eliminated (da Fonseca *et al.* 1990, Santori *et al.* 1995, D'Andrea *et al.* 1999). However, despite the level of disturbance, the reserve has species that are naturally rare, such as the greater naked-tailed armadillo (*C. tatouay*) (Reis *et al.* 2006), or that require large areas, such as the puma (*Puma*

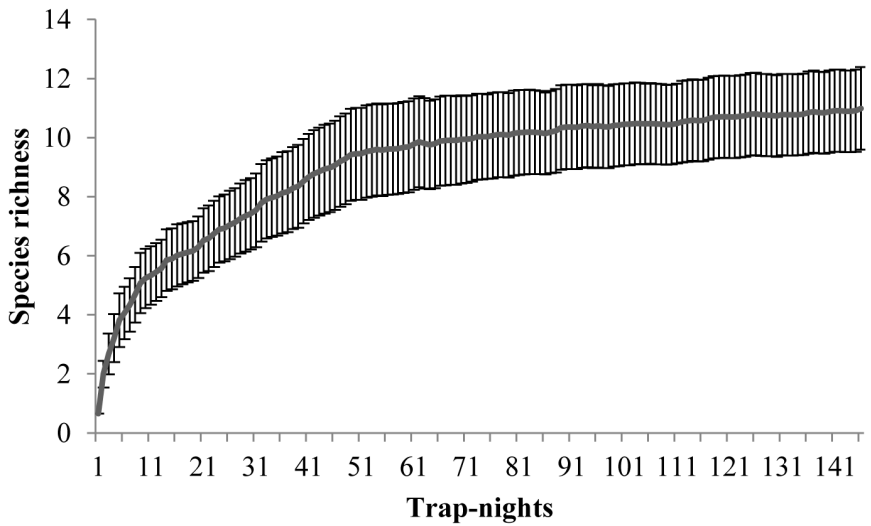

Figure 2. Rarefaction curve for species richness in the Augusto Ruschi Biological Reserve, Sertãozinho, SP, from October 2012 to May 2013. Bars represent standard deviation for species richness.

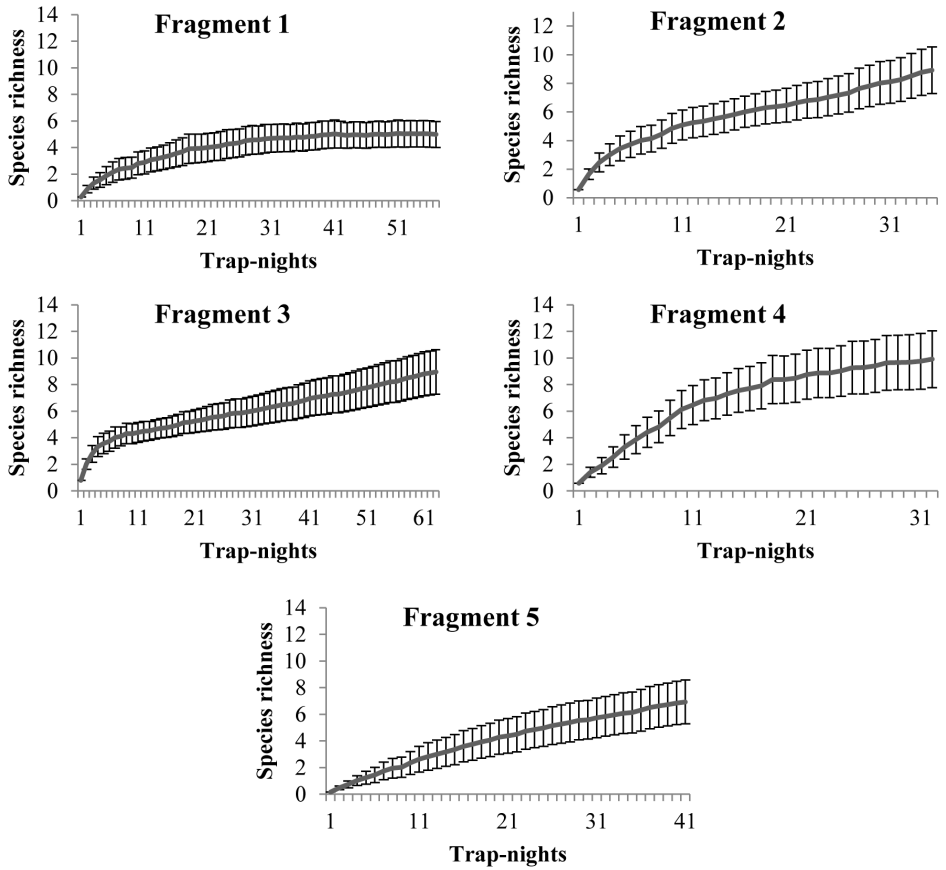

Figure 3. Rarefaction curves for species richness by fragment sampled in the Augusto Ruschi Biological Reserve, Sertãozinho, SP, from October 2012 to May 2013. Bars represent standard deviation for species richness.

concolor) (Crooks 2002) and the giant anteater (*M. tridactyla*) (Medri and Mourao 2005). Therefore, despite being affected by anthropogenic changes, the reserve is still able to maintain some threatened species.

There were four and two records for the puma and giant anteater, respectively, and these are considered threatened species in Brazil (Machado *et al.* 2008) and in the São Paulo state (Bressan *et al.* 2009), with both being classified as vulnerable to extinction (Table 2). The giant anteater is also considered "Vulnerable" on the Red List of the International Union for Conservation of Nature (IUCN 2014). Although these species were recorded in the ARBR, it is unlikely that they are restricted to ARBR fragments because the home range of the giant anteater can reach 11.9 km² (Medri and Mourao 2005) and the puma's home range reaches 100 km² (Franklin *et al.* 1999). The records of threatened

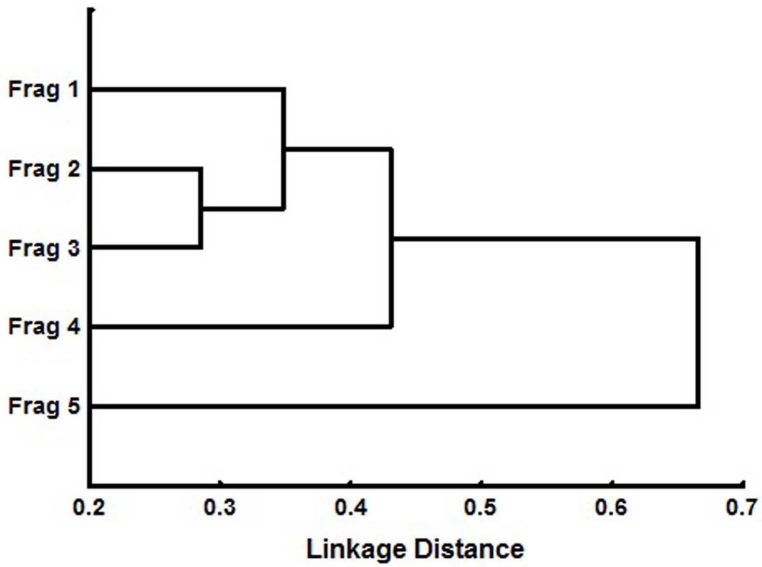

Figure 4. Similarity in species composition of five fragments in the Augusto Ruschi Biological Reserve, Sertãozinho, SP, from October 2012 to May 2013. Frag = fragment.

species and of species that require large home ranges suggest the importance of habitat remnants to species persistence in the landscape (Pires *et al.* 2006). The species from forested areas, such as arboreal Brazilian porcupines and primates, most likely depend on these remnants to persist in the fragmented landscape of the reserve.

Because traps were placed only in forest fragments, species such as the crab-eating fox (*Cerdocyon thous*) and the maned wolf (*Chrysocyon brachyurus*) were most likely not recorded due to their preference for open areas (Juarez and Marinho 2002). Other species found only through direct sightings or footprints, such as small cats, *Mazama* sp., *Coendou prehensilis*, *Alouatta caraya* and *Galictis* sp., may occur at low densities or may move more frequently through the canopy, which would underestimate their recording by camera traps.

The technique of camera trapping can also bring some associated errors, considering that the number of times animals are recorded does not represent the actual species abundance (Walker *et al.* 2000). However, in mammal communities, it is expected that smaller and more generalist species are more abundant (Tomblin and Adler 1998, Cohen *et al.* 2003). Thus, considering the body size and habits of the species most frequently recorded (*D. novemcinctus, D. albiventris* and *Dasyprocta azarae*), it is likely that the results of this study are directly proportional to the actual abundance of species in the area. The only exception would be *P. concolor* (fifth species most frequently recorded)

for which the relative frequency of occurrence is certainly overestimated, as the individual was possibly a dispersing juvenile.

It is probable that the differences in species composition between the fragments are related to the availability of key resources, such as the presence of water, since distance between fragments or fragment size does not seem to influence species composition. For instance, even though fragments 2 and 3 were the most similar in species composition, the distance between them is not the smallest one (Figure 1), nor their sizes are similar (Table 1).

The presence of domestic animals such as *C. familiaris* is a significant risk to species conservation due to the possibility of disease transmission to wildlife (Anderson *et al.* 2003, Hammer *et al.* 2004) and predation of wild species (Kays and DeWan 2004, Lepczyk *et al.* 2004, Knobel *et al.* 2014). For instance, in a study with feral dogs in the Brazilian Atlantic forest, Galetti and Sazima (2006) found that 75% of items consumed by dogs were wild mammals and the mammalian biomass killed in 44 months was estimated to be 98.39 kg (26.83 kg/year). Likewise, Campos *et al.* (2007) observed that mammals were the second most commonly consumed item by dogs (25.15%) in a forest of south-eastern Brazil. Domestic dogs are particularly abundant in regions with anthropic activities, such as rural areas (Paschoal *et al.* 2012, Frigeri *et al.* 2014) and predation on wildlife can be even stronger in small and isolated populations of wild animals or in populations of rare species (Ritchie *et al.* 2014). In addition, such predation is particularly important when the predator guild is severely reduced or absent, and dogs become the top predators (Ritchie *et al.* 2014). Therefore, the effect of dogs on local wildlife is expected to be strong in scenarios such as of the ARBR.

The presence of a highway that crosses the reserve is also a strong impact on species due to the great risk of roadkills, especially for large animals that often move between patches in fragmented landscapes (Espartosa 2009). Therefore, although the ARBR harbors a relatively high species richness when compared to similar-sized areas (Chiarello 2000, Alves *et al.* 2012), the recorded species are not fully protected.

The Augusto Ruschi Biological Reserve is an important set of small fragments that harbors a relatively high species richness of medium to large-sized mammals when compared to other areas of the state. In a faunal survey at Jataí Ecological Station, a *Cerrado* area of 9010 ha of São Paulo state and approximately 60 km from the ARBR, Lyra-Jorge (2007) found a richness of 18 species. This same study found a richness of 16 species in Vassununga State Park, a *Cerrado* area of 2082 ha, also in the São Paulo state and distant approximately 80 km from the ARBR. Although the species richness found in ARBR is smaller than that found by Lyra-Jorge (2007), the value is relatively high if we consider that the reserve is almost three times smaller than Vassununga State Park and nearly 10 times smaller than Jataí Ecological

Station. In addition to the relatively high species richness, the presence of both specialist and threatened species reinforces the importance of maintaining the ARBR.

This is the first inventory of medium to large-sized mammals of the reserve, and the results obtained are essential for establishing an effective management plan for the reserve. In this sense, we also recommend the inventory of small mammals, particularly because some wild rodents that are commonly found in the *Cerrado*, such as *Calomys tener*, *Necromys lasiurus* and *Akodon montensis*, may work as reservoirs for hantavirus (Suzuki *et al.* 2004, Oliveira *et al.* 2007), which causes a zoonosis that is particularly emergent in the region (Donalisio *et al.* 2008).

The appropriate management of the reserve may ensure the local persistence of small, specialist species while facilitating the long-distance movement of larger ones such as the puma, thereby contributing to species persistence at the landscape level as well. Based on our findings, specific management actions that must be implemented to enhance local species conservation are the exclusion of dogs from the reserve and actions to control traffic speed on the highway and to allow wildlife crossings.

ACKNOWLEDGEMENTS

We would like to thank Universidade Estadual Paulista "Júlio de Mesquita Filho" and Oswaldo Cruz Foundation for the technical support and the Zoological Society of London for financial support. We are also grateful to José V. F. Martins and Jamil Aparecido Ferraz for fieldwork help.

REFERENCES

Alves, T. R., R. C. B. Fonseca, and V. L. Engel. 2012. Medium and large sized mammalians and their relation to habitat patches at the Botucatu cuesta, state of São Paulo, Brazil. Iheringia Serie Zoologia 102:150-158.

Anderson, T. C., G. W. Foster, and D. J. Forrester. 2003. Hookworms of feral cats in Florida. Veterinary Parasitology 115:19-24.

Becker, M. and J. C. Dalponte. 1999. Rastros de mamíferos brasileiros. 180p., 2nd ed. Editora UnB, Brasília.

Borges, P. A. L. and W. M. Tomas. 2008. 148p., 1st ed. Guia de rastros e outros vestígios de mamíferos do pantanal. Embrapa, Corumbá.

Brasil. 1985. Lei nº 4.557, de 17 de abril de 1985. Governo do estado de São Paulo. JusBrasil. http://governo-sp.jusbrasil.com.br/legislacao/195307/lei-4557-85. Accessed: 02/10/2014.

Bressan, P. M., M. C. M. Kierulff, and A. M. Sugieda. 2009. Fauna ameaçada de extinção no estado de São Paulo: Vertebrados. 648p. Zoólogico de São Paulo, Secretaria do Meio Ambiente, Governo de São Paulo.

Campos, C. B., C. F. Esteves, K. M. P. M. B. Ferraz, P. G. Crawshaw Jr. and L. M. Verdade. 2007. Diet of free ranging cats and dogs in a suburban and rural environment, south-eastern Brazil. Journal of Zoology 273(1):14-20.

Chiarello, A. G. 1999. Effects of fragmentation of the Atlantic forest on mammal communities in south-eastern Brazil. Biological Conservation 89:71-82.

Chiarello, A. G. 2000. Density and population size of mammals in remnants of Brazilian Atlantic forest. Conservation Biology 14:1649-1657.

Cohen, J. E., T. Jonsson, and S. R. Carpenter. 2003. Ecological community description using the food web, species abundance, and body size. Proceedings of the National Academy of Sciences 100:1781-1786.

Colwell, R. K. Available in: <http://viceroy.eeb.uconn.edu/estimates/EstimateSPages/EstSUsersGuide/EstimateSUsersGuide.htm>. Accessed: 09/09/2013.

Crooks, K. R. 2002. Relative sensitivities of mammalian carnivores to habitat fragmentation. Conservation Biology 16:488-502.

D'Andrea, P. S. R., Gentile, R. Cerqueira, C. E. V., Grelle, C. Horta, and L. Rey. 1999. Ecology of small mammals in a Brazilian rural area. Revista Brasileira de Zoologia 16:611-620.

da Fonseca, G. A. B. and J. G. Robinson. 1990. Forest size and structure: Competitive and predatory effects on small mammal communities. Biological Conservation 53:265-294.

Dean, W. 1996. A ferro e fogo: a história e a devastação da Mata Atlântica brasileira. 484p., 1st ed. Companhia das Letras, São Paulo.

Donalisio, M. R., C. H., Vasconcelos, L. E. Pereira, A. M. H. Ávila, and G. Katz. 2008. Aspectos climáticos em áreas de transmissão de hantavirose no estado de São Paulo, Brasil. Cadernos de Saúde Pública 24(5):1141-1150.

Espartosa, K. D. 2009. Mamíferos terrestres de maior porte e a invasão de cães domésticos em remanescentes de uma paisagem fragmentada de Mata Atlântica: avaliação da eficiência de métodos de amostragem e da importância de múltiplos fatores sobre a distribuição das espécies. Instituto de Biociências, Universidade de São Paulo.

Franklin, W. L., W. E. Johnson, R. J. Sarno, and J. A. Iriarte. 1999. Ecology of the Patagonia puma *Felis concolor* patagonica in southern Chile. Biological Conservation 90:33-40.

Frigeri, E., C. R. Cassano, and R. Pardini. 2014. Domestic dog invasion in an agroforestry mosaic in southern Bahia, Brazil. Tropical Conservation Science 7(3):508-528.

Galindo-Leal, C., I. de Gusmão Câmara, and E. R. Lamas. 2005. Mata Atlântica: biodiversidade, ameaças e perspectivas. Pages 86-94 in M. Tabarelli, L. P. Pinto, J. M. Cardoso Da Silva, C. M. R. Costa, editors. Espécies ameaçadas e planejamento da conservação. 1st edition. Fundação SOS Mata Atlântica, São Paulo e Conservação Internacional, Belo Horizonte.

Galleti, M. and I. Sazima. 2006. Impact of feral dogs in an urban Atlantic forest fragment in south-eastern Brazil. Natureza & Conservação 4(1):146-151.

Hammer, A. S., H. H. Dietz, T. H. Andersen, L. Nielsen, and M. Blixenkrone-Moeller. 2004. Distemper virus as a cause of central nervous disease and death in badgers (*Meles meles*) in Denmark. The Veterinary Record 154:527-530.

IUCN. 2014. The IUCN Red List of Threatened Species. Version 2014.2. <www.iucnredlist.org>. Downloaded on 02 October 2014.

Juarez, K. M., and J. Marinho. 2002. Diet, habitat use, and home ranges of sympatric canids in central Brazil. Journal of Mammalogy 83:925-933.

Kasper, C. B., F. D. Mazim, J. B. G. Soares, T. G. D. Oliveira, and M. E. Fabián. 2007. Composition and relative abundance of the medium-large sized mammals of Turvo State Park, Rio Grande do Sul, Brazil. Revista Brasileira de Zoologia 24:1087-1100.

Kays, R. W., and A. A. DeWan. 2004. Ecological impact of inside/outside house cats around a suburban nature preserve. Animal Conservation 7:273-283.

Knobel, D. L., J. R. A. Butler, T. Lembo, R. Critchlow, and M. E. Gompper. 2014. Dogs, disease, and wildlife. Pages 144 - 169 in M. E. Gompper, editor. Free-Ranging Dogs and Wildlife Conservation. Oxford University Press, Oxford, UK.

Krebs, C. J. 1999. Ecological methodology. 620 p., 2nd. Benjamin/Cummings Menlo Park, California.

Kronka, F. J. N., M. A. Nalon, C. K. Matsukuma, M. M. Kanashiro, M. S. S. I. Ywane, M. Pavão, G. Durigan, L. M. P. R. Lima, J. R. Guillaumon, J. B. Baitello, S. C. Borgo, L. A. Manetti, A. M. F. Barradas, J. C. Fukuda, C. N. Shida, C. H. B. Monteiro, A. A. S. Pontinha, G. G. D. Andrade, O. Barbosa, and A. P. Soares. 2005. 200p. Inventário florestal da vegetação natural do estado de São Paulo. Biota/Fapesp, Fundação de Amparo à Pesquisa do Estado de São Paulo, São Paulo.

Lepczyk, C. A., A. G. Mertig, and J. Liu. 2004. Landowners and cat predation across rural-to-urban landscapes. Biological Conservation 115:191-201.

Lyra-Jorge, M. C. 2007. Avaliação de qualidade de fragmentos de Cerrado e floresta semidecídua na região da bacia do rio Mogi-Guaçu com base na ocorrência de carnívoros. Departamento de Ecologia, Universidade de São Paulo.

Machado, A. B. M., G. M. Drummond, and A. P. Paglia. 2008. 1420p. Livro vermelho da fauna brasileira ameaçada de extinção. Ministério do Meio Ambiente, Brasília.

Medri, I. M., and G. Mourao. 2005. Home range of giant anteaters (*Myrmecophaga tridactyla*) in the Pantanal wetland, Brazil. Journal of Zoology 266:365-375.

Ministério do Meio Ambiente. 2014. Portaria n. 444, de 17 de dezembro de 2014. Lista Nacional Oficial das Espécies da Fauna Brasileira Ameaçadas de Extinção. Diário Oficial da República Federativa do Brasil, Brasilia, DF. Seção 1, 245, p. 121-126.

Olifiers, N. and R. Cerqueira. 2006. Fragmentação de habitat: efeitos históricos e ecológicos. Pages 261-279 in C. F. D. Rocha, H. G. Bergallo, M. V. Sluys and M. A. S. Alves, editors. Biologia da conservação: essências. 1st edition. RiMa, São Carlos.

Oliveira, R. C., V. P. Martinez, and C. Bellomo. 2007. Identification of *Akodon montensis* as reservoir host of a novel hantavírus in South Brazil. VII International Conference on HFRS, HPS and Hantaviruses, Buenos Aires, Argentina, Abstract Book, p. 126.

Paglia, A. P., F. A. S. Fernandez, and P. De Marco Jr. 2006. Efeitos da fragmentação de habitats: quantas espécies, quantas populações, quantos indivíduos, e serão eles suficientes. Pages 281-316 in C. F. D. Rocha, H. G. Bergallo, M. V. Sluys and M. A. S. Alves, editors. Biologia da conservação: essências. 1st edition. RiMa, São Carlos.

Paschoal, A. M. O., R. L. Massara, J. L. Santos, and A. G. Chiarello. 2012. Is the domestic dog becoming an abundant species in the Atlantic forest? A study case in southeastern Brazil. Mammalia 76:67-76.

Pires, A. S., F. A. S. Fernandez, C. S. Barros, C. F. D. Rocha, and H. G. Bergallo. 2006. Vivendo em um mundo em pedaços: efeitos da fragmentação florestal sobre comunidades e populações animais. Pages 231-260 in C. F. D. Rocha, H. G. Bergallo, M. V. Sluys and M. A. S. Alves, editors. Biologia da conservação: essências. 1st edition. RiMa, São Carlos.

Reis, N. R., A. L. Peracchi, W. A. Pedro, and I. P. Lima. 2006. 437p. Mamíferos do Brasil. 1st edition. Universidade Estadual de Londrina, Londrina.

Ritchie, E. G., C. R. Dickman, M. Letnic, A. T. Vanak, and M. E. Gommper. 2014. Dogs as predators and trophic regulators. Pages 55-68 in M. E. Gompper, editor. Free-ranging dogs and wildlife conservation. 1st edition. Oxford University Press, Oxford, UK.

Rodrigues, R. R. and V. L. R. Bononi. 2008. Diretrizes para conservação e restauração da biodiversidade no estado de São Paulo. 230p., 1st ed. Secretaria do Meio Ambiente, Instituto de Botânica, São Paulo.

Santori, R. T., D. Astúa de Moraes, and R. Cerqueira. 1995. Diet composition of *Metachirus nudicaudatus* and *Didelphis aurita* (Marsupialia, Didelphoidea) in southeastern Brazil. Mammalia 59:511-516.

Santos, A. J. D. 2003. Estimativas de riqueza em espécies. Pages 19-41 in L. Cullen, R. Rudran and C. Valladares-Padua, editors. Métodos de estudos em biologia da conservação e manejo da vida silvestre. 1st edition. UFPR, Londrina.

Suzuki A., I. Bisordi, S. Levis, J. Garcia, L. E. Pereira, R. P. Souza, T. K. N. Sugahara, N. Pini, D. Enria, L. and T. M. Souza. 2004. Identifying rodent hantavirus reservoirs, Brazil. Emerging Infectious Diseases 10:2127-2134.

Tomblin, D. C. and G. H. Adler. 1998. Differences in habitat use between two morphologically similar tropical forest rodents. Journal of Mammalogy 79(3):953-961.

Walker, S. R., A. J. Novaro, and J. D. Nichols. 2000. Consideraciones para la estimación de abundancia de poblaciones de mamíferos. Mastozoología Neotropical 7(2):73-80.

Submetido em 09/07/2014
Aceito em 17/05/2015