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A survey of mid and large bodied mammals in Núcleo Caraguatatuba, Serra do Mar State Park, Brazil.

Darren Norris[1,3], José Moreira Ramírez[1], Carlos Zacchi[2] & Mauro Galetti[1]

[1]Departamento de Ecologia, Universidade Estadual Paulista Júlio de Mesquita Filho – UNESP , Av. 24A, 1515, Bela Vista, CP 199, CEP 13506-900, Rio Claro, SP, Brasil
[2]Parque Estadual da Serra do Mar – PESM, Rua Horto Florestal , 1200, 11675-730 , Caraguatatuba, SP Brasil
[3]Corresponding author: Darren Norris, e-mail: dnorris75@gmail.com

NORRIS, D., RAMÍREZ, J.M., ZACCHI, C. & GALETTI, M. **A survey of mid and large bodied mammals in Núcleo Caraguatatuba, Serra do Mar State Park, Brazil**. Biota Neotrop. 12(2): http://www.biotaneotropica.org.br/v12n2/en/abstract?inventory+bn00312022012

Abstract: We applied complementary survey techniques to obtain a baseline species list of mid and large bodied mammals in Núcleo Caraguatatuba, Serra do Mar State park, Brazil. Between May and September 2011 we surveyed the community of mid and large bodied mammals using diurnal line transect census (212.4 km), camera-traps (223.2 camera-trap days) and track-stations (478 track-station days). A total of 18 species were recorded from 14 families in eight orders. We recorded the presence of seven species considered threatened in the State of São Paulo, including Primates (*Brachyteles arachnoides*), Artiodactyla (*Mazama* cf. *americana* and *Tayassu pecari*), Carnivora (*Leopardus pardalis*, *Leopardus tigrinus* and *Puma concolor*) and Perissodactyla (*Tapirus terrestris*). Based on extrapolated (First order jackknife) species richness estimates we predict that there are between 19 and 32 species of mid and large bodied mammals in the Núcleo. Our revised Mammal Priority Index ranked Núcleo Caraguatatuba as being of medium overall importance for the conservation of mid and large bodied mammals in the Atlantic Forest. Combined with the number and diversity of species recorded, our results demonstrate that this Núcleo is an important area for mammal conservation.
Keywords: *Atlantic forest, inventory, mammals, protected area.*

NORRIS, D., RAMÍREZ, J.M., ZACCHI, C. & GALETTI, M. **Mastofauna de médio e grande porte na Núcleo Caraguatatuba, Parque Estadual Serra do Mar, SP, Brasil**. Biota Neotrop. 12(2): http://www.biotaneotropica.org.br/v12n2/pt/abstract?inventory+bn00312022012

Resumo: Nós aplicamos técnicas de amostragem complementares para obter uma lista de espécies de mamíferos de médio e grande porte no Núcleo Caraguatatuba, Parque Estadual da Serra do Mar, Brasil. As amostragens de campo realizaram-se nos meses de Maio e Setembro de 2011. Utilizou-se, censo ao longo de transectos (212,4 km), armadilhas fotográficas (223,2 armadilhas-dias) e armadilhas de pegadas (478 armadilhas-dias). Foram obtidos registros de 18 espécies, pertencentes a 14 famílias e oito ordens. Nós registramos a presença de sete espécies consideradas ameaçadas no Estado de São Paulo, incluindo primatas (*Brachyteles arachnoides*), Artiodactyla (*Mazama americana* e *Tayassu pecari*), Carnivora (*Leopardus pardalis*, *Leopardus tigrinus* e *Puma concolor*) e Perissodactyla (*Tapirus terrestris*). Com base em numa extrapolação da riqueza de espécies ("First order jackknife") nós prevemos que existem entre 19 e 32 espécies de mamíferos de médio e grande porte no Núcleo. Nosso "Mammal Priority Index" classificou o Núcleo Caraguatatuba como uma área de importância "média" para a conservação de mamíferos de médio e grande porte na Mata Atlântica. Combinado com o número e a diversidade de espécies registradas, nossos resultados demonstram que este Núcleo é uma área importante para a conservação de mamíferos no Estado.
Palavras-chave: *mata Atlântica, inventário, mamíferos, unidade de conservação.*

Introduction

The Atlantic Forest is the most intensively studied biome for Brazilian mammals (Brito et al. 2009). The sampling intensity and availability of both published and un-published studies has enabled the establishment of priority areas for the conservation of mammals across the Atlantic Forest biome (Galetti et al. 2009, Albuquerque et al. 2011). Yet these studies also highlight that there remain significant gaps not only in our understanding but also in the published data describing Atlantic Forest mammals (Brito et al. 2009, Galetti et al. 2009, Albuquerque et al. 2011). With greater attention required for the development and dissemination of studies focusing on obtaining solutions to the management problems facing wild mammal species (Brito et al. 2009).

Conservation initiatives in Brazil, particularly the Atlantic Forest, are cited as examples of the successful integration of legal protection, protected area management, and science-based conservation planning (Russo 2009, Brancalion et al. 2010, Tabarelli et al. 2010). However, despite such positive examples, the situation for the fauna and flora of the Brazilian Atlantic Forest remains precarious (Marsden et al. 2005, Tabarelli et al. 2005, Fonseca et al. 2009, Galetti et al. 2009, Teixeira et al. 2009, Tabarelli et al. 2010). Protected areas are recognized as a key part of conservation initiatives (Naughton-Treves et al. 2005, Rands et al. 2010, Stockstad 2010) with >13% of Brazilian terrestrial biomes receiving legal protection at federal or state levels (Rylands & Brandon 2005). There are >700 areas of Atlantic Forest with at least some level of legal protection (Galindo-Leal & Câmara 2003, Tabarelli et al. 2010). However, the management of protected areas for mid and large bodied mammals in the Atlantic Forest is challenging as the majority of these areas (~75%) are small i.e. <100 km^2 (Ribeiro et al. 2009) and may not retain suitable environmental conditions for endangered species (Norris et al. 2011a, Norris et al. 2011b) and threats from anthropogenic perturbations such as urbanization, illegal hunting and palm heart harvesting are ubiquitous (Galetti & Fernandez 1998, Tabarelli et al. 2005, Galetti et al. 2009, Teixeira et al. 2009, Tabarelli et al. 2010).

The Serra do Mar biogeographical sub-region is the largest area of Atlantic Forest in Brazil. More than 50% of forest cover in the sub-region is found in forest fragments >50,000 ha and it also includes the largest remnant - a continuous forest area of 1,109,546 ha that is located along the coast of São Paulo State (Ribeiro et al. 2009). The Serra do Mar State Park is embedded within this continuous area, protecting 315,390 ha of Atlantic Forest that includes a variety of habitat types from lowland (sea-level) coastal restinga to highland (>200 masl) dense mountainous ombrofilous forest (Instituto Florestal 2008, p. 11-15). The size of the protected area generates unique management challenges and to meet these challenges it was necessary to divide the area into eight administrative units or "Núcleos" (Instituto Florestal 2008, p. 13-15). Although this area is continuous, the Serra do Mar continues to suffer from intensive hunting and palm heart harvesting. The numerous highways that cross the park, and the presence of major gas and oil pipelines facilitates entry of hunters to "remote" park areas (Aguiar et al. 2003, Instituto Florestal 2008, p. 129). Additionally, park borders are densely populated and illegal hunting, palm heart and bromeliad harvesting is common place (Instituto Florestal 2008, p. 119-143).

Although challenging from a management perspective, the size and diversity of protected habitats means that we expect to find high levels of biodiversity within the Serra do Mar State park (Aguiar et al. 2003). Indeed, within such a well connected and biodiverse expanse of forest (Aguiar et al. 2003) it is not unreasonable to predict the occurrence of a significant proportion of the 45 species (De Vivo et al. 2011) of mid and large bodied terrestrial mammals recorded in São Paulo State within this park. However, even the most basic management information (i.e. which mammal species are present) is not available for the majority of the Serra do Mar Núcleos, with 6 of the 8 classified as having zero or low levels of knowledge regarding the mammalian fauna (Instituto Florestal 2008, p. 180).

Recent diurnal line transect surveys recorded a maximum of 8 mid to large bodied mammal species within 4 of the Serra do Mar Núcleos (Picinguaba, Caraguatatuba, Cunha and Santa Virginia (Galetti et al. 2009). Although standardized line transect surveys provide a powerful dataset for analysis of species abundances they are unlikely to approximate a truly representative sample of the mid and large bodied mammal fauna. This group includes rare, cryptic and illusive species that to achieve management objectives including knowledge of which species are present are best surveyed with a combination of techniques (Michalski & Peres 2007, Espartosa et al. 2011, Munari et al. 2011). The objective of the present study was to use complementary survey techniques to obtain a baseline species list and estimate the species richness of mid and large bodied mammals in Núcleo Caraguatatuba as the first step to increasing our knowledge of the regional mammalian fauna and to support the management activities within this protected area.

Material and Methods

1. Study area

Mammal surveys took place in Núcleo Caraguatatuba of the Serra do Mar State park (Figure 1). Núcleo Caraguatatuba protects 49,953 ha (Instituto Florestal 2008) of the pre-Cambrian Serra do Mar mountain chain (Mantovani 1993). Of the eight administrative "Núcleos" of the Serra do Mar, 5 including Caraguatatuba are coastal, with Núcleo Caraguatatuba being located in the center of the "litoral" tourist region of the state, receiving approximately 5000 visitors annually. The Núcleo is bisected by the Tamoios road, a state highway that leads to the town of Caraguatatuba (45° 25' 57" W and 23° 35' 52" S). The western portion of the Núcleo is also traversed by one of the main pipelines of the Brazilian petroleum company "Petrobras". The poorly monitored access provided by the Tamoios highway and the pipeline are the two principal vectors of anthropogenic pressure (i.e. illegal hunting and palm-heart harvesting) in the Núcleo (Instituto Florestal 2008, p. 119-143).

The regional climate is subtropical, with a mean annual temperature of 23.2 (daily means ranging from 4.6 to 36.1, data from 2010 downloaded from the Brazilian weather center http://www.cptec.inpe.br/, station ID: 83671, Lat: –21.98, Long: –47.35 m a.s.l. = 598) and annual rainfall from 1400 to 4000 mm (Mantovani 1993). Soils are predominantly nutrient-impoverished yellow-red latosol, podzols and lithosols (Brasil 1983). Forests range from coastal (≈20 m) to elevations >900 m, generating stark floristic gradients, from shrubs to well-developed montane forests (Veloso et al. 1991).

2. Mammal surveys

Between May and September 2011 we used complementary techniques (line transect census, track surveys and camera-traps) to sample the mid and large bodied mammal community across Núcleo Caraguatatuba (Figure 1). Surveys were conducted by two observers with a minimum of 5 years experience in monitoring neotropical mammals. Nomenclature follows that presented in De Vivo et al. (2011) except for *Alouatta guariba* which follows Groves (2005).

During 34 days we conducted a total of 212.4 km of diurnal line transect census along 13 (total km = 71.9) preexisting (established for >10 years) trails (trail length: mean, range = 4.9, 0.7-15.7 km).

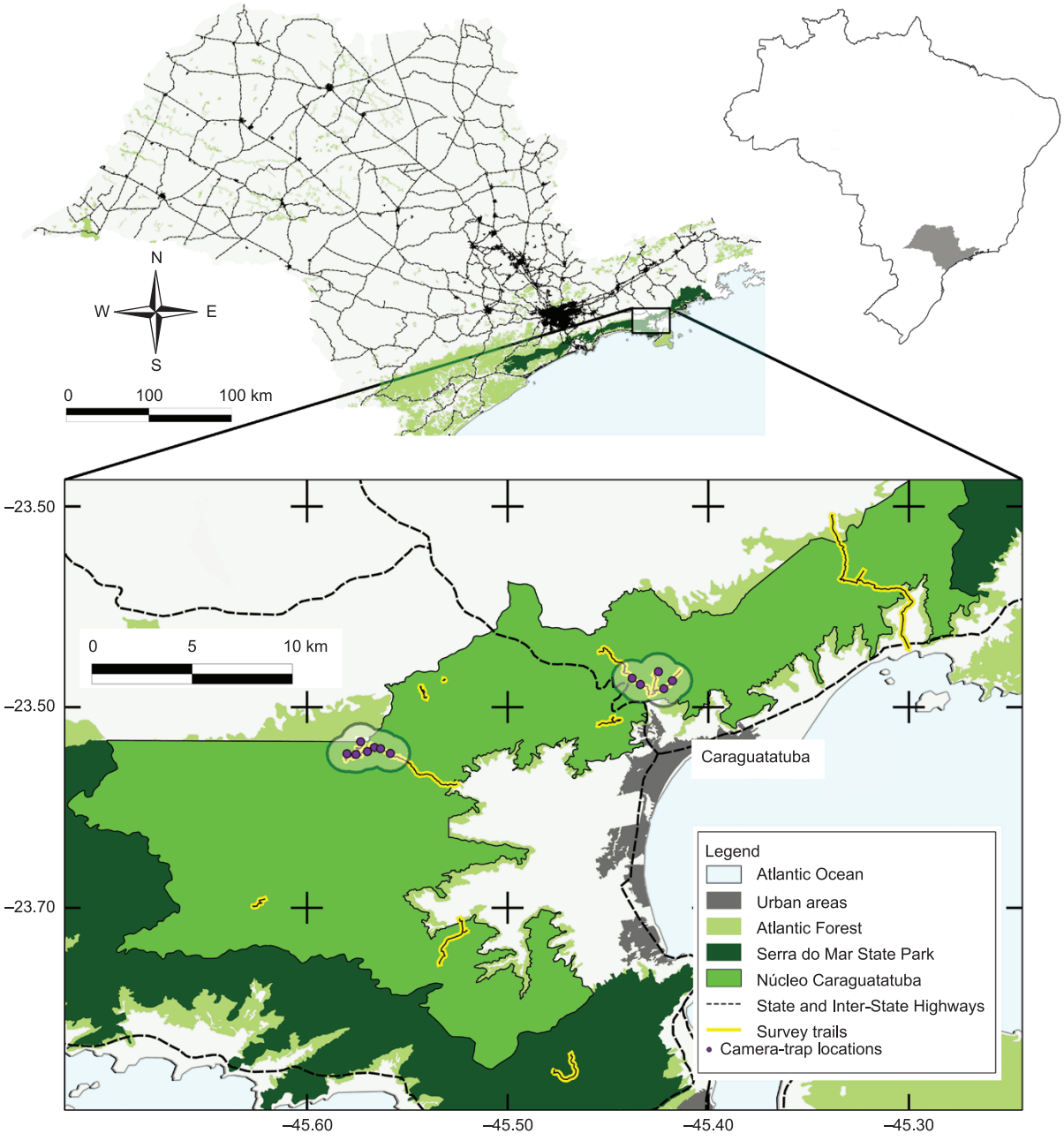

Figure 1. Study area showing locations of survey trails and camera-traps used to survey mid and large bodied mammals in Núcleo Caraguatatuba, Serra do Mar State Park, São Paulo, Brazil.

To provide a representative sample, trails were distributed throughout the Núcleo (Figure 1) and encompassed a variety of secondary and primary forest habitats. From the total of 71.9 trail km, the majority (51.9 km) were in forest dominated by early or advanced secondary successional stages, followed by primary (7.9 km) and eucalyptus and pine plantations (6.8 km).

Standard line transect protocols (Peres 1999, Buckland et al. 2010) were adapted to fit our main objective of sampling mid and large bodied mammals across the widest possible variety of habitats within the park. Census was not conducted during heavy rainfall but did occur during light showers i.e. when observers could walk comfortably without wearing protective clothing. Census was carried out during the morning (5:40 AM - 1:13 PM) and or afternoon (12:47 PM - 5:35 PM), with times varying due to logistical constraints and weather conditions. Although there was a slight overlap between the timing of morning and afternoon census, on any one day there was a minimum of 2 hours between the end of morning and start of afternoon census when we used the same trail and a minimum of 1 hour between morning and afternoon census when different trails were used. We do not consider this extension of the timing of our morning census to have biased our surveys. The standardization of census times has been determined from studies in tropical conditions where the heat during midday hours (between 12:00 AM and 2:00 PM) limits mammal activity (Peres 1999). Diurnal temperatures within our sub-tropical study area are not comparable to those in these tropical areas. At the latitude of Núcleo Caraguatatuba

mammals are often seen during these "midday" hours, appearing to avoid activity during the often cold (<14 °C) early mornings. For example we did not detect any mammals before 9 AM. To enable us to survey the maximum range of habitats possible we did not follow the recommended line transect survey speed of ≈1.25 km per hour (Peres 1999, Buckland et al. 2010). Although we did pause regularly at 100 to 300 m intervals to listen for detection cues, our mean per trail census speed was above the recommended value (survey speed: mean, range = 2.4, 1.1-3.4 km per hour). Although it is possible that this increased census speed resulted in missed detections, we found no significant relationship between the number of detections recorded per km and the survey speed (Spearmans correlation, rho = –0.223, p = 0.221). We are therefore confident that our modifications of the standard census protocols did not introduce any systematic bias and that our line transect survey results are directly comparable with previous studies.

During our line transect surveys we also recorded tracks that were visible along the trails. These "ad hoc" detection events were supplemented by a total of 25 un-baited track-stations placed along two of our census trails (Figure 1). Track-stations were prepared by removing leaf litter, rocks and surface roots from a 75 × 75 cm quadrant followed by loosening, separating and smoothing the soil surface with a machete so that it would be possible to discern track impressions of mid to large bodied mammals >2 kg (tested by the gentle application of finger tips to the prepared surface). Track-stations were checked at 3-6 day intervals. Days with heavy rain were excluded from our effort, resulting in an overall effort of 478 track-station days. Observers (each with >5 years experience of surveying mid and large bodied mammals in Neotropical forests) recorded the species identity of tracks with reference to field guides (Becker & Dalponte 1991, Emmons & Feer 1997). In cases where species identity was uncertain we took photos that were sent to specialists for confirmation. Any tracks that could not be reliably identified were not included in our analysis.

From June to July 2011 we installed 12 digital camera-traps (6 Reconyx, RECONYX, Inc. Wisconsin, USA - http://www.reconyx.com/ and 6 Ecotone, ECOTONE, São Paulo, Brazil http://www.ecotonebrasil.com). Cameras were installed in two areas (Figure 1) separated by a 12.9 km straight line distance – one close to the park base (5 cameras – 103.7 camera-trap days) and one in an area that receives no visitors and has been relatively undisturbed for at least 30 years (7 cameras – 119.5 camera-trap days), providing a total effort of 223.2 camera-trap days. Cameras were operational continuously over the 24 hours diel cycle and placed at random locations between 5 and 15 m to the side of existing trails within each area, with a minimum straight line nearest neighbor distance of 530 m. However, due to the steep topography including near vertical ravines, the minimum distance between cameras for any terrestrial mammal is effectively >1400 m. We attached cameras to trees at a height of ≈ 40 cm above the ground. The area in front of cameras was cleared of green foliage and herbs to prevent sunlight reflections damaging image quality. Due to licensing restrictions cameras remained un-baited, but were checked at 2 – 9 day intervals to ensure continuous operation and for routine maintenance e.g. to change batteries.

3. Data analysis

To understand the relationship between species richness and our survey effort we used the "specaccum" function of the "vegan" package (Oksanen et al. 2011) in the R software (R Development Core Team 2011) to estimate the individual based rarefaction curve of mean species richness per sample day. For this analysis we summed all individuals recorded for each species using any technique by the survey date, generating a matrix of 18 species by 22 survey days (we excluded days with no mammal species records). To predict the total number of species present in the Núcleo that it would be possible to detect using the combination of survey techniques we used the "First order jackknife" estimator to extrapolate the species richness from the frequencies of species encountered per day (function "specpool", package "vegan"). Although a number of extrapolation estimators are available we chose this one to enable comparison with previous studies (Espartosa et al. 2011).

To provide a measure of the conservation importance of Núcleo Caraguatatuba we calculated the Mammalian Priority Conservation Index (Galetti et al. 2009). This index provides a comparitive measure of the importance of the site by incorporating native species richness, species threat status (based on the threat status in the State of São Paulo (Magalhães-Bressan et al. 2009), species uniqueness and body size as well as the site forest area (see Galetti et al. 2009 for full details of index calculation and interpretation). To enable comparison with previous studies (Galetti et al. 2009) we only used data from the line transect censuses to derive the index.

Results

We obtained records of 18 mid to large bodied mammal species from 14 families in 8 orders, of which seven species are considered threatened ("Vulnerable" or "Endangered") in the State of São Paulo and five (27.8%) are considered threatened internationally (Table 1). Camera-traps recorded the most species (12), followed by tracks (10), other indirect detections (7) and finally direct visual detections from diurnal line transect census (6). *Tapirus terrestris* was the only species recorded with all four classes of detection technique, whereas six species (*Didelphis aurita* - photos, *Tayassu pecari* - tracks, *Leopardus tigrinus* - photos, *Lontra longicaudis* - tracks, *Bradypus variegatus* - carcass and *Brachyteles arachnoides*- visual) were only recorded by a single class (Table 1).

The estimated curve of species richness per survey day did not reach an asymptote, with species continuing to accumulate at a rate of 0.4 species per day after 22 survey days (Figure 2). Based on the First order jackknife our extrapolated species richness was 26 species (estimate ± 95% CI = 25.63 ± 6.07).

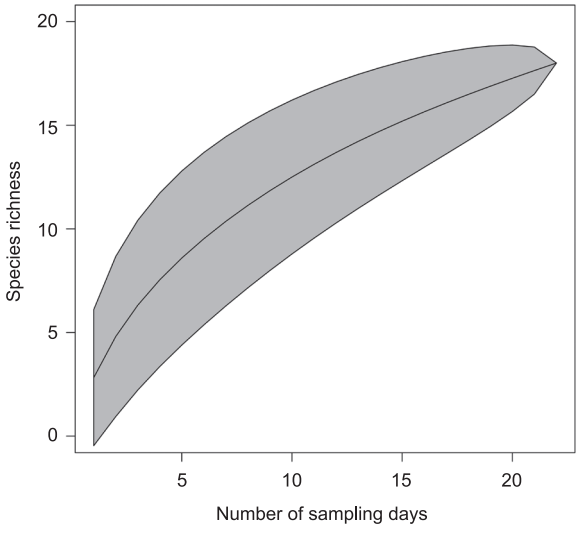

Figure 2. Mean accumulation curve and 95% confidence interval (shaded area) of the expected number of mid to large bodied mammal species in Núcleo Caraguatatuba, Serra do Mar State Park, São Paulo, Brazil.

Table 1. List of mammal species from Núcleo Caraguatatuba, Serra do Mar State Park, São Paulo, Brazil.

Order	Family	Species	Detection type[a]				Threat S[b]/Int[c]	Abundance[d]	
			Photo	Track	Visual	Other		LT	CT
Artiodactyla									
	Cervidae	*Mazama* cf. *americana* (Erxleben, 1777)		X	X		VU/DD	0.040	
	Tayassuidae	*Pecari tajacu* (Linnaeus, 1758)	X	X		X	NT/LC		0.081
		Tayassu pecari (Link, 1795)		X			EN/NT		
Carnivora									
	Felidae	*Leopardus pardalis* (Linnaeus, 1758)	X	X			VU/LC		0.161
		Leopardus tigrinus (Schreber, 1775)	X				VU/VU		0.081
		Puma concolor (Linnaeus, 1771)	X	X			VU/LC		0.081
	Mustelidae	*Lontra longicaudis* (Olfers, 1818)		X			NT/DD		
Cingulata									
	Dasypodidae	*Dasypus novemcinctus* (Linnaeus, 1758)	X	X		X	LC/LC		0.242
Didelphimorphia									
	Didelphidae	*Didelphis aurita* (Wied-Neuwied, 1826)	X				LC/LC		0.242
Perissodactyla									
	Tapiridae	*Tapirus terrestris* (Linnaeus, 1758)	X	X	X	X	VU/VU	0.040	0.524
Pilosa									
	Bradypodidae	*Bradypus variegates* (Schinz, 1825)				X	LC/LC		
Primates									
	Atelidae	*Alouatta guariba* (Humboldt, 1812)			X	X	NT/LC	0.202	
		Brachyteles arachnoides (É. Geoffroy, 1806)			X		EN/EN	0.040	
	Cebidae	*Cebus nigritus* (Goldfuss, 1809)	X		X	X	NT/NT	1.089	0.040
Rodentia									
	Caviidae	*Hydrochoerus hydrochaeris* (Linnaeus, 1766)	X			X	LC/LC		0.081
	Cuniculidae	*Cuniculus paca* (Linnaeus, 1766)	X	X			NT/LC		0.040
	Dasyproctidae	*Dasyprocta* cf. *azarae* (Lichtenstein, 1823)	X	X			LC/DD		0.040
	Sciuridae	*Guerlinguetus ingrami* (Thomas, 1901)	X		X		LC/NE	0.040	0.040

[a]How species were detected. Photo = camera-trap, Track = tracks observed along trails or on prepared track-stations, Visual = diurnal line transect census, and Other = carcass, feces, or vocalizations; [b]Threat status in the State of São Paulo (Magalhães-Bressan et al. 2009, p. 599). From least to most threatened: LC = least concern, NT = near threatened, VU = vulnerable, EN = endangered; [c]International threat status following (International… 2011). NE = not evaluated, DD = data deficient, then from least to most threatened: LC = least concern, NT = near threatened, VU = vulnerable, EN = endangered; [d]Species relative abundance.LT = detections per 10 km of line transect census and CT = independent photos per 10 camera-trap nights.

Relative abundances from line transect census ranged from 0.040 (*Brachyteles arachnoides*, *Mazama* cf. *americana*, *Tapirus terrestris*, and *Guerlinguetus ingrami*) to 1.089 (*Cebus nigritus*) detections per 10 km. The relative abundances obtained from diurnal census enabled us to calculate a revised Mammalian Priority Index of 15.29, which following the thresholds established by Galetti et al. (2009) classifies the Núcleo as an area of medium overall importance for large-bodied mammals in the Atlantic Forest.

Although rarely detected during diurnal censuses *Tapirus terrestris* was the most commonly recorded species with camera-traps (0.524 independent photos per 10 camera-trap nights), followed by *Dasypus novemcinctus* and *Didelphis aurita* (0.242 independent photos per 10 camera-trap nights). The most infrequently photographed species were *Cebus nigritus*, *Cuniculus paca*, *Dasyprocta* cf. *azarae*, and *Guerlinguetus ingrami* (0.040 independent photos per 10 camera-trap nights).

Discussion

Although Atlantic Forest mammals are relatively well studied there is little comparative data available from studies of mid and large bodied mammals in continuous forest areas. In a recent compilation (Galetti et al. 2009) found that from a total of 31 mid and large bodied mammal species a maximum of only 13 (41.9%) species were recorded using diurnal line transect census in 34 mainland Atlantic Forest sites. Other studies that employ a range of techniques generally record a greater number of species on a per site basis. For example, using line transect census (241 km) in secondary forest areas of the Morro Grande Forest Reserve - a 10,870 ha protected area close to the city of São Paulo Negrão & Valladares-Pádua (2006) recorded five species of mid to large bodied mammals but when these results were combined with sand track-stations (600 track-station days) a total of 18 species were recorded in the same area (Negrão & Valladares-Pádua 2006). Other studies from the Brazilian Atlantic Forest report similar patterns with more species recorded when different techniques were applied simultaneously: a total of 16 species were recorded in a 221 ha area of semi-deciduous Atlantic Forest using visual searches and camera-traps (Abreu Junior & Köhler 2009), 23 species in a 230 ha semi-deciduous forest area using line transect census (271 km), camera-traps (336.5 camera-trap days) and track-stations (1258 track-station nights) (Gaspar 2005), 29 species in a 17 491 ha protected area using visual searches (128 km), camera-traps (1842 camera-trap nights) and nocturnal surveys along park roads (Kasper et al. 2007). However none of these studies present species richness curves/

estimates that would facilitate a between site comparison of the mid to large bodied mammal communities.

Previous studies have demonstrated the importance of protected areas for the regional conservation of Atlantic Forest mammals (De Araujo et al. 2008, Galetti et al. 2009, Paviolo et al. 2009, Norris et al. 2011a, Norris et al. 2011b). Although it is not possible to make direct comparisons with other Atlantic Forest studies our predicted species richness shows the importance of Núcleo Caraguatatuba for the conservation of regional masto-fauna. Of the 18 species recorded seven (39%) are threatened in the State of São Paulo and five (27.8%) are threatened internationally (Table 1, Magalhães-Bressan et al. 2009, International… 2011). It is worth noting that of the 18 species recorded, populations of only one (*D. novemcinctus*) are increasing (Abba & Superina 2009). From a survey of 24 secondary forest sites (some connected to the western part of the Serra do Mar forest massive) using baited camera-traps (minimum effort of 2160 camera-trap days) and baited sand track-stations (minimum effort of 1224 track-station days) Espartosa et al. (2011) recorded a total of 14 native species of mid to large bodied mammals, with species richness estimates predicting a maximum of 15 native species present in the 10 000 ha study region. We managed to record a similar number of species to Espartosa et al. (2011) using a fraction of their survey effort and time, which emphasizes the richness and diversity of the mid and large bodied mammal community in Núcleo Caraguatatuba compared with unprotected and fragmented Atlantic Forest remnants. Another important difference is that the mammal community within the Núcleo appears to be relatively intact including large bodied species such as *T. terrestris* and *T. pecari*, whereas the species recorded by Espartosa et al. (2011) represented a relatively simplified assemblage of smaller bodied generalists.

As our species richness estimate showed that we missed between 2 and 14 species we also expect further studies to add to the list of threatened species within the Núcleo. For example populations of the threatened buffy-tufted-ear marmoset (*Callithrix aurita*) have been recorded in the neighboring Núcleo Santa Virginia (Norris et al. 2011b) and it seems likely that there may be as yet undetected populations within Núcleo Caraguatatuba. We would also expect to find carnivores such as jaguar (*Panthera onca*) and the crab-eating fox (*Cerdocyon thous*) plus at least one additional cervid species - the small brocket deer (*Mazama bororo*). Indeed, cervids highlight a remaining problem in neotropical mammalogy - uncertainty in species identification and classification (Brito et al. 2009). We identified the cervid species (*M.* cf. *americana*) based on characteristic size and coloration, however similarities with *M. bororo* mean that genetic studies are necessary to confirm the species presence. The same is true for the rodent *D. azarae*, which may be confused with *D. leporina*. Although the characteristic "red-rump" of *D. leporina* was not apparent in the photo taken, further genetic studies are required to confirm the species identity within the Núcleo. Although predicting which species are likely to be detected is inherently speculative, these issues highlight that even though the Atlantic Forest is the most intensively studied biome for mammals in Brazil (Brito et al. 2009), the knowledge necessary for effective conservation and management of Atlantic Forest mammals is far from complete.

Our revised Mammal Priority Index ranked Núcleo Caraguatatuba as being of medium overall importance for the conservation of mid and large bodied mammals in the Atlantic Forest. Combined with the number and diversity of species recorded we believe this group of mammals must be considered a management priority within this protected area. Our species list provides a baseline upon which management activities can be measured and evaluated. However, future studies focusing on species ecology, habitat preferences and population densities are required to inform management activities. For example further studies are required to enable the definition of zones within the protected area as defined by Brazilian Law (Law: 9.985/2000 (SNUC)). Zonation will enable the myriad objectives of a protected area to be met efficiently and in harmony with the regional and national socio-economic context (Wells & Brandon 1993, Halpin 1997). Although species richness and diversity is a criteria for establishing the conservation value of zones within the park (Instituto Florestal 2008, p. 257), there is as yet no data to define a spatially explicit map of species distributions for any floral or faunal group within Núcleo Caraguatatuba. We hope the list of mammals presented here encourages future studies to fill such gaps.

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