MEDIUM AND LARGE MAMMALS OF CAPARAÓ NATIONAL PARK, SOUTHEASTERN BRAZIL

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ABSTRACT. Brazil is considerate one of the countries with the highest diversity of mammals in the world. However, there are still many gaps in the knowledge of the ecology of mammalian species and because they are threatened by anthropic activities, it becomes increasingly necessary to gather information that contributes to their conservation. We characterized the medium and large-sized mammals in the Caparaó National Park (CNP), by analyzing species richness and frequency of records (hereafter abundance) in the two main vegetation types (i.e., Ombrophilous Forest and High Elevation Grasslands) found in the park. We carried out active searches and installed camera traps associated with sand-plots in 30 sampling sites. We performed rarefaction curves to verify that the sampling effort was sufficient to characterize species richness of the CNP, and we ordered the data obtained for species composition and abundance using a Non-Metric Multidimensional Scaling and assessed the relationship between the season (dry and rainy seasons) and vegetation types on mammalian species richness with a two-way analysis of variance. We recorded 34 native species of medium and large mammals and one exotic species (Canis lupus familiaris). Species composition and abundance differed between vegetation types. The Ombrophilous Forest presented higher species richness than the High Elevation Grasslands, which demonstrates that the medium and large mammalian community may be influenced by the environmental complexity. The CNP holds a rich community of medium and large mammals, with many endemic and endangered species of the Atlantic Forest.

RESUMO. Mamíferos de médio e grande porte no Parque Nacional do Caparaó: composição riqueza e abundância. O Brasil é considerado um dos países com maior diversidade de mamíferos do mundo. No entanto, ainda existem muitas lacunas no conhecimento da ecologia das espécies de mamíferos e, por estarem ameaçadas por atividades antrópicas, torna-se cada vez mais necessário reunir informações que contribuam para sua conservação. O objetivo desse estudo foi caracterizar a comunidade de mamíferos de médio e grande porte do Parque Nacional do Caparaó (PNC) analisando riqueza e abundância em duas principais fitofisionomias (i.e., Floresta Ombrófila e Campos de Altitude). Nossa hipótese foi de que a heterogeneidade ambiental exerce influência na comunidade de mamíferos. Instalamos 30 armadilhas fotográficas associadas a parcelas de areia nas duas principais fitofisionomias. Produzimos uma curva de rarefação para verificar se o esforço amostral foi suficiente para caracterizar a comunidade. Os dados obtidos de composição e abundância foram ordenados pelo Escalonamento Multidimensional Não Métrico (NMDS) e avaliamos a relação entre a estação (estações seca e chuvosa) e tipos de vegetação na riqueza de espécies de mamíferos com uma análise de variância bidirecional (ANOVA de duas vias). Registramos 34 espécies de mamíferos de médio e grande porte nativos e uma espécie exótica (Canis lupus familiaris). A composição e abundância das espécies diferiram entre as fitofisionomias. A floresta ombrófila apresentou maior riqueza de espécies em relação aos Campos de Altitude, o que demonstra que a comunidade de mamíferos de médio e grande porte pode ser influenciada pela complexidade ambiental. Com este estudo, foi possível demonstrar que no PNC ocorre uma rica comunidade de mamíferos de médio e grande porte, além de ser abrigo de diversas espécies endêmicas e/ou ameaçadas de extinção da Mata Atlântica.
**INTRODUCTION**

The Atlantic Forest is one of the world’s biomes with the highest biological diversity and most threatened taxa on the planet, classified as one of the 35 global biodiversity hotspots (Laurance 2009; Mittermeier et al. 2011). Originally, it occupied about 15% of the Brazilian territory, but today 26% of its native forest cover remains, which is distributed in small islands of vegetation, along a matrix of degraded areas, pastures, agriculture, and urban areas (Ribeiro et al. 2009; Joly et al. 2014; Rezende et al. 2018). Despite all this habitat loss and fragmentation, the Atlantic Forest remains an extremely biodiverse and heterogeneous biome, holding a high diversity of plant and vertebrate species, both with high levels of endemism (Tabarelli et al. 2005; Costa et al. 2019). National Parks in Brazil are areas protected by law and constitute natural environments. One of its functions is to guarantee the representativeness of significant samples of the different populations, habitats, and ecosystems of the national territory (Drummons et al. 2009). Currently, only 7% of the Atlantic Forest biodiversity hotspot is protected by law (Rezende et al. 2018).

The Caparaó National Park (CNP) has two main vegetation types that differ in their environmental complexity, with the less complex High Elevation Grasslands (HEG; Port Campos de Altitude) occurring generally above 1500 m a.s.l. and a more complex forest formation in the lower altitude areas (Simonelli & Fraga 2007; ICMBio 2015). According to the hypothesis of environmental complexity proposed by MacArthur & MacArthur (1961), structurally more complex environments provide a greater number of habitats and, therefore, may support a higher diversity of species (Bazzaz 1975; August 1983; Pacheco & Vasconcelos 2012). Generally, the diversity of species in a community is related to its structural characteristics; favoring activities such as escape from predators, and efficiency in foraging and reproduction (Tews et al. 2004). In most environments, plant communities determine the physical structure of habitats and thus have a strong influence on the distribution and interaction of animal species (Tews et al. 2004). However, depending on the taxonomic group, the diversity of species can decrease in more complex environments (Sullivan & Sullivan 2001; Tews et al. 2004). This pattern was observed for small mammals, where increased environmental complexity decreased species diversity (Sullivan & Sullivan 2001). In other studies, a positive correlation was found between the richness of mammal species and environmental complexity (Williams et al. 2002; Ferreguetti et al. 2017a; Pinho et al. 2017).

Mammals, especially medium and large ones, play an important role in the function of ecosystems (Lacher et al. 2019). They consume seeds (Logiudice & Ostfeld 2002) and disperse them (Acevedo-Quintero & Zanora-Abrego 2016), contributing to the maintenance and regeneration of the forest. In addition, they are prey and predators, involved in both top-down and bottom-up food chain processes (Terborgh et al. 2001). Despite Brazil is one of the countries with the highest diversity of mammals in the world (Paglia et al. 2012), there are still many gaps in the knowledge of the ecology of mammalian species. Because most species are threatened by anthropic activities (Pereira et al. 2018a), it becomes increasingly necessary to gather information that contributes to their conservation.

In this context, we characterized the medium and large mammal community of the CNP, a protected area (PA) that holds an important remnant of Atlantic Forest and has a high endemism of fauna and flora species (ICMBio 2015), in addition to being a refuge for rare and endangered mammal species such as Northern Muriqui (Brachyteles hypoxanthus), Ocelot (Leopardus pardalis) and Jaguarundi (Puma yagouaroundi) (ICMBio 2015). We analyzed species richness and frequency of records (hereafter abundance) of the community in the two main vegetation types of the CNP.

**MATERIAL AND METHODS**

**Study area**

We conducted the study in the Caparaó National Park (20°19′ S and 20°37′ S, 41°43′ W and 41°53′ W) which is located between the limit of the states of Minas Gerais (MG) and Espírito Santo (ES), Brazil (Fig. 1). The forest formations of the park are dense rain forest (montane and high montane) and a small portion of seasonal semideciduous montane forest. The HEG are formed by herbaceous-graminoid vegetation, interspersed with small shrubs (Garbin et al. 2017) that occur on rocky outcrops (ICMBio 2015). There are also areas of natural transition (ecotone) between forest and grasslands (ICMBio 2015).
We collected data in January-February (rainy season) and June-July (dry season) 2019, totaling 60 days of sampling effort in each site, 30 days per season. To assess the structure and species composition of the non-volant mammal’s community in the CNP, we selected 30 sampling sites to install one camera trap and four sand plots. These 30 sampling sites included the CNP’s two main vegetation types and were distributed as 20 sampling-sites in the Ombrophilous Forest and 10 sampling sites in the HEG. The number of sampling sites was proportional to the area of each vegetation type (70% forest and 30% HEG).

To determine the sampling sites, the CNP map was subdivided into grids of 1 km² each, from which 30 sites were selected (Fig. 1). The sites were chosen according to the accessibility, with a minimum distance of 1 km between each site to preserve the spatial independence of the samples. At each site, we installed one passive infrared sensor (i.e., detection caused by movement from individuals) Bushnell® camera trap in picture function, approximately 40-50 cm above the ground. All stations were examined every 20-25 days to change batteries, when necessary. We did not use bait to attract mammals. The camera traps were programmed to operate for 24 h/d. At each site, we also installed four sand-plots distributed 10 meters away from the camera trap, following the cardinal points (i.e., north, south, east, and west) and performed two hours of active search for direct (visualization and vocalization) and indirect (mammalian signs) records. The sampling effort of the camera traps was equivalent to the total days of operation, calculated with the minutes and hours recorded from the first to the last photograph (camera-days), totaling 1 800 hours/days of operation, with 2 100 hours/day in the forest and 600 hours/day in the HEG. The total effort for active searches was calculated per hour by two observers for each site, totaling 120 hours of active search, with 80 hours in the forest and 40 hours in the HEG.

Data analysis

The observed and estimated richness was represented by a rarefaction curve per vegetation type. We used the estimator Chao 1 due to the number of relatively rare species (Magurran 2013). The model with the estimators was performed with 1 000 randomizations and calculated in the software EstimateS® 9.2 (Colwell 2009). In general, we used field guides for species identification (Emmons & Feer 1997; Eisenberg & Redford 1999). For species such as felines of the genus *Leopardus*, armadillos of the genus *Dasypus* and brocket deer of the genus *Mazama*, we used specific literature (Oliveira 1998; Oliveira & Cassaro 1999; Duarte & González 2010; Groves & Grubb 2011; Feijo et al. 2018). We also used the known distribution of taxa in the states of Espírito Santo and Minas Gerais in the Atlantic Forest (Moreira et al. 2008; Paglia et al. 2012; Graipel et al. 2017). We considered the frequency of records of each species at intervals of 1 hour apart to maintain independence between the processed photos in each camera-trap. We ordered the data obtained from camera-traps by using a non-metric multidimensional scaling (NMDS) with Bray-Curtis metric to evaluate the similarity in composition and frequency records of the species. We used this analysis to verify the existence of some pattern in the community ordering in the CNP. The analyzes were performed in the R version 3.4.4 program, using a "metaMDS" function in the Vegan package version 2.5-4 for community analysis (Oksanen et al. 2013). We assessed the relationship between the season (dry and rainy seasons) and vegetation types on mammalian species richness with a two-way analysis of variance (Two-way ANOVA). Prior to running the two-way ANOVA, we tested whether the data met the assumption of normality using the Shapiro-Wilk statistic. We square-root transformed richness data. Homogeneity of variance was
We obtained 425 records in 60 days of effort per sampling site and recorded 34 native species of medium and large-sized mammals in the CNP, including five endemic species to the Atlantic Forest, and one exotic species the domestic dog, *Canis lupus familiaris* (Table 1). We found no difference in the species richness and abundance of mammals between seasons (F=0.125, p=0.72; rainy season=31 species and 205 records, and dry season=33 species and 220 records). From the 34 native species, we recorded 22 species present only in the forest vegetation type, 12 species using both vegetation types (Forest Ombrophile and HEG) and one species recorded exclusively in the HEG, the South American Tapir (*Tapirus terrestris*).

The 34 species recorded were distributed in 21 families belonging to nine orders, with the order Carnivora having the highest number of species (13 species), followed by Primates (six species), Rodentia (four species), Cingulata and Cetartiodactyla (three species each), Pilosa (two species), Didelphimorphia, Perisodactyla and Lagomorpha (both with one species each). The Forest rarefaction curve showed a tendency to stabilize and The HEG curve despite indicating a trend did not reach a plateau (Fig. 2). The estimated value (using the Chao 1 estimator) of the total richness for forested sites was approximately 31 species and the observed richness obtained in the survey was 24 species. In the HEG, estimated richness was 11 species and observed richness seven species (Fig. 2). This suggests that the list produced is sufficient to describe the composition of the medium and large mammal species of the CNP.

The NMDS showed that the composition and abundance of species in the medium and large mammal community differed between the vegetation types of the CNP (Fig. 3), with the Ombrophylous Forest showing a higher species richness (F=29.02, p<0.01; Fig. 4) in relation to HEG. The forested areas had an average richness of 22 species (ranging from 17 to 30 species). On the other hand, the HEG areas showed an average richness of seven species (ranging from 3 to 13 species). The most abundant species was *Nasua nasua* and * Sapajus nigritus* (both with 35 records) in the forest and *Cerdocyon thous* in the HEG. The least abundant species was *Bradypus variegatus* in the forest and *Herpailurus yagouaroundi* in the HEG.

### DISCUSSION

We recorded 34 species of medium and large mammals in the CNP, which represents approximately 19% of the medium and large mammal’s species found in the Atlantic Forest (Paglia et al. 2012). The species richness found in our study can be considered high when compared to other studies carried out in areas of Atlantic Forest in Brazil. A survey carried out in the Serra do Brigadeiro State Park with an area of 14 984 ha, using only camera-traps, recorded 10 species (Nunes et al. 2012). A study carried out at the Augusto Ruschi Biological Reserve (ARBR), which has an area of 4 000 ha, used a combination of different sampling techniques, including: active searches for sign such as footprints, feces, carcasses, and hair, in addition to field observation and use of camera traps, recorded 29 species (Gatti et al. 2014). Gatti et al. (2014) recorded a higher species richness in ARBR than the one recorded here and in the other studies mentioned before, suggesting that the use of more than one sampling method may be more efficient to record the richness of medium and large mammals (Laurindo et al. 2019).

We observed a difference in the composition, richness, and abundance of species between the two studied vegetation types, which may be related to environmental complexity. It is known that forest environments can provide a greater supply of resources such as fruits, seeds, plant biomass, as well as coverage and protection for dispersal and reproduction (Tscharntke et al. 2005; Fahrig et al. 2011), which probably likely supports a higher richness of medium and large mammals in the Ombrophylous Forest than in the HEG. In a study conducted on different vegetation types in the Cerrado in the state of Minas Gerais, the richness of medium and large mammal species was higher in more complex environments, and lower in less complex environments and, at higher altitudes (Pinho et al. 2017). Other studies have also found that species richness is higher in more complex environments (Prevedello et al. 2008; Ferreguetti et al. 2017a; Pinho et al. 2017). In our study, we observed species that are generally found in habitats with a higher degree of complexity, for example South American Red Brocket Deer (*Mazama americana*) (Duarte et al. 2012; Ferreguetti et al. 2015) and Ocelot (*Leopardus pardalis*). The Ocelot is a feline with specialized habits, frequently recorded in closed forest environments in the Atlantic Forest, as well as close to areas with water resources, and that avoids open areas environments and forest edges (Wolff et al. 2019). In the HEG, we recorded...
Table 1

List of medium and large mammal species recorded from January to July 2019 in the Caparaó National Park, located between the boundaries of the states of Espírito Santo and Minas Gerais, Brazil. Vegetation type: F - Ombrophilous Forest and HEG - High Elevation Grasslands. Method: CT – Camera-trap, FT – Footprint, and A – Active search. Conservation Status: LC: Least Concern; NT: Near Threatened; VU: Vulnerable, EN: Endangered and CR: Critically Endangered.

| Conservation status | Order | Family | Species | Common name | Vegetation type | Method | State | Endemism | ICMBio (2018) | IUCN (2020) |
|---------------------|-------|--------|---------|-------------|----------------|--------|-------|----------|--------------|-------------|
| Carnivora           | Canidae | Canis lupus familiaris* | Domestic dog | F | CT, FT, A | ES/MG | - | - | - | - |
|                     | Canidae | Cerdocyon thous | Crab-eating fox | HEG, F | CT, FT, A | ES/MG | Not | LC | LC |
|                     | Canidae | Chrysocyon brachyurus | Maned Wolf | F | CT, FT | MG | Not | VU | NT |
|                     | Felidae | Herpailurus yagouaroundi | Jagaarundi | F | CT | ES/MG | Not | VU | LC |
|                     | Felidae | Leopardus pardinus | Ocelot | HEG, F | CT, FT | ES/MG | Not | LC | LC |
|                     | Felidae | Leopardus guazulus | Southern Little Spotted Cat | F | CT | ES | Not | VU | VU |
|                     | Felidae | Leopardus wiedii | Margay | F | CT | ES | Not | VU | VU |
|                     | Felidae | Puma concolor | Puma | HEG, F | CT, FT | ES/MG | Not | VU | LC |
| Mespletidae         | Canidae | Canis semistriatus | Striped Hog-nosed Skunk | F | FT | MG | Not | LC | LC |
| Mustelidae          | Mustelidae | Eira barbara | Tayra | HEG, F | CT, FT, A | ES/MG | Not | LC | LC |
|                     | Mustelidae | Lontra longicaudis | Neotropical Otter | F | FT | ES | Not | LC | NT |
|                     | Mustelidae | Galictis cuja | Lesser Grison | F | FT | ES | Not | LC | LC |
| Procyonidae         | Canidae | Neosetara | South American Coati | HEG, F | CT, FT, A | ES/MG | Not | LC | LC |
|                     | Canidae | Procyon cancrivorus | Crab-eating Racoon | F | CT, FT, A | ES/MG | Not | LC | LC |
| Cetartiodactyla     | Cervidae | Mazama gouazoubra | South American Brown Brocket Deer | HEG, F | CT, A | ES/MG | Not | LC | LC |
|                     | Cervidae | Mazama americana | South American Red Brocket Deer | F | CT, A | ES | Not | LC | DD |
|                     | Tayassuidae | Pecari tajacu | Collared Peccary | F | CT, A | ES | Not | LC | LC |
| Cingulata           | Dasyproctidae | Cabassous tatusway | Greater Naked-tailed Armadillo | HEG, F | CT | ES | Not | LC | LC |
|                     | Dasyproctidae | Dasyprocta novemcincus | Nine-banded Armadillo | F | CT, A, ES/MG | Not | LC | LC |
|                     | Dasyproctidae | Dasyprocta sexcincus | Six-banded Armadillo | HEG, F | CT, A | ES/MG | Not | LC | LC |
| Didelphimorphia     | Didelphidae | Didelphis aurita | Southern Black-eared Opossum | F | CT, A | ES/MG | Not | LC | LC |
| Lagomorpha          | Leporidae | Sylvilagus floridanus | Tapeti | HEG, F | CT, A | ES/MG | Not | LC | LC |
| Perissodactyla      | Tapiridae | Tapirus terrestris | South American Tapir | HEG | CT, FT, MG | Not | VU | VU |
| Pilosa              | Myrmecophagidae | Tamandua tetradactyla | Southern Tamandua | F | CT, A | ES/MG | Not | LC | LC |
|                     | Myrmecophagidae | Bradypus variegatus | Brown-throated Solit | F | CT, A | ES | Not | LC | LC |
| Primates            | Atelidae | Aotus geoffroyi | Brown Howler Monkey | F | A | ES | Yes | LC | CR |
|                     | Atelidae | Alouatta caraya | Brown Howler Monkey | F | A | ES | Yes | CR | CR |
|                     | Callitrichidae | Callimico geoffroyi | Northern Maruquai | F | A | ES/MG | Yes | LC | LC |
|                     | Callitrichidae | Callimico penicillatus | Black-tailed Maruquai | F | A | ES/MG | Not | LC | LC |
|                     | Cebidae | Saimiri sciureus | Black-hooved Tufted Capuchin | F | CT, FT, A | ES/MG | Yes | LC | LC |
|                     | Cebidae | Callithrix penicillata | Black-tailed Capuchin | F | A | ES/MG | Yes | LC | LC |
|                     | Cebidae | Callithrix montosa | Northern Masked Titi Monkey | F | A | ES | Yes | LC | NT |
| Rodentia            | Caviidae | Hydrochoerus hydrochaeris | Capybara | HEG, F | CT, FT, A | ES/MG | Not | LC | LC |
|                     | Caviidae | Chinchilla | Spotted Paca | HEG, F | CT, FT, A | ES/MG | Not | LC | LC |
|                     | Caviidae | Coendou prehensilis | Brazilian Porcupine | F | A | ES | Not | LC | LC |
|                     | Caviidae | Guerilis brasilius | Southeastern Sparrow | F | CT, A | ES | Not | LC | LC |

*Exotic species.
species more frequently observed in open areas with less environmental complexity, such as the Crab-eating fox (*Cerdocyon thous*), Six-banded Armadillo (*Euphractus sexcinctus*) and the Tapeti (*Sylvilagus tapetillus*) (Juarez & Marinho-Filho 2002; Ferreguetti et al. 2016). The South American Tapir (*Tapirus terrestris*) was the only species recorded exclusively in the HEG. The tapir spends about 90% of their activity foraging (Medici 2010) and selects areas with vegetation in an early stage of succession to forage, because these places have more palatable plants, and the trees are smaller and shorter and more accessible to these mammals (Luca & Pardini 2017). In the CNP, tapirs were recorded only in HEG, which are areas where the vegetation is grassy, interspersed with small shrubs and, therefore, more accessible for foraging (Garbin et al. 2017). In addition, before being locally extinct, this species was also common in the HEG of the Serra dos Órgãos National Park (Cronemberger 2019).

Other factors may be acting in the community of non-volant mammals in the CNP, such as topography (terrain relief), historical factors (occurrence of species across evolutionary timescales), and climate conditions. In fact, Graham et al. (2014) argued that the variation in species richness and diversity along an altitudinal gradient is strongly linked to the natu-
...ral history and environmental characteristics of each chain of mountains. The climate conditions can also limit the number of species that can survive at different locations and elevations, while the physiological limits of species affect their occurrence (McCain & Grytnes 2010); being a possible explanation for the difference of richness between vegetation types in the CNP.

The higher representativity of species of the Orders Carnivora, Primates and Rodentia in our study was expected, because they are Orders of non-volant mammals with most diverse representation in the Atlantic Forest (Paglia et al. 2012). The Order Carnivora is commonly recorded in most of the studies conducted in the Atlantic Forest and in the Cerrado that used camera-traps as the main detection method (Nunes et al. 2012; Alves et al. 2014; Carvalho et al. 2014; Hendges et al. 2015; Ferreguetti et al. 2017a; Pereira et al. 2018b). Carnivores occupy several niches and have an important role in the ecosystem (Cheida et al. 2011; Ripple et al. 2014a). Top predators, such as the Puma (*Puma concolor*) can suppress populations of large and medium bodied herbivores, often increasing herbivores species richness as a result (Ripple & Beschta 2006; Ripple et al. 2014a,b; Laurindo et al. 2019). Ocelots also are specialists that depend on the forested environment and feed on smaller rodents and marsupials, as well as primates, armadillos and reptiles, thus promoting the population control of these prey (Fonseca & Robinson 1990; Terborgh 2000; Wolff et al. 2019).

About 25% of the total medium and large mammal fauna of the CNP is classified as endangered according to Instituto Chico Mendes of Biodiversity Conservation - ICMBio (2018) and the International Union for Conservation of Nature - IUCN (2020), emphasizing the importance of the CNP for the conservation of mammals of the Atlantic Forest. The jaguar (*Panthera onca*), appears in the CNP management plan, but it was not informed the method by which the species was recorded (ICMBio 2015). This feline was not recorded in the present study, so it was either not detected due to the small population size, or it may be extirpated in this region, which reinforces the importance of continued monitoring to validate this record.

The CNP is one of the protected areas in the country that hosts one of the most endangered primate species in the world, the Northern muriqui (*Brachyteles hypoxanthus*), which is also endemic to the Atlantic Forest (Mittermeier et al. 2005; Paglia et al. 2012). Historically, the main threats that led to the population reduction of this species were habitat loss and hunting (Ferraz et al. 2019). Northern muriquis are strictly forest primates and often use high altitude areas, above 1500 m, a fact that may be related to the availability of forest environments with low anthropic pressure (Cunha et al. 2009; Aximoff 2015).

The South American Tapir (*Tapirus terrestris*) is the largest terrestrial mammal in Brazil, classified as Vulnerable species (ICMBio 2018; IUCN 2020). Its low reproductive potential and long gestation period contribute to low population density of the species (Eisenberg & Redford 1999; Medici 2010; Ferreguetti et al. 2017b), which makes it vulnerable to local extinctions due to deforestation, illegal hunting, roadkill, and diseases transmitted by domestic animals (Medici et al. 2007; Ferreguetti et al. 2017b).

The presence of the Domestic dog (*Canis lupus familiaris*) in the CNP is a possible threat to the mammal community, because domestic dogs are opportunistic carnivores and can compete directly or indirectly with other wild carnivores, in addition to being potential transmitters and vectors of diseases to wild fauna (Nunes et al. 2012; Lessa et al. 2016). This species has been frequently recorded in studies carried out in protected areas of the Atlantic Forest (Srbeck-Araujo & Chiarello 2007; Nunes et al. 2012; Gatti et al. 2014; Allemand et al. 2019). In a fragment in the state of São Paulo, domestic dogs were observed preying on wild mammals such as Gray-brocket deer (*Mazama gouazoubira*) and Spotted Paca (*Cuniculus paca*) (Galetti & Sazima 2006). In the Serra dos Órgãos National Park, *Canis lupus familiaris* was the second most recorded species (Aximoff et al. 2015). In a recent study at Mata das Flores State Park in Espírito Santo, the presence of 89 individuals of domestic dogs was recorded within the park area in five months of sampling, equivalent to a density of 0.11 individuals per hectare (89/800 ha), demonstrating to be the highest density of domestic dogs registered in a protected area of Atlantic Forest (Allemand et al. 2019).

One of the main routes of entry for exotic species such as the domestic dog in PAs can be illegal hunting, because hunters use dogs to assist in the capture of desired species. Also, there are residences in the surroundings or even within PAs that facilitate the entry of these animals (Lessa et al. 2016). Actions for the control of exotic species must be conducted to reduce the impact caused on wild species. These actions include assessing the pathways of entry and establishment of an early detection system to increase the chances of eradicating these animals in PAs. Environmental programs also can make...
the population aware of the impact that domestic animals, such as dogs, can have on wild fauna (Lessa et al. 2016). The CNP has a high richness of species of medium and large mammals, harboring endemic species to the Atlantic Forest such as Alouatta guariba and Brachyteles hypoxanthus, and endangered species such as Leopardus guttatus and Tapirus terrestris. We found that, in general, species were more abundant in forest vegetation; suggesting that a higher environmental complexity as one of the factors that influences the distribution of species. In the case of the Atlantic Forest biome, that constantly suffers from the loss of habitat, and with a fauna that is extremely sensitive to environmental changes, it is important to have a PA like the CNP for the protection of fauna and flora. We hope that our study adds new knowledge about CNP mammals and stimulates further work, providing background for management plans and conservation measures.

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