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Survey of medium- and large-sized wild mammals in an Atlantic Forest fragment in the south of Minas Gerais state, Brazil

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ABSTRACT

Knowledge on medium- and large-sized mammals of the Atlantic Forest is still insufficient, especially because many sites remain to studied and inventoried, which hampers conservation initiatives. This study aimed to conduct a survey of the medium- and large-sized mammals that inhabit and/or use as migration routes the main area of forest reserve (12.2 ha) of the Federal Institute of Education, Science and Technology of southern Minas Gerais, Inconfidentes Campus – IFSULDEMINAS to collect data on occurrence, richness and diversity and thus fill a gap in scientific knowledge on local and regional mammalian species. The research was carried out from July 2012 to December 2014, with the camera trapping method being performed between February and December 2014. Records of 15 wild mammalian taxa belonging to 11 families and five orders were obtained, and complementarity of the different sampling methods was highly important for that outcome. This study allowed to conclude that, although reduced, the surveyed fragment contributes to conservation of these species by increasing food and shelter availability and by integrating to other areas with natural vegetation that are essential elements to the regional landscape.

Keywords: Mammalian fauna; Biodiversity; Sampling Methods

RESUMO

O conhecimento sobre os mamíferos de médio e grande porte da Mata Atlântica é ainda insuficiente, especialmente por existirem locais pouco estudados e inventariados, o que dificulta iniciativas para a conservação. O objetivo deste estudo foi efetuar o levantamento dos mamíferos de médio e grande porte que habitam e/ou utilizam em suas rotas migratórias a área principal de "reserva florestada" do Instituto Federal de Educação, Ciência e Tecnologia do Sul de Minas Gerais- IFSULDEMINAS - Campus Inconfidentes, descrevendo dados de ocorrência, riqueza, e diversidade, assim preenchendo uma lacuna no conhecimento sobre mastofauna local e regional. A pesquisa compreendeu o intervalo de julho de 2012 a dezembro de 2014. O método de armadilhamento fotográfico ocorreu entre fevereiro a dezembro de 2014. Quinze táxons de mamíferos silvestres pertencentes a cinco ordens e onze famílias foram registrados, destacando-se a importância da complementariedade dos diferentes métodos de amostragem para tal resultado. O presente trabalho permitiu inferir que, a despeito de constituir reduzida área (12,2 ha), a reserva contribui para a conservação da mastofauna de médio e grande porte, aumentando a disponibilidade de alimentos e abrigo além de integrar-se a outras áreas que restam da vegetação natural e que representam elementos essenciais da paisagem regional.

Palavras-chave: Mastofauna; Biodiversidade; Métodos de amostragem

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1 INTRODUCTION

Tropical forests are known as one of the greatest repositories of global biodiversity, hosting about two-thirds of the planet's plant and animal species (GARDNER et al., 2009; ALMEIDA, 2016; BARLOW et al. 2016). The Atlantic Forest, which is among the 34 regions of the planet recognized as a biodiversity hotspot (SCARANO; CEOTTO, 2015; SILVA, 2017; REZENDE et al., 2018), has lost its area and, consequently, its habitats (SILVA, 2017; SOS Mata Atlântica, 2017), thus resulting in isolated fragments of several sizes (RIBEIRO et al., 2009; ICMBio, 2018a; CALAÇA et al., 2019). Reduction in habitat areas causes the process of islands formation, which decreases gene flow among the species that inhabit the fragments; this favors endogamy and reduces the chances of survival of the individuals and the life conditions of plant and animal species (LEIMU-BROWN, et al., 2010; PERES et al., 2010; ALMEIDA, 2016; FALQUETTO et al., 2020). Reduction in the area of the ecosystems' remnants is intimately associated to human action, which rapidly converts the natural habitats into anthropogenic landscapes, also called human-modified landscapes (BOVO et al., 2018). A wide range of animal species undergo changes regarding their geographic distribution caused by anthropic actions (GRAIPEL et al., 2017; BIONDO; PLETSCH; GUZZO, 2019).

As regards biodiversity, Brazil is privileged in terms of flora and fauna. Because of its diversity, Brazil is second in the global rankings of total number of mammal species (PAGLIA et al. 2012; PERCEQUILLO et al. 2017; ICMBio, 2018a, BRANDÃO et al. 2019). Of the currently recognized mammals, about 732 species occur in Brazil (ICMBio, 2016, ICMBio, 2018a, ICMBio, 2018b; GRAIPEL et al., 2017). When four of the last published lists of the Brazilian mammalian species are compared, advancement of knowledge is observed (ICMBio, 2016, ICMBio, 2018a, ICMBio, 2018b; GRAIPEL et al., 2017). Among them, 110 were officially considered as threatened (15%) (ICMBio, 2016, ICMBio, 2018b).

The Atlantic Forest biome is one of the world's richest ecosystems in terms of diversity and endemism of plant and animal species. It has approximately 321

mammal species, 89 of them being endemic (PAGLIA et al., 2012; SILVA, 2017). Knowledge on the richness and diversity of the Brazilian mammals is still expanding due to factors such as the new techniques employed for species determination, the increasing number of taxonomists/systematists, the use of different concepts of species and subspecies, the new capture techniques, and the preparation of inventories in areas thus far unexplored in zoological terms (GRAIPEL et al., 2017). The Atlantic Forest is, unfortunately, the leader biome in species under threat of extinction: of the 1,173 animal species threatened in Brazil, 593, that is, a little over 50%, are in this forest, and 452 of them are endemic to this biome (ICMBio, 2018a).

The wild mammals are important bioindicators of the environmental quality of forests (CRUZ; CAMPELLO, 1998; JORGE et al., 2013; FALQUETTO et al., 2020). Machado; Drummont; Paguia (2008) stated that the main ecological interaction of these animals occurs through their feeding habits: herbivory, the animals feed on plants and seedlings, and thus control the plant populations (FALQUETTO et al., 2020); frugivory, the animals feed on fruits and disperse their seeds, thus contributing to plant genetic diversity and maintenance of the forests; granivory, the animals are seed eaters, dispersing or destroying them; insectivory, the animals control the populations of insects; carnivory, the animals control the populations of herbivores and other carnivores; and omnivory, the animals have a diverse diet, thus actively helping in the processes that influence the dynamics and maintenance of these ecosystems (REIS; PERACCHI; SANTOS, 2008; REIS; PERACCHI; PEDRO, 2011; MAGIOLI et al., 2015; GRAIPEL et., 2017).

In this scenario, survey of species occurring in different landscapes is of emerging importance to identify those most vulnerable to natural habitat loss, and thus ensure the minimum required for their survival (PRIMACK; RODRIGUES, 2001, SILVEIRA et al., 2010, ROBERTS, 2011); this will minimize the loss of genetic diversity (BOVO, et al., 2018). It is possible to protect and conserve the biodiversity of a given region when its endemic animal species are known (PIMM et al. 2014; GRAIPEL et., 2017).

The aim of the present study was to perform a survey of medium- and large-sized mammals in an Atlantic Forest reserve area in the Federal Institute of Education, Science and Technology of southern Minas Gerais, Inconfidentes Campus - IFSULDEMINAS, filling a gap in scientific knowledge by collecting data on the occurrence, richness and diversity of mammal species that inhabit the area or use it as feeding grounds or migration routes.

2 MATERIAL AND METHODS

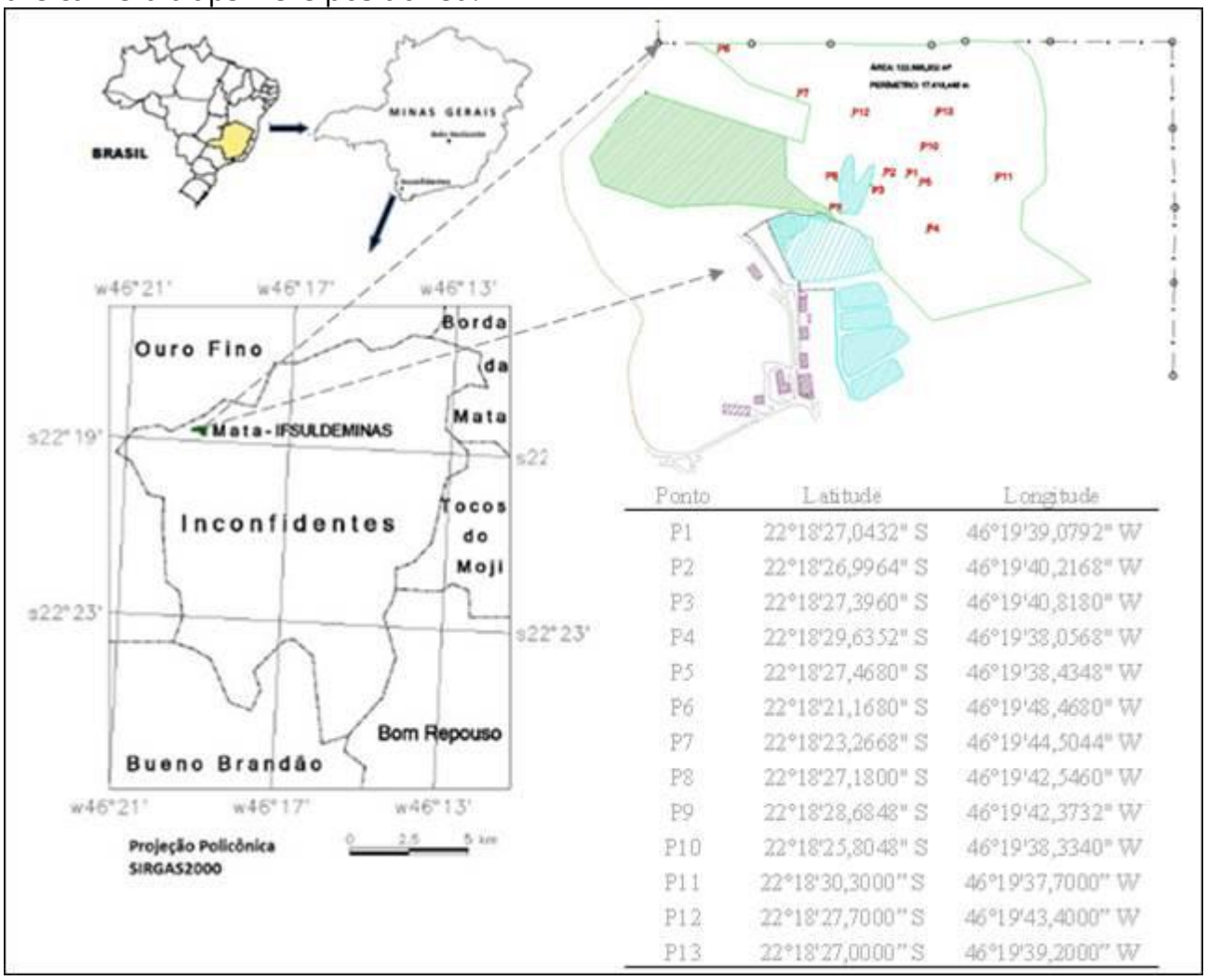
2.1 Study area

The survey was conducted in the municipality of Inconfidentes, in the south of Minas Gerais state, Brazil, next to Highway MG-290, with the geographic coordinates of 22° 19' 02" S; 46° 19' 40" W, at an average altitude of 855m. The municipality covers an area of 145 km^2 and presents a mountainous topography belonging to the hydrographic sub-basin of the Mogi-Guaçu River of the Rio Grande Basin.

According to Köppen's classification, the climate of the region is of the humid tropical type (Cwb), with two distinct seasons: the rainy one, which begins in October and ends in March, and the dry one, which extends from April to September. There is a predominance of mild and rainy summers, with a temperature of 22°C and annual rainfall between 1,400 and 1,700 mm. Winters are cold and dry, with temperatures of about 16.5°C and annual rainfall between 140 and 170 mm. The region's vegetation is characterized as Submontane Semidecidual Seasonal Forest (ALVARES et al., 2013).

The survey of medium- and large-sized mammals was performed in a forest reserve with an area of 12.2 ha in the Federal Institute of Education, Science and Technology of southern Minas Gerais, Inconfidentes Campus – IFSULDEMINAS (Figure 1). A Magellan Triton 500 GPS was used for georeferencing of the monitoring points, and the data were input to the DataGeosis *software*.

Figure 1 – Geographic location of the forest reserve of the Federal Institute of Education, Science and Technology of southern Minas Gerais, Inconfidentes Campus – IFSULDEMINAS, and the georeferenced sampling points where the footprint traps and the camera traps were positioned.



Ponto	Latitude	Longitude
P1	22°18'27,0432" S	46°19'39,0792" W
P2	22°18'26,9964" S	46°19'40,2168" W
P3	22°18'27,3960" S	46°19'40,8180" W
P4	22°18'29,6352" S	46°19'38,0568" W
P5	22°18'27,4680" S	46°19'38,4348" W
P6	22°18'21,1680" S	46°19'48,4680" W
P7	22°18'23,2668" S	46°19'44,5044" W
P8	22°18'27,1800" S	46°19'42,5460" W
P9	22°18'28,6848" S	46°19'42,3732" W
P10	22°18'25,8048" S	46°19'38,3340" W
P11	22°18'30,3000" S	46°19'37,7000" W
P12	22°18'27,7000" S	46°19'43,4000" W
P13	22°18'27,0000" S	46°19'39,2000" W

2.2 Experimental period

The research was conducted from July 2012 to December 2014. Data collection consisted of direct records, visualizations and photographs, and indirect records, occurrence of prints, scats and carcasses. The photographic records were taken from February to December 2014.

2.2.1 Footprint traps

The footprint traps were made in accordance with the protocol of Pardini et al. (2003), consisting of wooden boxes with an area of 50 cm^2 and 3 cm of height; the ground was covered with wet sand. The baits used to attract the mammals were banana, bacon and sardine. The traps were positioned at nine points spaced at least

50 m from each other. Data of the prints on the sand parcels were registered by visiting the sites every 15 days, for two consecutive days, from July 2012 to June 2014.

Every inspection the existing prints were photographed and identified, and then compared with field guides (BECKER; DALPONT, 1999; BORGES; TOMAS, 2004; OLIVEIRA; CASSARO, 2006). After being photographed, the prints were wiped off and the sand layer was renewed in order to allow a new homogeneous sampling (OLIVEIRA, 2007).

2.2.2 Line transects and active search for vestiges

The line transects and active search for vestiges census methods were performed concomitantly. For that, four transects were established along 2 km at a maximum distance of 500 m apart. The transects were covered at an average speed of 1 km h^{-1} always at the same time in the afternoon (from 14:00 to 18:00). Vestiges included prints, scats and carcasses of animals found in the transects (VOSS; EMMONS, 1996). The sampling effort totalized 384 km covered in 96 field days.

2.2.3 Camera trapping

The photographic records were made daily from July 14 to December 22, 2014, totaling 162 observation days, by installing four Tigrinus cameras with an infrared sensor for detecting presence and movement. The devices were placed at 13 distinct and strategic points within the fragment. Total sampling effort comprised 648 days and 15,552 hours. The traps were positioned 40 cm above ground level at a minimum distance of 100 m apart. The four cameras were reallocated every 40 days, with the exception of points 2 and 13, at which the traps were kept for 80 consecutive days due to the occurrence of species threatened with extinction. Images of the camera traps were consulted and identified through specialized literature (EMMONS; FEER, 1997; OLIVEIRA; CASSARO, 2006; BORGES; TOMAS, 2004) and experts.

2.3 Data analysis

After field data collection, analyses regarding occurrence, richness and diversity were performed. In order to comprise the list of occurrence and richness of the species found in the fragment, mammals weighing between 1.0 and 7.0 kg were considered medium-sized (CHIARELLO, 2000; FONSECA et al. (1996), while those weighing more than 7.0 kg were considered large-sized (EMMONS; FEER, 1997; FONSECA et al., 1996).

Species occurrence (presence/absence) was considered per point, with the number of records of each species being considered as the frequency of occurrence. Relative species abundance was expressed through the total number of photographic records of each species in relation to the total number of photographic records of all species, expressed in percentage and graphically shown.

The species diversity obtained for each point through camera trapping was assessed via the Shannon-Wiener (*H'*) diversity index, according to Magurran (1988). This index is calculated according to the relationship between the number of individuals of each species and the total number of sampled individuals through the following equation (1)

$$H' = -\sum_{i=1}^{S} \frac{ni}{N} * \ln \frac{ni}{N}$$

Where, *H'* is the diversity index; *S* is the number of species, named richness; *N* is the total number of all individuals; and *ni* is the number of individuals in each species *i*.

Animals with proven occurrence were also related to their conservation status or degree of threat they face in three official lists of wild fauna species: at global level, according to the IUCN Red List of Threatened Species (IUCN, 2016); at national level, as in Brazil Red Book of Threatened Species of Fauna (ICMBio, 2018a); and at regional level, according to Minas Gerais State Red List of Endangered Species (COPAM, 2010).

Classification of each species into trophic guilds by the predominant feeding habit was obtained from Marinho-Filho; Rodrigues; Juarez (2002) and Dalponte (2009).

The taxa were defined according to the nomenclature of species followed by Paglia et al. (2012), Patton; Pardiñas, D'elía (2015). The species occurring outside their natural range were considered exotic, as in Falk-Petersen; Boht; Sandlund (2006).

2.4 Ethical procedures

This research project is registered in the *Núcleo de Pesquisa e Extensão* (NIPE), Inconfidentes Campus, and was approved in Call Notice 03/2012, with private funds. The data obtained in the survey were registered afterwards by filling a lengthy online form consisting of the taxa of the medium- and large-sized mammals recorded in the study, as well as the methods employed, following instructions and answers to the technical questions of the researchers of the *Instituto Chico Mendes de Conservação da Biodiversidade*; authorization was obtained through license via protocol SISBIO # 35393-3.

3 RESULTS AND DISCUSSION

3.1 Species richness

Records of 16 mammalian taxa were obtained in the surveyed forest fragment, fifteen of them being medium- and large-sized wild mammals belonging to 11 families and five orders (Table 1; Figure 2). With respect to the conservation status, four of the registered taxa are in the Minas Gerais State Red List of Endangered Species and in the Brazil Red Book of Threatened Species of Fauna*: Chrysocyon brachyurus* (Illiger, 1815), *Leopardus tigrinus* (Schreber, 1775), *Ozotoceros bezoarticus* (Linnaeus, 1758) and *Puma concolor* (Linnaeus, 1771). The first three species appear in the IUCN Red List of Threatened Species.

Even though part of the species found in this study is not included in categories of threat of official lists, it may not be stated that they are not struggling with habitat degradation and fragmentation caused by anthropogenic disturbance. Such species are likely to present a greater plasticity and tolerance to such effects, besides being of a wide geographic distribution, as claimed by Preuss et al. (2016).

Two exotic species are among those recorded in the current investigation: *Myocastor coypus* (Molina, 1782) and *Canis familiaris* (Linnaeus, 1758). The first one is native to Neotropical South America, and the second to other zoogeographic regions. Similar species were observed by Bovo et al. (2018); as regards *Canis familiaris*, the species dispersal in rural environments favors incursion into forest reserves for alternative feed sources. *Myocastor coypus* has been currently registered in other areas of the municipality of Inconfidentes, most probably due to excessive food availability in rural environments, lack of proper handling of solid residues, and/or accumulation of organic matter being decomposed. This should alert local health authorities to make decisions aiming at protecting the ecosystem and the health of the population.

Table 1. Richness of medium- and large-sized species of mammals in Inconfidentes Campus/Minas Gerais state. Record type (RT): Ca: Carcass; Ct: Camera trap; Sc: Scats; Pr: Print; As: Active search (visualization and vestiges); Category of Threat (CT) EN: Endangered; VU: Vulnerable; NT: Near threatened *exotic species; MG = Minas Gerais state; BR = Brazil; IUCN (International Union for Conservation of Nature).

TAXON	COMMON NAME	RT	CT
ARTIODACTYLA			
Cervidae			
Ozotoceros bezoarticus (Linnaeus, 1758)	Pampas deer	Ct	EN(MG),VU(BR)NT(IUCN)
CARNIVORA			
Canidae			
Cerdocyon thous (Linnaeus, 1766)	Crab-eating fox	Pr/Ct	-
Chrysocyon brachyurus (Illiger, 1815)	Maned wolf	Pr/Ct	VU(MG,BR), NT(IUCN)
Canis familiaris (Linnaeus, 1758)*	Domestic dog	As/Ct	-
Felidae			
Puma concolor (Linnaeus, 1771)	Puma	Pr/Ct	VU(BR, MG)
Leopardus tigrinus (Schreber, 1775)	Northern tiger cat	Ct	EN(BR),VU(MG,IUCN)
Procyonidae			
Nasua nasua (Linnaeus, 1766)	South American coati	Pr/Ct/As	-
Procyon cancrivorus (G.Cuvier, 1798)	Crab-eating raccoon	Ca	-
Mustelidae			
Galictis cuja (Molina, 1782)	Lesser grison	Ct	-
CINGULATA			
Dasypodidae			
Dasypus novemcinctus (Linnaeus, 1758)	Nine-banded armadillo	Ca	-
Euphractus sexcinctus (Linnaeus, 1758)	Yellow armadillo	Ct	-

DIDELPHIMORPHIA			
Didelphidae			
Didelphis aurita (Wied-Neuwied, 1826)	Brazilian common opossum	As/Ct	-
RODENTIA			
Caviidae			
Hydrochaeris hydrochaeris (Linnaeus, 1766)	Capybara	Pr/Sc/As/Ct	-
Cuniculidae			-
Agouti paca (Linnaeus, 1758)	Agouti	Pr/Ct	-
Erethizontidae			
Coendou prehensilis (F. Cuvier, 1823)	Brazilian porcupine	As	-
Myocastoridae			
Myocastor coypus (Molina, 1782)*	Coypu	Pr/As	-

The table with the list of species was elaborated by combining the four sampling methods: firstly, prints were identified; next, occurrences of vocalizations and observation of dens, carcasses and scats were registered when covering the line transects; then, direct visual sightings of individuals *in vivo*; and, lastly, photographic records of live individuals *in situ*. The use of a single method would probably not explain the occurrence of so many taxa in such a reduced fragment. Thus, complementarity of the four methods, the length of time and the sampling effort explain the success in the amount of taxa in this reduced fragment.

Figure 2 - Medium- and large-sized mammals recorded in Inconfidentes Campus/Minas Gerais state; a: *Puma concolor*; b: *Leopardus tigrinus*; c: *Ozotoceros bezoarticus;* d: *Chrysocyon brachyurus;* e: *Cerdocyon thous*; f: *Canis familiaris*; g*: Nasua nasua*; h: *Galictis spp.;* i: *Procyon cancrivorous*; j: *Hydrochoerus hydrochaeris*; k: *Agouti paca*; l: *Myocastor coypus*; m: *Euphractus sexcinctus;* n: *Dasypus novemcinctus;* o: *Didelphis aurita*.

Ribeiro et al. (2009) verified that 83.4% of the Atlantic Forest fragments are within the size class ranging from 0 to 50 ha, thus validating the importance of surveying these reduced fragments for the development of conservation strategies at local and regional level. Despite the reduced area of the forest fragment under

investigation, the present findings revealed that the 12.2-ha area presented a relatively high species richness in comparison with other assessments carried out in Atlantic Forest fragments, which indicates the need for further studies and conservation efforts. The presence of endangered and vulnerable species in such a small physical space which has highways going through it is among other claims.

Preuss et al. (2016) registered 23 taxa within a 220-ha area in the western region of Santa Catarina state; Wolfart et al. (2013) recorded 20 taxa in a 220-ha Atlantic Forest remnant in southeastern Paraná state, while Rossaneis (2014) registered 14 taxa in four small forest remnants (fragments) with a total area of 27.4 ha in the north of the same state. The distinct number of taxa reported in the different studies may result from the variation in size between the sampled areas as well as from a greater effort and the use of a combination of methodologies. Silva (2008) recorded 17 species in five forest fragments totaling 35 ha, and Alves; Fonseca; Engel (2012) registered 18 species in 747 ha using different methods. The number of species found in this study was smaller than that observed by Bovo et al. (2018), who described 22 species, six of them being small-sized and 16 medium- and large-sized, in three forest fragments (10, 14 and 26 ha); nonetheless, the survey was performed in a 50-ha area in the Atlantic Forest biome, which is four times greater than the fragment assessed in the current survey. The species richness found in this study, represented by 16 taxa, is within the range normally reported in investigations conducted in Seasonal Forests: from 13 to 34 species (ALVES; FONSECA; ENGEL, 2012).

It must be noted that the present investigation observed a difference between the tested methods, thus corroborating the results of Santos, Bueno; Casella (2013) and Roberts (2011). Such difference may be related to the fact that the sampling efforts and the methods compared are distinct and complementary. Voss; Emmons, (1996) preconize the need for a combined application of several surveying methods, since the use of a single methodology may not be able to explain the different species found in a given area. Pardini et al. (2003) claim that line-transect censuses may not be capable of detecting rare species as carnivores, while trail counts are not

trustworthy for closely related groups of species which have very similar trails, such as deers, wild pigs and small cats (BORGES; TOMAS, 2004).

In keeping with Oliveira (2007) and Roberts (2011), the present study highlights that footprint traps is a cheap and efficient method; camera trapping, in turn, requires time and great physical effort to be set up, and is thus not indicated for rapid surveys. On the other hand, the use of camera trapping may produce a more efficient mammalian survey with regard to time, equipment and costs, which is in agreement with Melo; Sponchiado; Caceres (2012); these authors demonstrated that such method improved the chances to evaluate species composition in a shorter period of time, with particular respect to those lower-density and cryptic ones.

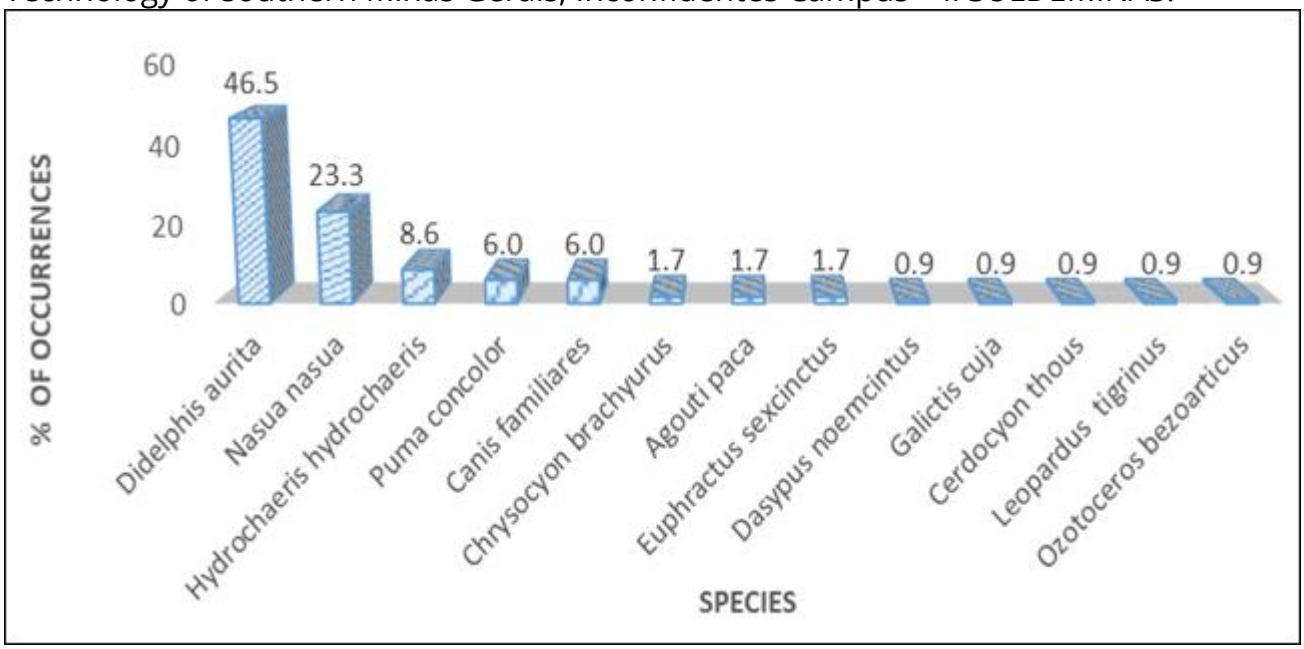
The use of camera traps in the current assessment allowed to monitor species that exhibit a nocturnal behavior and that occur at low densities, such as *Puma concolor* (Linnaeus, 1771*)* and *Chrysocyon brachyurus* (Illiger, 1815); this is in accordance with Tomas and Miranda (2003) and Reis et al. (2009), who stated that this is a complementary and greatly important method for surveying low-density species. Besides, the active search method has added more taxa.

3.2 Frequency of occurrence per taxon

The camera trap method allowed to analyze the occurrence of the species (Figure 3) found in the 162 sampling days. Constancy of occurrence indicated that the species with the greatest frequency during the study period were: *Didelphis aurita* (Wied-Neuwied, 1826), with 46.5%; *Nasua nasua* (Linnaeus, 1766), with 23.3%; *Hydrochaeris hydrochaeris* (Linnaeus, 1766), with 8.6 %; and *Puma concolor* (Linnaeus, 1771) and *Canis familiares* (Linnaeus, 1758), both with 6.0%. Of the mentioned taxa, *Nasua nasua* (Linnaeus, 1766) is considered vulnerable in Rio Grande do Sul state (REIS et al., 2009), and *Puma concolor* (Linnaeus, 1771) is listed as a vulnerable species under the Brazil Red Book of Threatened Species of Fauna (ICMBio, 2018a) and the Minas Gerais State Red List of Endangered Species (COPAM, 2010). *Didelphis aurita* (Wied-Neuwied, 1826) was the most observed taxon in the photographic records. Indeed, marsupials are very common in their distribution area,

which demonstrates their efficiency to adapt to the most varied habitats, including the urban centers (ROSSI; BIANCONI; PEDRO, SILVA, 2008); according to Monteiro Filho and Abe (1999), this species may aid in the regeneration of disturbed forests by composing its diet of fruits and pioneer plants and thus act as seed dispersers, especially for living at a high density.

Figure 3 - Frequency of occurrences per taxon according to the camera trapping method in the forest reserve of the Federal Institute of Education, Science and Technology of southern Minas Gerais, Inconfidentes Campus – IFSULDEMINAS.



Nasua nasua (Linnaeus, 1766) was widely represented in percentage of occurrence in the assessment area, which was corroborated by the remaining survey methods; this finding indicates that the species uses the area as an important site for its life and includes the fragments in its migratory routes. This taxon was visualized in line transects and during active search for vestiges; the animals were sighted in treetops, where, according to Campos; Santos; Setz (2006), is the main place they live. Although the fragment under study is small, the colony of coatis uses the forest in its routine activities.

The species *Hydrochaeris hydrochaeris* (Linnaeus, 1766), verified through the prints, traps and active search methods, was identified with numerous offspring, thus indicating that the populations are reproducing and, therefore, have the potential to

increment the number of individuals along the time (BOVO et al., 2018). This taxon is privileged for adapting to altered environments and different foods, as shown by Ferraz et al. (2009) and Pereira; Eston (2007).

This study observed an expressive occurrence of *Puma concolor* (Linnaeus, 1771), the greatest remaining predator, most probably because it uses the forest as an ecologic corridor or stepping stone (MAGIOLI et al., 2015); its living area may vary from 10 to more than 1000 km^2, being generally smaller in the case of females (REIS et al. 2009). Such finding shows that the fragment helps to maintain this taxon in the region, and must thus be the target of biological restoration (BOVO et al., 2018). As stated by Machado; Drumont; Paguia (2008), the presence of this mammal, which occupies the top of the food chain, may directly influence in the dynamics of the ecosystem where it lives. It is worth mentioning that the occasional occurrence of some taxa may be related to the natural rarity of their members or to their peculiar characteristics, mostly solitary and/or nocturnal, as is the case of *Chrysocyon brachyurus* (Illiger, 1815) and *Ozotoceros bezoarticus* (Linnaeus, 1758); consequently, visibility and occurrence are reduced, as reported by Preuss et al. (2016).

An important issue to be approached with regard to this forest fragment is the constant presence of free-ranging dogs; territorial competition is among the main threats to native species, since the simple presence of domestic or feral dogs in these areas intensifies competition for space and natural resources (MACK et al., 2000). Predation is another threat; domestic dogs usually prey on wildlife just to play. They may hurt animals and cause their death in these games of predators and preys, but not always feed on them (GOMPPER, 2013). Disease transmission is another menace for wildlife, since these dogs act as reservatories of parasites and pathogens to which the wild animals are not immune; thus, they offer potential risk of diseases as canine distemper virus, canine parvovirus, rabies, leishmaniasis, etc (LESSA, 2017).

3.3 Diversity

Based on the data collected via camera trapping, the Shannon-Wiener *H´* diversity index found in this study was 1.53. This is considered a relevant value: according to Magurran (1988), who was cited by Rocha; Dalponte (2006), this index usually ranges from 1.5 to 3.5. Rossaneis (2014) conducted a study in forest remnants with areas varying from 5.4 to 15 ha in the Atlantic Forest in the north of Paraná state and registered diversity indices ranging from 1.97 to 2.02, respectively. The author demonstrated that the smaller the anthropic interferences, the greater the *H´*; therefore, the diversity index is related to the level of environmental disturbance.

An assessment performed in a 470-ha area of Cerrado in Mato Grosso do Sul state, where the plant formation is different, found a Shannon-Wienner *H´* diversity index of 2.4, that is, formations with tree and field layers attract different fauna and may have contributed to a higher number of registers (SPONCHIADO, 2011). The *H´* value found in the mentioned study was greater than the one obtained in the current survey. Nonetheless, as seen in other investigations, larger sampling areas have greater diversity indexes. Besides the reduced sampling area (12.2 ha), strong and growing pressure as well as anthropogenic interference were confirmed in the present study, which may explain the lower diversity index.

4 CONCLUSIONS

This study described considerable richness regarding medium- and large-sized wild mammals, despite the anthropic pressures to which the surveyed forest fragment is subjected and also the reduced area it covers. Attention must be drawn to the occurrence of species under threat of extinction, as *Puma concolor* (Linnaeus, 1771), *Chrysocyon brachyurus* (Illiger, 1815), *Ozotocerus bezoarticus* (Linnaeus, 1758) and *Leopardus tigrinus* (Schreber, 1775); the last species is considered endangered in Minas Gerais state.

A small fragment is not an ideal environment for wild species, since it does not ensure survival of its populations in the long term, especially of those which require great areas to survive and occur at low densities such as *Puma concolor*, *Chrysocyon brachyurus* and *Leopardus tigrinus*. However, a reduced forest area must be considered within the context of the landscape as a possibility for the connection of threatened populations, thus contributing to reduce endogamy. The fragment under study presents opportunities for the conservation of endangered and vulnerable species, being able to work as a stepping stone.

It is important to establish monitoring programs for the effective conservation of the species; such programs should guide management practices in the forest area, aiming to promote conservation of local and regional biodiversity. When taken in time, certain measures may minimize the existing impacts and prevent risks of reduction in the diversity and of natural resources scarcity, which are currently under threat in this area, for future generations.

The present survey suggests studies that consider individual identification of the sampled specimens, thus allowing for a population approach of the mammals in the investigated area as well as in the region it is located. It contributes to population studies, which have a great relevance in biodiversity conservation, especially when performed in the long term and generate data that can be compared along the time.

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