Birds of prey (Accipitriformes and Falconiformes) of Serra de Itabaiana National Park, Northeastern Brazil

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Abstract

Birds of prey are important for maintaining ecosystems, since they can regulate the populations of vertebrates and invertebrates. However, anthropic activities, like habitat fragmentation, have been decreasing the number of birds of prey, affecting the habitat ecological relations and, decreasing biodiversity. Our objective was to evaluate species of birds of prey (Accipitriformes and Falconiformes) in a protected area of the Atlantic forest in northeastern Brazil. The area was sampled for 17 months using fixed points and walking along a pre-existing trail. Birds of prey were classified by their Punctual Abundance Index, threat status and forest dependence. Sixteen birds of prey were recorded, being the most common *Rupornis magnirostris* and *Caracara plancus*. Most species were considered rare in the area and not dependent of forest vegetation. None of the registered species were threatened with extinction. Our results showed that the studied area presents a considerable diversity of birds of prey, including species sensitive to environmental changes. Thus, it is important to protect this area to increase the availability of feeding and nesting areas for birds of prey.

Keywords: Caatinga, ecotone, falcon, hawk.

Aves de rapina (Accipitriformes e Falconiformes) do Parque Nacional da Serra de Itabaiana, Nordeste do Brasil

Resumo

As aves de rapina são importantes para a manutenção dos ecossistemas, pois podem regular as populações de vertebrados e invertebrados. Porém, atividades antrópicas, como a fragmentação do habitat, vêm diminuindo o número de aves de rapina, afetando as relações ecológicas do habitat e diminuindo a biodiversidade. Nosso objetivo foi avaliar espécies de aves de rapina (Accipitriformes e Falconiformes) em uma área protegida de Mata Atlântica no nordeste do Brasil. A área foi amostrada por 17 meses em pontos fixos e percorrendo uma trilha pré-existente. As aves de rapina foram classificadas por seu Índice de Abundância Pontual, status de ameaça e dependência da floresta. Dezesseis aves de rapina foram registradas, sendo as mais comuns *Rupornis magnirostris* e *Caracara plancus*. A maioria das espécies foi considerada rara na área e não dependente da vegetação florestal. Nenhuma das espécies registradas estava ameaçada de extinção. Nossos resultados mostraram que a área estudada apresenta uma diversidade considerável de aves de rapina, incluindo espécies sensíveis às mudanças ambientais. Assim, é importante proteger esta área para aumentar a disponibilidade de áreas de alimentação e nidificação para aves de rapina.

Palavras-chave: Caatinga, ecótono, falcão, gavião.

Introduction

Birds of prey (also known as raptors: Accipitriformes and Falconiformes) are animals of great importance for the ecological balance of different ecosystems (Donázar *et al.*, 2016). As top predators, these birds regulate prey populations, which includes rodents, insects, reptiles, amphibians, and other birds, thus playing a key role in maintaining biodiversity (Donázar *et al.*, 2016; Buechley *et al.*, 2019).

Birds of prey can be found in a variety of habitats, from grasslands to forests, and behavioral, ecological, and physiological characteristics of the species determines their habitat selection and use (Buechley *et al.*, 2019). Normally,

birds of prey present low-density populations, but with individuals occupying large territories (Donazar *et al.*, 2016), which makes them excellent "umbrella species" for conservation efforts (Donazar *et al.*, 2016).

Several studies have pointed out that the loss of bird species in a given environment is directly related to habitat reduction and fragmentation (Sarasola, Grande & Bechard, 2018), which, although affecting all biodiversity, have a more intense effect on groups such as the birds of prey, which can be highly sensitive to environmental changes (McClure *et al.*, 2018). This is the case of the Atlantic forest of Brazil, who is a biome extremely rich in biodiversity, but also extremely destroyed and fragmented by human activities (Eisenlohr, Oliveira-Filho & Prado, 2015). In the Northeast of Brazil, the Atlantic Forest presents the most worrying scenario, since only 2% of the original cover remains, from which the conservation units protect only 3% (Tabarelli, Aguiar, Ribeiro, Metzger, & Peres, 2010).

Bird surveys are the first step aiming raptor conservation (Poirazidis, 2017), however, although raptor surveys are conducted in the southern areas of Atlantic forest, they are scarce on the Atlantic forest fragments of northeastern Brazil (Silveira, Olmos & Long, 2003). Brazil has elaborated a National Conservation Plan for birds of prey (Soares *et al.*, 2008), but raptor surveys are needed for better implementation of the conservation plan. In this scenario, studies that evaluate the occurrence, richness, and abundance of birds of prey are necessary, especially in highly fragmented habitat such as the Atlantic forest of northeastern Brazil. Thus, the present study aimed to investigate the community of birds of prey in a protected area located in a transition zone between the Atlantic Forest and the semi-arid region in the Brazilian Northeast.

Material and Methods

Study area

The study was conducted in the Serra de Itabaiana National Park (PARNASI), Sergipe state, Northeastern Brazil (10°46'9.174"S, 37 °20'12.113"W). The PARNASI is formed by a complex of three mountain ranges: Serra do Cajueiro, Serra Comprida and Serra de Itabaiana, which together comprise an area of 7,966 ha, presenting about 659 m of maximum altitude, in the Serra de Itabaiana (Costa, 2014). The matrix that surrounds PARNASI is composed of an anthropic landscape, formed mainly by pastures and arable land. The predominant climate in the region, according to the Köppen classification, is of the As type, tropical, with dry summer and moderate water surplus in winter, with average temperature varying from 21° to 26 °C and annual rainfall between 900 to 1200 mm (Costa, 2014).

The transition from the Atlantic Forest to the semi-arid region (*Caatinga*) establishes an ecotone in the region, in which species of fauna and flora from both ecosystems coexist, distributed between open and closed vegetal formations (Dantas & Ribeiro, 2010). Composed of shrubs and trees of small and medium size, the open areas occur on slopes and areas of altitude, developing on white-sandy soils, while the closed areas are formed by secondary forests, located mainly on the slopes and along the streams (Dantas & Ribeiro, 2010).

Sampling and data analysis

Sampling was carried out between November 2014 and March 2016. We perform fixed point observation, where birds were identified by visual and vocalization contacts, using 8x42 binoculars and literature consults (Sick, 1997). Five sampling points were distributed on the margins of forest fragments in the Serra de Itabaiana with favorable conditions for the detection of birds of prey (Figure 1). Observations were made from 06:00 AM to 12:00 PM in each point; visits were drawn at random, in a way that all points were visited once per month. In addition, we also made observations on a pre-existing trail of approximately 3 km, located within PARNASI, in order to obtain a better representation of the phytophysiognomic variations present in the area and to register the species that usually occupy the interior of these environments. Observations on the trail were also made once a month, from 06:00 AM to 12:00 PM.
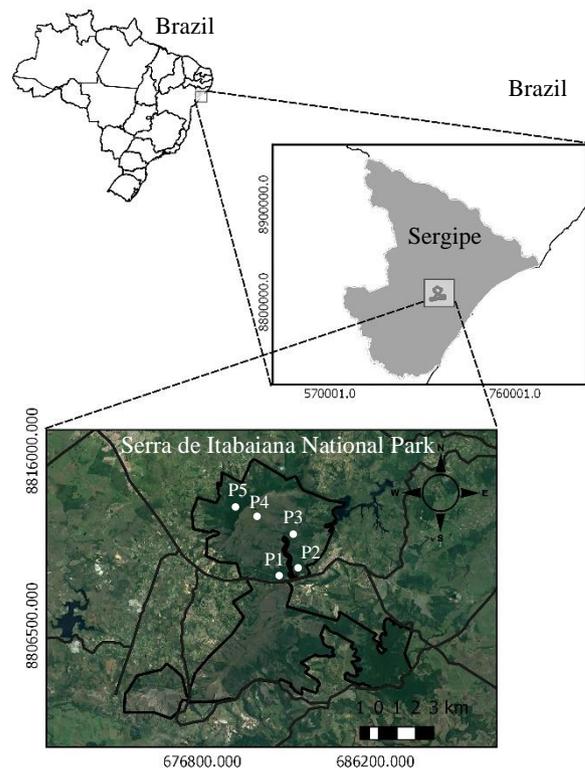

Figure 1. Location of the sampling points (P1-P5) and the trail in the Serra de Itabaiana National Park, Sergipe, Brazil.

The taxonomic classification followed the Committee of Brazilian Ornithological Records (Piacentini *et al.*, 2015). To express the abundance of raptor species recorded at each point, the Punctual Abundance Index (PAI) was calculated. This index indicates the abundance of each species according to its conspicuousness coefficient, through the number of contacts (visual and / or auditory) of a given species in relation to the total number of samples (Thompson III & La Sorte, 2008). For the present study, each contact was considered as an individual detection during sampling, either by visual or auditory contacts.

We classified species into three categories: independent (species that feed and reproduce mainly in open vegetation,

like grasslands, *Cerrado*, etc.), semi-dependent (species that feed on or reproduce in both forested and open areas) and dependent on forest (species that feed on and reproduce mainly in forested habitats) (Silva, 1995). The Brazilian conservation status followed Ministry of Environment (MMA, 2016) and Global status follow International Union for Conservation of Nature (IUCN, 2020).

To evaluate the efficiency of the sampling effort, we constructed a species accumulation curve using the Chao 2 richness estimator using the software EstimateS 8.0. By using the Punctual Abundance Index (PAI), a quartile analysis and a Whittaker graph were made to assess the distribution of abundance in the prey community, using the software PAST 3.08.

Results and Discussion

One hundred and two visits were made, resulting in a sampling effort of 612 hours, with 383 contacts of 16 species of birds of prey (Accipitriformes and Falconiformes) (Table 1). The most representative family was Accipitridae, with 10

species (62.5%), followed by Falconidae with six species (37.5%). Ten species were recorded exclusively in fixed-points, and one species was recorded only on transect observations; five species were recorded by both methods (Table 1). Species richness recorded using the fixed-point method was 15 species, while abundance was of 302 individuals. In the trail, the species richness was of six species, while the abundance was of 81 individuals.

The species accumulation curve indicated that more species could still be registered in the area if a greater sampling effort were applied, since it did not show a tendency to stability. However, the estimated species richness was very similar to that recorded (Chao 2: N = 17.34 species; richness recorded: N = 16 species) (Figure 2).

The most recorded species were *Caracara plancus* (127 contacts; PAI = 7.47), *Rupornis magnirostris* (PAI = 5.47) and *Milvago chimachima* (PAI = 2.11), while the least recorded species were *Gampsonyx swainsonii*, *Accipiter bicolor*, *Buteo albonotatus*, *Micrastur semitorquatus* and *Falco femoralis* (PAI = 0.05).

Table 1. Birds of prey (Accipitriformes and Falconiformes) recorded from November 2014 to March 2016 in the Serra de Itabaiana National Park (SE).

Family and Specie	Contact		PAI	FD
	FP	TR		
Accipitridae Vigors, 1824				
Leptodon cayanensis (Latham, 1790)*	-	2	-	DE
Chondrohierax uncinatus (Temminck, 1822)	2	-	0.11	SD
Gampsonyx swainsonii (Vigors, 1825)	1	-	0.05	IN
Elanus leucurus (Vieillot, 1818)	2	-	0.11	IN
Accipiter bicolor (Vieillot, 1817)	1	-	0.05	DE
Geranospiza caerulescens (Vieillot, 1817)	2	1	0.11	SD
Rupornis magnirostris (Gmelin, 1788)	93	17	5.47	IN
Geranoaetus albicaudatus (Vieillot, 1816)	10	-	0.58	IN
Buteo brachyurus (Vieillot, 1816)	2	-	0.11	SD
Buteo albonotatus (Kaup, 1847)	1	-	0.05	IN
Falconidae Leach, 1820				
Caracara plancus (Miller, 1777)	127	28	7.47	IN
Milvago chimachima (Vieillot, 1816)	36	11	2.11	IN
Herpetotheres cachinnans (Linnaeus, 1758)	19	22	1.11	SD
Micrastur semitorquatus (Vieillot, 1817)	1	-	0.05	SD
Falco sparverius (Linnaeus, 1758)	4	-	0.23	IN
Falco femoralis (Temminck, 1822)	1	-	0.05	IN

* Species recorded only on the trail (random record). Contact: FP – fixed point, TR – trail. PAI – Punctual Abundance Index. FD – Forest dependence: IN – independent, SD – semi-dependent, DE – dependent.

Regarding forest dependence, nine species were classified as independent of forest environments (56.2%), five as semi dependents (31.2%) and two as dependents (12.5%) (Table 1). No species recorded in the area were threatened with extinction, according to the list of endangered species of birds of the MMA (2016) and IUCN (2020).

The total number of birds of prey recorded in this study corresponds to 36.3% of the total of 44 species (Accipitriformes and Falconiformes) recorded for the state of Sergipe (Avibase, 2020) and 66.6% of the total of 24 species (Accipitriformes and Falconiformes) known for the PARNASI (Sousa, 2009; Silva, Dias & Carmo, 2016). The lowest species richness found in this study is probably because this research

was carried out only in the Serra de Itabaiana. In contrast, this result was higher than the number of species found in Mata do Crasto (N = 13 species) (Sousa, 2009) and Mata do Junco (N = 7 species) (Ruiz-Esparza *et al.*, 2015), two other important areas for bird conservation in Sergipe.

Although, the estimated species richness has very similar to that recorded, such as *Spizaetus ornatus* (Sousa, 2009), were not observed in the present study. It is a strictly forested, sensitive to habitat fragmentation and rare hawk, with low population densities and difficult to detect, as it rarely flatters above the forest canopy and hardly vocalizes (Ortega-Álvares *et al.*, 2018).
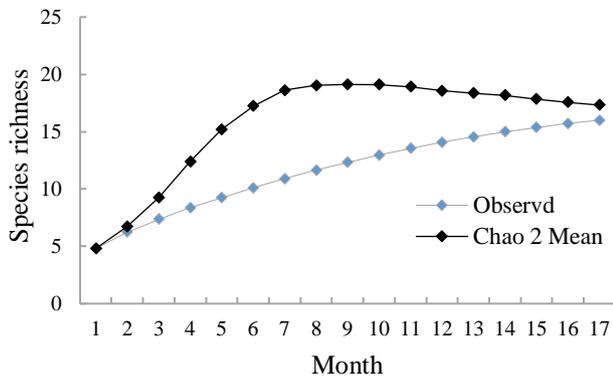
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Figure 2. Cumulative curve of birds of prey (Accipitriformes and Falconiformes) recorded from November 2014 (1st month) to March 2016 (17th month) in the Serra de Itabaiana National Park (SE).

The analysis of the distribution of the abundance showed that most species of birds of prey (N = 9 species; 60%) are found in the lower quartile, being considered rare. Therefore, the distribution of the abundance of the raptor community in the studied area follows the normal Log distribution (Figure 3), which is characterized by the existence of a small number of species with a great abundance of individuals and the majority of the community composed of rare species (less abundant) (Magurran, 2004).

The most abundant species, *C. plancus* (N = 155 contacts) and *R. magnirostris* (N = 110 contacts), which correspond to 69.1% of the records, are generalists on diet, habitat and tolerant to environmental disturbances (Sick, 1997), which contributes to the regularity of these species in the area. Other studies carried out in areas of Atlantic Forest have also reported *C. plancus* and *R. magnirostris* as the most frequent and abundant species (Benfica, 2013; Menq & Delariva, 2015). Birds of prey explore different types of habitat, including anthropic areas, however, forested areas are still preferred, and the greatest raptor diversity is found in forested areas (McClure *et al*., 2018). For some raptors sensitive to environmental changes, the quality of the habitat and the consequent availability of breeding and feeding areas are important factors to ensure its occurrence and maintenance in the area (McClure *et al*., 2018).
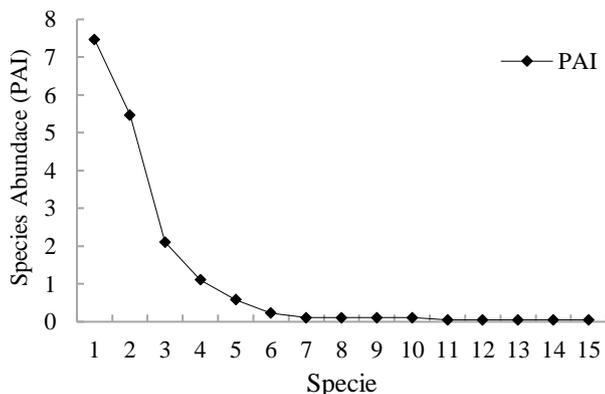

Figure 3. Distribution of the abundance (normal log) of raptor species sampled in Serra de Itabaiana (Sergipe), between November 2014 and March 2016.

Conclusion

The Serra de Itabaiana National Park presents a considerable diversity of birds of prey from the Accipitridae and Falconidae families, including the presence of rare species and that are sensitive to environmental changes. Therefore, the habitats found in the studied area, although altered, are still capable of maintaining some strictly forestry, susceptible to environmental changes raptor species, such as *Leptodon cayanensis*, *A. bicolor*, *Buteo brachyurus* and *M. semitorquatus* (Saralosa *et al*., 2018). In this sense, PARNASI shows itself as an important area for the conservation of birds of prey.

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