

BATS OF RPPN PÉ DE SERRA, A RESERVE OF CAATINGA IN THE NORTHEASTERN BRAZIL

MORCEGOS DA RPPN PÉ DE SERRA, UMA RESERVA DA CAATINGA NO NORDESTE DO BRASIL

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Abstract

Caatinga is the least protected among all biomes within Brazil, and a vast part of its total area is located at the Bahia state, northeastern Brazil. Mammal inventories of Caatinga areas are sparse, and it harbors one of the two poorest known bat fauna within Brazil, as less than 10% of its extension has been minimally sampled. In this paper we report the results of the first bat inventory conducted at the Reserva Particular do Patrimônio Natural Pé de Serra, Ibotirama, NE Brazil, a protected area of Caatinga in the São Francisco river Valley and highlight the potential importance of this reserve for the conservation of the Caatinga biome of Brazil. Using mist-nets and searching for diurnal roosts, we recorded 55 bats in the RPPN Pé de Serra, belonging to 11 species, 10 genera and 2 families. The most frequently captured species was *Artibeus planirostris* (Spix, 1823), followed by *Carollia perspicillata* (Linnaeus, 1758) and *Platyrrhinus lineatus* (É. Geoffroy, 1810). Collecting bats at their diurnal roosts allowed to the first record of *Saccopteryx leptura* (Schreber, 1774) for the Bahia state and the record of *Chrotopterus auritus* (Peters, 1856) representing one of a few records of this species for the Caatinga biome. Our data can be useful to reinforce the urge to create new reserves to protect the Caatinga biome, in order to conserve and restore the habitat remnants, and to enable connectivity between protected areas.

Keywords: Chiroptera, mammals, distribution, species richness.

Resumen

Murciélagos de la RPPN Pé de Serra, una reserva de la Caatinga en el nordeste de Brasil. La Caatinga es el bioma menos protegido de Brasil, y una gran parte de su área total está localizada en el estado de Bahia, nordeste brasileño. Los inventarios de mamíferos en el área de Caatinga son escasos, y el bioma alberga una de las faunas más pobres de murciélagos, lo que puede ser resultado de sub-muestreo, ya que menos del 10% de su extensión fue mínimamente muestreada. En este artículo comunicamos los resultados del primer inventario de murciélagos conducido en la Reserva Particular del Patrimonio Natural Pé de Serra, Ibotirama, nordeste de Brasil, un área protegida de Caatinga en el Valle del Río São Francisco, y destacamos la potencial importancia de esta reserva para la conservación del bioma Caatinga de

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Brasil. Por medio de capturas con redes de neblina y búsquedas por abrigos diurnos, registramos 55 murciélagos en la RPPN Pé de Serra, pertenecientes a las 11 especies, 10 géneros y 2 familias. La especie más capturada es *Artibeus planirostris* (Spix, 1823), seguida por *Carollia perspicillata* (Linnaeus, 1758) y *Platyrrhinus lineatus* (Geoffroy, 1810). Las colectas en abrigos diurnos permitieron el primer registro de *Saccopteryx leptura* (Schreber, 1774) para el estado de Bahia, y el registro de *Chrotopterus auritus* (Peters, 1856), el cual representa uno de los primeros registros para el bioma de la Caatinga. Este y otros estudios discutidos en este trabajo proporcionan evidencias sobre la importancia de la creación de nuevas áreas protegidas en el bioma Caatinga, para conservar y restaurar los hábitats restantes y aumentar la conectividad de las áreas protegidas.

Palabras-clave: Chiroptera, mamíferos, distribución, riqueza de especies.

Resumo

A Caatinga é o bioma menos protegido do Brasil, e uma grande parte de sua área total está localizada no estado da Bahia, nordeste brasileiro. Inventários de mamíferos na área da Caatinga são esparsos, e o bioma abriga uma das faunas mais pobres de morcegos, o que pode ser resultado de sub-amostragem, uma vez que menos de 10% de sua extensão foi minimamente amostrada. Neste artigo comunicamos os resultados do primeiro inventário de morcegos conduzido na Reserva Particular do Patrimônio da Natural Pé de Serra, Ibotirama, nordeste do Brasil, uma área protegida de Caatinga no Vale do Rio São Francisco, e destacamos a potencial importância desta reserva para a conservação do bioma Caatinga do Brasil. Por meio de capturas com redes-de-neblina e buscas por abrigos diurnos, nós registramos 55 morcegos na RPPN Pé de Serra, pertencentes à 11 espécies, 10 gêneros e 2 famílias. A espécie mais capturada foi *Artibeus planirostris* (Spix, 1823), seguido por *Carollia perspicillata* (Linnaeus, 1758) e *Platyrrhinus lineatus* (É. Geoffroy, 1810). As coletas em abrigos diurnos permitiram o primeiro registro de *Saccopteryx leptura* (Schreber, 1774) para o estado da Bahia, e o registro de *Chrotopterus auritus* (Peters, 1856), o qual representa um dos primeiros registros para o bioma da Caatinga. Este e outros estudos discutidos neste trabalho fornecem evidências sobre a importância da criação de novas áreas protegidas no bioma Caatinga, de forma a conservar e restaurar os habitats remanescentes e aumentar a conectividade das áreas protegidas.

Palavras-chave: Chiroptera, mamíferos, distribuição, riqueza de espécies.

INTRODUCTION

The Caatinga biome is completely nested in the Brazilian territory occupying an area estimated to approximately 844,453 km² (IBGE, 2004). Unfortunately, recent estimates indicate that 30% to 52% of the Caatinga has been replaced by pastures or agriculture, and that the Caatinga is the least protected among all biomes within Brazil (Leal et al. 2005). A vast part of the total Caatinga area (approximately 30%, or

249,500 km²) is located in the Bahia state, northeastern Brazil. Mammal inventories of Caatinga areas are sparse (Brito et al. 2009) but recent data has revealed that the Caatinga mammalian fauna might actually be richer than previously thought, with nearly 153 species, including at least 10 endemic mammals (Lewinsohn 2006). According to Bernard et al. (2011) the Caatinga harbors one of the two poorest known bat fauna within Brazil, as less than 10% of its extension has been minimally surveyed. To date at least 82 species of bats were recorded for the Caatinga biome, including the endemic genus and species *Xeronycteris vieirai* (Gregorin and Ditchfield 2005, Paglia et al. 2012; Moratelli and Dias 2015; Feijó et al. 2015 a,b; Rocha et al. 2015, 2018, Carvalho-Neto et al. 2017).

Records of bats from the Bahia state of Brazil have been relatively sparse and most inventories were restricted to the humid coastal region in Atlantic forest until very recently (Faria, 2006; Faria et al. 2006). More recent surveys of the caatinga bats have been reported to localities within the Parque Nacional da Chapada Diamantina (e.g. Gregorin & Mendes 1999, Sbragia & Cardoso 2008), a “humid island” in Caatinga (*sensu* Sá et al. 2003: 24), from several localities distributed in the southwestern and southeastern Bahia (Lapenta and Bueno 2015), and from the caatingas of Caetité (Soares et al. 2018).

In this paper we report the results of a first bat inventory conducted at the Reserva Particular do Patrimônio Natural (RPPN) Pé de Serra, Ibotirama, NE Brazil, a protected area of caatinga in the São Francisco River Valley, and highlight the potential importance of the small reserves such as the RPPN Ibotirama for the conservation of the Caatinga biome of Brazil.

METHODS

Study site

The RPPN Pé de Serra (1,259 ha) is located in the municipality of Ibotirama (12°18' 00" S, 43°13'00" W; Fig. 1), inserted in the highly xerophytic vegetation domains of the Caatinga (Sá *et al.*, 2003). The climate is Aw type, equatorial savannahs with a dry winter, according to Köppen classification (Kottek et al. 2006).

We conducted bat captures during the winter, the drier season yearly, from September 14 to 18, and in the summer season from February 16 to 19, 2008. We used ground-level mist-nets (6, 9 and 12 x 3 m) kept open five hours/night beginning at sunset to capture bats. Most nets were set close to forest edges and to the water to improve chances of getting a larger volume of captures (Kunz and Kurta 1988), and near to fruit crops such as cashew and mango trees. We estimated capture efforts according to the calculations suggested by Straube and Bianconi (2002).

Bats were identified in the field using several identification keys (Vizotto and Taddei 1973, Simmons and Voss 1998, Lim and Engstrom 2001, Gardner 2007).

The following data was collected from each individual captured: forearm length (mm), body mass (g), sex, reproductive status through observation of external characteristics, and age based in the ossification of digital epiphyses. Individuals were also categorized in the feeding guilds frugivore, omnivore, sanguinivore, nectarivore, gleaning insectivore, aerial insectivore and carnivore (Wilson, 1975, Kalko 1997, Schnitzler and Kalko 1998). Taxonomy followed Nogueira et al. (2014).

We evaluated the degree of completeness of our inventory with randomized (500x) sample-based species accumulation curves (Gotelli and Colwell 2001) and estimated the number of species expected to occur at the site using first-order Jackknife estimator. We used EstimateS 9.1.0 (Colwell 2013) to make the calculations and Biodiversity Pro (McAleece et al. 1997) to plot rank abundance curves. All individuals collected were preserved in 70% alcohol and sent to be deposited in the mammal collection at Alexandre Rodrigues Ferreira of the Universidade Estadual de Santa Cruz, Ilhéus, northeastern Brazil.

RESULTS

We captured a total of 55 individuals in the RPPN Pé de Serra from 9 species, 8 genera, and 2 families employing a total of 6,525 m².h of capture efforts (Tab. 1). We also recorded two species by diurnal roosting search, totalizing 11 species recorded for the RPPN.

When searching for diurnal roosts we found two individuals of *Saccopteryx leptura* at the edge of a crevice near the area known as “Mangueiras”, and a small colony of six individuals of *Glossophaga soricina* near an old mining crystal cave.

The results obtained with mist-net capturing methods represent approximately 71% of the local expected richness (Jackknife₁ = 15.4 ± 3.0), and the species-accumulation curve does not seem to reach stabilization to an asymptote (Fig. 2). The rank abundance curve revealed a few dominant species, and several species represented by a low number of records (Fig. 3).

The most frequently captured species was *Artibeus planirostris* with nearly 27% of the captures, followed by *Carollia perspicillata* (20%) and *Platyrrhinus lineatus* (16%). Frugivores formed the richer ensemble (36% of captured species), followed by aerial insectivorous (18%), with the remainder 9% representing other feeding ensembles (Tab. 1).

DISCUSSION

Bat species richness and abundance patterns in the caatingas of Ibotirama were similar to those found in the caatingas of the Parque Nacional Serra das Confusões, in Piauí (Gregorin et al. 2008). On the other hand, the richness of bats

from Ibotirama that we were able to document were comparatively higher than that of the caatingas of the Planalto da Conquista (Falcão et al. 2005) and the caatingas of Caetité, in southwest of Bahia (Soares et al. 2018). The Parque Nacional Serra das Confusões and RPPN Pé de Serra reserves are less fragmented than the Planalto da Conquista region (F. C. Falcão *pers. obs.*), and probably are also more conserved than the Caetité region that harbors no conservation units, which may have contributed to those differences.

Most individuals captured (approx. 75%) were frugivores, primarily because of sampling bias introduced with the use of ground-level mist-nets but also because frugivore phylostomids are abundant components of the neotropical bat fauna (Kunz & Kurta 1988; McSwiney et al. 2008). A high richness of insectivores in the caatinga have been recorded by several authors (e.g. Gregorin et al. 2005, Zeppelini et al. 2017), and that illustrates the need of using acoustic techniques, including echolocation recordings, and increasing efforts to diurnal roost searching to a broad sampling of the local diversity.

A brief survey of bats at their roosts allowed to the first record of the species *Saccopteryx leptura* for the Bahia state (see Peracchi and Nogueira 2007, Tavares et al. 2008, Lapenta and Bueno 2015, Carvalho-Neto et al. 2017), and to the record of *Glossophaga soricina* in a crystal mine, which has been already reported in other parts of its distribution (Alvarez et al. 1991).

Captures of micronycterines such as *Micronycteris minuta*, and some phylostomines such as *Chrotopterus auratus* may be indicative of relatively less disturbed environments, as they have been considered indicative of habitat quality (Fenton et al. 1992, Medellín et al. 2000, Schulze et al. 2000, Faria 2006, Jones et al. 2009). The phyllostomine bat *Chrotopterus auritus* is the second largest Neotropical bat species, feeding on small rodents, birds, lizards, other species of bats, insects and fruits (Giannini and Kalko 2004). In Bahia, there are records of *C. auritus* mostly in forested and/or karstic areas including the interior of large fragments of forests, caves in the Pardo River Basin (Faria et al. 2006) in the southern part of the state, and a few in drier regions such as the Chapada Diamantina, central part of Bahia state (Gregorin and Mendes 1999). Within the Brazilian Caatinga biome *C. auritus* has been previously recorded in different phytophysiognomies, such as the dry forests of Jaíba, northern Minas Gerais (Silva et al. 2003; Tavares et al. 2008), in the valley of the middle São Francisco River in Bahia (Sá-Neto & Marinho-Filho 2013), and in the humid Brejos de Altitude in the Paraíba state (Feijó and Langguth 2011).

Unfortunately, from 30 to 52% of the Caatinga have already been used to pastures and/or plantations (Aguiar and Zórtea 2008). Our study, and several others (e.g. Silva et al. 2003; Leal et al. 2005; Bernard et al. 2011, Lapenta and Bueno 2015, Feijó et al. 2015 a,b; Carvalho-Neto et al. 2017, Rocha et al. 2015, 2018) highlight the importance of creating new protected areas in still so poorly known Caatinga biome in order to conserve and restore the habitat remnants, and also increase the connectivity of the protected areas.

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Table 1 – List of bats recorded in the RPPN Pé de Serra, Ibotirama, Bahia, northeastern Brazil. Feeding guilds: frugivore- FR, omnivore – ON, sanguinivore – SA, nectarivore – NE, gleaning insectivore – GI, aerial insectivore - AI, and carnivore - CA.

	Taxon	N (%)	Feeding Guild
Emballonuridae	<i>Peropteryx macrotis</i> (Wagner 1843)	1 (1,8%)	AI
	<i>Saccopteryx leptura</i> (Schreber, 1774)	1 (1,8%)	AI
Phyllostomidae	<i>Artibeus planirostris</i> (Spix, 1823)	15 (27,3%)	FR
	<i>Artibeus obscurus</i> (Schinz, 1821)	6 (10,9%)	FR
	<i>Carollia perspicillata</i> (Linnaeus, 1758)	11 (20%)	FR
	<i>Chrotopterus auritus</i> (Peters, 1856)	2 (3,6%)	CA
	<i>Desmodus rotundus</i> (É. Geoffroy, 1810)	1 (1,8%)	SA
	<i>Glossophaga soricina</i> (Pallas, 1766)	6 (10,9%)	NE
	<i>Phyllostomus hastatus</i> (Pallas, 1767)	2 (3,6%)	ON
	<i>Platyrrhinus lineatus</i> (É. Geoffroy, 1810)	9 (16,4%)	FR
	<i>Micronycteris minuta</i> (Gervais, 1856)	1 (1,8%)	GI



Figure 1 - Location of municipality of Ibotirama, Bahia, northeastern Brazil.



Figure 2 - Xerophylic vegetation present in RPPN Pé de Serra, Ibotirama, in the Caatinga biome.



Figure 3 - *Saccopteryx leptura*, an insectivorous species found during searches in diurnal roosts in the Reserve.

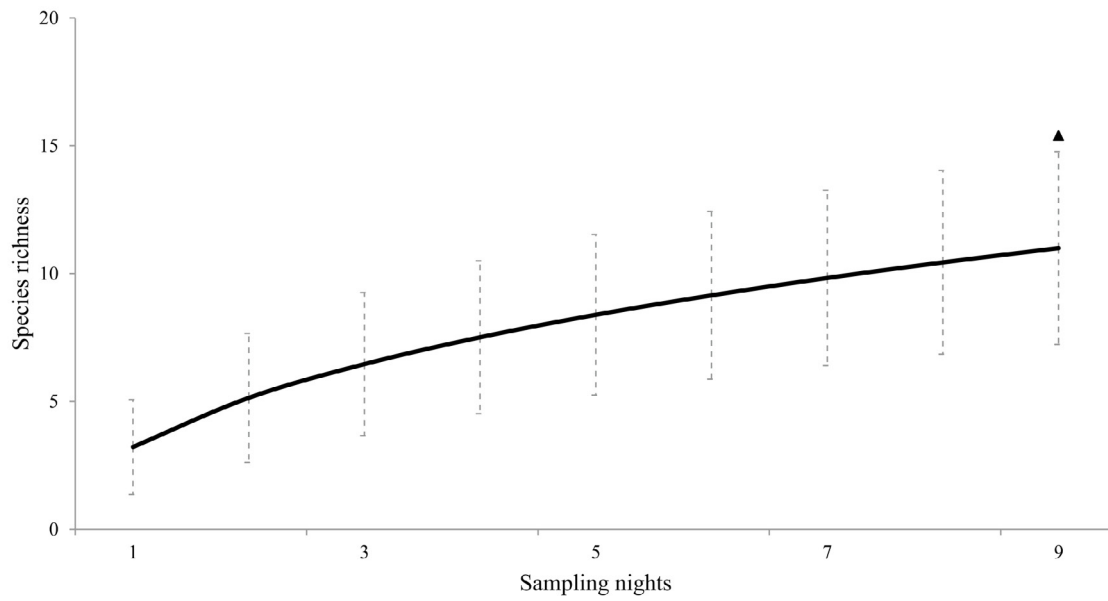


Figure 4 - Species accumulation curve with 95% confidence intervals and Jackknife 1 richness estimator (\blacktriangle) for the bat fauna of RPPN Pé de Serra, Ibotirama, Brazil.

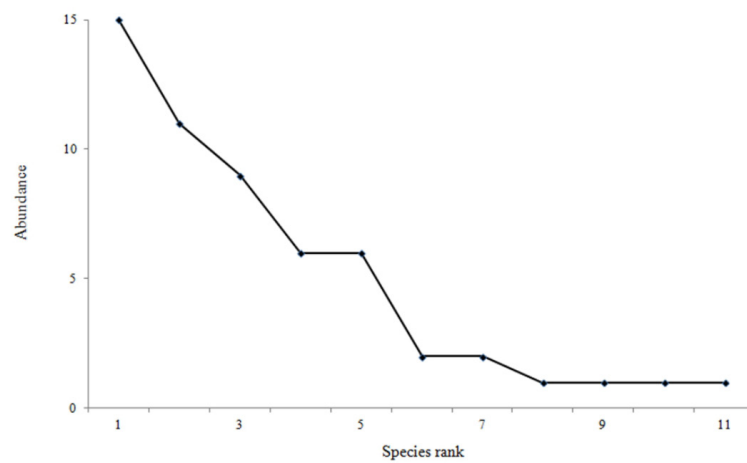


Figure 5 - Rank abundance plot for the bat fauna of RPPN Pé de Serra, Ibotirama, Brazil.