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Bats in fragments of xeric woodland caatinga in Brazilian semiarid

R.J. Sá-Neto [a,c,*], J. Marinho-Filho [a,b]

[a] Programa de Pós-Graduação em Ecologia, Departamento de Ecologia, Instituto de Biologia, Campus Universitário Darcy Ribeiro, Universidade de Brasília – UNB, Asa Norte, Brasília, DF 70.910-900, Brazil
[b] Departamento de Zoologia, Instituto de Biologia, Campus Universitário Darcy Ribeiro, Universidade de Brasília – UNB, Asa Norte, Brasília, DF 70.910-900, Brazil
[c] Laboratório de Biodiversidade do Semi-Árido, Departamento de Ciências Naturais, Campus Universitário da UESB, Universidade Estadual do Sudoeste da Bahia – UESB, Estrada do Bem-Querer, Km 04, Vitória da Conquista, BA 45.083-900, Brazil

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ABSTRACT

Caatinga is a mosaic of xeric woodland with several savanna and tropical rainforest enclaves in interior of Northeastern Brazil. These enclaves seemingly result from expansion/retraction of mesic and dry biomes of South America following dynamics of climate changes in Pleistocene. Little is known about the influences of proximity to enclaves in species composition of xeric woodlands. The objective of this study was to analyze faunal components of bat communities in xeric woodland caatinga of the middle São Francisco River plain. Bats were collected in 20 caatinga fragments during one year. These data were compared with bibliographic data about bats' surveys in caatinga. The results showed high species richness in study area. We found a strong influence of rainforests but almost no influence of savanna habitats on bat species composition. There were no differences between habitats, however, when we considered taxonomy, body size and the composition of feeding guilds. Species richness and habitat use patterns may be associated with both the past occurrence of rainforests in the region during the Holocene as well as proximity to current rainforest enclaves.

1. Introduction

Neotropical zone harbors the richest species diversity of all biogeographic zones in the world (Williams et al., 1997). Besides species richness, the Neotropics also presents a high diversity of biomes and ecoregions – 211 ecoregions in 11 biomes (Olson et al., 2001). These ecoregions were formed by several events of isolation, expansion and retraction due to tectonic events and climate changes that occurred throughout the geological history of the Neotropics (Auler et al., 2004; van der Hammen, 1974).

According to WWF (2010), there are 18 ecoregions in the biome "Deserts and Xeric Shrublands" (hereafter referred to as DXS) in the Neotropics. Overall, these ecoregions have an arid or semiarid climate, a high unpredictability of rainfall and xeric-adapted plant species. However, the physiognomy of vegetation is very heterogeneous, ranging from open grasslands to seasonal tropical dry forests (WWF, 2010). Other open formations such as savannas and punas differ from DXS, because, although all three present a dry season during the annual cycle, in the first two the rainfall season is more predictable.

Among all DXS ecoregions, caatinga represents 62.4% of this biome in the Neotropics (WWF, 2010). For Prado (2003), caatinga is a mosaic of xerophytic, deciduous, thorn scrub and seasonally dry forests lying in the plains between plateaus from Northeastern Brazil to the North of the state of Minas Gerais. Due to the high heterogeneity of habitats, Prado (2003) named this ecoregion as the caatingas of South America.

Studies on the biogeographic history of caatinga are scarce (Auler et al., 2004; Carmignotto et al., 2012; Leal et al., 2005; Pennington et al., 2004). However, Roig-Juñent et al. (2006), pointed out caatinga as the first arid region to be isolated in South America, considering the arthropod fauna, and this isolation was so old that it could not be associated to any known vicariance event in the geological history of South America. Moreover, along with the origins of caatinga, it is known that all South American environments were changed by expansion/retraction processes, due to arid and wet phases that switched throughout the climatic history of the Earth. These changes resulted in the presence of dry forest enclaves in savanna and rainforest areas, as well as enclaves of humid tropical forests and savannas in caatinga (Auler et al., 2004).

* Corresponding author. Present address: Laboratório de Biodiversidade do Semi-Árido – LABISA, Departamento de Ciências Naturais, Universidade Estadual do Sudoeste da Bahia – UESB, Estrada do Bem Querer, Km 04, Vitória da Conquista, Bahia 45.083-900, Brazil. Tel.: +55 77 3423 9394; fax: +55 77 3424 8655.
E-mail addresses: sa-neto@uol.com.br (R.J. Sá-Neto), jmarinho@unb.br (J. Marinho-Filho).

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This mosaic of xerophytic physiognomies with enclaves from other biomes raises much discussion about the classification and boundaries of caatinga. Ab'Sáber (2008) labeled the caatinga as a domain, which included not only xerophytic physiognomies (caatinga *stricto sensu*), but also the enclaves and ecotones present in the region (caatinga *lato sensu*). Other classifications consider these enclaves as distinct ecoregions (World Wildlife Fund, 2010). However, the caatinga is still a poorly studied area, and the knowledge about its ecological processes related to succession and colonization of plant and animal species is scarce, as well as the importance of the enclaves to the domain's local and regional diversity (Leal et al., 2005).

The ecoregion of the middle São Francisco River plain contains heterogeneous vegetation in a homogeneous geomorphologic and climatic formation. Xeric woodlands in this region are surrounded by enclaves of savannas, cerrado ecotones (Brazilian tropical savanna) and the riparian forest of the São Francisco River, a large enclave of tropical rainforest (Brasil, 2000; Silva et al., 2004).

Early studies on the mammals of caatinga considered it poor in number of species and endemics and described its mammalian community as a subset of the cerrado mammal fauna, which included a few endemic species that are not adapted to arid environments (Mares et al., 1985). This fact renders caatinga singular among other arid regions of the planet (Mares et al., 1985). However, later studies indicate that the caatinga mammalian diversity is higher and richer in endemic species than first supposed, but still similar to the cerrado (Carmignotto et al., 2012; Fonseca et al., 1999; Oliveira et al., 2003).

Chiroptera is the second richest mammalian order, after the Rodents. Bats have a high local diversity, and even rare bat species may have wide geographical distribution (Willig et al., 2003), resulting in lower species turnover when one reduces the scale of observation. Thus, faunistic analysis of bats is better performed in large-scale approaches. Moreover, bats represent 44.7% of the mammal species in caatinga (Oliveira et al., 2003) and faunistic analysis of bats can be useful to observe interactions among xeric physiognomies, enclaves and ecotones formations in caatinga environments.

The present study analyzed the species of bats in fragments of xeric woodland caatinga of the middle São Francisco River plain. The objective of this study is answering the following questions: (1) Which species of bats are recorded in the caatinga domain and in xeric woodland caatinga physiognomy? (2) Are the bat fauna of fragments of xeric woodland caatinga of the middle São Francisco River plain a subsample of xeric caatinga physiognomy for taxonomic, body size, feeding guilds and habitat of occurrence components?

2. Materials and methods

2.1. Study area

Field data collection was carried out in the region of São Francisco River, the largest (2700 km long) river entirely within Brazil and the most important hydrographical basin in the caatinga (Ab'Sáber, 2008; Brasil, 2011). This river is divided into four regions (Fig. 1), (a) Upper São Francisco (Alto São Francisco): from its headwaters to Pirapora town in Minas Gerais state, corresponding to 17.5% of the basin's total area; (b) Middle São Francisco (Médio São Francisco): from Pirapora to Remanso in Bahia state,

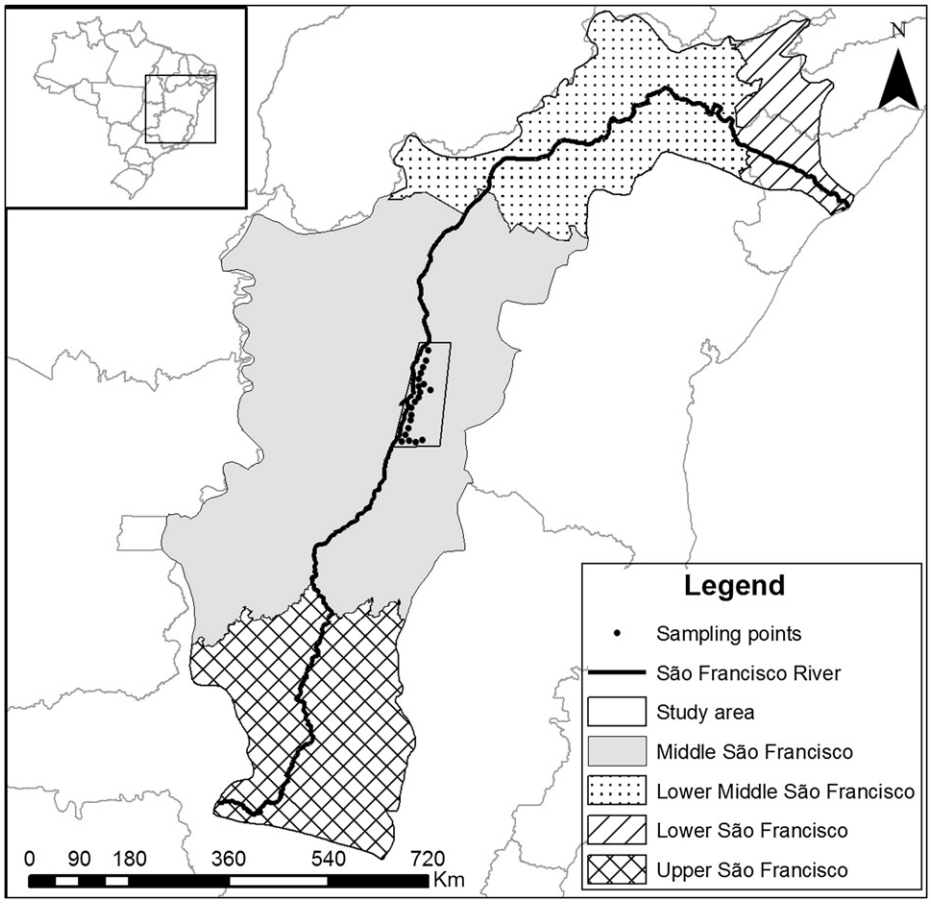

Fig. 1. São Francisco basin subdivisions and Sampling points and study area in Middle São Francisco river plain.