

# Structure of a bat assemblage (Mammalia, Chiroptera) in Serra do Caraça Reserve, South-east Brazil

Fábio de C. Falcão<sup>1</sup>; Victor Fontão Rebêlo<sup>1</sup> & Sônia A. Talamoni<sup>1,2</sup>

<sup>1</sup> Conservation, ecology and animal behaviour group, Programa de Pós-graduação em Zoologia de Vertebrados, Pontifícia Universidade Católica de Minas Gerais, Belo Horizonte, Minas Gerais, 30535-610, Brasil.

E-mail: falcaobio@hotmail.com, victorbio21@hotmail.com

<sup>2</sup> Corresponding author. E-mail: talamoni@pucminas.br

**ABSTRACT.** The Serra do Caraça Reserve is situated in the southern portion of the Espinhaço Mountain Range, and contains areas of “campos de altitude”, “cerrado” and atlantic forest. This study had as its objective the registering of the bats species that occur in the reserve. The data collection was carried out in one year through monthly samplings, using mist nets set on trails, and also through hand capture. A total of 246 individuals were collected (0.72 bats/net-hour), distributed across 15 species, belonging to the families Phyllostomidae (83.0%; nine species), Vespertilionidae (12.5%; three species) and Molossidae (4.5%; three species). The most abundant species were *Sturnira lilium* (E. Geoffroy, 1810) (n = 121, 60.5%), *Myotis nigricans* (Schinz, 1821) (n = 21, 10.5%) and *Platyrrhinus lineatus* (E. Geoffroy, 1810) (n = 10, 5.0%), and less represented were *Lasiurus blossevilli* (Lesson y Garnot, 1826) (n = 2, 1.0%), *Eumops perotis* (Schinz, 1821) (n = 2, 1.0%) e *Vampyressa pusilla* (Wagner, 1843) (n = 1, 0.5%). The richness of species found and the non-occurrence of phyllostomines in the reserve could be indicative of some level of forest disturbance.

**KEY WORDS.** Bats, Chiroptera, Diversity, RPPN Serra do Caraça.

Bats represent approximately one-third of the Brazilian land mammal fauna (MARINHO-FILHO & SAZIMA 1998) because they are abundant and biologically diverse, bats play a number of different and important ecological roles in tropical communities. However, these animals often induce fear in humans, as they are frequently considered harmful. Moreover, the numeric abundance and the role of these animals in terrestrial ecosystems are often under appreciated (EISENBERG & REDFORD 1999).

Bat populations appear to be in decline across the whole world. A number of species are already considered extinct, and others are in the process of extinction, either because of destruction of their natural shelters or due to other human activities fuelled by ignorance of these animals (MARINHO-FILHO & SAZIMA 1998). Conservation efforts are frequently hampered by insufficient knowledge about the distribution and natural history of many species.

The phyllostomid bats are considered important indicators of forest disturbance (FENTON *et al.* 1992, MEDELLÍN *et al.* 2000). However, despite the increasing number of studies on their biology and ecology, many aspects of their biology remain unknown and this makes it difficult to elaborate efficient plans for the conservation of the group, as well as of its habitats (FENTON 1997). In view of the relevance of the conservation of

these animals, this study intends to determine the occurrence of bat species in a private natural heritage reserve in South-east Brazil – the Serra do Caraça Reserve. The reserve constitutes an area of special interest to conservation, which resulted in its inclusion in an Atlas of Priority Areas of Conservation in the State of Minas Gerais, Brazil (COSTA *et al.* 1998).

## MATERIAL E METHODS

The Serra do Caraça Reserve (20°05'S, 43°29'W) has an area of 10,187 ha. It is situated in the Espinhaço Mountain Range, which delimitates a zone of contact between the Cerrado (savannas) and the Atlantic Forest, in the south, and a zone of transition from Cerrado to Atlantic Forest to Caatinga, in the north (GIULIETTI *et al.* 1997). The reserve contains protected artistic and cultural-historical assets represented by buildings that attest to over two centuries human occupation of region (ANDRADE 2000).

With altitudes ranging from 850 to 2070 m and mild temperatures throughout the year (18° to 19°C), of which the maximum rarely exceeds 30°C and the minimum can reach negative values. In accordance with the meteorological data supplied by the Energy Company of the State of Minas Gerais,

the region is characterized by a rainy season (October to March), and a dry season (April to September). During the study period, 194 mm of precipitation were registered in December, which was the most humid month, and 2.5 mm during May, which was the driest month. The reserve has various floristic formations including: a seasonal semideciduous forest; "campos de altitude"; "campos rupestres" consisting of grasslands, surrounded by rock outcrops, shrubs and small trees.

The data collections were carried out monthly from September 2000 to September 2001. Bats were sampled with mist nets (12 x 3 m) placed on trails near the forest and in areas of human dwellings, as well as with hand capture from their diurnal dwellings using hand nets and leather gloves. Three mist nets were usually set from 18:30 to 24:00 h, resulting in a total capture effort of 312 net hours. In the field, the bats were marked using numbered plastic rings, were weighed, measured and the reproductive stage recorded (*e.g.* pregnancy, lactation, large scrotal testes). The unidentified individuals were sacrificed for later identification using the identification keys of VIZOTTO & TADDEI (1973), JONES & CARTER (1976) and LIM & ENGSTROM (2001). After identification, some specimens were incorporated to the reference collection of Natural Sciences Museum of the Pontifical Catholic University of Minas Gerais. The bats were grouped into one of the four trophic categories, according their diets: frugivorous, nectarivorous, insectivorous and blood-feeding.

The studied areas varied in degree of succession, and were classified as follows, in increasing order of degree of alteration: (1) exposed areas in the main building complex of the reserve; (2) trail to "cascatinha", characterized by vegetation in the initial stage of succession; (3) entrance of the reserve, bordered by vegetation in the initial stage of succession, due to a recent forest fire; (4) trail to "campo de fora", characterized by a modified forest, with great amount of liana; (5) "taboões", forest edge characterized by a low canopy, and located next to a waterfall; and (6) "tanque grande", area of vegetation that presents a canopy of about 20 m height; this area is the oldest of the reserve, with approximately 50 years.

## RESULTS

Two hundred and forty-six individuals belonging to 15 species, 14 genus and three families were captured (Tab. I), of these 195 were marked and nine of them were recaptured (4.61%). Two hundred and twenty-five individuals were captured using mist nets, resulting a capture success of 0.72 bats/net-hour. The asymptotic nature of the curve of the number of species captured was observable from the seventh month onwards (Fig. 1).

The hand captures accounted for 21 bats, belonging to three species, found in diurnal shelters in the church of the Sanctuary:

*Myotis nigricans* (Schinz, 1821): colony in the tower of the church composed of 200 to 300 individuals, observed at the beginning of the data collection period; various females with youngsters were observed. After a few months, this colony was never again observed.

*Tadarida brasiliensis* (Desmarest, 1819): colonies situated next to the two lateral windows of the attic of the Church. The most numerous colony had between 30 and 50 individuals, it was found under the lining of the roof of the church, while

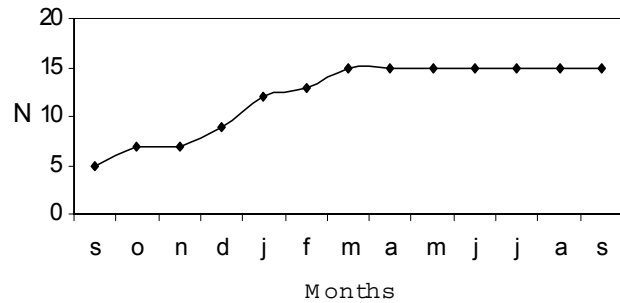


Figure 1. Cumulative number of bat species collected in Serra do Caraça Reserve.

Table I. Bats captured in mist nets and hand capture in Serra do Caraça Reserve. (FR) Frugivorous, (NE) nectarivorous, (AI) aerial insectivorous, (BF) blood-feeding, (1-6) degree of alteration of the sites of capture (described in methods) in increasing order.

Species *	N	Diet	Degree of alteration of the sites of capture
<i>Anoura caudifer</i> (E. Geoffroy, 1818)	5	NE	1, 5
<i>Anoura geoffroyi</i> Gray, 1838	6	NE	1, 5
<i>Artibeus lituratus</i> (Olfers, 1818)	9	FR	1, 2, 3, 4, 5
<i>Carollia perspicillata</i> (Linnaeus, 1758)	7	FR	2, 5, 6
<i>Desmodus rotundus</i> (E. Geoffroy, 1810)	8	BF	1, 2, 4, 6
<i>Platyrrhinus lineatus</i> (E. Geoffroy, 1810)	10	FR	1, 5
<i>Pygoderma bilabiatum</i> (Wagner, 1843)	7	FR	1, 2, 6
<i>Sturnira lilium</i> (E. Geoffroy, 1810)	159	FR	1, 2, 3, 4, 5, 6
<i>Vampyressa pusilla</i> (Wagner, 1843)	1	FR	4
<i>Eptesicus brasiliensis</i> (Desmarest, 1819)	2	AI	1, 4
<i>Lasiurus blossevillii</i> (Lesson y Garnot, 1826)	2	AI	6
<i>Myotis nigricans</i> (Schinz, 1821)	21	AI	1, 6
<i>Eumops perotis</i> (Schinz, 1821)	2	AI	1
<i>Molossus molossus</i> (Pallas, 1766)	3	AI	1
<i>Tadarida brasiliensis</i> (L. Geoffroy, 1824)	4	AI	1

\* According WILSON & REEDER (1993).

the less numerous colony, with six individuals, was seen between a grating and a window.

*Eumops perotis* (Schinz, 1821): two solitary individuals were found between a grating and a large lateral window of the Church. One of them was sacrificed and the other was measured, weighed and marked: it was never again observed.

Two hundred and twelve of the bats captured belonged to the Phyllostomidae family (86.2%), 25 to the Vespertilionidae family (10.2%) and nine to the Molossidae family (3.6%). The frugivorous bats were the most represented, constituting 78.4% of the individuals, insectivorous constituted 13.8%, nectarivorous constituted 4.5% and the blood feeding bats constituted 3.3%. The majority of individuals (n = 150) were

captured during the rainy season (Fig. 2); this corresponded to 66.7% of the individuals captured using mist nets, these being *S. lilium* (115 individuals), *A. lituratus* (Olfers, 1818) (six individuals) and *P. lineatus* (E. Geoffroy, 1810) (seven individuals). Pregnant or lactating females and males with large testes were captured during this season. Pregnant females of *S. lilium*, the most abundant species, were captured in the months of January (n = 28), September (n = 11) and November (n = 6).

It was intended to analyze the number of bats captured in terms of the degree of habitat alteration, however, this was not possible because in the month of January the mist nests were placed close to a tree full of fruits in an area of high degradation (i.e., with the Sanctuary complex). Thus, any analysis would be over shadowed by this result, however this data point could simply not be removed as there were other months in which no bats were captured (see figure 2).

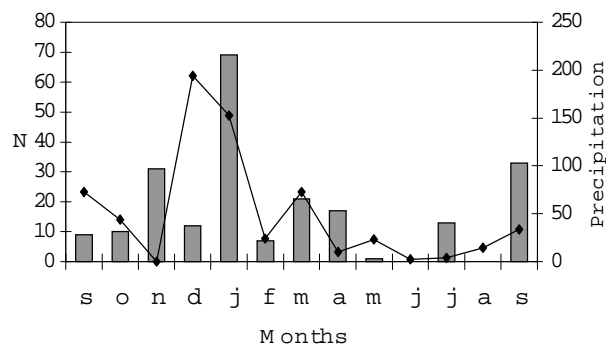


Figure 2. Monthly numbers of captures in mist nets in Serra do Caraça Reserve. Bars: number of animals, line: precipitation.

## DISCUSSION

The high number of phyllostomid bats captured was expected due to the fact that this is the most diversified Neotropical bat family, and due to the capture method used (FENTON *et al.* 1992). According to KUNZ *et al.* (1996) and PORTFORS *et al.* (2000), several other capture methods can enhance the capture success of species not normally caught in mist nets.

In spite of the asymptotic curve of the cumulative number of species captured, the number of obtained species may be an underestimate. Some other factors, such as high altitude could have some negative influence (W.A. Pedro, pers. comm.). The low temperatures registered during the cold months could also influence the abundance of some species and hence species diversity (ERCKERT 1982).

According to MARINHO-FILHO & SAZIMA (1998), *P. bilabiatum* (Wagner, 1843) should be associated with Atlantic Forest and Pantanal; however, the occurrence of this species in a transition zone of Cerrado and Atlantic Forest is indicative of the fact that the distribution of this species is more extensive. The disappearance of the colonies of *M. nigricans*, *T. brasiliensis* and the individuals of *E. perotis* in February 2001, which were observed in October 2000, could be due to the repair of the ceiling of the church at this time, as well as because of our

own interference in these colonies. The colonies of *T. brasiliensis* were considered small because this species normally lives in colonies of thousands or even millions of individuals (KUNZ 1982). *Eumops perotis* were found on a high window and this can be explained by the fact that this species usually needs space to launch into flight. NOWAK (1994) observed that, although a non-migratory species, this species can change its shelter with climatic changes: a fact that can explain the dispersion of this species in the Sanctuary.

The high number of individuals captured during the rainy season can be explained by high food availability during this season (TAVARES 1999). The highest number of individuals of *S. lilium* was captured during January probably due to a significant increase of food resources near the capture sites. The predominance of this species was also observed in other studies: PERACCHI & ALBUQUERQUE (1971), PEDRO & TADDEI (1997), ISAAC-JÚNIOR & SÁBATO (1994) and MEDELLÍN *et al.* (2000) observed that *A. lituratus* and *S. lilium* are very common species in Neotropical bat communities because of their generalist-frugivorous diet. Another factor that can contribute to the abundance of *S. lilium* is the fact that this species during the dry season includes nectar in its diet (HEITHAUS *et al.* 1975).

In accordance with FENTON *et al.* (1992) and MEDELLÍN *et al.* (2000), the non capture of phyllostominae could be a reflection on the vegetation present with its different levels of degradation in Serra do Caraça Reserve since, as suggested by TAVARES (1999), this group seems to be an excellent indicator of forest degradation.

## ACKNOWLEDGMENTS

We thank H.P. Godinho, R.J. Young, W.A. Pedro, V.A. Taddei and to the anonymous reviewer for the helpful comments on the manuscript. Thanks also to the Administration of Serra do Caraça Reserve and its employees. Financial support was provided by FIP-PUC Minas.

## REFERENCES

- ANDRADE, M.G. 2000. *A educação exilada, Colégio do Caraça*. Belo Horizonte, Editora Autêntica, 214p.
- COSTA, C.M.R.; G. HERRMANN; C.S. MARTINS; L.V. LINS & I.R. LAMAS. 1998. *Biodiversidade em Minas Gerais. Um atlas para sua conservação*. Belo Horizonte, Fundação Biodiversitas, Governo de Minas Gerais, IEF, Conservation International, 94p.
- EISENBERG, J.F. & K.H. REDFORD. 1999. *Mammals of neotropics: the central neotropics*. Chicago, University Chicago Press, III+609p.
- ERCKERT, H.G. 1982. Ecological aspects of bat activity rhythms, p. 201-242. In: T.H. KUNZ (Ed.). *Ecology of bats*. New York, Plenum Press, XVIII+425p.
- FENTON, M.B. 1997. Science and the conservation of bats. *Journal of Mammalogy*, Lawrence, 78 (1): 1-14.
- FENTON, M.B.; L. ACHARYIA; D. AUDET; M.B. HICKEY; C. MERRIMAN; M.K. OBRIST & D.M. SYME. 1992. Phyllostomid bats as indicators of habitat disruption in the neotropics. *Biotropica*, Washington, D.C., 24 (3): 440-446.
- GIULIETTI, A.M.; J.R. PIRANI & R.M. HARLEY. 1997. Espinhaço Range region, Eastern Brazil, p. 397-404. In: S.D. DAVIS; V.H. HEYWOOD; O. HERRERA-MACBRYDE; J. VILLA-LOBOS & A.C. HAMILTON (Eds) *Centres of plant diversity, a guide and strategy*

- for their conservation. Oxford, Information Press, 562p.
- HEITHAUS, E.R.; T.H. FLEMING & P.A. OPLER. 1975. Foraging patterns and resource utilization in seven species of bats in a seasonal tropical forest. *Ecology*, Washington, D.C., **56**: 841-854.
- ISAAC-JÚNIOR, J.B. & E.L. SÁBATO. 1994. Caracterização da fauna de morcegos (Mammalia: Chiroptera), na área de influência da variante ferroviária Capitão Eduardo/Costa Lacerda no município de Caeté (Minas Gerais). *Bios*, Belo Horizonte, **2** (2): 25-29.
- JONES JR., J.K. & D.C. CARTER. 1976. Annotated checklist, with keys to subfamilies and genera, p. 7-38. *In*: R.J. BAKER; J.K. JONES & D.C. CARTER (Eds) **Biology of bats of New World. Family Phyllostomatidae, Part I**. Lubbock, Texas Tech University. Museum, Special Publication, X+38.
- KUNZ, T.H. 1982. Roosting ecology of bats, p. 1-55. *In*: T.H. KUNZ (Ed.). **Ecology of bats**. New York, Plenum Press, XVIII+425p.
- KUNZ, T.H.; D.W. THOMAS; G.C. RICHARDS; C.R. TIDEMANN; E.D. PIERSON & P.A. RACEY. 1996. Observational techniques for bats, p. 105-114. *In*: D.E. WILSON; F.R. COLE; J.D. NICHOLS; R. RUDRAN & M.S. FOSTER (Eds). **Measuring and Monitoring Biological Diversity. Standard Methods for Mammals**. Washington, D.C., Smithsonian Institution Press, 409p.
- LIM, B.K. & M.D. ENGSTROM. 2001. Species diversity of bats (Mammalia: Chiroptera) in Iwokrama Forest, Guyana, and the Guianan subregion: implications for conservation. **Biodiversity and Conservation**. Dordrecht, **10**: 13-657.
- MARINHO-FILHO, J. & I. SAZIMA. 1998. Brazilian bats and conservation biology; a First Survey, p. 282-294. *In*: T.H. KUNZ & P.A. RACEY (Eds). **Bat, biology and conservation**. Washington, D.C., Smithsonian Institution Press, 365p.
- MEDELLÍN, R.A.; M. EQUIHUA & M.A. ALMIN. 2000. Bat diversity and abundance as indicators of disturbance in Neotropical Rainforests. **Conservation Biology**, Stanford, **14** (6): 1666-1675.
- NOWAK, R.N. 1994. **Walker's bats of the world**. Baltimore, Johns Hopkins University Press, 287p.
- PERACCHI, A.L. & S.T. ALBUQUERQUE. 1971. Lista provisória dos quirópteros dos estados do Rio de Janeiro e Guanabara, Brasil (Mammalia: Chiroptera). **Revista Brasileira de Biologia**, São Carlos, **31**: 405-413.
- PEDRO, W.A. & V.A. TADDEI. 1997. Taxonomic assemblage of bats from Panga Reserve, southeastern Brazil: abundance patterns and trophic relations in the Phyllostomidae (Chiroptera). **Boletim do Museu de Biologia Mello Leitão, Nova Série**, Santa Teresa, **6**: 3-21.
- PORTFORS, C.V.; M.B. FENTON; L.M.S. AGUIAR; J.E. BAUMGARTEN; M.J. VONHOF; S. BOUCHARD; D.M. FARIA; W.A. PEDRO; N.I.L. RAUNTENBACH & M. ZORTÉA. 2000. Bats from Fazenda Intervalles, Southeastern Brazil – species account and comparison between different sampling methods. **Revista Brasileira de Zoologia**, Curitiba, **17** (2): 533-538.
- TAVARES, V.C. 1999. Flight morphology, diet and composition of a bat assemblage (Mammalia: Chiroptera) in the Rio Doce State Park, South-east Brazil. **Chiroptera Neotropical**, Brasília, **5** (1-2): 117-118.
- VIZOTTO, L.D. & V.A. TADDEI. 1973. Chave para a determinação de quirópteros brasileiros. **Boletim de Ciências**, São José do Rio Preto, **1**: 1-72.
- WILSON, D.E. & D.M. REEDER. 1993. **Mammal species of the world: a taxonomic and geographic reference**. Washington, D.C., Smithsonian Institution Press, 1206p.

---

Received in 04.I.2003; accepted in 03.VI.2003.