

Articles

IS THE AREA OF THE ARTHUR THOMAS PARK, WITH ITS 82.72 HA, SUFFICIENT TO MAINTAIN VIABLE CHIROPTERAN POPULATIONS?

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Species preservation is highly dependent on the creation of biological preservation areas (Humphreys & Kitchener, 1982). Although new parks are created every year, the truth is that various of the existing parks are under constant attacks and reductions, in the name of other interests from surrounding human pressures. Nowadays, less than 5% of the world's forests are protected as parks and preservation areas; and even those are vulnerable to political and economic pressures (Brown, 1985).

Establishing preservation areas in ecosystems that still have not been damaged will not be enough any more. Most of this planet's areas are too scarce and climate changes may prevent their maintenance (Peters & Darling, 1985). The forests are being destroyed so fast that they will probably disappear in the next century leading hundreds of thousands of species to extinction. Thus, even if an endangered species is saved from extinction, it will probably lose most of its internal diversity (Wilson, 1997). Today, this intraspecific genetic diversity is fastly decreasing on most of the world's surface, an unannounced loss of one of humanity's most vital resources. In addition, this resource is mostly irreplaceable (Ehrlich, 1997).

Recently, within Londrina's metropolitan area, the last "preservation site" consists of what has been left of the Arthur Thomas Municipal Park (ATMP), with an area of 82,72 ha. This site used to shelter a rich mammal, bird, reptile, amphibian and fish fauna (Ornelas, 1991). Within this context, the aim of this study is to verify if this area is sufficient to shelter bat populations.

METHODOLOGY

The ATMP is located within the urban perimeter of Londrina, which is at 23° 23' 30"S latitude and 51° 11' 5"W longitude. It has a humid subtropical climate with an average annual temperature of 22°C and annual rainfall rate of approximately of 1500 mm (Iapar, 1994). The park has an area of 82.72 ha and is cut by the Cambé stream (Fig.1). It is covered by 66 ha of native vegetation, sheltering species such as 'peroba-rosa' (*Aspidosperma polyneuron*), 'pau-d'alho' (*Gallesia integrifolia*), 'paineira' (*Chorisia speciosa*), 'primaveras-arbóreas' (*Bougainvillea glabra*), 'canjarana' (*Cabralea canjerana*), cedar trees (*Cedrella* sp.), 'gurucaia' (*Parapiptadenia rigida*), 'ingá' (*Inga* sp.), 'alecrim-de-campinas' (*Holocalix balansae*), fig trees (*Ficus* sp.), 'jerivá' (*Syagrus romanzoffiana*), palm trees (*Euterpe edulis*), cinnamon trees (*Nectandra puberula*) and various animal species that were observed during the collection period such as (*Didelphis albiventris*) skunks, (*Dasyopus novemcinctus*) armadillos, (*Cebus apella*) monkeys, (*Cerdocyon thous*) wild dogs, (*Nasua nasua*) 'quatis', (*Hydrochaeris hydrochaeris*) 'capivaras', (*Dasyprocta azarae*) 'cotias', (*Silvilagus brasiliensis*) 'tapetis' and various bird species.

Field studies were carried out from May/1999 to April/2000 with 2 collections per month in the park. The capture techniques were adapted from those described by Greenhall & Paradiso (1968). A standard methodology was followed in all of the collections

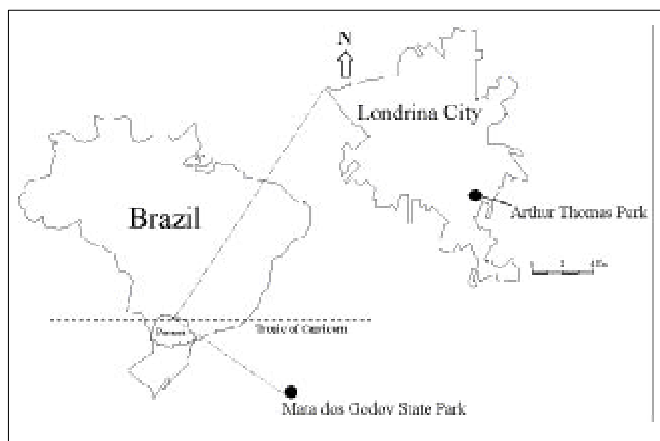


Figure 1. Location of Arthur Thomas Park in Londrina city, Brazil.

sampled in this region, they were carried out during the first three hours after sunset, four days a month, with an average of 96m² of mist nets. The collections at the Arthur Thomas Park were compared to two extreme conditions for a more clarifying analysis – the Mata dos Godoy State Park, an untouched model forest fragment with 680 ha and the metropolitan area, which is practically sterile.

It is important to mention that the collections extended until there was no occurrence of any new species for 6 consecutive months. Two specimen of each species were identified following the criteria of Vizotto & Taddei (1973) and are at the moment placed in the museum of the Rural Federal University of Rio de Janeiro and at the Zoology Museum of Londrina State University.

RESULTS

We captured a total of 555 individuals containing 12 species from 11 genera belonging to two families - Phyllostomidae and Vespertilionidae. In order to facilitate the interpretation of the analysis, data from previous studies in Londrina, like Muller & Reis (1992), Reis *et al.* (1993a), Reis *et al.* (1993b), Reis & Muller (1995) and Reis *et al.* (1998) were added to the present study. This data reveals that in this park there are 25 species that have been collected to date (Tab.1). *Noctilio leporinus*, *Eumops glaucinus*, *Molossops abrasus*, *Molossus ater*, *Molossus molossus*, *Nyctinomops laticaudatus*, *N. macrotis* and *Tadarida brasiliensis* were not collected during the present study, although they had already been collected in the park's surroundings, which could indicate that these individuals also occur in the park and were therefore included in this study. In this region, in addition to roosting in buildings, many molossids roost in hollows of big trees, like the 'peroba rosa' (*Aspidosperma plyneuron*), which is found within the limits of the park.

A. lituratus was the most commonly found species, having been captured in all the collections, representing 61.8% of the total amount captured in the ATMP, followed by *C. perspicillata* (12%), *Sturnira lilium* (10.2%) and *Platyrrhinus lineatus* (4.15%), which altogether represent 88.15% of all the collected individuals. The other species represent only 11.85%. *C. auritus*, *M. megalotis*, *P. hastatus*, *A. caudifer*, *A. jamaicensis*, *P. bilabiatum*, *E. brasiliensis*, *E. diminutus*, *L. borealis* and *M. ruber* represent less than 1% of the total number of captured bats. *E. brasiliensis* and *E. diminutus* represent less than 0.1% of the capture rate.

DISCUSSION

The damage caused to natural resources today must be the most common reason for the disappearance of species in Brazil. Due to its species richness compared to other places, Brazil suffers more from habitat fragmentation (Whitmore, 1997). An environmental crisis caused by the increase of technology is evident, resulting in the non-structured use of natural resources (Marini-Filho & Martins, 2000). All of this led us to evaluate if the ATMP, with 82.72 ha, would be sufficient to shelter viable bat populations.

It is believed that the ideal number of species in the Londrina region is at least 39, according to 20 years of periodic collections carried out at Mata dos Godoy State Park, with 680 ha of pristine, well preserved and protected forest, far away from the city center. As a matter of comparison, there are 62 species in the entire Atlantic Forest in the state of São Paulo (Pedro *et al.*, 1995). At the same time, 25 species were captured in the ATMP, in other words, 64,1% of the 39 species considered to be ideal for that region. On the other hand, 14 species other than the 12 species which can be found in the urban area of Londrina were collected in the ATMP (Tab.1). In degraded areas in the French Guyana, 48 out of the 75 original species did not occur (Brosset *et al.*, 1996), which represents a 46% loss. In the ATMP 35.8% was lost.

Why does species loss occur? It is useful to refer to the edge effects described by Lewin (1984). The ATMP is subjected to this type of effect. It has a rectangular shape and suffers dehydration due to wind and rain effects when entering the forest, leaving only a small area in the centre isolated from these problems. Another evident fact of this edge effect is the uncontrolled growth of pioneer vegetation, like Piperaceae, Solanaceae and Cecropiaceae, which favor common bat species with high adaptation potential that can find abundant food. These bats breed in a disorganized manner occupying all the available space and consequently disfavor the more sensitive species (Reis *et al.*, 2000). Here, *A. lituratus* proliferation in a modified environment is remarkable.

Another related question is to what extent the noise of cars coming from the nearby highway affects the insectivores (*Eptesicus* spp., *Lasiurus* spp. and *Myotis* spp.), which ideally should be protected by the vegetation. Perhaps that is why only 5 of the 10 species of Vespertilionidae in the region were found in the park. Goosem (1997) affirmed that highways next to forest fragments violently affect the wild life.

After 20 years of periodic field studies, it can be concluded that ATMP, with its numerous problems mentioned above, is not what we can consider ideal, once 14 of the 39 existing species in the region were

Table 1. Species that occur in Mata dos Godoy, Arthur Thomas Park and Metropolitan Area.

Species of the Mata dos Godoy and surrounds	Arthur Thomas Park		Metropolitan Area	
	Total	%	Total	%
Family Noctilionidae				
<i>Noctilio albiventris</i> Desmarest, 1818				
<i>Noctilio leporinus</i> (Linnaeus, 1758)	Ev			
Family Phyllostomidae				
Sub-family Phyllostominae				
<i>Chrotopterus auritus</i> (Peters, 1856)	21	0,98		
<i>Micronycteris megalotis</i> (Gray, 1842)	12	0,56		
<i>Phyllostomus hastatus</i> (Pallas, 1767)	16	0,75		
Sub-family Glossophaginae				
<i>Anoura caudifer</i> (E. Geoffroy, 1818)	4	0,19		
<i>Glossophaga soricina</i> (Pallas, 1766)				
Sub-family Carollinae				
<i>Carollia perspicillata</i> (Linnaeus, 1758)	257	12		
Sub-family Stenodermatinae				
<i>Artibeus fimbriatus</i> Gray, 1838	79	3,68		
<i>Artibeus jamaicensis</i> Leach, 1821	10	0,47		
<i>Artibeus lituratus</i> (Olfers, 1818)	1326	61,8	7	1,3
<i>Artibeus obscurus</i> Schinz, 1821				
<i>Chiroderma doriae</i> Thomas, 1891				
<i>Chiroderma villosum</i> Peters, 1860				
<i>Platyrrhinus lineatus</i> (E. Geoffroy, 1810)	89	4,15	1	0,2
<i>Pygoderma bilabiatum</i> (Wagner, 1843)	7	0,33		
<i>Sturnira lilium</i> (E. Geoffroy, 1810)	219	10,2		
<i>Uroderma bilobatum</i> Peters, 1866				
<i>Vampyressa pusilla</i> (Wagner, 1843)	46	2,14		
Sub-family Desmodontinae				
<i>Desmodus rotundus</i> (E. Geoffroy, 1810)				
<i>Diaemus youngi</i> (Jentink, 1893)				
<i>Diphylla ecaudata</i> (Spix, 1823)				
Family Vespertilionidae				
Sub-family Vespertilioninae				
<i>Eptesicus brasiliensis</i> (Desmarest, 1819)	1	0,05	14	2,6
<i>Eptesicus diminutus</i> Osgood, 1915	2	0,09		
<i>Eptesicus furinalis</i> (d'Orbigny, 1847)				
<i>Histiotus velatus</i> (I. Geoffroy, 1824)				
<i>Lasiurus borealis</i> (Muller, 1776)	3	0,14	1	0,2
<i>Lasiurus ega</i> (Gervais, 1856)			2	0,4
<i>Myotis levis</i> (I. Geoffroy, 1824)				
<i>Myotis nigricans</i> (Schinz, 1821)	51	2,38		
<i>Myotis ruber</i> (E. Geoffroy, 1806)	3	0,14		
<i>Rogheessa tumida</i> H. Allen, 1866				
Family Molossidae				
<i>Eumops glaucinus</i> (Wagner, 1843)	Ev		20	3,8
<i>Molossops abrasus</i> (Temminck, 1827)	Ev		Ev	
<i>Molossus ater</i> E. Geoffroy, 1805	Ev		214	40
<i>Molossus molossus</i> (Pallas, 1766)	Ev		38	7,1
<i>Nyctinomops laticaudatus</i> (E. Geoffroy, 1805)	Ev		201	38
<i>Nyctinomops macrotis</i> (Gray, 1840)	Ev		34	6,4
<i>Tadarida brasiliensis</i> (I. Geoffroy, 1824)	Ev		Ev	
Total of species	25		12	
Total of individuals	2146	100	532	100

not captured: *N. albiventris*, *G. soricina*, *A. obscurus*, *C. doriae*, *C. villosum*, *U. bilobatum*, *D. rotundus*, *D. youngi*, *D. ecaudata*, *E. furinalis*, *H. velatus*, *L. ega*, *M. levis* and *R. tumida*. Moreover, there are 10 species collected in the park which represent less than 1% of the total amount captured (Tab.1). These species may be endangered. It is crucial to emphasize that in the park there are 14 additional species to those present only in the urban area, including an endangered species (*M. ruber* and a probably extinct one: *P. bilabiatum*). That alone would already justify the park's preservation because even though there are problems, this site is a better procreation habitat than the urban area, which is a more important reason than the size of the area itself. That does not mean that the minimum size is not important, what we need is to preserve sufficient areas to guarantee the maintenance of viable populations, as stated by Zimmerman & Bierregaard (1986).

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**PRELIMINARY INVENTORY OF THE BAT
SPECIES OF THE POÇO DAS ANTAS
BIOLOGICAL RESERVE, RJ**

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The Atlantic Forest is an ecosystem that is quickly vanishing from southeastern Brazil. Most remaining areas are located in the hills of the Serra do Mar (Fundação SOS Mata Atlântica *et al* 1998). The reduction of lowland forest has been even more intense. This process threatens the rich animal and plant life in this system. Among mammals, bats are the second most diverse order in this system, being critical for the dynamics of tropical forests (Marinho-Filho 1991).

Poço das Antas Biological Reserve is the largest lowland Atlantic Forest remnant in the state, covering about 6100 ha. It is located in the lowlands of central Rio de Janeiro state, in the Silva Jardim municipality (22°30'-22°33'S; 49°15'-42°19'W). The reserve's main habitat is a swamp-like, flooded forest (locally named "mata paludosa"). Poço das Antas is one of the last representatives of this ecosystem.

Despite the great conservational significance of Poço das Antas for the state, only a few people have studied its bat fauna. There is only one study with bats being conducted in the southern area of the reserve (Mello & Fernandez 2000).

The aim of the present study was to make a preliminary list of the bats species recorded in the Poço das Antas Biological Reserve.

Some of the reserve's environments were sampled (Figure 1), like the Aldeia Velha River; the Portuense

forest, a well-preserved rocky hill area; the main road crossing the reserve (at three points) in the north-south heading; some human-made structures, like houses and bridges; and the system of small forested hills known as the "Ilhas dos Barbados", which vary in size from 1.5 to 16ha. The Ilhas dos Barbados has been sampled for bats, monthly, since 1997, what makes it the most well represented area of our analysis.

In this article, we considered data from our samplings from 1996 to 1999, as well as records by other researchers, found in the Museu Nacional, in Rio de Janeiro. It is important to notice that there are still many other sites to be sampled in the reserve. This list is only a preliminary approach to answer the question: how many bat species are there in Poço das Antas?

Bats were captured using mist nets (3x7m and 3x12m), placed along possible "flyways", like rivers, streams, trails and gaps in the forest. Hand captures were also conducted in roosts, like abandoned houses and rock crevices. Nets were opened the entire night, for almost all samples. More than half of the individuals were marked with aluminum rings (A.C. Hughes, Inc.), attached to the bat's right forearm.

We registered the species sex, age, weight and other body measures, like forearm, tibia, and skull length for all captured individual. Species-level identification was based on the works of Cloutier & Thomas (1992), Davis (1980), Jones & Hood (1993), Marques (1994),

Table 1: bat species captured using mist-nets outside roosts in the Poço das Antas Biological Reserve, RJ, from July 1997 to November 1999. The number of individuals captured was calculated considering only the first capture of each individual for each species.

Taxon	no. individuals
<i>Carollia perspicillata</i>	1075
<i>Sturnira lilium</i>	147
<i>Artibeus lituratus</i>	92
<i>Phyllostomus hastatus</i>	41
<i>Molossus ater</i>	15
<i>Noctilio leporinus</i>	12
<i>Glossophaga soricina</i>	9
<i>Myotis nigricans</i>	7
<i>Platyrrhinus lineatus</i>	7
<i>Mimon crenulatum</i>	6
<i>Desmodus rotundus</i>	3
<i>Artibeus obscurus</i>	2
<i>Chrotopterus auritus</i>	1
<i>Lonchophylla</i> sp.	1
<i>Pygoderma bilabiatum</i>	1
Total	1419