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Diversity, similarity and trophic guild of chiropterofauna in three southern Pantanal sub-regions, State of Mato Grosso do Sul, Brazil

Ademir Kleber Morbeck de Oliveira[1*], Marilizi Duarte de Oliveira[2], Silvio Favero[1] and Larissa Figueiredo de Oliveira[2]

*[1]Programa de Pós-graduação em Meio Ambiente e Desenvolvimento Regional, Universidade Anhanguera-Uniderp. Av. Alexandre Herculano, 1400, 79037-280, Campo Grande, Mato Grosso do Sul, Brazil. [2]Laboratório de Chiroptera, Universidade Anhanguera-Uniderp, Campo Grande, Mato Grosso do Sul, Brazil. *Author for correspondence: E-mail: akmorbeck@hotmail.com*

ABSTRACT. In the Brazilian Pantanal, virtually no studies of communities of bats, despite the richness of spcies. As the chiropterofauna in the Pantanal is still poorly known, this works purpose was to verify the diversity, trophic guild and similarity in three sub-areas (Aquidauana, Miranda-Abobral and Nhecolândia) of the Pantanal, Mato Grosso do Sul. From May 1994 to November 2004, 221 sampling sessions were performed, using mist nets and capture effort of 17,148,495 h m^2, 2.818 bats were captured, belonging to 34 species distributed in 5 families (Emballonuridae, Molossidae, Noctilionidae, Phyllostomidae and Vespertilionidae). The families Molossidae (n = 9) and Phyllostomidae (n = 15) showed the greatest number of species and the predominant genus was *Myotis* (4). Twenty seven species were recorded in Aquidauana sub-region, 23 in Miranda-Abobral and 30 in Nhecolândia. The species diversity (Shannon H index) was greater in the Nhecolândia (3.33), followed by Aquidauana (3.12) and Miranda-Abobral (2.0). Regarding the similarity of species, Aquidauana and Nhecolândia (0.83) presented larger similarity, both Aquidauana compared to Miranda-Abobral and Nhecolândia to Miranda-Abobral presented the same similarity (0.78). The trophic guild insectivorous prevailed with 58.8%, followed by frugivorous with 17.6%, nectarivorous, hematophagous and omnivorous with 5.9% each, carnivorous and piscivorous with 2.9%. The results indicate that the sub-regions show high similarity and diversity of species, compatible with that suggested for the Neotropical region (2.0).

Keywords: species composition, Chiroptera, Aquidauana, Miranda-Abobral, Nhecolândia.

Diversidade, similaridade e guilda alimentar da quiropterofauna em três sub-regiões do Pantanal Sul, Estado de Mato Grosso do Sul, Brasil

RESUMO. No Pantanal brasileiro, praticamente não existem estudos de comunidades de morcegos, apesar da riqueza de espécies. Levando-se em consideração que a quiropterofauna do Pantanal ainda é pouco conhecida, este trabalho teve como objetivo verificar a diversidade, guilda alimentar e similaridade entre três diferentes sub-regiões do Pantanal Sulmatogrossense (Aquidauana, Miranda-Abobral e Nhecolândia). Entre maio de 1994 e novembro de 2004, ocorreram 221 coletas com auxílio de redes de neblina e esforço de captura de 17.148.495 h m^2, sendo capturados 2.818 exemplares, pertencentes a 34 espécies distribuídas em cinco famílias, Emballonuridae, Molossidae, Noctilionidae, Phyllostomidae e Vespertilionidae, e as famílias Molossidae (9) e Phyllostomidae (15) foram as mais diversificadas em número de espécies e o gênero *Myotis* predominante em número de espécies (4). Foram registradas 27 espécies para a sub-região de Aquidauana, 23 para Miranda-Abobral e 30 para Nhecolândia. A diversidade (índice de Shannon H) foi maior para a região de Nhecolândia (3,36), seguido por Aquidauana (3,12) e Miranda-Abobral (2,0). Quanto à similaridade, Aquidauana apresentou maior similaridade em relação à Nhecolândia (0,83). Aquidauana em relação à Miranda-Abobral (0,78) e Nhecolândia e Miranda-Abobral (0,78), menor similaridade. Em relação à estrutura trófica, os insetívoros predominaram com 58,8% de espécies, frugívoros com 17,6%, nectarívoros, hematófagos e onívoros com 5,9% cada, carnívoro e piscívoro com 2,9%. Os resultados indicam que as sub-regiões apresentam alta similaridade e diversidade compatível com a sugerida para a região Neotropical (2,0).

Palavras-chave: composição de espécies, Chiroptera, Aquidauana, Miranda-Abobral, Nhecolândia.

Introduction

The Pantanal is a seasonal floodplain of about 139,000 km^2, drained mainly by the Paraguay river and its left board tributaries, originated in Brazilian territory. This flooding area varies from 11,000 to 110,000 km^2 with an average of 53,000 km^2 and comprises the largest continuous wetland in South America, making part of the Higher Paraguay river Basin (Bacia do Alto Paraguai - BAP) and it is shared by Brazil, Bolivia and Paraguay (ALHO, 2003; ALHO; GONÇALVES, 2005).

According to Oliveira (2007) the geological, geomorphological and climatic characteristics, together with seasonal hydrological variations, form distinct plains, considering the duration and level of flooding, which may vary due to fluctuations of rivers water level, local rainfall distribution and groundwater depth. This author points out that such conditions, combined with the influence of surrounding biomes (Cerrado, Amazon Rainforest, Atlantic Forest and Chaco), result in a mosaic of habitats with different phytophysiognomies (landscape units). According to Silva and Abdon (1998), the Pantanal is divided into 11 sub-regions that receive local names based on regional characteristics, such as Aquidauana, Abobral, Miranda and Nhecolândia sub-regions.

Among the existing environmental factors, the seasonal cycle of flood and drought is the most important phenomenon in the Pantanal wetland, an essential condition to nutrient cycling and water availability, to the enhancement of organism diversity and soil fertility level, and for the majority of ponds connected to rivers and influenced by flooding (ALHO; GONÇALVES, 2005; OLIVEIRA, 2007; FANTIN-CRUZ et al., 2008).

The fauna is also a reflection of the surrounding biomes, with rare presence of endemic species, Cerrado and Pantanal generally share the same fauna, with no relevant differences in the species number (ALHO, 2003; ALHO; GONÇALVES, 2005), because a great portion of Pantanal is comprised by vegetation formations of the biome Cerrado.

One mammal group with great species diversity in the Pantanal wetland is the order Chiroptera, with six families and thirty-nine species recorded in the Higher Paraguay river Basin (BRASIL, 1997). In the world, this order consists of about 1,120 species, being the second largest mammal order, only surpassed by the order Rodentia, which have more than 2,000 species (SIMMONS, 2005; WILSON; REEDER, 2005). In Brazil, there are approximately 167 species belonging to nine families (REIS et al., 2007).

Bats are important to the tropical ecosystem regulation, representing 40 to 50% of the mammal species in some areas (TIMM, 1994), being the determining group on the difference between the mammal diversity patterns in tropical and temperate regions (EISENBERG, 1981). As the chiropterans share resources, especially food, they influence the dynamic of natural ecosystems, acting as seeds dispersers, pollinators and regulators of some animal populations. Moreover, this group is an indicator of environment disturbance levels and good object of study on diversity (FENTON et al., 1992).

In the Brazilian Pantanal, virtually no studies on bat communities were performed. However may be cited, among others, Leite et al. (1998), who recorded twenty-nine species belonging to four families during the period May 1997 to June 1998, in the Aquidauana and Nhecolândia sub-regions, Longo et al. (2007), who studied the occurrence of *Vampyressa pusilla* in southern Pantanal and Cáceres et al. (2008), that accomplished a review study recording 60 species of bats in the State of Mato Grosso do Sul.

As the chiropterofauna in the Pantanal is still poorly known, this work aimed to ascertain the diversity, trophic guild and similarity in three sub-regions of the Pantanal of Mato Grosso do Sul, State.

Material and methods

Study area

Fieldwork were carried out in Aquidauana, Miranda-Abobral and Nhecolândia sub-regions (Figure 1), Mato Grosso do Sul Sate, Brazil.

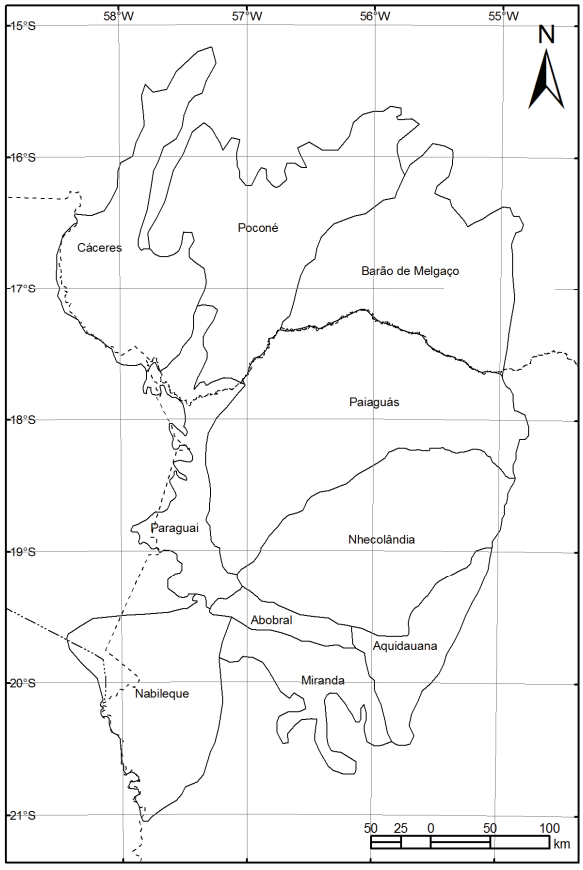

Figure 1. Sub-regions of Brazilian Pantanal, by Jorge Adámoli.

The Aquidauana sub-region comprises only the municipality of Aquidauana and is inserted into the

sub-regions groups that has approximately 70% of its area occupied by the Cerrado biome, characterized by the presence of woody vegetation and rock formations (SILVA; ABDON, 1998). In this sub-region, sampling were accomplished at the Farms Santa Maria (19°32.1'17.2" S; 55°38'69.7" W), Olhos D'Água (19°42'12" S; 55°21'30" W), Conquista (19°30'13.1" S; 55°24'57.9" W) and Santa Emília (19°30.2'44.5" S; 55°36.4'57.2" W).

The Nhecolândia sub-region aggregates the municipalities areas of Rio Verde (Mato Grosso, State), Corumbá and Aquidauana, Mato Grosso do Sul, State (SILVA; ABDON, 1998). The dominant vegetation is the Cerrado (about 40-50%), and highlights the occurrence of "baías" (permanent ponds), "salinas" (brackish water ponds), "vazantes" (temporary water channels), "corixos" (permanent water channels) and "cordilheiras" (ridges that rise to about 3 meters above the plain), with flooding periods of three to four months (ALHO; GONÇAVES, 2005). In this sub-region the collects were performed at the Farms Campo Neta (18°45'32.8" S, 56°17'48.3" W) and Santa Terezinha (19°22'38.5" S, 56°03'20.5" W), both in the municipality of Aquidauana and at Guanabara Farm (18°14'06.5" S, 55°45'00.9" W), municipality of Corumbá.

The Miranda-Abobral sub-region, according to Silva and Abdon (1998), aggregates the municipalities areas of Aquidauana, Bodoquena and Miranda, and is one of the smallest Pantanal sub-regions. Allem and Valls (1987) identify the savannah, forest and grassland as the dominant vegetations in this area, with high concentration of "carandá" (*Copernicia australis* Becc.) and specially the "paratudo" [*Tabebuia aurea* (Manso) Benth. & Hook. f. ex S. Moore]. In this sub-region, sampling were carried out at Estância Caiman (19°57'15" S, 56°18'15" W) located in the municipality of Miranda, at São Vicente Farm (20°48'51.1" S, 56°42'51.4" W) in the municipality of Bodoquena; and at Passo do Lontra Farm (19°34'37" S, 57°00'42" W), located on the border of the municipalities of Miranda and Corumbá.

Sampling and identification

From May 1994 to November 2004, 219 specimens were collected by different researchers group, with authorization of the Ibama (Brazilian Environmental Agency - license number: 014/2005). All captured specimens were deposited in the scientific collection of the Laboratory of Chiroptera of the Anhanguera-Uniderp University, Campo Grande, Mato Grosso do Sul, State. In the Miranda-Abobral sub-region were accomplished 29 collects, 51 in Aquidauana sub-region and 132 in Nheconlândia.

The animals were captured at night using mist nets (7 x 3 m), always armed proximate to the ground, in places near to food supplies, possible flight routes and at exits of diurnal roosts, previously located by direct search. The capture effort was 17,148.495 h m^{-2}, following the criteria of Straube and Bianconi (2002).

To standardize the bat captures, the nets were armed for approximately seven hours and the sampling dates were established according to the lunar phase, avoiding the full and crescent moon nights, periods of lower nocturnal activity of some bat species (MORRISON, 1980; UIEDA, 1992). Diurnal collects were also accomplished directly in the roosts, using dip nets and mist nets armed at the openings and within the roosts.

After cervical dislocation, the specimens were transported in cloth bags properly identified to the laboratory or field base. They were measured, fixed using formaldehyde solution (10%) and preserved permanently in ethylic alcohol (70º GL). For each specimen was assigned a collection number, as well as the location and date of capture.

Species identification followed Vizotto and Taddei (1973), Anderson (1997), Taddei (1999) and Gregorin and Taddei (2002), and the trophic guild composition followed Wilson (1973), Findley (1993) and Reis et al. (2007).

Statistical analysis

Shannon diversity index (with base *e* logarithm) was used for diversity analysis, and Shannon evenness index (J) was utilized to confirm the diversity, because it is less variable. Using PAST software package, the similarity between the environments was estimated by Sørensen index and rarefaction curve, according to Krebs (1989).

Results and discussion

Were analyzed 2,818 specimens of Chiroptera, belonging to 34 species in 5 families, as follows: Phyllostomidae with 15 species, Molossidae with nine, Vespertilionida with six, and Emballonuridae and Noctilionidae with two species each (Table 1).

In Aquidauana sub-region 23 species were recorded, in Miranda-Abobral 23 and in Nhecolândia 30 (Tables 1 and 2). All species found

in this study had already been described in the State of Mato Grosso do Sul (CÁCERES et al., 2008), indicating that the majority is widely distributed in the State.

Table 1. Bat families, species and trophic guild found in three sub-regions (Aquidauana - Aq; Miranda-Abobral - MA; Nhecolândia - Nh) of southern Pantanal in the period of 1994 to 2004.

Families/Species/Regions	Aq.	MA.	Nh.	Trophic guild*
Family Emballonuridae Gervais, 1955				
Peropteryx macrotis (Wagner, 1843)	-	01	-	Insectivorous
Rhynchonycteris naso (Wied-Neuwied, 1820)	08	01	-	Insectivorous
Family Molossidae Gervais, 1955				
Eumops auripendulus (Schaw, 1800)	02	-	32	Insectivorous
Eumops glaucinus (Wagner, 1843)	-	01	06	Insectivorous
Cynomops abrasus (Temminck, 1827)	-	-	41	Insectivorous
Cynomops planirostris (Peters, 1865)	-	-	20	Insectivorous
Molossops temminckii (Burmeister, 1854)	07	06	28	Insectivorous
Molossus molossus (Pallas, 1766)	28	74	410	Insectivorous
Molossus pretiosus (E. Geofroy, 1905)	-	-	39	Insectivorous
Promops centralis (Thomas, 1915)	17	-	09	Insectivorous
Promops nasutus (Spix, 1823)	01	-	02	Insectivorous
Family Noctilionidae Gray, 1821				
Noctilio albiventris (Desmarest, 1818)	17	90	432	Insectivorous
Noctilio leporinus (Linnaeus, 1758)	03	08	24	Piscivorous
Family Phyllostomidae Bonaparte, 1845				
Anoura caudifer (E. Geoffroy, 1818)	01	-	-	Nectarivorous
Artibeus lituratus (Olfers, 1818)	10	-	02	Frugivorous
Artibeus planirostris (Spix, 1823)	172	31	207	Frugivorous
Carollia perspicillata (Linnaeus, 1758)	08	07	03	Frugivorous
Chiroderma villosum (Peters, 1860)	01	-	01	Frugivorous
Chrotopterus auritus (Peters, 1856)	-	01	03	Carnivorous
Desmodus rotundus (E. Geoffroy, 1810)	11	17	01	Hematophagous
Diaemus youngi (Jentink, 1893)	03	01	08	Hematophagous
Glossophaga soricina (Pallas, 1766)	12	14	33	Nectarivorous
Lophostoma silvicolum (d'Orbigny, 1836)	05	01	15	Insectivorous
Mimon bennetii (Gray, 1838)	01	-	-	Insectivorous
Phyllostomus discolor (Wagner, 1843)	02	01	07	Omnivorous
Phyllostomus hastatus (Pallas, 1767)	05	02	25	Omnivorous
Platyrrhinus lineatus (E. Geoffroy, 1810)	28	19	102	Frugivorous
Sturnira lilium (E. Geoffroy, 1810)	09	09	32	Frugivorous
Family Vespertilionidae Gray, 1821				
Eptesicus furinalis (d'Orbigny, 1847)	-	-	12	Insectivorous
Lasiurus ega (Gervais, 1855)	01	01	09	Insectivorous
Myotis albecens (E. Geoffroy, 1906)	04	36	30	Insectivorous
Myotis nigricans (Schinz, 1821)	29	451	107	Insectivorous
Myotis riparius (Handley, 1960)	07	01	03	Insectivorous
Myotis simus (Thomas, 1901)	02	04	11	Insectivorous

*Trophic guild according to the criteria proposed by Wilson (1973), Findley (1993) and Reis et al. (2007).

Considering that there are 62 bat species recorded in the Pantanal (ALHO, 2003), the captured species in this work represent 54.8% of occurring bats species in this wetland. A previous survey, which verified the occurrence of bat species per regions (Amazon Rainforest, Cerrado, Pantanal, Chaco and Southeast), recorded only 19 bat species for Pantanal: *Artibeus lituratus*, *Carollia perspicillata*, *Chiroderma villosum*, *Cynomops planirostris*, *Desmodus rotundus*, *Diaemus youngi*, *Eumops auripendulus*, *Eptesicus furinais*, *Glossophaga soricina*, *Myotis albescens*, *M. nigricans*, *M. teminckii*, *Molossus molossus*, *M. rufus*, *Noctilio albiventris*, *N. leporinus*, *Phyllostomus hastatus*, *Rhynchonycteris naso* and *Sturnira lilium* (BRASIL, 1997).

Afterward, Leite et al. (1998) recorded 29 species in the Aquidauana and Nhecolândia sub-regions. Hence, the species occurrence described in this study was high for the Aquidauana sub-region (23).

Regarding the Brazilian Cerrado, are known about 80 species of bats (MARINHO-FILHO, 1996), in the present study were found 42.5% of species recorded for this biome, showing similarity between these regions.

In the study area, the families Molossidae and Phyllostomidae showed highest number of recorded species, 9 and 15, respectively. The samplings also revealed a large number of individuals of certain families, due to captures within and at exits of colonies day roosts, despite the Gomes and Uieda (2004) recommendation, that should not be performed capture inside the roosts, since can cause stress to the resident animals, breaking their social organization and may lead most of colonies members to escape to other roosts.

The family Phyllostomidae showed 810 captured individuals, 410 of these *A. planirostris*, a very abundant species in the Cerrado according to Reis et al. (2007). This family has 160 species recorded in the Neotropics, of which 90 occur in Brazil (SIMMONS, 2005), and fifteen of which were captured in the study areas. The phyllostomids are, usually, abundant in number of specimens and show the largest biodiversity in the mammal communities, besides they occupy different niches (FENTON et al., 1992; KOOPMAN, 1993; REIS et al., 2007). Furthermore, these animals tend to be easily mist netted, allowing an abundant sampling, even though it is selective (PEDRO; TADDEI, 1997). These factors together may explain the higher species number of this family recorded in this study.

The family Molossidae had 723 specimens collected, the majority belonging to the species *M. molossus* (n = 512), characterized by insectivorous trophic habit and is found both in natural as urban areas, in places such as residences ceilings and other buildings (REIS et al., 2007), which would explain their abundance in built environments. Across the globe, this family is represented by 86 species, 26 of which are documented in Brazil (SIMMONS, 2005). In the present study were caught nine species. The high and fast flight, typical of molossids, hinders the captures of this bats through mist nets (GREGORIN; TADDEI, 2002), thus the diversity obtained in this study resulted from the effort to search for day roosts, with colonies previously located by direct search, and capture at exits or directly into the roosts.

Regarding the family Vespertilionidae, 708 individuals were captured, of which 587 were represented by *M. nigricans*, an abundant species in areas with anthropogenic influence, often dependent on built places for roosting (REIS et al., 2007). This is the family with greatest diversity and geographical distribution among Chiroptera, with 48 genera and 407 species, individuals may be found alone, in small or large groups, utilizing every type of roosts (REIS et al., 2007; SIMMONS, 2005).

Were collected 574 bats of the family Noctilionidae, the great portion was represented by *N. albiventris*, an insectivorous bat well known by hunt insects next to the water, frequently found in tropical lowlands associated with watercourses, in colonies of tens to hundreds of individuals, including one genus and two sympatric species, *N. albiventris* and *N. leporinus* (EISENBERG, 1981; NOWAK, 1994; REIS et al., 2007), both found in the study area.

The family with the lowest number of species (2) and individuals (10) was Emballonuridae. According to Reis et al. (2007) there are 15 species of this family in Brazil, characterized by being small insectivorous bats that capture insects in flight, they form colonies generally with 10-20 individuals, but may reach up to 80, and are usually difficult to capture because their ability to detect the nets.

Regarding the diversity (Shannon index), the value obtained for the Aquidauana sub-region was 3.12, for Miranda-Abobral was 2.0 and Nhecolândia 3.33. Which was confirmed by Shannon J evenness index, that considers the existing species richness (Aquidauana: 0.672; Miranda-Abobral: 0.447; Nhecolândia: 0.699). These results indicate that the Nhecolândia sub-region has the greatest species diversity, probably due to the largest number of samplings performed on this sub-region, which in turn presents great environment heterogeneity.

Pedro and Taddei (1997) stated that the bat diversity in large extent of the Neotropical region is He' = 2.0, even with the variation of the sampled species. Individually, the Aquidauana sub-region showed the highest diversity (He' = 3.33) and Miranda-Abobral sub-region the lowest (He' = 2.0). Generally, bat species richness is significantly higher in preserved areas than in disturbed areas (FENTON et al., 1992). Whereas values greater than suggested for the Neotropics indicates areas with high species richness, all three studied areas can be regarded as preserved.

In the three sub-regions were collected 19 species in common: *A. planirostris*, *C. perspicillata*, *D. rotundus*, *D. youngi*, *G. soricina*, *L. ega*, *L. silvicolum*, *M. temminckii*, *M. molossus*, *M. albecens*, *M. nigricans*, *M. riparius*, *M. simus*, *N. albiventris*, *N. leporinus*, *P. discolor*, *P. hastatus*, *P. lineatus* and *S. lilium*.

The faunal similarity analysis (Sorensen) indicated that the sub-region Aquidauana compared to Nhecolândia showed the value of 0.83, suggesting great similarity. Nhecolândia compared to Miranda-Abobral and Aquidauana to Miranda-Abobral showed equal values (0.78), what demonstrate great similarity between all areas, regarding the composition of bat species.

In Aquidauana sub-region were identified two restricted species (*Anoura caudifer* and *Mimon bennettii*). In the Miranda-Abobral sub-region, there was just one, *Peropteryx macrotis*. The Nhecolândia sub-region had the highest number of restricted species (four), *Eptesicus furinalis*, *Cynomops abrasus*, *C. planirostris* and *Molossus pretiosus*. It is important to emphasize that in Nhecolândia the capture effort was higher, which leaded to greater number of captured bats and, therefore, higher probability to catch different species.

The rarefaction curves allow comparisons between different areas, when there is unequal number of samples (MAGURRAN, 1988). In the present work, it demonstrated that Nhecolândia sub-region richness of bat species tends to be stabilized, even if increase the capture effort.

The Aquidauana and Miranda-Abrobral sub-regions showed a tendency to increase their diversity, suggesting that if increase the capture effort, new species will be found (Figure 2). Thus, probably there is a significant number of species not captured in both areas.

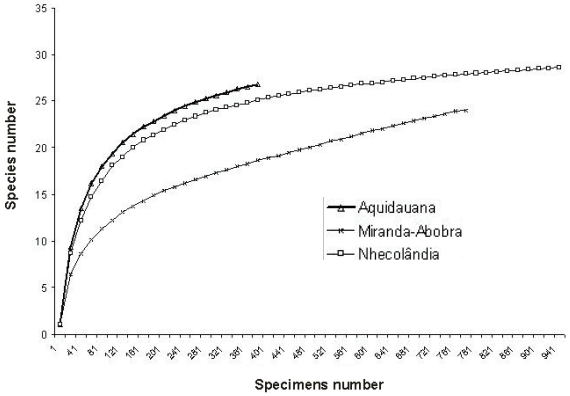

Figure 2. Rarefaction curve for bat species richness between 1994 and 2004 in Aquidauana, Miranda-Abobral and Nhecolândia sub-regions, Mato Grosso do Sul, Brazil.

As for the trophic structure found, insectivorous predominated with 58.8% of the species (20), frugivorous with 17.6% (7), nectarivorous, hematophagous and omnivorous with 5.9% each (two

species for each food habit), carnivorous and piscivorous with 2.9% each, with one species recorded for both.

According to Pedro and De Marco Jr. (2008) there is a trend to increase the number of insectivorous species the extent that enlarges the forest fragment size. As the sampling areas had large extensions of relatively well preserved areas, the predominance of insectivorous species was confirmed.

Additionally, insectivorous species also comprise the genera with higher species number recorded in the three sub-regions, as *Myotis* with four species, and *Eumops*, *Cynomops*, *Mossolus* and *Promops* with two species each. The other genera with two species were *Artibeus*, with frugivorous feeding habit, and *Phyllostomus*, characterized by omnivorous diet.

Leite et al. (1998) report that some bat species in the Pantanal are generally well adapted to man-modified environments, using residences ceilings and other buildings to roosting, furthermore there are normally water and various surrounding natural roosts, such as tree canopies, trunks, rock crevices and among others, which can favor the insectivorous species. The existence of man-made structures increases bat populations in these places, because, besides the availability of roosts favorable for the protection of the colony, the farms have artificial light that attracts insects, increasing the food supply, which makes the insectivorous feeding habits predominant, with 58.8% of the recorded species.

The presence of horses and other domestic animals may favor hematophagous species like *D. rotundus* and *D. youngi*, found in three sub-regions. Their colonies can contain 10-50 individuals with ability to use different substrates as day roosts (BREDT; SILVA, 1996; TADDEI et al., 1991). However, the number of hematophagous specimens captured was not large, which could be explained by netting in areas with insignificant individuals number or the existence of population control effort of the agricultural organizations, to prevent possible outbreaks of bovine rabies in the region.

Only one specimen was recorded of *Mimon bennettii*, *Anoura caudifer* and *Peropteryx macrotis*, the first two in Aquidauana sub-region and the last one in Miranda-Abobral.

M. bennettii constitutes small colonies (two to four individuals), as well as *P. macrotis*, which occurs in small groups of six to twelve individuals (NOWAK, 1994). This could explain the low abundance and catch of these species in the present study. On other hand, *Anoura caudifer* is commonly reported in local surveys, occurring in primary and secondary forests (REIS et al., 2007). Its low sampling indicates that the capture sites were not adequate or that the species has no major colonies in the studied regions.

As for the species *Promops nasutus*, with three captured specimens, no information on the number of individuals per colony was found. However, this family has long and narrow wings, adapted to flying fast and maneuverable (REIS et al., 2007), what perhaps allowed to escape from the nets. For *Chiroderma villosum* (two captured specimens) no information about the colony size or flight characteristics were found yet. For *Chrotopterus auritus*, with four captured individuals, Nowak (1994) and Reid (1997) state that this species tends to form small groups (one to seven specimens), which could explain the low sampling of this species.

Conclusion

In all three sub-regions were recorded 42.5% of the total species identified in the Cerrado, the families Molossidae and Phyllostomidae showed the greatest species abundance and the predominant genus was *Myotis*. The greatest species diversity was recorded in Nhecolândia sub-region ($H_e' = 3.33$).

The results suggest that the three sub-regions show high similarity between them, with 19 species in common, preponderance of the insectivorous trophic guild (58.8%) and large numbers of individuals of the species *Molossus molossus*, *Myotis nigicans* and *Noctilio albiventris*.

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References

ALHO, C. **Conservação da biodiversidade da Bacia do Alto Paraguai**. Campo Grande: Uniderp, 2003.

ALHO, C. J. R.; GONÇALVES, H. C. **Biodiversidade do Pantanal**: ecologia e conservação. Campo Grande: Uniderp, 2005.

ALLEN, A. C.; VALLS, J. F. M. **Recursos forrageiros ativos do Pantanal Mato-grossense**. Brasília: Embrapa-Cenargem, 1987.

ANDERSON, S. Mammals of Bolivia, taxonomy and distribution. **Bulletin of the American Museum of Natural History**, n. 231, p. 1-652, 1997.

BRASIL. Programa Nacional do Meio Ambiente, Ministério do Meio Ambiente. PCBAP (Plano de Conservação da Bacia do Alto Paraguai). **Diagnóstico dos Meios Físicos e Bióticos**. Brasília: PNMA, 1997.

BREDT, A.; SILVA, D. M. **Morcegos em áreas urbanas e rurais: manual de manejo e controle**. Brasília: Fundação Nacional de Saúde, 1996.

CÁCERES, N. C.; CARMIGNOTTO, A. P.; FISCHER, E.; SANTOS, C. F. Mammals from Mato Grosso do Sul, Brazil. **Check List**, v. 4, n. 3, p. 321-335, 2008.

EISENBERG, J. F. **The mammalian radiations: an analysis of trends in evolution, adaptation, and behavior**. Chicago: The University of Chicago Press, 1981.

FANTIN-CRUZ, I.; LOVERDE-OLIVEIRA, S.; GIRARD, P. Caracterização morfométrica e suas implicações na limnologia de lagoas do Pantanal norte. **Acta Scientiarum. Biological Sciences**, v. 30, n. 2, p. 133-140, 2008.

FENTON, M. B.; ACHARYA, L.; AUDET, D.; HICKEY, M. B. C.; MERRIMAN, C.; OBRIST, M. K.; SYME, D. M. Phyllostomid bats (Chiroptera: Phyllostomidae) as indicators of habitat disruption in the Neotropics. **Biotropica**, v. 24, n. 3, p. 440-446, 1992.

FINDLEY, J. S. **Bats**: a community perspective. Cambridge: Cambridge University Press, 1993.

GOMES, M. N.; UIEDA, W. Abrigos diurnos, composição de colônias, dimorfismo sexual e reprodução do morcego hematófago *Desmodus rotundus* (E. Geoffrey) (Chiroptera, Phillostomidae) no Estado de São Paulo, Brasil. **Revista Brasileira de Zoologia**, v. 21, n. 3, p. 629-638, 2004.

GREGORIN, R.; TADDEI, V. A. Chave artificial para a identificação de molossídeos brasileiros (Mammalia, Chiroptera). **Mastozoología Neotropical**, v. 9, n. 1, p. 13-32, 2002.

KOOPMAN, K. F. Classification of bats. In: WALTON, D. W. (Ed.). **A chiropteran biology symposium**. Dallas: Southern Methodist University Press, 1993. p. 22-28.

KREBS, C. J. **Ecological methodology**. New York: Harper and Row Publishers, 1989.

LEITE, A. P.; MENEGHELLI, M.; TADDEI, V. A. Morcegos (Chiroptera: Mammalia) dos Pantanais de Aquidauana e da Nhecolândia, Mato Grosso do Sul. I. Diversidade de espécies. **Ensaios e Ciências**, v. 2, n. 2, p. 149-163, 1998.

LONGO, J. M.; FISCHER, E.; CAMARGO, G.; SANTOS, C. F. Ocorrência de *Vampyressa pusilla* (Chiroptera, Phyllostomidae) no Pantanal sul. **Biota Neotropical**, v. 7, n. 3, p. 369-372, 2007.

MAGURRAN, A. E. **Ecological diversity and its measurement**. Cambridge: Cambridge University Press, 1988.

MARINHO-FILHO, J. Distribution of bat diversity in the southern and southeastern Brazilian Atlantic Forest. **Chiroptera Neotropical**, v. 2, n. 2, p. 51-54, 1996.

MORRISON, D. W. Foraging and day-roosting dynamics of canopy fruit bats in Panama. **Journal of Mammalogy**, v. 61, n. 1, p. 20-29, 1980.

NOWAK, R. M. **Walker's bats of the world**. Baltimore: Johns Hopkins University Press, 1994.

OLIVEIRA, A. K. M. Pantanal - alguns parâmetros físico-químico e biológicos. In: BARBOSA, L. M.; SANTOS JUNIOR, N. A. (Org.). **A botânica no Brasil**: pesquisa, ensino e políticas públicas ambientais. São Paulo: Sociedade Botânica do Brasil, 2007. p. 263-266.

PEDRO, W. A.; DE MARCO JR., P. Fragmentação de hábitat e sua influência sobre as comunidades de morcegos no Brasil. In: PACHECO, S. M.; MARQUES, R. V.; ESBERARD, C. E. L. (Org.). **Morcegos do Brasil**: biologia, sistemática, ecologia e conservação. Porto Alegre: Armazém Digital, 2008. p. 375-380.

PEDRO, W. A.; TADDEI, V. A. 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**, v. 6, p. 3-21, 1997.

REID, F. A. **A field guide to the mammals of Central America and southeast México**. New York: Oxford University Press, 1997.

REIS, N. R.; PERACCHI, A. L.; PEDRO, W. A.; LIMA, I. P. **Morcegos do Brasil**. Londrina: Nélio R. dos Reis, 2007.

SILVA, J. S. V.; ABDON, M. M. Delimitação do Pantanal brasileiro e suas sub-regiões. **Pesquisa Agropecuária Brasileira**, v. 33, n. esp., p. 1703-1711, 1998.

SIMMONS, N. B. Order Chiroptera. In: WILSON, V.; REEDER, D. M. (Ed.). **Mammals species of the world**: a taxonomic and geographic reference. Baltimore: Johns Hopkins University Press, 2005. p. 312-529.

STRAUBE, F. C.; BIANCONI, G. V. Sobre a grandeza e a unidade utilizada para estimar esforços de captura com utilização de redes-de-neblina. **Chiroptera Neotropical**, v. 8, n. 1/2, p. 150-152, 2002.

TADDEI, V. A. **Chave para determinação das famílias de quirópteros brasileiros**. Campo Grande: Uniderp, 1999.

TADDEI, V. A.; GONÇALVES, C. A.; PEDRO, W. A.; TADEI, W. J.; KOTAIT, I.; ARIETA, C. **Distribuição do morcego vampiro *Desmodus rotundus* (Chiroptera, Phyllostomidae) no Estado de São Paulo e a raiva dos animais domésticos**. Campinas: Secretaria de Agricultura e Abastecimento do Estado de São Paulo, 1991.

TIMM, R. M. The mammal fauna. In: MCDADE, L. A.; BAWA, K. S.; HESPENHEIDE, H. A.; HARTSHORN, G. S. (Ed.). **La selva**: ecology and natural history of a Neotropical rain forest. Chicago: University of Chicago Press, 1994. p. 229-237.

UIEDA, W. Período de atividade alimentar e tipos de presas dos morcegos hematófagos no sudeste do Brasil. **Revista Brasileira de Biologia**, v. 52, n. 4, p. 563-573, 1992.

VIZOTTO, L. D.; TADDEI, V. A. Chave para determinação de quirópteros brasileiros. Revista da Faculdade de Filosofia, Ciências e Letras de São José do Rio Preto. **Boletim de Ciências**, v. 1, p. 1-72, 1973.

WILSON, D. E. Bat faunas: a trophic comparision. **Systematic Zoology**, v. 22, n. 1, p. 14-29, 1973.

WILSON, D. E.; REEDER, D. M. **Mammal species of the world**. Washington, D.C.: Johns Hopkins University Press, 2005.

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