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Checklist of mammals from Mato Grosso do Sul, Brazil

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ABSTRACT. We updated the checklist of mammals from Mato Grosso do Sul, Brazil based on primary records only. One hundred and sixty-six mammal species were listed as occurring in the state, 47 of them being medium to large, 47 small mammal and 73 bat species. The listed species are distributed in 31 families: Didelphidae (17 spp.), Dasypodidae (7 spp.), Myrmecophagidae (2 spp.), Cebidae (1 sp.), Callithrichidae (2 spp.), Aotidae (1 sp.), Pitheciidae (1 sp.), Atelidae (1 sp.), Leporidae (1 sp.), Felidae (7 spp.), Canidae (4 spp.), Mustelidae (5 spp.), Mephitidae (2 spp.), Procyonidae (2 spp.), Tapiridae (1 sp.), Tayassuidae (2 spp.), Cervidae (4 spp.), Sciuridae (1 sp.), Cricetidae (22 spp.), Erethizontidae (1 sp.), Caviidae (3 spp.), Dasyproctidae (1 sp.), Cuniculidae (1 sp.), Echimyidae (4 spp.), Phyllostomidae (41 spp.), Emballonuridae (2 spp.), Molossidae (16 spp.), Vespertilionidae (9 spp.), Mormoopidae (1 sp.), Noctilionidae (2 spp.), and Natalidade (1 sp.). These numbers represent an increase of fourteen species with primary records for the state in comparison with the previously published checklist. However, it is evident the scarcity of information at several regions of the state, and the need of implementation of regional zoological collections. The state of Mato Grosso do Sul represent only 4.19% of the Brazilian territory, but the number of mammal species reach 24.13% of the known species occurring in the country.

KEYWORDS. Mammals, Mato Grosso do Sul, checklist, Biota-MS Program.

RESUMO. Lista de mamíferos do Mato Grosso do Sul, Brasil. Atualizamos a lista de mamíferos do estado de Mato Grosso do Sul, Brasil com base em registros primários. Cento e sessenta e seis espécies são listadas como ocorrentes no estado, sendo 47 de mamíferos de médio e grande porte, 46 de pequenos mamíferos e 73 de morcegos. As espécies listadas estão distribuídas em 31 famílias: Didelphidae (17 spp.), Dasypodidae (7 spp.), Myrmecophagidae (2 spp.), Cebidae (1 sp.), Callithrichidae (2 spp.), Aotidae (1 sp.), Pitheciidae (1 sp.), Atelidae (1 sp.), Leporidae (1 sp.), Felidae (7 spp.), Canidae (4 spp.), Mustelidae (5 spp.), Mephitidae (2 sp.), Procyonidae (2 spp.), Tapiridae (1 sp.), Tayassuidae (2 spp.), Cervidae (4 spp.), Sciuridae (1 sp.), Cricetidae (22 spp.), Erethizontidae (1 sp.), Caviidae (3 spp.), Dasyproctidae (1 sp.), Cuniculidae (1 sp.), Echimyidae (4 spp.), Phyllostomidae (41 spp.), Emballonuridae (2 spp.), Molossidae (16 spp.), Vespertilionidae (9 spp.), Mormoopidae (1 sp.), Noctilionidae (2 spp) e Natalidade (1 sp.). Estes números representam um aumento de quatorze espécies com registro primário para o estado em comparação com a listagem publicada anteriormente. Ainda assim, é evidente a escassez de informações em diversas regiões do estado, e a necessidade de implementação de coleções zoológicas regionais. O estado de Mato Grosso do Sul representa apenas 4,19% do território brasileiro, mas o número de mamíferos atinge 24,13% do total de espécies que ocorrem no país.

PALAVRAS-CHAVE. Mamíferos, Mato Grosso do Sul, Lista, Programa Biota-MS.

The mammalian fauna from Mato Grosso do Sul state of Brazil was first compiled by Cáceres *et al*. (2008), but checklists have been published for specific regions in the state, such as the Acurizal ranch, in the Amolar mountain range (Schaller, 1983; Tomas & Mourão, 2007), the Nhumirim ranch, in the Nhecolândia region of the Pantanal (Alho *et al*., 1987), the Bodoquena mountain range (Cáceres *et al*., 2007b; Camargo *et al*., 2009), Serra de Maracaju (Hannibal & Godoy, 2015), and the Urucum mountains, near Corumbá (Bordignon & França, 2009; Godoi *et al*., 2010a; Cáceres *et al*., 2011). Additional publications report the distribution of isolated species or group of species, often not comprehending solely the Mato Grosso do Sul territory (e.g., Carmignotto, 2004; Carmignotto & Monfort, 2006; Cáceres *et al*., 2006, 2007b; Santos *et al*., 2010; Godoi *et al*., 2010b; Silveira *et al*., 2011; Hannibal *et al*., 2012; Teribele *et al*., 2012).

Collections of zoological material have been conducted in Mato Grosso do Sul since 1817 by naturalist expeditions crossing the western region of Brazil, with

specimens usually deposited in several overseas and national museums. J. Natterer, for example, visited the western region of the modern state of Mato Grosso do Sul from 1824 to 1830 (Pelzen, 1883; Vanzolini, 1993); H. H. Smith travelled through the state up to Cuiabá, in the modern state of Mato Grosso, navigating along the Paraguay river in 1882 and 1886 (Cope, 1889; Allen, 1891, 1892, 1893); many mammal records and specimens were obtained during the construction of telegraph lines by Marechal Cândido M. S. Rondon, crossing also many parts of the sate (Miranda Ribeiro, 1914), and by the Roosevelt-Rondon Expedition, which crossed the Pantanal region from 1913 to 1914 (Miller, 1915). The Instituto Oswaldo Cruz, conducted expeditions to the Cuiabá and São Lourenço rivers in 1922, which separate Mato Grosso from Mato Grosso do Sul states (Travassos *et al*., 1927). Collections of zoological material were also conducted in Salobra region, Mato Grosso do Sul, along the Noroeste do Brasil railway (e.g., Vieira, 1940, 1955; Travassos, 1940). These expeditions provided relevant scientific material that become the basis for many published mammal checklists for Brazil (e.g, Vieira, 1955) and are still supporting regional analysis of the vertebrate fauna in the western region of the country.

Since then, little effort has been applied to establish regional zoological collections, as well as to conduct sound inventories in most of the state. Two comprehensive inventories were conducted more than 30 years ago, both in the Pantanal wetland (Schaller, 1983; Alho *et al*., 1987). Recently, some inventories have been conducted in Mato Grosso do Sul, such as those in the Aporé and Sucuriú river basins, in the northeastern region of the state (Bordignon *et al*., 2006), in the Bodoquena mountain range, in the southwestern region of the state (Cáceres *et al*., 2007a), in the Pousada Araraúna, located in the southeastern region of the Pantanal (Mamede & Alho, 2006), in the northwestern region (Pulchério-Leite *et al*., 1998; Alho *et al*., 2011), at the Serra do Amolar (Tomas & Mourão, 2007), Serra de Maracaju (Hannibal & Godoy, 2015) and in the Urucum mountains near Corumbá (Godoi *et al*., 2010a; Cáceres *et al*., 2011). However, these inventories do not include all taxonomic groups among mammals. Additional publications are restricted to species distribution, such as Tomas *et al*. (2009).

This article aims to update the checklist of mammal species from Mato Grosso do Sul in the light of recent data, especially those based on museum specimens and geo-referenced photographs and videos cataloged in image collections. As a result, the present checklist should be considered conservative, as non-primary records were excluded. We also intend to point out taxonomic inconsistencies that should be subjected to more detailed studies concerning taxonomy and species distribution.

MATERIAL AND METHODS

The list of mammal species (Tab. I) is based only on primary records. Specimens deposited at regional and national collections were obtained directly from specimens examination and from recent publications that listed vouchers used to report species occurrence, taxonomic reviews, and species distributions. Given the difficulties in accessing important mammal collections at relevant national and international museums, especially those that do not offer online information on the specimens, we consider this list as a basic checklist. Overall taxonomic nomenclature follows Paglia *et al*. (2012), which incorporates Wilson & Reeder (2005). Recent modifications were used, such as Lim *et al*. (2004) for *Artibeus planirostris*, Weksler *et al*. (2006) for the genera *Cerradomys*, *Euryoryzomys* and *Hyaleamys*, Lynch Alfaro *et al*. (2011) for *Cebus*, Garbino & Tejedor (2012) for *Natalus macrourus*, and Nascimento *et al*. (2013) for *Thrichomys*. The specimens and image records considered in this article are listed in the Table III. To avoid an inflated list of species, we did not include in the present checklist undetermined or not yet described species (reported as Genus). Taxonomic entities described as "group" were not considered, as the authors who published them stated that this treatment was adopted due to the impossibility to precisely identify the voucher species with cariotipying as not suitable samples are available. Data from and reports based on interviews were avoided. Pictures of signs (tracks, burrows and other evidence) were included only if they permit unmistakably identification of the species. All taxa were considered up to the species level, not considering sub-species. Non-native species were not included.

RESULTS AND DISCUSSION

One hundred and sixty-six mammal species were listed as occurring in the Mato Grosso do Sul state, Brazil, 47 of them being medium to large, 46 small mammal and 73 bat species. These numbers represent an increase of fourteen species to the previous publication (Cáceres *et al*., 2008), considering that we did not account for undefined species cited as Genus, or group of species, or species with no primary records. The mammal species confirmed to the state are distributed in 31 Families: Didelphidae (17 spp.), Dasypodidae (7 spp.), Myrmecophagidae (2 spp.), Cebidae (1 sp.), Callithrichidae (2 spp.), Aotidae (1 sp.), Pitheciidae (1 sp.), Atelidae (1 sp.), Leporidae (1 sp.), Felidae (7 spp.), Canidae (4 spp.), Mustelidae (5 spp.), Mephitidae (2 sp.), Procyonidae (2 spp.), Tapiridae (1 sp.), Tayassuidae (2 spp.), Cervidae (4 spp.), Sciuridae (1 sp.), Cricetidae (22 spp.), Erethizontidae (1 sp.), Caviidae (3 spp.), Dasyproctidae (1 sp.), Cuniculidae (1 sp.), Echimyidae (4 spp.), Phyllostomidae (41 spp.), Emballonuridae (2 spp.), Molossidae (17 spp.), Vespertilionidae (9 spp.), Mormoopidae (1 sp.), Noctilionidae (2 spp.) and Natalidade (1 sp.). However, these numbers should be considered not definitive, as sound inventories are still rare in several regions of the state. As an example, in the Southern Cone (south of the Ivinhema river basin), once covered by the Atlantic Forest, little is known about the mammal fauna, and only one checklist for this region has been published (Hannibal, 2014). We estimate that

Tab. I. Checklist of mammal species from Mato Grosso do Sul state, Brazil.

ORDER FAMILY	Species
DIDELPHIMORPHIA	
DIDELPHIDAE	
	Caluromys lanatus (Olfers, 1818)
	Caluromys philander Linnaeus, 1758
	Chironectes minimus (Zimmermann, 1780)
	Cryptonanus agricolai (Moojen, 1943)
	Cryptonanus chacoensis (Tate, 1931)
	Didelphis albiventris Lund, 1840
	Didelphis aurita (Wied-Neuwied, 1826)
	Didelphis marsupialis Linnaeus, 1758
	Gracilinanus agilis (Burmeister, 1854)
	Lutreolina crassicaudata (Desmarest, 1804)
	Marmosa (*Micoureus*) *constantiae* (Thomas, 1904)
	Marmosa murina Linnaeus, 1758
	Marmosops ocellatus (Tate, 1931)
	Monodelphis domestica (Wagner, 1842)
	Monodelphis kunsi Pine, 1975
	Phillander opossum (Linnaeus, 1758)
	Thylamys macrurus (Olfers, 1818)
CINGULATA	
DASYPODIDAE	
	Dasypus novemcinctus Linnaeus, 1758
	Dasypus semptemcinctus Linnaeus, 1758
	Euphractus sexcinctus (Linnaeus,1758)
	Priodontes maximus (Kerr, 1792)
	Tolypeutes matacus (Desmarest, 1804)
	Cabassous unicinctus (Linnaeus, 1758)
PILOSA	
MYRMECOPHAGIDAE	
	Myrmecophaga tridactyla Linnaeus, 1758
	Tamandua tetradactyla (Linnaeus, 1758)
PRIMATES	
CEBIDAE	
	Sapajus cay (Illiger, 1815)
CALLITHRICHIDAE	
	Mico melanurus (É. Geoffroy, 1812)
	Callithrix penicillata (É. Geoffroy, 1812)
AOTIDAE	
	Aotus azarae (Humboldt, 1812)
PITHECIIDAE	
	Callicebus **cf.** *pallescens* Thomas, 1907
ATELIDAE	
	Alouatta caraya (Humboldt, 1812)
LAGOMORPHA	
LEPORIDAE	
	Sylvilagus brasiliensis (Linnaeus, 1758)
CARNIVORA	
FELIDAE	
	Leopardus colocolo (Molina, 1782)
	Leopardus pardalis (Linnaeus, 1758)
	Leopardus guttulus (Schreber, 1775)
	Leopardus wiedii (Schinz, 1821)
	Puma concolor (Linnaeus, 1771)
	Puma yagouaroundi (É. Geoffroy, 1803)
	Panthera onca (Linnaeus, 1758)
CANIDAE	
	Cerdocyon thous (Linnaeus, 1766)
	Chrysocyon brachyurus (Illiger, 1815)
	Lycalopex vetulus (Lund, 1842)
	Speothos venaticus (Lund, 1842)
MUSTELIDAE	
	Lontra longicaudis (Olfers, 1818)
	Pteronura brasiliensis (Gmelin, 1788)
	Eira barbara (Linnaeus, 1758)

Tab. I. Cont.

ORDER / FAMILY	Species
	Galictis cuja (Molina, 1782)
	Galictis vitatta (Scheber, 1776)
MEPHITIDAE	
	Conepatus semistriatus (Boddaert, 1785)
	Conepatus chinga (Molina, 1782)
PROCYONIDAE	
	Nasua nasua (Linnaeus, 1766)
	Procyon cancrivorus (G. Cuvier, 1798)
PERISSODACTYLA	
TAPIRIDAE	
	Tapirus terrestris (Linnaeus, 1758)
ARTIODACTYLA	
TAYASSUIDAE	
	Pecari tajacu (Linnaeus, 1758)
	Tayassu pecari (Link, 1795)
CERVIDAE	
	Blastocerus dichotomus (Illiger, 1815)
	Mazama americana (Erxleben, 1777)
	Mazama gouazoubira (Fischer, 1814)
	Ozotoceros bezoarticus (Linnaeus, 1758)
RODENTIA	
SCIURIDAE	
	Urosciurus spadiceus (Olfers, 1818)
CRICETIDAE	
	Akodon montensis Thomas, 1913
	Akodon toba Thomas, 1921
	Calomys **aff.** *callidus* (Thomas, 1916)
	Calomys callosus (Rengger, 1830)
	Cerradomys maracajuensis (Langguth & Bonvicino, 2002)
	Cerradomys scotti (Langguth & Bonvicino, 2002)
	Euryoryzomys nitidus (Thomas, 1884)
	Holochilus chacarius Wagner, 1842
	Hylaeamys megacephalus (Fischer, 1814)
	Necromys lasiurus (Lund 1841)
	Nectomys rattus (Pelzeln, 1883)
	Nectomys squamipes (Brants, 1827)
	Oecomys bicolor (Thomas, 1860)
	Oecomys catherinae Thomas, 1909
	Oecomys mamorae (Thomas, 1906)
	Oecomys paricola (Thomas, 1904)
	Oligoryzomys chacoensis (Myers & Carleton, 1981)
	Oligoryzomys fornesi (Massoia, 1973)
	Oligoryzomys nigripes (Olfers, 1818)
	Oxymycterus delator Thomas, 1903
	Pseudoryzomys simplex (Winge, 1887)
	Rhipidomys macrurus (Gervais, 1855)
ERETHIZONTIDAE	
	Coendou prehensilis (Linnaeus, 1758)
CAVIIDAE	
	Cavia aperea Erxleben, 1777
	Cavia fulgida Wagler, 1831
	Hydrochoerus hydrochaeris (Linnaeus, 1766)
DASYPROCTIDAE	
	Dasyprocta azarae Lichtenstein, 1823
CUNICULIDAE	
	Cuniculus paca (Linnaeus, 1766)
ECHIMYIDAE	
	Clyomys laticeps (Thomas, 1909)
	Proechimys longicaudatus (Rengger, 1830)
	Proechimys roberti Thomas, 1901
	Thrichomys fosteri (Thomas, 1903)
CHIROPTERA	
PHYLLOSTOMIDAE	
	Lophostoma brasilienses Peters, 1866
	Lophostoma silvicolum d'Orbigny, 1836

Tab. I. Cont.

ORDER FAMILY	Species
	Macrophyllum macrophyllum (Schinz, 1821)
	Micronycteris sanborni Simmons, 1996
	Micronycteris minuta (Gervais, 1856)
	Micronycteris megalotis Gray, 1842
	Chrotopterus auritus (Peters, 1856)
	Lonchorhina aurita Tomes 1863
	Mimon bennettii (Gray, 1838)
	Mimon crenulatum (E. Geoffroy, 1803)
	Phylloderma stenops Peters, 1865
	Phyllostomus elongatus (E. Geoffroy, 1810)
	Phyllostomus hastatus (Pallas, 1767)
	Phyllostomus discolor Wagner, 1843
	Tonatia bidens (Spix, 1823)
	Trachops cirrhosus (Spix, 1823)
	Vampyrum spectrum (Linnaeus, 1758)
	Artibeus cinereus (Gervais, 1856)
	Artibeus fimbriatus Gray, 1838
	Artibeus planirostris (Spix, 1823)
	Artibeus obscurus (Schinz, 1821)
	Artibeus lituratus (Olferns, 1818)
	Chiroderma villosum Peters, 1860
	Chiroderma doriae O. Thomas, 1891
	Platyrrhinus helleri (Peters, 1866)
	Platyrrhinus lineatus (E. Geoffroy, 1810)
	Pygoderma bilabiatum (Peters, 1863)
	Uroderma bilobatum Peters, 1866
	Uroderma magnirostrum Davis, 1868
	Vampyressa pusilla (Wagner, 1843)
	Vampyrodes caraccioli (Thomas, 1889)
	Sturnira lilium (E. Geoffroy, 1810)
	Desmodus rotundus (E. Geoffroy, 1810)
	Diaemus youngi (Jentink, 1843)
	Anoura geoffroyi Gray, 1838
	Anoura caudifer (E. Geoffroy, 1818)
	Glossophaga soricina (Pallas, 1766)
	Lonchophylla dekeyseri Taddei, Vizotto & Sazima, 1983
	Lonchophylla mordax (Thomas, 1903)
	Lionycteris spurrelli (Thomas, 1913)
	Carollia perspicillata (Linnaeus, 1758)
EMBALLONURIDAE	
	Peropteryx macrotis (Wagner, 1843)
	Rhynchonycteris naso (Wied-Neuwied, 1820)
MOLOSSIDAE	
	Cynomops abrasus (Temminck, 1827)
	Cynomops planirostris (Peters, 1865)
	Eumops bonariensis (Peters, 1874)
	Eumops dabbenei Thomas 1914
	Eumops glaucinus (Wagner, 1843)
	Eumops patagonicus Thomas, 1924
	Eumops perotis (Schinz, 1821)
	Eumops auripendulus (Shaw, 1800)
	Molossops temminckii (Burmeister, 1854)
	Molossus rufus (E. Geoffroy, 1805)
	Molossus molossus (Pallas, 1856)
	Molossus pretiosus (Miller, 1902)
	Nyctinomops macrotis (Gray, 1840)
	Nyctinomops laticaudatus (E. Geoffroy, 1805)
	Promops centralis Thomas, 1915
	Promops nasutus (Spix, 1823)
	Tadarida brasiliensis (I. Geoffroy, 1824)
VESPERTILIONIDAE	
	Eptesicus furinalis (d'Orbigny, 1847)
	Eptesicus brasiliensis (Desmarest, 1819)
	Lasiurus blossevillii (Lesson & Garnot, 1826)
	Lasiurus cinereus (Beauvois, 1796)

Tab. I. Cont.

ORDER FAMILY	Species
	Lasiurus ega (Gervais, 1856)
	Myotis nigricans (Schinz, 1821)
	Myotis simus Thomas, 1901
	Myotis riparius Handley, 1960
	Myotis albescens (E. Geoffroy, 1806)
MORMOOPIDAE	
	Pteronotus parnellii (Gray, 1840)
NOCTILIONIDAE	
	Noctilio albiventris (Desmarest, 1818)
	Noctilio leporinus (Linneaus, 1758)
NATALIDAE	
	Natalus macrourus (Gervais, 1856)

about 14 species may be included in future checklists as additional inventories and taxonomic studies are developed. To date, there is no evidence of any endemic mammal species occurring in the state.

The total number of mammal species in the world is nearly 5,490 (IUCN, 2012), while the estimated number of bat species is 1,100 (Jan *et al*., 2012), resulting in 4,390 non-flying mammal species. In comparison, the number of mammal species in Brazil has been estimated as 688 (Reis *et al*., 2011), including bats and cetaceans. The Mato Grosso do Sul state comprises only 4.19% of the Brazilian Territory (357,125 km^2 and 8,515,767 km^2, respectively), but the number of species in the state represent 24.13% of the known mammalian fauna for the entire country. The number of non-flying mammal species in the Mato Grosso do Sul fits well in an expected species-area relationship curve (Fig. 1), which includes data from Brazil, Okavango Delta (Ramberg *et al*., 2006), Amazon Rainforest, Atlantic Forest, Caatinga, Cerrado, Chaco, Llanos from Venezuela and Colombia (Ojasti, 1990), Congo Rainforest, Borneo Rainforest, Guinean Rainforest (see Tomas *et al*., 2011; Myers *et al*., 2000), Paraguay (Yahnke *et al*., 1998), the São Paulo State (De Vivo *et al*., 2011), and Brazil as a whole (Reis *et al*., 2011).

The present list of species reveals a necessity of better taxonomic evaluation for specific taxa. One example is the *Callicebus* from the western limit of the Pantanal wetland, in the border with Bolivia. The species recognized as occurring in this region is *Callicebus pallescens* (Groves, 2001; Roosmalen *et al*., 2002), despite several publications since Hershkovitz (1990), including the last review of the Genus (Roosmalen *et al*., 2002), place the species as occurring inside the Pantanal wetland. In reality, within Mato Grosso do Sul State, *Callicebus* is restricted to the mountainous region near Corumbá and in the Serra do Amolar range (Tomas *et al*., 2011). The taxonomic identity of these *Callicebus* populations are still confuse, since both phenotypic traits, such as coat color patterns (Tomas *et al*., 2011), and molecular genetic data (Auricchio, 2005) indicate that individuals from Corumbá are distinguishable from both *C. pallescens* and *C. donacophilus*. The northern populations from the Serra do Amolar region resemble *C. donacophilus* (Tomas *et al*., 2011), while the southern population seems to differ from both valid species (*C. pallescens* and *C. donacophilus*). Thus, it is possible that the populations from Corumbá will correspond to a separated species, requiring more detailed taxonomic studies based on molecular genetics at finer geographic detail. Among primates, *Sapajus* seems to be represented by two species, considering the presumable occurrence of *Sapajus libidinosus* in the northeastern portion of the state. This species is well known to occur at Emas National Park and it is distributed along a diagonal gradient from northeastern to central Brazil (Lynch Alfaro *et al*., 2011; Cáceres *et al*., 2015). There is no reason for its absence in the northeastern region of the Mato Grosso do Sul, as a portion of the Emas National Park is within the state.

Among carnivores, relatively common species are still little known regarding occurrence and taxonomic identity. The lack of museum specimens difficults the analysis on the occurrence and distribution of *Conepatus* and *Galictis*.

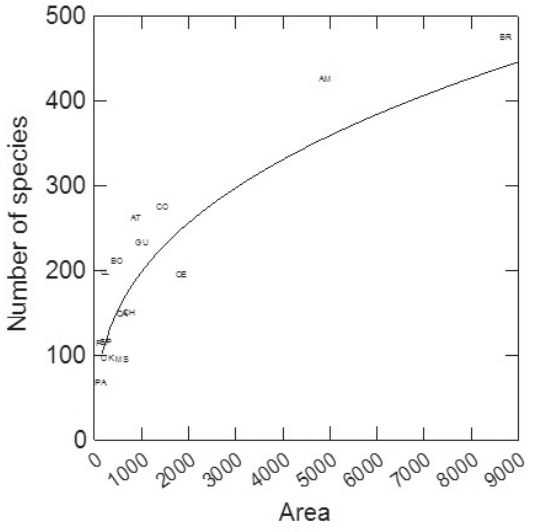

Fig. 1. Species-area relationship for the number of non-flying mammal species from several tropical ecosystems and regions/countries (modified from Tomas et al., 2011). The fitted model is: Number of species = 11.78*AREA$^{0.41}$; Mean corrected R^2(1-residual/corrected) = 0.88; Regions: AM, Amazon rainforest; AR, Argentina; AT, Atlantic rainforest; BO, Borneo rainforest; BR, Brazil; CA, Caatinga; CE, Cerrado; CH, Chaco; CO, Congo rainforest; GU, Guinean rainforest; LL, Llanos; MS, Mato Grosso do Sul state (this checklist); OK, Okavango delta; PA, Pantanal wetland; PY, Paraguay; SP, São Paulo state.

Rare records have been published on *Conepatus*, but we present evidence of two species occurring in the state. *Conepatus semistriatus* occurs at Emas National Park (Rodrigues *et al*., 2002), part of which is located in Mato Grosso do Sul, and we present a photographic record of this species in the northeastern region of Mato Grosso do Sul (MCPAPI 515). The dimensions of several tracks documented in the Pantanal wetland suggest *C. semistriatus* in the floodplains, but this evidence is not sufficient to confirm the species there. Another species of this genus, *Conepatus chinga* have been reported from Maracaju municipality (AMNH 133946), in the central-southern region of the state (Dragoo *et al*., 2003). Based on these evidences, we included the two species in our checklist. Yensen & Tarifa (2003a) report the occurrence of *Galictis vitatta* for the state, but we found no museum specimen to document it. We included this species in our list based on photograph documentation from Pantanal, which is placed in the mammal reference collection at Embrapa Pantanal (MCPAPI 501). The occurrence of *G. cuja* follows the same situation (Yensen & Tarifa, 2003b), and we have included this species in our list based on two photographic records placed in the Embrapa's reference collection (MCPAPI 5008, 516). Among cats, we found no evidence of *L. geofroyii* in the state despite distribution maps often include this species in the southwestern region (e.g., Cheida & Santos, 2010).

After the review by Trigo *et al*.(2013), we considered *Leopardus guttulus* as the species valid for Mato Grosso do Sul, instead of *L. tigrinus*, cited by other authors before(e.g., Cáceres *et al*., 2008). Trigo *et al*. (2013) used in their analysis one sample collected from one individual originated from Miranda-MS, and kept in a Zoo at Catanduva, São Paulo state (bLti-072, deposited in the Banco de Amostras from the Laboratório de Biologia Genômica e Molecular, from the Universidade Federal do Rio Grande do Sul; this individual is identified as the number 017 in the Plano de Manejo de Pequenos Felinos Brasileiros). Thus, in the Tables II and III, all the specimens formerly considered as *L. tigrinus* will be considered as *L. guttulus*, despite additional genetic analysis is still required to clarify this issue.

We found in the Order Cingulata that *Cabassous chacoensis* has no confirmed records in Brazil, although it occurs in the Chaco region of Paraguay and Bolivia (Wetzel, 1980). One *C. chacoensis* specimen has been labeled as "from Brazil", but no further information is available about the locality of its collection (Wetzel, 1980). Thus, the species has not been included in our list, even considering that the southwestern region of the state is in close contact with the Chaco, and presents typical Chacoan vegetation along the border with Paraguay in the Porto Murtinho municipality.

Among small mammals, we excluded *Akodon* gr. *cursor* reported by Carmignotto (2004), and also *Proechimys* gr. *goeldii* and *Oecomys* gr. *catherinae* listed by Carmignotto (2004) and Cáceres *et al*. (2008), as we adopted a conservative approach to construct the present checklist. Following the same approach, we did not include in our checklist *Rhipidomys* sp., listed by Carmignotto (2004), and *Akodon* sp. and *Callomys* sp., listed by Carmignotto (2004) and Cáceres *et al*. (2008) respectively (see Tables III and IV). Among potential species to be occurring in the state, we speculate that in the northeastern region of Mato Grosso do Sul it is possible to find *Thylamys velutinus*, *Calomys expulsus* and *Carterodon sulcidens*. These species do occur in the nearby region contiguous to the state of Goiás, where there are no evident geographic barriers, which would limit dispersion between both states (e.g., large rivers). *Micoureus paraguayanus* and *Phillander frenatus* may also occur in the southernmost part of the state, once covered by the Atlantic forest, as these species are known to occur in the adjacent eastern regions of Paraguay. The occurrence of *Metachirus nudicaudatus* was reported by Gardner & Dagosto (2008) in the Urucum Mountains, near Corumbá, and in the Dourados municipality. However, the authors did not provide information about voucher specimens. Thus, this species was not included in our checklist. A probable new species of *Dasyprocta* may occurs in the Serra do Amolar region (Iack-Ximenez, 1999), but we did not include it in the present checklist, as it is still not formally described. As for bats, Coelho (2005) reported *Rhinophylla pumilio* for the northern region of the state, however without a voucher specimen.

The specimens from Mato Grosso do Sul considered by Cáceres *et al*. (2008) and Carmingnoto (2004) as *Holochilus sciureus* are still in need of analysis to clarify if they actually correspond to *H. chacarius*, as the presence of the former species in the state have been questioned by Brandão & Nascimento (2015). These specimens originated in the state and deposited elsewhere are AMNH 37077, FMNH 26758-2678, USNM 390249-39050, MN 1989-4207-4209- 4205-4271, AMNH 37077, MN 1987, MZUSP 3780-27430, UFSM 266, USNM 390249, and those deposited as MCPAP 217-218-221-223 (see Table III for the institution names). The consistence of *H. chacarius* occurring in the state is indicated in the recent publication by D'elía *et al*.(2015), based on molecular analysis.

At least four exotic species are known to occur in the Mato Grosso do Sul as feral populations. The feral pig, *Sus scrofa*, also known as "porco monteiro", has been introduced by the first settlers two centuries ago, and is presently abundant in the Pantanal wetland. The wild hog, also *Sus scrofa*, is invading several regions of the state after releases from captivity few years ago, and is about to become a nuisance in the central and southern areas of the state. The European hare, *Lepus europaeus,* have been reported for the Bodoquena mountains (Cáceres *et al*., 2007a), despite no primary records are available to the present. *Rattus rattus* has been reported by Cáceres *et al*. (2007a). Finally, relatively small populations of feral water buffaloes *Bubalus bubalis* scattered in the Pantanal floodplains (Mourão *et al*., 2002).

Twelve mammal species listed by the Brazilian government as threatened do occur in the Mato Grosso do Sul state, all of them classified as Vunerable: nine for Carnivora, one for Artiodactyla, one for Cingulata, and one for Pilosa. The IUCN Red List included 17 globally

Tab. II. Threatened mammals species listed by Brazilian government (Ministério do Meio Ambiente, 2014) and International Union for Conservation of Nature (IUCN) occurring in the state of Mato Grosso, Brazil (Categories: NT, Near Threatened; VU, Vulnerable; EN, Endangered).

Species	Common name	Brazil	IUCN
Blastocerus dichotomus	Marsh deer	VU	VU
Chrysocyon brachyurus	Manned wolf	VU	NT
Leopardus colocolo	Pampas cat	VU	NT
Leopardus pardalis	Ocelot	VU	
Leopardus guttulus	Oncilla	EN	VU
Leopardus wiedii	Magay	VU	NT
Lonchophylla dekeyseri	Dekeyser's nectar bat	EN	NT
Lonchorhina aurita	Tome's sword-nosed bat	VU	
Lycalopex vetulus	Hoary fox	VU	
Myrmecophada tridactyla	Giant anteater	VU	
Natalus macrourus	Brazilian funnel-eared bat	VU	
Ozotoceros bezoarticus	Pampas deer	VU	NT
Panthera onca	Jaguar	VU	NT
Priodontes maximus	Giant armadillo	VU	VU
Pteronura brasiliensis	Giant otter	VU	EN
Puma concolor	Puma	VU	
Puma yagouarondi	Weasel cat	VU	
Sapajus cay	Capuchin monkey	VU	
Speothos venaticus	Bush dog	VU	NT
Tapirus terrestris	Tapir	VU	VU
Tayassu pecari	White-lipped peccary	VU	VU
Thylamys macrurus	Paraguayan fat-tailed mouse possum	EN	NT
Tolypeutes matacus	Southern three-banded armadillo		NT
Vampyrum spectrum	Spectral bat		NT

Tab. III. Specimens considered in the elaboration of the checklist of non-flying mammals of the Mato Grosso do Sul state, Brazil. The specimens examined by other authors are followed by the reference to the correspondent publication. The taxons follow an alphabetical order, independent of their higher level taxonomic classification (Subfamily, Family, Order). The collections included are: MCPAP, Coleção de Referência de Mamíferos da Embrapa Pantanal; MCPAPI, Coleção de Imagens de Referência de Mamíferos da Embrapa Pantanal; MN, Museu Nacional; MZUSP, Museu de Zoologia da Universidade de São Paulo; UFSM, Coleção de Mamíferos da Universidade Federal de Santa Maria; AMNH, American Museum of Natural History; CEUCM, Centro Universitário de Corumbá – Coleção de Mamíferos; FMNH, Field Museum of Natural History; MHNCI, Museu de História Natural Capão da Imbuia; OMNH, Oklahoma Museum of Natural History; UEMS, Universidade Estadual do Mato Grosso do Sul; UFMG, Universidade Federal de Minas Gerais; UFSC, Universidade Federal de Santa Catarina; USNM, National Museum of Natural History; JLP, James L. Patton (voucher at UFMG mammal collection, as cited by Weksler, 2003); CRB (Cibele R. Bonvicino); LBCE (Laboratório de Biologia e Parasitologia de Mamíferos Reservatórios silvestres, Fiocruz); MVZ (Museum of Vertebrate Zoology, University of California, Bekerley) (*, records not included in present checklist; see Material and Methods).

Species	Specimens	Photographic records
Akodon gr. *cursor**	AMNH 134495-134498-134499-134829-134830-134837-134856-134859, MN 5177-5178-5180-4325-4368 (Carmignotto, 2004 – see the comments of the author on the impossibility of using caryotipe to discriminate species from these vouchers).	
Akodon montensis	UFMG 2682-2714, UFMG 2715 (Carmignotto, 2004); UFSM 09 (Cáceres *et al*., 2007a); UFMG 2682 (Cáceres *et al*., 2008).	MCPAPI 386
Akodon sp.*	APC 975 985 996 997 (Carmignotto, 2004).	
Akodon toba	USNM 390251-390252-390160-390162, CEUC 58 (Carmignotto, 2004); UFSM 269, USNM 390251 (Cáceres *et al*., 2008); UFSM 258-269 (Godoi *et al*., 2010a).	
Alouatta caraya	MN 4813, MZUSP 778-3364-3365-3769-19033-19034-5891-5892, (Gregorin, 2006); MN 4794-4813-19176, MZUSP 3769 (Cáceres *et al*., 2008); MCPAP 116-117-121-125-362-527.	MCPAPI 520
Aotus azarae	MN 9608, MZUSP 9608 (Cáceres *et al*., 2008).	
Blastocerus dichotomus	MHNCI 4037-4077, MZUSP 28867 (Cáceres *et al*., 2008); MCPAP 014-017-018-030-031-196-499.	MCPAPI 471
Cabassous unicinctus	MN 4975 (Cáceres *et al*., 2008)	MCPAPI 405-465
Cabassous tatouay	AMNH M-133384	
Callicebus **cf.** *pallescens*	MN 3355-3356-3358-3359-3351 (Auricchio, 2005); MZUSP 3356-3358 (Cáceres *et al*., 2008); MCPAP 528.	MCPAPI 446 (a,b,c, d)-447-448-449-450-454-457-458-459-460-462
Callithrix penicillata		MCPAPI 502-503-504
Callomy sp.*	UFSM 28 (Cáceres *et al*., 2007a).	

Tab. III. Cont.

Species	Specimens	Photographic records
Calomys **aff.** *callidus*	UFSM 109 (Cáceres *et al*., 2008).	
Calomys callosus	APC 897-934-951-957-971, CN 700-763 (Carmignoto, 2004); UFSM 162-165 (Godoi *et al*., 2010a); MCPAP 232-343.	
Caluromys lanatus	AMNH 133206 (Carmignotto, 2004).	MCPAPI 384
Caluromys philander	AMNH 139815 (Carmignotto, 2004); UFSM 234 (Cáceres *et al*., 2008).	MCPAPI 425
Cavia aperea	FMNH 26638-26639-26870, MZUSP 4292-4293, MN 4476-4481 (Carmignotto, 2004); FMNH 26638, MN 4476, MZUSP 4292 (Cáceres *et al*., 2008); MCPAP 325.	
Cavia fulgida	MZUSP 28757 (Carmignotto, 2004); MZUSP 28757 (Cáceres *et al*., 2008).	
Cerdocyon thous	MN 4908, MN 25602, MZUSP 3769 (Cáceres, 2008); MCPAP 103-106-135-136-140-145-302-321.	MCPAPI 392
Cerradomys maracajuensis	MN 4409-4410-5207-34199, MN 44178, MZUSP 28766 (Carmignotto, 2004 – citado como *Oryzomys maracajuensis*); MN 44178, MZUSP 28766, UFSM 088 (Cáceres *et al*., 2008).	
Cerradomys scotti	OMNH 19655, APC 885-887, MN 4414 (Carmignotto; 2004; citado como *Oryzomys scottii*); UFSM 02-03-04-08-25 (Cáceres *et al*., 2007a); MN 4414, OMNH 19655, UFSM 025-360 (Cáceres *et al*., 2008); MCPAP 226-228.	
Chironectes minimus	UFSM 031 (Cáceres *et al*., 2008).	MCPAPI 467
Chrysocyon brachyurus	UFSM 081 (Cáceres *et al*., 2008).	MCPAPI 368-396-466-484-485-517-518
Clyomys laticeps	UFMG 2346- 2350, MN 24156-24158-31565, MN 24159 (Carmignotto, 2004); MN 24156-63945, UFMG 2346 (Cáceres *et al*., 2008); MCPAP 188-207-213-216-278-294-313-342.	
Coendou prehensilis	MN 3635, MZUSP 1859 (Cáceres *et al*., 2008); MCPAP 234.	
Conepatus chinga	AMNH 133946 (Dragoo *et al*., 2003).	
Conepatus semistriatus		MCPAPI 515 (a,b,c)
Cryptonanus agricolai	UFSM 089-477 (Cáceres *et al*., 2008).	MCPAPI 385-389-404
Cryptonanus chacoensis	UFSM 267 (Cáceres *et al*., 2008); MCPAP 220-341-346-355.	
Cuniculus paca	MN 4871 (Cáceres *et al*., 2008).	MCPAPI 481
Dasyprocta azarae	MN 4968, MZUSP 5896 (Cáceres *et al*., 2008); MCPAP 112-113-114.	
Dasypus novencinctus	MHNCI 5660, MZUSP 28768 (Cáceres *et al*., 2008); MCPAP 131.	MCPPI 369
Dasypus septemcinctus		MCPAPI 541 (a, b, c, d, e, f)
Didelphis albiventris	MZUSP 3779-28753-28755-28803, MN 1187-4486-4487-4493-4497-4498-4766-4900-46898, AMNH 132988, UFMG 2560-2558-2559-2561-2562 (Carmignotto, 2004); MN 4486, MZUSP 3779-28753, UFMG 2558, UFSM 045 (Cáceres *et al*., 2008); MCPAP 219-285-297.	MCPAPI 393
Didelphis aurita	AMNH 133036 (Carmignotto 2004, Cáceres *et al*., 2008).	
Eira barbara	MN 3110-5163, MZUSP 3375 (Cáceres *et al*., 2008); MCPAP 118-165-301.	MCPAPI 377-412-419-488-510
Euphractus sexcinctus	MHNCI 5663, MN 4972, MZUSP 28544 (Cáceres *et al*., 2008); MCPAP 128-129-131-309.	
Galictiss cuja		MCPAPI 508 - 514(a,b,c) - 516 (a,b)
Galictis vittata		MCPAPI 501
Gracilinanus agilis	MZUSP 11800-11801-1712-342, PNPA 203, USNM 390025, UFMG 2500-2533, APC 896, CN 70, MN 4465-4783-4787-4790, AMNH 133225-133227-133230-133231 (Carmignotto, 2004); MN 4465, MZUSP 1712-11800, UFMG 2500, UFSM 086, USNM 390025 (Cáceres *et al*., 2008); MCPAP 243-318.	MCPAPI 395- 406
Gracilinanus chacoensis	PNPA 205-207 (Carmignotto, 2004)	

Tab. III. Cont.

Species	Specimens	Photographic records
Holochilus chacarius	MN 1987, MZUSP 27430-3780 (Cáceres *et al*. 2008, after Brandão & Nascimento, 2015).	
Hydrochoerus hydrochaeris	MHNCI 5658, MZUSP 25358 (Cáceres *et al*., 2008); MCPAP 077-087-092-094-179.	
Hylaeamys megacephalus	UFSM 11-30 (Cáceres *et al*., 2007a); MZUSP 4303, UFMG 2909, UFSM 016-033-061 (Cáceres *et al*., 2008).	MCPAPI 383
Leopardus colocolo	AMNH 133977-354 (Garcia Perea, 1994); MN 24904, MZUSP 7786 (Cáceres *et al*., 2008); video registrado (Sánchez-Soto, 2007).	MCPAP 428-491-513 (a,b)
Leopardus pardalis	MN 68885, MZUSP 13673, UFSC 346-413 (Cáceres *et al*., 2008); MCPAP 033-034-036-040-174-176-324.	MCPAPI 410- 495-512
Leopardus guttulus	UEMS-Mundo Novo (Cáceres *et al*., 2008); LBGM- UFRS bLti-072.	
Leopardus wiedii	MCPAP 168.	
Lontra longicaudis	MN 3020 (Cáceres *et al*., 2008); MCPAP 312	
Lutreolina crassicaudata	APC 655-657, MN 4780-4781-4784-20977, AMNH 133250-133251-133254-133255 (Carmignotto, 2004); MN 20977, UFSM 326 (Cáceres *et al*., 2008).	MCPAPI 374-507(a,b)
Lutreolina crassicaudata	APC 655-657, MN 4780-4781-4784-20977, AMNH 133250-133251-133254-133255 (Carmignotto, 2004); MN 20977, UFSM 326 (Cáceres *et al*., 2008).	MCPAPI 374-507(a,b)
Lycalopex vetulus	MN 4869-5151 (Cáceres *et al*., 2008)	
Marmosa (Micoureus) constantiae	PNPA 102-313, APC 883-895-899-947-984 (Carmignotto, 2004); UFSM 06-14 (Cáceres *et al*., 2007a);UFSM 13-263-534 (Cáceres *et al*., 2008).	
Marmosa murina	APC 658, MZUSP 1704-28756, UFMG 2599 (Carmignotto, 2004); MZUSP 1704-28756, UFMG 2599, UFSM 536 (Cáceres *et al*., 2008)	MCPAPI 375-379
Marmosops ocellatus	PNPA 312-314-315- 95-320-332-353-354-356 (Carmignotto, 2004); MZUSP 32877, UFSM 213-268 (Cáceres *et al*., 2008).	
Mazama americana	MZUSP 3735 (Cáceres *et al*., 2008); MCPAP 014.	MCPAPI 387-390-463- 473-492
Mazama gouazoubira	MZUSP 3785 (Cáceres *et al*., 2008); MCPAP 001-003-007-011-012-015-029.	
Mico melanurus	MN 3370, MZUSP 3370 (Cáceres *et al*., 2008).	MCPAPI 464-497-521(a, b)
Monodelphis domestica	MZUSP 17424-1705-1707-1709-1711-3781, PNPA 96-307-309-311-93-94-101-114-115-117-123-124-305-319-330-352-355, USNM 390016, OMNH 19132, AMNH 37098, APC 891-901-915-921-931-933-936-949-960-964-974-1000-1008 (Carmignotto, 2004); UFSM 07-10-24-29 (Cáceres *et al*., 2007a); AMNH 37098, MZUSP 1709-3781-17424, UFSM 040 (Cáceres *et al*., 2008); MCPAP 205-215-271-272-273-275-276-330-332-334-364.	MCPAPI 413
Monodelphis kunsi	PNPA 286, APC 884-917-965-980-989-1007 (Carmignotto, 2004); UFSM 167-265 (Cáceres *et al*., 2008); ZUFMS-MA 10001 (Hannibal *et al*., 2012); MCPAP 222.	MCPAPI 370- 414
Myrmecophaga tridactyla	MZUSP 3727-7484-7485-7486-7487-7789-6893, MN 7053-24828 (Vaz, 2003); MHNCI 4048, MN 5073, MZUSP 7789 (Cáceres *et al*., 2008); MCPAP 111-181-323.	MCPAPI 371
Nasua nasua	MNHNCI 2551, MN 4895, MZUSP 3366 (Cáceres *et al*., 2008); MCPAP 104-105-107-127-134-144-147-300-320-347-357-359-361.	
Necromys lasiurus	PNPA 329-348-351, MZUSP 1701, FMNH 26640, AMNH 37103-37104-134496, FMNH 26759, APC 926, CN 732-744-745-765-766 (Carmignotto, 2004); AMNH 37104, FMNH 26640, MZUSP 1701-4301, OMNH 19132, UFSM 022 (Cáceres *et al*., 2008); UFSM 264-415 (Godoi *et al*., 2010a).	MCPAPI 397, MCPAPI 400, MCPAPI 411, MCPAPI 427
Nectomys rattus	UFSM 27 (Cáceres *et al*., 2007a); MN 46876, MZUSP 6010, UFSM 133 (Cáceres *et al*., 2008).	MCPAPI 380-399

Tab. III. Cont.

Species	Specimens	Photographic records
Nectomys squamipes	MN 4371-4381-34198, MN 42685 (Carmignotto, 2004); UFSM 44, MZUSP 28858 (Cáceres *et al*., 2008).	
Oecomys bicolor	MN 2520-2528-2544, FMNH 26806, MN 34200, AMNH 134510-134511, UFMG 2818-2825-2817 (Carmignotto, 2004); FMNH 26806, MN 2520-34200, UFMG 2817-2825, UFSM 054-246-273 (Cáceres *et al*., 2008); UFSM 273 (Godoi *et al*., 2010a).	MCPAPI 373-398-420
Oecomys catherinae	USNM 531278, UFMG, FMNH 26811, UFMG 2345-2827-2828-2829-2838, AC 2270-2271, APC 902-961-970-988-990-993-999 (Carmignotto, 2004).	
Oecomys gr. *catherinae**	MZUSP 28767 (Carmignotto, 2004); MZUSP 28767 (Cáceres *et al*., 2008).	
Oecomys mamorae	JLP 16961 - voucher at UFMG (Weksler, 2003); CEUCCM 211, FMNH 26811, MZUSP 2270, UFMG 2827, UFSM 411, USNM 521278 (Cáceres *et al*., 2008); MCPAP 229-239-247-268-269-329-331-333-363.	
Oecomys paricola	CEUCN 198 (Cáceres *et al*., 2008).	
Oligoryzomys chacoensis	FMNH 26805-26807-26810-26641, USNM 390124-390125, APC 889-908-922-929, CN 758 (Carmignotto, 2004); FMNH 26641, UFSM 168-271, USMN 390125 (Cáceres *et al*., 2008); UFSM 174-271 (Godoi *et al*., 2010a).	
Oligoryzomys fornesi	OMNH 19657-19661-19660-19663, FMNH 26642, APC 907-966-981, CN 747 (Carmignotto, 2004); OMNH 19657, UFSM 020-242-272-367-378 (Cáceres *et al*., 2008).	MCPAPI 403-408
Oligoryzomys nigripes	MZUSP 25869, APC 890-903-906-909-913-923-927-928-945-946-948-958-959-967-969-979-1003-1004-1006, CN 699-746-764, MN 4301-4303-4306-5219, AMNH 134541-134546-134551, UFMG 2760-2763 (Carmignotto, 2004); UFSM 01 (Cáceres *et al*., 2007): MN 5219, MZUSP 25869, UFMG 2760, UFSM 001-021-278-486 (Cáceres *et al*., 2008); UFSM 278-353 (Godoi *et al*., 2010a).	MCPAPI 394
Oryzomys (Euryoryzomys) nitidus	FMNH 26786, USNM 390109-390110 (Carmignotto, 2004); FMNH 26786, UFSM 260-261, USNM 390110 (Cáceres *et al*., 2008).	
Oryzomys megacephalus	MZUSP 1700-4303, APC 898-916-925-937-939-941-943-953-955-963-973-977-978-982-991-992-998-1005, CN 743, UFMG 2909-2913-2924 (Carmignotto, 2004); MCPAP 242.	
Oxymycterus delator		MCPAPI 519 (a,b,c,d,e)
Ozotoceros bezoarticus	MZUSP 01920 (Cáceres *et al*., 2008); MCPAP 020-021-022-023-025-032-162.	MCPAPI 422
Panthera onca	MHNCI 4384, MN 24859, MZUSP 9018, UFSC 3105 (Cáceres *et al*., 2008); MCPAP 045-046-047-048-049-306-530.	MCPAPI 444-445-451-468-472-478-487-496-511
Pecari tajacu	MN 3826, MZUSP 3342 (Cáceres *et al*., 2008); MCPAP 051-052- 053-068-070-153-161-166-311	MCPAPI 381-409
Phillander opossum	AMNH 37063, UFMG 2662-2665, MN 29949, MZUSP 8306 (Carmignotto, 2004); AMNH 37063, MN 29949, MZUSP 8306, UFMG 2662 (Cáceres *et al*., 2008).	
Priodontes maximus	MN 1323 (Vaz, 2003); MCPAP 148-149.	MCPAPI 415-416-475-477-480-483-486-490
Procyon cancrivorus	MCPAP 120-123-126-164-172-173-180	MCPAPI 388
Proechimys gr. *goeldii**	FMNH 26732 (Carmignotto, 2004); FMNH 26732 (Cáceres *et al*., 2008).	
Proechimys longicaudatus	PNPA 104-321-322-357, AMNH 37085-37086 (Carmignotto, 2004); AMNH 37085, UFSM 034-259 (Cáceres *et al*., 2008); UFSM 259-354 (Godoi *et al*., 2010a).	

Tab. III. Cont.

Species	Specimens	Photographic records
Proechimys roberti	UFSM 282 (Cáceres *et al*., 2008).	
Pseudoryzomys simplex	APC 659 (Carmignotto, 2004).	
Pteronura brasiliensis	MN 67470, MZSP 5890 (Cáceres *et al*., 2008); MCPAP 115.	MCPAPI 443
Puma concolor	MZUSP 28868, UFSC 322 (Cáceres *et al*., 2008); MCPAP 035-037-039-044.	MCPAPI 376-391-407-418-426-489-494
Puma yagouaroundi	UFSM 331 (Cáceres *et al*., 2008); MCPAP 299-358-365.	MCPAPI 474
Rhipidomys macrurus	UFMG 2945 (Carmignotto, 2004); UFMG 2945-032-156 (Cáceres *et al*., 2008).	MCPAPI 401
Rhipidomys sp.*	MN 4297-4442-30018-30024 (Carmignotto, 2004).	
Sapajus cay	MZUSP 377-5133 (Mendes Pontes *et al*., 2006); MZUSP 19680 (Cáceres *et al*., 2008); MCPAP 124.	MCPAPI 382
Speothos venaticus	MCPAP 119-322.	MCPAPI 498
Sylvilagus brasiliensis	MN 4774, UFSM 498 (Cáceres *et al*., 2008); MCPAP 122.	MCPAPI 479-493
Tamandua tetradactyla	MN 5056, MZUSP 20000, UFSC 900 (Cáceres *et al*., 2008); MCPAP 150-151-178-360.	MCPAPI 402
Tapirus terrestris	MZUSP 3727 (Cáceres *et al*., 2008); MCPAP 066-067-191.	MCPAPI 378
Tayassu pecari	UFSM 334 (Cáceres *et al*., 2008); MCPAP 152-154-159-160-171-182-308.	MCPAPI 421-423
Thrichomys fosteri	MZUSP 2673-26732-25868-25867-7499, PNPA 87-88-310-331-91-92-125-304-306, UFMG 3008, MN 6228-6229, APC 888-892-894-900-914-918-920-924-935-938-940-944-954-956-962-972-976-983-986-987-994-1001-1002, MN 46896 (Carmignotto, 2004); UFSM 15-26 (Cáceres *et al*., 2007a); MN 6228, MZUSP 7499-26731, UFMG 3008, UFSM 161 (Cáceres *et al*., 2008); MCPAP 184-190-197-208-236-250-259-265-287-315-345-354; CRB 553, LBCE 1920-1903-1960, MVZ 197572-197573 (Nascimento *et al*., 2013).	
Thylamys macrurus	MZUSP 3782, APC 932-950-952-32097, NC 35-05 (Carmignotto, 2004); MZUSP 3782-32094-3296-32097, NC 05-35 (Carmignotto & Monfort, 2006); UFSM 35-05 (Cáceres *et al*., 2007a), MZUSP 32097 (Cáceres *et al*., 2007a); MZUSP 3782 (Cáceres *et al*., 2008); MCPAP 225-231-326-328-335-336-337-338-339-340-356.	MCPAPI 424
Tolypeutes matacus		MCPAPI 452-453-455-456-461-469-476-509
Urosciurus spadiceus	MN 1923, MZUSP 3352 (Cáceres *et al*., 2008); MCPAP 430.	

threatened species recorded in the state: eight for Carnivora, three for Artiodactyla, two for Cingulata, two Chiroptera, one for Pilosa, and one for Didelphimorphia, from which eight species are Vulnerable, 10 are Near Threatened, and one Edangered (Tab. II). Some of these species are known to present large populations in the state (Tomas *et al*., 2011), especially in the Pantanal wetlands, 65% of which is located in Mato Grosso do Sul. For example, we may cite the Marsh deer (Mourão *et al*., 2000), the Giant otter (Tomas *et al*., 2014, in press), the Jaguar (Cavalcanti *et al*., 2012; Camilo, 2011), and the Pampas deer (Mourão *et al*., 2000).

The previous checklist of mammals from the Mato Grosso do Sul reports 151 species, including 61 bat species (Cáceres *et al*., 2008). In comparison, the present list represents an increase in the number of 15 species with primary records for the state, even considering that we avoided the inclusion of grouped specimens, interview data, non-confirmed or cataloged records, and non-native species. Although we attempted to produce a conservative checklist, we maintained few taxa that are still in need of taxonomic evaluation, such as *Callicebus* **cf.** *pallescens* and *Callomys* **aff.** *callidus*. It is evident also that *Dasyprocta*, *Akodon*, *Rhipidomys*, and *Callomys* deserve detailed taxonomic studies, and that scientific, regional mammal collections should be implemented to better document the species from Mato Grosso do Sul. Finally, it is clear that inventories at specific regions in the state are urgent, such as in the Chaco of the southwestern region, in the southern region previously covered by the Atlantic forest, and in the northeastern region near the border with Goiás and Mato Grosso states. Beyond the list of species, data on species occurrence are also required, as distribution maps are not available, what difficult the evaluation of the effectiveness of protected areas in conserving the species diversity, as

Tab. IV. Specimens considered in the elaboration of the checklist of Chiroptera of the Mato Grosso do Sul State, Brazil. The specimens examined by other authors are followed by the reference to the correspondent publication. The taxons follow an alphabetical order, independent of their higher level taxonomic classification (Subfamily, Family, Order). The collections included are: MCPAP: Coleção de Referencia de Mamíferos da Embrapa Pantanal; MCPAPI: Coleção de Imagens de Referência de Mamíferos da Embrapa Pantanal; ZUFMS: Coleção Zoológica da Universidade Federal de Mato Grosso do Sul; UNIDERP – Coleção do Laboratório de Quirópteros da Universidade para o Desenvolvimento do Estado e da Região do Pantanal/ Anhanguera; UFSM: Coleção de Mamíferos da Universidade Federal de Santa Maria.

Species	Specimens
Anoura caudifer	ZUFMS 1170, 1180, 1291 (Bordignon, 2006); ZUFMS 230 (Camargo *et al*., 2009); ZUFMS 453 (Fernandes, 2009); ZUFMS 500 (Ferreira *et al*., 2010); ZUFMS 293, 292 (Cunha *et al*., 2011); ZUFMS 188, 192 (Erickson *et al*., 2011).
Anoura geoffroyi	ZUFMS 0151, 0368, 0454; ZUFMS 0292, 0293 (Cunha *et al*., 2011); ZUFMS 454 (Fernandes, 2009).
Artibeus cinereus	ZUFMS 0389 (Cunha *et al*., 2011); ZUFMS 0360.
Artibeus fimbriatus	UFSM 541 (Cáceres *et al*., 2008).
Artibeus lituratus	ZUFMS 0577; ZUFMS 1145, 1161, 1191, 1232, 1252, 1300 (Bordignon, 2006); ZUFMS 913, 1064 (Bordignon & França, 2009); ZUFMS 316 (Cunha *et al*., 2009); ZUFMS 2070, 2120 (Longo, 2009); ZUFMS 507 (Ferreira, 2010).
Artibeus obscurus	ZUFMS 715, 717 (Bordignon & Santos, 2010).
Artibeus planirostris	ZUFMS (0179, 0371, 0372); ZUFMS 1242, 1295 (Bordignon, 2006); ZUFMS 910, 1074 (Bordignon & França, 2009); ZUFMS 482 (Camargo *et al*., 2009); ZUFMS 323, 328 (Cunha *et al*., 2009); ZUFMS 444, 452 (Fernandes, 2009); ZUFMS 508 (Ferreira *et al*., 2010).
Carollia perspicillata	ZUFMS 0258; ZUFMS 1157, 1160, 1253, 1298 (Bordignon, 2006); ZUFMS 916, 1040 (Bordignon & França, 2009); ZUFMS 218, 222 (Camargo *et al*., 2009); ZUFMS 313 (Cunha *et al*., 2009); ZUFMS 455, 459 (Fernandes, 2009); ZUFMS 497 (Ferreira *et al*., 2010); ZUFMS 521 (Cunha *et al*., 2011).
Chiroderma doriae	ZUFMS 0258; ZUFMS 912, 1058, 1069 (Bordignon & França, 2009); ZUFMS 493 (Ferreira *et al*., 2010).
Chiroderma villosum	ZUFMS 0158, 0159, 0208, 0209, 0505; ZUFMS 492 (Ferreira *et al*., 2010).
Chrotopteus auritus	ZUFMS 0109, 0354; ZUFMS 1194 (Bordignon, 2006); ZUFMS 254, 255 (Camargo *et al*., 2009).
Cynomops abrasus	ZUFMS 0377; ZUFMS 220 (Camargo *et al*., 2009).
Cynomops planirostris	ZUFMS 0162; ZUFMS 1163, 1209 (Bordignon, 2006).
Desmodus rotundus	ZUFMS 0115, 0121, 0340, 0364; ZUFMS 339 (Camargo *et al*., 2009); ZUFMS 314 (Cunha *et al*., 2009); ZUFMS 86 (Erickson *et al*., 2011).
Diaemus youngii	ZUFMS 0078, 0164, 0165.
Eptesicus brasiliensis	ZUFMS 0160; UFSM 390 (Cáceres *et al*., 2008).
Eptesicus furinalis	ZUFMS 525.
Eumops auripendulus	ZUFMS 0146.
Eumops bonariensis	ZUFMS 1240 (Bordignon, 2006).
Eumops dabbenei	ZUFMS 1319 (Fischer *et al*., 2015)
Eumops glaucinus	ZUFMS 0145, 0298; ZUFMS 1276 (Bordignon, 2006).
Eumops patagonicus	ZUFMS 718 (Bordignon *et al*., 2011).
Eumops perotis	ZUFMS 0045.
Glossophaga soricina	ZUFMS 0283, 0344, 0366, 0367, 0369; ZUFMS 1181, 1255, 1250, 1282 (Bordignon, 2006); ZUFMS 920, 1088, 1124 (Bordignon & França, 2009); ZUFMS 248. 312 (Cunha *et al*., 2009); ZUFMS 499 (Ferreira *et al*., 2010).
Lasiurus blossevillii	ZUFMS 0134, 0135, 0171, 0252; UNIDERP 2043 (Alho *et al*., 2011).
Lasiurus cinereus	UNIDERP 78 (Alho *et al*., 2011).
Lasiurus ega	ZUFMS 0138, 0176, 0253; ZUFMS 1296 (Bordignon, 2006).
Lionycteris spurrelli	ZUFMS 1288 (Bordignon, 2006).
Lonchophylla dekeyseri	ZUFMS 522, 523 (Cunha *et al*., 2011).
Lonchophylla mordax	ZUFMS 1179 (Bordignon, 2006).
Lonchorhina aurita	ZUFMS 1287 (Bordignon, 2006).
Lophostoma brasiliense	ZUFMS 0113, 0318, 0357; ZUFMS 1286 (Bordignon, 2006).
Lophostoma silvicolum	ZUFMS 0110, 0181, 0356; ZUFMS 1159 (Bordignon, 2006); ZUFMS 1121 (Bordignon & França, 2009).
Macrophyllum macrophyllum	ZUFMS 0072; ZUFMS 152 (Camargo *et al*., 2009).
Micronycteris megalotis	ZUFMS 0347; ZUFMS 153 (Erckson *et al*., 2011).
Micronycteris minuta	UNIDERP 117 (Alho *et al*., 2011).
Micronycteris sanborni	ZUFMS 0161 (Santos *et al*., 2011).
Mimon bennettii	ZUFMS 441 (Fernandes, 2009).
Mimon crenulatum	ZUFMS 0108 (Camargo & Fischer, 2005).
Molossops temminckii	ZUFMS 0147; ZUFMS 1279 (Bordignon, 2006); ZUFMS 291 (Cunha *et al*., 2009); ZUFMS 494, 495 (Ferreira *et al*., 2010); ZUFMS 294 (Cunha *et al*., 2011).
Molossus molossus	ZUFMS 0271; ZUFMS 1275 (Bordignon, 2006); ZUFMS 219 (Camargo *et al*., 2009).
Molossus pretiosus	ZUFMS 682; UNIDERP 394 (Alho *et al*., 2011).
Molossus rufus	ZUFMS 09, 011 (Caceres *et al*., 2008).
Myotis albescens	ZUFMS 0141, 0170; UNIDERP 227.
Myotis nigricans	ZUFMS 0133, 0137, 0172, 0175, 0203, 0204, 0283, 0378, 0379, 0381; ZUFMS 1156 (Bordignon, 2006); ZUFMS 213, 215 (Camargo *et al*., 2009); ZUFMS 498 (Ferreira *et al*., 2010); UNIDERP 1616.
Myotis riparius	ZUFMS 0140; UNIDERP 1516.

Tab. IV. Cont.

Species	Specimens
Myotis simus	ZUFMS 0006; UNIDERP 1498.
Natalus macrourus	ZUFMS 0329, 0330, 0331; ZUFMS 144, 169 (Cunha *et al*., 2009); ZUFMS 295 (Cunha *et al*., 2011).
Noctilio albiventris	ZUFMS 0365; ZUFMS 0055, 0058 (Cáceres *et al*., 2008).
Noctilio leporinus	ZUFMS 0143 (Cáceres *et al*., 2008).
Nyctinomops laticaudatus	ZUFMS 0008, 0012, 0018, 0149, 0305, 0306, 0478.
Nyctinomops macrotis	ZUFMS 0148; UNIDERP 3401 (Alho *et al*., 2011).
Peropteryx macrotis	ZUFMS 906 (Bordignon, 2005); UNIDERP 2175.
Phyllosderma stenops	UNIDERP 547 (Pulchero-Leite *et al*., 1998).
Phyllostomus discolor	ZUFMS 0105, 0155, 0355, 0468; ZUFMS 467 (Cunha *et al*., 2011).
Phyllostomus elongatus	ZUFMS 1120 (Bordignon & França, 2009).
Phyllostomus hastatus	ZUFMS 0106, 0352, 0353; ZUFMS 1195 (Bordignon, 2006); ZUFMS 1115 (Bordignon & França, 2009); ZUFMS 300, 301 (Cunha *et al*., 2009); ZUFMS 491 (Ferreira *et al*., 2010).
Platyrrhinus helleri	ZUFMS 0158, 0361; ZUFMS 1173, 1292 (Bordignon, 2006); ZUFMS 442, 443 (Fernandes, 2009); UNIDERP 1328, 1923, 1936, 11668, 0058,0059, 10345 (Alho *et al*., 2011).
Platyrrhinus lineatus	ZUFMS 0210, 0211, 0212, 0266, 0349, 0370; ZUFMS1149, 1234 (Bordignon, 2006); ZUFMS 899, 1099 (Bordignon & França, 2009); ZUFMS 223, 228 (Camargo *et al*., 2009); ZUFMS 503, 506 (Ferreira *et al*., 2010); UNIDERP 847, 863, 236, 745, 1329, 928, 532 (Alho *et al*., 2011).
Promops centralis	ZUFMS 00039 (Caceres *et al*., 2008).
Promops nasutus	ZUFMS 000021 (Caceres *et al*., 2008).
Pteronotus parnellii	ZUFMS 1289 (Bordignon, 2006).
Pygoderma bilabiatum	ZUFMS 128 (Erickson *et al*., 2011).
Rhynchonycteris naso	ZUFMS 0234, 0260, 0261.
Sturnira lilium	ZUFMS 1241, 1274 (Bordignon, 2006); ZUFMS 131, 216, 217 (Camargo *et al*., 2009).
Tadarida brasiliensis	ZUFMS 623 (Santos & Bordignon, 2011).
Tonatia bidens	ZUFMS 237 (Cunha *et al*., 2011); UNIDERP 941.
Trachops cirrhosus	ZUFMS 524 (Cunha *et al*., 2011).
Uroderma bilobatum	ZUFMS 132.
Uroderma magnirostrum	UNIDERP 2397.
Vampyressa pusilla	ZUFMS 356.
Vampyrodes caraccioli	ZUFMS 129.
Vampyrum spectrum	M-CPAP 307 (Silveira *et al*., 2011).

well as the elaboration of an endangered species list for the Mato Grosso do Sul state.

Main research groups. At Mato Grosso do Sul there are few institutions studying mammals. At Embrapa Pantanal, in Corumbá, most of the research has been focused on ecology of medium to large mammals, and small mammals, with little effort on taxonomy and distributions. At the Universidade Federal de Mato Grosso do Sul (UFMS) there are specialists on small mammals, primates and bats. Both institutions usually interact well, and partnership with several other institutions in Brazil increases the potential approaches to study the mammal fauna in the state. It is particularly relevant the role of post-graduation programs, such as the Ecology and Conservation Program, and the Animal Biology Program, at UFMS, in the establishment of partnership among institutions.

Main collections. The main in-state zoological collections are the Reference Vertebrate Collection of Embrapa Pantanal at Corumbá, the Zoological Collection of the Universidade Federal de Mato Grosso do Sul and the Zoological Collection of Laboratório de Quirópteros of Universidade para o Desenvolvimento do Estado e da Região do Pantanal (UNIDERP) at Campo Grande. However, these are relatively small collections, which do not comprehend all taxonomic groups among mammals. It is clear from the data used in this article that most of the specimens came from larger collection in Brazil and abroad. The main depositories of specimens from the state are Museu Nacional, Rio de Janeiro, RJ; Museu de Zoologia da Universidade de São Paulo, São Paulo, SP; American Museum of Natural History, New York, USA; Field Museum of Natural History, Chicago, USA; the collections of the Laboratório de Biologia e Parasitologia de Mamíferos Reservatórios Silvestres - Fiocruz, Rio de Janeiro, RJ; Museum of Vertebrate Zoology, University of California at Bekerley, USA; and the Mammal Collection of the Universidade Federal de Santa Maria, Santa Maria, RS. Therefore, it is important to incentive the implementation of representative zoological collections by the local universities and research institutions to improve the knowledge and the data base for taxonomic studies and distribution assessments.

Main knowledge gaps. It is still necessary to develop studies on distributions of most of the mammalian species in the state, especially in regions where the man-made changes has eliminated the natural ecosystems, such as in the southern, central and eastern regions of the state. The southern region was once covered by the Atlantic forest, and it is presently highly developed with mechanized agriculture. Little is known about the mammal fauna in this area, especially along the border with Paraguay. It is possible that new records would be produced in the region, as several species known to occur in the other side of the frontier has not yet been found in Mato Grosso do Sul. In the central and eastern regions little has been done to increase the knowledge on the mammal fauna, and these areas are currently under expansion of forestry and biofuel projects (sugarcane plantations), as well as the intensification of

cattle ranching and agriculture. Most of these areas are in the Cerrado ecosystem, but several types of wetlands exist in the headwaters. Hydroelectric developments are also a threat to these ecosystems as wetlands are usually located in lower terrain, which are the first to be eliminated together with its terrestrial mammalian fauna. The southwestern region, influenced by the Paraguayan Chaco, requires sound inventories as some species may be restricted in Brazil to this relatively small area. There is still a need for specific studies on taxonomy and distribution of some taxa, such as *Oligoryzomys*, *Callomys,* and *Callicebus*. The role of protected areas in conserving representative mammalian faunas in the state is still in need of consistent evaluation, including estimation of population sizes and trends for the most sensitive or endangered species. The knowledge on mammalian ecological functions (e.g. predators, pollinators, seed dispersers, vector/host of diseases) have been well studied only for some particular species or sites, lacking a more general picture across species and regions. Other relevant research hiatus are related to population dynamics, genetic structure, landscape use, dispersal, and local evolutionary histories. Furthermore, the general focus of available studies is on biological patterns rather than on the process shaping them. The use of mammals as indicator species is also necessary for habitat recovery and impact evaluations. Finally, the Mato Grosso do Sul is still requiring an official list of endangered species and their habitats, in order to influence public policies to protect them.

Perspectives for the next 10 years. In the following decade the perspectives for mammals from Mato Grosso do Sul will depend on the development of a strategic approach to increase the knowledge on this taxonomic group, particularly if partnership among specialists and institutions is achieved. In this sense, the BIOTA-MS Program, focused on the biodiversity at the state, certainly will play an important role. The BIOTA-MS should incentive and coordinate inventories at priority regions in the state, as well as help to increase the institutional capacity to organize, maintain and make available information from zoological collections. Among priority areas, we may list the Chaco in the southwestern region, the wetlands, the southern region, the northeastern region, and the western region along the border with Bolivia. For the future, ongoing new research lines will provide knowledge on some identified gaps. For instance, research projects in progress, including Ph.D. thesis and Master dissertations, have increasingly focused important lines in population ecology, dispersal, genetics and landscape use. Large-scale biogeographical patterns and local community assembly processes are other research lines which have been recently launched, which tend to substantially improve the knowledge on Mato Grosso do Sul's bat fauna and other mammalian groups in the state. Also, it may be expected an increase of the knowledge on ecology, natural history, and distribution of mammal species, as post-graduation program has been established and consolidated in the state. However, it is still necessary to understand the impact of economic development on mammal species, with focus on the responses to habitat fragmentation and degradation, and on the abundance and distribution of their populations. These types of knowledge are fundamental to establish conservation priorities, such as the selection of areas to be protected, the recovering of endangered species populations and habitats, the elaboration of public policies for ecosystem services payment schedules, and the strategies to ensure wildlife conservation in private lands.

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