Checklist of mammals from Goiás, central Brazil

Wellington Hannibal¹, Marlon Zortéa², Analice M. Calaça³, Ana Paula Carmignotto¹, Alexandra M. R. Bezerra¹, Henrique G. Carvalho⁴, Cibele R. Bonvicino⁵, Ana C. M. Martins¹,⁶, Ludmilla M. S. Aguiar⁷, Marcelino B. de Souza⁸, Ingrid de Mattos⁴, Roniel F. Oliveira⁸, Daniel Brito¹, Diego A. Silva¹, Marco A. Guimarães¹,‡, Edwilson M. B. do Carmo¹,‡ & Jânio C. Moreira¹,‡

¹Universidade Estadual de Goiás, Laboratório de Ecologia e Biogeografia de Mamíferos, Quirinópolis, GO, Brasil.
²Universidade Federal de Jataí, Laboratório de Biodiversidade Animal, Jataí, GO, Brasil.
³Universidade Federal de São Carlos, Departamento de Biologia, Laboratório de Diversidade Animal, Campus Sorocaba, Sorocaba, SP, Brasil.
⁴Museu Paraense Emílio Goeldi, Coordenação de Zoologia, Mastozoologia, Belém, PA, Brasil.
⁵Universidade Federal de Goiás, Programa de Pós-Graduação em Biodiversidade Animal, Goiânia, GO, Brasil.
⁶INCA, Divisão de Genética, Rio de Janeiro, RJ, Brasil.
⁷Instituto Chico Mendes de Conservação da Biodiversidade, Coordenação de Identificação e Planejamento de Ações para Conservação – COPAN, Brasília, DF, Brasil.
⁸Universidade de Brasília, Departamento de Zootologia, Campus Darcy Ribeiro, Brasília, DF, Brasil.
⁹Universidade Federal de Goiás, Instituto de Ciências Biológicas, Laboratório de Mutagênese, Goiânia, GO, Brasil.
¹⁰Universidade de Brasília, Programa de Pós-Graduação em Zoologia, Campus Darcy Ribeiro, Aná Norte, Brasília, DF, Brasil.
¹¹Universidade Federal de Goiás, Departamento de Ecologia, Laboratório de Ecologia Aplicada e Conservação, GO, Brasil.
¹²Instituto Federal Goiano, Laboratório de Ecologia, Evolução e Sistemática de Vertebrados, Rio Verde, GO, Brasil.
¹³Universidade de Brasília, Programa de Pós-Graduação em Zoologia, Campus Darcy Ribeiro, Asa Norte, Brasília, DF, Brasil.
¹⁴Universidade Federal de Catalão, Catalão, GO, Brasil.
¹⁵Corresponding author: wellingtonhannibal@gmail.com

Abstract: The state of Goiás, in central Brazil, is covered mainly by the Cerrado domain, with the Alto Paraná Atlantic Forest occupying its central-southern portion. Goiás is one of the 20 Brazilian federative units without a mammal checklist. In this study, we provide the first checklist of mammals from Goiás state. We recorded mammal species based primarily on the analysis of specimens housed in scientific collections as well as on literature with associated voucher material. We listed 191 mammalian species belonging to 125 genera, 31 families and 10 orders, which represents 25.2% of the mammal species occurring in Brazil. The most speciose orders were Chiroptera (90 spp.), followed by Rodentia (43 spp.), Carnivora (19 spp.) and Didelphimorphia (17 spp.). The following orders accounted for a smaller portion of the state diversity: Cetartiodactyla (7 spp.), Cingulata (7 spp.), Primates (4 spp.), Pilosa (2 spp.), Lagomorpha (1 sp.) and Perissodactyla (1 sp.). A total of 28 species (14.7%), mainly represented by medium and large-sized mammals, are nationally threatened while 12 (6.3%) are globally threatened. Our results indicate great portions of the state lacking a proper survey of mammals, especially the northwestern portion. We discuss species richness, distribution and conservation status of the mammals of Goiás state in national and regional scenarios. We highlight the need for mammal inventories based on complementary survey techniques with the collection of vouchers in order to provide karyologic, molecular, morphologic, parasitologic, and ecological data. These informations are the basis for integrative studies that lead to the understanding of current mammalian richness and diversity. Indeed, knowledge on species richness distribution in the state will guide conservation strategies, especially in areas undergoing habitat loss and fragmentation, such as the central-southern portion of Goiás.

Keywords: Atlantic Forest; Bats; Cerrado; Inventory; Large mammals; Small non-volant mammals.
Lista de Mamíferos de Goiás, Brasil central

Resumo: O estado de Goiás, no Brasil central, é coberto principalmente pelo domínio do Cerrado, com a Mata Atlântica do Alto Paraná ocupando sua porção centro-sul. Goiás é uma das 20 unidades federativas brasileiras que ainda não possui uma lista de espécies de mamíferos. Neste estudo, apresentamos a primeira lista de mamíferos para o estado. Registramos as espécies de mamíferos com base principalmente na análise de espécimes depositados em coleções científicas, bem como na literatura apresentando material testemunho associado. Listamos 191 espécies pertencentes a 125 géneros, 31 famílias e 10 ordens, as quais representam 25,2% das espécies de mamíferos que ocorrem no Brasil. As ordens mais especiais foram Chiroptera (90 spp.), seguida pelas ordens Rodentia (43 spp.), Carnivora (19 spp.) e Didelphimorphia (17 spp.), com as demais ordens respondendo por uma porção menor da diversidade: Cetartiodactyla (7 spp.), Cingulata (7 spp.), Primates (4 spp.), Pilosa (2 spp.), Lagomorpha (1 sp.) e Perissodactyla (1 sp.). Um total de 28 espécies (14,7%), principalmente representadas por mamíferos de médio e grande porte, estão ameaçadas nacionalmente e 12 (6,3%) encontram-se globalmente ameaçadas. Nossos resultados indicaram grandes porções do estado ainda não devidamente pesquisadas em relação aos seus mamíferos, com informações escassas e fragmentadas, principalmente no que diz respeito à sua porção noroeste. Discutimos a riqueza de espécies, a distribuição e o estado de conservação dos mamíferos do estado de Goiás nos cenários nacional e regional. Ressaltamos a importância da realização de inventários que utilizem técnicas complementares de amostragem, incluindo a coleta de material testemunho, proporcionando a obtenção de dados cariotípicos, moleculares, morfológicos, parasitológicos e ecológicos. Estas informações são a base de estudos integrativos, os quais aumentam nossa compreensão a respeito da riqueza e diversidade atual dos mamíferos. O conhecimento a respeito da distribuição da riqueza de espécies em Goiás é essencial para embarasar estratégias de conservação, tão necessárias em áreas que vem sofrendo com a perda e fragmentação de seus hábitats naturais, como a porção centro-sul do estado.

Palavras-chave: Cerrado; Inventário; Mamíferos de médio e grande porte; Mata Atlântica; Morcegos; Pequenos mamíferos não voadores.

Introduction

The number of mammalian species has increased through time; currently, more than 6,400 species are recognized worldwide, with the Neotropics considered as the third most species-dense biogeographic region (Burgin et al. 2018; 2019). Within this region, Brazil is the richest country, which might be related to its large area and environmental heterogeneity (Quintela et al. 2020). This diverse country holds 759 native species, distributed in 249 genera, 51 families and 11 orders (Abreu et al. 2020; Quintela et al. 2020).

Although there is an enormous potential to describe new species [e.g., many have been recently surveyed, while many groups need taxonomic reviews (Gonçalves & Oliveira 2014; Nascimento & Feijó 2017; Bezerra et al. 2020)] and a great field for research on their ecology, biogeography, and population genetics, among others, we are facing an unfavorable scenario for conservation biology in the country (Quintela et al. 2020). The Cerrado and Atlantic Forest domains harbor a high mammalian diversity and endemism (Paglia et al. 2012; Gutiérrez & Marinho-Filho 2017; Quintela et al. 2020), and have been severely threatened by anthropogenic impacts, moreover were listed, among only 34 other regions, as biodiversity hotspots for the world conservation (Myers et al. 2000; Mittermeier et al. 2004). More than 80% of the remnants of the Brazilian Atlantic Forest are smaller than 50 ha (Ribeiro et al. 2009), and for the Cerrado, more than 50% of its original area (approximately 2 million km²) have been converted into pasture and agricultural areas (Klink & Machado 2005; Strassburg et al. 2017).

Considering the large Brazilian territory, its environmental heterogeneity and conservation status, currently only seven federative units have checklists of mammals available: Amapá (Silva et al. 2013), Espírito Santo (Moreira et al. 2008), Mato Grosso (Brandão et al. 2019), Mato Grosso do Sul (Cáceres et al. 2008; Tomas et al. 2017), Santa Catarina (Cherem et al. 2004), São Paulo (Vivo 1998; Vivo et al. 2011), and Rio de Janeiro (Rocha et al. 2004). A checklist is the first step in order to plan inventories, conduct biogeographic and systematic studies, and develop conservation actions; thus, a review of the mammal records for each Brazilian state is warranted (Brandão et al. 2019). In this study, we provide the first checklist of mammals from Goiás state, with comments on their distribution and conservation.

Material and Methods

1. Study site

The state of Goiás is located in central Brazil (12° to 19° S, 46° to 53° W) and is represented by two ecoregions: Cerrado and Alto Paraná Atlantic Forest (Dinerstein et al. 2017) (Figure 1). Goiás has the seventh largest territorial extension among the 27 federative units in the country, with approximately 340,106 km² (IMB 2020), representing 4% of the largest territorial extension among the 27 federative units in the country, with approximately 340,106 km² (IMB 2020), representing 4% of the national territory. It is almost entirely characterized by the Cerrado domain, with its remnants being severely fragmented mainly by cattle ranching and agriculture activities (Prado et al. 2012), as well as other threats such as hydroelectric dams and mining (Melo & Soares 2005).

The Brazilian savanna is composed of a continuous mosaic represented by different phytophysiognomies ranging from grasslands to closed canopy forests (Eiten 1972). However, the distribution of these phytophysiognomies throughout the domain is not equitable (e.g., while gallery forests represent only 5% of the total area of the Cerrado, the stricto sensu cerrados cover about 70% of the landscape) (Ribeiro et al. 1998; Oliveira et al. 2017). The Cerrado in Goiás also ranges through a great elevational gradient, from valleys and depressions...
mainly located at its western portion at the Araguaia river margins, to highlands located at the Brazilian Central Plateau in its central and eastern portions (Cardoso & Marcuzzo 2014). The Chapada dos Veadeiros and Serra Geral do Paranã, at its northeastern border, are the most elevated regions, ranging from 800 to 1,700 meters high (NASA 2002). Three main hydrographic basins delimit and cross the Cerrado in Goiãs: the Araguaia at west, Tocantins at central, and São Francisco at its eastern border. The other ecoregion, the Alto Paranã Atlantic Forest, is represented by forest patches in its central-southern portion (Figure 1), mainly located at river margins and valleys of the Paranã hydrographic basin, also at the Brazilian Central Plateau slopes (RADAMBRASIL 1982). Goiãs climate is classified as Köppen’s Aw – tropical with dry winters (Setzer 1966). The mean annual temperature is around 23℃, and the mean annual pluviosity around 1,500 mm. However, the temperature and rainfall regime define two distinct seasons: the hot and wet season during the months of October to April, with temperatures around 26-27℃, concentrating 85% of the rainfall; and the cold and dry season, ranging from May to September, with a total pluviosity around 200 mm, and mean temperatures around 21℃ (Cardoso & Marcuzzo 2014).

These environmental features, together with the climatic fluctuations during the Tertiary and Quaternary periods, have shaped the biogeography and evolutionary history of the Cerrado, leading to the great biodiversity and endemism currently found, with the neighboring forested domains playing a major role (Da Silva & Bates 2002; Werneck 2011).

2. Data collection

We recorded mammal species based primarily on the analysis of specimens housed in mammalian scientific collections: American Museum of Natural History; New York, USA (AMNH); Laboratório de Biodiversidade Animal, Universidade Federal de Jataí, Goiás, Brazil (CF); Laboratório de Biologia e Parasitologia de Mamíferos Silvestres Reservatórios, Instituto Oswaldo Cruz, Fiocruz, Rio de Janeiro, Brazil (LBCE); Museu Nacional, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil (MN); Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil (MZUSP); Universidade de Brasília, Brasilia, Brazil (UnB); CMVUNB [Coleção de Mamíferos Voadores da Universidade de Brasília]; Universidade Federal de Minas Gerais, Belo Horizonte, Brazil (UFMG); Universidade Federal da Paraíba, João Pessoa, Brazil (UFPB). We tried to include at least one voucher per species to attest the presence of each taxon in the state (see Table 1).

We also searched for articles about mammals from Goiãs in the following databases: Scientific Electronic Library Online (Scielo, www.scielo.org), Web of Science (WoS, http://portal.isiknowledge.com), Scopus® (www.scopus.com) and Periódicos CAPES (http://www.periodicos.capes.gov.br/). The combination of the keywords “Goiãs AND mammals”, “Cerrado AND mammals”, “savanna AND mammals” were used. We also used the database of the Brazilian Digital Library of Theses and Dissertations of the Brazilian Institute of Sciences and Technology (BDTD 2020). The bibliography with voucher material (records based on photographic evidences – of camera trap, tracks or direct observations - were also considered as vouchers in the case of medium and large-sized mammals) were cited in Table 1 and included as Supplementary Material (S1). The recorded localities were classified by mammal group (bats, small non-flying mammals and medium and large mammals) and plotted in a map (Figure 1) in order to give a general picture of the surveyed areas in Goiãs state.

We followed the updated and annotated checklists of mammals from Brazil (Abreu et al. 2020; Quintela et al. 2020) for taxonomic hierarchical categories and nomenclature of the mammal taxa. Since these checklists differ in the treatment of some taxa, we cited our decisions bellow. We used the name Cetartiodactyla Montgelard, Catzeflis & Douzery, 1997 for the order including members of Artiodactyla Owen, 1848 and Cetacea Brisson, 1762; we used the name Dicotyles Cuvier, 1816 for the genus of the collared peccary according to Acosta et al. (2020); both decisions followed Abreu et al. (2020). For the taxonomic nomenclature of Chiroptera we followed Garbino et al. (2020). We considered Conepatus amazonicus Herskovitz, 1994 as a valid taxon; we also treated Cabassous squamicaudis (Lund, 1845) as a valid species; both decisions followed Quintela et al. (2020). Here we used the concept of Marmosa demerarae (Thomas, 1905) of Silva et al. (2019a) following Quintela et al. (2020). We treated Calomys matevii Gurgel-Filho, Feijó & Langguth 2015 as a junior synonym of C. expansus (Lund, 1840), according to Gutiérrez & Marinho-Filho (2017), Sylvilagus minensis as a valid species based on Ruedas et al. (2017) and Silva et al. (2019b); and we did not treat Galea flavidenis as valid, according to Bezerra (2008), differing from the previous checklists. The concept of Holochilus sciureus follows the recent study of Prado et al. (2021). Conservation statuses are based on the Brazilian (ICMBio/MMA 2018) and international (IUCN 2020) red lists of threatened species.

Results and Discussion

A total of 191 mammalian species, distributed in 125 genera, 31 families and 10 orders were recorded for Goiãs state. The richest order is Chiroptera, with 90 species, followed by Rodentia (43 spp.), Carnivora (19 spp.), and Didelphimorphia (17 spp.). The other orders comprise less diverse groups: Cetartiodactyla (7 spp.), Cingulata (7 spp.), Primates (4 spp.), Pilosa (2 spp.), Lagomorpha (1 sp), and Perissodactyla (1 sp.) (Table 1). These results corroborate the richness pattern found in Brazil and in the world, where the most diverse mammals are bats and rodents (Burgin

Figure 1. Map of Goiãs state in central Brazil. Sampling points for mammalian species according to records listed in Table 1 (see Supplementary Material S1 for access to the references and coordinates). Ecoregions and rivers (adapted from Dinerstein et al. 2017). Black lines indicate the political geographic boundaries.
et al. 2018; Abreu et al. 2020; Quintela et al. 2020), as well as the pattern found in the Cerrado domain, where Chiroptera represents the richest order followed by the Rodentia, Didelphimorphia and Carnivora (Carmignotto et al. 2012). However, bats presented a much higher proportion in the state (47%) compared to the Cerrado (35%), while the opposite trend was found for rodents (22% in Goiás and 34% for the Cerrado), evidencing the lack of studies on this latter group in the state.

A total of 28 species (14.7%) are included in some national threat category (four as endangered – one armadillo, one bat, two rodents - and 24 as vulnerable – one marsupial, one armadillo, one anteater, five bats, one primate, two rodents, nine carnivores, a tapir, two deer, one peccary), while 12 species (6.3%) are globally threatened (three as endangered and nine as vulnerable), 10 (5.2%) are considered as Near Threatened (NT), and 12 (6.3%) as Data Deficient (DD), with this later category mostly represented by rodents and bats (Table 1). The high percentage of threatened and DD species highlight the need to increase our efforts regarding further studies and conservation of target mammalian species and/or poorly surveyed regions in the state.

1. **Didelphimorphia**

We recorded 10 genera and 17 species from the family Didelphidae for Goiás state. These taxa include members from two subfamilies: Caluromyinae (2 spp.) and Didelphinae (15 spp.), as well as from three Didelphinae tribes: Marmosini (6 spp.), Didelphini (5 spp.) and Thylamyini (4 spp.). These numbers represent 26% of the 65 Brazilian didelphids (Abreu et al. 2020) and equates richness with other Brazilian states, such as Mato Grosso do Sul (17 spp.– Tomas et al. 2017) and Rio de Janeiro (14 spp.– Rocha et al. 2004).

In relation to general distribution patterns, 53% of these taxa (9 spp.) are widely distributed, and shared between the Cerrado and forested domains, such as the Amazonian and Atlantic Forests. This is the case of *Caluromys lanatus*, *C. philander*, *Chironectes minimus*, *Marmosa murina*, *M. demerarae*, *M. paraguayaana*, *Monodelphis americana*, *Phaleran canus* and *P. quica*. The other half (47% - 8 spp.) is represented by Cerrado endemics (*Thylamys velutinus*) and by taxa shared with other open formations, such as the Caatinga, Pantanal and Chaco, which include *Cryptonanus chacoensis*, *Gracilinanus agilis*, *Didelphis albiventris*, *Lutreolina crassicaudata*, *Monodelphis domestica*, *M. kuni* and *Thylamys karimii*. These data reveal the composite nature of the didelphid fauna of the state, characterized by inhabitants of forested and open formations, due to the presence of a vegetation mosaic, typical of the Cerrado domain (Carmignotto et al. 2012), and the semideciduous seasonal forest fragments, which still persist in the state (Ribeiro & Walter 2008; IBGE 2011).

Considering the local distribution patterns, we can cite six didelphids that are rare in Goiás, with few records restricted to different portions of the state: *Marmosa paraguayaana* and *Philander quica*, both widely distributed in the Atlantic Forest of southeastern Brazil, are restricted to the southeast of Goiás (Carmignotto 2005; Silva et al. 2019a), suggesting a closer relationship between this region and the Atlantic Forest; *Caluromys philander* and *Monodelphis americana*, which occur on both forested domains (Amazon and Atlantic Forest), present few and scattered records in southwestern (only *Caluromys*), central and northern portions of the state (Carmignotto 2005; Cáceres et al. 2008; Pavan et al. 2014); *Lutreolina crassicaudata*, a marsupial with a disjunct distribution in South America, is restricted to its southern portion (Cáceres et al. 2008; Carmignotto et al. 2014); and *Thylamys velutinus*, a Cerrado endemic species, is restricted to southwestern and northeastern portion of the state, in two protected areas (Parque Nacional das Emas and Parque Nacional da Chapada dos Veadeiros) (Bonvicino et al. 2002; 2005; Carmignotto & Monfort 2006; Carmignotto et al. 2014). Besides the restricted distribution in the state, this latter species is also threatened in Brazil, classified as vulnerable (Rossi et al. 2018). *Thylamys karimii*, although presenting a wider distribution, is also treated as vulnerable at the IUCN Red List (Carmignotto et al. 2016). In the case of *L. crassicaudata*, it is also important to note that the records from Goiás delimit the northeastern range of the southern portion of its distribution in South America (Martínez-Lanfranco et al. 2014).

The richest didelphid communities were found within conservation units, such as the Parque Nacional das Emas (10 spp.– Carmignotto et al. 2014), Parque Nacional da Chapada dos Veadeiros (8 spp.– Bonvicino et al. 2002; 2005), Parque Estadual da Serra de Caldas Novas (6 spp.– Carvalho et al. 2002; Costa et al. 2003; Carmignotto 2005), and areas very well sampled, such as the region of the Hydroelectric dam of Serra da Mesa (11 spp.– Carvalho et al. 2002; Costa et al. 2003; Carmignotto 2019) and the region of Anápolis (7 spp.– Carmignotto 2005). So, the majority of the records were based on few and well sampled localities, ranging from six to 11 didelphids, while the other regions of the state are still poorly sampled (most of them with records of only one species) (Carmignotto 2005).

Indeed, there are some didelphid taxa that need additional taxonomic comments: *Cryptonanus chacoensis* has proven to be a species complex, composed of very similar taxa in morphology, but distinct at molecular levels, with at least three putative species for the state (Carmignotto et al. 2014; Fegies et al. in press). The cited records for the state are all part of *C. chacoensis* complex (see de la Sancha and D’Elía 2014), including those cited as *G. emiliae* by Carvalho et al. (2002) and as *C. agricolai* (Gardner 2008; Gomes et al. 2015). Recent revisionary studies on the genus *Marmosa* subgenus *Micoureus* have also shown genetically and geographically structured populations within *M. demerarae* (Silva et al. 2019a), with populations from central Brazil treated as distinct taxa, such as *M. limae* Thomas, 1920 by Voss et al. (2020) and Abreu et al. (2020), or *M. domina* Thomas, 1920 by Bonvicino et al. (2021). For *Philander*, molecular and morphological studies have also shown that populations from central Brazil can be treated as a distinct taxon: *P. canus*, but the limits of the geographic distribution between this species and *P. quica*, the species from southeastern Brazil, are not delimited yet. Both species are recorded in Goiás, but several records in the state need to be reexamined based on molecular and morphological grounds (Costa 2003; Voss et al. 2018).

2. **Cingulata**

We recorded seven species of Cingulata for Goiás state, which represents 58.3% of the species listed for Brazil (Quintela et al. 2020). According to other Brazilian states’ checklists, armadillos range from five species in São Paulo (Vivo et al. 2011) and Amapá (Silva et al. 2013), to nine species in Mato Grosso (Brandão et al. 2019). The occurrence of the southern three-banded armadillo *Tolypeutes matacus* was mentioned in an interview for the region of the Parque Nacional das Emas, but only in the past (Rodrigues et al. 2002). Considering that there is no reliable record or voucher material for the species in Goiás, *T. matacus* was not included in the list.

The largest populations of Brazilian three-banded armadillo *Tolypeutes tricinctus* occurs in areas of Bahia on the border with Goiás.
Table 1. Checklist of mammals from Goiás state, Brazil. Records are based primarily on the analysis of specimens housed in scientific collections (numbers between brackets) and on literature with associated voucher material (numbered citations). Conservation statuses are based on the Brazilian and international red lists of threatened species (ICMBio/MMA 2018 and IUCN 2020, respectively). Acronyms for conservation status categories: DD = data deficient, EN = endangered, NT = near threatened, P/R = pending (re)evaluation, VU = vulnerable. For scientific collections acronyms, please see Material and Methods.

| Taxon | Common Name | Record | ICMBio | IUCN |
|-------|-------------|--------|--------|------|
| DIDELPHIMORPHA Gill, 1872 | | | | |
| DIDELPHIDAE Gray, 1821 (17 species) | | | | |
| Caluromys lanatus (Olfers, 1818) | Brown-eared Woolly Opossum | 18, 82, 103 [MN 20963, UnB 2564] | | |
| Caluromys philander (Linnaeus, 1758) | Bare-tailed Woolly Opossum | 82, 83 [MZUSP 1160] | | |
| Chironectes minimus (Zimmermann, 1780) | Water Opossum | 13, 19, 80, 84 [MN 37815] | | |
| Cryptonanus chacoensis (Tate, 1931) | Chacoan Gracile Opossum | 13, 101 [CRB 3067] | | |
| Didelphis albiventris Lund, 1840 | White-eared Opossum | 3, 13, 18, 19, 79, 80, 82, 98 [MN 43054, MN 46514, UnB 1119] | | |
| Didelphis alziventris | | 3, 13, 18, 19, 79, 81, 82, 83, 88, 101 [MN 46574, MN 67080, UnB 1198] | | |
| Gracilinanus agilis (Burmeister, 1854) | Agile Gracile Opossum | 83, 88, 101 [MN 46574, MN 67080, UnB 1198] | | |
| Lutreolina crassicaudata (Desmarest, 1804) | Little Water Opossum | 13, 19, 82, 83 [MN 71673, UnB 1927] | | |
| Marmosa demerarae (Thomas, 1905) | Wooly Mouse Opossum | 3, 79, 80, 82, 87 [MN 46883, MN 67082] | | |
| Marmosa murina (Linnaeus, 1758) | Tate's Woolly Mouse Opossum | 13, 19, 82, 83, 102 [UnB 2551] | | |
| Marmosa paraguayana (Tate, 1931) | Tate's Woolly Mouse Opossum | 87 [UnB 2987] | | |
| Monodelphis americana (Müller, 1776) | Faint-striped Opossum | 3, 82, 85 [MN 46570] | | |
| Monodelphis domestica (Wagner, 1842) | Gray Short-tailed Opossum | 3, 13, 18, 79, 80, 82, 85, 90, 100 [MN 67084, MN 46574, MN 46583] | | |
| Monodelphis kunsi Pine, 1975 | Pygmy Short-tailed Opossum | 13, 18, 80, 82, 85, 90 [MZUSP SAMA 53] | | |
| Philander canus (Osgood, 1913) | Gray Four-eyed Opossum | 13, 80, 82, 86, 89 [UnB 1577] | P/R | P/R |
| Philander quica (Temminck, 1824) | Gray Four-eyed Opossum | 82 [UFMG 769] | | |
| Thylamys karimii (Petter, 1968) | Karimi's Fat-tailed Mouse Opossum | 4, 80 [MN 36285, MZUSP 32242, UnB 1158] | VU A2c+3c | |
| Thylamys velutinus (Wagner, 1842) | Dwarf Fat-tailed Mouse Opossum | 3, 4 [MZUSP 32098, MN 66461] | VU A2c | NT |
| CINGULATA Illiger, 1811 | | | | |
| CHLAMYPHORIDAE Bonaparte, 1850(5 species) | | | | |
| Cabassous squamicaudis (Lund, 1845) | Southern Naked-tailed Armadillo | 16, 19, 21-23, 25 and 77 | P/R | P/R |
| Cabassous tatouay (Desmarest, 1804) | Greater Naked-Tailed Armadillo | 2 | DD | |
| Euphractus sexcinctus (Linnaeus, 1758) | Yellow Armadillo | 1, 2, 12, 16, 19, 21, 23, 25 and 77 [UnB 1628, UnB 2221, UnB 2235] | | |
| Priodontes maximus (Kerr, 1792) | Giant Armadillo | 1, 16, 20, 22, 23 and 25 | VU A2cd | VU A2cd |
| Tolypeutes tricinctus (Linnaeus, 1758) | Brazilian Three-banded Armadillo | 78, [Photo (Supplementary Material S2)] | EN A2cd | VU A2cd |

DASYPODIDAE Gray, 1821 (2 species)

continue...
| Animal Name | Scientific Name | Common Name | References |
|-------------|-----------------|-------------|------------|
| *Dasypus novemcinctus* Linnaeus, 1758 | Nine-banded Armadillo | 1, 2, 11, 12, 19, 21, 22, 23, 25, 77, 115 [UnB 1118, UnB 1602, MZUSP 4130, MN 24460] |
| *Dasypus septemcinctus* Linnaeus, 1758 | Brazilian Lesser Long-nosed Armadillo | 1, 18, 115 [MN 59336] |
| *Myrmecophaga tridactyla* Linnaeus, 1758 | Giant Anteater | 1, 2, 11, 12, 16, 17, 19-25 and 77 [MN 55699, UnB 1603-UnB1607] |
| *Tamandua tetradactyla* (Linnaeus, 1758) Southern Tamandua | 1, 2, 11, 12, 16, 17, 19, 21, 22, 23, 25, and 77 [UnB 1238, UnB 2063] |
| *Molossus currentium* Thomas, 1901 Corrientes Mastiff Bat | 65 |
| *Molossus molossus* (Pallas, 1766) Palla's Mastiff Bat | 1, 40, 62, 65 and 67 [CJ 05, CJ 21, CJ 22] |
| *Moletimus griseus* (Van Rossem, 1868) | Black Mastiff Bat | 65 [CJ 557] |
| *Neotamandua johnstoni* (Thomas, 1911) Mato Grosso Dog-faced Bat | 34, 37 and 42 [UnB 791] |
| *Nyctinomops laticaudatus* (É. Geoffroy, 1805) Geoffroy’s Free-tailed Bat | 1, 7, 27, 32, 34, 40, 42, 46, 50, 51, 53, 55-58 and 65 [CMVUNB 1190, 1191, 1193] |
| *Pteronotus personatus* (Wagner, 1843) Wagner’s Mustached Bat | 7 [CJ 630] |
### Mammals of Goiás, Brazil

Biota Neotropica 21(3): e20201173, 2021

https://doi.org/10.1590/1676-0611-BN-2020-1173 http://www.scielo.br/bn

**Pteronotus rubiginosus** (Wagner, 1843) Ferruginous Mustached Bat 1, 7, 33-35, 40-42, 46, 50, 51, 56 and 65

**NATALIDAE** Gray, 1866 (1 species)

**Natalus macrourus** (Gervais, 1856) Brazilian Funnel-eared Bat 34, 38, 41, 42 and 52 VU A3c NT

**NOCTILIONIDAE** Gray, 1821 (2 species)

**Noctilio albiventris** Desmarest, 1818 Lesser Bulldog Bat 7

**Noctilio leporinus** (Linnaeus, 1758) Greater Bulldog Bat 27, 28, 31 and 55 [CMVUNB 1198-CMVUNB 1203]

**PHYLLOSTOMIDAE** Gray, 1825 (49 species)

**Carollia brevicauda** (Schinz, 1821) Silky Short-tailed Bat 43 [UnB 1557]

**Carollia perspicillata** (Linnaeus, 1758) Seba’s Short-tailed Bat 50-53, 55-59, 60, 62 and 66 [CMVUNB 1153-CMVUNB 1157]

**Desmodus rotundus** (É. Geoffroy, 1810) Common Vampire Bat 1, 7, 18, 32, 33-35, 41, 42, 46, 50-53, 55-59, 60, 62 and 66 [CMVUNB 1262-1264]

**Diaemus youngi** (Jentink, 1893) White-winged Vampire Bat 32, 35, 41, 46, 50, 55 and 69

**Diphylla ecaudata** Spix, 1823 Hairy-legged Vampire Bat 59 [CJ 503, CMVUNB 1277]

**Anoura caudifer** (É. Geoffroy, 1818) Lesser Tailless Bat 7, 18, 32, 35, 39-41, 51, 55, 57, 58, 62 and 66 [CMVUNB 1145, CMVUNB 1159]

**Anoura geoffroyi** Gray, 1838 Geoffroy’s Tailless Bat 1, 7, 34, 39, 40-42, 46, 50, 51, 53, 56-58 [CJ 50, CJ 204, CJ 210]

**Choeroniscus minor** (Peters, 1868) Lesser Long-tailed Bat 41

**Glossophaga soricina** (Pallas, 1766) Pallas’s Long-tongued Bat 1, 7, 18, 28, 31, 32, 34, 35, 39-42, 46, 50-53, 55-58, 61, 62, 66 and 67 [CMVUNB 1249, CMVUNB 1252]

**Glyphonycteris behnii** (Peters, 1865) Behn’s Big-eared Bat 51 VU A4c DD

**Hsuniycteris thomasi** (J. A. Allen, 1904) Thomas’s nectar bat [UnB 1567]

**Lionycteris spurrelli** Thomas, 1913 Chestnut Long-tongued Bat 7, 32, 34, 42 and 66 [CJ 556]

**Lonchophylla bockermanni** Sazima, Vizotto & Taddei, 1978 Bokermann’s Nectar Bat 42 EN B1ab (iii)

**Lonchophylla dekeyseri** Taddei, Vizotto & Sazima, 1983 Dekeyser’s Nectar Bat 1, 7, 35, 40, 41, 56, 50, 52, 53, 55, 63 and 66 [CMVUNB 1290, CMVUNB 1291] EN C2a (iIOn) EN C2a (i)

**Lonchophylla mordax** Thomas, 1903 Goldman’s Nectar Bat 42 NT

**Xeronycteris vieirai** Gregorin & Ditchfield, 2005 Vieira’s Long-tongued Bat 68 VU A4c DD

**Lonchorhina aurita** Tomes, 1863 Tome’s Sword-nosed Bat 7, 32, 34, 35, 41, 42, 52, 56, 59 and 66 [CJ 502] VU A3c

**Micronycteris megalotis** (Gray, 1842) Little Big-eared Bat 57 and 59 [CJ 49, CJ 55, CJ 232]

---

**continuation...**
continuation...

| Species Name                                      | Common Name                        | References |
|--------------------------------------------------|------------------------------------|------------|
| Micronycteris minuta (Gervais, 1856)              | White-bellied Big-eared Bat        | 1, 40, 41, 46, 50, 51, 53 and 55 [CMVUNB 1251, CMVUNB 1261] |
| Chrotopterus auritus (Peters, 1856)               | Woolly False Vampire Bat           | 1, 32, 40, 41, 51, 52, 55, 56, 58 and 60 [CMVUNB 1266] |
| Gardnerycteris cremulatum (É. Geoffroy, 1810)    | Striped Hairy-nosed Bat            | 7, 34, 42, 51 and 57 and 58 [CMVUNB 215, CMVUNB 261] |
| Lophostoma brasiliense Peters, 1866              | Pygmy Round-eared Bat              | 7, 42, 46, 50, 51, 58 and 60 [CMVUNB 208] |
| Lophostoma carrikeri (J. A. Allen, 1910)         | Carriker’s Round-eared Bat         | 54         |
| Lophostoma silvicola d’Orbigny, 1836            | White-throated Round-eared Bat     | 7, 34, 42 and 51 [CMVUNB 900, UnB 647] |
| Macrophyllum macrophyllum (Schinz, 1821)         | Long-legged Bat                    | 32, 34 and 42 [CMVUNB 547] |
| Minon bennettii (Gray, 1838)                     | Southern Golden Bat                | 18, 34, 35, 41, 42, 46, 48, 50-53, 55, 57 and 58 [CMVUNB 1161, UnB 1420] |
| Phyllostomus discolor (Wagner, 1843)             | Pale Spear-nosed Bat               | 1, 7, 34, 40, 42, 46, 50, 51, 57, 58, 62 and 62 [CMVUNB 301, 304, 305] |
| Phyllostomus elongatus (É. Geoffroy, 1810)       | Lesser Spear-nosed Bat             | 7 [CMVUNB 549] |
| Phyllostomus hastatus (Pallas, 1767)             | Greater Spear-nosed Bat            | 7, 18, 27, 28, 31, 34, 35, 41, 42, 46, 50, 51, 53, 56, 57, 59, 60 and 62 [CMVUNB 231, 335, 336] |
| Tonatia bidens (Spix, 1823)                      | Greater Round-eared Bat            | 34, 42 and 55 [CMVUNB 1265, CMVUNB 1283] |
| Tonatia maresi Williams, Willig & Reid, 1995     | Maresi Round-eared Bat             | 7          |
| Trachops cirrhosus (Spix, 1823)                  | Fringe-lipped Bat                  | 34, 41, 42, 53 and 66 [CMVUNB 19, CMVUNB 493] |
| Artibeus cinereus (P. Gervais, 1856)             | Gervais’s fruit-eating Bat         | 7, 18, 40, 46, 50, 51, 53, 56-58, 60 and 62 [CMVUNB 200, CMVUNB 256] |
| Artibeus concolor Peters, 1865                   | Brown Fruit-eating Bat             | 44, 46 and 50 |
| Artibeus lituratus (Olfers, 1818)                | Great Fruit-eating Bat             | 1, 7, 18, 34, 40-42, 46, 50, 51, 56-58, 60, 62, 64 and 67 [CMVUNB 68, CMVUNB 286, CMVUNB 287] |
| Artibeus obscurus (Schinz, 1821)                 | Dark Fruit-eating Bat              | 34, 42 and 55 [CMVUNB 1178-CMVUNB 1181] |
| Artibeus planirostris (Spix, 1823)               | Flat-faced Fruit-eating Bat        | 1, 7, 32, 34, 40-42, 46, 50, 51, 56-60, 62, 64 and 67 [CMVUNB 29, CMVUNB 69, CMVUNB 101] |
| Chiroderma doriae Thomas, 1891                   | Brazilian Big-eyed Bat             | 32 and 42 |
| Chiroderma villosum Peters, 1860                 | Hairy Big-eyed Bat                 | 7, 34 and 42 [UnB 39] |
| Mesophylla macconnelli Thomas, 1901              | Macconnell’s Bat                   | 34, 42, 44, 51 and 58 [CMVUNB 12] |
| Platyrrhinus brachycephalus (Rouk & Carter, 1972)| Short-headed Broad-nosed Bat       | 32        |
continuation...

| Species                                      | Common Name                      | References                                                                 |
|----------------------------------------------|----------------------------------|---------------------------------------------------------------------------|
| *Platyrrhinus incarum* (Thomas, 1912)         | Incan Broad-nosed Bat            | 7, 34, 42, 46, 50, 51, 53, 56-58 and 60 [CJ 220, CJ 288, CJ 423]          |
|                                              |                                 | 1, 7, 18, 26, 28, 31, 32, 34, 35, 40-43, 46, 50,                         |
|                                              |                                 | 66 [CMVUNB 1168, CMVUNB 1260]                                          |
| *Platyrrhinus lineatus* (É. Geoffroy, 1810)   | White-lined Broad-nosed Bat      | 51, 53, 55-58, 62, 63 and                                               |
|                                              |                                 | 66 [CMVUNB 1250]                                                        |
| *Sturnira lilium* (É. Geoffroy, 1810)         | Little Yellow-shouldered Bat     | 1, 7, 18, 32, 34, 40-42, 51, 55-58, 60 and 62 [CMVUNB 1250]           |
| *Sturnira tildae* de la Torre, 1959           | Tilda’s Yellow-shouldered Bat    | 42 and 60 [UnB 1554]                                                    |
| *Uroderma bilobatum* Peters, 1866             | Tent-making Bat                  | 7, 34 and 42 [UnB 888]                                                  |
| *Uroderma magnirostrum* Davis, 1968           | Brown Tent-making Bat            | 7, 34, 42 and 55 [CMVUNB 1278]                                         |
| *Vampyressa pusilla* (Wagner, 1843)           | Southern Little Yellow-eared Bat | 32, 34, 41, 42 and 45 [CJ 10]                                           |
|                                              |                                 | DD                                                                       |
| VESPERTILIONIDAE Gray, 1821 (12 species)      |                                 |                                                                           |
| *Eptesicus andinus* J. A. Allen, 1914         | Andean Brown Bat                 | 29 and 30                                                                |
| *Eptesicus brasiiliensis* (Desmarest, 1819)    | Brazilian Brown Bat              | 1, 27, 28, 34, 35, 40, 42 and 65                                        |
| *Eptesicus chiriquinus* Thomas, 1920          | Chiriqui Brown Bat               | 65                                                                       |
| *Eptesicus diminutus* (Osgood, 1915)          | Little Serotine                  | 7, 51 and 58 [CJ 398, UnB 769]                                          |
| *Eptesicus furinalis* (d’Orbigny & Gervais,  | Argentine Brown Bat              | 7, 55, 62 and 65 [CMVUNB 1246, CMVUNB 1258]                             |
| 1847)                                        |                                 |                                                                           |
| *Histiotus velatus* (I. Geoffroy, 1824)       | Tropical Leaf-eared Bat          | 65 [UnB 1038]                                                           |
| *Lasiusus blossevilli* (Lesson, 1826)         | Southern Red Bat                 | 1, 40 and 51 [CJ 40, CJ 46, CJ 56]                                       |
| *Lasiusus villosissimus* (Palisot de Beauvais, | Hoary Bat                       | [CJ 399]                                                                |
| 1796) *                                      |                                 |                                                                           |
| LAGOMORPHA Brandt, 1855                       |                                 |                                                                           |
| *Leporidae* Fischer, 1817 (1 species)         |                                 |                                                                           |
| *Sylvilagus minensis* Thomas, 1901            | Brazilian Cottontail Rabbit      | 12, 17, 19, 22, 23, 79 and 99 [MN 43003, UnB 2636]                     |
|                                              |                                 | P/R                                                                      |

https://doi.org/10.1590/1676-0611-BN-2020-1173
http://www.scielo.br/bn
### RODENTIA Bowdich, 1821

**CAVIDAE** Fischer, 1817 (4 species)

| Scientific Name                        | Common Name                        | Status | Collection Details |
|----------------------------------------|------------------------------------|--------|--------------------|
| *Cavia aperea* Erxleben, 1777          | Brazilian Guinea Pig               | 1 and 94 [UnB 1625] |
| *Galea spixii* (Wagler, 1831)         | Spix’s Yellow-toothed Cavy         | 6 [MN 2615, MN 22583, MZUSP 25304] |
| *Kerodon acrobata* Moojen, Locks & Langguth, 1997 | Acrobat Rock Cavy | 8 [MN 22728-MN 22730, UnB 2525, UnB 2523] |
| *Hydrochoerus hydrochaeris* (Linnaeus, 1766) | Capybara                          | 1, 12, 16, 17, 19, 21, 22, 25 and 77 [UnB 2247] |

**CRICETIDAE** Fischer, 1817 (29 species)

| Scientific Name                        | Common Name                        | Status | Collection Details |
|----------------------------------------|------------------------------------|--------|--------------------|
| *Akodon gr. cursor*                    | Montane Akodont                     | 82 [AMNH 134567, MN 5176, MZUSP MRT 7903] |
| *Calomys expulsus* (Lund, 1840)        | Rejected Vesper Mouse              | 3, 79, 93 and 110 [MN 61583, MN 61588, MN 71958, UnB 1178] |
| *Calomys tener* (Winge, 1887)          | Delicate Vesper Mouse              | 93 and 110 [MN 61575, MN 67075] |
| *Cerradomys maracajuensis* (Langguth & Bonvicino, 2002) | Maracaju Rice Rat                  | 97 [LBCE 7475] |
| *Cerradomys marinus* (Bonvicino, 2003) | Marinho’s Rice Rat                 | 13, 97, 105 [UnB 1901] |
| *Cerradomys scotti* (Langguth & Bonvicino, 2002) | Lindbergh’s Rice Rat               | 3, 13, 97, 105, 106 and 112 [MN 61674, MN 61684, MN 67089] |
| *Cerradomys subflavus* (Wagner, 1842)  | Flavescent Cerradomys              | 105, 106 and 112 [MN 437, AMNH 134562] |
| *Euryoryzomys lamia* (Thomas, 1901)    | Monster Rice Rat                   | 3, 104, 106 and 112 [MN 67090] |
| *Holochilus sciareus* Wagner, 1842     | Amazonian Marsh Rat                | 107 [MN 34181] |
| *Hylaeamys megacephalus* (G. Fischer, 1814) | Large-headed Rice Rat            | 3, 13, 79, 98 and 106 [MN 46867, MN 46866, MN 67092, UnB 1167] |
| *Kunsia tomentosa* (Lichtenstein, 1830) | Woolly Giant Rat                  | 13 [MN 62579, UnB 1706] |
| *Neacomys amoenus* Thomas, 1903        | Common Spiny Mouse                 | 98 [UFPB CRB 70] |
| *Necromys lasiurus* (Lund, 1841)       | Hairy-tailed Bolo Mouse            | 3, 13, 79 and 82 [MN 46828, MN 67073] |
| *Nectomys rattus* (Pelzelin, 1883)     | Common Water Rat                   | 3, 13, 79 and 106 [MN 67075, UnB 383] |
| *Oecomys catherinae* Thomas, 1909      | Atlantic Forest Rat                | 91 and 113 [MN 62174] |
| *Oecomys cleberi* Locks, 1981          | Cleber Arboreal Rat                | 113 [UnB 1716] |
| *Oecomys roberti* (Thoms, 1904) *      | Robert’s Oecomys                   | 82 [MZUSP MRT 7965] |
| *Oligoryzomys mattogrossae* (J. A. Allen, 1916) | Mato Grosso Colilargo            | 3, 13, 79, 92, 104 and 108 [MN 67089] |
| *Oligoryzomys moojeni* Weksler & Bonvicino, 2005 | Moojen’s Colilargo              | 3 and 104 [MN 50307, MN 67087] |
| *Oligoryzomys nigripes* (Ooffers, 1818) | Black-footed Colilargo           | 104 [MN 5210] |
| *Oligoryzomys rupestris* Weksler & Bonvicino, 2005 | Highlands Colilargo           | 3 [MN 50286] |
| *Oligoryzomys stramineus* Bonvicino & Weksler, 1998 | Straw-colored Colilargo      | 79 [MN 46406, MN 46410] |
| *Oxymycterus dasytrichus* (Sehinz, 1821) | Atlantic Forest Hocicudo       | 70 [MN 32890] |
| *Oxymycterus delator* Thomas, 1903    | Spy Hocicudo                      | 3, 13, 70 and 111 [UnB 2084, MN 46619, MN 71657] |
| Order | Family | Genus | Species | Status | Conservation | References |
|-------|--------|-------|---------|--------|--------------|------------|
| Rodentia | Cuniculidae | Pseudoryzomys | simplex | False Oryzomys | 1, 3 and 106 [UnB 2084, MN 46619, MN 71657] |
| | Dasyproctidae | Rhipidomys | macrurus | Cerrado Rhipidomys | 71 and 72 [UnB 1581] |
| | | mastacalis | Tree Rat | 71 and 72 [MN 37350] |
| | | Thalpomys | cerradensis | Cerrado Mouse | 98 [UnB 1157] | VU A2c+3c |
| | | Wiedomys | cerradensis | Cerrado Wiedomys | 73 [UnB 2593] |
| | Cuniculidae | Cuniculus | pacu | Lowland Paca | 1, 11, 16, 17, 18, 20, 23, 25 and 77 [UnB 2232] |
| | Dasyproctidae | Dasyprocta | azarae | Azara’s Agouti | 1, 11, 17-20, 22, 23 and 74 [MN 71690] | DD |
| | | leporina | Red-rumped Agouti | 74 [MZUSP 3944] |
| | Echimyidae | Carterodon | sulcidens | Owl’s Spiny Rat | 10 [MN 54368, UnB 2716] | DD |
| | | Clyomys | laticeps | Broad-headed Spiny Rat | 13, 96 [UnB 2155, UnB 2717] |
| | | Dactylomys | dactylinus | Amazon Spiny Rat | 5 [UnB 2067-UnB 2071] |
| | | Proechimys | longicaudatus | Long-tailed Spiny Rat | 13 and 98 [MN 71668] |
| | | roberti | Thomas, 1901 | Robert’s Spiny Rat | 3 [MN 50219, MN 67093] |
| | | Thrichomys | pachyurus | Paraguayan Punaré | 3, 79, 95 and 109 [MN 66132] | P/R |
| | Erethizontidae | Coendou | prehensilis | Brazilian Porcupine | 1, 11, 16-19, 21, 23, 75 and 77 [AMNH 134062] |
| | Carnivora | Canidae | Cerdocyon | thous | Crab-eating Fox | 1, 9, 12, 17-23, 25 and 77 [MN 68181] |
| | | Chrysocyon | brachyurus | Maned Wolf | 1, 12, 16-21, 23, 25 and 77 [MN 68175] | VU A3c; E | NT |
| | | Lycalopex | vetulus | Hoary Fox | 1, 16-21, 23, 25 and 77 [MN 68180] | VU A2cd+3cd |
| | | Speothos | venaticus | Bush Dog | 1, 21 [MN 68179, UnB 3275] | VU C1 | NT |
| | Felidae | Leopardus | braccatus | Pampas Cat | 1, 23, 76 and 77 [UnB 2237] | VU C1 | NT |
| | | pardalis | Linnaeus, 1758 | Ocelot | 9, 12, 16-20, 22-24, 25 and 77 [UnB 2021] |
| | | emiliae | Thomas, 1914 | Emilia Oncilla Cat | 114 [MZUSP 19900] | P/R |
| | | wiedii | Schinz, 1821 | Margay | 9, 18, 21 and 23 | VU C1 | NT |
| | | Panthera | onca | Jaguar | 1, 9, 20 and 77 | VU A2b; C1 | NT |
| | | Puma | concolor | Puma | 1, 9, 12, 16-20, 22, 23, 25 and 77 [UnB 2026] | VU C1 |
| | | Herpailurus | yagouaroundi | Jaguarundi | 1, 18, 21-23, 25 and 77 [UnB 1889] | VU C1 |
MEPHITIDAE Bonaparte, 1845 (1 species)

Conopatus amazonicus (Lichtestein, 1838) Striped Hog-nosed Skunk 17-19, 21 and 77 [MN 59335] P/R P/R

MUSTELIDAE Fischer, 1817 (4 species)

Eira barbara (Linnaeus, 1758) Tayra 1, 9, 11, 17-23, 25 and 77

Galictis cuja (Molina, 1782) Lesser Grison 18 and 19 [MN 68975] NT

Lontra longicaudis (Olfers, 1818) Neotropical Otter 1, 16-19, 21, 23 and 25

Pteronura brasiliensis (Gmelin, 1788) Giant Otter [MZUSP 3161, MZUSP 3162] VU EN

PROCYONIDAE Gray, 1825 (3 species)

Nasua nasua (Linnaeus, 1766) South American Coati 1, 11, 9, 16-22 and 77 [MN 55094] NT

Potos flavus (Schreber, 1774) Kinkajou 24

Procyon cancrivorus (Cuvier, 1798) Crab-eating Raccoon 1, 9, 11, 12, 16-19, 21-23, 25 and 77

PERISSODACTYLA Owen, 1848

TAPIRIDAE Gray, 1821 (1 species)

Tapirus terrestris (Linnaeus, 1758) Lowland Tapir 1, 18-23, 25 and 77 [MN 53701] VU A2bcd+3bcd VU A2cde+3cde

CETARTIODACTYLA Montgelard, Catzeflis & Douzery, 1997

CERVIDAE Goldfuss, 1820 (4 species)

Blastocerus dichotomus (Illiger, 1815) Marsh Deer 1 and 77 VU A4ade VU A4cde

Mazama americana (Erxleben, 1777) Red Brocket 1, 12, 18, 19, 23 and 77 DD

Mazama gouazoubira (Fischer, 1814) Gray Brocket 1, 17, 18, 23, 25 and 77

Ozotoceros bezoarticus (Linnaeus, 1758) Pampas Deer 1 and 77 [MN 55093] VU A4cde; C1 NT

TAYASSUIDAE Palmer, 1897 (2 species)

Dicotyles tajacu (Linnaeus, 1758) Collared Peccary 1, 12, 16-19, 21-23, 25 and 77

Tayassu pecari (Link, 1795) White-lipped Peccary 1, 23 and 78 [MN 68178, MN 68182] VU A2bcede+3bcede VU A2bcede+3bcede

INIIDAE Gray, 1846 (1 species)

Inia araguaiaensis Hrbek, Farias, Dutra & da Silva, 2014 Araguaian river Dolphin 15 P/R P/R

*New record for the state of Goiás. Sources: 1- Rodrigues et al. (2002); 2- Sanderson & Silveira (2003); 3- Bonvicino et al. (2005); 4- Carmignotto & Monfort (2006); 5- Bezerra et al. (2007); 6- Bezerra (2008); 7- Zortéa & Darc (2019); 8- Bezerra et al. (2010); 9- Calaça et al. (2011); 10- Bezerra et al. (2010); 11- Bernardo & Melo (2013); 12- Ribeiro & Melo (2013); 13- Carmignotto et al. (2014); 14- Colodetti (2014); 15- Hrberk et al. (2014); 16- Araújo et al. (2015); 17- Estrela et al. (2015); 18- Gomes et al. (2015); 19- Hannibal et al. (2015); 20- Cabral et al. (2017); 21- Miranda et al. (2017); 22- Oliveira & Hannibal (2017); 23- Calaça et al. (2018); 24- Miranda et al. (2018); 25- Oliveira et al. (2019); 26- Pelzeln (1883); 27- Vieira (1942); 28- Vieira (1955); 29- Davis (1965); 30- Davis (1966); 31- Piccinini (1974); 32- Coimbra et al. (1982); 33- Trajano & Gnaspini-Netto (1991); 34- Trierweiler 1998; 35- Bredt et al. (1999); 36- Salles et al. (1999); 37- Avila et al. (2001); 38- Taddei & Uieda (2004); 39- Zortéa (2003); 40- Coelho (2005); 41- Schmitz et al. (2005); 42- Pracasso & Sales (2005); 43- Nunes (2005); 44- Zortéa & Tomaz (2006); 45- Longo et al. (2007); 46- Tomaz (2007); 47- Tomaz et al. (2007); 48- Gregorin et al. (2008); 49- Sodré et al. (2008); 50- Tomaz & Zortéa (2008); 51- Zortéa & Alho (2008); 52- Silva et al. (2009); 53- Tomaz (2009); 54- Pinto et al. (2009); 55- Bezerra & Marinho-Filho (2010); 56- Gomes (2010); 57- Zortéa et al. (2010); 58- Graciolli et al. (2010); 59- Chaves et al. (2012); 60- Pina et al. (2013); 61- Oprea (2013); 62- Teixeira et al. (2015); 63- Moratelli & Dias (2015); 64- Assunção (2016); 65- Arias-Aguilar et al. (2018); 66- Bichuette et al. (2018); 67- Benvindo-Souza et al. (2019); 68- Dias & Oliveira (2020); 69- Hope et al. (2019); 70- Oliveira & Gonçalves (2015); 71- Andrades-Miranda et al. (2014); 72- Tribu (2015); 73- Bezerra et al. (2013); 74- Patton & Emmons (2015); 75- Voss (2015); 76- Bagno et al. (2004); 77- Giazzo et al. (2017); 78- This study; 79- Bonvicino et al. (2002); 80- Carvalho et al. (2002); 81- Costa et al. (2003); 82- Carmignotto et al. (2003); 83- Cáceres et al. (2008); 84- Brandão et al. (2014); 85- Pavan et al. (2014); 86- Voss et al. (2018); 87- Silva et al. (2019); 88- Creighton & Gardner (2008); 89- Patton & Silva (2008); 90- Pine & Handley (2008); 91- Carleton & Musser (2015); 92- Weksler et al. (2017); 93- Salazar-Bravo (2015); 94- Dunnun (2015); 95- Pessóa et al. (2015); 96- Bezerra & Oliveira (2010); 97- Bonvicino et al. (2014); 98- Bonvicino et al. (1996); 99- Bonvicino et al. (2015); 100- Caramaschi et al. (2011); 101- Faria et al. (2013a); 102- Faria et al. (2013b); 103- Fonseca & Astúa (2015); 104- Moreira et al. (2020); 105- Percequillo et al. (2008); 106- Prado & Percequillo (2013); 107- Prado et al. (2021); 108- Weksler et al. (2017); 109- Basile (2003); 110- Bonvicino & Almeida (2000); 111- Oliveira (1998); 112- Percequillo (1998); 113- Suárez-Villota et al. (2018); 114- Nascimento & Feijó (2017); 115- Feijó et al. (2018). [see Supplementary Material S1 for cited references].
is scansorial (Paglia et al. 2012), but both occur in open (open grasslands
M. tridactyla
Concerning locomotor habits, (Rodrigues et al. 2002; Gomes et al. 2015; Cabral et al. 2017; Oliveira et al. 2019).

In general, species of Cingulata listed for the state are common and widely distributed, being found in different types of environments and domains. The nine-banded armadillo (Dasypus novemcinctus) and the yellow armadillo (Euphractus sexcinctus) are the most frequent species (Rodrigues et al. 2002; Bernardo & Melo 2013; Calaça et al. 2018; Feijó et al. 2018), being tolerant to disturbed environments, although they are rare in places where they suffer intense hunting pressure (Cabra et al. 2017). We consider Cabassous squamicaudis as a full species as treated by Feijó & Langguth (2013). This species co-occurs with Cabassous tatuay in Goiás (Rodrigues et al. 2002; Sanderson & Silveira, 2003; Rocha et al. 2019) and, as well as for other species of armadillos, the number of records varied between studies, depending on the type of habitat, and the degree of conservation of surveyed areas. Toxopeus tricinctus and C. tatuay were the rarest species throughout its range in Cerrado, including Goiás (Anacleto et al. 2006; Uhabd et al. 2010).

Studies on armadillos remain incipient in Goiás, but the studies evaluating the ecology of the giant armadillo Priodontes maximus are worth mentioning, developed in the Parque Nacional das Emas (Silveira et al. 2009; Vynte et al. 2009). Considered as the largest and most conspicuous armadillo species, P. maximus generally is more sensitive, being recorded in more preserved environments of the Cerrado (Anacleto & Marinho-Filho 2001; Silveira et al. 2009; Carter et al. 2016; Lemos et al. 2020). According to Anacleto & Marinho-Filho (2001), high densities of the species can be observed in Goiás, but their populations have been drastically reduced, being listed as vulnerable (VU) (ICMBio/MMA 2018; IUCN 2020). Habitat loss, fragmentation, fires and roadkill are the main threats for the species (Silveira et al. 1999; Hannibal et al. 2018; Lemos et al. 2020).

We reinforce the north and northeastern areas of the state as regions of knowledge gaps for Cingulata, mainly the Paraná Valley, as well as the southwestern of Goiás, including the region of Serranópolis and Serra do Caiapó. This latter region was informally mentioned as area of occurrence of T. matacus, but requires further studies to confirm the presence of this species.

3. Pilosa

Only two species of the order Pilosa occur in Goiás state, the giant anteater (Myrmecophaga tridactyla) and the southern tamandua (Tamandua tetradactyla), both representing the family Myrmecophagidae. These species comprised 16.6% of Pilosa members found in Brazil (Quintela et al. 2020). In other Brazilian states, Pilosa richness varied from one (in Santa Catarina – Cherem et al. 2004) to five species (in Amapá – Silva et al. 2013, and Mato Grosso – Brandão et al. 2019).

Giant anteaters are considered common in Goiás state, being a frequently registered species in mammalian studies conducted in the region (Rodrigues et al. 2002; Gomes et al. 2015; Cabral et al. 2017; Oliveira et al. 2019). Concerning locomotor habits, M. tridactyla is terrestrial and T. tetradactyla is scansorial (Paglia et al. 2012), but both occur in open (open grasslands and scrubland) and forested areas (woodland savanna, semideciduous and riparian forests). However, M. tridactyla prefers open formations, while T. tetradactyla selects forested areas (Desbiez & Medri 2010).

The giant anteater is categorized as a vulnerable species (ICMBio/ MMA 2018; IUCN 2020). Human activities such as agriculture, deforestation, hunting, roadkill, and fire are the main threats for population establishment (Miranda et al. 2014a). On the other hand, T. tetradactyla is classified as Least Concern, even though the knowledge on its population density is scant. This species suffers the same threats as those cited for M. tridactyla (Miranda et al. 2014b).

4. Chiroptera

We recorded 90 species of bats including five new records for the Goiás state. Only Thyropteridae, one of the nine families occurring in Brazil, has not yet been registered in the state. Phyllostomidae is the most speciose family (49 spp.), followed by Molossidae (14 spp.), Vespertilionidae (12 spp.), Emballonuridae (8 spp.), Mormoopidae (3 spp.), Noctilionidae (2 spp.), Furipteridae (1 sp.), and Natalidae (1 sp.).

The first bat collected in the region currently corresponding to Goiás state dates back to 1819, by Auguste de St-Hilaire (I. Geoffroy St.-Hilaire 1824). In his study, Isidore St-Hilaire describes the species Vesperitillo hiliarai, later synonymized as Eptesicus brasiliensis (Carter & Dolan 1978; Gardner 2008). Gervais (1855) cited the occurrence of six species for Goiás based on F. Castelnau’s expedition to the ‘Province of Goiás’. One of the species, Vesperitillo chiloensis (= Myotis chiloensis), was not considered here because it must be an incorrect identification, since the species has a distribution restricted to Chile and southwestern Argentina (Gardner 2008). The third record was made in 1823 by Dr. Johann Emanuel Pohl, on an expedition to Goiás (Pelzeln 1883). The only city in Goiás mentioned by Pelzeln is the old state capital, Goiás city. However, the exact locality of the record is imprecise, since the expedition entered the state along the border with Minas Gerais state, along the Rio das Velhas, and proceeded in the direction to the river that, according to this author, is probably the Araguaia River (Pelzeln 1883).

The panorama of the number of bat species registered for Goiás over the years shows four peaks, with the highest increase in 1982, 1998, 2005, and 2017-2020 (Figure 2). The first increment concerns to the study of Coimbra et al. (1982), with the contribution to the zoogeography and ecology of bats in Cerrado regions of central Brazil. In 1998, a single study added 21 new species. It refers to Fernanda Trierveiler’s unpublished master dissertation in the Serra da Mesa hydroelectric reservoir region, in northern Goiás (Trierveiler 1998). Moreover, five articles published in 2005 resulted in the third peak of species addition with 11 new records, 64% of those by Fracasso & Salles (2005). This paper stands out for being the only one based on fossil material and including recent (non-fossil) material deposited in a scientific collection (the Museu Nacional, Universidade Federal do Rio de Janeiro, MN). Bezerra & Marinho-Filho (2010) added five new records (Diphylla ecaudata, Tonatia bidens, Artibeus obscursus, Uroderma magnirostrum and Eptesicus furinalis), based on voucher specimens collected mainly at limestone outcrops of northeastern Goiás. More recently, 18 additional species have been reported (Arias-Agúilar et al. 2018; Hope et al. 2019; Zortea & Darc 2019; Dias & Oliveira 2020; Hintze et al. 2020; present study).

Arias-Agúilar et al. (2018) added eight species, and the new species recorded can be attributed to the sampling methodology used by the
The family Phyllostomidae is the most diverse in Brazil (93 spp.-
Garbino et al. 2020), a pattern reflected in our study. Phyllostomidae
bats are most commonly captured in the understory with mist nets,
the country’s most-used capturing method (Delgado-Jaramillo et al.
2020). Families such as Molossidae and Vespertilionidae are also
diverse, but they demand complementary methods to be registered (e.g.,
bioacoustics inventory), which is still rarely used in Brazil. Other species
not registered in Goiás are likely to occur due to close records in the
state’s frontiers, as the record of Pygoderma bilabiatum in the IBGE’s
Reserve in the city of Brasilia, Federal District (Schneider et al. 2011).

Regarding endemism, three species considered endemic to the dry
diagonal of Brazil [Lonchophylla bokermanni, Lonchophylla dekeyseri
(Cerrado), and Xeronycteris vieirai (Cerrado and Caatinga)] are found
in Goiás (Aguirau et al. 2010; Zortéa et al. 2017; Dias & Oliveirae 2020).
We found registers of seven threatened bat species in Goiás, six of which
are included in the Brazilian red list (ICMBio/MMA 2018): *Furipтерes
horrens* (Vulnerable), *Natalus macrourus* (Vulnerable), *Glyphonycteris
behnii* (Vulnerable), *Lonchophylla dekeyseri* (Endangered), *Lonchorhina
aurita* (Vulnerable), and *Xeronycteris vieirai* (Vulnerable). IUCN lists
Lonchophylla dekeyseri and L. bokermanni as Endangered (Aguirau 2016;
Aguirau & Bernard 2016), but the Brazilian red list does not include L.
bokermanni in any threat category. *Glyphonycteris behnii*, X. vieirai, Eumops
maurus and Vampyressa pusilla are classified as data deficient according
to IUCN red list (IUCN 2020).

Despite the remarkable diversity of bats reported here, Goiás still
stands out as one of the Brazilian states with the lowest bat sampling
locations (Bernard et al. 2011), thus it is indicated by Aguirau et al.
(2020) as a priority area for bat inventories. Bat records are concentrated
mainly in the southern and eastern portions of the state (Mambai region
(Figure 1). The number of species can be higher, if we consider the
lack of bioacoustic studies. For example, in addition to the 20 species
recorded by Arias-Aguilare et al. (2018), several sonotypes were not
identified by them, including complexes from several families.

Many of the Cerrado areas were converted into agriculture,
especially soy monoculture, which reduced this domain to just 20% of
the original area (Strassburge et al. 2017). Goiás is home to a large
portion of the Cerrado domain. Currently, the economy model based
on agriculture affects bat assemblages changing habitat structure and
leading to reduced shelter and food availability, which can potentially
cause local and even permanent extinctions according to a climate
modeling study (Aguirau et al. 2016). In addition, the reduction of habitat
availability imposed by the expansion of agriculture contributes to the
loss of environmental quality. This scenario favors the susceptibility
of contact with pollutants in water resources, in the air, and in ingested
food (Bayat et al. 2014; Souza et al. 2020), which can jeopardize animal
immune responses and increase the chances of contracting diseases,
leading to the decline of bat populations (Naidoo et al. 2016; Miguel
et al. 2019).

There are indications that the southern and southeastern parts of the
Cerrado (including areas in Goiás) are potential regions of high habitat
suitability for many bat species in a dispersion scenario motivated by
climate change (Aguirau et al. 2016). This adds value to the region for
long-term conservation of chiropterans and further emphasizes the need
for inventory efforts and updating species richness and distribution in
the state. These data are essential for elaborating effective landscape
management strategies to guarantee the persistence of suitable habitats

**Figure 2.** Temporal trend in cumulative species richness for Chiroptera in Goiás
state. The 2020 year refers to the present study.
for bat species and their ecosystem services, such as pollination, agricultural pest predation, and seed dispersion.

5. Primates

We recorded four primate species in Goiás state, belonging to three genera and three families, which represents only 2.7% of this group diversity in the country (Jerusalinsky & Melo 2018). In the Brazilian states, richness of primates varied from three (in Santa Cataria – Cherem et al. 2004) to 25 species (Mato Grosso – Brandão et al. 2019). Primate richness in the Cerrado is considered lower (5 spp.) compared to Amazon and Atlantic Forest (Paglia et al. 2012).

The four primate species recorded here are common in its geographical range. *Alouatta caraya*, *Sapajus libidinosus* and *Callithrix penicillata* are abundant in Goiás, and display great environmental plasticity, occurring even in urban fragments (Grande et al. 2020). Black-pencilled marmosets can reach high densities and be more common in degraded areas (Grande et al. 2020), and were not registered in protected areas such as Parque Nacional das Emas (Rodrigues et al. 2002), and Chapada dos Veadeiros (Ferreugetti et al. 2019). The geographical distribution of *Sapajus cay* reaches Goiás state (IUCN 2020), where it was recorded in Atlantic Forest enclaves in the municipalities of Aporé and Itajai, southwestern of the state (Calaça et al. 2018; Gusmão et al. 2018). Habitat loss has been the main threat for capuchin monkeys. In the last 48 years, the populations of *S. cay* declined about 30%, which led the species to be currently categorized as Vulnerable in the Brazilian red list (Rimoli et al. 2018).

6. Carnivora

In Goiás state, richness of Carnivora order was extremely representative, with five families, 15 genera and 19 species. In comparative terms with Brazilian Carnivora richness, these data represent 53% of total species (36 spp., Quintela et al. 2020). When compared to other state lists, Goiás ranges around 90-95% of Carnivora species found in Mato Grosso (21 spp., Brandão et al. 2019) and Mato Grosso do Sul states (20 spp., Tomas et al. 2017). In contrast, Goiás holds two more Carnivora species than São Paulo (17 spp., Vivo et al. 2011), and six more than Amapá state (13 spp., Silva et al. 2013). The species found here correspond to 90% of carnivora mammals recorded for the Cerrado (21 spp., Paglia et al. 2012).

Most carnivores species listed for Goiás present a large geographical distribution in Neotropical region (IUCN 2020). In the Cerrado domain, *Cercocyon thous, Chrysocyon brachyurus, Speothos venaticus, Leopardus pardalis, L. emiliae, L. wiedii*, *Herpailurus yagouaroundi, Puma concolor, Panthera onca, Nasua nasua, Procyon cancrivorus, Galictis cuja* and *Eira barbara* occur in open and forested environments, covering several physiognomies (Juarez & Marinho-Filho 2002; Marinho-Filho et al. 2002; Leuchtenberger et al. 2013; Lima et al. 2014). On the other hand, species such as *Lontra longicaudis* and *Pteronura brasiliensis* inhabit mainly forests (Leuchtenberger et al. 2013), while *Lycalopex vetulus, Leopardus braccatus* and *Conopatus amazonicus* occur almost exclusively in open areas (Juarez & Marinho-Filho 2002; Marinho-Filho et al. 2002; Feijó & Languth 2013; Nascimento et al. 2021). Recently, Miranda et al. (2018) recorded an individual of *Potos flavus* roadkilled over a highway in southwest Goiás, adding a recent record for the state, and corroborating its presence for the Cerrado. The kinkajou occurs exclusively in forested habitats (Marinho-Filho et al. 2002), and this individual was close to a forest, which reinforces the importance of conservation of these physiognomies in the Brazilian savanna (Miranda et al. 2018).

We recorded 47.4% 9 spp.) of carnivora categorized as vulnerable (*C. brachyurus, L. vetulus, S. venaticus, L. braccatus, L. wiedii, P. onca, H. yagouaroundi, P. concolor and P. brasiliensis*) according to the Brazilian Red List (ICMBio/MMA 2018). Carnivora is the most threatened Brazilian mammal group, being habitat destruction the biggest challenge for the conservation of these animals. In the Atlantic Forest, Carnivora species richness is affected by the amount of native vegetation cover (Regolin et al. 2017). In the Cerrado, there is higher occupancy of *C. brachyurus* and *P. concolor* in strictly protected areas (Ferreira et al. 2020). Further, the conflict with humans (i.e., retaliation), roadkills, urbanization, fires and diseases are other concerns about Carnivora conservation (Beisiegel 2017).

7. Perissodactyla

The lowland tapir (*Tayassu terrestris*) represents the unique species of Perissodactyla confirmed for Goiás. The species is widely distributed in Brazil and common in several regions of the state, recorded in open and forested environments, as well as in crop lands (Rodrigues et al. 2002; Cabral et al. 2017; Oliveira et al. 2019). However, in southeastern Goiás, the presence of lowland tapir is rare, occurring only in landscapes with higher native habitat amount (Rocha et al. 2018). Lowland tapir is nationally and globally threatened, categorized as vulnerable (ICMBio/ MMA 2018; IUCN 2020). According to the Brazilian red list (ICMBio/ MMA 2018), *T. terrestris* reaches different threatened categories across the Brazilian domains (e.g., regionally extinct - Caatinga, endangered - Cerrado and Atlantic Forest, near threatened - Pantanal, and least concern - Amazon ) (Medici et al. 2018). In the Brazilian Cerrado, agricultural expansion and consequent low percentage of native remnants are the highest threats to lowland tapir populations (Medici et al. 2012).

8. Cetartiodactyla

We recorded seven species of Cetartiodactyla for Goiás state, representing only 12% of the group species richness cited for Brazil (Quintela et al. 2020). This richness is similar to those registered in other states of the country, with six species in Mato Grosso do Sul (Tomas et al. 2017) and nine species in Mato Grosso (Brandão et al. 2019), but lower than richness found in other states that harbor aquatic mammal species (e.g., São Paulo, with 33 species – Vivo et al. 2011). Collared peccary and White-lipped peccary, species of Tayassuidae, present a wide geographical range in the Brazilian territory (Desbiez et al. 2012; Keuroghlian et al. 2012). *Dicotyles tajacu* is more resistant to environmental degradation, managing to survive even in devastated areas (Sows 1997; Desbiez et al. 2012), while *Tayassu pecari* in Brazil is classified as vulnerable (Keuroghlian et al. 2018). This species is in peril in regions most impacted by human action such as southeastern Goiás, where the most recent records date from approximately ten years ago (Keuroghlian et al. 2012).

*Mazama americana* and *M. gouazoubira* are considered common, occurring in all domains of Brazil, with the red brocket evaluated as data deficient, and the gray deer as least concern in the IUCN Red List (Duarte et al. 2012a; b; Duarte & Vogliotti 2016). *Ozioctenoceras bezoarticus* is classified as vulnerable in Brazil, due to population decline and geographical isolation...
(Gonzalez et al. 2010; Duarte et al. 2012c; Duarte et al. 2018) and as near threatened in the IUCN Red List (González et al. 2016). Despite being very common in some areas in the southwestern region of Goiás (Rodrigues et al. 2002), the subspecies *Ozotoceros bezoarticus bezoarticus* is considered vulnerable due to a 98% decrease in its distribution area, which depends on preserved open vegetation formations in the Cerrado (Weber & González 2003; Duarte & Gonzalez 2010; Duarte et al. 2012c). *Blastroctes dichtomus* is the largest species of deer in Brazil, being classified as vulnerable in national and international red lists (Duarte et al. 2012d, 2016, 2018). It inhabits floodplains of the great rivers and their affluents. The highest concentrations of marsh deer can be observed in the Pantanal and in the region of Ilha do Bananal in the Araguaia River (Tiepolo & Tomas 2009; Duarte et al. 2012d).

*Inia araguaiaensis* was recently described as a distinct species of *Inia*, being restricted to the Araguaia-Tocantsins basin (Hrbeck et al. 2014; Siciliano et al. 2016). Although its status is not yet recognized by the IUCN and Ministério do Meio Ambiente (MMA), Hrbeck et al. (2014) suggest the classification to be considered as vulnerable due to the great threats in its occurrence area, such as agricultural and industrial development, and hydroelectric dams, which contributes to the fragmentation of populations.

9. Lagomorpha

The Lagomorpha order is represented by a single genus in Brazil, *Sylvilagus*, which was treated as monotypic, represented by *S. brasiliensis* with several subspecies until recently. Currently, this complex taxonomic history began to be elucidated based on phylogenetic relationships among South American populations. Ruedas et al. (2017) recognized at least three distinct species for the country: *S. brasiliensis, S. minensis* and *S. aptenodon*, with other taxonomic issues yet to be clarified (Silva et al. 2019b). In Goiás state, only *S. minensis* is expected to occur (Bonvicino et al. 2015; Ruedas et al. 2017). In general, Brazilian cottontail rabbits are considered common, with a widespread distribution and preference for edges of forest habitats, although they are also recorded in open environments, bamboo forests and disturbed areas (Emmons & Feer 1997; Silva Júnior et al. 2005; Borges et al. 2014; Dias et al. 2019). *Sylvilagus minensis* was one of the most common medium-large mammal species recorded in fragmented areas of the southwestern region of the state (Gomes et al. 2015; Rocha et al. 2018), being associated with forest environments (Gomes et al. 2015). However, the species was not recorded in some conservation units, such as the Parque Nacional das Emas (Rodrigues et al. 2002) and the Parque Nacional Chapada dos Veadeiros (Ferreugetti et al. 2019), which present a predominance of shrublands. Due to recent taxonomic rearrangements, *S. minensis* has not yet been evaluated by the IUCN and MMA.

10. Rodentia

A total of 29 genera and 43 species, belonging to six rodent families, occur in Goiás state. These species and families are divided in two infraorders (*sensu* D’Elía et al. 2019), as follows: infraorder Hystricognathi, including the families Caviidae (4 spp.), Cuniculidae 1 sp., Dasyproctidae (2 spp.), Echimyidae (6 spp.), and Erethizontidae (1 sp.); and infraorder Myomorpha, represented only by the family Cricetidae (29 spp.). The total number of species represents ca. 16% of the 258 rodent species of Brazil ( Quintela et al. 2020). This richness is comparable to that found in other Brazilian states (*e.g.*, Rio de Janeiro state - 49 spp.; Rocha et al. 2004), which ranges from 33 species in Mato Grosso do Sul (Tomas et al. 2017) to 67 species in Mato Grosso state (Brandão et al. 2019). Below we describe the rodent richness in both infraorders.

10.1. Hystricognathi

Seven rodent families represent the infraorder Hystricognathi in Brazil, being five of them found in Goiás state. Among these families, we account a total richness of 12 genera and 14 species, distributed as described above. Comparing to other states of central-western Brazil, this richness fits in a range of nine genera and 10 species in Mato Grosso do Sul (Tomas et al. 2017) to 15 genera and 20 species in Mato Grosso state (Brandão et al. 2019).

Concerning the general distribution patterns in Goiás state, 64% (9 spp.) of the Hystricognathi species are forest vegetation inhabitants, with six species widely distributed (*i.e.*, *Cavia aperea, Coendou prehensilis, Cuniculus paca, Dasyprocta azarae, Dasyprocta leporina, and Hydrochoerus hydrochaeris*), occurring on the forested environments of the Cerrado, as well as in other domains of Brazil, especially in the Atlantic Forest (Patton et al. 2015). Two exceptions regarding widely distributional ranges are *Cavia aperea*, which has no records in Amazon (Dunnum 2015), and *Dasyprocta leporina*, with no records in Pantanal and Caatinga (Patton & Emmons 2015). Three species with restricted range distribution in the state also inhabit forested formations, being two species only shared between Cerrado and Amazon (*i.e.*, *Dactylomys dactylinus* – Bezerra et al. 2007, and *Proechimys robusti* – Patton & Leite 2015), and one species shared among Cerrado, Pantanal, and Amazon (*i.e.*, *Prolongica longicaudatus* – Patton & Leite 2015).

Species occurring in open vegetation domains account for 36% of the total (5 spp., *i.e.*, *Galea spixii, Carterodon sulcidentes, Cynomys laticeps, Kerodon acrobata*, and *Thrichomys pachyurus*). In this group, we have the only Hystricognathi species found in Goiás state that are Cerrado endemics (3 spp.): *Carterodon sulcidentes*, distributed in eastern Goiás (Bezerra et al. 2011); *Kerodon acrobata*, restricted to north and northeastern Goiás (Moujen et al. 1997; Bezerra et al. 2010; Zappes et al. 2014); and *Thrichomys pachyurus*, ranging throughout Goiás, except the southern end of the state (Nascimento et al. 2013; Bonvicino et al. 2020 – specimens with 2n =30, FN= 56). In regards to the remaining two species, one is shared between Cerrado and Caatinga (*Galea spixii* – Bezerra 2008), and the other between Cerrado and Pantanal (*Cynomys laticeps* – Bezerra & Oliveira 2010).

Regarding the conservation status, two species are considered under some threaten level. The narrowly distributed species *Kerodon acrobata*, figures as vulnerable at Brazilian red list, and as data deficient in the IUCN, due mainly to habitat loss and illegal hunt, since it is a game species (Bezerra et al. 2010, Roach 2016). The second species, *Dasyprocta azarae*, is classified as data deficient in the IUCN Red List, but faces population decline tendency due to decreasing number of mature individuals, habitat loss and illegal hunt (Catzelfis et al. 2016).

There are some taxa needing taxonomic review. *Galea spixii* have proven to be a species complex, composed of distinct morphological groups, and needs to be studied based on molecular data, including the description and redescription of some taxa (Bezerra 2008; Dunnum 2015); *G. flavidens* (Brandt, 1835) listed for Goiás by Bonvicino et al. (2005), is not considered here since it has no designated holotype, and “Brasil” as type locality (Brandt 1835), and can be considered a synonym of the fossil species *Cavia bilobidens* (Winge, 1888), which is considered related to *G. spixii* (Paula Couto 1950, Bezerra 2008; Proechimys is the most speciose genus of the family Echimyidae and needs revision in both molecular and morphological grounds, including here the represented species groups *P. longicaudatus* and *P. guyannensis*, which includes *P. longicaudatus* and *P. roberti*, respectively (Patton & Leite 2015).
10.2. Myomorphi

The highly diverse infraorder Myomorphi is represented in Brazil by the family Cricetidae, subfamily Sigmodontinae (Paton et al. 2015). We recorded 17 genera and 29 species for Goiás state, belonging to five tribes (sensu Salazar-Bravo et al. 2016): Akodontini (6 spp.), Oryzomyini (18 spp.), Phyllotini (2 spp.), Thomasomomyini (2 spp.), and Wiedomyini 1 sp.). This number of sigmodontine species is similar to the ones found in other Brazilian states, such as Rio de Janeiro, with 32 species (Rocha et al. 2004), and Mato Grosso do Sul, with 22 species (Tomas et al. 2017), but is lower than that found in Mato Grosso state, with 42 species (Brandão et al. 2019).

In relation to general distribution patterns, 10% (3 spp.) of Cricetidae species are widely distributed and are shared between the Cerrado and forested domains such as the Amazon and Atlantic Forests. This is the case of Necromys lasiurus, Necromys ratti, and Pseudoryzomys simplex. Species occurring in Cerrado and Atlantic Forest domains represent 38% (11 spp., Oecomys catherinae, Oligoryzomys mottagrossae, Oligoryzomys rupestris, Oligoryzomys stramineus, Oligoryzomys nigripes, Oxyemycter dusistrchus, Rhipidomys macrurus and Rhipidomys mastacalis), and in Cerrado and Amazon, 14% (4 spp., Cerradomys maracajuensis, Hylaemys megacephalus, Neacomys amoenus and Oecomys roberti). The remaining species, 24% (7 spp.), are Cerrado endemics (Cerradomys marinus, Euryoryzomys lamia, Holochilus sciureus [sensu Prado et al. 2021], Oecomys cleberi, Oligoryzomys moojeni, Thalpomys caderensis and Wiedomys caderensis) or are shared between Cerrado and other open formations, such as Chaco, Pampas or Caatinga, representing 14% (4 spp., Calomys expulsus, Cerradomys scotti, Kunsia tomentosus and Oxyemycter delator).

Some species are known from only one locality in Goiás, as is the case of: Cerradomys maracajuensis, recorded at Serranópolis, southern Goiás; Kunsia tomentosus, recorded only at Parque Nacional das Emas, in southwestern Goiás; Neacomys amoenus, recorded in Baliza, at western Goiás; Oligoryzomys rupestris, a species with a disjunct distributional range, and endemic to highly elevated rupetian grasslands, recorded in Parque Nacional da Chapada dos Veadeiros at northern Goiás; Akodon gr. cursor, Oecomys roberti and Oxyemycter dusistrchus, all recorded only in the region known as ‘Mato Grosso de Goiás’ at the central portion of Goiás state; and Wiedomys caderensis, recorded in São Domingos, eastern Goiás. Other species, typical of forested formations, also have few records in the state, such as Euryoryzomys lamia, restricted to eastern Goiás.

Here we provide the first published records for Akodon gr. cursor and Oecomys roberti based on examined material housed at scientific collections. These records are for Anápolis (Akodon gr. cursor) and Petrolina de Goiás (Oecomys roberti) (see Carmignotto, 2005; Table 1 – present study).

Among the abovementioned species, five are classified under some threaten category, being two of them classified as endangered in the Brazilian red list (Euryoryzomys lamia and Oligoryzomys rupestris) and one as vulnerable (Thalpomys caderensis). The IUCN red list accounts for four species, being three classified as data deficient (Oecomys cleberi, Oligoryzomys moojeni, Oligoryzomys rupestris) and one as vulnerable (Euryoryzomys lamia). Among the cricetid rodents of Goiás state, the later species, Euryoryzomys lamia is included in the more severe threaten categories of both Brazilian and IUCN red lists. This species has occupancy area of less than 2,000 km² and is known from only four locations, two of them are already completely destroyed due to agriculture (Percequillo & Weksler 2018). All threatened and data deficient species have in common the relatively small distribution, habitat loss due to conversion for agribusiness, and a few or no population study (see ICBio/MMA 2018, IUCN 2020).

There are some species needing taxonomic review: Rhipidomys macrurus and Rhipidomys mastacalis have proven to be species complexes, composed of taxa morphologically similar, but distinct at molecular levels (Costa et al. 2011; Lanes 2020), as well as Oecomys catherinae (Suárez-Villota et al. 2018). So, specimens from Goiás cited as Oecomys trinitatis by Carleton and Musser (2015) and as Oecomys rex by Costa (2001), as well as those cited as Oecomys sp.1 (2n = 60), O. trinitatis (2n = 54) and Oecomys gr. catherinae (morphological data) by Carmignotto (2005), refer to O. catherinae species complex of Suárez-Villota et al. (2018), represented by at least two distinct lineages in the state. A specimen (MN 36150 from 55 km N Niquelândia, GO) cited by Andrades-Miranda et al. (2000) with 2n = 60 and FNa = 64, and treated as Hylaemys yunganus (see also Moreira et al. 2020), was not included in the present checklist, since the voucher material was not examined by us nor other authors working with this genus (Prado & Percequillo 2013; Percequillo 2015), being its taxonomic identity waiting to be confirmed.

The rodent fauna of Goiás state is also a composite, characterized by inhabitants of forested and open formations due to the presence of a vegetation mosaic (grasslands, shrublands, and forests) typical of the Cerrado domain (Carmignotto et al. 2012), and also by the presence of Seasonally Dry Tropical Forest remnants that still persist in the state (Ribeiro & Walter 2008; IBGE 2011). The connection between the Atlantic Forest and Amazon through forest formations of the Cerrado is already described (Costa 2003), as well as the mammal fauna shared between Cerrado and Caatinga (Carmignotto et al. 2012). Richest rodent communities were found in conservation units, such as the Parque Nacional das Emas (13 spp., Carmignotto et al. 2014) and the Parque Nacional da Chapada dos Veadeiros (14 spp., Bonvicino et al. 2002, 2005), as well as in regions under hydroelectric dam projects, such as the Serra do Facão dam reservoir (16 spp., Gomes et al. 2015) and the Serra da Mesa dam reservoir (12 spp., Carmignotto 2019), at southeastern and northeastern of Goiás state, respectively. Furthermore, a significant number of species is also found in areas of extensive cattle ranching intermixed with natural landscapes, such as the Cadoz farm (11 spp., Bonvicino et al. 2011) and Vão dos Bois farm (9 spp., Bonvicino et al. 2002), in northeastern Goiás state. Besides the relevant richness present in conservation units, endemic and rare species were also recorded in regions affected by hydroelectric reservoirs, where it was observed a high diversity loss due to landscape flooding (e.g., Carmignotto 2019), highlighting the real need for strategic efforts to conserve rodent communities of Goiás state.

10.3. Potential rodent species in Goiás state

Among potential species which could occur in the state, we speculate that in the central region of Goiás it is possible to find records of Akodon lindberghi, Gyldenstolpia planatensis, Thalpomys lasiotis and Phyllostomus centralis. These species have been recorded in Federal District of Brazil, which is within Goiás state, and neighboring federative unities such as Mato Grosso and Minas Gerais states (Andrade et al. 2004; Ribeiro & Marinho-Filho 2005; Bezerra 2011; Machado et al. 2018).
Conclusions

Goiás state harbors a rich mammalian fauna, especially for bats, rodents, carnivores, and marsupials. Regardless of state geographical size, the number of species listed for Goiás is higher than the listed for other Brazilian states, except for Mato Grosso and São Paulo. The mammalian fauna of Goiás is characterized by inhabitants of open (e.g. Cerrado and Caatinga) and forested environments (e.g., Amazon and Atlantic Forest), due to the presence of a vegetation mosaic in the Cerrado domain. Gallery forests and semideciduous forests contribute to mammal richness in central Brazil, and habitat selectivity seems to be more evident for small mammals. Medium and large-sized mammals tend to be more generalists in terms of habitat and are widely distributed across Goiás state.

Another pattern found here is that the studies reporting largest numbers of mammal species for Goiás state were carried out in conservation units, and some species have been found only inside these protected areas. Thus, we highlight the need to increment the number of conservation units in the state, especially regarding the central and southeastern portion of Goiás, which was once represented by a large area part of Alto Paraná Atlantic Forest ecoregion, but now is represented by few, scattered and small remnants, with no conservation units (Giustina et al. 2018). We also conclude that there are still great portions of the state lacking a proper mammal survey. There is scant and fragmented information about mammals based on specimens housed in scientific collections, especially from the northwestern portion of Goiás. Thus, the increase in the number of inventories in the state, including complementary survey techniques (see Srbek-Araujo & Chiarello 2004; Bovendorp et al. 2017; Arias-Aguilar et al. 2018), and the collection of vouchers and tissue samples to provide correct species delimitation and identification, will allow a better understanding on the biodiversity and conservation of mammals in Goiás state.

Acknowledgments

The curators and curator assistants Robert S. Voss (AMNH), João A. Oliveira and Stella M. Franco (MN/UFURJ), Mario de Vivo and Juliana Guala (MZUSP), Bárbara Costa (UFMG), Pedro Cordeiro-Estrela (UFPB), Jader Marinho-Filho and Pedro de Pedestá (UnB and CMVUNB). MZ, AMC and DAS thanks Conselho Nacional de Desenvolvimento Científico e Tecnológico – CNPq and Fundação de Amparo à Pesquisa do Estado de Goiás - FAPEG within the scope of the Jataí PELD project (Process # 15/2017-1026700329) and to D. Sampaio, for confirming a record. ARB received research fellowships from CNPq [BJT 372459/2013-7, DCR 300461/2016-4, PCI-DA 300670/2019-2]; APC thanks Fundação de Amparo à Pesquisa do Estado de São Paulo - FAPESP (Processes #00/06642-4, #2011/20022-3); CRB granted a project CNPq (BJT 402176/2012-0) and research grants [CNPq 304498/2014 and Fundação de Amparo à Pesquisa do Estado do Rio de Janeiro - FAPERJ E26/2014].

Supplementary Material

The following online material is available for this article:
Table S1. Literature data with records of mammal species for Goiás state, central Brazil.
Figure S1. Visual observation of *Tolypeutes tricinctus* in Mambai, Goiás.

Author Contributions

Wellington Hannibal: Substantial contribution in the concept and design of the study. Contribution to critical revision, adding intellectual content.
Marlon Zortéa: Contribution to data collection and manuscript preparation – Bats; Contribution to critical revision, adding intellectual content.
Analice M. Calaça: Contribution to data collection and manuscript preparation - Medium and large-sized mammals; Contribution to critical revision, adding intellectual content.
Ana Paula Carmignotto: Contribution to data collection and manuscript preparation - Non-volant small mammals, Contribution to critical revision, adding intellectual content.
Alexandra M. R. Bezerra: Contribution to data collection and manuscript preparation - Non-volant small mammals, Contribution to critical revision, adding intellectual content.
Henrique G. Carvalho: Contribution to data collection and manuscript preparation – Bats;
Cibele R. Bonvicino: Contribution to data collection and manuscript preparation - Non-volant small mammals, Contribution to critical revision, adding intellectual content.
Ana C. M. Martins: Contribution to data collection and manuscript preparation – Bats; Contribution to critical revision, adding intellectual content.
Ludmilla M. S. Aguiar: Contribution to data collection and manuscript preparation – Bats:
Marcelino B. de Souza: Contribution to data collection and manuscript preparation – Bats;
Ingrid de Mattos: Contribution to data collection and manuscript preparation – Bats; Contribution to critical revision, adding intellectual content.
Roniel F. Oliveira: Contribution to data collection and manuscript preparation - Medium and large-sized mammals; Contribution to critical revision, adding intellectual content.
Daniel Brito: Contribution to data collection and manuscript preparation – Bats;
Diego A. Silva: Contribution to data collection and manuscript preparation - Medium and large-sized mammals;
Marco A. Guimarinhas: Contribution to data collection and manuscript preparation - Medium and large-sized mammals;
Ewilson M. B. do Carmo: Contribution to data collection and manuscript preparation – Bats;
Jânio C. Moreira: Contribution to data collection and manuscript preparation - Medium and large-sized mammals;
All authors reviewed the manuscript and gave final approval for publication.

Conflicts of Interest

The authors declare that they have no conflict of interest related to the publication of this manuscript.

References

ABREU, E.F., CASALI, D.M., GARBINO, G.S.T., LORETTO, D., LOSS, A.C., MARMONTEL, M., NASCIMENTO, M.C., OLIVEIRA, M.L., PAVAN, S.E. & TIRELLI, F.P. 2020. Lista de Mamíferos do Brasil. Comité de Taxonomia da Sociedade Brasileira de Mastozoologia (CT-SBMz). <https://www.sbmz.org/mamiferos-do-brasil> (28 August 2020).
Mammals of Goiás, Brazil

ACOSTA, L.E., GARBINO, G.S.T., GASPARINI, G.M. & DUTRA, R.P. 2020. Unraveling the nomenclatural puzzle of the collared and white-tipped peccaries (Mammalia, Cetartiodactyla, Tayassuidae). Zootaxa 4851(1):60-80. https://doi.org/10.1164/zootaxa.4851.1.2

AGUIAR, L.M.S. & MACHADO, R. B. 2010. Do current vampire bat (Desmodus rotundus) population control practices pose a threat to Dekeyser’s Nectar Bat’s (Lonchophylla dekeyseri) long-term persistence in the Cerrado? Acta Chiropterologica 12(2): 275-282.

AGUIAR, L. 2016. Lonchophylla bockermanni. The IUCN Red List of Threatened Species 2016. <https://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T12263A20308287.en> (1 July 2020).

AGUIAR, L. & BERNARD, E. 2016. Lonchophylla dekeyseri. The IUCN Red List of Threatened Species 2016. <https://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T12263A22030827.en> (1 July 2020).

AGUIAR, L.M.S., BERNARD, E., RIBEIRO, V., MACHADO, R.B. & JONES, G. 2016. Should I stay or should I go? Climate change effects on the future of Neotropical savannah bats. Global Ecol. Conserv. 5:22-33.

AGUIAR, L.M.S., BERNARD, M.J.R., MENEZES, A.N., SANTOS, R. & PEREIRA, M.J.R. 2010. Taxonomic implications of cranial variation in the genus Clyomys Linnaeus 1758 (Rodentia: Echimyidae) from the Cerrado of Brazil. Zootaxa 2301: 39-50.

ANDRADE, A.F.B., BONVICINO, C.R., BRIANI, D.C. & KASAHARA, S. 2008. Chromosomes and phylogeography of Sylvilagus (Mammalia: Rodentia: Cricetidae) from Central Brazil, with remarks on the taxonomy of the genus. Zoologia 31:525-540.

ANACELETO, T.C.S. & MARINHO-FILHO, J. 2001. Hábito alimentar do tatu-canastra (Xenarthra, Dasyopodidae) em uma área de cerrado do Cerrado Central. Rev. Bras. Zool. 18:681–688.

ANDRADE, A.F.B., BONVICINO, C.R., BRIANI, D.C. & KASAHARA, S. 2004. Karyologic diversification and phylogenetics relationships of the genus Thalpomys (Rodentia, Sigmodontinae). Acta Theriol. 49(2):181-190.

ANDRADES-MIRANDA, J., ZACHIN, N.I.T., OLIVEIRA, L.F.B., LANGGUTH, A.R. & MATTEVI, M.S. 2000. Cytogenetic studies in nine taxa of the genus Orzyomys (Rodentia, Sigmodontinae) from Brazil. Mammalia 65(4): 461-472.

ARIAS-AGUILAR, A., HINTZE, F., AGUIAR, L.M.S., RUFRAY, V., BERNARD, E. & PEREIRA, M.J.R. 2018. Who’s calling? Acoustic identification of Brazilian bats. Mammal Res. 65:231-253.

BAYAT, S., GEISER, F., KRISTIANSEN, P. & WILSON, S.C. 2014. Organic contaminants in bats: trends and new issues. Environ. Int. 63:40–52.

BEZERRA, A.M.R. 2016. Revision of the distribution, morphology, and habit of the Owl’s Spiny Rat Carterodon sulcidens (Lund, 1841) (Rodentia: Echimyidae). Zool. Stud. 50:566–576.

BEZERRA, A.M.R. & OLIVEIRA, J.A. 2010. Taxonomic implications of cranial morphometric variation in the genus Clyomys Thomas 1916 (Rodentia: Echimyidae). J. Mammal. 91:260–272.

BEZERRA, A.M.R., DA SILVA JR, N.J. & MARINHO-FILHO, J. 2007. Dactylomys dactylinus (Rodentia: Echimyidae) in Cerrado of Central Brazil and the role of gallery forests in its distribution. Biota Neotrop. 7:235–237. http://www.biotaneotropica.org.br/v7n1/pt/abstract?short-communication+bn03507012007

BEZERRA, A.M.R., BONVICINO, C.R. & MARINHO-FILHO, J.S. 2007. Bats of the Paranã River Valley, Tocantins and Goiás states, Central Brazil. Zootaxa 2725: 41-56.
CÁCERES, N.C., CARMIGNOTTO, A.P. FISCHER, E. & SANTOS, C.F. 2008. Mammals from Mato Grosso do Sul, Brazil. Check List 4:321.

CÁCERES, N.C., CASELLA, J., VARGAS, C.F., PRATES, I.L., TOMBINI, A.A.M., GOULART, C.S. & LOPES, W.H. 2008. Distribuição geográfica de pequenos mamíferos não voadores nas bacias dos rios Araguaia e Paranã, região centro-sul do Brasil. Iheringia, Sér. Zool., 99 (2): 173-180.

CALAÇA, A., FACHI, M. SILVA, D.A. OLIVEIRA, S.R. & MELO, F.R. 2018. Mammals recorded in isolated remnants of Atlantic Forest in southern Goiás, Brazil. Biota Neotrop. 19:e20180575. http://dx.doi.org/10.1590/1676-0611-BN-2018-0575

CARDOSO, M.R.D., & MARCUZZO, F.F.N. 2014. Classificação climática de Köppen-Geiger para o estado de Goiás e o Distrito Federal. ACTA Geográfica 8 (16): 40-55.

CARLETON, M.D. & MUSSER, G.G. 2015. Genus Ocomys Thomas, 1906. In Mammals of South America, Vol 2, Rodents (J.L. Patton, U.F.J. Pardiñas & G. D’Elia, eds.). The University of Chicago Press, Chicago and London, p.393-416.

CARMIGNOTTO, A.P. 2005. Pequenos mamíferos terrestres do bioma Cerrado: padrões faunísticos locais e regionais. Tese de Doutorado, Universidade de São Paulo, São Paulo.

CARMIGNOTTO, A.P. 2019. Effects of damming on a small mammal assemblage in Central Brazil Cerrado. Bol. Soc. Bras. Mastozool. 11:5-73.

CARMIGNOTTO, A.P. & ASTUA DE MORAES, D. 2016. Phylogeny of Rhipidomys (Rodentia: Cricetidae: Sigmodontinae) and description of two new species from southeastern Brazil. J. Mammal. 87:58-70.

CARMIGNOTTO, A.P., BEZERRA, A.M.R. & RODRIGUES, F.H.G. 2014. Nonvolant small mammals from a southwestern area of Brazilian Cerrado: diversity, habitat use, seasonality, and biogeography. Therya 5:535–558.

CARMIGNOTTO, A.P., VIVO, M. & LANGGUTH, A. 2012. Mammals of the Cerrado and Caatinga: distribution patterns of the tropical open biomes of Central South America. In Bones, Clones, and Biomes: The History and Geography of Recent Neotropical Mammals (B.D. Patterson & L.P. Costa, eds.). University of Chicago, Chicago, p.307–350.

CARTER, D.C. & DOLAN, P.G. 1978. Catalogue of type specimens of Neotropical bats in selected European museums. Special publications. Texas Tech University Press. 136 p.

CARTER, T.S., SUPERINA, M. & LESLIE, D.M. 2016. Priodontes maximus (Didelphidae: Thylamyini): evidence for a recent and complex diversification in South American open biomes. Mol. Phylogenet. Evol. YMPEV 107213.

CARVALHO, A.T., OLIVEIRA, M.B. 2020. First record of Xeronycteris vieirai Gregorin & Ditchfield, 2005 (Chiroptera, Phyllostomidae) for the Cerrado biome. Oecol. Aust. 24:696–703.

DINERSTEIN, E. ET AL. 2017. An Ecoregion-Based Approach to Protecting Half the Terrestrial Realm. BioScience 67:534–545.

DUARTE, J.M.B. ET AL. 2016a. Avaliação do Risco de Extinção do Veado-mateiro Mazama americana Erxleben, 1777, no Brasil. Biodivers. Bras. 33:41-42.

DUARTE, J.M.B. ET AL. 2016b. Avaliação do Risco de Extinção do Veado-catingueiro Mazama gouazoubira G. Fischer, 1814, no Brasil. Biodivers. Bras. 30–58.

DUARTE, J.M.B. ET AL. 2012a. Avaliação do Risco de Extinção do Veado-campeiro Otozobero bezoarticus Linnaeus, 1758, no Brasil. Biodivers. Bras. 20–32.

DUARTE, J.M.B. ET AL. 2012b. Avaliação do Risco de Extinção do Cervo-do-pantanal, Blastocerus dichotomus Illiger, 1815, no Brasil. Biodivers. Bras. 3–11.

DUARTE, J.M.B. ET AL. 2018. Blastocerus dichotomus Illiger, 1815. Livro Vermelho da fauna brasileira ameaçada de extinção (ICMBio/MMA, ed.). Instituto Chico Mendes de Conservação da Biodiversidade, Brasília.

DUARTE, J.M.B. & GONZALEZ, S. 2010. Neotropical Cervidiology, Biology and Medicine of Latin American Deer. Funep/IUCN.

DUARTE, J.M.B. & VOGLIOTTI, A. 2016. Mazama americana. The IUCN Red List of Threatened Species 2016: e.T29619A22158427. https://dx.doi.org/10.2305/IUCN.UK.2016-1. RLTS.T29619A22158427.en. Downloaded on 07 March 2021.

DUNNUM, J.L. 2015. Family Caviidae. In Mammals of South America, Vol 2, Rodents (J.L. Patton, U.F.J. Pardiñas & G. D’Elia, eds.). The University of Chicago Press, Chicago and London, p.690-725.

EGER, J.L. 1977. Systematics of the Genus Eumops (Chiroptera: Molossidae). Life Sci. Contribution 110:1–69.

EITEN, G. 1972. The cerrado vegetation of Brazil. Bot. Rev. 38:201–341.

EMMONS, L. & FEER, F. 1997. Neotropical Rainforest Mammals: A Field Guide. 2nd edition. The University of Chicago Press, Chicago.

FEGIES, A.C., CARMIGNOTTO, A.P., PEREZ, M.F., GUILARDI, M.D. & LESSINGER, A.C. In press. Molecular Phylogeny of Cryptonanus (Didelphidae) with comments on the alpha taxonomy of Cryptonanus and Philander. Mammalia 79(3):343-356.

FELIZANGRO, A.C., LESSA, I.C.M., VIEIRA, E.M., CUNHA, A.A. & BERGALLO, H.G. 2019. Medium- and large-sized mammal composition in the Chapada dos Veadeiros National Park and adjacent areas, state of Goiás, Brazil. Pap. Avulsos Zool. 59:e20195942.
MIRANDA, F., BERTASSONI, A. & ABBA, A.M. 2014a. Myrmecophaga tridactyla. The IUCN Red List of Threatened Species. The IUCN Red List of Threatened Species. https://dx.doi.org/10.2305/IUCN.UK.2014-1.RLTS.T142244474161.en (7 June 2020).

MIRANDA, F., FALLABRINO, A., ARTEAGA, M., TIRIRA, D.G., MERITT, D.A. & SUPERINA, M. 2014b. Tamandua tetradactyla. The IUCN Red List of Threatened Species. The IUCN Red List of Threatened Species. https://dx.doi.org/10.2305/IUCN.UK.2014-1.RLTS.T2135004742916.en (7 June 2020).

MIRANDA, J.E.S., MELO, F.R., FACHI, M.B., OLIVEIRA, S.R. & UMETSU, R.K. 2018. New records of the Kinkajou, Potos flavus (Schreber, 1774) (Mammalia, Potosidae) in the cerrado. Check List 14:357–361.

MITTERMEIER, R.A., GIL, P.R., HOFFMANN, M., PILGRIM, J., BROOKS, T., MITTERMEIER, C.G., LAMOREUX, J. & FONSECA, G.A.B. 2004. Hotspots revisited. CEMEX.

MOJOEN, J., LOCK, M. & LANGGUTH, A. 1997. A new species of Kerodon from Costa Rica, with the description of new karyotypes. Zootaxa 4876 (1): 001–111.

MOREIRA, D.D.O., COUTINHO, B.R. & MENDES, S.L. 2008. Current state and future perspectives for the Alpine Leea specimen of the prehistoric waterfowl. Nature 453:70–73.

NASA (National Aeronautics and Space Administration). Estados Unidos, 2002. Disponível em: http://www.asterweb.jpl.nasa.gov. Acesso em: 4 de julho de 2010.

OLIVEIRA, R.F., DE MORAIS, A.R. & TERRIBILE, L.C. 2019. Medium- and large-sized mammals in forest remnants of the southern Cerrado: Diversity and ecology. Neotropical Biol. Conserv. 14:29–42.

OLIVEIRA, H.F.M., DE CAMARGO, N.F., GAGER, Y. & AGUIAR, L.M.S. 2007. The response of bats (Mammalia: Chiroptera) to habitat modification in a Neotropical Savannah. Trop. Conser. Sci. 10:1-14.

OLIVEIRA, M.E.C., FERREIRA, M. & PERCEQUILLO, A.R. 2014. Molecular phylogeny of short-tailed opossums (Didelphidae: Monodelphius): Taxonomic implications and tests of evolutionary hypotheses. Mol. Phylogenet. Evol. 79(1):199-214.

PERCEQUILLO, A.R. 2015. Genus Hylaemys Wessels, Percequillo, and Voss, 2006 In Mammals of South America, Vol 2, Rodents (J.L. Patton, U.F.J. Pardiñas & G. D’Elia, eds.). The University of Chicago Press, Chicago and London, p.733-761.

PERCEQUILLO, A.R. & WEKSLER, M. 2018. Euryoryzomys lamia. The IUCN Red List of Threatened Species 2018: e.T15602A739675.en. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T15602A739675.en. Downloaded on 08 March 2021.

PELZELN, A. V. 1883. Brasiliische säugegittere: resultate von Johann Natterer’s Reisen in den Jahren 1817 bis 1835. Verh. der Kaiserlich-Königlichen Zool. Bot. Ges. Wien 33:1–140.

PRADO, L.A., MIZIARA, F. & FERREIRA, M.E. 2012. Expansão da fronteira agrícola e mudanças no uso do solo na região sul de Goiás: ação antrópica e características naturais do espaço. Bol. Goiá. Geogr. 32(1):151-162. https://doi.org/10.5216/bgg.v32i1.18962.

PRADO, J.R. & PERCEQUILLO, A.R. 2013. Geographic distribution of the genera of the Tribe Oryzomyini (Rodentia: Cricetidae: Sigmodontinae) in South America: patterns of distribution and diversity. Anq. Zool. 44 (1): 1-120.

PRADO, J.R., KNOWLES, L.L. & PERCEQUILLO, A.R. 2021. New species boundaries and the diversification history of marsh rat taxa clarify historical connections among ecologically and geographically distinct wetlands of South America. Mol. Phylogenet. Evol. 155 (2021) 106992.

QUINTELA, F.M., DA ROSA, C.A. & FEIJÓ, A. 2020. Updated and annotated checklist of recent mammals from Brazil. An Acad. Bras. Cienc. 92 (1). 58.

RADAMBRAIL. 1982. Projeto RadamBrasil – levantamento de recursos naturais. Vol. 29. Folha SD. 23 Brasilia. Ministério das Minas e Energia, DNPM. Rio de Janeiro.

REGOLIN, A.L. ET AL. 2017. Forest cover influences occurrence of mammalian carnivores within Brazilian Atlantic Forest. J. Mammal. 98:1721–1731.

REIS, M.L., ET AL. 2018. Tolypeutes trinicutus (Linnaeus, 1758). In Livro Vermelho da Fauna Brasileira Ameaçada de Extinção, Volume II - Mamíferos (ICMBio/MMA). Brasilia. p.53-58.

RIESE, J.R., IFELT AND WALTER, B.M.T. 2008. As principais fitofisionomias do bioma Cerrado. In Cerrado: ecologia e flora (S.M. Sano, ed). Embrapa-CPAC, Planaltina, p.151–212.

RIESE, J.F., WALTER, B.M.T., SANO, S.M. & ALMEIDA, S.D. 1998. Fitofisionomias do Cerrado. In Cerrado: Ambiente e flora (S.M. Sano ed). Embrapa-CPAC, Planaltina, p.89-166.

RIESE, M.C., METZGER, J.P., MARTENSEN, A.C., PONZONI, F.J. & HIROTA, M.M. 2009. The Brazilian Atlantic Forest: How much is left, and how is the remaining forest distributed? Implications for conservation. Biol. Conserv. 142:1141–1153.

RIEBO, R. & MARINHO-ILHO, J. 2005. Estrutura da comunidade de pequenos mamíferos (Mammalia, Rodentia) da Estação Ecológica de Águas Emedadas, Planaltina, Distrito Federal, Brasil. Rev. Bras. Zool. 22:898-907.

RÍMOLI, J., MELO, F.R., DOS SANTOS, M.C. & LUDWIG, G. 2018. Sapajus cay (Illiger, 1815). In Livro vermelho da fauna brasileira ameaçada de extinção (ICMBio/MMA, ed.). Instituto Chico Mendes de Conservação da Biodiversidade, Brasília, p.261–267.

ROACH, N. 2016. Kerodon acrobata. The IUCN Red List of Threatened Species 2016: e.T136222A22190183. https://dx.doi.org/10.2305/IUCN.UK.2016-2.RLTS.T136222A22190183.en. Downloaded on 08 March 2021.

ROCHA, E.C. ET AL. 2004. Fauna de anfíbios, répteis e mamíferos do Estado do Rio de Janeiro, sudeste do Brasil. Publ. Avulsas Mus. Nac. Rio de Janeiro 104:3-23.

ROCHA, E.C., BRITO, D., SILVA, P.M., SILVA, J., BERNARDO, P.V.S. & JUEN, L. 2018. Effects of habitat fragmentation on the persistence of medium and large mammal species in the Brazilian Savanna of Goiás State. Biota Neotrop. 18(3):e20170483. http://dx.doi.org/10.1590/1676-0611-BN-2017-0483.
