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ATTACK OF A WIDE-RANGING NEOTROPICAL OWL (*Glaucidium brasilianum*) ON AN ABUNDANT SPECIES OF FRUIT BAT (*Carollia perspicillata*) IN THE BRAZILIAN CERRADO

Sérgio Gomes da Silva[1,2], Francimeire Fernandes Ferreira[3], Frederico Augusto Guimarães Guilherme[3,4] & Gustavo Rodrigues Canale[5]*

[1] Instituto Federal de Educação, Ciência e Tecnologia de Mato Grosso, campus Pontes e Lacerda, Grupo de pesquisa EcoBats, Rodovia MT-473, s/nº, CEP 78250-000, Pontes e Lacerda, MT, Brasil.

[2] Universidade do Estado de Mato Grosso, Centro de Pesquisa de Limnologia, Biodiversidade, Etnobiologia do Pantanal, Programa de Pós-Graduação em Ciências Ambientais, Av. Santos Dumont, s/n, Cidade Universitária (Bloco II), CEP 78200-000, Cáceres, Mato Grosso, Brasil.

[3] Universidade do Estado de Mato Grosso, campus Nova Xavantina, Progama de Pós-Graduação em Ecologia e Conservação, Grupo de pesquisa EcoBats, Rua Prof. Dr. Renato Figueiredo Varella, s/nº, CEP 78690-000, Nova Xavantina, MT, Brasil.

[4] Universidade Federal de Jataí, campus Jatobá, Unidade Acadêmica de Ciências Biológicas, BR 364, km 195, nº 3800, CEP 75801-615, Jataí, GO, Brasil.

[5] Universidade Federal de Mato Grosso, campus Sinop, ICNHS/NEBAM/Grupo de Ecologia aplicada de Sinop (GECAS) e Instituto Ecótono, Av. Alexandre Ferronato, 1200, Residencial Cidade Jardim, CEP 78550-728, Sinop, MT, Brasil.

E-mails: sergiogomesbats@gmail.com (*corresponding author), ferreira.francimeire2@gmail.com, fredericoagg@ufj.edu.br, grcanale@gmail.com

Abstract: The southern Neotropics harbour one of the largest diversity of bats and raptors in the world, however, few records on the predation of bats, especially by owls, are reported in the literature. Here we have expanded our knowledge on the feeding habits of the ferruginous pygmy owl (*Glaucidium brasilianum*) by describing its attack on a Seba's short-tailed fruit bat (*Carollia perspicillata*). Also, we compiled a list of 10 vertebrate species, including now three bat species, which are predated by this wide-ranging Neotropical owl. Thus, we recommend special attention to the monitoring of abundant bat populations and their predators, as much as their role in the ecosystem services, such as seed dispersal.

Keywords: interspecific interaction; Neotropical bats; predation; Phyllostomidae; Strigidae.

Neotropical bats are a highly-diverse group of flying mammals with morphological adaptations resulting in a taxonomic group with a wide range of feeding habits (López-Baucells *et al.* 2016), and capable of occupying several ecological roles in the ecosystems where they occur (Kunz *et al.* 2011). One of the most species-rich guild of bats are the frugivores, which are key dispersers of seeds from several tropical plants (Carvalho-Ricardo *et al.* 2014). Among the 181 bat species occurring in Brazil (Garbino *et al.* 2021), *Carollia perspicillata* (Chiroptera, Phyllostomidae) is one of the most abundant (Brändel *et al.* 2020). They occur in all the Brazilian biomes and are well-adapted to foraging

and roosting, both in forests and urban zones (Reis *et al.* 2007, Silva & Anacleto 2011).

Besides providing several ecosystem services, bats also support a large biomass of predators, including reptiles (Carvalho *et al.* 2019), birds (Camargo & Laps 2016), and other mammals, including carnivorous bats (Castro *et al.* 2011). Among flying raptors, owls are one of the most important bat predators, including the mottled owl (*Strix virgata,* Strigiformes, Strigidae), barn owls (*Tyto alba,* Strigiformes, Tytonidae), and the tawny-bellied screech-owl (*Megascops watsonii,* Strigiformes, Strigidae) (Motta-Júnior & Taddei 1992, Vargas *et al.* 2002, Rocha & López-Baucells 2014, Serra-Gonçalves *et al.* 2017). Several events of bat predation by Stringidae owls were reported so far, including one predation of a *Nycticeius humeralis* (Chiroptera, Vespertilionidae) by a ferruginous pygmy owl (*Glaucidium brasilianum*, Strigiformes, Strigidae) in Mexico (Proudfoot & Beasom 1997). This small owl has a wide extent of occurrence, from the southern United States of America to southern Brazil and Argentina (König & Weick 2008). In spite of its wide distribution range in the southern Neotropics, this is the first record of a predation attempt of a Neotropical bat, namely the Seba's short-tailed fruit bat (*C. perspicillata*), by a ferruginous pygmy owl (*G. brasilianum*).

The predation attempt was recorded in the Brazilian Cerrado in Mato Grosso State, in the municipality of Poconé in a forest fragment (15° 56' 10,84" S, 56° 59' 47,6" W, datum SAD69) of 22.45 ha, predominantly formed by *Cerrado sensu stricto* vegetation, with the tallest trees reaching 9 m height. We sampled this forest fragment for two nights on the 7th and 8th of April 2020 using 10 mist nets (10 m × 3 m) from dusk (18 h) to midnight (0 h), in flight corridors in the understorey. This was part of a large research project sampling the ecotone between the Amazon and the Cerrado in the States of Mato Grosso and Rondônia (under the license SISBIO nº 65436 and the permission of Research Animal and Ethics Committee – authorisation number 013/2018). Bats were captured, sexed, and measured following a biometric protocol (Diaz *et al.* 2021) using scales (Pesola 100 g) and a calliper (resolution 0.01 mm). The species were identified using the available literature (Diaz *et al.* 2021). For specific identification of the *C. perspicillata*, we analysed the skull (Figure 1) and took specific measurements of the forearm and the skull (following some characteristics of Ruelas 2017, Lemos *et al.* 2020). The specimens were deposited in the didactic collection of the Instituto Federal de Mato Grosso, Pontes e Lacerda campus, which is in the process of assembling a scientific collection of Chiroptera. Also, we compiled the peer-reviewed publications reporting the predation of vertebrates by the ferruginous pygmy owl using the search tools: Google Scholar and ScieLO Brazil. For the search we used the keywords "pygmy owl", "*Glaucidium brasilianum*", "bat predation" and "*Carollia perspicillata*". These searches were made in November 2021.

Figure 1. View of skull and mandible of *Carollia perspicillata* extracted (scale 10 mm). Morphometric characteristics (forearm: 40.9 mm; tibia: 16.8 mm; skull size: 23.3 mm; skull shape: little globular; rostrum: slightly flared and robust; sagittal crest: pronounced; maxillary dental row: wide and little divergent; upper molars: slightly stout.

We found 786 results for our search and, after selecting scientific papers reporting predation events by ferruginous pygmy owls, we came to nine scientific papers (Table 1). In spite of its small body

Table 1. Records of vertebrates in the diet of the ferruginous pygmy owl (*G. brasilianum*)

Class	Prey species	Source
Reptilia	*Ameivula ocellifera*	Vieira *et al.* 2018
	Iguana iguana	Contreras-Lozano & Ballesteros-Medrano 2018
Mammalia	*Calomys expulsus*	Hannibal *et al.* 2016
	Necromys urichi	Quiroga-Carmona & Isasi-Catalá 2013, Carrera *et al.* 2008
	Molossus molossus	Proudfoot & Beasom 1997
	Nycticeius humeralis	
Bird	*Tyrannus savanna*	Motta-Junior 2007
	Polytmus guainumbi	Sazima 2015
	Hylocharis chrysara	
	Turdus grayi	Soto & Jiménez 2016

mass (61.4 – 75.1 g; Earhart & Johnson 1970), we found 10 vertebrate species in the diet records of the ferruginous pygmy owl, namely reptiles (2 spp), mammals (4 spp), and birds (4 spp), including two bat species (Table 1). For the first time, we report the predation attempt of a southern Neotropical bat (*C. perspicillata*) by a ferruginous pygmy owl (Table 1), based on the injuries and the death of the bat trapped in the mist net, close to a ferruginous pygmy owl, which was also trapped.

At 19:24 h, we found, in the middle pocket of the mist net, a dead adult female of *C. perspicillata* (Figure 2). It had blood over its body and perforations at its *left/right* wing, ventral, and dorsal region, moreover, it had lost its nasal leaf, and the wounds were still bleeding. In another pocket, about 30 cm below, there was a ferruginous pygmy owl caught in the lowest pocket. Another adult female *C. perspicillata* was about a meter from the owl, in the same pocket.

Based on a previous report of the predation of the ferruginous pygmy owl on a fast-flying bird, the fork-tailed flycatcher (*Tyrannus savanna*, Passariformes, Tyrannidae) (Motta-Junior 2007), we hypothesised that the bat was caught in flight and brought to the ground by the raptor, similar to the predation of the fork-tailed flycatcher (Motta-Junior 2007). On the ground, the bat must have been killed and had its nasal leaf torn off by the pygmy owl. Afterward, the pygmy owl was caught in the mist net, while flying to a feeding roost, and dropped the bat. Both, bat and owl, were caught in the net. Alternatively, the pygmy owl could have attacked the short-tailed fruit bat opportunistically, while the latter was already netted, as observed by Rocha & López-Baucells (2014) who reported two predation attempts of Seba's short-tailed fruit bat by the crested owl (*Lophostrix cristata,* Strigiformes, Strigidae). However, it seems unlikely that the pygmy owl could grasp the bat firmly enough to kill it and to tear its nasal leaf off while hanging on the middle pocket, and, eventually, to get caught in the lowest pocket of the mist net, leaving the dead bat trapped above its head.

Previous reports on the predation of bats by ferruginous pygmy owls include only two species: *M. molossus* in the Argentinean Chaco (Carrera *et al.* 2008), and *N. humeralis* in Mexico (Proudfoot & Beasom 1997) (Table 1). It was suggested, however, that Seba's short-tailed fruit bat is preyed on by several other owl species, namely Barn (*T. alba*), Mottled (*S. virgata*), and Spectacled (*Pulsatrix perspicillata,* Strigiformes, Strigidae) owls (Cloutier & Thomas 1992, Motta- Jr. & Taddei 1992, Vargas *et al.* 2002).

Here, we present for the first time a predation attempts on one of the most abundant and wide-ranging Neotropical bats by a ferruginous pygmy owl. Both species have largely-overlapping distribution ranges and are able to occupy a wide array of habitat types, from pristine and degraded forests to urban zones (Pine 1972, Proudfoot &

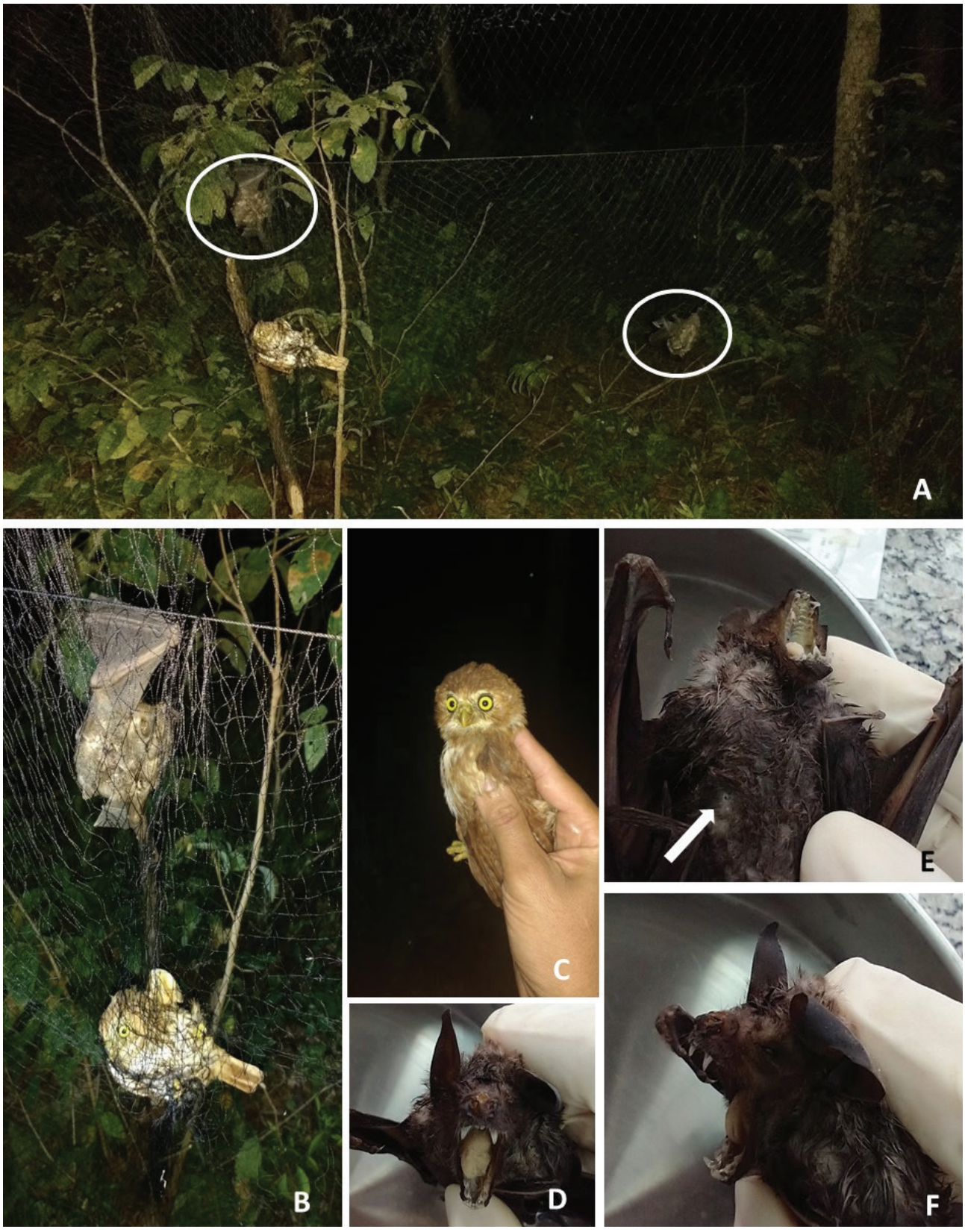

Figure 1. (A) Mist net with two *C. perspicillata* and one *G. brasilianum*. (B) Detail of the raptor and its bat prey, (C) A ferruginous pygmy owl (*G. brasilianum*), (D) Frontal facial view of the Seba's short-tailed fruit bat (*C. perspicillata*), (E) Ventral wounds inflicted by the tallons of the raptor, (F) Detail of the fruit bat's nasal leaf torn off.

Johnson 2000, König & Weick 2008, Silva & Anacleto 2011). Considering the reduction of forest cover and the importance of Cerrado for food production in Brazil (Zaiatz *et al.* 2018), the species *C. perspicillata* has a highly-relevant role in seed dispersal (Salazar *et al.* 2013) and pest control (Russo *et al.* 2018), further studies on the trophic relations involving owls and bats are fundamental to the conservation strategies involving these animal populations and their environment.

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