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SHORT-COMMUNICATION

# Collared Forest-Falcon (*Micrastur semitorquatus*) preying on a squirrel in a fragment of Atlantic Forest with a revision of the predation events for the species

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**ABSTRACT:** We recorded predation on the squirrel *Guerlinguetus ingrami* by a Collared Forest-Falcon (*Micrastur semitorquatus*) through camera trapping in a forest fragment of Atlantic Forest in the interior of São Paulo state, Brazil. The squirrel was captured while it moved across the forest floor. A compilation from bibliographic and other sources resulted in 68 vertebrate and 03 invertebrate species as prey of the Collared Forest-Falcon, with birds more commonly reported in the diet of the species. The majority of prey (66% of species) did not exceed 300 g, but some prey species (12%) such as guans (*Penelope* spp.) were heavier than the falcon. The Collared Forest-Falcon could affect the population dynamics of smaller vertebrates in forest fragments of Atlantic Forest due to its flexibility in diet and habitat use, an aspect that deserve a more thorough investigation.

**KEY-WORDS:** bird-mammal, hawk diet, interaction, predator-prey, Seasonal Semideciduous Forest.

The Collared Forest-Falcon (*Micrastur semitorquatus*) is the largest member of the genus composed of seven species of forest falcons, with a total size varying from 46 to 58 cm with average body mass of 563 g for males and 800 g for females (Thorstrom 2000, Ferguson-Lees & Christie 2001, Menq 2016).

The species is found from southern Mexico to central Argentina, including Brazil (Ferguson-Lees & Christie 2001, Thorstrom 2007, Sigrist 2014). Its known habitat includes primary forest, forest edge and secondary forest with dense undergrowth (del Hoyo *et al*. 1993). Individuals nest in cavities of trees and rocks; though there are also records of nests in human buildings (Carrara *et al*. 2007, Vallejos *et al*. 2008, Viana *et al*. 2012). In Guatemala, the home range of Collared Forest-Falcon varied from 996 ha during the reproductive season to 555 ha during the non-reproductive season (Thorstrom 2007).

The Collared Forest-Falcon is a predator that captures its prey on the ground and in vegetation, through ambushes from hidden perches (Sigrist 2014, Menq 2016). It also follows army ant columns, where it captures insectivorous birds (Ferguson-Lees & Christie 2001, Antas 2005). Here we report the predation of the squirrel *Guerlinguetus ingrami*, a predominantly arboreal rodent some 19.6 cm in length and 242 g in body mass (Bonvicino *et al*. 2008), which also forages on the ground, by *M. semitorquatus* (Collared Forest-Falcon), and include a summary of the predation events known for this falcon.

Our study area was a forest fragment of 79 ha in the Abraão de Moraes Astronomical Observatory, with a predominance of Atlantic Forest Biome, Semideciduous Seasonal Forest phytophysiognomy, in Valinhos city, São Paulo state, southeastern Brazil. This is one of the few forest remnants remaining in the region.

The predation event was recorded through a camera trap (MiniTrapa model - with infrared sensor) installed 30 cm from the ground as part of a survey of medium and large mammals. In addition, we collated the available data on predation events by *M. semitorquatus* from the bibliography and public databases such as Google Images, Wikiaves, YouTube and Flickr using as keyword search "*Micrastur semitorquatus*".

At 09:00 h on 9 October 2016 we recorded a single squirrel *G. ingrami* squirrel foraging on the ground on the leaf litter under a closed canopy of an old (45 years) secondary forest (Fig. 1A). The following day, at about the same time and location (23º0'17.48''S; 46º57'48.22''W), we recorded a *M. semitorquatus* attacking a *G. ingrami* on the ground (Fig. 1B). Seconds later, the falcon carried away its prey, probably towards a perch to feed on it. The photographed bird had barred chest plumage, a dark throat and collar and a long and voluminous tail (Fig. 1B), field marks that characterize it as a juvenile of *M. semitorquatus* (Ferguson-Lees & Christie 2001, Menq 2016).

The revision of predation events of *M. semitorquatus* resulted in the identification of 71 predated species (Appendix I) with birds being the most common prey (50 species), followed by mammals ($n$ = 11), reptiles ($n$ = 6), invertebrates ($n$ = 3) and amphibians ($n$ = 1). Although most prey species (66%) had a mean body mass less than 300 g (Fig. 2). Prey of *M. semitorquatus* cover a wide size spectrum, with 12% of prey exceeding the mass of the predator itself (Fig. 2).

This note presents the first documented predation record of a *G. ingrami* squirrel by *M. semitorquatus*. Other species of squirrels (*Sciurus deppei* and *S. yuacatanensis*) have been reported as prey of this raptor (Throstrom 2000). *Guerlinguetus* squirrels are arboreal and inhabit the intermediate and lower strata of the forest descending to the ground to forage (Bonvicino *et al.* 2008), where they are potentially more vulnerable to predators. In the

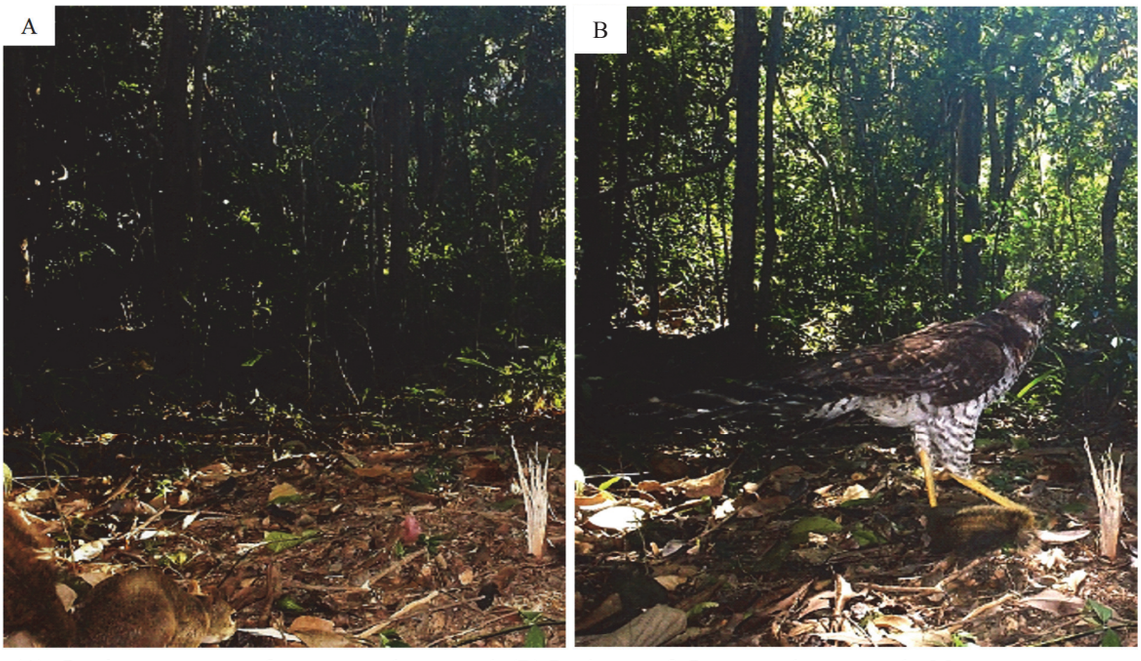


**Figure 1.** (**A**) *Guerlingetus ingrami* foraging on the ground; (**B**) Predation of *G. ingrami* by a juvenile *Micrastur semitorquatus*.

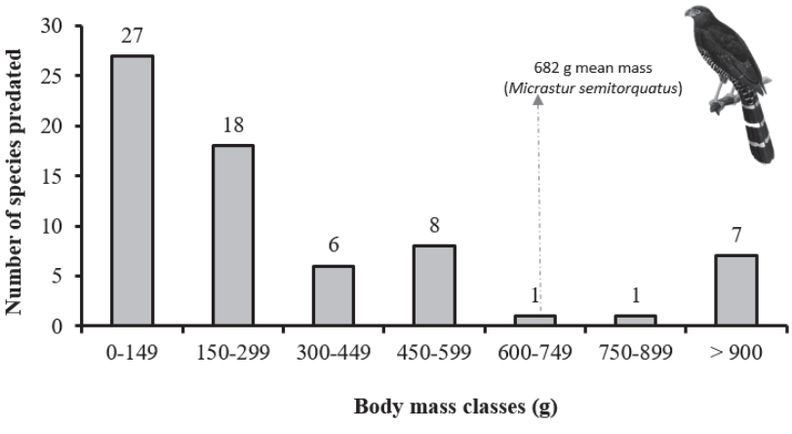


**Figure 2.** Prey eaten by *Micrastur semitorquatus* distributed in 150 g body mass classes. Data from Appendix I.

studied forest fragment, we recorded other potential prey of Collared Forest-Falcon, including Plumbeous Pigeon (*Patagioenas plumbea*), Rusty-margined Guan (*Penelope superciliaris*), Calico Lizard (*Tropidurus torquatus)*, Black-and-white Tegu (*Salvator marianae*), and Brazilian Forest Rabbit (*Sylvilagus brasiliensis*).

The predation event described here demonstrates the agility and behavioral flexibility of *M. semitorquatus* as a predator that inhabits the forest interior. Others studies suggest that this falcon has the most diversified diet within the *Micrastur* genus (Thorstrom 2000, Appendix I). Our compilation indicates that birds are also a relevant dietary component, in terms of both diversity and biomass, in the diet of Collared Forest-Falcon.

The occurrence of *M. semitorquatus* in a forest remnant surrounded by a highly human-modified landscape highlights the capacity of the species to adapt to disturbed environments (Viana *et al*. 2012). In addition, the study site is located in a region with abundant granite outcrops whose crevices and cavities provides suitable nesting sites for *M. semitorquatus* individuals, as shown in other regions of Brazil (Vallejos *et al*. 2008).

The demonstrated flexibility in diet and habitat use (del Hoyo *et al*. 1993, Thorstrom 2000) suggests that *M. semitorquatus* could be a local avian top predator (Brook *et al*. 2012, Colman *et al*. 2014) affecting the population dynamics of small vertebrates in forest fragments in the Atlantic Forest. The role of *M. semitorquatus* (and other forest falcons) in the trophic webs of forest fragments should be accessed through quantitative ecological studies, similar to those conducted in Guatemala (Thorstrom 2000).

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## APPENDIX I

List of prey species of *Micrastur semitorquatus* compiled from different sources.

| Prey species | Adult body length (cm) | Adult body mass (g) | Study regions | Sources |
|---|---|---|---|---|
| Arthropods | | | | |
| Unidentified species (ant) | - | <5 | Costa Rica | Skutch (1981), Mays (1985) |
| Unidentified species (cicada) | - | 10 | Brazil, Pantanal | Carrara *et al.* (2007) |
| Unidentified species (spider) | - | 10 | Costa Rica | Skutch (1981) |
| **Amphibian** | | | | |
| Unidentified species (frog) | - | 20 | Guatemala | Thorstrom (2000) |
| **Birds** | | | | |
| *Amazona amazonica* | 32[1] | 384[7] | Brazil, Pantanal | Carrara *et al.* (2007) |
| *Anodorhynchus hyacinthinus*#[1] | 70–100[1] | 1500[7] | Brazil, Mato Grosso | Salles (2010) |
| *Aramides cajaneus* | 42[1] | 403[7] | Brazil, Pantanal | Guedes (1993), Carrara *et al.* (2007) |
| *Aulacorhynchus* spp. | 33* | 150[3] | Guatemala | Thorstrom (2000) |
| *Brotogeris chiriri* | 23[1] | 50* | Brazil, Pantanal | Carrara *et al.* (2007) |
| *Cacicus cela* | 26[1] | 80[7] | Brasil, Pantanal, Peru[a] | Robinson (1994)[a], Carrara *et al.* (2007)[b] |

| Prey species | Adult body length (cm) | Adult body mass (g) | Study regions | Sources |
|---|---|---|---|---|
| Caprimulgidae | 20* | 70* | Brazil, Pantanal | Carrara *et al.* (2007) |
| *Celeus* spp. | 25* | 85[3] | Guatemala | Thorstrom (2000) |
| *Columbina picui* | 17[1] | 53[7] | Brazil, Pantanal | Carrara *et al.* (2007) |
| *Crax rubra* | - | 500[3] | Guatemala | Thorstrom (2000) |
| *Crotophaga ani* | 36[1] | 148[7] | Brazil, Pantanal | Guedes (1993), Carrara *et al.* (2007) |
| *Crotophaga major* | 46[1] | 150[7] | Brazil, Pantanal | Guedes (1993) |
| *Crotophaga sulcirostris* | 34* | 80* | Mexico | Willis *et al.* (1983) |
| *Crypturellus obsoletus* | 25–30[1] | 360–600[1] | Brazil, São Paulo | Souza (2015) |
| *Cyanocorax chrysops* | 34[1] | 200* | Brazil, Mato Grosso | Salles (2012) |
| *Cyanocorax morio* | 35* | 200[3] | Guatemala | Thorstrom (2000) |
| *Dendrocincla homochroa* | - | 42[4] | Guatemala | Thorstrom (2000) |
| *Eurypyga helias* | 45[1] | 220[4] | Brazil, Mato Grosso | Labelle (2010) |
| *Gallus gallus domesticus* | 50* | >3000 | El Salvador | Slud (1964), West (1988) |
| *Guira guira* | 38[1] | 141[7] | Brazil, Pantanal | Guedes (1993), Carrara *et al.* (2007) |
| *Geotrygon albifaces* | 24* | 55* | Guatemala | Vannini (1989) |
| *Geotrygon montana* | 24[1] | 55* | Guatemala | Vannini (1989) |
| *Heliornis fulica* | 28[1] | 150[7] | Brazil, São Paulo | Souza (2014) |
| *Icterus gularis* | 20* | 65* | Mexico | Sutton *et al.* (1942) |
| *Laterallus viridis* | 18[1] | 140* | Brazil, Pantanal | Carrara *et al.* (2007) |
| *Leptotila* spp. | 27* | 160[3] | Guatemala | Thorstrom (2000) |
| *Melanerpes* spp. | 18* | 81[3] | Guatemala | Thorstrom (2000) |
| *Meleagris ocellata* | 100[1] | 3000[3] | Guatemala | Thorstrom (2000) |
| *Mesembrinibis cayennensis* | 58[1] | 750[7] | Brazil, Pantanal | Carrara *et al.* (2007) |
| *Momotus* spp. | 44* | 133[3] | Guatemala | Thorstrom (2000) |
| *Odontophorus capueira* | 24[1] | 426.5[6] | Brazil, Paraná | Vallejos *et al.* (2008) |
| *Ortallis canicollis* | 50–56[1] | 480–600[1] | Brazil, Pantanal | del Hoyo (1997), Olmos *et al.* (2006), Carrara *et al.* (2007) |
| *Ortallis* spp. | 50* | 450* | Mexico, Panama[b] | Sutton *et al.* (1942), Wetmore (1965)[b] |
| *Ortalis vetula* | 50* | 450[3] | Guatemala | Thorstrom (2000) |
| *Patagioenas plumbea* | 34[7] | 215[7] | Brazil, São Paulo | This study |
| *Penelope jacquacu* | 71[1] | 1530[1] | Peru | Robinson (1994) |
| *Penelope obscura* | 68–75[1] | 1000–1200[1] | Brazil, Paraná[a]; Argentina[b] | Vallejos *et al.* (2008)[a], Cuñado (2014)[b] |
| *Penelope purpurascens* | 50* | 600[3] | Guatemala | Thorstrom (2000) |
| *Penelope* sp. | 68[1] | 1000[1] | Brazil, Rio de Janeiro | Blanco (2013) |
| *Piaya cayana* | 44[1] | 75* | Brazil, Pantanal | Carrara *et al.* (2007) |
| *Primolius auricollis* | 40[1] | 250[7] | Brazil, Pantanal | Carrara *et al.* (2007) |
| *Psarocolius angustifrons* | 41[1] | 258* | Peru | Robinson (1994) |

| Prey species | Adult body length (cm) | Adult body mass (g) | Study regions | Sources |
|---|---|---|---|---|
| *Psarocolius decumanus* | 42[1] | 258[7] | Brazil, Pantanal | Carrara *et al*. (2007) |
| *Pteroglossus torquatus* | - | 220[3] | Guatemala | Thorstrom (2000) |
| *Quiscalus mexicanus* | 42[9] | 160[9] | Mexico | Flores (2017) |
| *Ramphastos* sp. | 42–61[1] | 350* | Brazil, Paraná | Vallejos *et al*. (2008) |
| *Ramphastos sulfuratus* | 50* | 350[3] | Guatemala | Thorstrom (2000) |
| *Rupicola rupicola* | 27–32[1] | 200[4] | North Amazonia[a]; Guiana[b] | Trail (1987)[b], Sigrist (2014)[a] |
| *Strix virgata* | 34[1] | 240[3] | Guatemala | Thorstrom *et al*. (1990) |
| *Taraba major* | 19[1] | 50* | Brazil, Pantanal | Guedes (1993) |
| **Mammals** | | | | |
| *Artibeus* spp. | 90* | 50[3] | Guatemala | Thorstrom (2000) |
| *Callithrix humeralifer* | 21.5[2] | 470[2] | Brazil, Mato Grosso | Rylands (1981) |
| *Callithrix jacchus* | 21.5[2] | 470[2] | Brazil, Paraíba[a] | Alonso & Langguth (1989)[a], Pontes & Soares (2005)[b] |
| *Callithrix penicillata* | 21.5[2] | 470[2] | Brazil, São Paulo | This study |
| *Guerlinguettus ingrami* | 19.6[4] | 242[5] | Brazil, São Paulo | This study |
| *Heteromys* spp. | - | 76[3] | Guatemala | Thorstrom (2000) |
| *Sciurus deppei* | - | 205[3] | Guatemala | Thorstrom (2000) |
| *Sciurus yucatanensis* | - | 400[3] | Guatemala | Thorstrom (2000) |
| *Sigmodon hispidus* | - | 150[3] | Guatemala | Thorstrom (2000) |
| Unidentified rodent #[2] | - | - | Brazil, Paraná | Vallejos *et al*. (2008) |
| Unidentified marsupial#[2] | - | - | Brazil, Paraná | Vallejos *et al*. (2008) |
| **Reptiles** | | | | |
| *Ameiva* sp. | 15* | 40* | Brazil, Pantanal | Guedes (1993) |
| *Corytophanes* spp. | - | <150* | Guatemala | Thorstrom (2000) |
| *Coluber* sp. | - | 45[3] | Guatemala | Thorstrom (2000) |
| *Ctenossaura similis* | 130[8] | 1500[8] | Vera Cruz, México | Haemig (2012) |
| *Salvator marianae* | 100* | >1000* | Brazil, São Paulo | Martinhão (2012) |
| *Micrurus* sp. (coral snake) | - | <150* | Brazil, Mato Grosso do Sul | Messias (2015) |

[1]Sigrist (2014), [2]Reis *et al*. (2015), [3]Throrstrom (2000), [4]Hilty 2002, [5]Ribeiro *et al*. (2010), [6]del Hoyo *et al*. (1993), [7]Wikiaves, [8]Savage (2002), [9]Wehtje (2003).
"[a]" and "[b]" refers to the authors responsible for information.
*Based on species of the same genus.
# data not used in the graphic;
#[1] the predation reported was of macaw nestlings (undefined mass);
#[2] undefined species (may be great variation on the mass).