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NOTE

Adaptive nesting and diet data of the Collared Forest-Falcon (*Micrastur semitorquatus*) in southern Brazil

Nidificação adaptativa e dados de dieta do falcão-relógio (*Micrastur semitorquatus*) no sul do Brasil

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ABSTRACT

This note reports the nesting of *M. semitorquatus* inside a human construction, adding new data on its breeding behavior and diet at the southern limit of its distribution. The study area is located in southern Brazil, about 3 km from Turvo State Park, one of the most important protected areas in southern Brazil. The area is near the Uruguay River, in the municipality of Barra do Guarita, in the northwest region of the state of Rio Grande do Sul. The nest was made inside a human building on an abandoned farm surrounded by a fragmented landscape of forest fragments and cultivated areas. The nest was being used by a female, still incubating the eggs. After the breeding period, and once the adult and young birds left the nest, five pellets and alimentary remains were collected. The alimentary remains found in the nest were composed of bird species, rodents, and a lizard species. Among the birds, we identified three new prey species for the Collared Forest-Falcon: *Patagioenas picazuro*, *Furnarius rufus*, and *Turdus* sp. Therefore, we show that anthropic constructions can be used as alternative nesting sites for this species, which likely foraged in open or agricultural landscapes. These observations demonstrate that the Collared Forest-Falcon has some tolerance to modified environments, an important aspect for its conservation.

Keywords: Raptors, Falconiformes, Breeding biology, Food habits, Atlantic Forest.

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RESUMO

Esta nota relata a nidificação de *M. semitorquatus* dentro de uma construção humana, acrescentando novos dados sobre seu comportamento reprodutivo e dieta no limite sul de sua distribuição. A área de estudo está localizada no Sul do Brasil, a cerca de 3 km do Parque Estadual do Turvo, uma das mais importantes unidades de conservação do Sul do Brasil. A área fica próxima ao rio Uruguai, no município de Barra do Guarita, região noroeste do estado do Rio Grande do Sul. O ninho foi feito dentro de uma construção humana em uma fazenda abandonada cercada por uma paisagem de fragmentos florestais e áreas cultivadas. O ninho estava sendo utilizado por uma fêmea, ainda incubando os ovos. Após o período de reprodução e após a saída dos adultos e filhotes do ninho, foram coletados cinco egagrópilas e restos de presa. Os restos alimentares encontrados no ninho eram compostos por espécies de aves, roedores e uma espécie de lagarto. Entre as aves, identificamos três novas espécies de presas para o falcão-relógio: *Patagioenas picazuro*, *Furnarius rufus* e *Turdus* sp. Portanto, mostramos que construções antrópicas podem ser utilizadas como locais alternativos de nidificação para esta espécie, que provavelmente se alimenta em paisagens abertas ou agrícolas. Essas observações demonstram que o falcão-relógio possui certa tolerância a ambientes modificados, aspecto importante para sua conservação.

Palavras-chave: Raptores; Falconiformes; biologia reprodutiva; hábitos alimentares; Mata Atlântica.

The genus *Micrastur* comprises seven species of small to medium-sized forest falcons (White, Olsen, Kiff, 1994; Sick, 1997). The Collared Forest-Falcon (*Micrastur semitorquatus*), the largest member of the genus, is an uncommon species without pronounced sexual dimorphism (Thorstrom, 2000; Ferguson-Lees and Christie, 2001). The plumage varies between individuals, with adults showing three basic types: light, cream, and dark morphs (Ferguson-Lees and Christie, 2001). It has a long tail and short, rounded wings, adaptations for maneuvering inside dense tree vegetation (Bierregaard, 1994).

The distribution of the Collared Forest-Falcon ranges from southern Mexico to northern Argentina (White et al., 1994; Sick, 1997; Ferguson-Lees and Christie, 2001). It is found in evergreen and deciduous forests, disturbed forests, dense shrubby thickets, and riparian zones, from coastal areas to 1,000 m above sea level (Ferguson-Lees and Christie, 2001). Despite its wide distribution in the neotropical region, little is known about its natural history, feeding habits, and breeding biology (Carrara, Antas, Yabe, 2007; Vallejos, Lanzer, Aurélio-Silva, Silva-da-Rocha, 2008). The most consistent data published on the species are from Guatemala (Thorstrom, 2000, 2001).

Most of the nests found have been recorded in hollows of large trees (Mader, 1979; Cobb, 1990; López-Lanús, 2000; Thorstrom, 2001; Carrara et al., 2007). Although less common, nesting in human constructions has been reported by some authors (Cobb, 1990; Carvalho-Filho, Carvalho, Carvalho, 1998; Marreis, Dalenogare, Sander, 2009). The breeding season in Brazil seems to start in August and lasts until November (Carrara et al., 2007). The species lays two to three eggs with an incubation period of 46-48 days (Thorstrom et al., 2000). There is a record in southern Brazil of four eggs in the nest (Bôlla, Gava-Just, Spilere-Romagna, Réus-Viana, Zocche, 2018).

The Collared Forest-Falcon is a predator that captures its prey both on the ground and in vegetation through ambushes from hidden perches (Thorstrom, 2012; Sigrist, 2014). It can also follow army ants, capturing insectivorous birds (Ferguson-Lees and Christie, 2001). Its diet is known to be composed mainly of small vertebrates, such as mammals, birds, and lizards (White et al., 1994; Ferguson-Lees and Christie, 2001; Carrara et al., 2007).

This note aims to document the nesting of *M. semitorquatus* inside a human structure and to provide new information on its breeding behavior and diet at the southernmost extent of its range.

STUDY AREA

The study area is located in southern Brazil, about 3 km from Turvo State Park, one of the most important protected areas in southern Brazil. The area is near the Uruguay River, in the municipality of Barra do Guarita, northwest region of Rio Grande do Sul state (Fig. 1). The predominant biome is the Atlantic Forest, and according to the Köppen classification, the climate in the region is Cfa, characterized as subtropical, with a mean altitude of 194 m above sea level.

NEST SITE

The nest was located on an abandoned farm in a rural area, surrounded by a fragmented landscape of forest fragments and cultivated areas. Three days later, we found the female perched in a tree near the barn, and the chicks, still unable to fly, were perched on the board over the right side of the nest. When the nest was found on September 27, 2020, it was being used by a female, still incubating the eggs. On December 14, 2020, we checked the nest and found the female guarding the nest with two chicks (Fig. 2), same numbers of egges or chicks found in Rio Grande do Sul state by Vallejo et al. (2008), for Argentina by Grilli, Pagano, Juárez, Marateo (2013) and Campeche in Mexico by Monter-Pozos, Hernández-Hernández (2022). Other studies report different numbers of eggs or chicks in the nests of the *M.semitorquatus*. For example, Viana et al. (2012), also in southern

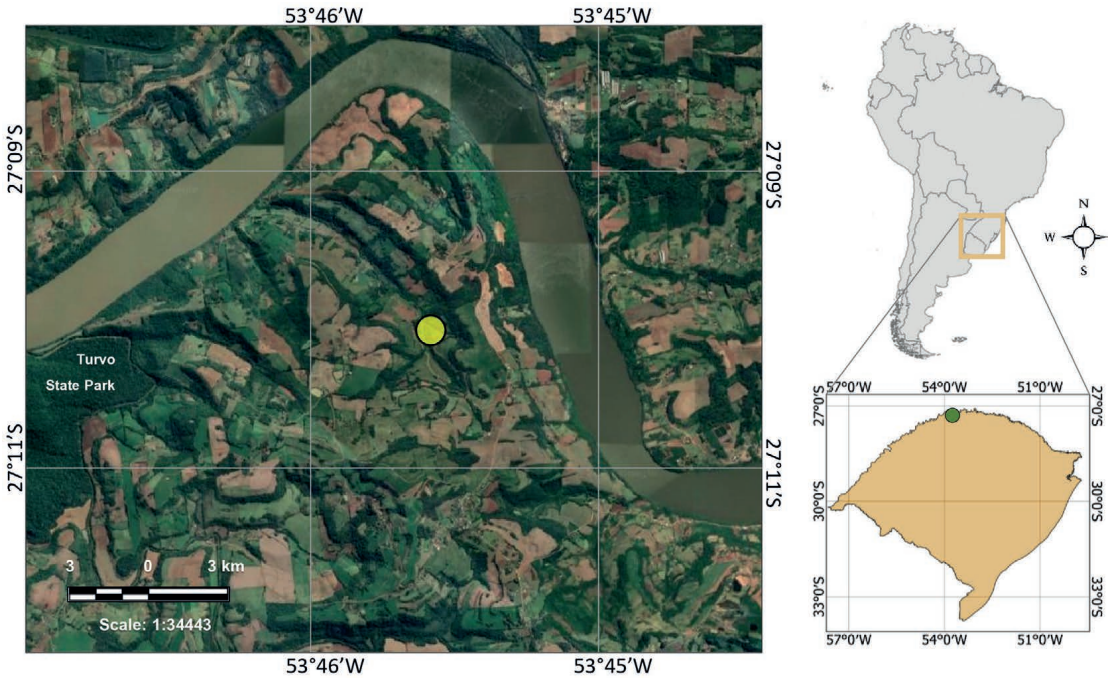

Figure 1. Location of the nest found in Barra do Guarita municipality.
Figura 1. Localização do ninho encontrado no município de Barra do Guarita.

Figure 2. Female and chicks of *Micrastur semitorquatus* in the nest in a barn in Barra do Guarita municipality. Photo: DAM.

Figura 2. Fêmea e filhotes de *Micrastur semitorquatus* no ninho em celeiro no município de Barra do Guarita. Foto: DAM.

Brazil, found a clutch of three eggs, and Barbosa, Filadelfo, Guedes (2014) observed three chicks in an artificial nest used by *Anodorhynchus hyacinthinus* in the Pantanal of the Mato Grosso do Sul state.

This type of adaptive nesting used by *M. semitorquatus* has also been reported in other locations. Carvalho-Filho et al. (1998) recorded a nest of this species on the floor of an unoccupied bathroom in the state of Minas Gerais. In southern Brazil, Marreis et al. (2009) documented a nest in a barbecue grill, also in Rio Grande do Sul, and Viana et al. (2012) reported another nest in a human habitation in the state of Santa Catarina.

DIET

After the breeding period, and once the adult and young birds left the nest, five pellets and alimentary remains (such as feathers, bones, skulls, etc.) were collected. The identification of the material was carried out to the most accurate taxonomic level possible, based on comparisons with specimens deposited at the Museum of Zoology of the Pampa (MZPAMPA), located at the Laboratory of Biology of Mammals and Birds (LABIMAVE) on the campus of the Federal University of Pampa (UNIPAMPA), municipality of São Gabriel, Rio Grande do Sul. It was not possible to distinguish the number of individuals of each species in the collected material, but it was possible to identify ten different prey items consumed during the nesting period (Tab. 1).

Table 1. Diet items of *Micrastur semitorquatus* collected from the nest after the species' breeding season, in northwestern Rio Grande do Sul. Source of measurements: AVONET Supplementary dataset.

Tabela 1. Itens da dieta de *Micrastur semitorquatus* coletados do ninho após a estação reprodutiva da espécie, no noroeste do Rio Grande do Sul. Fonte das medições: Conjunto de dados suplementares AVONET.

Taxon	Weight of adults (g)
Aves	
Cyanocorax chrysops	166 g
Patagioenas picazuro	279 g
Furnarius rufus	46,4 g
Gallus gallus domesticus	1,600 – 3,500 g
Turdus sp.	70 – 80 g
Caprimugidae	46 – 128 g
Other Aves	–
Mammalia	
Rodentia	–
Reptilia	
Salvator merianae	– up to 6,500 g
Insecta	
Coleoptera	< 10 g

Three items found in the alimentary remains are new records for the diet of the Collared Forest-Falcon: *Patagioenas picazuro*, *Furnarius rufus*, and *Turdus* sp. Although this is the first record of *P. picazuro*, pigeons of the genus *Patagioenas*, such as the Plumbeous Pigeon (*P. plumbea*), have already been recorded in the species' diet (Rocha et al., 2017). The record of the Rufous Hornero (*Furnarius rufus*) suggests that this falcon was foraging in open and/or anthropized areas, and not only within forest environments. Although common in both anthropized and preserved areas of Atlantic Forests, the thrush (genus *Turdus*) was identified for the first time in the diet of the Collared Forest-Falcon.

Three other species found in this study had already been mentioned as prey of the Collared Forest-Falcon: the Plush-crested Jay (*Cyanocorax chrysops*), recorded in the state of Mato Grosso (Salles, 2012); the White Tegu (*Salvator merianae*), recorded in the state of São Paulo (Martinhão, 2012); and the domestic chicken (*Gallus gallus domesticus*), recorded on two occasions in El Salvador (Slud, 1964; West, 1988). The record of the consumption of domestic chicken was made through an observation in loco, where the falcon was observed holding a chicken close to the nest site (DAM, pers. obs.). Afterward, we identified feathers of domestic chicken among the alimentary residuals. The predation of domestic stock is always interesting as it demands the attention of researchers and conservationists. These kinds of losses can lead to potential retaliations by rural workers, who need education or better practices to avoid the access of predators to their chickens.

When it comes to the observed richness, the prey items brought to the nest were predominantly bird species. Bird predominance as prey of the Collared Forest-Falcon was also found by Thorstrom (2000) and Carrara et al. (2007). However, the prevalence of birds in our sample may also be related to the fact that larger feathers, such as flight feathers, are not consumed and end up remaining in the nest, as noted by Guedes (1993). In contrast, mammals, reptiles, and insects are often completely consumed, as also noted by Guedes (1993).

One particular note is the inclusion of the lizard *Salvator merianae*, a species considerably larger than the other prey. This might indicate a peculiar hunting behavior or a preference based on prey availability, as seen in other locations (Marreis et al., 2009). The lizard's inclusion in the diet suggests that the falcon might bring larger prey in smaller, more manageable pieces rather than transporting it whole, aligning with Thorstrom's (2000) observations.

In conclusion, our findings suggest that the Collared Forest-Falcon can use human-made structures as nesting sites, demonstrating adaptability to altered environments. This adaptability is essential for conservation efforts, as it shows the species' potential to tolerate some degree of habitat modification due to human activity. This is particularly important in regions like southern Brazil, where forest fragmentation is prevalent. Additionally,

the new prey records expand our understanding of the species' diet and underscore the importance of continuous monitoring to further uncover its natural history.

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