



## RECENT RECORDS OF HAWK-EAGLES (*SPIZAETUS* SPP.) IN NORTHWESTERN RIO GRANDE DO SUL, BRAZIL

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**Abstract** · I report unpublished observations of three *Spizaetus* hawk-eagles in northwestern Rio Grande do Sul, Brazil. These consist of five records of Black Hawk-Eagles (*S. tyrannus*), including four recent and one unpublished historical observation. I report 30 records of Black-and-White Hawk-Eagles (*S. melanoleucus*), including 10 showing territorial behavior (one with mating displays), 3 of juveniles, 4 involving prey items or hunting behavior, and 7 interactions with other raptor species. I also provide information on 29 records of Ornate Hawk-Eagles (*S. ornatus*), including 5 involving territorial behavior, 11 of juvenile or immature birds, 6 of prey or hunting behavior, and 3 interactions with other raptor species. From these records, I inferred that *S. tyrannus* is the rarest of these three hawk-eagles, with recent presence only in the Missões region, next to the Ijuí River; *S. ornatus* is more frequently recorded, but restricted to Turvo State Park; and *S. melanoleucus* is the most widespread species and has been recently recorded in Turvo State Park, Guarita Indigenous Land, the Parizinho Corridor, Braga, and Entre-Ijuís, next to the Ijuizinho River. *Spizaetus* hawk-eagles are regionally threatened and require attention regarding hunting, logging, and habitat loss.

### Resumo · Novos registros de águias-florestais (*Spizaetus* spp.) no noroeste do Rio Grande do Sul, Brasil

São divulgadas neste artigo várias observações com três águias-florestais (*Spizaetus* spp.) no noroeste do Rio Grande do Sul, Brasil. Cinco registros são descritos para o gavião-pega-macaco (*S. tyrannus*), incluindo quatro recentes e uma observação histórica não publicada. Quanto ao gavião-pato (*S. melanoleucus*), 30 registros são relatados, incluindo 10 apresentando comportamento territorial (um com exibições de acasalamento), 3 para juvenis, 4 para dieta ou comportamento de caça e 7 interações com outras espécies de aves de rapina. Finalmente, 29 registros são relatados para o gavião-de-penacho (*S. ornatus*), incluindo quatro apresentando comportamento territorial, 11 de aves juvenis ou imaturas, 6 para dieta ou comportamento de caça e 3 interações com outros rapinantes. A partir destes registros, infere-se que *S. tyrannus* é a mais rara destas três águias-florestais, com ocorrência recente apenas na região das Missões, próximo ao rio Ijuí. *Spizaetus ornatus* é mais frequentemente registrado, embora restrito ao Parque Estadual do Turvo. *Spizaetus melanoleucus*, por outro lado, é a mais distribuída espécie, tendo sido registrada recentemente no Parque Estadual do Turvo, Terra Indígena do Guarita, Corredor do Parizinho, Braga e em Entre-Ijuís, próximo ao rio Ijuizinho. As águias-florestais do gênero *Spizaetus* estão regionalmente ameaçadas e requerem atenção para enfrentar impactos humanos, como a caça, extração de madeira e perda de habitat.

**Key words:** Black Hawk-Eagle · Black-and-white Hawk-Eagle · Guarita Indigenous Land · Ijuí River · Ornate Hawk-Eagle · Parizinho Corridor · Turvo State Park

## INTRODUCTION

*Spizaetus* hawk-eagles are still poorly known. There are three species in Brazil: the Ornate Hawk Eagle (*S. ornatus*, Daudin 1800), globally considered near-threatened; the Black Hawk-Eagle (*S. tyrannus*, Wied 1820); and the Black-and-white Hawk-Eagle (*S. melanoleucus*, Vieillot 1816). The latter two are regarded as least concern (BirdLife International 2016), but all of them are threatened or near threatened in most of the Brazilian states where the Atlantic Forest is present (see Alves et al. 2000, Mikich & Bérnils 2004, Simon et al. 2007, Drummond et al. 2008, Silveira et al. 2009, CONSEMA 2011, Rio Grande do Sul 2014). In Rio Grande do Sul (RS), where they reach the southern limit of their distribution, all three species are classified as threatened. *S. ornatus* had been considered locally extinct in the past (Belton 1994, Bencke et al. 2003) and has only recently been rediscovered (Mendonça-Lima et al. 2006). In Argentina, the situation is similar to the Atlantic Forest in Brazil (Chebez 2008, 2009).

Recent records (after 2000) for these species are scarce in RS. They come mostly from two large tracts of forest separated by a vast fragmented and agricultural landscape. There are records from Serra Geral and Pelotas River's forests in the north-

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**Table 1.** Old and recent records of Black Hawk-Eagles (*Spizaetus tyrannus*) in northwestern Rio Grande do Sul, Brazil. (\*) Territorial behavior.

| Date         | Locality                      | Coordinates              | Habitat                     | Description of observations   |
|--------------|-------------------------------|--------------------------|-----------------------------|---|
| 1992         | Porto García, PET             | 27°13'13"S<br>54°00'47"W | Primary forest river bank   | An <i>S. tyrannus</i> individual observed by J. Albuquerque (pers. com. in Meller 2011)                               |
| 04 July 2015 | Sítio Água Doce, Santo Ângelo | 28°19'34"S, 54°17'54"W   | Patches of secondary forest | An adult soaring together with a Black Vulture ( <i>Coragyps atratus</i> ) and, after a while, gliding away (Fig. 2A) |
| 17 June 2021 | Atafona, Santo Ângelo         | 28°20'41"S, 54°23'20"W   | Patches of secondary forest | * An adult soaring high and vocalizing  |
| 25 June 2021 | Atafona, Santo Ângelo         | 28°20'33"S, 54°24'2"W    | Patches of secondary forest | * An adult soaring, vocalizing and doing courtship displays   |
| 1 July 2021  | Atafona, Santo Ângelo         | 28°20'55"S, 54°23'47"W   | Patches of secondary forest | An adult soaring over the forest  |

east, and from the Misiones Green Corridor in the northwest, where Turvo State Park (Parque Estadual do Turvo, PET) and the Guarita Indigenous Land (Terra Indígena do Guarita, TIG) are located (Bencke et al. 2003, Silva et al. 2005, Albuquerque et al. 2006, Meller 2011, 2014, Zilio 2017).

In this paper, I report 64 recent records of the three species of hawk-eagles for northwestern RS, recorded between 2009–2021, plus another unpublished historical report for *S. tyrannus*. I also provide information on conservation and territorial behavior, diet and hunting, and interactions with other raptors. My aim was to contribute to the knowledge of these threatened and poorly-known hawk-eagles.

## METHODS

The northwestern region of RS is located at the transition between two biomes: the Atlantic Forest and the Pampa (IBGE 2004). The forest formations in the northern part are represented mostly by semideciduous seasonal forest and, to a lesser extent, by mixed ombrophilous forest (Veloso et al. 1991). This region suffered intense deforestation in the first half of the twentieth century, and most of the original landscape has been transformed into agriculture (Albuquerque 1977, Silva et al. 1995, Meller 2017). Even so, some of the most important forests in RS remained protected in this region as parks or indigenous areas, such as PET and TIG (Belton 1994, Bencke et al. 2003).

Observations of raptors were conducted by myself in the region of PET, TIG, and the Parizinho Corridor from 2009–2021. Some of these observations were carried out during raptor surveys executed as part of unpublished academic monographs (Meller 2011, 2014). Other records in northwestern RS (including PET and TIG) were conducted during trips with Ave Missões, a group of birdwatchers that promotes monthly observations in this region since 2009 (<http://avemissoes.blogspot.com>). Finally, the remaining records were obtained incidentally while visiting PET for other purposes. I also obtained unpublished records from other researchers by consulting WikiAves (<http://wikiaves.com>).

Field records were made by using at least one of the following equipment: binoculars 8 x 35, 10 x 42, scope 20–60 x 60, and a photo camera with 300 and 400 mm lenses. Records made by other researchers, and reported here for the first time, were made using binoculars, photo cameras, or camera traps. Territorial or breeding behaviors were interpreted according to specialized literature (i.e., Brown & Amadon 1968, Thiollay 1989, del Hoyo et al. 1994, Ferguson-Lees & Christie 2001, Whitacre et al. 2012). Maps were composed with the software QGIS v. [3.4.7] (QGIS Development Team 2018) and records were georeferenced with the use of

a GPS Garmin Etrex 20x and the software Google Earth Pro (Google 2019).

## RESULTS

***Spizaetus tyrannus*.** I report five records in northwestern RS, four recent and one historical. The recent records were made in the Missões region, and two of them involved territorial behavior, whereas the historical one was made inside PET (Table 1, Figure 1).

***Spizaetus melanoleucus*.** I report details of 30 new observations of this species: 15 in PET, 9 in TIG, 3 in fragments at the Parizinho Corridor, 1 in Braga, and 2 in Entre-Ijuís, next to the Ijuizinho River (Figure 1). Ten of these observations included territorial behavior, three included records of juveniles, four included observations related to food items or hunting behavior, and seven include interactions with other raptors (Table 2).

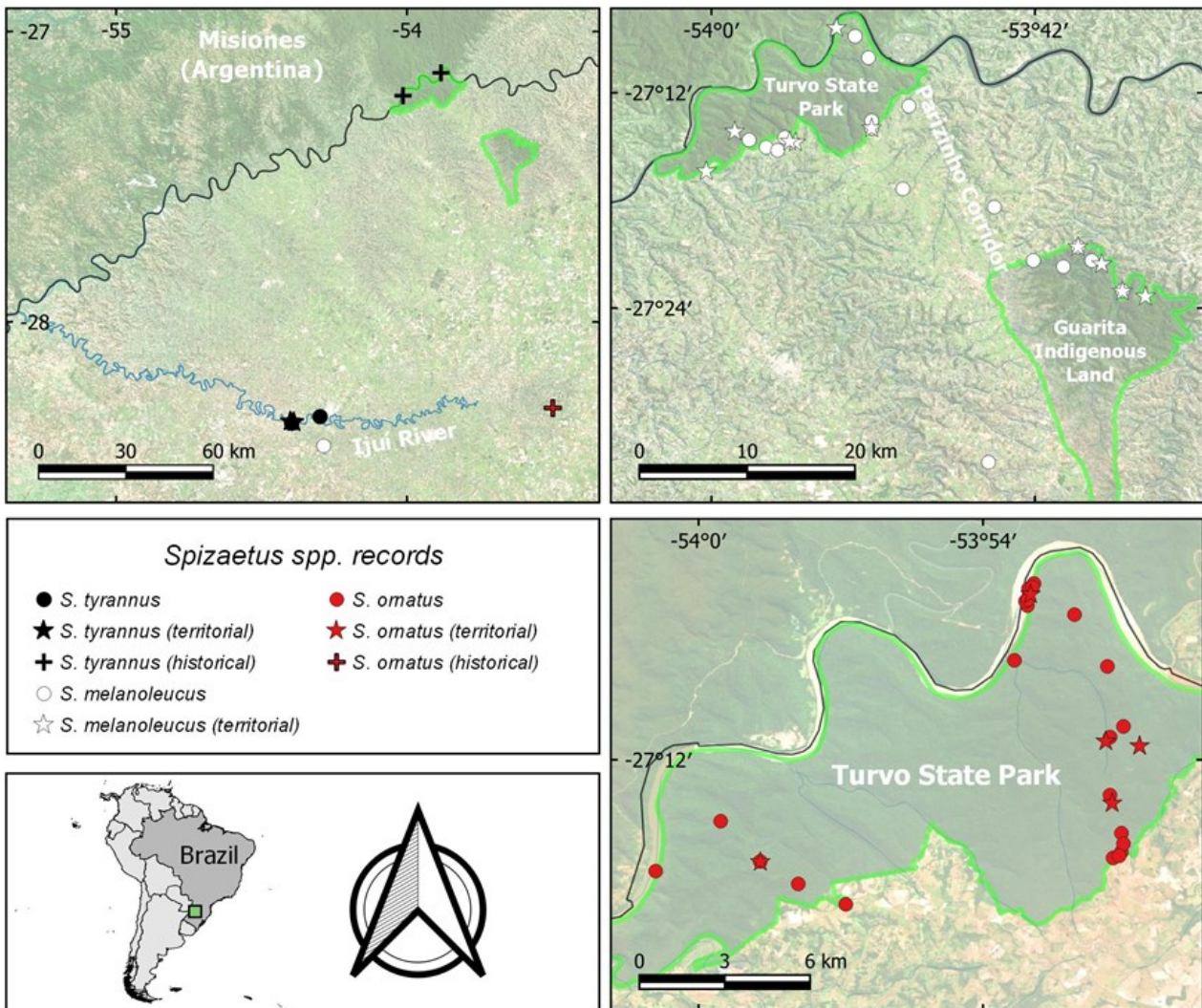
***Spizaetus ornatus*.** The only recent records for the species in northwestern RS came from PET, where it was seen on 29 occasions (Figure 1). In five observations, territorial behavior was detected, and 11 records were of juveniles or immature birds, 6 were related to diet or hunting behavior, and three observations were of interactions with other raptors (Table 3).

## DISCUSSION

### *Spizaetus tyrannus*

**Occurrence in the region.** Despite being the first *Spizaetus* reported in PET, this species has not been found in recent years (Mähler 1996, Bencke et al. 2003, Meller 2011). In contrast, *S. tyrannus* is the most abundant hawk-eagle in the Atlantic coast of Brazil (Sick 1997, del Hoyo et al. 1994, Ferguson-Lees & Christie 2001, Ridgely et al. 2015). The recent records in Santo Ângelo on July 2015 and June and July 2021 (Figure 2A) suggest that this species still inhabits the northwest of the state. These records were unexpected since hawk-eagles are normally seen in well-preserved forests and in the region of Santo Ângelo there are few remaining forest fragments (SOS Mata Atlântica 2011).

*S. tyrannus* appears to be less demanding about high-quality habitat conditions than its congeners, occurring also in secondary forests and forest edges (Thiollay 1985). It has been reported in Misiones, Argentina, where it is almost always present in secondary forests and close to water courses (Chebez 2008, Martinez 2016). The record made in Santo Ângelo was next to the Ijuí River and could represent a



**Figure 1.** Records of *Spizaetus* hawk-eagles in northwestern Rio Grande do Sul, Brazil. Recent records (after 2000) are itemized on Tables 1–3. Historical records of Ornate Hawk-Eagles (*Spizaetus ornatus*) and Black Hawk-Eagles (*Spizaetus tyrannus*) were based on Pinto (1938), Mähler (1996), and Meller (2011).

member of a sparse population established in the remaining forests of the Ijuí River basin. If the latter is true, these hawk-eagles could also be associated with the forests of the Ijuizinho River, especially where they reach the Ijuí River, as this particular record was not far from it and the landscape is better conserved as well. Furthermore, typical prey for *S. tyrannus*, such as the Southeastern Squirrel (*Guerlinguetus ingrami*), are present in the riparian forests of the Ijuí River (DAM, pers. observ.).

### *Spizaetus melanoleucus*

**Occurrence in the region.** In northwestern RS, *S. melanoleucus* was previously known only from PET, where its occurrence was first reported by Bencke et al. (2003). After that, it was classified as occasional in a previous study, in which it was considered the most common hawk-eagle in the park (Meller 2011). Bencke et al. (2003) mentioned Black-and-White Hawk-Eagles flying over rural areas in the surroundings of PET. I found it more frequently in the edge, rather than inside the park (Meller 2011), in agreement with its preference of landscape mosaics over dense forests (del Hoyo et al. 1994, Ferguson-Lees & Christie 2001). This suggests that as long as there are areas of natural habitat with some connectivity and low hunting, this hawk-eagle could

survive in modified landscapes (Chebez 2009).

This species is the most common and widespread *Spizaetus* in northwestern RS, occurring in PET, TIG, Parizinho Corridor, Braga, and the Ijuizinho River basin. It is also considered the most common hawk-eagle in Misiones, Argentina (Olgos 1985, Chebez 2009). This species was also found in regions close to northwestern RS, in the municipalities of Iraí and Não-Me-Toque (Santos & Petry 2010, Kilpp 2018).

**Territorial behavior.** Although there are no nesting records in RS (Maurício et al. 2013), I made observations of *S. melanoleucus* juveniles at PET (Table 2), indicating that the species is probably breeding in the area. It should be mentioned that the juvenile is very similar to the adult and can often go unnoticed as such (Phillips 2009). The four records of pairs described for TIG (Table 2) included one with aerial displays, suggesting a nesting territory. Zilio (2017) described similar mating displays for this species in the state of Santa Catarina, Brazil, which were made close to a nest. Other six records I described for PET were recognized as territorial, including two different localities (Visitors Center and Falcão River) where juveniles have also been observed (Table 2).

**Food and hunting behavior.** The behavior reported in Table 2 of an *S. melanoleucus* individual leaving the park's forest

**Table 2.** Recent records of Black-and-White Hawk-Eagles (*Spizaetus melanoleucus*) in northwestern Rio Grande do Sul, Brazil. (\*) Territorial behavior.

| Date                     | Locality                  | Coordinates               | Habitat   | Description of observations  |
|--------------------------|---------------------------|---------------------------|---|--|
| 19 December 2009         | Centro Novo, Derrubadas   | 27°15'01"S<br>53°56'56"W  | Second-growth forest fragment                   | An <i>S. melanoleucus</i> individual chased away by a pair of vocalizing <i>Ictinia plumbea</i>  |
| 26 June 2010             | Centro Novo, Derrubadas   | 27°15'12"S,<br>53°56'18"W | Second-growth forest fragment                   | An adult perched atop a snag, with a full crop, indicating it was feeding around the area  |
| 27 June 2010             | Turvo River               | 27°16'21"S, 54°00'16"W    | Primary forest edge                             | * Two hawk-eagles flying together. They did not differ in size. When they approached each other one, began warning calls   |
| 24 November 2010         | Road to Porto Garcia      | 27°14'37"S<br>53°57'53"W  | Primary forest                                  | A hawk-eagle soaring and gliding high, chased by a Plumbeous Kite ( <i>I. plumbea</i> )  |
| 17 March 2018            | Salto do Yucumã Road      | 27°10'02"S<br>53°51'15"W  | Primary forest                                  | Perched on an <i>Apuleia leiocarpa</i> tree  |
| 08 March 2013            | Surroundings of PET       | 27°14'42"S, 53°55'38"W    | Primary forest edge, close to Falcão River      | A juvenile soaring and an adult leaving the park and later returning with an unidentified bird in its talons (Fig. 2B). After that, it was forced to return into the forest while two Southern Caracaras ( <i>Caracara plancus</i> ) tried to steal its food   |
| 25 March 2013            | TIG, Tenente Portela      | 27°23'02"S, 53°37'07"W    | Primary forest edge                             | Flying high over this indigenous territory   |
| 26 April 2013            | Parizinho Corridor        | 27°12'44"S,<br>53°49'00"W | Secondary forest, close to PET                  | Soaring over a forest fragment   |
| 29 May 2013              | TIG, Tenente Portela      | 27°21'33"S, 53°38'16"W    | Primary forest edge                             | * A pair flying high over a site close to the Guarita River  |
| 30 May 2013              | Parizinho Corridor        | 27°18'22"S, 53°44'14"W    | Secondary forest                                | An adult soaring and gliding over a forest fragment of about 40 ha next to the Parizinho River   |
| 02 June 2013             | TIG, Tenente Portela      | 27°23'02"S, 53°37'07"W    | Primary forest edge                             | * A pair flying high together  |
| 09 November 2013         | TIG, Tenente Portela      | 27°21'21"S, 53°38'49"W    | Primary forest edge                             | Flying high over an area next to the Guarita River   |
| 09 November 2013         | TIG, Tenente Portela      | 27°23'20"S, 53°35'49"W    | Primary forest                                  | * Male and female performing aerial displays, including foot-touching without complete grapple of talons, while flying above the forest canopy, close to emergent trees  |
| 2014                     | Cedro Marcado, Derrubadas | 27°17'21"S, 53°49'20"W    | Agricultural                                    | Perched high on an eucalyptus tree   |
| November 2014            | Visitors Center of PET    | 27°13'57"S, 53°51'04"W    | Primary forest edge                             | * A pair flying together, vocalizing   |
| 19 February 2015         | Visitors Center of PET    | 27°13'57"S, 53°51'04"W    | Primary forest edge                             | A juvenile perched in emergent trees   |
| 12 March 2015            | Visitors Center of PET    | 27°13'57"S, 53°51'04"W    | Primary forest edge                             | A juvenile unsuccessfully tried to catch a Black-fronted Piping-Guan ( <i>Aburria jacutinga</i> ) in a fig tree  |
| 06 September 2015        | Campestre, PET            | 27°14'09"S, 53°58'42"W    | Primary forest edge                             | * An <i>S. melanoleucus</i> individual soaring high with some vultures, which then glided to meet an <i>S. ornatus</i> individual in the air; after flying together and threatening each other with their talons, with most attacks coming from the <i>S. melanoleucus</i> flying above, the <i>S. ornatus</i> went away |
| 17 November 2015         | Surroundings of PET       | 27°14'42"S, 53°55'38"W    | Primary forest edge                             | * A probable female soaring and vocalizing over the forest   |
| November 2016            | Salto do Yucumã Road      | 27°13'33"S<br>53°51'4"W   | Primary forest                                  | Some Swallow-tailed Kites ( <i>Elanoides forficatus</i> ) chasing an <i>S. melanoleucus</i> perched on a tree; after a while, it flew away   |
| 14 June 2018             | Salto do Yucumã Road      | 27°08'50"S<br>53°51'59"W  | Primary forest                                  | An <i>S. melanoleucus</i> individual soaring and being chased by a pair of vocalizing Short-tailed Hawks ( <i>Buteo brachyurus</i> )   |
| 09 September 2018        | SY recreational area, PET | 27°08'21"S, 53°52'57"W    | Primary forest clearing                         | * A pair flying high   |
| 23 February 2019         | Surroundings of PET       | 27°14'45"S<br>53°55'18"W  | Primary forest edge, close to Falcão River      | * Two <i>S. melanoleucus</i> individuals were flying close and vocalizing, but they weren't different in size. After a few interactions, they flew in opposite directions  |
| 07 April 2019            | TIG, Tenente Portela      | 27°20'S<br>53°39'W        | Primary forest edge                             | * A pair soaring was photographed by C. Furini (pers. comm.).  |
| 18 May 2019              | TIG, Tenente Portela      | 27°21'41"S<br>53°40'24"W  | Primary forest clearing                         | An adult soaring with some <i>Coragyps atratus</i>   |
| 19 May 2019              | TIG, Tenente Portela      | 27°20'35"S<br>53°39'35"W  | Primary forest edge                             | An adult was being chased by a <i>B. brachyurus</i> individual while soaring with some <i>C. atratus</i>   |
| 19 May 2019              | TIG, Tenente Portela      | 27°21'20"S<br>53°42'04"W  | Primary forest edge                             | An adult was soaring high with some <i>C. atratus</i> when it started a long dive into a forested valley. After catching no prey, it gained altitude quickly again   |
| 18 and 20 September 2019 | Entre-ljuís               | 28°25'36"S<br>54°17'09"W  | Patches of secondary forest, in Ijuizinho River | G. Brusco (pers. comm.) watched an adult flying in two days (a photo was deposited on WikiAves under catalog number 3499237)   |
| 16 July 2020             | Braga                     | 27°32'36"S<br>53°44'34"W  | Patches of secondary forest                     | A. Fick observed an eagle flying (a photo was deposited on WikiAves under catalog number 3880108)  |

for the rural area and then returning with an unidentified bird (Figure 2B) could be interpreted as an example of the role of mosaic habitat preference. Willis (1988) observed that this way of foraging is favored by wings longer than those of its congeners, more adapted for soaring and gliding, which also explains why it is often found near open habitats and at forest edges. Moreover, Menq (2015) recorded this eagle using open areas for hunting. This habit of hunting birds may often lead *S. melanoleucus* to hunt domestic prey, such as chicken and ducks, with some reports of it being fatally shot by dwellers, as seen by Chebez (2009) in Misiones,

Argentina.

**Interaction with other raptors.** I watched seven events of interactions with other raptor species. Five of them were birds defending their territories against *S. melanoleucus*, including the Plumbeous Kite (*Ictinia plumbea*), the Swallow-tailed Kite (*Elanoides forficatus*), and the Short-tailed Hawk (*Buteo brachyurus*). Another interaction involved an *S. ornatus* individual chased away by an *S. melanoleucus* individual. One last interaction was the kleptoparasite behavior of two Southern Caracaras (*Caracara plancus*) against *S.*



**Figure 2.** A) Black Hawk-Eagle (*Spizaetus tyrannus*) recorded at Atafona District, in Santo Ângelo, RS, Brazil, soaring over patches of secondary forest next to the Ijuí River. B) Black-and-White Hawk-Eagle (*Spizaetus melanoleucus*) returning to the forest with a prey in its talons, caught in the surroundings of PET. C) An adult Ornate Hawk-Eagle (*Spizaetus ornatus*) with an agouti in its claws in the road that leads to Salto do Yucumã. Photos: DAM.

*melanoleucus* (Table 2).

### ***Spizaetus ornatus***

**Occurrence in the region.** In addition to the historical record of an *S. ornatus* individual in Panambi in 1915 (Pinto 1938), the records reported herein are the only known records for northwestern RS (Table 3). There is still suitable habitat in TIG, but the species was not found there in recent raptor surveys (Meller 2014).

This species is usually considered a trustworthy indicator of well-conserved forests, often being the most common *Spizaetus* hawk-eagle in primary forest and the first one to decline with habitat loss (Thiollay 1985). In the region of Taquara, RS, it was considered the most common hawk-eagle by naturalists in the 19<sup>th</sup> century. It was deemed ex-

tinct in the state after that for a long time until its recent rediscovery (Berlepsch & Ihering 1885, Bencke et al. 2003, Mendonça-Lima et al. 2006). Although there are no historical records for PET, it is reasonable to assume, from the record made in Panambi, RS (Pinto 1938), that the species was distributed all over the forests of northwestern RS. The vast deforestation of the region in the past (Albuquerque 1977) probably led to a massive reduction of *S. ornatus* populations in northwestern RS. Therefore, the various recent records in PET could be the result of a population recovering in the area. Until the 1950s, logging was intense in the region, including the park (Silva et al. 2005). With legal protection, in 1947 a regeneration process started. This recovery probably provided more suitable habitat sites to this hawk-eagle, and this regeneration has also been observed in other forest remnants in the region and the state of RS as well (Vacarro &

**Table 3.** Recent records of the Ornate Hawk-Eagle (*Spizaetus ornatus*) in northwestern Rio Grande do Sul, Brazil. (\*) Territorial behavior.

| Date              | Locality                         | Coordinates            | Habitat                           | Description of observations  |
|-------------------|----------------------------------|------------------------|-----------------------------------|--|
| 02 November 2010  | Salto do Yucumã Road             | 27°10'01"S, 53°51'22"W | Primary forest                    | A second-year immature spotted over the road, soon flying into the forest. Then a <i>B. brachyurus</i> started to vocalize. After that, the <i>S. ornatus</i> individual soared over the canopy into a thermal with a <i>C. aura</i> |
| 25 November 2010  | Mairosa Stream, PET, Derrubadas  | 27°09'54"S, 53°53'20"W | Primary forest                    | An adult perched on a branch of a <i>Peltophorum dubium</i> tree   |
| 03 March 2013     | Salto do Yucumã                  | 27°08'44"S, 53°53'03"W | Primary forest river bank         | A juvenile perched on a tree, peeking at a limpkin ( <i>Aramus guarana</i> )   |
| 19 October 2013   | Salto do Yucumã                  | 27°08'39"S, 53°53'06"W | Primary forest river bank         | A second-year immature (probably the same eagle) perched in the lower vegetation   |
| 18 March 2014     | Lagoa das Marrecas, PET          | 27°13'46"S, 53°51'02"W | Primary forest natural clearing   | An adult spotted at the edge of this clearing  |
| 18 August 2014    | Visitors Center, PET, Derrubadas | 27°13'57"S, 53°51'04"W | Primary forest edge               | An adult perched on a tree   |
| 29 November 2014  | Uruguay River, PET, Derrubadas   | 27°14'21"S, 54°00'54"W | Primary forest river bank         | A juvenile flying over the riparian forest (pers. comm. A.P. Gauer)  |
| 10 March 2015     | Salto do Yucumã Road             | 27°08'56"S, 53°52'04"W | Primary forest                    | An adult eating a tegu ( <i>Salvator merianae</i> ) at the ground of the road  |
| 12 March 2015     | Salto do Yucumã                  | 27°08'23"S, 53°53'02"W | Primary forest river bank         | An adult trying to catch a Snowy Egret ( <i>Egretta thula</i> ) in the river bank; after the unsuccessful attempt, it went to drink water in the river   |
| 13 March 2015     | Salto do Yucumã                  | 27°08'36"S, 53°53'02"W | Primary forest river bank         | An adult spotted in the riparian forest  |
| 13 May 2015       | Salto do Yucumã Road             | 27°08'16"S, 53°52'55"W | Primary forest                    | An adult with an agouti ( <i>Dasyprocta azarae</i> ) in its talons; the hawk-eagle was perching on the ground. After we spotted it, it took flight with its prey and perched in a tree about 5 m high (Fig. 2C)                      |
| 19 August 2015    | Salto do Yucumã Road             | 27°11'42"S, 53°50'41"W | Primary forest                    | * An adult flying high, noticed first by its territorial vocalization  |
| 06 September 2015 | Campestre, PET                   | 27°14'09"S, 53°58'42"W | Primary forest natural clearing   | An adult flying high when intercepted by an <i>S. melanoleucus</i> individual. After a few moments flying together, and sometimes having been attacked, the <i>S. ornatus</i> went away  |
| 05 March 2016     | Salto do Yucumã Road             | 27°12'55"S, 53°51'16"W | Primary forest                    | * L.E. Santos (pers. comm.) and T. Wagener observed an adult flying high and vocalizing over the forest (photo deposited on WikiAves under catalog number 2044263)   |
| 14 May 2016       | SY recreational area, PET        | 27°08'21"S, 53°52'57"W | Primary forest anthropic clearing | * An adult perched on a <i>Peltophorum dubium</i> , where there was a group of <i>C. aura</i> chasing all of them away. After that, another hawk-eagle called from inside the forest, making the first one fly in that direction     |
| 05 June 2016      | Visitors Center, PET             | 27°13'57"S, 53°51'04"W | Primary forest edge               | An adult spotted in this area  |
| 01 July 2016      | Visitors Center, PET             | 27°13'57"S, 53°51'04"W | Primary forest edge               | An adult soaring in a thermal at the end of the morning  |
| 20 July 2016      | SY recreational area, PET        | 27°08'21"S, 53°52'57"W | Primary forest anthropic clearing | An agouti preyed upon by an adult <i>S. ornatus</i>  |
| 07 February 2017  | Salto do Yucumã Road             | 27°12'45"S, 53°51'19"W | Primary forest                    | An adult flying from the edge of the road to perch on a tall <i>Apuleia leiocarpa</i>  |
| 23 January 2018   | Road to Porto Garcia             | 27°13'18"S, 53°59'32"W | Primary forest                    | An adult photographed by M. Elsenbach (pers. comm.) on a road, perching on the ground  |
| 17 September 2018 | Trail inside PET                 | 27°11'31"S, 53°51'18"W | Primary forest                    | A juvenile found in a remote place inside the park   |
| 18 September 2018 | Trail inside PET                 | 27°11'S, 53°51'W       | Primary forest                    | * A juvenile vocalizing and flying from one emergent tree to another; after that, soaring and vocalizing over a valley, where a pair of adults started to vocalize and soar  |
| 21 September 2018 | Trail inside PET                 | 27°11'17"S, 53°51'01"W | Primary forest                    | A juvenile perched on an <i>A. leiocarpa</i>   |
| 19 December 2018  | Salto do Yucumã Road             | 27°12'55"S, 53°51'16"W | Primary forest                    | An adult with full crop was photographed by C.N. Kuhn (pers. comm.)  |
| 31 December 2018  | Road to Porto Garcia             | 27°14'25"S, 53°58'18"W | Primary forest natural clearing   | A juvenile was photographed on the ground by a camera trap; picture provided by C.N. Kuhn (pers. comm.)  |
| 05 February 2019  | Road to Porto Garcia Road        | 27°14'25"S, 53°58'18"W | Primary forest natural clearing   | A juvenile was photographed in the ground by a camera trap; picture provided by C.N. Kuhn (pers. comm.)  |
| 21 June 2019      | Campestre, PET, Derrubadas       | 27°14'09"S, 53°58'42"W | Primary forest natural clearing   | An adult in gliding flight   |
| 15 February 2021  | Campestre, PET, Derrubadas       | 27°14'09"S, 53°58'42"W | Primary forest natural clearing   | * Two adult <i>S. ornatus</i> flying high, vocalizing and doing courtship displays   |
| 16 March 2021     | Centro Novo, PET, Derrubadas     | 27°15'01"S, 53°56'56"W | Second-growth forest fragment     | An immature second-year <i>S. ornatus</i> was being mobbed by some Plush-crested Jays while perched on a tree in a rural property, probably trying to catch domestic birds   |

Longhi 1995, Fontana et al. 2003).

This species is commonly shot for threatening domestic animals. For instance, Zilio (2017) found chicken in the diet of *S. ornatus* in southern Brazil. It is possible that hunting has contributed to its decline in the region. There is at least one record of this kind involving a raptor in the surroundings of PET, where a Harpy Eagle (*Harpia harpyja*) was shot in the 1970s (Meller & Guadagnin 2016). The rural exodus of people towards cities carried out in the Derrubadas municipality in recent years (Silva et al. 2005) probably helped the recovery of the *S. ornatus* population, as with less dwellers there would be less exposure to shootings at the edge of the forest.

**Territorial behavior.** I report five instances of territorial behavior by *S. ornatus*. These records involved, in four occasions, at least one adult soaring high while producing territorial vocalizations, which could indicate they were close to the center of their territories. On another occasion, a perched eagle was vocalizing in interaction with a second individual (Table 3). It is known that this species often soars over its nesting territory (del Hoyo et al. 1994). In a long-term study in Guatemala, Whitacre et al. (2012) observed that the behavior of soaring high over the forest, at times with calls, was the primary mechanism of signaling territorial ownership. The territorial instance in which the eagle was perched was at the recreational area of the Salto do Yucumã, and could

represent another pair close to the center of their territory (see Table 3). Next to this recreational area, an *S. ornatus* juvenile was observed three years before, and a second-year immature six months later. Adults were also observed at the recreational area of the Salto do Yucumã, sometimes hunting and feeding (Figure 2C). These records indicate that *S. ornatus* likely breeds in PET, and the species has also been reported in nearby areas of Misiones, Argentina (Seipke & Cabanne 2002).

**Food and hunting behavior.** The hunting and feeding observations of *S. ornatus* preying on Azara's Agouti (*Dasyprocta azarae*), the Black and White Tegu (*Salvator merianae*), and an attempt to catch a Snowy Egret (*Egretta thula*) revealed a versatile hunter of relatively large species (Table 3, Figure 2C). Del Hoyo et al. (1994) report that *S. ornatus* has a preference for large vertebrates, and mention toucans and guans as part of its diet. In the Atlantic Forest of southern Brazil, birds, including large preys such as Brown Tinamous (*Crypturellus obsoletus*) and Dusky-legged Guans (*Penelope obscura*), were the most abundant prey in nests (Joenck et al. 2011, Zilio 2017), whereas Southeastern Squirrels (*Guerlinguetus ingrami*) and Azara's Agoutis (*D. azarae*) were the only mammals found in these studies.

**Interactions with other raptors.** I report three interactions of *S. ornatus* with other raptor species (Table 3). Two of them involved territorial defense by *B. brachyurus* and *S. melanoleucus* against *S. ornatus*. The third instance involved dozens of Turkey Vultures (*Cathartes aura*) that flew away after an *S. ornatus* individual arrived by surprise to the tree they were perched on.

**Conservation issues.** If there is an *S. tyrannus* population in the extant forests of the Ijuí River basin, it should be facing conflicts with humans, as reported in Misiones, Argentina (Chebez 2008). This could also happen to *S. melanoleucus* if there was a population in the Ijuizinho River basin. This situation would most likely occur in the surroundings of PET, TIG and Parizinho Corridor, as the species uses forest edges to patrol its territory and hunting. *S. ornatus* may also be susceptible to this type of conflict in the surroundings of PET. Other threats to *S. ornatus* come from hunting pressure inside PET, and certainly from the predicted flooding by Panambi's Hydroelectric Project, which would result in the loss of riparian forests and the disconnection of PET from the Yabotí Biosphere Reserve in Misiones, Argentina (Bencke et al. 2006, Meller 2014, Meller & Guadagnim 2016). Joenck et al. (2011), based on their experience at the Pelotas and Uruguay River basins, brought up an alert on the damage that hydroelectric structures can cause to this species.

It is important to mention that PET, TIG, Parizinho Corridor, and the Ijuí River basin are classified as important areas for the conservation of biodiversity in Brazil (MMA 2007), but the latter two don't have legal protection for their forests. Maintaining a healthy population of *Spizaetus* hawk-eagles in northwestern RS requires consideration to the Garabi-Panambi's Hydroelectric complex, the hydroelectric projects in the Ijuí and Ijuizinho Rivers basins, hunting in PET, hunting and logging in TIG, the lack of a protected area in the Ijuí River basin, and the abandonment of the Parizinho Corridor restoration project. Therefore, much of the native fauna

in the region would also benefit from the "umbrella" role played by *Spizaetus* hawk-eagles.

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