

## THE WHITE-RUMPED HAWK (*BUTEO LEUCORRHUS*) IN SOUTHERN BRAZIL: STATUS, CONSERVATION, AND FIRST DESCRIPTION OF THE NEST

Felipe Zilio<sup>1</sup> & André de Mendonça-Lima<sup>2</sup>

<sup>1</sup>Programa de Pós-graduação em Biologia Animal, Departamento de Zoologia, Universidade Federal do Rio Grande do Sul, Av. Bento Gonçalves, 9500, Porto Alegre, RS, Brasil.

*E-mail:* fzilio@msn.com

<sup>2</sup>Programa de Pós-graduação em Ecologia, Departamento de Ecologia, Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, Brasil.

**Resumo.** – O gavião-de-sobre-branco (*Buteo leucorrhous*) no sul do Brasil: status, conservação e a primeira descrição do ninho da espécie. – O gavião-de-sobre-branco é uma espécie florestal rara ao leste de sua distribuição, no bioma Mata Atlântica, com poucos registros recentes para Brasil. A biologia reprodutiva da espécie é pouco conhecida, oriunda de poucos relatos, sem descrição detalhada do ninho ou período reprodutivo. Nós apresentamos novos registros para a espécie no sul do Brasil coletados durante um período de sete anos de amostragens de aves de rapina na bacia do rio Pelotas e na bacia do rio Guaporé, no sul do Brasil. Também apresentamos o primeiro registro de nidificação da espécie na Mata Atlântica, com descrição detalhada de um ninho e ovos. Foram observados 95 gaviões, sendo apenas um registro ocorrido na bacia do rio Guaporé e um total de 35 indivíduos estimados para a bacia do rio Pelotas. Em sua maioria foram observados indivíduos solitários, mas em sete ocasiões foram observados casais realizando displays aéreos. Um ninho foi encontrado em outubro de 2009, em Campo Belo do Sul, Santa Catarina. O ninho foi construído em um talhão de *Pinus elliottii* com 27 anos de idade, apresentando sub-bosque relativamente denso e cercado por remanescentes de floresta secundária e campo. O ninho (54 x 38 cm de diâmetro e 18 cm de altura) encontrava-se a 22 m de altura e continha dois ovos de coloração clara, manchados de marrom. Nossos resultados sugerem que a espécie possa estar subestimada no sul do Brasil. Embora os poucos registros recentes tenham ocorrido apenas em grande remanescentes florestais, é possível que a altitude seja o fator mais limitante à distribuição da espécie.

**Abstract.** – The White-rumped Hawk is a forest species, rare in the eastern portions of its distribution in the Atlantic Forest biome, with few recent records for Brazil. The reproductive biology of the species is poorly known, from only a few accounts, and with no detailed descriptions of the nest or reproductive period. Here we present new records for the species in southern Brazil, collected over seven years of raptor surveys in the Pelotas River basin and in the Guaporé River basin. We also present the first nesting record of the species in the Atlantic Forest, with detailed descriptions of a nest and eggs. A total of 95 raptors were recorded, only one from the Guaporé River basin. In the Pelotas River basin, a total of 35 individuals was estimated. Most observations were of solitary individuals, but on seven occasions we observed pairs performing aerial displays. A nest was found in October 2009, in Campo Belo do Sul, Santa Catarina. The nest was in a 27-year-old stand of *Pinus elliottii*, with a relatively dense understory and surrounded by grassland and remnants of secondary forest. The nest (54 cm long, 38 cm wide, and 18 cm in external depth) was constructed at a height of 22 m, and contained two creamy-white eggs with rust-brown scrawls and spots. Our observations suggest that the numbers of this species in southern Brazil may be underestimated. Although a few recent records have occurred only in large forest rem-

nants, it is possible that altitude is an important constraint on the distribution of this species. *Accepted 12 January 2012.*

**Key words:** White-rumped Hawk, *Buteo leucorrhous*, conservation, reproduction, Atlantic Forest, Brazil.

## INTRODUCTION

The White-rumped Hawk (*Buteo leucorrhous*) is a Neotropical raptor with a disjunct distribution (Thiollay 1994, Ferguson-Lees & Christie 2001). In South America, it inhabits high-altitude forests (above 1,500 m a.s.l.) in northern and western Venezuela and northern Colombia through Peru, Bolivia, and northwestern Argentina (Thiollay 1994, Ferguson-Lees & Christie 2001). Its eastward range extends patchily to the Atlantic Forest of Paraguay, northeastern Argentina, and southern Brazil (Rio Grande do Sul northward to northern Minas Gerais and Rio Janeiro) (Thiollay 1994, Sick 1997, Ferguson-Lees & Christie 2001).

Common in the western part of its range, this hawk is rare and locally threatened in the eastern portion, where its populations may be declining (Thiollay 1994, Bierregaard 1995, Ferguson-Lees & Christie 2001). In southern Brazil, the White-rumped Hawk is critically endangered in Rio Grande do Sul, threatened by deforestation and habitat fragmentation (Marques *et al.* 2002, Bencke *et al.* 2003). Apparently less rare in the past, recently it has been recorded in a few locations in northern Rio Grande do Sul (Bencke *et al.* 2003). Although it is not considered to be locally threatened in the states of Paraná and São Paulo, few recent records exist from these regions (Mikich & Bérnils 2004, Silveira *et al.* 2009, Soares *et al.* 2008). In Santa Catarina, the species is rare, recorded mostly in the eastern portion of the state (Rosario 1996).

The breeding biology of the White-rumped Hawk is poorly known. Copulation was observed in Ecuador in June (Freile & Chaves 2000), and one active nest was recorded in February–March in Colombia

(Hilty & Brown 1986). Brooding of 1–2 (locations not provided) and 2–3 eggs (Argentina) was mentioned (Thiollay 1994, Ferguson-Lees & Christie 2001), but without detailed descriptions of the shapes or sizes of the nest or eggs. Brown & Amadon (1968) reported an egg from Brazil, collected in October, and described the sizes of six other eggs (without mentioning their origin). Here we present new records and the first observations of breeding, with a detailed description of the nest and eggs, of the White-rumped Hawk in southern Brazil.

## STUDY AREA AND METHODS

*Study area.* The data presented here were collected over seven years (from 2002 to 2004 and 2007 to 2010) in two studies conducted in the Pelotas and Guaporé river basins in southern Brazil (Fig. 1). The faunal monitoring program of the Barra Grande Hydroelectric Power Station (hereafter BGHPS) started in August 2002, with a rapid survey in 10 areas in the Pelotas River basin, in Santa Catarina (SC) and Rio Grande do Sul (RS) (Fig. 1b). In 2003, monitoring was reduced to four areas in the municipalities of Campo Belo do Sul (SC) (A2 and A3; 27°58'S, 50°49'W; 961 m a.s.l.), Bom Jesus (RS) (A6, 28°18'S, 50°42'W; 911 m a.s.l.), and Anita Garibaldi (SC) (A8, 27°47'S, 51°08'W; 851 m a.s.l.).

The region has a subtropical highland climate (Cfb, Köppen classification), with warm summers, cold winters (with frost), and no defined dry season. The mean annual rainfall ranges around 1500–2000 mm, and the mean annual temperature from 16–22°C, being usually below 0°C in winter and up to 35°C in summer (Nimer 1990 *apud* Overbeck *et al.*

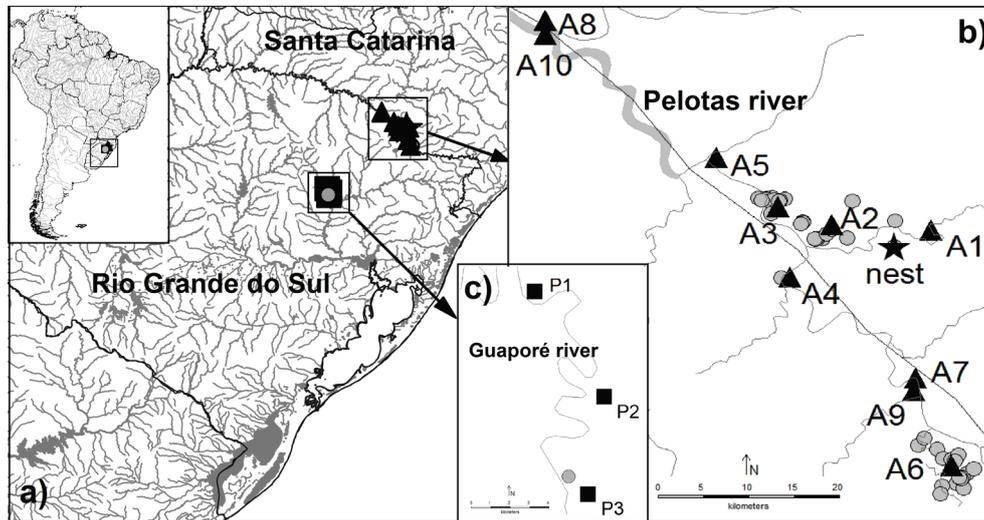


FIG. 1. Study areas in southern Brazil (a) and records of White-rumped Hawk (grey dots) in Pelotas river basin (b) and Guaporé river basin (c). Triangles are areas surveyed (in b) and squares are point counts (in c). Grey lines represent rivers and dark lines the political boundaries of the Brazilian states. Central coordinates and approximate mean elevation (a.s.l.): A1 = 28°01'S, 50°44'W, 895 m; A2 = 28°02'S, 50° 51'W, 887 m; A3 = 27°59'S, 50°54'W, 938 m; A4 = 28°04'S, 50°53'W, 961 m; A5 = 27°56'S, 50°57'W, 894 m; A6 = 28°18'S, 50°42'W, 911 m; A7 = 28°11'S, 50°45'W, 898 m; A8 = 27°47'S, 51°08'W, 851 m; A9 = 28°12'S, 50°45'W, 865 m; A10 = 27°48'S, 51°08'W, 815 m; P1 = 28°55'S, 51°56'W, 363 m; P2 = 28°58'S, 51°54'W, 406 m; P3 = 29°01'S, 51°54'W, 412 m.

2007). Seasonal Deciduous Forest covers the lower stretches along the banks of the Pelotas River. In the upper parts, between 400 m and 1000 m a.s.l., the forest changes to Araucaria Moist Forest (characterized by the presence of the Brazilian Pine *Araucaria angustifolia*), mixed with natural grasslands that replace the forest on the hilltops (Klein 1978, IBGE 1992). In addition to Brazilian Pine, *Ocotea puberula*, *Ocotea pulchella*, *Ilex paraguariensis*, *Cryptocarya aschersoniana*, *Nectandra megapotamica*, *Nectandra lanceolata*, and *Nectandra grandiflora* are common in these forests (Klein 1978, IBGE 1992). Areas A2 and A3, within the tract managed by the company Florestal Gateados Ltda., include large areas of exotic tree plantations (*Pinus* spp., about 7000 ha; *Eucalyptus* spp., about 500 ha; and *Araucaria angustifolia*, about 500 ha). Nevertheless, 6000 ha are covered by native forests, which are legally pro-

tected (RPPN Emílio Einsfeld Filho). In area A6, the secondary forest (mainly in river valleys) is mixed with natural grasslands (on the hilltops); area A8, the most disturbed area, is a group of small cattle ranches surrounded by remnants of secondary forest, mostly in river valleys.

In the Guaporé River basin, raptors were surveyed from April 2008 to November 2010, in the municipalities of Guaporé and Dois Lajeados (Fig. 1c). The region is similar to the Pelotas River basin, but lower in altitude, around 400–500 m a.s.l. The climate is subtropical humid (Cfa, Köppen classification), with mean annual precipitation around 2000 mm and mean annual temperature around 18°C (usually < 0°C in winter and > 30°C in summer) (means from the last 18 years in Guaporé). Seasonal Deciduous Forest covers the lower-elevation areas and is replaced by

Araucaria Moist Forest in higher areas, but natural grasslands no longer exist. The region has been intensively modified by human activities, and the original forested habitats are almost entirely replaced by farmlands.

*Survey method.* In the BGHPS area, records of raptors from September 2002 to December 2004 were obtained opportunistically during other monitoring activities rather than in specific surveys. In April 2007, as part of the faunal monitoring program, raptors began to be monitored with the fixed point count method. From April 2007 to January 2010 (except in the spring of 2009), four areas (A2, A3, A6, A8) were surveyed once per season, for 4–6 days per area. The White-rumped Hawk was recorded during raptor surveys carried out in eight fixed point counts, each over a 1-km radius (Whitacre *et al.* 1992), 5 km distant from each other (Fig. 1). The point counts were conducted in elevated areas (cliffs, hilltops), usually on edges, with a broad view over the forest. Counts began between 08:10 h and 09:30 h (2–3 h after sunrise, UTC –3) and lasted for 3–5 h. The mean length of the counts was  $4.67 \pm 1.1$  h (SD) and the total time spent surveying raptors, in 43 days, was 402 h (A2 = 105 h, A3 = 109 h, A6 = 97 h, A8 = 91 h). Surveys were conducted by one observer, with 10x42 binoculars and a 20–60x spotting scope, mostly on sunny days with calm winds. No surveys were done during rainy periods.

In the Guaporé River basin, the survey method followed the BGHPS surveys (survey schedule, number of observers, weather conditions). Three 1-km fixed radius point counts were conducted near cliffs or hilltops, with a broad view of the Guaporé River valley, at least 5 km distant from each other (Fig. 1c). Counts began between 08:15 h and 09:30 h (2–3 h after local sunrise) and lasted for 3–5 h. The mean length of counts was  $4.75 \pm 0.47$  h (SD) for a total of 114.5 h in 10 surveys.

*Population estimates and data analyses.* The minimum number of individuals (MNI) and the relative abundance were estimated for each campaign. The MNI was estimated based on date, time, and location of records, and age (juvenile or adult), molt stage, or natural marks of individuals observed. Individuals without natural distinguishing features (age, molt, or marks) recorded on different dates, or at different times on the same date, were considered as different individuals only if the records occurred at least 2 km apart. White-rumped Hawk density was estimated for the Florestal Gateados Ltda. (A2+A3; ca. 17,000 ha) and for A6 (ca. 4000 ha) areas. Estimates were based on the pair home-range sizes (133 ha) of the Red-shouldered Hawk (*Buteo lineatus*) (Howell & Chapman 1997), and on the mean (131 ha) and largest size (421 ha) of home-ranges of the Roadside Hawk (*Buteo magnirostris*) (Granzinoli 2009). The relative abundance of the White-rumped Hawk was calculated as the number of individuals observed per hour in the point-count surveys.

We performed an Analysis of Variance to evaluate seasonal and spatial differences in the relative abundance of hawks in the BGHPS areas. The non-parametric Kruskal-Wallis test and the post-hoc multiple comparison test ('kruskalmc' function of the 'pgirmess' package for R) was performed because of the heteroscedasticity of the data (Bartlett's test; Sokal & Holf 1995). The analysis was done with the R software package (R Development Core Team 2011), and statistical significance was set at  $P = 0.05$ .

## RESULTS

*White-rumped Hawk records.* A total of 74 observations of White-rumped hawks (95 raptors observed) were made during the surveys. White-rumped hawks were first recorded in September 2002. A pair was observed soaring and calling in A4 (Fig. 1b), but no records

were made in the other nine areas surveyed in that year, nor in the four areas surveyed in 2003. Only one observation was made in 2004, in area A3. From April 2007 to January 2010, a total of 71 observations of White-rumped hawks (91 raptors observed) were recorded at three locations in the BGHPS (A2, A3, A6; Fig. 1b). Most observations were of single individuals ( $n = 61$  observations) or pairs ( $n = 9$ ), mainly flying above the forest or soaring high in thermals ( $n = 66$ ). Perched hawks were observed 15 times (15.8% of the observations), always a single hawk perched in a tree, near a road or forest edge, in native forest ( $n = 6$ ), *Pinus* sp. stands ( $n = 5$ ), and *Araucaria angustifolia* stands ( $n = 4$ ). In the Guaporé River basin, only one individual was recorded, soaring above the river, in March 2009 (Fig. 1c).

*Abundance and population estimates.* The relative abundance of the White-rumped Hawk was 0.11 ind./h in BGHPS, and did not differ among areas ( $H = 0.12$ ,  $df = 2$ ,  $P = 0.94$ ). Although the species was recorded throughout the year, the relative abundance differed among seasons ( $H = 8.45$ ,  $df = 3$ ,  $P = 0.04$ ). Most of the contacts occurred during autumn (Table 1), but abundance differed only between autumn and winter ( $P < 0.05$ ). In the Guaporé River, the relative abundance of the White-rumped Hawk was 0.009 ind./h (single record, Table 1).

The minimum number of individuals (MNI) recorded in each area ranged between 1 and 10 per survey (no records in eight campaigns, Table 1). We estimated a total of 35 individuals recorded in the BGHPS (A6 = 15 ind.; A3 = 8 ind.; A2 = 10 ind.; A4 = 2 ind.). A total of 130–133 potential territories was estimated in the Florestal Gateados Ltda. area (A2 + A3), and 30–31 in A6. More conservative estimates, based on the largest territory size of the Roadside Hawk (421 ha, Granzinoli 2009), would give 41 potential territories

in Florestal Gateados Ltda. and nine in A6.

*Aerial displays.* Mutual aerial displays of White-rumped Hawk pairs were observed on seven occasions, all but one between mid-April and early May. The first observation occurred in September 2002, in area A4, when a pair was observed soaring and calling. In April 2008, three pairs were observed in area A6. On 13 April, at 09:30 h, a pair was observed at the forest-grassland edge. The female was flying low (soaring in circles), just above the canopy; while the male was flying higher, calling, in a series of short dives. At times, the male dove toward the female, which remained soaring, and then turned back up. No contacts, foot-touching, or whirling (*sensu* Brown & Amadon 1968) were observed. This behavior was performed for 40 min before visual contact with the hawks was lost. On the following day, similar behavior was observed about 1 km away. On 15 April at about 10:00 h, two pairs were observed in the same location where a pair was recorded on 13 April. One pair was observed during 30 min, soaring higher above the forest, while another displayed as above. On 18 April, about 4 km distant, a pair was observed gliding in a thermal at 10:40 h. On 5 May 2008, at 09:23 h, a pair was observed soaring in a thermal and, at the same time, a single individual was seen soaring away. In the following year, on 20 April (about 10:00 h), two pairs were observed in area A3. They were flying together and calling.

*Nest and nest site characteristics.* A nest of White-rumped Hawk was found on 2 October 2009 in the Florestal Gateados Ltda. area in Campo Belo do Sul, southern Santa Catarina, Brazil (Fig. 1), where a pair was observed.

The nest was in a 27-year-old stand of *Pinus elliottii*, with a canopy of around 26 m in height. The understory was relatively dense, composed by native tree species (mainly

TABLE 1. Minimum number of individuals (MNI) observed and relative abundance (RA = individuals/hour) of the White-rumped Hawk in Barra Grande Hydroelectric Power Station areas (A2, A3, A6; A8 with no records) from April 2007 to January 2010 and in Guaporé river basin (A11) from April 2008 to November 2010 (- = no field campaigns carried out). Season: Summer = January to March; Autumn = April to June; Winter = July to September; Spring = October to December. \*MNI estimated was 36 individuals (data presented here plus two individuals recorded in A4).

| Year      | Season | AD2 |      | AC3 |      | AD6 |      | GP  |      | Total |      |
|-----------|--------|-----|------|-----|------|-----|------|-----|------|-------|------|
|           |        | MNI | RA   | MNI | RA   | MNI | RA   | MNI | RA   | MNI   | RA   |
| 2007      | Autumn | 3   | 0.10 | 2   | 0.10 | 0   | 0.00 | -   | -    | 5     | 0.07 |
|           | Winter | 0   | 0.00 | 2   | 0.00 | 0   | 0.00 | -   | -    | 2     | 0.00 |
|           | Spring | 1   | 0.10 | 3   | 0.00 | 1   | 0.10 | -   | -    | 5     | 0.07 |
| 2008      | Summer | 0   | 0.00 | 1   | 0.00 | 0   | 0.00 | -   | -    | 1     | 0.00 |
|           | Autumn | 4   | 0.40 | 1   | 0.10 | 8   | 0.67 | 0   | 0.00 | 13    | 0.26 |
|           | Winter | 1   | 0.00 | 1   | 0.00 | 2   | 0.20 | 0   | 0.00 | 4     | 0.05 |
| 2009      | Spring | 1   | 0.10 | 1   | 0.10 | 0   | 0.00 | 0   | 0.00 | 2     | 0.05 |
|           | Summer | 2   | 0.20 | 3   | 0.10 | 5   | 0.20 | 1   | 0.07 | 10    | 0.14 |
|           | Autumn | 1   | 0.00 | 5   | 0.40 | 10  | 0.40 | 0   | 0.00 | 16    | 0.18 |
| 2010      | Winter | 0   | 0.00 | 1   | 0.00 | 0   | 0.00 | 0   | 0.00 | 1     | 0.00 |
|           | Spring | 2   | -    | -   | -    | -   | -    | 0   | 0.00 | 2     | 0.00 |
|           | Summer | 2   | 0.20 | 1   | 0.10 | 0   | 0.00 | 0   | 0.00 | 3     | 0.07 |
| Sub-total | Autumn | -   | -    | -   | -    | -   | -    | 0   | 0.00 | 0     | 0.00 |
|           | Winter | -   | -    | -   | -    | -   | -    | 0   | 0.00 | 0     | 0.00 |
|           | Spring | -   | -    | -   | -    | -   | -    | 0   | 0.00 | 0     | 0.00 |
| Total     | Summer | 2   | 0.13 | 4   | 0.07 | 5   | 0.07 | 1   | 0.04 | 0     | 0.08 |
|           | Autumn | 7   | 0.17 | 6   | 0.20 | 14  | 0.38 | 0   | 0.00 | 0     | 0.18 |
|           | Winter | 1   | 0.00 | 2   | 0.00 | 2   | 0.08 | 0   | 0.00 | 0     | 0.02 |
| Total     | Spring | 4   | 0.10 | 4   | 0.05 | 1   | 0.06 | 0   | 0.00 | 0     | 0.05 |
|           | Summer | 10  | 0.10 | 8   | 0.08 | 15  | 0.15 | 1   | 0.01 | 34*   | 0.08 |

young individuals), reaching around 6 m in height. The most abundant understory species were *Cupania vernalis*, *Nectandra megapota-mica*, *Piptocarpha angustifolia*, *Gochnatia polymorpha*, *Litbraea brasiliensis*, and *Symplocos tetrandra*. The stand was one of a group of several 27-year-old stands of *P. elliotii* that covered about 170 ha on the hilltops. The stands were bounded by a 6000 ha remnant of secondary old-growth forest to the west and south, and by grasslands and young stands of *Pinus* spp. on the other sides.

The nest was on the top of a *P. elliotii* (DBH = 203 cm; height = 26 m), which had an uncommon shape. This tree had five terminal branches, forming a sort of crown that

supported the nest (Fig. 2). On 24 October, the tree was climbed. The nest was 22 m high, and was constructed of small *Pinus* branches and a few sticks of other plants (Fig. 2). The nest, a low cup/fork type according to the nest classification of Simon & Pacheco (2005), was 54 cm long, 38 cm wide, and 18 cm in external depth. The nest chamber was 12.7 cm in diameter and 4.3 cm deep. It was lined with a few green leaves of *Litbraea brasiliensis* (Anacardiaceae), and contained two creamy-white eggs with rust-brown scrawls and spots. The eggs measured between 42.64–44.48 mm and 34.74–34.52 mm, and weighed 25–28 g. We were unable to return to the nest after this visit, but the



FIG. 2. Nest of the White-rumped Hawk in a *Pinus elliottii* stand (a) inside the Florestal Gateados Ltda., Campo Belo do Sul, Santa Catarina, Brazil. Nest (b, c) and eggs (d) in details.

stand was harvested in November 2009 (V. D. Ribeiro pers. com.).

## DISCUSSION

In the Atlantic Forest, the White-rumped Hawk has been recorded only above 600 m a.s.l., in both pristine and second-growth forests (Albuquerque 1995, Albuquerque & Brüggemann 1996, Mähler & Fontana 2000, Anjos 2002, Mendonça-Lima & Pacheco 2003, Gussoni & Campos 2004, Straube *et al.*

2005, Straube & Urben-Filho 2005a, Corrêa *et al.* 2008) as well as in highly fragmented ones (Anjos & Graf 1993, Anjos 2001). It seems to be absent or very rare at lower altitudes (below 500 m a.s.l.), even in large continuous forests. In Misiones, northern Argentina, only two individuals were observed in two years (Seipke & Cabanne 2002), and the species was not recorded at Turvo State Park, northwestern Rio Grande do Sul (Albuquerque 1981, Mähler 1996), at Iguaçú National Park (Straube *et al.* 2004, Straube & Urben-Filho

2005b), or in the Paraná River valley in north-western Paraná (Loures-Ribeiro & Anjos 2006). Contrasting with this apparent rarity, the White-rumped Hawk was one of the most abundant raptors recorded in the Pelotas River basin, even outnumbering other raptors, such as the Rufous-thighed Kite (*Harpagus diodon*), Sharp-shinned Hawk (*Accipiter striatus*), and Bicolored Hawk (*A. bicolor*) (pers. observ.). At least seven pairs of White-rumped Hawks are assumed to breed in BGHPS areas, but this number may be an underestimate. These areas could support about 50 to 100 potential territories, and less than half of them were actually surveyed. In contrast, the record in the Guaporé River basin was probably a vagrant (the species was not detected in the last two years, and this record is more than 100 km distant from the records in BGHPS or any other known record in Rio Grande do Sul).

The nesting record and the observation of individuals in all but one month (June) indicate that the White-rumped Hawk is a resident species in southern Brazil. The greater number of observations made during autumn, compared with other seasons, is likely related to easier detectability rather than to migratory or local movements. The White-rumped Hawk is an inconspicuous species when perched inside a forest, and during autumn, most records were of individuals flying above the forest or making aerial displays, which are more easily detected.

Our observations about the breeding biology of the White-rumped Hawk must be interpreted with caution. Although the single nest and the behaviors recorded provide important information about this poorly known raptor, further data are needed for solid conclusions about its nest-site preferences and breeding season. This nest was constructed at the edge of the pine stand, where a clearing provided unobstructed access to the nest, an important feature for

tree-nesting raptors (Moore & Henny 1983, Cerasoli & Penteriani 1996, Malan & Robinson 2001). The choice of a pine tree as a nest site might have been based on the ease of access to the nest tree, and probably does not indicate any preference for exotic over indigenous trees. In most of the area managed by Florestal Gateados Ltda., *Pinus*, *Eucalyptus*, and *Araucaria* plantations are contiguous with native forests, and several raptors, including the White-rumped Hawk, were recorded perched inside these exotic forests, especially in old-age woodlots of *Pinus* spp. (e.g., *Leucopternis polionotus* and *Spizæetus ornatus*; pers. observ.). Tree-nesting raptors have been reported to nest in exotic trees (*Eucalyptus*, *Pinus*, or *Acacia*) in both tropical Africa (e.g., *Accipiter melanoleucus* and *Stephanoæetus coronatus* in South Africa; Malan & Robinson 2001, Malan & Schultz 2002) and the Neotropics (e.g., *Accipiter striatus* in southern Brazil; Mendonça-Lima & Fontana 2000), in open or disturbed landscapes. Deforestation is the main threat to forest raptors in tropical regions (Bierregaard 1998); the presence of exotic forests might be more favorable than agriculture or cattle ranches for many species, increasing the availability of potential habitats in fragmented regions.

The White-rumped Hawk is presumed to breed in October in Brazil (Ferguson-Lees & Christie 2001), an hypothesis supported by our data. However, most of the aerial displays were recorded during the austral autumn (April to June). Pairs were observed circling together, calling, and performing dives and swooping flights, similar to the courtship behaviors of other raptors (Brown & Amadon 1968, Thiollay 1994, Ferguson-Lees & Christie 2001). The behavior as a whole suggests that it is related to breeding, but the nesting period, which is in spring (September–October), does not support this hypothesis. Also, the copulation behavior observed in Ecuador did not involve flight displays, but

rather perched vocalizations, similar to *Accipiter* and *Micrastur* spp. (Brown & Amadon 1968, Freile & Chaves 2000). Probably, the displays observed occurred outside the breeding season; such displays may be used by raptors to strengthen pair bonding (Brown & Amadon 1968, Wrege & Cade 1977). Large raptors, such as the Ornate Hawk-Eagle (*Spizaetus ornatus*) and Black-and-white Hawk-Eagle (*S. melanoleucus*), breed in the areas studied from autumn to spring (Joenck *et al.* in press, FZ unpubl. data), but they have long breeding cycles. Long breeding cycles would not be expected for smaller species, such as the White-rumped Hawk (Newton 1979, Thiollay 1994). The timing of breeding is related to weather and the availability of food (Newton 1979). Incubation periods of Neotropical hawks last a month, and laying during the Austral autumn (even late in the season) or in early winter necessitates feeding the nestlings in winter, when prey tend to be scarce, increasing the probability of breeding failure.

Our observations suggest that the White-rumped Hawk is not as rare in southern Brazil as has been assumed. Its distribution seems to be limited by altitude and by the size of forest remnants. Although studies in Paraná (Anjos & Graf 1993, Anjos 2001) supported, to a certain degree, the hypothesis that the White-rumped Hawk is tolerant of fragmented habitats (Thiollay 1994, Ferguson-Lees & Christie 2001), the absence of records in disturbed areas in BGHPS may argue against this assumption. In addition, recent records in Rio Grande do Sul were made only in large preserved areas (Bencke *et al.* 2003). The Pelotas River basin and probably also the Canoas River basin (in Santa Catarina) seem to be important areas that support nesting populations of the White-rumped Hawk in southern Brazil. Deforestation and, more recently, the construction of hydroelectric power plants, which have flooded large areas of undisturbed and old second-growth forest, are the major

threats to forest-inhabiting raptors in southern Brazil. Besides the obvious necessity of preservation of the undisturbed forest remnants, studies to remedy the lack of knowledge of the biology and ecology of the White-rumped Hawk are urgently needed in order to promote, at least locally, its future conservation.

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