ORNITOLOGIA NEOTROPICAL 18: 469–476, 2007

A DESCRIPTION OF A NEST AND NESTLINGS OF THE RUFOUS-THIGHED KITE (*HARPAGUS DIODON*), WITH ADDITIONAL COMMENTS ON DIET AND BEHAVIOR

Gustavo Sebastián Cabanne[1] & Ignacio Roesler[2]

[1]Departamento de Genética e Biologia Evolutiva, Instituto de Biociências, Universidade de São Paulo, Rua do Matão 277, 05508-090, São Paulo, SP, Brazil.
E-mail: gscabanne@yahoo.com

[2]Facultad de Ciencias Naturales y Museo, Universidad Nacional de La Plata, Buenos Aires, Argentina.

Descripción de un nido, de pichones y de aspectos de la dieta y comportamiento del Milano de Corbata (*Harpagus diodon*).

Key words: *Harpagus diodon,* Rufous-thighed Kite, Atlantic forest, *Tropidacris,* Itatiaia National Park, Juréia Ecological Station, Chapada Diamantina.

INTRODUCTION

The Rufous-thighed Kite (*Harpagus diodon*, Accipitridae) is a small raptor that inhabits primary and secondary rainforests in eastern and central South America (Thiollay 1994). It also occupies agro-ecosystems, but usually only those associated with native forest patches (Cabanne unpubl.). Even though the Rufous-thighed Kite is abundant in some regions (Anjos *et al.* 1997, Cabanne 2005), basic aspects of its breeding biology are totally unknown (Bierregaard 1995, 1998). Only one nest has been briefly mentioned (Wolfe 1938, Brown & Amadon 1968), nestlings and many aspects of behavior are unknown, and the breeding season is merely speculated (Cabanne 2005, Azevedo *et al.* 2007). The Rufous-thighed Kite is thought to prey mostly on insects and lizards, but its diet is also poorly known (Thiollay 1994, Bierregaard 1998, Ferguson-Lees & Christie 2001). Here we describe a nest and the nestlings of the Rufous-thighed Kite and report original observations on the kite's diet and general aspects of its reproductive biology.

METHODS

Study area. Table 1 presents the locations of studied breeding attempts. Nesting sites were in continuous Atlantic forest (Galindo-Leal & Câmara 2003), except in Guaraú. Lençois is in the eastern slope of the Chapada Diamantina region at the northern limit of the hilly range Serra do Espinhaço. The climate at Lençois is tropical and seasonal, with a rainy season from March to June (1000–1300 mm/year). Itatiaia National Park is in the northern hilly

TABLE 1: Studied breeding attempts of the Rufous–thighed Kite in eastern Brazil and estimated age of the young at the time of discovery.

Locality	Period of study	Effort (h)	Coordinates	Altitude (m a.s.l.)	Forest characteristics	Number of young	Estimated age of young (days)
Lençois, Bahia	27 March to 5 May 2006 (10 days)	18	12°35'S, 41°21'W	520	Secondary, semideciduous	1	11-14
Itatiaia National Park, Rio de Janeiro	19 January 2004	4	22°21'S, 44°44'W	800	Primary, ever green	1	30-35
Guaraú, Peruíbe, São Paulo	13 to 16 January 2006 (three days)	12	24°22'S, 47°01'W	3	Late secondary, lowland ever green	1	23-26
Barra do Una, Juréia State Park, São Paulo	13 January 2006	1	24°26'S, 47°03'W	20	Primary, lowland ever green	2	30-35

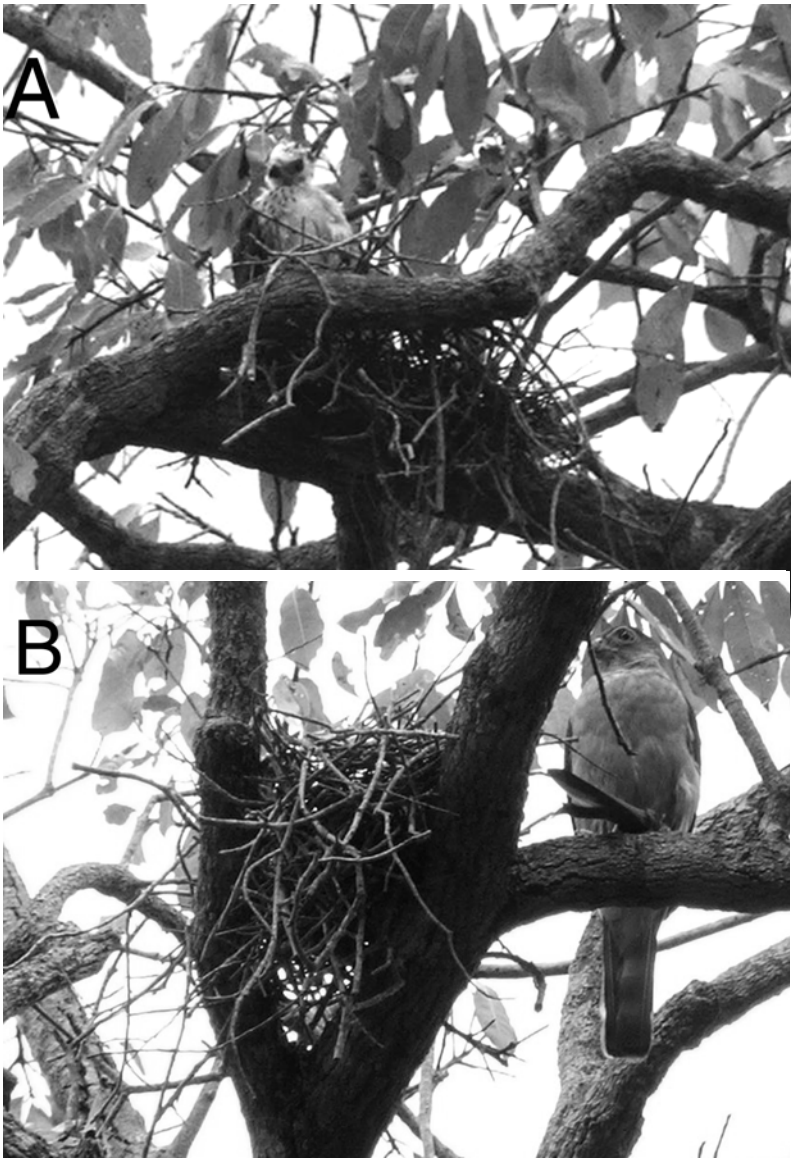

FIG. 1. Nest and nestling of the Rufous-thighed Kite, Bahia, Brazil. A) Nest and nestling (est. 19–23 days of age). B) Nest and adult (putative female) holding a *Tropidacris* sp. grasshopper delivered by other adult. This is an oblique view from beneath where the young cannot be seen.

range Serra da Mantiqueira. Guaraú and Barra do Una are in the lowland coastal region of the state of São Paulo. Guaraú was covered originally by a continuous forest, but, at the time we made the observations, the site was being urbanized and forest cover was near 50%. The climate in Rio de Janeiro and coastal São Paulo is tropical and rains are con-

centrated from December to March (2000–4000 mm/year).

Field methods. We found breeding attempts by direct observation of the nest and young, by following adults carrying prey, or by detecting calling adults or offspring. For all breeding attempts, we made observations opportunistically for a total of 35 h. We studied the diet by direct observation of prey deliveries to the young, and by collecting prey remains on the ground below the nest of Lençois, ground that was deliberately cleared. Insect identifications were based on Hogue (1993). We estimated the age of young according to their plumage development and to comparisons with the young of the Double-toothed Kite (*Harpagus bidentatus*) (Schulze *et al.* 2000). For comparison, we also studied specimens in fresh juvenile plumage (characterized by remains of white down on the head and the wide white tip of rectrices) at Museo Bernardino Rivadavia (Buenos Aires, Argentina), and Museo de Zoologia of the Universidade de São Paulo (São Paulo, Brazil).

RESULTS

Characteristics of nest and nest sites. Four breeding attempts of the Rufous-thighed Kite were found between 2004 and 2006, all in regions of primary or late secondary rainforest with closed canopy (Table 1). Guaraú was the only nesting territory in a fragmented landscape, but the forest remnants there were relatively intact. Three nesting sites were located near open areas, but this may have been a result of greater observational effort at the forest edge.

The only nest structure we examined was located at Lençois (Figs 1A and 1B). The nest tree (DBH 40 cm, height 14 m) was alive and near a low transited road (approx. one car per hour); it was broad-leafed and partially isolated from the forest canopy. The nest was placed in the upper third of the tree, at a height of c. 12 m and in a fork of two secondary horizontal branches (diameter 8–10 cm). The top of the nest tree was not dense, so the nest was very visible to observers. The nest was a shallow cup composed of 100–150 dried sticks of 0.5–1 cm in diameter and 15–35 cm long. The nest diameter was 25–45 cm and the external depth was 15 cm. No leaf lining was visible in the nest.

The young at Guaraú passed most of the time (> 80%) by a large bromeliad 15 m up in a tree, particularly in the early morning, and the attending adult fed the young in the tree. Even though we were not able to see the nest structure, it was probably placed in the bromeliad [based on the behavior of the young and the adults, and on the fact that Double-toothed Kites frequently build nests on bromeliads (Schulze *et al.* 2000)]. Furthermore, we failed to find a nest in the surrounding trees. The bromeliad's tree (DBH 50 cm, estimated height 20 m) was broad-leafed, integrated to the forest canopy, and located at near 20 m of the forests' border (a road and a house).

Characteristics of nestling and juveniles. All breeding attempts had one young, except at Barra do Una (two fledgings). When observations began at Lençois, the nestling was 11–14 days old and spent all of its time in the nest; occasionally the attendant adult (putative female) roosted next to it. The nestling was approx. 60% the size of the attending adults and almost covered by white down. Contour feathers were beginning to emerge on the chest and flanks (ochre with brown blotches), as were covert feathers on the wings (50% grown, dark brown). The bill was black, the cere and gape orange, the lores and periocular greenish yellow, and the iris dark. The tarsi were orange. When we stopped observing the Lençois´ nest, the nestling was 20–23 days old and had not started to fly yet; however, it passed all its time standing up at the nest's

border (Fig. 1A). White down was visible only on the forehead, neck, hindneck, breast and belly. The wing coverts were 90% grown and the nape and crown were dark brown. The remiges and rectrices were 20% grown. The vent was white, and the underwing coverts and thighs were rufous.

When we found the Guaraú nesting attempt, the juvenile was already beginning to fly. During the study it dispersed up to 60 m from the tree where it was originally found. White down was still visible on the forehead, supercilium, cheeks and malars. The remiges were fully grown and the rectrices were approx. 60% grown. All the other characteristics were similar to those described in the literature for juvenile Rufous-thighed Kites (Thiollay 1994, Ferguson-Lees & Christie 2001), except that no central throat-streak was yet evident, the breast-streaks were narrower, the eyes were a lighter orange than in adults, the mantle had white blotches, and the wing and mantle coverts had rufous edges. We observed similar blotches on the mantle and rufous-edged coverts on museum skins of juvenile Rufous-thighed Kites (Appendix 1)

The juveniles at Itatiaia and Barra do Una were found when adults were feeding them. These young had fully grown juvenile plumage, according to museum specimens (Appendix 1) and published descriptions (Thiollay 1994, Ferguson-Lees & Christie 2001).

Behavior of adults and young. Young were accompanied by one attending adult between 67% to 96% of the observation time per locality. The attending adult chased two other birds, a Yellow-headed Caracara (*Milvago chimachima*) and a Red-ruffed Fruitcrow (*Piroderus scutatus*), received food from the other adult (n = 7), hunted near the nesting site (n = 8), and fed the young (n = 16). The attending adult usually perched on an exposed snag at a maximum distance of 100 m from the offspring, but often perched at the edge of the nest or on the same branch. The other adult always delivered prey to the branches of certain trees located 30–100 m from the young, never on the wing. When an adult with prey approached the breeding site (n = 7), the young and the attending putative female emitted high pitched monosyllabic (*cheee*) or disyllabic begging calls (*cheee-weet*), then the attending adult flew to the perch to retrieve the prey that had been delivered. After delivering the prey, the non-attending adult typically gave high pitched calls and stayed at the site for no longer than 2 min. Young also emitted series of begging calls that lasted up to 20 min, especially of the disyllabic type. The adults were not aggressive and did not vocalize when human observers approached the territory. However, the adults always stopped feeding the young when observers approached the Lençois´ nest.

Diet and hunting behavior. We recorded 40 prey individuals. Insects represented the majority of prey (n = 31, 77%), vertebrates (three lizards, two frogs and one mouse) represented 15%, and unidentified items represented 7.5% of prey. Of the insect prey, 77.4 % were Orthoptera (Romaelidae and Acrididae), 6.4% Homoptera (Cicadidae), 3.2% Hymenoptera (Pompilidae, *Pepsis* sp.), 3.2% Mantodea, and 9.6% unidentified. Large species predominated in the insect prey, 80% being longer than 8 cm, i.e., *Tropidacris* sp. (Romaelidae) was 13–15 cm long. Wing and abdomen remains of *Tropidacris* sp. represented approx. 20 individuals, all collected in Lençois. The two preyed frogs, probably *Phyllomedusa* sp. or *Hyla* sp. (Pombal & Gordo 2004), were hunted from trees.

Attending adults hunted insects and frogs in the nesting territory; all lizards were delivered by males. All hunts started from a perch and all prey were taken from branches of the medium to high canopy, never on the ground or on the wing. On one occasion, the adult

perched in a *Cecropia* sp. and, after 2 min, flew upward to catch a frog at the tree top (height 15 m). In another occasion, we observed an adult hunting in São Paulo city. It spent several minutes perched in the canopy, flying to capture prey from nearby branches or to change to a nearby perch, approximately every 2 min. Finally, we also observed one Rufous-thighed Kite associated with a group of capuchin monkeys (*Cebus apella*) in Morro Grande State Park, São Paulo (January 2006). The bird was foraging 20 m from the monkeys, presumably catching prey flushed by the monkeys. Willis & Oniki (1998) also report encountering Rufous-thighed Kites associated with capuchin monkeys.

DISCUSSION

Even though the Rufous-thighed Kite can be very abundant in fragmented rainforest (Anjos *et al.* 1997, Cabanne unpubl.), it seems to require undisturbed forest for breeding. All our nest observations were made in undisturbed forest, as well as other breeding activities such as adults displaying or flying together with juveniles (Cabanne 2005, Azevedo *et al.* 2007).

Most of the reports on the kite's breeding come from its southeastern population, which ranges from southern Rio de Janeiro and Minas Gerais to Argentina and Paraguay. This population seems to reproduce during November to January (end of the austral spring and the beginning of the summer). This inference is based on our finding of fledglings in mid-January, on observations of young and museum specimens from Santa Catarina state at 27ºS (Azevedo *et al.* 2007), on collection dates of juveniles with fresh plumage from Itatiaia, São Paulo and Misiones in Argentina (Appendix 1), and on one active nest at 18ºS in Minas Gerais on 21 October (Wolfe 1938). Furthermore, recent reports confirm that at least part of this southeastern population migrates northward from March to September–October (austral autumn and winter) (Hayes *et al.* 1994, Krügel & Anjos 2000, Cabanne & Seipke 2005, Azevedo *et al.* 2007), which should limit breeding to the spring and summer. In Rio de Janeiro and São Paulo, spring and summer match the wet season, however southern regions such as Santa Catarina do not present climate seasonality. Thus, the nesting activity of the southeastern population of Rufous-thighed Kites is likely affected by the photoperiod and not by the beginning of a wet season. Finally, the breeding season of the kite´s southeastern population may differ from that of northern non-migrant populations, as suggested by juvenile kites with fresh plumage collected in Pará (3ºS), Brazil, during late May and late July (austral autumn and winter, Appendix 1), and by our observations at Lençois in April (austral autumn).

Typically, a single adult fed the offspring or stood next to it, as does the Double-toothed Kite and several other raptors like *Accipiter* and *Circus* (Newton 1979, Schulze *et al.* 2000). Notwithstanding our limited observations, conversely to other raptors such as *Accipiter* (Cabanne unpubl.), Rufous-thighted Kites never were aggressive towards humans. On one occasion, one adult Rufous-thighed Kite chased another bird of prey, a behavior that Schulze *et al.* (2000) did not report in the Double-toothed Kite.

The diet of the Rufous-thighed Kite seems to be similar to that of the Double-toothed Kite, which mainly consists of insects and lizards (Schulze *et al.* 2000, Ferguson-Lees & Christie 2001). Insects, particularly large ones (i.e., *Tropidacris* sp.), composed the majority of the prey of the Rufous-thighed Kites in this study, which is in accordance with the literature (Riker 1891, Thiollay 1994, Ferguson-Lees & Christie 2001, Willis & Oniki 2002, Azevedo *et al.* 2007). We also observed Rufous-thighed Kites capturing

frogs, which has not been recorded before (Thiollay 1994, Ferguson-Lees & Christie 2001).

Even though Rufous-thighed Kites usually soar at a high altitude for several minutes at a time (Cabanne 2005), we never observed them hunting out of the forest. All hunts were within the canopy and from a perch, and prey were always caught from branches at mid to high canopy, never on the wing. Notwithstanding our limited observations, the hunting strategy of the Rufous-thighed Kite seems to differ from that of sympatric insectivorous kites, namely Plumbeous Kites (*Ictinia plumbea*) and Swallow-tailed Kites (*Elanoides forficatus*), which take prey on wings or hover and snatch quarry from the upper canopy, and usually do not hunt from a perch (Ferguson-Lees & Christie 2001). This difference would provide a degree of resource partitioning among kites, as has been proposed for Double-toothed Kites (Schulze *et al.* 2000). Finally, Rufous-thighed Kites seem to follow monkey groups, probably to capture flushed prey, as has been frequently reported for Double-toothed Kites (Thiollay 1994).

Predation on insects such as locusts and grasshoppers, which are often plagues for agriculture, can make Rufous-thighed Kites vulnerable in landscapes with heavy insecticide management.

ACKNOWLEDGMENTS

We thank to Maria Elena Danoviz and Fernando Nodari for their help during field works and to Pablo Tubaro and Luiz Fabio Silveira for their assistance during museum skins examinations. We also appreciate the improvements in English usage made by Christina Riehl through the Association of Field Ornithologists' program of editorial assistance. Finally we thank Raymond McNeil, Clayton White and Jorge Albuquerque for the useful suggestions that improved an early version of the manuscript. This work was supported by the Coordenação de Aperfeiçoamento de Pessoal de Nivel Superior, the Fundação de Amparo à Pesquisa do Estado de São Paulo and the Universidade de São Paulo, São Paulo, Brazil.

REFERENCES

Anjos, L., K.-L. Schuchmann, & R. Berndt. 1997. Avifaunal composition, species richness, and status in the Tibagi River Basin, Paraná State, Southern Brazil. Ornitol. Neotrop. 8: 145–173.

Azevedo, M. A. G., V. Q. Piacentini, I. R. Ghizoni-Jr., J. L. B. Albuquerque, E. S. Silva, C. M. Joenck, A. Mendonça-Lima, & F. Zilio. 2007. Biologia do gavião-bombachinha, *Harpagus diodon*, no Estado de Santa Catarina, sul do Brasil. Rev. Bras. Ornitol. 14: 351–357.

Bierregaard, R. O., Jr. 1995. The biology and conservation status of Central and South American Falconiformes: a survey of current knowledge. Bird Conserv. Int. 5: 325–340.

Bierregaard, R. O., Jr. 1998. Conservation status of birds of prey in the South American tropics. J. Raptor Res. 32: 19–27.

Brown, L., & D. Amadon. 1989. Eagles, hawks and falcons of the world. Volume I. Wellfleet Press, Secaucus, New Jersey.

Cabanne, G. S. 2005. Observaciones sobre los vuelos de exhibición de tres milanos de la Selva Atlántica: el Milano Gabeza Gris (*Leptodon cayanensis*), el Milano Plomizo (*Ictinia plumbea*) y el Milano de Corbata (*Harpagus diodon*). Ornitol. Neotrop. 16: 197–204.

Cabanne, G. S., & S. H. Seipke 2005. Migration of the Rufous-thighed Kite (*Harpagus diodon*) in southeastern Brazil. Ornitol. Neotrop. 16: 547–549.

Ferguson-Lees, J., & D. A. Christie. 2001. Raptors of the world. Houghton Mifflin Company, New York, New York.

Galindo-Leal, C., & I. Gusmão Câmara. 2003. The state of the hotspots: the atlantic forest. Center for Applied Biodiversity Science, Conservation International, Washington D.C.

Hayes, F. E., P. A. Scharf, & R. S. Ridgely. 1994.

Austral bird migrants in Paraguay. Condor 96: 83–97.

Hogue, C. 1993. Latin American insects and entomology. Univ. of California Press, Berkeley, California.

Krügel, M. M., & L. dos Anjos. 2000. Bird communities in forest remnants in the city of Maringá, Paraná state, southern Brazil. Ornitol. Neotrop. 11: 315–330.

Newton, I. 1979. Population ecology of raptors. T & AD Poyser, Berkhamsted, UK.

Pombal, J. O., & M. Gordo. 2004. Anfíbios anuros da Juréia. Pp. 243–256 *in* Marques, O. A. V., & W. Duleba (eds.). Estação ecológica Juréia-Itatins. Ambiente físico, flora e fauna. Holos Editora, Riberão Preto, Brazil.

Riker, C. B. 1891. A list of birds observed at Santarem, Brazil. Auk 8: 158–164.

Schulze, M. D., J. L. Córdova, N. E. Seavy, & D. F. Whitacre. 2000. Behavior, diet, and breeding biology of Double-toothed Kites at a Guatemalan lowland site. Condor 102: 113–126.

Thiollay, J. M. 1994. Familiy Accipitridae (Hawks and eagles). Pp. 52–205 *in* del Hoyo, J., A. Elliot, & J. Sargatal (eds.). Handbook of the birds of the world. Volume 2: New World vultures to Guineafowl. Lynx Edicions, Barcelona, Spain.

Willis, E. O., & Y. Oniki. 1998. One-parent nesting in Cinnamon-vented Pihas (*Lipaugus lanioide*s, Cotinginae, Tyrannidae). Ornitol. Neotrop. 9: 129–159.

Willis, E. O, & Y. Oniki. 2002. Birds of Santa Teresa, Espírito Santo, Brazil: do humans add or subtract species? Pap. Avulsos Zool. 42: 193–264.

Wolfe, L. R. 1938. Eggs of the Falconiformes. Oologists Rec. 28: 2–10

Accepted 19 March 2007.

APPENDIX 1. Studied museum specimens of the Rufous-thighed Kite, all juveniles with fresh plumage.

Museo Bernardino Rivadavia: #33456, Tobuna, Misiones, Argentina, 27/2/1952.

Museo de Zoologia da Universidade de São Paulo. #7616, Senhor de Bomfim, Bahia, Brazil, 6/1908. #34127, National Park Itatiaia, Rio de Janeiro, Brazil, 25/1/1952. #46218, Fordlandia, Pará, 31/7/1961. #58113, Fordlandia, Pará, Brazil, 30/5/1963. #63951, Ilha Vitoria, São Paulo, Brazil, 27/3/1964.