

Records of Harpy and Crested Eagles in the Brazilian Atlantic forest

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Forest raptor populations are declining throughout the world, and information on the ecology and even the distribution of most species is still lacking (Bierregaard 1995; see also del Hoyo *et al.* 1994). The main threats for raptors are deforestation, hunting and competition with humans for prey (Thiollay 1984, Redford 1992). The Atlantic forest of Brazil once covered 1 million km², of which only about 5% now remains; it holds a vast diversity of endemic birds and mammals and is considered one of the most endangered ecosystems of the world (SOS Mata Atlântica & INPE 1992).

The Harpy Eagle *Harpia harpyja* is the largest raptor in America and one of the largest in the world. It occurs from México to Bolivia and Argentina, and in a large part of Brazil (Sick 1993). Its ecology and distribution is very poorly known and most studies have been located in the Amazon region (Rettig 1978, Izor 1985). Harpy Eagles are considered scarce in the Atlantic forest and recent records are few (Chebez *et al.* 1990, Albuquerque 1995).

The Crested Eagle *Morphnus guianensis* is similar to an immature Harpy Eagle but the crest is not divided into two 'horns' (Sick 1993). It occurs from Guatemala to Bolivia and Argentina (Misiones), and there are records from most of Brazil (Sick 1993). Very little is known about its ecology and distribution (Bierregaard 1984).

This paper presents six recent records of Harpy Eagle and four of Crested Eagle in the Atlantic forest of Brazil, and suggests a possible migratory population of Harpy Eagles in the south of its range.

Observations

Harpy Eagle

On 25 July 1991 a Harpy Eagle was observed around 15.00 h at Estação Experimental Pau-Brasil, Porto Seguro, south of Bahia (16°19'S, 39°11'W). The area is a reserve of 1145 ha covered mainly by mature forest and secondary vegetation (Mori *et al.* 1983). The eagle was a mature individual perched in a dead tree in logged secondary vegetation. Possible prey for large eagles that occur in this area are the monkeys *Callithrix geoffroyi* and *Cebus apella*, and the sloth *Bradypus variegatus* (Oliver & Santos 1991).

On 11 August 1992, an adult Harpy Eagle was observed just after it killed a sloth (*Bradypus variegatus*) in the Companhia Vale do Rio Doce Reserve (CVRD), Linhares, Espírito Santo (19°06'S, 39°45'W). The eagle was perched only 5 m up and flew away on being observed. On 18 December 1992 probably the same individual was observed, perched

TABLE 1

Comparative density, expressed as no. of groups/km², of arboreal prey of large raptors in two localities of the Atlantic forest

Area (State)	Forested area (km ²)	Density					
		<i>Bradypus</i>	<i>Cebus</i>	<i>Alouatta</i>	<i>Callicebus</i>	<i>Callithrix</i>	<i>Potos</i>
Linhares* (E.S. ¹)	157	?	2.19	+	1.15	10.46	?
Intervales** (S.P. ²)	490	—	0.16	+	—	—	—

*data from Chiarello (1995); **data from M. Galetti in prep.

¹Total forested area in the state is 4,023 km².

²Total forested area in the state is 17,314 km².

Abundance: +=occurs but extremely rare; —=does not occur; ?=occurs but density unknown.

at a height of 20 m. In 1995 a Harpy Eagle nest was found in a lecythidaceous tree in CVRD (R. Jesus pers. comm.). Faunal surveys in other areas of Espírito Santo state have not recorded Harpy Eagles (A. G. Chiarello pers. comm.). The CVRD reserve holds a high density and diversity of prey for large predators (both mammalian and avian), including agoutis, pacas and monkeys, as well as large birds (Chiarello 1995, Scott & Brooke 1985; see Table 1).

On 29 January 1990 a claw of a Harpy Eagle was confiscated from a hunter. The hunter stated that the eagle was killed in July 1989 at Varadouro, Cananéia, São Paulo (25°15'S, 48°05'W). On 1 July 1990 two adult Harpy Eagles were observed soaring at Ariri, on the south coast of São Paulo state (25°03'S, 48°07'W). In July 1991 and 1993 two Harpy Eagles were observed further north in the Cananéia region within 45 km² of continuous forest. The eagles were observed there during the entire month. This region is covered by pristine Atlantic forest, mangroves and *restinga*, ranging from sea level to 1350 m altitude.

Crested Eagle

On 25 May 1990 an adult Crested Eagle was observed soaring over Parque Estadual Jacupiranga at 750 m a.s.l. (24°53'S, 48°22'W). Also in the same park but at 50 m a.s.l. an eagle was observed on 14 December 1992. This park covers 1100 km² of Atlantic forest ranging from lowland to montane forest.

On 14 December 1992 another adult Crested Eagle was observed in Parque Estadual do Morro do Diabo (see Valladares-Padua & Cullen 1994 for site description), in semideciduous forest close to the Rio Paranapanema. This area contains 320 km² of semideciduous and riverine forest and is the largest fragment of forest remaining in the hinterland of São Paulo.

At 17.05 h on 24 February 1995, a Crested Eagle was observed perched 20 m up at Carmo station (700 m a.s.l.), Parque Estadual Intervales (24°14'S, 48°04'W), near Capão Bonito, São Paulo. This reserve covers 490 km² of secondary and primary Atlantic forest, which

is continuous with the Parque Estadual Carlos Botelho and Petar (see Pizo *et al.* 1995). Large prey species (monkeys, agoutis, deer) for large predators are very scarce in this area (M. Galetti unpubl. data; Table 1).

Discussion

Both Harpy and Crested Eagles need large areas for survival. Thiollay (1989) estimated that a pair of either species may have a home range more than 100 km². The Harpy Eagle's diet usually includes game species, such as monkeys (*Alouatta*, *Cebus*), sloths (*Bradypus*), deer (*Mazama*) and also large birds (cracids, macaws, seriemas) (Rettig 1978, Izor 1985, Sick 1993). Crested Eagles prey mainly on snakes, large birds (trumpeters, cock-of-the-rock) and occasionally arboreal mammals such as kinkajous and young spider monkeys (Bierregaard 1984, Julliot 1994; see also del Hoyo *et al.* 1994).

The remaining, highly fragmented Atlantic forest covers *c.* 60 000 km² (SOS Mata Atlântica & INPE 1992). The size of this area suggests there is still suitable habitat for large raptors, but the area *per se* cannot predict the abundance of large raptors in this forest. Thiollay (1984) suggests that the human impact of hunting on game animals can reduce the prey availability for large raptors, and the Harpy Eagle would be the first species to disappear in hunted forests. In fact, hunting pressure in Neotropical forests can extirpate most game species in a few years (Peres 1990).

The remaining forested area in São Paulo (*c.* 17 314 km²) is much greater than in Espírito Santo (*c.* 4023 km², data from SOS Mata Atlântica & INPE 1992). Harpy Eagles have been recorded recently in São Paulo only during the winter (June, July and August), suggesting migratory movements (see Sick 1993). Migratory movement is also suggested by the date of collection of earlier specimens of Harpy Eagles in São Paulo (MZUSP, two eagles collected in August, one in Ituverava and another in Juquiá). Albuquerque (1995) also recorded the Harpy Eagle only in the winter (or after the passage of a cold air mass) in Serra do Tabuleiro, Santa Catarina. Straube (1989) suggests that the Atlantic avifauna colonized Misiones via riverine forest of the Iguazu river. Harpy Eagles might be expected to migrate along the forests fringing the Paranapanema river.

Harpy Eagles are known to breed in Misiones, Argentina (Chebez *et al.* 1990), and have been recorded there as recently as January 1996 (E. R. Krauczuk *in litt.*). Three nests in Argentina were located in sites protected from cold winds from the south, and the eagles probably migrate during cold winters (E. R. Krauczuk *in litt.*). Chebez (1994) suggests that Parque Provincial Urugua-í and Yabotí are the only places that still have Harpy Eagles in Argentina.

The rarity of Harpy Eagles in the Atlantic forests of São Paulo (and probably Santa Catarina and Paraná) can be explained not only by habitat loss but also by the density of their prey. Large mammal prey (mainly primates and sloths) have low densities in most large reserves in southeastern Brazil (Chiarello & Galetti 1994, M. Galetti unpubl. data; Table 1). The exceptions are the north of Espírito Santo and

south of Bahia where the density of monkeys, agoutis and other possible prey of Harpy Eagles is high (Oliver & Santos 1991, Chiarello 1995, A. Chiarello unpubl. data). It is not known why the density of arboreal mammals in Espírito Santo and Bahia is so different from São Paulo; both areas are affected heavily by hunting. In CVRD, Espírito Santo, Harpy Eagles have been observed since the 1970s, and it is one of the few places in the whole Brazilian Atlantic forest where this eagle is known to breed. Houston (1987) found a high correlation between the density of mammals and vultures in Neotropical forests, and the same is probably true for large raptors as well (see also Thiollay 1984).

The data presented here suggest that there are at least two populations of Harpy Eagles in the Atlantic forest: sedentary individuals in the north of Espírito Santo and south of Bahia, and migratory ones in the south of Brazil (São Paulo, Paraná and Santa Catarina), breeding in Misiones, Argentina.

The Crested Eagle is considered naturally rare (Sick 1993), and the only previous record of this species for São Paulo was in 1900 (MZUSP 2417 from Apiaí). There has been a recent report from Barrolândia, near Porto Seguro Bahia (Anon. 1995). It is difficult to know why the Crested Eagle is so rare in southeastern Brazil, but arboreal snakes (boas), their main prey, are extremely rare in the Atlantic forest of São Paulo (pers. obs.).

To sum up, the status of Harpy and Crested Eagles in the Atlantic forest is highly endangered. Large raptors need more than large areas to survive; it is also necessary to maintain high levels of their prey (see Redford 1992). Most reserves in the Brazilian Atlantic forests are 'empty forests' where hunting is still a common practice (Oliver & Santos 1991, Galetti & Chivers 1995). Several reserves still have a high human population, hunting and logging in the forest, and the boundaries of many reserves are just virtual.

The conservation of Harpy Eagles should be given special attention if migratory movements are confirmed (probably possible by radio-telemetry only). Also it is paramount to protect the forests in northern Espírito Santo and southern Bahia where Harpy Eagles are resident. Oliver & Santos (1991) suggest several areas where new reserves could be established. Harpy and Crested Eagles may also occur in other remaining large forest blocks (e.g. Parque Nacional de Monte Pascoal), and these should be investigated.

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