

## CONSERVATION STATUS OF BIRDS OF PREY IN THE SOUTH AMERICAN TROPICS

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**ABSTRACT.**—The ICBP/IUCN Red Data Book lists as Threatened or Endangered five of the 82 species of Falconiformes and one of the 32 Strigiformes that breed in tropical South America. The White-collared Kite (*Leucopternis forbesi*), an endemic of the Atlantic coastal forests of Brazil, can be added to this list. Because vast areas of South America, most notably its tropical forests, have been inadequately surveyed and few studies have been carried out on raptor species or assemblages, our knowledge of the distribution and natural history of many raptor species, especially owls and forest-dwelling Falconiformes, is rudimentary at best. Most needed for conservation purposes is information on population densities, distribution, and reproductive biology that will tell us how large populations are and how fast they can reproduce. For most species, these data are anecdotal or nonexistent. Although the majority of South America's tropical raptors appear not to be globally threatened at present, more information is needed to confirm current assessments, recognize when species become threatened, and to move quickly and efficiently to address such threats.

**KEY WORDS:** *Falconiformes; Strigiformes; endangered species; habitat loss; South America; tropical forest; conservation.*

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Estado de conservación de las aves rapaces en los trópicos de América del Sur

**RESUMEN.**—El Libro Rojo de la ICBP/IUCN incluye como amenazadas o en peligro a cinco de las 82 especies de Falconiformes y una de las 32 Strigiformes que se reproducen en los trópicos de América del Sur. *Leucopternis forbesi*, endémica de los bosques costeros del Atlántico en Brasil puede ser adicionada a esta lista. Vastas áreas de Suramérica, mas específicamente los bosques tropicales han sido inadecuadamente investigados y pocos estudios han sido realizados sobre las especies de aves rapaces o sobre sus ensamblajes, nuestro conocimiento de la distribución e historia natural de muchas especies de aves rapaces, especialmente buhos y Falconiformes de bosque, es rudimentario. Para propósitos de conservación se requiere de información relacionada con densidades poblacionales, distribución, biología reproductiva, que pueda decirnos de que tamaño son las poblaciones y que tan rápido se pueden reproducir. Para la mayoría de las especies estos datos son anecdóticos e inexistentes. A pesar de que la mayoría de las aves rapaces de América del Sur no están globalmente amenazadas en el presente, se requiere de mas información para confirmar las evaluaciones actuales y poder reconocer cuando una especie se encuentra en peligro y poder actuar rápidamente para en forma eficiente abordar las amenazas.

[Traducción de César Márquez]

The South American continent is renowned for its avian diversity; roughly 32% (3100 species) of the world's avifauna is found there, on only 12% of the world's land surface. Birds of prey are no exception. Eighty-four Falconiformes and 32 Strigiformes are resident in South America (following the taxonomy in Hume [1991] and del Hoyo et al. [1994]). These totals represent 28% and 21%, respectively, of the world's species in these two orders. Most (82) of the Falconiformes (Appendix 1) and all of the owls (Appendix 2) are tropical or

are found primarily south of the tropics but have ranges that extend into the tropics (north of 30°S).

Not coincidentally, South America is also renowned for its Amazonian rainforests, home to many of the continent's remarkable avifauna. Among the raptors, 52 Falconiformes and 25 owls are associated with some sort of tropical forest, from the lowlands to high-altitude cloud forests.

Tropical forests around the world are being cleared at alarming rates (Whitmore 1997), with an inevitable loss of primary habitat and fragmenta-

tion of what remains. These landscape-wide changes have profound implications for the conservation of biological diversity and have piqued the attention of biologists from the conservation community (e.g., Laurance and Bierregaard 1997). Although the loss of tropical forests is the most conspicuous threat to tropical species, the conversion of wooded or open savanna to intensive agriculture is also taking its toll by reducing available habitat.

Birds of prey, as top-order predators with large home ranges and generally low population densities, may be especially sensitive to such habitat loss and fragmentation. Due to this, certain taxa may be important indicators of habitat integrity. Along with their high visibility and general allure, they are ideal "flagship species" for the conservation of critically endangered habitats.

In this paper, I review the aspects of the biology of tropical species that I feel need to be better understood if we are to assess accurately their conservation status, and then I briefly summarize the areas where our knowledge is weakest. Within this framework, I discuss the principal threats to raptor species in the South American tropics, review the general trends that are apparent, discuss the status of eight species that seem to merit special attention, and make recommendations for future research.

#### DATA NEEDED

Effective conservation must be based on a sound understanding of a number of biological factors, principally but not exclusively: distribution and population density, taxonomy, breeding behavior and reproductive rates, and habitat requirements, or, conversely, sensitivity to habitat modification. Information on migratory habits and prey specialization is important as well. Distribution and population density together provide an estimate of population size, which is crucial in monitoring the vulnerability of a species.

Although it is not often considered in conservation discussions, our understanding of taxonomy at the specific and subspecific level is indeed important. In fact, we face many problems in defining biological and phylogenetic species and in deciding how to deal with distinct populations (Zink and McKittrick 1995). These questions have conservation implications because conservation laws focus at only the species level.

Among Falconiformes, subspecific differentia-

tion has hardly been studied in the South American tropics. Including subspecies, the 82 Falconiform species in South America represent only 128 strictly South American taxa. Most species are monotypic and four species alone account for 22 of these taxa (Appendix 1). The constraint of only considering South American forms is clearly artificial since many of the species occur in Central America, Mexico, and the Caribbean, where many are represented by various distinct populations. Including Central American, Mexican, and Caribbean populations, the number of taxa represented by the 82 species climbs from 128 (1.6 taxa/species) to 170 (2.1 taxa/species) (Appendix 1). Hence, the much smaller Central American region contains a great deal of biological diversity and is of great conservation concern, particularly given the greater annual rate of deforestation there when compared to tropical South America (Whitmore 1997).

Data on reproductive biology such as behavior, clutch size, frequency of nesting attempts, survivorship of nestlings, and recruitment into the adult population can provide an estimate of a species' potential rate of population growth. Combined with estimates of population size or density, these data are important in assessing the potential resilience of a population.

Finally, information on each species' habitat requirements will also help us to assess threats to its persistence. Not all species that are typically found in any given habitat are behaviorally or ecologically restricted to it. A number of North American raptors have shown great behavioral plasticity and are nesting in suburban (e.g., Merlins [*Falco columbarius*; Sodhi et al. 1991], Swainson's Hawks [*Buteo swainsoni*; England et al. 1995], Cooper's Hawks [*Accipiter cooperii*; Rosenfield et al. 1995]) or urban (Peregrine Falcon [*Falco peregrinus*]) settings. In Central America, a number of raptors nest in both primary forest as well as more disturbed landscape mosaics of agriculture, second growth, and primary forest (Whitacre pers. comm.).

#### DATA IN HAND

A recent review (Bierregaard 1995) highlighted the gaps in our knowledge of the natural history of the Falconiformes in Meso- and South America. Overall, the species we know the least about are the small residents of primary forest, especially those in the genera *Accipiter*, *Leucopternis*, and *Micrastur*. Nests have not been described for 16 species (Table 1), and fewer than five nests have been

Table 1. South American Falconiformes with very poorly known natural histories.

	NEST UNDESCRIBED	UNKNOWN BREEDING BIOLOGY	SCANT OR NO PREY DATA <sup>a</sup>
<i>Leptodon forbesi</i>	x	x	0
<i>Harpagus diodon</i>		x	+
<i>Circus buffoni</i>			+
<i>Accipiter poliogaster</i>	x	x	0
<i>Accipiter superciliosus</i>			+
<i>Accipiter collaris</i>	x	x	0
<i>Accipiter ventralis</i>	x		+
<i>Accipiter erythronemius</i>	x	x	0
<i>Leucopternis schistacea</i>	x	x	+
<i>Leucopternis plumbea</i>	x	x	+
<i>Leucopternis princeps</i>	x	x	+
<i>Leucopternis melanops</i>	x	x	+
<i>Leucopternis kuhli</i>	x	x	+
<i>Leucopternis lacernulata</i>	x	x	+
<i>Leucopternis polionota</i>	x	x	+
<i>Buteogallus subtilis</i>			+
<i>Harpyhaliaetus solitarius</i>			+
<i>Harpyhaliaetus coronatus</i>			+
<i>Buteo albigula</i>		x	+
<i>Buteo ventralis</i>		x	+
<i>Phalcoboenus carunculatus</i>		x	
<i>Phalcoboenus megalopterus</i>		x	
<i>Phalcoboenus albogularis</i>		x	+
<i>Milvago chimachima</i>		x	
<i>Micrastur plumbeus</i>	x	x	+
<i>Micrastur gilvicolis</i>	x		+
<i>Micrastur mirandollei</i>	x	x	+
<i>Micrastur buckleyi</i>	x		0
<i>Spizaapteryx circumcinctus</i>			+

<sup>a</sup> 0 = no prey data available, + = anecdotal data only.

described for an additional 12 species. Breeding behavior is unknown for 20 species and is only anecdotally known for an additional 18 species (Table 1). No prey data have been reported for five species and only anecdotal data are available for an additional 21 species (Table 1).

Why do we know so little about so many species? Most of the poorly-known species are small, secretive inhabitants of dense, continuous forest, where observation is extremely difficult. Many, such as the forest falcons of the genus *Micrastur*, are cavity nesters and rarely seen, and field identification of many species is not always easy (Howell and Whitaker 1995).

Given all these difficulties, it is not surprising that with the notable exception of Thiollay's work in French Guiana (e.g., Thiollay 1989b) there have been no intensive studies of more than a handful

of raptor species in tropical South American forests. The majority of what we know about most raptors is derived from data that were collected incidentally during other studies. The discovery of 38 nests of the Barred Forest-falcon (*Micrastur ruficollis*; Thorstrom et al. 1991) stands out as one of the more remarkable studies.

#### THREATENING FACTORS

The loss of primary, native habitats is the most serious threat to the flora and fauna of the world, and raptors in the tropics are no exception. The clearing of tropical rainforests occurred globally at an average rate of 0.81% *per annum* over the 1980s and shows no sign of abating (FAO 1993, cited by Whitmore 1997). Annual deforestation in Central America and the Caribbean (0.97%) was substantially above, while that in tropical South America

(0.71%) was slightly below the global decade average (FAO 1993, cited by Whitmore 1997).

The tropical forests of South America can be coarsely divided into four regions: the lowlands and foothills west of the Andes, which are biogeographically an extension of the Central American forests (or vice versa; Gentry 1990); the higher elevation forests of the Andean Cordillera; the Amazon basin; and the Atlantic forests of Brazil, which extend south through parts of Paraguay and Uruguay into northern Argentina (Misiones).

Deforestation occurs across these four regions with variable causes, rates, and extents. It is occurring most rapidly in northwestern Ecuador and Colombia, across a broad front along the northern and southern fringes of the Amazon basin, and throughout the Atlantic coastal forests of Brazil approximately 500 km southeast of Amazonia. Currently, the extent of deforestation runs from roughly 90% in the Atlantic forests (where deforestation began over 300 yr ago) and Ecuador's Pacific lowlands and foothill forests below 900 m (Dodson and Gentry 1991) to roughly 6% in Amazonia as of 1988, with 15% of the region affected by deforestation, isolation, and edge effects (Skole and Tucker 1993).

While the conservation of tropical forest is crucial, the conversion of open country such as the llanos and cerrado to cattle grazing and intensive agriculture is also vital due to the detrimental effects on a broad range of different raptors. Particularly egregious are the large-scale soybean and sugar cane plantations of eastern and southern Brazil. Compounding the problems associated with implanting vast expanses of monoculture crops is the indiscriminant use of pesticides.

Alvarez-López and Kattan (1995) reviewed the status of 14 species of resident, diurnal birds of prey in the Cauca Valley of Colombia. Several species have declined as expected due to reduction in forest or wetland habitats, but three open-country species unexpectedly declined as well. This may have been due to the effects of heavy cattle grazing and/or pesticide use.

Hunting by humans is certainly a problem for larger species of raptors. The frequency with which radio-tagged Harpy Eagles (*Harpia harpyja*) have been shot is an indication of this (E. Alvarez pers. comm.). Thiollay (1989a) has suggested that many forest species may be sensitive to what would be considered mild hunting pressure, and already reduced in the large tracts of unsurveyed rainforest

where they have been hunted by gold miners, rubber tappers, and indigenous peoples for hundreds of years (Redford 1992).

#### OVERALL TRENDS

Because so little of lowland Amazonia has been clearcut and most raptor species are broadly distributed across the region, there are no species in great peril in this area. In contrast, some species inhabiting the slopes of the Andean Cordillera and Brazil's Atlantic coastal forests are more vulnerable because they have more limited ranges and these ecosystems have been extensively clearcut.

Throughout tropical South America, we can be fairly confident that 53 species are not globally threatened at present. Some species are even increasing their range as forests are felled and converted to a mosaic of forest fragments, agricultural land and second growth. For example, the Black-chested Buzzard-eagle (*Geranoaetus melanoleucus*; Teixeira et al. 1988) and White-tailed Hawk (*Buteo albicaudatus*; Pacheco and Whitney 1995) are moving northeast into the decimated Atlantic forests of Brazil.

Del Hoyo et al. (1994) considered 11 species to be Near Threatened (Appendix 1). Three of these are far too poorly known to make an assessment of their status, and the remaining eight are included primarily because they are large (e.g., Harpy and Crested Eagles [*Morphnus guianensis*]), rare (Black Solitary Eagle [*Harpyhaliaetus solitarius*]), or have restricted ranges (Mantled Hawk [*Leucopternis polionota*]).

There are insufficient data to adequately assess the status of at least 14 species. Of these, three are considered Near Threatened by del Hoyo et al. (1994) and 11 are probably Not Threatened (Appendix 1).

As a group, owls are probably less vulnerable than diurnal birds of prey because there are no very large species with large home ranges, and their nocturnal habits make them much less vulnerable to hunting. As with the Falconiformes, however, special attention should be paid to species of owls in the Andes and Pacific slope where endemic species with very restricted ranges occur, as well as those in the Atlantic coastal forests.

Three species of owls (Black-capped Screech Owl [*Otus atricapillus*], Rusty-barred Owl [*Strix hylophila*] and Tawny-browed Owl [*Pulsatrix koeniswaldiana*]), which are endemic to southern Brazil and portions of its Atlantic coastal forest, should be

watched simply because of the scale of habitat loss in this region. We can presume the Black-capped Screech Owl has small enough home range requirements that it should be able to hold out in relatively small remnant forest reserves, while the other two species are too poorly known to speculate on their situation.

#### SPECIES OF SPECIAL CONCERN

The Andean Condor (*Vultur gryphus*) is Threatened over most of its range (Collar et al. 1992). Although it is still common in some areas, it is very rare in the northern Andes, where reintroduction programs are underway. The species is very poorly known biologically, but apparently has very low reproductive rates and consequently is very susceptible to persecution.

The recently rediscovered White-collared Kite (*Leucopternis forbesi*; Teixeira et al. 1987), considered a valid species by del Hoyo et al. (1994), may be the most endangered raptor in South America. While it is not uncommon in its range, the species is restricted to the extreme northeast of the Atlantic coastal forests of Brazil, an area undergoing devastating deforestation.

The White-necked Hawk (*Leucopternis lacernulata*), another endemic to Atlantic forests of eastern Brazil, is also considered vulnerable/rare, with its population only partly protected. A recent report, however, provided interesting observations on hunting behavior, confirming that the species is an insect specialist that follows monkeys, army ants, and even lawn mowers to capture flushed insects (Martuscelli 1996). Such adaptability to the presence of humans in the environment suggests that the species might persist as long as some habitat remains.

The Gray-backed Hawk (*Leucopternis occidentalis*) is considered seriously endangered and in need of urgent action. It is endemic west of the Andes in Ecuador and adjacent northwest Peru, where deforestation is proceeding rapidly, and it maintains sizeable populations at only two sites. Recent studies by Vargas (1995) have substantially increased our knowledge and provided specific recommendations for protecting habitats for the species.

The Crowned Solitary Eagle (*Harpyhaliaetus coronatus*) is mostly a bird of subtropical to temperate regions of South America, but it does extend into tropical zones in Brazil and Bolivia. Although it has been recorded over a broad geographic range, it apparently occurs at extremely low densities. Be-

cause so little is known about possible threats to the species, it is considered only to be Vulnerable and is largely unprotected. It is in need of study.

The Lesser Collared Forest-falcon (*Micrastur buckleyi*) is a very poorly known species recorded only from a small area in western Amazonia. It is considered rare, but its secretive habits and similarity to the sympatric Collared Forest-falcon (*M. semitorquatus*) suggest that the bird may be more widespread. Collar et al. (1992) listed the species as insufficiently known and in need of further protection, concluding, however, that it will probably prove relatively widespread and secure. I feel that it is a species for which we have insufficient data but which is probably not threatened. A western Brazilian record for the species has been retracted; the specimens on which this range extension was based are under study and may represent a new taxon (A. Whittaker pers. comm.).

The Plumbeous Forest-falcon (*Micrastur plumbeus*), endemic to the western slope of the Andes in Colombia and Ecuador, is Vulnerable, largely unprotected, and is in need of study. The species' biology is practically unknown, but a study is underway in the Rio Nambi Nature Reserve in southwestern Colombia with encouraging preliminary results (P. Salaman pers. comm.).

The Long-whiskered Owl (*Xenoglaux loweryi*) was recently discovered and described at only two localities on the east slope of the Andean Cordillera. It is considered insufficiently known and in need of further protection (Collar et al. 1992).

#### RESTRICTED TAXA

A number of subspecies that are obligate forest dwellers with ranges occurring in areas undergoing rapid deforestation are worthy of careful attention. In Central America and the western slope of the Andes in Colombia and Ecuador, they are the Ornate Hawk-eagle (*Spizaetus ornatus vicarius*), Barred Forest-falcon (*Micrastur ruficollis interstes*), and Collared Forest-falcon (*Micrastur semitorquatus naso*). In the forests of eastern Brazil and into northern Argentina, there is also a race of the Black Hawk-eagle (*Spizaetus tyrannus tyrannus*). A race of the Barred Forest-falcon (*M. r. obrogii*) occurs only in the dry forests of northwest Argentina.

#### NEW RESEARCH

Since my earlier review (Bierregaard 1995), studies have documented range expansions of several species. Black Hawk-eagles and Ornate Hawk-ea-

gles, for example, have been recorded in new parts of Paraguay (Williams 1995) and in the third largest tract of forest in Brazil's Atlantic forest in Santa Catarina (Serra do Tabuleiro) where Harpy Eagles were also reported as recently as 1989 (Albuquerque 1995). The Crested Eagle has been reported in Beni, Bolivia (Pearman 1994) and the Black-and-white Hawk-eagle (*Spizastur melanoleucus*) was reported in a new area in Paraguay (Lowen et al. 1995). The Near Threatened Mantled Hawk has been discovered in an important tract of forest in southeastern Brazil (Forrester 1993, cited by Gonzaga et al. 1995).

In Venezuela, 30 breeding pairs of Harpy Eagles have been located (Anonymous 1996, and E. Alvarez pers. comm.). Preliminary results indicate that nests are much closer than would have been predicted by previous estimates of density and home range (Thiollay 1989a). Important data are being collected on local movement of juveniles instrumented with satellite radiotransmitters. Two important studies on the Gray-backed Hawk and Plumbeous Forest-falcon (Vargas 1995, and P. Salaman pers. comm.), species whose biology was previously virtually unknown (Bierregaard 1995), are providing data needed to monitor tropical raptors and design effective conservation action plans.

#### FUTURE DIRECTIONS

Almost any information about any Neotropical raptor, especially forest species, is useful. Studies of endemic species or subspecies in the Atlantic forests of Brazil are certainly of a very high priority. Similarly, raptor research in the Andes or Chocó region of Colombia and adjacent Ecuador could provide a significant amount of information. In the central Amazonian lowlands, studies of any species in the genera *Leucopternis*, *Accipiter*, or *Micrastur* are important.

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Appendix 1. Number of Falconiform taxa in Meso-America and Tropical South America.

SPECIES	WORLD- WIDE TAXA	MESO- AMER- ICAN TAXA	TROP- ICAL S.A. TAXA
<b>CATHARTIDAE</b>			
<i>Cathartes aura</i>	4	1	2
<i>Cathartes burrovianus</i>	2	2	2
<i>Cathartes melambrotus</i>	1		1
<i>Coragyps atratus</i>	3	1	2
<i>Sarcoramphus papa</i>	1		1
<i>Vultur gryphus</i>	1		1
<b>ACCIPITRIDAE</b>			
<i>Leptodon cayanensis</i>	2		2
<i>Leptodon forbesi</i>	1		1
<i>Chondrohierax uncinatus</i>	3	2	1
<i>Elanoides forficatus</i>	2	1	1
<i>Gampsonyx swainsonii</i>	3		3
<i>Elanus leucurus</i>	2	1	1
<i>Rostrhamus sociabilis</i>	3	2	1
<i>Rostrhamus hamatus</i>	1		1
<i>Harpagus bidentatus</i>	2		2
<i>Harpagus diodon</i>	1		1
<i>Ictinia plumbea</i>	1		1
<i>Circus buffoni</i>	1		1
<i>Circus cinereus</i>	1		1
<i>Accipiter poliogaster</i>	1		1
<i>Accipiter superciliosus</i>	2		2
<i>Accipiter collaris</i>	1		1
<i>Accipiter ventralis</i>	1		1
<i>Accipiter erythronemius</i>	1		1
<i>Accipiter bicolor</i>	4	1	3
<i>Geranoospiza caerulescens</i>	6	2	4
<i>Leucopternis plumbea</i>	1		1
<i>Leucopternis schistacea</i>	1		1
<i>Leucopternis princeps</i>	1		1
<i>Leucopternis melanops</i>	1		1
<i>Leucopternis kuhli</i>	1		1
<i>Leucopternis lacernulata</i>	1		1
<i>Leucopternis semiplumbea</i>	1		1
<i>Leucopternis albicollis</i>	4	1	3
<i>Leucopternis occidentalis</i>	1		1
<i>Leucopternis polionota</i>	1		1
<i>Buteogallus aequinoctialis</i>	1		1
<i>Buteogallus anthracinus</i>	3	2	1
<i>Buteogallus subtilis</i>	3	2	1
<i>Buteogallus urubitinga</i>	2	1	1
<i>Buteogallus meridionalis</i>	1		1
<i>Parabuteo unicinctus</i>	2		2
<i>Busarellus nigricollis</i>	2		2
<i>Geranoaetus melanoleucus</i>	2		2
<i>Harpyhaliaetus solitarius</i>	2	1	1
<i>Harpyhaliaetus coronatus</i>	1		1

Appendix 1. Continued.

SPECIES	WORLD- WIDE TAXA	MESO- AMER- ICAN TAXA	TROP- ICAL S.A. TAXA
<i>Buteo nitidus</i>	4	1	3
<i>Buteo magnirostris</i>	12	6	6
<i>Buteo leucorrhous</i>	1		1
<i>Buteo brachyurus</i>	2	1	1
<i>Buteo albigula</i>	1		1
<i>Buteo albicaudatus</i>	3		3
<i>Buteo galapagoensis</i>	1		1
<i>Buteo polyosoma</i>	2		1
<i>Buteo poecilochrous</i>	1		1
<i>Buteo albonotatus</i>	1		1
<i>Morphnus guianensis</i>	1		1
<i>Harpia harpyja</i>	1		1
<i>Spizastur melanoleucus</i>	1		1
<i>Spizaetus tyrannus</i>	2		2
<i>Spizaetus ornatus</i>	2		2
<i>Oroaetus isidori</i>	1		1
<b>FALCONIDAE</b>			
<i>Daptrius ater</i>	1		1
<i>Daptrius americanus</i>	1		1
<i>Phalcoboenus carunculatus</i>	1		1
<i>Phalcoboenus megalopterus</i>	1		1
<i>Caracara (Polyborus) plancus</i>	4	2	2
<i>Milvago chimachima</i>	2		2
<i>Milvago chimango</i>	2		1
<i>Herpotheres cachinmans</i>	3	1	2
<i>Micrastur ruficollis</i>	6	1	5
<i>Micrastur plumbeus</i>	1		1
<i>Micrastur gilvicolis</i>	1		1
<i>Micrastur mirandollei</i>	1		1
<i>Micrastur semitorquatus</i>	2		2
<i>Micrastur buckleyi</i>	1		1
<i>Spizapteryx circumcinctus</i>	1		1
<i>Falco sparverius</i>	17	8	7
<i>Falco femoralis</i>	3	1	2
<i>Falco rufigularis</i>	3		3
<i>Falco deiroleucus</i>	1		1
<i>Falco peregrinus</i>	19	1	1
82 species, total taxa:	190	42	128
Taxa/species (tropical S.A. only)			1.6
Taxa/species (tropical M-A. & S.A.)			2.1



Appendix 2. Number of Strigiformes in Meso-America and Tropical South America.

SPECIES	WORLD- WIDE TAXA	MESO- AMER- ICAN TAXA	TROP- ICAL S.A. TAXA
<b>TYTONIDAE</b>			
<i>Tyto alba</i>	35	9	5
<b>STRIGIDAE</b>			
<i>Otus albogularis</i>	3		3
<i>Otus atricapillus</i>	3		3
<i>Otus choliba</i>	17		16
<i>Otus colombianus</i>	1		1
<i>Otus guatemalae</i>	17	10	7
<i>Otus ingens</i>	3		3
<i>Otus koepckeae</i>	1		1
<i>Otus marshalli</i>	1		1
<i>Otus petersoni</i>	1		1
<i>Otus roboratus</i>	1		1
<i>Otus watsonii</i>	6		6
<i>Lophotrix cristata</i>	3	2	1
<i>Bubo virginianus</i>	17	3	6
<i>Pulsatrix koeniswaldiana</i>	1		1
<i>Pulsatrix melanota</i>	2		2
<i>Pulsatrix perspicillata</i>	6	2	4
<i>Glaucidium brasilianum</i>	12	2	9
<i>Glaucidium hardyi</i>	1		1
<i>Glaucidium jardi</i>	2	1	1
<i>Glaucidium minutissimum</i>	8	7	1
<i>Glaucidium peruanum</i>	1		1
<i>Xenoglaux loweryi</i>	1		1
<i>Speotyto cunicularia</i>	19	5	12
<i>Ciccaba albitarsus</i>	2		2
<i>Ciccaba huhula</i>	1		1
<i>Ciccaba nigrolineata</i>	1		1
<i>Ciccaba virgata</i>	8	3	5
<i>Strix hylophila</i>	1		1
<i>Strix rufipes</i>	3		1
<i>Rhinoptyyx clamator</i>	3		3
<i>Asio flammeus</i>	10	2	4
<i>Asio stygius</i>	6	4	2
<i>Aegolius harrisii</i>	3	3	
34 species, total taxa:	200	53	108
Taxa/species			
(tropical S.A. only)			3.2
Taxa/species			
(tropical M-A. and S.A.)			4.7