Bird Conservation International (1995) 5:325–340

The biology and conservation status of Central and South American Falconiformes: a survey of current knowledge

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Summary

Based on an extensive literature review for the 81 species of Falconiformes (excluding vultures) that breed primarily in Central and South America, I summarize the current state of our knowledge of the biology and conservation status of these birds. Most of what is known about the diurnal raptors in the region is based on studies carried out in the southern U.S.A., the Petén of Guatemala, extreme north-eastern South America (Venezuela through the Guianas) and Chile. The least-known species are residents of primary forest, especially in the genera *Accipiter*, *Leucopternis* and *Micrastur*. Nests remain undescribed for 19 species, and less than five nests have been described for an additional 12 species. No prey data are available for six species and only anecdotal data have been published for a further 25 species. Breeding behaviour is unknown for 27 species and known only anecdotally for an additional 18. The migratory habits of 28 species are poorly understood. Available data permit a reasonable assessment of the conservation status for 39 species and a well-educated guess for another 31, but any assessment for the remaining 11 would be speculation at best.

Basado en un estudio muy extensivo de la literatura para 81 especies de Falconiformes (excluyendo Cathartidae) que se aparean principalmente en Centro y Sur América, hago un resumen de nuestro conocimiento más actual de la biología y el estado de conservación en que se encuentran estas aves. La mayor parte de la información que se tiene sobre raptores diurnos de la región está basada en estudios que fueron llevados acabo en el sur de los Estados Unidos, el Petén en Guatemala, la parte noreste de América del Sur (Venezuela hasta las Guianas) y Chile. Las especies menos conocidos son residentes de bosque primario, especialmente de los géneros *Accipiter*, *Leucopternis* y *Micrastur*. Falta describir nidos para 19 especies y menos de cinco nidos han sido descritos para 12 especies adicionales. No hay información sobre la alimentación para seis especies y solamente información anecdotal ha sido publicada para 25 especies adicionales. Comportamiento de apareo se desconoce para 27 especies y solamente es conocido por anécdotas par 18 especies adicionales. Las costumbres migratorias de 28 especies se conocen muy poco. Información disponible permite juzgar razonablemente el estado de conservación para 39 especies y se puede estimarlo para 31 más, pero el juzgar de los 11 que restan sería solamente especulación.

Introduction

Birds of prey are charismatic organisms that, with the exception of deep-forest species, tend to be conspicuous in their habitats. While they are an alluring

group to field biologists, their low densities and often secretive nature make the collection of quantitative data on all aspects of their natural history problematical.

Because they occupy a trophic level at the top of long food chains, some species, such as the Peregrine *Falco peregrinus*, Osprey *Pandion haliaetus* and Bald Eagle *Haliaeetus leucocephalus*, have proved to be sensitive to environmental degradation and have drawn our attention to alarming environmental contamination (Hickey 1969). Given this sensitivity, birds of prey should prove to be very useful monitors of habitat degradation in Central and South America, where growing human populations and economic pressures are resulting in diverse and widespread pressures on currently pristine habitats through deforestation as well as through contamination of food chains by the indiscriminate use of pesticides.

Furthermore, Terborgh (1992) has recently suggested that the loss of top-order predators from tropical forests may have surprising and dramatic effects on various aspects of tropical forest community structure, not only of the prey-base species but also through secondary effects on the plant community. Thus the conservation of tropical raptors may be particularly important in maintaining tropical forest biodiversity.

Including New World vultures, 90 species, or roughly 30% of the world's Falconiformes, breed in Central and South America. Despite their general appeal, as a whole birds of prey are poorly known over much of this geographical region. The eventual usefulness of these species as indicators of environmental degradation will depend on reliable baseline data on population densities and natural history. In these analyses I focused on the 81 species of Falconiformes whose ranges lie primarily in Central and South America. This report emphasizes what is *not* known about these birds, drawing attention to the species that are least studied and highlighting important gaps in our knowledge of their natural history. A review of what *is* known is available in del Hoyo *et al.* (1994).

Finally, I include from del Hoyo *et al.* (1994) an assessment of the population trends of the 81 species that breed primarily in the region.

Material and methods

I conducted an extensive literature review of 81 species of Falconiformes (vultures excluded) that breed primarily in Central and South America. A computerized, key-word search for all 81 species was performed on the BIOSIS database for the past 10 years. All the resulting references that were available in local libraries or through inter-library loan were reviewed, and all citations in each reference were subsequently pursued. This process was repeated until I could find no further literature citations for the target species. Of the 566 citations thus compiled, 135 are in old or obscure journals that were not located; information from these references is based on secondary citations. Logistical constraints prohibited a volume-by-volume search of all issues of all Latin American journals that specialize in birds or ecology (e.g. *El Hornero* of Argentina or *Acta Científica Venezolana*), so references to raptors in these journals that were not cited in more broadly distributed journals will have been missed.

However, many of the 135 papers that I could not obtain were in fact in just these journals, suggesting that this source of information was well canvassed in my literature review. Similarly, papers cited in the 135 papers that were identified in my search but not located will also have been overlooked. It was obviously not possible to cite here all the references used in this review, but nearly all of them can be found in the bibliography of del Hoyo *et al.* (1994). Four species that breed in the area but whose centres of distribution occur outside the region (Red-tailed Hawk *Buteo jamaicensis*, Sharp-shinned Hawk *Accipiter striatus*, American Kestrel *Falco sparverius* and Peregrine) were not included in the review. Taxonomy follows Stresemann and Amadon (1979) as modified in del Hoyo *et al.* (1994).

I scored the level of knowledge of the biology of these species in seven categories: taxonomy, distribution, prey and hunting behaviour, nest (season, site, construction, and clutch size), breeding biology (parental behaviour during breeding, incubation and fledging times, post-fledging dependency period), migratory habits, and conservation status. Two overall scores were generated for each species. First the numerical scores were summed across all categories and then across all categories excluding taxonomy, as much of the uncertainty in this category stems from subjective interpretation or nomenclatural rules (e.g. Banks and Dove 1992) and is less relevant to the conservation status of the species than are data on their natural history.

A scale of 0–5 was used for each category, with 0 indicating no knowledge and 5 (rarely assigned) suggesting a very thorough knowledge of that aspect of the species's biology across the majority of its geographical distribution. Specifically, the scoring criteria for each category were as follows.

Taxonomy

Three aspects of the taxonomy of each species were considered: first, the validity of the species itself; second, its affinities to other species or genera; and finally questions about the validity of subspecies of the taxon in question. If there is widespread consensus on all three of these areas, a score of 5 was assigned, if questions remain about one of the three areas, a 3 was assigned, and if there are doubts about two of the three, a 1 was assigned.

Distribution

Because all but a very few species have at least a type-locality, no scores of 0 were assigned in this category. A species known only from the type-locality would have received a score of 1 (none of the species considered is so poorly known). A form known from less than 15 locations was scored 2. Where the species has not been recorded for large areas of apparently suitable habitat, a 3 was scored. When a range is well known but probably could be extended somewhat in poorly studied areas, a 4 was scored. Only island forms whose ranges are clearly delimited received a 5.

Prey, nest and breeding biology

For these three categories, a score of 1 was assigned if only scattered anecdotal reports are available; 2 if quantitative data are available from a detailed study

of one pair; 3 if more than one pair from a local population was studied in quantitative detail or if substantial non-quantitative (anecdotal) data are available from representative areas in different portions of the species's range; 4 if quantitative data are available from separate populations across scattered portions of the range of the species; and a 5 only if detailed information is available from representative portions of the whole range of the species.

Migration

Species in northern and southern regions for which no information was available received a 0. A score of 1 was assigned for species with anecdotal evidence of migration or nomadic wandering; 2 in partially migratory species if the limits of resident and migratory populations are not known and the status (migratory or resident) of some populations is undetermined; 3 if the species is known to be partially migratory, but the limits of resident and migratory populations are not known; 4 if, in the absence of any evidence to the contrary, the species is presumed to be sedentary; and 5 if the lack of migration is clearly documented or in migratory species if population limits and routes are well known.

Conservation status

To assess adequately the conservation status of a species, three sorts of information are required: knowledge of population densities, the species's range, and its sensitivity to habitat alteration. The latter will be affected by the degree of habitat specificity the species exhibits as well as population densities and reproductive rates; species with low densities that are restricted to primary forest and only breed every third year will be more sensitive than species with more catholic patterns of habitat use and higher intrinsic rates of population growth. Species were scored 1 if only an estimate of one of the three types of information is available, 2 if only one type of information is available and it is well documented, 3 if only two types of information can be estimated, 4 if two categories are well known or three types are confidently estimated, and 5 only if solid information is available for all three types of information.

Population trends

Finally, based on del Hoyo *et al.* (1994), a summary of actual population trends (as opposed to an assessment of our knowledge of them) is presented. Species were classified as increasing range-wide (no cases), locally increasing, stable, locally decreasing, decreasing range-wide or endangered. Species considered endangered, vulnerable, rare, near-threatened or with endangered subspecies are indicated. Species that are restricted to primary Neotropical forests but with no data on population trends were considered to be decreasing locally as a necessary consequence of ongoing deforestation in their ranges. Species with more catholic habitat requirements were considered stable given the lack of any information to the contrary.

Results and discussion

Our knowledge of the biology and status of most species of diurnal raptors in Central and South America is substantially incomplete (see Appendix), as it is for Falconiformes throughout the world's tropical rainforests (Thiollay 1985b). Until quite recently most of what was published about Neotropical forest ecology came from work carried out at Barro Colorado Island in Panama and the La Selva station in Costa Rica (Gentry 1990). Similarly, most of our knowledge of New World raptors south of the U.S. border comes from studies carried out in a very small portion of the geographical ranges of these species. Specifically, we base much of what we know on studies conducted in the southern U.S.A., restricted portions of Central America and extreme north-eastern and south-western South America.

Species whose ranges extend into the U.S.A. (Snail Kite *Rostrhamus sociabilis*, White-tailed Kite *Elanus leucurus*, Common Black Hawk *Buteogallus anthracinus*, Harris's Hawk *Parabuteo unicinctus*, Short-tailed Hawk *Buteo brachyurus* and White-tailed Hawk *Buteo albicaudatus*) are relatively well-known in small and perhaps unrepresentative portions of their ranges. The unusual cooperative breeding behaviour of Harris's Hawk (e.g. Bednarz and Lignon 1988; also Mader 1979a and references therein), has not been reported elsewhere in the extensive range of this species. Is this because it only occurs under the unique conditions encountered at the extreme limit of the species's range, or is it simply an artefact of the lack of focal studies of the species further south?

Without a doubt, the most impressive increase in our knowledge of the natural history of Neotropical raptors is due to the remarkable and fascinating studies carried out by the researchers of the Peregrine Fund's Maya Project (Whitacre and Thorstrom 1992, and previous reports). While the first nest of any species in the genus *Micrastur* was only described in 1979 (Mader 1979b), thanks to the Maya Project we now have detailed information from 38 nesting attempts of the Barred Forest-falcon *M. ruficollis* alone from the Petén region of Guatemala (Thorstrom 1989, 1990, Thorstrom *et al.* 1990, 1991, 1992, Thorstrom and Morales 1993). The Maya Project will eventually provide the first complete description of the ecology of a tropical forest raptor community. Unfortunately, these studies have been carried out near the northern limit of the ranges of most of the species involved, so that confident generalizations for the species as a whole await some replication of the studies in South America. A significant body of knowledge on selected species in extreme northern South America has been developed. For over five decades, F. Haverschmidt reported on raptors in Surinam (Haverschmidt 1947, 1954, 1959a,b, 1962, 1964, 1968, 1970, 1972, 1980). W. J. Mader and S. R. Beissinger have made important contributions from Venezuela (Mader 1981, 1982, Beissinger 1983, Beissinger *et al.* 1988), while J.-M. Thiollay's studies in French Guiana (Thiollay 1984, 1985a,c, 1989a,b, 1991) have provided important insights into the natural history and conservation of raptors, particularly given his studies of raptors on other continents. Several raptors that breed in Chile are also fairly well studied, due to the efforts of F. Jaksic and his colleagues, who have presented data on raptor hunting behaviour and diet that are especially valuable because they are accompanied by data on prey availability in the habitat (Jaksic *et al.* 1980, 1981, 1987, 1991, 1992, Jaksic

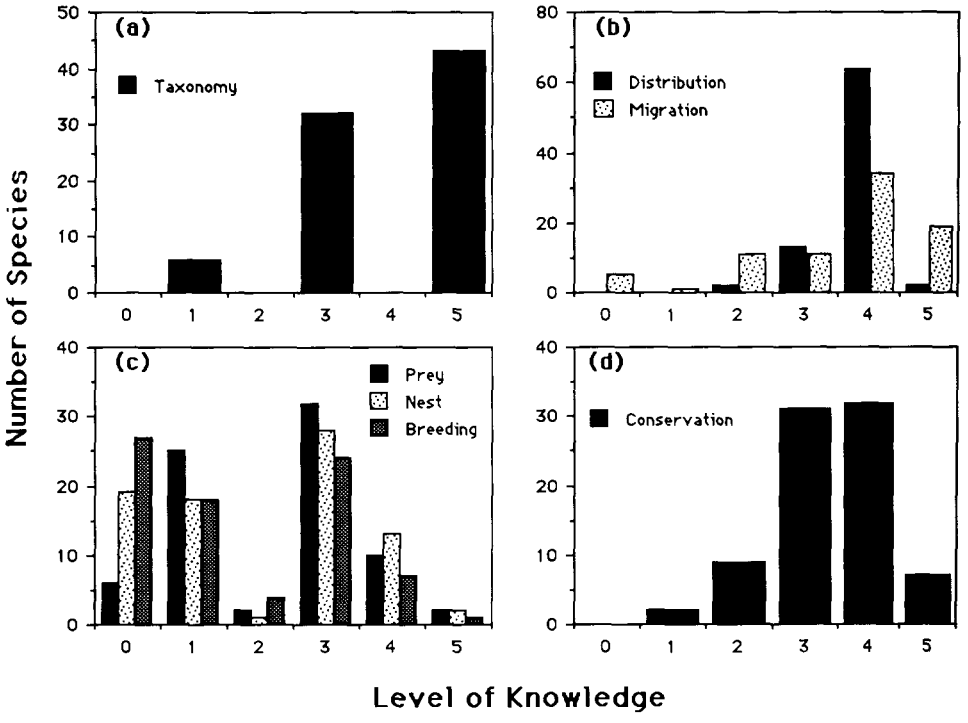

Figure 1. Histograms of current level of knowledge about various aspects of the natural history and conservation status of Central and South American Falconiformes. Scores of 0 (no knowledge currently available in the literature) to 5 (quantitative data available from representative populations across the range of the species) were assigned to each species. See text for details of scoring criteria and Appendix for species' scores.

and Jiménez 1986, Jaksic and Delibes 1987). Over most of the rest of South America, with the exception of a few focal studies carried out near Manaus, Brazil (Bierregaard 1985, Klein and Bierregaard 1988a,b, Klein *et al.* 1988), virtually all we know of the natural history and status of the resident Falconiformes comes from anecdotal observations. For instance, almost all data on the diet and hunting of the Double-toothed Kite *Harpagus bidentatus*, which frequently follows monkey troops to feed on cicadas and lizards flushed by the monkeys, is found in the primate literature (Greenlaw 1967, Moynihan 1976, Fontaine 1980, Terborgh 1983, Boinski and Timm 1985, Boinski and Scott 1988, Egler 1991, Heymann 1992).

Despite their relatively low densities, some of the larger and more dashing species, most notably the Harpy Eagle *Harpia harpyja* and the Orange-breasted Falcon *Falco deiroleucus*, have attracted the attention of dedicated fieldworkers (Fowler and Cope 1964, Rettig 1977, 1978, Jenny and Cade 1986, Jenny 1989,

Table 1. Species with substantial taxonomic uncertainties

Leptodon forbesi	*Phalcoboenus carunculatus*	*Phalcoboenus albogularis*
Geranospiza caerulescens	*Phalcoboenus megalopterus*	*Phalcoboenus australis*

https://doi.org/10.1017/S0959270900001076 Published online by Cambridge University Press

Table 2. Species with uncertain migratory behaviour

Accipiter collaris	*Elanoides forficatus*	*Buteo albigula*
Accipiter chionogaster	*Circus cinereus*	*Buteo polyosoma*
Accipiter ventralis	*Circus buffoni*	*Buteo albonotatus*
Accipiter erythronemius	*Accipiter poliogaster*	*Falco femoralis*
Buteo leucorrhous	*Buteogallus urubitinga*	
Buteo poecilochrous	*Buteo brachyurus*	

Table 3. Species for which the nest is undescribed

Leptodon forbesi	*Leucopternis plumbea*	*Buteogallus subtilis*
Accipiter poliogaster	*Leucopternis princeps*	*Micrastur plumbeus*
Accipiter collaris	*Leucopternis melanops*	*Micrastur gilvicollis*
Accipiter chionogaster	*Leucopternis kuhli*	*Micrastur mirandollei*
Accipiter ventralis	*Leucopternis lacernulata*	*Micrastur buckleyi*
Accipiter erythronemius	*Leucopternis occidentalis*	
Leucopternis schistacea	*Leucopternis polionota*	

Table 4. Species with unknown breeding biology

Leptodon cayanensis	*Leucopternis plumbea*	*Buteo ventralis*
Leptodon forbesi	*Leucopternis princeps*	*Daptrius ater*
Harpagus diodon	*Leucopternis melanops*	*Phalcoboenus carunculatus*
Accipiter poliogaster	*Leucopternis kuhli*	*Phalcoboenus megalopterus*
Accipiter collaris	*Leucopternis lacernulata*	*Phalcoboenus albogularis*
Accipiter chionogaster	*Leucopternis semiplumbea*	*Phalcoboenus australis*
Accipiter erythronemius	*Leucopternis polionota*	*Milvago chimachima*
Accipiter chilensis	*Buteogallus subtilis*	*Micrastur plumbeus*
Leucopternis schistacea	*Buteo albigula*	*Micrastur mirandolloei*

Table 5. Species with few or no prey data

Leptodon forbesi	0	*Leucopternis lacernulata*	+
Accipiter poliogaster	0	*Leucopternis semiplumbea*	+
Accipiter collaris	0	*Leucopternis occidentalis*	+
Accipiter chionogaster	0	*Leucopternis polionota*	+
Accipiter erythronemius	0	*Buteogallus subtilis*	+
Micrastur buckleyi	0	*Harpyhaliaetus solitarius*	+
Harpagus diodon	+	*Harpyhaliaetus coronatus*	+
Circus buffoni	+	*Buteo leucorrhous*	+
Accipiter superciliosus	+	*Buteo albigula*	+
Accipiter ventralis	+	*buteo ventralis*	+
Accipiter chilensis	+	*Phalcoboenus albogularis*	+
Leucopternis schistacea	+	*Micrastur plumbeus*	+
Leucopternis plumbea	+	*Micrastur gilvicollis*	+
Leucopternis princeps	+	*Micrastur mirandollei*	+
Leucopternis melanops	+	*Spiziapteryx circumcinctus*	+
Leucopternis kuhli	+		

0, no prey data available; + anecdotal data.

https://doi.org/10.1017/S0959270900001076 Published online by Cambridge University Press

Table 6. Species of uncertain conservation status

Accipter poliogaster	*Leucopternis kuhli*	*Micrastur buckleyi*
Accipiter chionogaster	*Buteo polyosoma*	*Spiziapteryx circumcinctus*
Accipiter ventralis	*Oroaetus isidori*	*Falco deiroleucus*
Accipiter chilensis	*Micrastur plumbeus*	

Alvarez 1993, 1994, Baker and Whitacre 1993) and are better known than many much more abundant species.

Taxonomically, Falconiformes are fairly well known, with only six of the species considered here requiring substantial study (Figure 1a, Table 1) or a consensus to be reached among systematists. Likewise, the distribution of most species is fairly well defined (Figure 1b), although there will doubtless continue to be major surprises as exploration continues along the Andean Cordillera, such as the discovery of the Mountain Caracara *Phalcoboenus megalopterus* north of the north Peruvian Low (Parker *et al.* 1985), and as open country species expand their ranges into deforested regions.

Most of the species in this report occur in tropical regions and either do not or almost certainly do not migrate, so our general level of knowledge of migratory behaviour is better than most other categories (Figure 1b), but there are still 17 species for which we lack important information (Table 2) and 11 more where the exact limit between migratory and sedentary populations is unknown. In some cases even the origin (austral or northern) of some migratory populations is unclear. Not surprisingly, the most poorly known taxa are relatively small species that dwell exclusively in primary rainforest, especially in the genera *Accipiter*, *Leucopternis* and *Micrastur*. Twenty-five of the 85 species that breed in Central and South America are included in these three genera, while they represent 17 of the 19 species for which no nest has been discovered (Figure 1c, Table 3).

Breeding behaviour is even more poorly documented than nest construction and clutch size, as these latter data are available from a chance encounter with a nest, but gathering data on development and behaviour around the nest usually requires a substantial commitment of time and energy. Thus while there are 19 species for which the nest is undescribed, there are 27 species for which no data on breeding behaviour have been recorded (Figure 1c, Table 4). Even for fairly common species, surprisingly little information may be available. Caracaras in the genus *Phalcoboenus* are not uncommon in the appropriate habitat, and their nests seem to be fairly well described, yet almost no information is available on parental behaviour during the nesting period for this genus. Since most quantitative prey data for raptors come from studies at a nest, the species with poorly documented breeding biology tend to have equally poorly understood diets. No prey data are available for six species and only very sketchy, anecdotal data are available for an additional 26 (Figure 1c, Table 5). Hunting behaviour may be more adequately known at least qualitatively, since field biologists often make observations of hunting behaviour while engaged in some other study (e.g. primatologists' observations of Double-toothed Kites mentioned above).

Based on the three criteria used in the assessment of our ability to determine the conservation status of these species (distribution, densities, and sensitivity

to habitat alteration) there are only 11 species for which we cannot venture at least an educated guess (Table 6, Figure 1d). Knowledge of reproductive biology was implicitly included in the scoring, as this will affect the sensitivity of a species to habitat disturbance; species that raise only one young every third year will clearly be more sensitive than species with larger clutches that breed annually.

Among the 70 species for which more reliable estimates of actual population trends are possible (scores of 3 or higher on conservation knowledge), eight (11%) are locally increasing, 26 (37%) appear to have stable populations and 31 (44%) are declining in some parts of their ranges, although seven of these are increasing in other parts of their ranges. Three species (4%) are in region-wide decline, and two species (3%) and one subspecies are endangered (Appendix; see also Collar *et al.* 1992). Among the species for which data are less reliable, all 11 species are probably declining in portions of their ranges. Three are considered near-threatened, and one vulnerable and rare, in part because so little is known about them. It must be emphasized that these estimates are probably overly optimistic, as the assumption is made that most populations are unaffected where their habitat remains intact.

The danger in this assumption has been pointed out by several authors. Alvarez-López and Kattan (1995, in this issue) report that the change from undisturbed open country to cattle ranches or extensive agricultural use in the middle Cauca valley of Colombia has accompanied declines or even local extinctions in open-country raptors commonly assumed to be in little danger, especially when compared with rainforest species. Redford (1992) and Thiollay (1984) have shown that tropical forest ecosystems seem to be remarkably sensitive to hunting pressure. Widespread declines in many rainforest species, raptors included, may have already taken place beneath an undisturbed forest canopy. This possibility makes information on raptors in the Amazon region all the more important. While there will be few strictly comparable baseline data from pristine forests other than from French Guiana (Thiollay 1985a,c, 1989b) and Manu National Park in eastern Peru (Terborgh *et al.* 1990), it is nonetheless important to establish some baseline data, even if it is from perturbed forests, against which future changes can be assessed. Knowledge of contamination by anthropogenic chemical pollutants and its effect on raptors is practically nil, save one alarming report by Olrog (1979), and would be of great importance for monitoring populations.

Conclusions

While we are making significant gains in our knowledge of certain species, our information base needs to be expanded geographically for almost all species; even the better-known species remain unstudied across much of their distributional ranges. Further studies of the natural history of all species are needed. With a broader geographical base to our knowledge, we will not only be able to contribute to conservation, both through the use of raptors as indicator species as well as the implementation of manipulative wildlife management when the need arises, but also to make important contributions to the understanding of the ecology and evolution of tropical ecosystems.

Acknowledgements

Thanks to P. Jenny for the initial suggestion to write this paper and his suggestions for improvements to the manuscript. I also thank the many colleagues who generously helped find obscure material in the literature. C. Gascon and S. Beissinger made useful suggestions on earlier versions of the paper. The summary was kindly translated by Tyana Wachter.

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Appendix. An assessment of current knowledge of the biology and conservation status of 81 species of Falconiformes whose ranges occur primarily in Central and South America.

The Knowledge scores sum across categories with and without taxonomy.

The number of nests that have been reported in the literature as well as an estimation of each species's general population trends based on reviews in del Hoyo *et. al.* (1994) are presented for each species. See text for detailed explanation of the scoring criteria for each category.

	Taxonomy	Distri-bution	Prey	Nest	Breeding behaviour	Migra-tion	Conservation status	Knowledge (except tax.)	Knowledge (all cats)	Rank	Population trend	Number of nests
Leptodon cayanensis	3	4	4	1	0	4	3	16	19	t51	2	1?
Leptodon forbesi	1	2	0	0	0	4	3	9	10	t80	5	0
Chondrohierax uncinatus	3	4	3	4	3	4	3	21	24	t29	1/3, end. ssp.	+
Elanoides forficatus	3	4	3	3	3	2	3	18	21	t42	2	++
Gampsonyx swainsoni	5	4	3	3	3	4	3	20	25	t21	1	<5
Elanus leucurus	5	4	5	4	4	3	4	24	29	t3	1	++
Rostrhamus sociabilis	3	4	4	4	4	3	4	23	26	t16	3	++
Rostrhamus hamatus	3	3	3	3	3	4	3	19	22	t40	3	+
Harpagus bidentatus	5	4	3	3	1	4	4	19	24	t29	2	+?
Harpagus diodon	5	4	1	1	0	4	3	13	18	t58	2, ?	1
Ictinia plumbea	3	4	3	3	3	3	3	19	22	t40	2	++?
Circus buffoni	5	4	1	1	1	2	3	12	17	t66	2	+
Circus cinereus	5	4	3	3	1	2	4	17	22	t40	1/3	++?
Accipiter poliogaster	5	3	0	0	0	2	2	7	12	t77	3, n-t, ?	0
Accipiter superciliosus	5	4	1	1	1	4	3	14	19	t51	2, ?	<5
Accipiter collaris	5	4	0	0	0	0	3	7	12	t77	3, n-t, ?	0
Accipiter chionogaster	3	4	0	0	0	0	2	6	9	81	3, ?	0
Accipiter ventralis	3	4	1	0	1	0	2	8	11	78	3, ?	0
Accipiter erythronemius	3	4	0	0	0	0	3	7	10	t80	3	0
Accipiter gundlachi	3	4	3	3	1	5	4	20	23	t33	3, v/r	+
Accipiter bicolor	3	4	3	3	3	4	4	21	24	t29	3	+
Accipiter chilensis	3	4	1	1	0	3	2	11	14	t73	3, ?	+?
Geranospiza caerulescens	1	4	3	1	1	4	4	17	18	t58	2	+?
Leucopternis plumbea	5	4	1	0	0	4	3	12	17	t66	3, n-t, ?	0
Leucopternis schistacea	5	4	1	0	0	4	3	12	17	t66	2	0
Leucopternis princeps	5	4	1	0	0	4	3	12	17	t66	3, ?	0
Leucopternis melanops	5	4	1	0	0	4	3	12	17	t66	2, ?	0
Leucopternis kuhli	3	4	1	0	0	4	2	11	14	t73	3, ?	0

Leucopternis lacernulata	5	4	1	0	0	4	4	13	18	t58	4, v/r	0
Leucopternis semiplumbea	5	4	1	1	0	4	4	14	19	t51	3, n-t	1
Leucopternis albicollis	5	4	3	3	3	4	5	22	27	t11	2	+
Leucopternis occidentalis	5	4	1	0	1	5	4	15	20	t45	5	0
Leucopternis polionota	5	3	1	0	0	4	3	11	16	t69	4, n-t, ?	0
Buteogallus aequinoctialis	5	4	3	1	1	5	5	19	24	t29	2	+
Buteogallus anthracinus	3	4	4	4	4	3	4	23	26	t16	2	++?
Buteogallus subtilis	3	4	1	0	0	5	3	13	16	t69	2, ?	0
Buteogallus urubitinga	5	4	4	3	3	2	5	21	26	t16	2	++
Buteogallus meridionalis	3	4	3	4	3	3	4	21	24	t29	1	++
Parabuteo unicinctus	3	4	4	4	4	3	4	23	26	t16	3	++
Busarellus nigricollis	5	4	3	1	1	4	4	17	22	t40	3	+?
Geranoaetus melanoleucus	5	4	4	3	3	4	4	22	27	t11	1/3	++?
Harpyhaliaetus solitarius	5	4	1	1	1	4	3	14	19	t51	3, n-t ?	<5
Harpyhaliaetus coronatus	5	3	1	1	1	3	3	12	17	t66	3, n-t, ?	<5
Buteo nitidus	5	4	3	3	3	3	4	20	25	t21	1	++?
Buteo magnirostris	3	4	3	3	3	4	5	22	25	t21	1	++?
Buteo ridgwayi	3	5	3	5	4	5	4	26	29	t3	4, ?	+
Buteo leucorrhous	3	3	1	1	1	0	3	9	12	t77	3, ?	+?
Buteo brachyurus	3	4	3	1	1	2	4	15	18	t58	2	+
Buteo albigula	3	4	1	1	0	2	3	11	14	t73	2	++?
Buteo albicaudatus	5	3	3	3	3	2	4	18	23	t33	1/3	++?
Buteo galapagoensis	5	5	5	5	5	5	5	30	35	1	2	++
Buteo polyosoma	3	4	4	3	3	2	2	18	21	t42	3	++
Buteo poecilochrous	3	4	4	1	1	1	3	14	17	t66	2	++?
Buteo albonotatus	3	3	3	3	2	2	4	17	20	t45	2	++?
Buteo ventralis	3	4	1	1	0	4	4	14	17	t66	3, n-t, ?	2
Morphnus guianensis	5	4	2	2	2	5	3	18	23	t33	3, n-t	2
Harpia harpyja	5	4	3	4	3	5	3	22	27	t11	3, n-t	+
Spizastur melanoleucus	5	4	3	1	1	4	4	17	22	t40	2, n-t	1
Spizaetus tyrannus	3	3	3	3	3	5	4	21	24	t29	3	+?
Spizaetus ornatus	3	3	4	4	4	5	4	24	27	t11	3	+
Oroaetus isidori	5	4	2	3	2	4	2	17	22	t40	3, n-t, ?	<5
Daptrius ater	5	3	3	1	0	4	3	14	19	t51	2, ?	0
Daptrius americanus	3	4	3	3	2	5	4	21	24	t29	3	<5
Phalcoboenus carunculatus	1	4	3	3	0	4	3	17	18	t58	1	+?

Appendix. *cont.*

	Taxonomy	Distribution	Prey	Nest	Breeding behaviour	Migration	Conservation status	Knowledge (except tax.)	Knowledge (all cats)	Rank	Population trend	Number of nests
Phalcoboenus megalopterus	1	3	3	3	0	5	4	18	19	t51	2	++
Phalcoboenus albogularis	1	4	1	3	0	4	3	15	16	t69	2	+?
Phalcoboenus australis	1	4	3	3	0	4	3	17	18	t58	2, n-t	++
Polyborus plancus	5	4	3	4	3	3	4	21	26	t16	1/3	++
Milvago chimachima	3	4	3	3	0	4	5	19	22	t40	1	++?
Milvago chimango	3	4	3	4	3	3	5	22	25	t21	1	++
Herpetotheres cachinnans	5	4	3	4	3	4	4	22	27	t11	2	+
Micrastur ruficollis	5	4	3	3	3	5	4	22	27	t11	3	++
Micrastur plumbeus	3	4	1	0	0	4	2	11	14	t73	3, v/r	0
Micrastur gilvicollis	5	4	1	0	1	5	4	15	20	t45	3	0
Micrastur mirandollei	5	4	1	0	0	5	3	13	18	t58	3, ?	0
Micrastur semitorquatus	5	4	3	3	3	5	4	22	27	t11	3	9
Micrastur buckleyi	5	2	0	0	1	4	1	8	13	74	3, ?	0
Spiziapteryx circumcinctus	5	4	1	3	3	5	2	18	23	t33	3, ?	++
Falco femoralis	5	4	3	4	3	2	3	19	24	t29	1/3	++
Falco rufigularis	5	3	4	3	3	5	4	22	27	t11	1/3	++
Falco deiroleucus	5	3	3	4	4	5	1	20	25	t21	3, n-t	+

Notes:

Taxonomy	Distribution	Prey	Nest	Breed behav.	Migration	Conservation status	Rank	Population trend	Number of nests
0, unknown	0, unknown	0, unknown	0, unknown	0, unknown	0, unknown	0, unknown	t, tied	0, increasing	+, >5 but <15
1, 2/3 ?	1, type only	1, anecdotal	1, anecdotal	1, anecdotal	1, anecdotal	1, 1/3 est.		1, local increases	++, >15
	2, <15 specimens	2, 1 pair	2, 1 pair	2, 1 pair	2, limits/status	2, 1/3 known		2, stable	
3, 1/3 ?	3, large areas?	3, >1 pair	3, >1 pair	3, >1 pair	3, res/mig?	3, 2/3 est.		3, local decreases	
	4, few queries	4, >1 site	4, >1 site	4, >1 site	4, presumed	4, 2/3 known		4, widespread decrease	
5, well known	5, well known	5, well known	5, well known	5, well known	5, well known	5, well known		5, endangered	
								end. ssp., endangered subsp.	
								n-t, near threatened	
								v/r, vulnerable/rare	
								?, more information needed	