

Bird conservation on Santa Catarina Island, Southern Brazil

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Summary

The island of Santa Catarina lies in the Atlantic Forest Domain of southern Brazil, one of the most threatened ecosystems on the planet. It holds a wide variety of habitats, ranging from sand dune 'restingas' to mature rain forest. We report, for the first time, a survey of the bird species and their conservation status for the different habitats present on the island. We recorded 269 bird species of 54 families (25 species were seabirds). More than 50% (140) of the total number of species were residents or probable residents, 20% (58) were visitors and a relatively high number of species (61, 23%) had indeterminate residential status. Nearly 15% (35 species) of the 244 landbird species observed were endemic to the Atlantic Forest. Habitat specificity was recorded for 40% (97 species). We recorded one Endangered (Solitary Tinamou *Tinamus solitarius*), one Vulnerable (White-necked Hawk *Leucopternis lacernulata*), and three Near-threatened species (Azure Jay *Cyanocorax caeruleus*, Azure-shouldered Tanager *Thraupis cyanoptera*, Black-backed Tanager *Tangara peruviana*). We also recorded six locally threatened species that we predict will become extinct in the near future. The future for the birds of the island is uncertain, especially for habitat specialists, due to habitat loss for resort developments, and a lack of concern by the government and local people.

Introduction

Santa Catarina Island is the largest continental island on the Brazilian coast. The island lies within the Atlantic Forest Domain, which is not only one of the most fragmented and threatened ecosystems in the world (Brown and Brown 1994, Fearnside 1996), but is also a biodiversity hotspot (Bibby *et al.* 1992, Myers *et al.* 2000). The Atlantic Forest has the highest rate of bird endemism on earth (Wege and Long 1995), comprising an avifauna of 682 species, including 199 endemics and 144 species threatened with extinction, most due to habitat loss (Stotz *et al.* 1996, Collar *et al.* 1997).

Once, the entire coast and much of inland eastern Brazil was covered by lush tropical forests. Nowadays only 5% of the original area of the Atlantic Forest, or 60,000 km², remains (Brown and Brown 1994). In 1712, Santa Catarina Island was covered by pristine forests, mangroves and sand-plains, being inhabited by only '147 white men, a few Indians and a few freed negroes' (Frézier 1716 in Haro 1996). Since then, many things have changed on this island: the biggest urban area of the island, Florianópolis, is now the state capital, with a human population of 150,000 and growing (CECCA 1997a).

The island rises to almost 600 m above sea level, with habitats comprising sand-plain forests (or restingas), mangroves and other wetlands, and lowland and lower-montane evergreen forests. Originally, 74% of the island was covered by forests (313 km²), but by 1938 forested areas totalled only 12% (52 km²) (Caruso 1990). Thus almost 60 years ago, after little more than 300 years of European colonization, most of the island had already been cleared for pastures and manioc, rice and sugar cane plantations. The island's main economic activities are now linked strongly to tourism, leading to a decline in agricultural activity. As a result, many of these areas have been abandoned, beginning a slow and spontaneous recovery by the original vegetation (CECCA 1997a). Today, nearly 50% of the island is covered by second-growth forests (Caruso 1990). The shift in major economic activities led to a reevaluation of lowland areas, mainly during the 1980s, resulting in the systematic destruction of restingas and mangroves as a result of land speculation, unplanned settlements, unrealistic government development plans, and ever-increasing tourism activity (CECCA 1997a).

Despite the level of destruction that the island has suffered during the last 300 years, it still holds a diverse and rich avifauna, which shows close affinities to the Parana and the Serra do Mar endemic centres (Cracraft 1985). Lying near the limit of these centres, Santa Catarina Island is important zoogeographically because: (1) it is only 80 km from the southern limit of the mangrove formation in the Americas (Rizzini 1963); (2) it is the southernmost limit of occurrence of some endemic bird species of the Atlantic Forest (Naka *et al.* in press); and (3) it represents the northernmost limit for some typical grassland birds from southern South America (Sick 1993).

Although the state of Santa Catarina lies in one of the most developed regions of Brazil and holds a relatively large number of well-preserved but still unprotected areas, only recently has it received attention from ornithologists. Few areas have been systematically surveyed in the state (e.g. Albuquerque and Brüggemann 1996, Machado 1996, Marterer 1996, Rosário 1996). This is particularly true for Santa Catarina Island, for which a complete treatment of its avifauna was lacking until recently (see Naka and Rodrigues 2000). These latter authors provided a historical review and a characterization of the habitats of Santa Catarina Island, in addition to behavioural, distributional, and life-history details for each bird species recorded for the island.

Here, we present an analysis of the avifauna of Santa Catarina Island focusing on its composition, seasonality and habitat specificity. We also provide a list of all species known to have occurred on the island. Finally, we point out the major threats to bird diversity, review the main conservation problems of the island, establish conservation priorities and suggest actions to ensure the maintenance of the island's biodiversity.

Study area

Santa Catarina Island (hereafter SCI) is located 500 m off the coast of the state of Santa Catarina in southern Brazil (between 27°10'–27°50' S and 48°25'–48°35' W). The island has an elongated shape with a maximum length (N–S) of 54 km, and a maximum width (E–W) of 18 km. It is 425 km² in area and has a shoreline of

172 km. It is formed by two geomorphological units: (1) a rocky mountain range that crosses the length of the island (NNE–SSW) that comprises low hills rising to a maximum elevation of 600 m above sea level; and (2) the surrounding lowland plains, formed by marine sediments (Figure 1) (Caruso 1990).

The climate is strongly influenced by southern, polar winds during winter (May–September) and by Atlantic, tropical winds from north-eastern Brazil during summer (October–April). The annual, average temperature is about 20°C, with January being the hottest month (mean temperature of 24°C) and July the coldest (mean temperature of 16°C). The average rainfall of 1,500 mm is distributed evenly during the year (CECCA 1997a).

The following vegetation types, or habitats, are found on the island:

- (1) Lower-montane evergreen forest. This vegetation type is very rich with a canopy reaching to 20 or 30 m. Most of this habitat is now composed of patches of secondary growth. The best preserved, remnant patches are confined to the highest areas of the slopes (Klein 1978).
- (2) Lowland evergreen forest (or lowland quaternary forest). This forest grows on marine sedimentary soils (formed during the Quaternary period). It is characterized by many epiphytes with an understory covered with bromeliads (Bresolin 1979), and a canopy averaging 15 m in height. Although pristine evergreen forests (lower-montane and lowland) comprise only 10% of the island's area, almost 50% of the island is now occupied by forests at different stages of regeneration (Caruso 1990).
- (3) Restinga. A coastal strip of shrubby vegetation typical of eastern Brazil, which grows on Holocene sandy soils of the littoral plains (Rizzini 1979). This habitat covers approximately 6% of the island's area.
- (4) Mangroves. These forests, which occur only on the western coast of the island, are dominated by three tree species: *Avicennia schaueriana*, *Rhizophora mangle* and *Laguncularia racemosa* (Bresolin 1979). The mangroves cover about 6% of the island.
- (5) Other wetlands. They occur along the coastal plains, in areas where rainfall accumulates. These areas are inhabited by many species of Cyperaceae (Reitz 1961). There are also two large lagoons on the island: *Lagoa do Peri* (a freshwater lagoon) and *Lagoa da Conceição* (filled with saline water). Wetlands, including the lagoons cover about 6% of the island's area.
- (6) Rural areas including old cattle pastures and abandoned agricultural lands, presently covering about 20% of the island.
- (7) Urban areas are formed by the city of Florianópolis and a myriad of small villages throughout the island. The main economic activities are linked to tourism. More than 8% of the island is now urbanized, harbouring a human population of about 150,000 (CECCA 1997a).

Methods

We surveyed the island's avifauna during 48 visits to various points on the island between August 1997 and September 1998. Thirty-eight of these visits were concentrated on seven inventory sites that were chosen a priori (Table 1). These sites were selected based on accessibility, habitat disturbance, and the types of habitats

Table 1. Description of the seven main inventory sites on the island of Santa Catarina, southern Brazil, visited from August 1997 to September 1998.

Site	Conservation status	Habitats sampled
Old Road to Daniela	Unprotected	R, LQF, W
Ibiza plains	Unprotected	LQF, W, M
Morro da Lagoa	Protected	LMEF
Pirajubaé	Partially protected	W, M, AA
Lagoa do Peri	Protected	LMEF, R, W, L
Toucans complex	Unprotected	LMEF, W, AA
Naufregados	Partially protected	LMEF, R, C

Key for habitats: LQF, lowland Quaternary forest; LMEF, lower-montane evergreen forest; R, restinga; M, mangroves; C, coastal waters and beaches; W, wetlands and marshlands; L, lakes and lagoons; AA, antropic areas, roads and pastures.

represented. Opportunistic data collection began in 1995. Since then, we have visited more than 30 additional localities on the island. Data was also gathered from the literature and from unpublished observations kindly given by other local researchers (sources of each record can be found in Naka and Rodrigues 2000).

During our 13-month survey, relative abundance was estimated from visual and audio detection, walking slowly (1 km/h) on paths, roads and tracks during non-rainy days. Each bird species was assigned an abundance class according to its frequency of occurrence following Hilty and Brown (1986). The frequency of occurrence for each species was calculated as the number of surveys in which a given species was detected, divided by the number of surveys undertaken in suitable habitat. This method results in the frequency of occurrence for a given habitat and not for the whole study area (see Appendix for more details on the abundance classes). We assumed that birds that were recorded outside our 48 censuses (or those recorded by other workers, but by none of us), were rare, extremely rare or occasional on SCI. To estimate the relative abundance of migratory species, we used the total number of samples within the period spanning the first and last observations of the species. We recognize that our relative abundance estimates may be biased by the year and the localities that we visited. However, because most of us have lived on the island for at least five years, we believe that our estimates are relatively accurate.

Seasonal patterns are based on our original data, but to understand global migration patterns we consulted several key references (Harrison 1983, Belton 1984, 1985, Hayman *et al.* 1986, Ridgely and Tudor 1989, 1994, Stotz *et al.* 1996, Sick 1997). We classified bird species as residents (species recorded on the island throughout the year), probable residents (secretive and rare species that are seldom detected outside the breeding season, but given their behaviour and ecological requirements are unlikely to leave SCI at any given time of the year) and migrants. We used Hayes's (1995) classification for definitions of migrants. Nearctic migrants are those species breeding in North America during the boreal summer (May–September) that reach SCI during the non-breeding season; Neotropical migrants (species that breed on SCI or adjacent areas during the austral summer (October–April) and migrate further north reaching northern South America during the non-breeding season); austral migrants (species breeding in

southern South America during the austral summer that reach SCI during the non-breeding season); and altitudinal migrants (species from the highlands that reach the lowlands of Santa Catarina state and SCI during the austral winter). Unfortunately, given the lack of knowledge about the seasonal movements of many Neotropical birds, the seasonality of a number of species could not be assessed, and thus was considered undetermined.

Habitat assignments are based exclusively on observations of birds on SCI. For species not observed by us, habitat designations are based on the authors' observations on the island. Notes on breeding behaviour are the result of opportunistic observations.

Remarks on the conservation status of the species are based on Bernardes *et al.* (1990) and Collar *et al.* (1992, 1994). The term 'locally threatened' (LT) was incorporated by us, and was assigned to species that are very local on SCI and whose habitats: (1) are not included in any conservation unit, or (2) are vulnerable to human destruction in the near future. Some species suffering a clear threat by local, illegal trade were also assigned to this category. Note that some of these species may be common and not threatened outside the island.

Birds were identified with the aid of binoculars, spotting scopes, and tape-recordings commercially available (Hardy *et al.* 1990). Recordings of the bird voices were made using a Sony TCM-5000 tape-recorder and a Sennheiser ME-66 directional microphone.

Taxonomic sequence follows Sick (1997), but we adopted a number of recent taxonomic or nomenclatural changes at the species level (see Appendix). Justification for those changes can be found in Naka and Rodrigues (2000).

Results

Species richness, seasonal patterns and habitat specificity

A total of 269 bird species of 54 families are known to have occurred on SCI (Appendix). Of these, 25 are seabirds and 244 are landbirds. At least 27 species can be considered vagrants, occasional visitors or species now extirpated from SCI. Therefore, the core avifauna, composed of resident species and regular visitors, including those that use the island as a stop-over during longer migrations, can be estimated at about 240 bird species.

More than half (132) the core species of SCI are confirmed residents, and another 14 are yet to be confirmed. We found that at least 72 species breed on SCI, and another 77 are likely to do so. About 20% of the birds recorded on the island (59 species) are visitors (see Appendix). Nineteen species are southern migrants, represented mostly by seabirds breeding in Patagonia, sub-Antarctic islands, and the Antarctic peninsula (Harrison 1983). Most of these seabirds occasionally appear dead on SCI's beaches, but a number can be regularly seen offshore during winter (although so far no systematic study has been carried out offshore). Besides these, other southern visitors are Magellanic Penguin *Spheniscus magellanicus*, White-tufted Grebe *Rollandia rolland*, Brown-hooded Gull *Larus maculipennis* and two passerines: Bar-winged Cinclodes *Cinclodes fuscus*, which is apparently an occasional visitor, and Tawny-headed Swallow *Alopochelidon fucata*, a regular visitor. Nearctic migrants comprise 14 species, most of which are

shorebirds. There also are two Procellariiformes (which could also be considered Palearctic migrants), two raptors: Osprey *Pandion haliaetus* and Peregrine Falcon *Falco peregrinus*, a few terns (Sternidae) and two *Hirundo* swallows. Nineteen Neotropical migrants were recorded on SCI, among them Swallow-tailed Kite *Elanoides forficatus*, Plumbeous Kite *Ictinia plumbea*, Dark-billed Cuckoo *Coccyzus melacoryphus*, some swifts (Apodidae), and many tyrant flycatchers such as Streaked Flycatcher *Myiodynastes maculatus*, Fork-tailed Flycatcher *Tyrannus savanna* and Tropical Kingbird *T. melancholicus*. Altitudinal migrants, probably arriving from the nearby mainland, are represented by White-throated Hummingbird *Leucochloris albicollis*, Black-breasted Plovercrest *Stephanoxis lalandi*, Yellow-legged Thrush *Platycichla flavipes*, Green-headed Tanager *Tangara seledon*, Brassy-breasted Tanager *T. desmaresti*, and Chestnut-backed Tanager *T. preciosa*. These species are common in the highlands and they have only been recorded on SCI during winter, but unfortunately, little data exist to assess the regularity of this type of migration.

A high degree of habitat specificity was found among the birds of SCI. Almost 50% of the landbirds recorded on SCI have been recorded only in a single habitat (Appendix). The largest number of habitat-specific birds live in forests. Of the 111 forest species, 76 appear to be habitat-restricted (35 of which are endemic to the Atlantic Forest). Wetlands contain 20 habitat-specific species, followed by the restingas with nine, and mangroves with six species. A number of species are more generally associated with open habitats including restingas, mangroves, wetlands, and rural and urbanised areas.

Conservation status

A number of species recorded on the island are of conservation concern. Among them are one Endangered (E), one Vulnerable (V), and three Near-threatened species (NT) (based on Collar *et al.* 1994). We also believe that eight species are locally threatened (LT) and, unless some action is taken, we predict their extinction on SCI in the near future.

Solitary Tinamou *Tinamus solitarius* (NT) and (LT)

This Atlantic Forest endemic was recorded at Morro da Lagoa in October 1997 and September 1998. Single individuals were heard calling along a stream in humid tall secondary forest. These are the first published records for SCI. We consider the Solitary Tinamou to be locally endangered (possibly critically so). It is threatened by heavy hunting and low population levels (Rodrigues 1997). Its presence was already known by hunters on SCI (J. Albuquerque verbally). As well as being globally near-threatened, Solitary Tinamou is included in the official list of Brazilian endangered species (Bernardes *et al.* 1990).

White-necked Hawk *Leucopternis lacernulata* (V)

A single individual of this Brazilian and Atlantic Forest endemic was captured in the urban area of Florianópolis in April 1993, and left under the care of the

IBAMA Rehabilitation Centre (Albuquerque 1995). The main threat for this species seems to be habitat loss (Collar *et al.* 1994).

Black Hawk-eagle *Spizaetus tyrannus* (LT)

There are a number of records from SCI, where this species appears to be resident. We consider it to be locally threatened due to its need for large prey items, but even more so because some of the areas where it regularly occurs, such as Toucan Area (Table 1), are unprotected and in great risk of disappearing in the near future, giving way to a large summer resort.

Common Miner *Geositta cunicularia* (LT)

Although this species is a common resident and breeder on SCI at the sand dunes of Joaquina, Moçambique, and Santinho beaches (Figure 1), most of its range on the island has been invaded by illegal and even legal, residential summer houses and resorts, giving rise to concern for the future of this species in its limited area on the island. SCI represents the northernmost limit of the species's range along the Atlantic coast (Rosário 1996).

Azure Jay *Cyanocorax caeruleus* (NT)

Although this Atlantic Forest endemic was considered Near-threatened by Collar *et al.* (1992), and an indicator of good quality habitat by Stotz *et al.* (1996), it is very common in all habitats of SCI, from urban areas to old secondary forest. In fact, it appears that numbers may be increasing, which may be a cause for concern, given that like many other jays, it is a nest predator (Rodrigues 1997). The species is also common in the coastal areas of the nearby mainland (Albuquerque and Brüggemann 1996). We suggest that the Azure Jay's status is safe, at least in Santa Catarina, given the variety of habitats where it occurs and its abundance in many other sites of the state.

Brazilian Tanager *Ramphocelus bresilius* (LT)

This restinga specialist, endemic to the Atlantic Forest domain, is considered rare in Santa Catarina (Rosário 1996), where there are only a few recent records, all of them from the northern limits of the state. Records from SCI apparently represent the southernmost limit of the species's range (Naka *et al.* 2000). It is rare and also quite localised on the island. The pet trade has been pointed out as the major threat for this species (Stotz *et al.* 1996). Brazilian Tanager is very common on some small islands adjacent to SCI (e.g. Campeche and Papagaio Islands), where the pressure from the local pet trade is minimal. Therefore its rarity on SCI itself can probably be attributed to a local demand for the species as pets.

Azure-shouldered Tanager *Thraupis cyanoptera* (NT)

This Atlantic Forest endemic is regularly recorded in forest edges, the canopy of old secondary forests, and also, but to a lesser extent, in orchards on SCI. Its continued presence on the island appears to be secure.

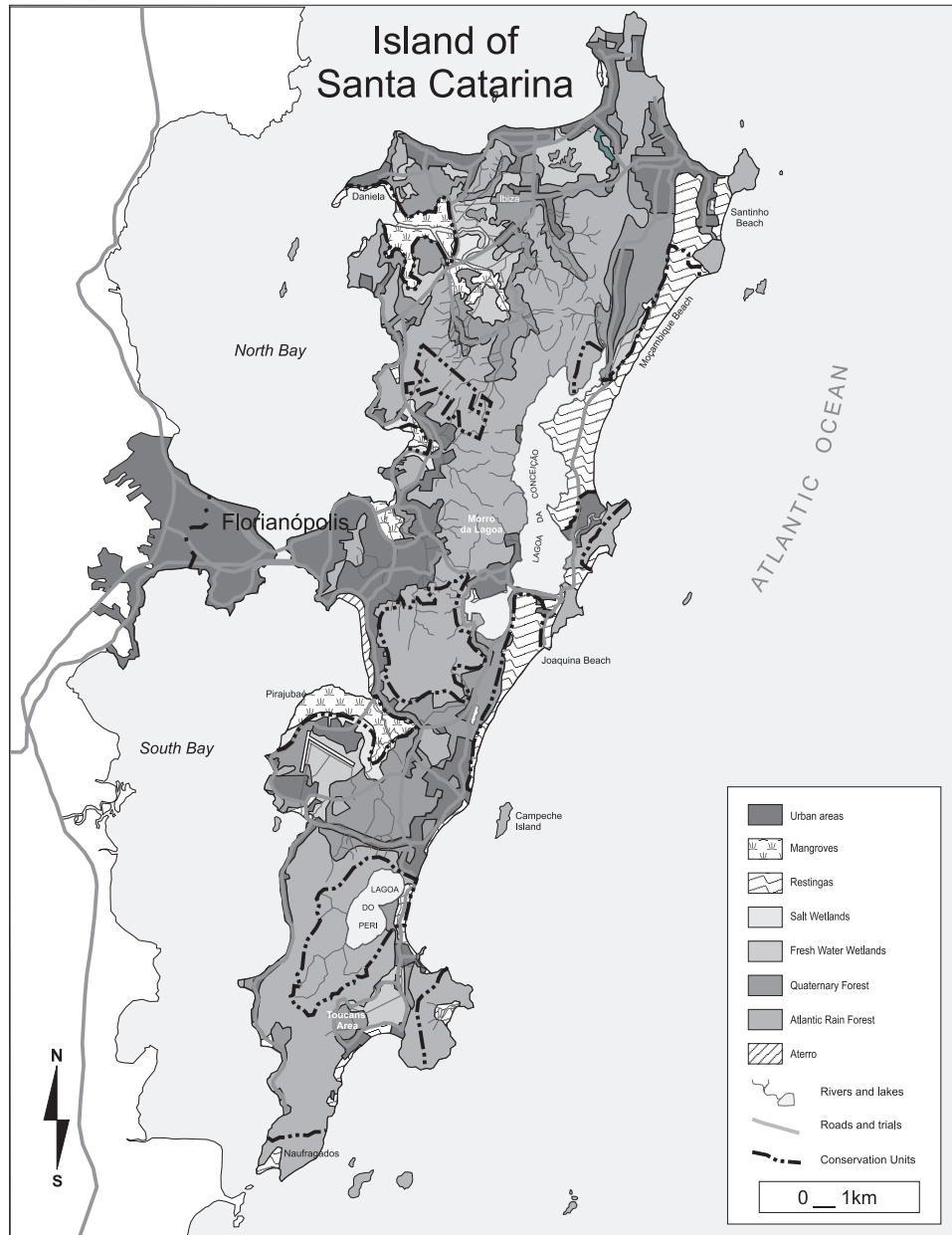


Figure 1. Map of Santa Catarina Island, southern Brazil, showing main habitat types and localities.

Black-backed Tanager *Tangara peruviانا* (E) and (LT)

This endemic species of the lowland evergreen forests and restingas of the Brazilian South-east, has been recorded from Espírito Santo south to Santa Catarina (Collar et al. 1992; J.F. Pacheco, *in litt.*). According to Collar et al. (1992), the only

confirmed records for Santa Catarina are those of Hellmayr in 1936. Nonetheless, a number of records of *T. peruviana* can be assigned to H. Sick and L. A. do Rosário (Naka *et al.* 2000). These records were not considered by other workers (e.g. Collar *et al.* 1992, Ridgely and Tudor 1989) because Sick and Rosário treated this species as a subspecies of the more widespread Chestnut-backed Tanager. As mentioned by Naka *et al.* (2000), it is likely that most coastal records of *T. peruviana* found in Rosário (1996), who stated that this species lives in *Araucaria* forests as well as in restingas, represent records of the endangered Black-backed Tanager. This species is resident on SCI, but records come exclusively from a mosaic of unprotected, lowland forests, restinga, and mangroves in the northern part of the island (Naka and Rodrigues 2000). It is thus vulnerable to extinction on the island.

Lesser Grass-Finch *Emberizoides ypiranganus* (NT) and (LT)

Considered rare in Santa Catarina (Rosário 1996), Lesser Grass-Finch is a regular resident at the Pirajubaé swamps where it nests (Figure 1) (Naka and Rodrigues 2000). Although locally common at this site, its presence on SCI is severely threatened by habitat loss, since residential areas are replacing most of these swamps at an alarming rate. Unless measures are taken quickly to avoid further destruction of the site, this species is likely to disappear from SCI.

Double-collared Seedeater *Sporophila caerulescens* (LT)

Although this species is widespread in most open habitats of South America, illegal trade may eliminate it from SCI. During our 13-month survey, we failed to find a single male of the species. Not surprisingly, males receive most of the pressure from the pet trade, for which they are heavily trapped after the breeding season (V.Q. Piacentini verbally). Although it is possible that the species could recolonize the island from the mainland, it is necessary to reduce the pressure on this species to ensure its continued existence on SCI.

Scarlet-headed Blackbird *Amblyramphus holosericeus* (LT)

This wetland specialist and handsome blackbird is locally common in the unprotected marshes of Daniela (Figure 1). These wetlands represent the only site where it occurs on the island. The future of both wetlands and blackbirds is uncertain because, unless formally protected, these marshes could be developed for housing at any time (see Conservation priorities and recommendations).

Discussion

Avian diversity

With about 240 core species, SCI harbours about half the core species of the state, illustrating the strategic importance of the island to the overall richness of birds in Santa Catarina. It represents a stronghold in the state for some threatened

species, such as Black-backed Tanager, and more importantly, from a biogeographical and evolutionary perspective, it represents a transition between the Atlantic Forest and the pampas. Some species have their northernmost limit on SCI (e.g. Common Miner and Bar-winged Cinclodes) and for others, the island represents the southernmost extent of their range (e.g. Brazilian and Black-backed Tanagers). Whereas forest bird species on SCI show strong affinities with the Serra do Mar endemic centre (Cracraft 1985) (see Appendix), waterbirds and open habitat species are more clearly related to the avifauna of Rio Grande do Sul, Uruguay and Argentina.

It is possible that after more than 300 years of colonization and habitat destruction, much of the original avifauna of the island has already disappeared, as can be seen by comparisons with the mainland (see Missing bird species). Clearly, the key to the bird species richness present on SCI is habitat heterogeneity.

Missing bird species

A few species that were known to occur in the past are no longer found on the island. The best example of a local extinction on SCI is probably Scarlet Ibis *Eudocimus ruber*. This species, which formerly occurred from Mexico to Santa Catarina, has almost completely disappeared from the Brazilian South-east (Sick 1997) and SCI. Another example is Red-tailed Amazon *Amazona brasiliensis*, a globally endangered, Brazilian endemic (Collar *et al.* 1992), which probably occurred on the island in reasonable numbers when the first European explorers arrived (as is evident from written comments left by explorers since 1712; Haro 1996). All described large numbers of parrots, which they ate, and whose descriptions closely matched that of Red-tailed Amazon. This species now occurs only in a very narrow, coastal strip between São Paulo and Paraná (Martuscelli 1995).

We speculate that a number of other bird species absent from the island are the result of local extinctions following human disturbance. We will probably never know what was lost on SCI, but as pointed out by Rodrigues (1997), the lack of some obligate frugivores is at least surprising. No trogons (Trogonidae), cotingas (Cotingidae), or guans (Cracidae) (except the Scaled Chachalaca *Ortalis squamata*) inhabited SCI during our surveys, despite the fact that at least eight such species are present on the nearby mainland (Albuquerque and Brüggemann 1996). If indeed present before the arrival of the Europeans, the elimination of these species may not only have resulted in a markedly reduced avian biomass, but also a greatly reduced ability of trees to disperse their seeds, given that frugivores are of prime importance for seed dispersal in many tropical tree species (Gilbert 1980, Howe 1984, Terborgh 1986, Silva and Tabarelli 2000). Alternatively, the island could have always been out of range of some species with poor dispersal capabilities, such as trogons. In the Amazon, rivers just 500 m wide may act as barriers to dispersal, separating sister, parapatric species on opposite banks (Sick 1993, A. Aleixo *in litt*).

Maintaining biodiversity of Santa Catarina Island: conservation priorities and recommendations

As noted above, the biodiversity of SCI is dependent on habitat heterogeneity. The variety of habitats present on SCI is perhaps the highest in the entire state,

as endorsed by the statement that '[outside the island] it is very hard to find lowland and montane forests, restingas, mangroves, sand dunes, marshlands and lagoons in such a concentrated way' (CECCA 1997a).

Historically, forests were the most exploited habitat on SCI following the arrival of the Europeans, with the lowland quaternary forests destroyed almost completely (Caruso 1990). Restingas, mangroves and other wetlands were not used for any kind of human activity until the advent of tourism in the late 1970s (CECCA 1997a). Roads, tourist resorts, and housing have replaced much of these habitats on SCI in recent decades.

The current status of different habitats on the island is clear. Lower-montane evergreen forests are going through a slow but continuous recovery process, and the proximity of the nearby mainland may help this recovery. Fortunately there are a number of reserves protecting this key habitat on SCI. Nevertheless, forest corridors must be established and preserved to ensure its existence. By contrast, none of the few remnants of lowland quaternary forests are formally protected (CECCA 1997b). This vegetation type now represents the highest priority for conservation on SCI. Although restingas and mangroves are formally protected by law, pressure from landowners is constant. The high demand for beach-front property is not a problem unique to SCI, but is part of a more widespread phenomenon in south-eastern Brazil, where endemic birds (such as Restinga Tyrannulet *Phylloscartes kronei* and Restinga Antwren *Formicivora littoralis*) are threatened with extinction due to beach development (Gonzaga and Pacheco 1990, Collar *et al.* 1992, Willis and Oniki 1992). No further permits to build on restingas should be issued.

Government development plans for the southern part of SCI further threaten both the biodiversity of the entire island and the well-being of the human population. A recent plan of the Instituto de Planejamento Urbano de Florianópolis (IPUF) recommends housing up to 500,000 people in this region.

We recommend the following urgent action to support biodiversity conservation on SCI:

- (1) A network of reserves comprising the last remnants of lower evergreen forests should be established. Especially important are the areas along the old road to Daniela and the Ibiza plains, both of which represent a mosaic of key habitats on SCI. Both areas, which are privately owned, are located outside the nearby Carijós Ecological Station. A clear step to protect these sites would be to include them within the reserve.
- (2) The swamps at Pirajubaé and along the old road to Daniela are not only unique on the island, but also represent the only sites for some species on SCI. Without urgent protection, these sites face imminent destruction, which is likely to result in the local extinction of at least three passerine species on SCI. Furthermore, both sites are important nesting areas for many water and marsh birds, including several heron (Ardeidae) species.
- (3) All well-preserved restingas on SCI, including sand dunes, should receive formal and consistent protection. Further construction of tourist houses and resorts in such areas should stop, and illegal settlements in this key habitat should be removed.
- (4) Government development plans should be examined in greater detail and the participation of local NGOs in decision making should be encouraged.

Santa Catarina Island represents a great opportunity for conservation planning in the Neotropics. If controlled, tourism can play an important role in preserving the biodiversity and the habitat heterogeneity of the island, as habitat clearance can easily be avoided. Unfortunately, the future of the avifauna on SCI is uncertain, its fate being closely linked with political decisions. Two possible, future scenarios are an island inhabited by common landbirds from open unspecialized habitats, combined with the empty forests predicted by Redford (1992), or a demonstration that sustainable development, nature conservation, and human well-being are strongly related.

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Appendix. Bird species recorded on Santa Catarina Island, Brazil, giving conservation status, endemism, abundance, seasonality, breeding behaviour and habitat. Taxonomy follows Sick (1997), unless noted otherwise by an asterisk (*), indicating the adoption of a different author at the species level. English names follow Sick (1993).

Conservation and endemism: TH, threatened, and NT, near-threatened (according to Collar *et al.* 1994); LT, locally threatened (conservation status within the island); EXT, extirpated from the island; ATL, species endemic to the Atlantic Forest; ATL(ssp), subspecies endemic to the Atlantic Forest.

Abundance: C, (common) recorded 75–100% of the visits in proper habitat and season; F, (fairly common) 50–74%; U, (uncommon) 25–49%; R, (rare) recorded on less than 25% of the visits to suitable habitat, often with only few records for the island; X, (extremely rare) with only 1 or 2 records; O, (occasional) wanderers or vagrants recorded without any clear pattern; H, (historical record) not recorded during the last 50 years.

Status: RES, (resident) species recorded throughout the year on SCI; PRE, (probable resident) refers to species that although not recorded throughout the year, are unlikely to leave the island; NAM, (Nearctic migrant) species breeding in North America that migrate south, reaching SCI during the non-breeding season (October–April); NTM, (Neotropical migrant) breeders in SCI that migrate north reaching northern South America during the non-breeding season (May–September); AUS, (austral migrant) species breeding in southern South America that migrate north, reaching SCI during the non-breeding season (May–September); ALT, (altitudinal migrant), species that undertake altitudinal movements, reaching SCI during the austral winter (May–September); VAG, (wanderers and vagrants); UND, (undetermined) species without clear, seasonal pattern.

Breeding: BRE, breeder on the island; BRp, probable breeder.

Habitat: F, forests; Fe, forest edges; R, resting; M, mangroves; C, coastal waters and beaches; P, pelagic waters; W, wetlands and marshlands; L, lakes and lagoons; AA, antropic areas, roads and pastures; U, urban areas, gardens; O, overhead, followed by the habitats which they fly over.

Families and species	English name	Conservation and endemism	Abundance	Status	Breeding	Habitat
TINAMIDAE (3 species)						
<i>Tinamus solitarius</i>	Solitary Tinamou	NT/LT/ATL	R	RES	BRp	F
<i>Crypturellus obsoletus</i>	Brown Tinamou	ATL(ssp)	C	RES	BRp	F
<i>Nothura maculosa</i>	Spotted Nothura		X	PRE		R, AA
PODICIPEDIIDAE (2 species)						
<i>Rollandia rolland</i>	White-tufted Grebe		R	AUS		L
<i>Podilymbus podiceps</i>	Pied-billed Grebe		X	UND		L
DIOMEDEIDAE (4 species)						
<i>Diomedea exulans</i>	Wandering Albatross		O	AUS		P
<i>Diomedea epomophora</i>	Royal Albatross		X	AUS		P
<i>Thalassarche melanophris</i> *	Black-browed Albatross		R	AUS		P, C
<i>Thalassarche chlororhynchos</i> *	Yellow-nosed Albatross		O	AUS		P

Appendix. Continued							
Families and species	English name	Conservation and endemism	Abundance	Status	Breeding	Habitat	
PROCELLARIIDAE (11 species)							
<i>Macronectes giganteus</i>	Antarctic Giant Petrel		O	AUS		P, C	
<i>Fulmarus glacialisoides</i>	Southern Fulmar		O	AUS		P	
<i>Pterodroma incerta</i>	Hooded Petrel		X	AUS		P	
<i>Pterodroma lessonii</i>	White-headed Petrel		X	AUS		P	
<i>Pachyptila desolata*</i>	Broad-billed Prion		O	AUS		P	
<i>Pachyptila belcheri</i>	Slender-billed Prion		O	AUS		P	
<i>Procellaria aequinoctialis</i>	White-chinned Petrel		O	AUS		P, C	
<i>Calonectris diomedea</i>	Cory's Shearwater		X	NAM		P	
<i>Puffinus gravis</i>	Greater Shearwater		O	AUS		P	
<i>Puffinus griseus</i>	Sooty Shearwater		O	AUS		P	
<i>Puffinus puffinus</i>	Manx Shearwater		O	NAM		P	
HYDROBATIDAE (1 species)							
<i>Oceanites oceanicus</i>	Wilson's Storm-petrel		X	AUS		P	
SPHENISCIDAE (1 species)							
<i>Spheniscus magellanicus</i>	Magellanic Penguin		U	AUS		P, C	
SULIDAE (1 species)							
<i>Sula leucogaster</i>	Brown Booby		C	RES	BRE	C	
PHALACROCORACIDAE (1 species)							
<i>Phalacrocorax brasilianus</i>	Neotropic Cormorant		C	RES	BRE	C, W, L, M	
FREGATIDAE (1 species)							
<i>Fregata magnificens</i>	Magnificent Frigatebird		C	RES	BRE	C	
ARDEIDAE (10 species)							
<i>Ardea cocoi</i>	White-necked Heron		U	RES	BRp	M, L	
<i>Ardea alba*</i>	Great Egret		F	RES	BRE	C, M, L, W, AA, U,	
<i>Egretta thula</i>	Snowy Egret		C	RES	BRE	C, M, L, W, AA, U	

Appendix. Continued

Families and species	English name	Conservation and endemism	Abundance	Status	Breeding	Habitat
<i>Egretta caerulea</i>	Little Blue Heron		F	RES	BRp	M, C
<i>Bubulcus ibis</i>	Cattle Egret		F	RES	BRE	AA, W, M
<i>Butorides striatus</i>	Green-backed Heron		F	RES	BRE	W, L, M, AA
<i>Syrigma sibilatrix</i>	Whistling Heron		C	RES	BRE	AA, W, L, R
<i>Nycticorax nycticorax</i>	Black-crowned Night Heron		F	RES	BRE	C, M, W, AA, L
<i>Nyctanassa violacea</i>	Yellow-crowned Night Heron		U	RES	BRE	W, M
<i>Ixobrychus exilis</i>	Least Bittern		X	VAG		
COCHLEARIIDAE (1 species)						
<i>Cochlearius cochlearius</i>	Boat-billed Heron		X	VAG		L
THRESKIORNITHIDAE (2 species)						
<i>Eudocimus ruber</i>	Scarlet Ibis	EXT	H	UND		M, L
<i>Ajaja ajaja*</i>	Roseate Spoonbill		U			
CATHARTIDAE (2 species)						
<i>Coragyps atratus</i>	Black Vulture		C	RES	BRp	AA, R, U, C
<i>Cathartes aura</i>	Turkey Vulture		C	RES	BRp	AA, R, U, F
ANATIDAE (5 species)						
<i>Dendrocygna viduata</i>	White-faced Whistling-duck		R	UND		L, AA
<i>Coscoroba coscoroba</i>	Coscoroba Swan		H			
<i>Anas georgica</i>	Yellow-billed Pintail		U	RES	BRE	L, W, AA
<i>Amazonetta brasiliensis</i>	Brazilian Duck		F	RES	BRE	L, W, R, AA
<i>Cairina moschata</i>	Muscovy Duck		X	UND		L
ACCIPITRIDAE (12 species)						
<i>Elanus leucurus</i>	White-tailed Kite		R	PRE		AA, R
<i>Elanoides forficatus</i>	Swallow-tailed Kite		C	NTM	BRE	O (F, R, AA, U)
<i>Harpagus diodon</i>	Rufous-thighed Kite		R	PRE		F, Fe, AA

Appendix. Continued						
Families and species	English name	Conservation and endemism	Abundance	Status	Breeding	Habitat
<i>Ictinia plumbea</i>	Plumbeous Kite		R	NTM		O (F)
<i>Rostrhamus sociabilis</i>	Snail Kite		R	UND		M
<i>Accipiter erythronemius</i> *	Rufous-thighed Hawk		R	UND		F
<i>Geranoaetus melanoleucus</i>	Black-chested Buzzard-eagle		X	UND		AA
<i>Buteo brachyurus</i>	Short-tailed Hawk		U	RES	BRp	F, AA
<i>Rupornis magnirostris</i>	Roadside Hawk		C	RES	BRE	R, AA, Fe, W, U
<i>Leucopternis lacernulata</i>	White-necked Hawk	TH/ATL	X	UND		F
<i>Spizaetus tyrannus</i>	Black Hawk-eagle	ATL(ssp)	R	RES	BRp	F
<i>Pandion haliaetus</i>	Osprey		R	NAM		L, M
FALCONIDAE (5 species)						
<i>Mitogo chimachina</i>	Yellow-headed Caracara		C	RES	BRE	R, AA, U, M, Fe
<i>Mitogo chimango</i>	Chimango Caracara		F	RES	BRE	R, AA, U, C
<i>Caracara plancus</i> *	Crested Caracara		U	RES	BRE	AA, R
<i>Falco peregrinus</i>	Peregrine Falcon		U	NAM		U, R
<i>Falco sparverius</i>	American Kestrel		X	UND		R
CRACIDAE (1 species)						
<i>Ortalis squamata</i>	Scaled Chachalaca		C	RES	BRp	F, Fe, R, AA
RALLIDAE (9 species)						
<i>Pardirallus sanguinolentus</i> *	Plumbeous Rail		R	PRE		W
<i>Pardirallus nigricans</i> *	Blackish Rail		U	RES	BRp	W
<i>Rallus longirostris</i>	Clapper Rail		R	RES	BRE	M
<i>Aramides cajana</i>	Grey-necked Wood-rail		C	RES	BRE	W, M
<i>Aramides sarcura</i>	Slaty-breasted Wood-rail	ATL	F	RES	BRp	F
<i>Porzana albicollis</i>	Ash-throated Crane		F	RES	BRp	W
<i>Laterallus melanophaius</i>	Rufous-sided Crane		F	RES	BRp	W
<i>Gallinula chloropus</i>	Common Moorhen		U	RES	BRp	L
<i>Fulica armillata</i>	Red-gartered Coot		H	L	BRE	L

Appendix. Continued

Families and species	English name	Conservation and endemism	Abundance	Status	Breeding	Habitat
JACANIDAE (1 species) <i>Jacana jacana</i>	Wattled Jacana		F	RES	BRE	W, L, AA
HAEMATOPODIDAE (1 species) <i>Haematopus palliatus</i>	American Oystercatcher		U	RES	BRE	C
CHARADRIIDAE (4 species) <i>Vanellus chilensis</i> <i>Pluvialis squatarola</i> <i>Charadrius semipalmatus</i> <i>Charadrius collaris</i>	Southern Lapwing Black-bellied Plover Semipalmated Plover Collared Plover		C R R U	RES NAM NAM PRE	BRE	AA, R, U, M, W L M C, M
SCOLOPACIDAE (7 species) <i>Tringa solitaria</i> <i>Tringa flavipes</i> <i>Tringa melanoleuca</i> <i>Actitis macularia</i> <i>Calidris canutus</i> <i>Calidris fuscicollis</i> <i>Gallinago paraguanae</i>	Solitary Sandpiper Lesser Yellowlegs Greater Yellowlegs Spotted Sandpiper Red Knot White-rumped Sandpiper South American Snipe		R F F R R R F	NAM NAM NAM NAM NAM NAM RES	BRp	M M, L M, L M, C C M L, W, AA
RECURVIROSTRIDAE (1 species) <i>Himantopus himantopus</i>	Black-winged Stilt		F	RES	BRE	L, M, W
LARIIDAE (7 species) <i>Larus dominicanus</i> <i>Larus cirrocephalus</i> <i>Larus maculipennis</i> <i>Sterna hirundinacea</i> <i>Sterna superciliaris</i> <i>Sterna maxima</i> <i>Sterna sandvicensis</i> *	Kelp Gull Grey-hooded Gull Brown-hooded Gull South American Tern Yellow-billed Tern Royal Tern Sandwich Tern		C X R F X R F	RES UND AUS AUS UND UND AUS/NAM	BRE C, L, W C, L, W BRE	C, L, AA, O C C C C, L, W C C BRE

Appendix. Continued							
Families and species	English name	Conservation and endemism	Abundance	Status	Breeding	Habitat	
RYNCHOPIDAE (1 species)							
<i>Rynchops niger</i> *	Black Skimmer		F	RES	BRp	C, L	
COLUMBIDAE (7 species)							
<i>Columba licia</i>	Rock Dove		C	RES	BRE	AA, U	
<i>Columba picazuro</i>	Picazuro Pigeon		R	UND		R, AA	
<i>Columba cayennensis</i>	Pale-vented Pigeon		U	RES	BRp	R, AA, Fe	
<i>Columbina talpacoti</i>	Ruddy Ground-Dove		C	RES	BRE	R, AA, U	
<i>Columbina picui</i>	Picui Ground-Dove		F	RES	BRE	R, AA, U	
<i>Leptotila verreauxi</i>	White-tipped Dove		C	RES	BRp	F, Fe, R, AA	
<i>Leptotila rufaxilla</i>	Grey-fronted Dove		U	RES	BRp	F, R	
PSITTACIDAE (5 species)							
<i>Pyrrhura frontalis</i>	Reddish-bellied Parakeet		R	PRE		F	
<i>Forpus xanthopterygius</i>	Blue-winged Parrotlet		U	PRE		Fe, R, AA	
<i>Brotogeris tirica</i>	Plain Parakeet	ATL	R	PRE		Fe, AA	
<i>Pionus maximiliani</i>	Scaly-headed Parrot		R	PRE		F, Fe	
<i>Amazona brasiliensis</i>	Red-tailed Amazon	EXT/TH/ATL	H				
<i>Amazona aestiva</i>	Turquoise-fronted Parrot		U	RES	BRp	Fe, AA	
CUCULIDAE (5 species)							
<i>Coccyzus melacoryphus</i>	Dark-billed Cuckoo		X	NTM	BRp	Fe, R	
<i>Piaya cayana</i>	Squirrel Cuckoo		F	RES	BRE	F, R, AA, U	
<i>Crotophaga ani</i>	Smooth-billed Ani		C	RES	BRE	R, AA, U	
<i>Guitra gutra</i>	Guitra Cuckoo		F	RES	BRE	R, AA, U	
<i>Tapera naevia</i>	Striped Cuckoo		F	RES	BRp	R	
TYTONIDAE (1 species)							
<i>Tyto alba</i>	Barn Owl		R	RES	BRp	AA, U	
STRIGIDAE (5 species)							
<i>Otus choliba</i>	Tropical Screech-owl		U	RES	BRp	F	
<i>Speotyto cunicularia</i>	Burrowing Owl		C	RES	BRE	R, AA	

Appendix. Continued

Families and species	English name	Conservation and endemism	Abundance	Status	Breeding	Habitat
<i>Strix hylophila</i>	Rusty-barred Owl	ATL	F	RES	BRp	F, Fe
<i>Pseudoscops clamator</i> *	Striped Owl		R	RES	BRE	AA, F, Fe
<i>Asio stygius</i>	Stygian Owl		X	UND		F, Fe, AA
NYTIBIDAE (1 species)						
<i>Nyctibius griseus</i>	Common Potoo		F	RES	BRp	AA, Fe
CAPRIMULGIDAE (5 species)						
<i>Lurocalis semitorquatus</i>	Short-tailed Nighthawk		R	UND		Fe
<i>Podager nacunda</i>	Nacunda Nighthawk		X	UND		AA, R
<i>Nyctidromus albicollis</i>	Pauraque		U	RES	BRp	AA, W, Fe
<i>Caprimulgus longirostris</i>	Band-winged Nightjar		X	UND		AA
<i>Hydropsalis torquata</i> *	Scissor-tailed Nightjar		U	RES	BRp	R, AA, U, Fe
APODIDAE (4 species)						
<i>Streptoprocne zonaris</i>	White-collared Swift		F	UND		O
<i>Cypseloides fumigatus</i>	Sooty Swift		X	UND		O
<i>Chaetura cinereiventris</i>	Grey-rumped Swift		U	UND		O
<i>Chaetura meridionalis</i> *	Sick's Swift		F	NTM		O
TROCHILIDAE (8 species)						
<i>Melanotrochilus fuscus</i>	Black Jacobin		U	UND		F, R, AA, U
<i>Anthracoceros nigricollis</i>	Black-throated Mango		X	UND		Fe, U, AA
<i>Stephanoxis lalandi</i>	Black-breasted Plovercrest	ATL	O	ALT		Fe
<i>Chlorostilbon aureoventris</i>	Glittering-bellied Emerald		R	UND		AA, R, Fe
<i>Thalurania glaucopis</i>	Violet-capped Woodnymph	ATL	C	RES	BRE	F, AA, R, U
<i>Leucochloris albicollis</i>	White-throated Hummingbird		R	ALT		Fe, AA
<i>Amazilia versicolor</i>	Versicoloured Emerald		X	UND		AA, U, R
<i>Amazilia fimbriata</i>	Glittering-throated Emerald		C	RES	BRE	R, AA, UND
ALCEDINIDAE (4 species)						
<i>Ceryle torquata</i>	Ringed Kingfisher		C	RES	BRE	W, M, AA, L

Appendix. Continued						
Families and species	English name	Conservation and endemism	Abundance	Status	Breeding	Habitat
<i>Chloroceryle amazona</i>	Amazon Kingfisher		R	PRE	BRp	M, W
<i>Chloroceryle americana</i>	Green Kingfisher		U	RES	BRp	L, W, M
<i>Chloroceryle inda</i>	Green-and-rufous Kingfisher		H			
RAMPHASTIDAE (2 species)						
<i>Ramphastos vitellinus</i>	Channel-billed Toucan		C	RES	BRp	F
<i>Ramphastos dicolorus</i>	Red-breasted Toucan		U	RES	BRp	F
PICIDAE (7 species)						
<i>Picumnus temminckii</i> *	Ochre-collared Piculet	ATL	C	RES	BRp	F, Fe, R, AA, U
<i>Colaptes campestris</i>	Campo Flicker		F	RES	BRE	R, AA
<i>Colaptes melanochloros</i>	Green-barred Woodpecker		R	UND		R
<i>Ceolus flavescens</i>	Blond-crested Woodpecker		F	RES	BRp	F, R
<i>Dryocopus lineatus</i>	Lineated Woodpecker		R	RES	BRE	F
<i>Melanerpes formicivorus</i>	Yellow-fronted Woodpecker		R	UND		Fe
<i>Ventilornis spilogaster</i>	White-spotted Woodpecker	ATL	F	RES	BRp	F
RHINOCRYPTIDAE (1 species)						
<i>Scytalopus indigoticus</i>	White-breasted Tapaculo	ATL	F	RES	BRp	F
FORMICARIIDAE (8 species)						
<i>Thamnophilus caerulescens</i>	Variable Antshrike		R	UND		F, Fe
<i>Thamnophilus ruficapillus</i>	Rufous-capped Antshrike		X	UND		R
<i>Dysithamnus mentalis</i>	Plain Antvireo		C	RES	BRp	F, R
<i>Myrmotherula gularis</i>	Star-throated Antwren	ATL	X	UND		F
<i>Herpsilochmus rufimarginatus</i>	Rufous-winged Antwren		U	RES	BRp	F
<i>Pyriglena leucoptera</i>	White-shouldered Fire-eye	ATL	X	UND		F
<i>Myrmeciza squamosa</i> *	Squamate Antbird	ATL	C	RES	BRp	F
<i>Formicarius colma</i>	Rufous-capped Antthrush	ATL(ssp)	F	RES	BRp	F
CONOPOPHAGIDAE (1 species)						
<i>Conopophaga melanops</i>	Black-cheeked Gnatcatcher	ATL	F	RES	BRp	F

Appendix. Continued

Families and species	English name	Conservation and endemism	Abundance	Status	Breeding	Habitat
FURNARIDAE (9 species)						
<i>Geositta cunicularia</i>	Common Miner	LT	F	RES	BRE	R
<i>Cinclodes fuscus</i>	Bar-winged Cinclodes		O	AUS		L
<i>Furnarius rufus</i>	Rufous Hornero		C	RES	BRE	R, AA, U
<i>Synallaxis spixi</i>	Spix's Spinetail		C	RES	BRp	R, Fe, AA
<i>Philydor atricapillus</i>	Black-capped Foliage-gleaner	ATL	F	RES	BRp	F
<i>Philydor lichtensteini</i>	Ochre-breasted Foliage-gleaner	ATL	R	RES	BRp	F
<i>Philydor rufus</i>	Buff-fronted Foliage-gleaner		U	RES	BRp	F
<i>Xenops rutilans</i>	Streaked Xenops		R	PRE		F
<i>Sclerurus scansor</i>	Rufous-breasted Leaf-tosser	ATL	F	RES	BRp	F
DENDROCOLAPTIDAE (2 species)						
<i>Sittasomus griseicapillus</i>	Olivaceous Woodcreeper		U	RES	BRp	F
<i>Xiphocolaptes albicollis</i>	White-throated Woodcreeper		R	PRE		F
TYRANNIDAE (36 species)						
<i>Phyllosmyias fasciatus</i>	Planalto Tyrannulet		R	UND		F
<i>Comptosia obsoletum</i>	Southern Beardless Tyrannulet		F	RES	BRp	R, AA, U
<i>Elaenia flavogaster</i>	Yellow-bellied Elaenia		F	RES	BRp	R, AA, U
<i>Elaenia parvirostris</i>	Small-billed Elaenia		X	UND		Fe
<i>Elaenia mesoleuca</i>	Olivaceous Elaenia		X	UND		Fe
<i>Elaenia obscura</i>	Highland Elaenia		F	RES	BRE	R, AA
<i>Serpophaga nigricans</i>	Sooty Tyrannulet		X	UND		M
<i>Serpophaga subcristata</i>	White-crested Tyrannulet		F	RES	BRp	R, AA, U
<i>Mionectes rufiventris</i>	Grey-hooded Flycatcher	ATL	R	RES	BRp	F
<i>Leptopogon amaurocephalus</i>	Sepia-capped Flycatcher		F	RES	BRp	F
<i>Tolmomyias sulphureus</i>	Yellow-olive Flycatcher		U	RES	BRp	F, Fe
<i>Platyrinchilus mystacatus</i>	White-throated Spadebill		U	RES	BRp	F
<i>Myiophobus fasciatus</i>	Bran-coloured Flycatcher		U	RES	BRE	R, AA, U

Appendix. Continued

Families and species	English name	Conservation and endemism	Abundance	Status	Breeding	Habitat
TYRANNIDAE (36 species) continued						
<i>Lathrotriccus euleri</i>	Euler's Flycatcher		F	NTM	BRp	F
<i>Cnemotriccus fuscatus</i>	Fuscous Flycatcher		U	UND		F, R
<i>Pyrocephalus rubinus</i>	Vermilion Flycatcher		R	NTM	BRp	R, AA
<i>Xolmis irupero</i>	White Monjita		X	UND		AA, R
<i>Satrapa icterophrys</i>	Yellow-browed Tyrant		U	RES	BRp	AA, U, R
<i>Machetornis rixosus</i>	Cattle Tyrant		F	RES	BRp	AA, U, R, C
<i>Attila rufus</i>	Grey-hooded Attila	ATL	F	RES	BRp	F
<i>Sirystes sibilator</i>	Sirystes		R	UND		F, Fe
<i>Myiarchus ferox</i>	Short-crested Flycatcher		X	UND		M
<i>Myiarchus tyrannulus</i>	Brown-crested Flycatcher		X	UND		Fe
<i>Myiarchus swainsoni</i>	Swainson's Flycatcher		U	NTM	BRE	F
<i>Pitangus sulphuratus</i>	Great Kiskadee		C	RES	BRE	R, AA, U, M, W, L, C
<i>Megarynchus pitangua</i>	Boat-billed Flycatcher		R	UND		Fe
<i>Myiozetetes similis</i>	Social Flycatcher		F	NTM	BRp	AA, U, R, Fe
<i>Conopias trivirgata</i>	Three-striped Flycatcher		R	UND		F, Fe
<i>Myiodinastes maculatus</i>	Streaked Flycatcher		F	NTM	BRE	Fe
<i>Legatus leucophaeus</i>	Piratic Flycatcher		R	NTM	BRp	F, Fe
<i>Empidonax varius</i>	Variiegated Flycatcher		U	NTM	BRp	Fe, AA
<i>Tyrannus vociferans</i>	Fork-tailed Flycatcher		F	NTM	BRE	R, AA, U
<i>Tyrannus melancholicus</i>	Tropical Kingbird		C	NTM	BRE	R, AA, U
<i>Pachyramphus validus</i>	Crested Becard		R	UND		Fe
<i>Tityra cayana</i>	Black-tailed Tityra		R	UND		F, Fe
<i>Tityra inquisitor</i>	Black-crowned Tityra		X	UND		Fe
PIPRIDAE (3 species)						
<i>Chiroxiphia caudata</i>	Blue Manakin	ATL	F	RES	BRE	F
<i>Manacus maniacus</i>	White-bearded Manakin		F	RES	BRE	F, R
<i>Schiffornis virescens</i>	Greenish Mounier	ATL	F	RES	BRp	F

Appendix. Continued

Families and species	English name	Conservation and endemism	Abundance	Status	Breeding	Habitat
HIRUNDINIDAE (8 species)						
<i>Tachycineta leucorrhoa</i>	White-rumped Swallow		C	NTM	BRp	O (R, M, AA, L)
<i>Progne tapera*</i>	Brown-chested Swallow		F	NTM	BRE	O (AA, U)
<i>Progne chalybea</i>	Grey-breasted Martin		F	NTM	BRE	O (AA, U, R, M)
<i>Notiochelidon cyanoleuca</i>	Blue-and-white Swallow		C	RES	BRE	O (R, AA, U, M)
<i>Alopocheilidon fucata</i>	Tawny-headed Swallow		R	AUS		O (R)
<i>Stelgidopteryx ruficollis</i>	Southern Rough-winged Swallow		F	NTM	BRE	O (R, W, AA, U)
<i>Hirundo rustica</i>	Barn Swallow		R	NAM		O (R)
<i>Hirundo pyrrhonota</i>	Cliff Swallow		R	NAM		O (AA)
CORVIDAE (1 species)						
<i>Cyanocorax caeruleus</i>	Azure Jay	NT/ATL	C	RES	BRp	F, Fe, AA, U, R, M
TROGLODYTIDAE (1 species)						
<i>Troglodytes aedon</i>	House Wren		C	RES	BRE	R, AA, U
MUSCICAPIDAE (5 species)						
<i>Platycichla flavipes</i>	Yellow-legged Thrush	ATL(ssp)	R	ALT		F
<i>Turdus rufigentris</i>	Rufous-bellied Thrush		R	UND		R, AA
<i>Turdus leucomelas</i>	Pale-breasted Thrush		X	UND		F
<i>Turdus amaurochalinus</i>	Creamy-bellied Thrush		C	RES	BRE	R, M, AA, U
<i>Turdus albicollis</i>	White-necked Thrush		F	RES	BRp	F
MIMIDAE (1 species)						
<i>Mimus saturninus</i>	Chalk-browed Mockingbird		U	RES	BRp	AA, R
MOTACILLIDAE (1 species)						
<i>Anthus lutescens</i>	Yellowish Pipit		F	RES	BRE	R, AA

Appendix. Continued

Families and species	English name	Conservation and endemism	Abundance	Status	Breeding	Habitat
VIREONIDAE (2 species)						
<i>Cyclarhis gujanensis</i>	Rufous-browed Peppershrike		X	UND		F
<i>Vireo chizi</i>	Chivi Vireo		C	NTM	BRE	F, Fe, R, AA
EMBERIZIDAE (38 species)						
<i>Parula pitiayumi</i>	Tropical Parula		C	RES	BRp	F, Fe, R, AA, U
<i>Geothlypis acuinotialis</i>	Masked Yellowthroat		C	RES	BRE	R, W, M, AA, U
<i>Basileuterus culicivorus</i>	Golden-crowned Warbler		C	RES	BRp	F, R, AA
<i>Coereba flaveola</i>	Bananaquit		F	RES	BRE	F, AA, U, R
<i>Hemithraupis ruficapilla</i>	Rufous-headed Tanager	ATL	R	UND		Fe
<i>Tachyphonus coronatus</i>	Ruby-crowned Tanager		C	RES	BRE	F, Fe, R, AA
<i>Trichothraupis melanops</i>	Black-goggled Tanager		U	RES	BRp	F
<i>Habia rubica</i>	Red-crowned Ant-tanager		F	RES	BRp	F, Fe
<i>Ramphocelus bresilius</i>	Brazilian Tanager	LT/ATL	R	REp		R, Fe
<i>Thraupis sayaca</i>	Sayaca Tanager		C	RES	BRE	R, AA, U
<i>Thraupis cyanoptera</i>	Azure-shouldered Tanager	NT/ATL	U	RES	BRp	F
<i>Thraupis ornata</i>	Golden-chevroned Tanager	ATL	X	UND		Fe
<i>Thraupis palmarum</i>	Palm Tanager		F	RES	BRp	AA, U, R
<i>Pipraeidea melanonota</i>	Fawn-breasted Tanager		R	UND		Fe, R
<i>Euphonia violacea</i>	Violaceous Euphonia		F	RES	BRE	F, R, AA, U
<i>Euphonia pectoralis</i>	Chestnut-bellied Euphonia		R	RES	BRp	F, Fe
<i>Chlorophonia cyanea</i>	Blue-naped Chlorophonia		R	RES	BRp	F, Fe
<i>Tangara selodon</i>	Green-headed Tanager	ATL	R	UND		F, Fe
<i>Tangara cyanocephala</i>	Red-necked Tanager	ATL	F	RES	BRE	F
<i>Tangara desmaresti</i>	Brassy-breasted Tanager	ATL	X	ALT		F
<i>Tangara peruviana*</i>	Black-backed Tanager	TH/LT/ATL	U	RES	BRp	R, M, Fe
<i>Tangara preciosa*</i>	Chestnut-backed Tanager	ATL	R	ALT		AA, Fe
<i>Dacnis cayana</i>	Blue Dacnis		F	RES	BRE	AA, U, F, Fe, R

Appendix. Continued

Families and species	English name	Conservation and endemism	Abundance	Status	Breeding	Habitat
EMBERIZIDAE (38 species)						
<i>Zonotrichia capensis</i>	Rufous-collared Sparrow		C	RES	BRE	R, AA, U
<i>Ammodramus humeralis</i>	Grassland Sparrow		R	UND		R, AA
<i>Donacospiza albifrons</i>	Long-tailed Reed-finch		R	UND		W
<i>Sicalis flaeola</i>	Saffron Finch		C	RES	BRE	AA, UND, R
<i>Sicalis luteola</i>	Grassland Yellow-finch		X	UND		AA
<i>Emberizoides ypiranganus</i>	Lesser Grass-finch	NT/LT	U	RES	BRE	W
<i>Volatinia jacarina</i>	Blue-black Grassquit		F	RES	BRE	R, AA
<i>Sporophila caerulescens</i>	Double-collared Seedeater	LT	R	PRE	BRp	R, AA
<i>Saltator similis</i>	Green-winged Saltator		R	UND		F
<i>Icterus cayanensis</i>	Epaulet Oriole		X	UND		Fe
<i>Agelaius ruficapillus</i>	Chestnut-capped Blackbird		X	UND		W
<i>Sturnella superciliaris</i>	White-browed Blackbird		U	RES	BRp	W, AA, R
<i>Pseudoleistes virescens</i>	Brown-and-yellow Marshbird		U	RES	BRp	W, AA
<i>Amblyramphus holosericeus</i>	Scarlet-headed Blackbird	LT	U	UND		W
<i>Molothrus bonariensis</i>	Shiny Cowbird		F	RES		U, AA, R
FRINGILLIDAE (1 species)						
<i>Carduelis magellanica</i>	Hooded Siskin		R	PRE		R, AA
PASSERIDAE (1 species)						
<i>Passer domesticus</i>	House Sparrow		C	RES	BRE	AA, U
ESTRILDIDAE (1 species)						
<i>Estrilda astrild</i>	Common Waxbill		C	RES	BRE	R, U, AA, W

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