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Bird community composition and species abundance on two inshore islands in the Atlantic forest region of Brazil

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RESUMO. **Composição da comunidade de aves e abundância de espécies em duas ilhas oceânicas na Mata Atlântica.** Muitas aves endêmicas da Mata Atlântica estão ameaçadas de extinção e algumas ilhas costeiras foram identificadas como áreas prioritárias para a conservação dessas aves. Nós usamos o método de contagem por pontos para registrar as aves florestais em duas destas ilhas, o Parque Estadual da Ilha do Cardoso (com 22.500 ha) e o parque Estadual da Ilha Grande (com 5.600 ha e 450 km à nordeste). A riqueza de aves registrada na Ilha do Cardoso foi maior no que na Ilha Grande (75 contra 57 espécies), assim como a diversidade e a importância para as espécies da Lista Vermelha (8 contra 2 espécies). A contribuição de várias famílias para a avifauna variou entre as ilhas, sendo Columbidae e Pipridae mais comuns na Ilha Grande, e Trochilidae, Picidae e Formicariidae mais dominantes no Cardoso. A abundância de Turdidae e a raridade de psitacídeos foram notáveis nas duas ilhas, quando comparadas com outros locais na Mata Atlântica. Não houve nenhuma correlação entre a abundância de espécies individuais nas duas ilhas. Na verdade, 34% e 49% das espécies foram registradas exclusivamente na Ilha Grande e na Ilha do Cardoso respectivamente. As estimativas da densidade total de aves foram similares nas duas ilhas (ao redor de 2000 aves por km^2), valor muito similar para locais na Mata Atlântica continental e na Floresta Amazônica, como no Peru e na Guiana Francesa. No entanto, as avifaunas das ilhas apresentam dominância de umas poucas espécies com densidade estimada excedendo qualquer outro lugar nos Neotrópicos. Isto é particularmente verdade para a Ilha Grande, onde muitas espécies de borda e de floresta secundária dominam a avifauna.
PALAVRAS-CHAVE: Floresta Atlântica, comunidade de aves, diversidade de aves, Brasil, ilhas, densidades populacionais.

ABSTRACT. Many endemic birds are threatened with extinction in Brazil's Atlantic forest and several inshore islands have been identified as key areas for bird conservation. We used a point count method to record forest birds on two of these islands, in the 22,500 ha Ilha do Cardoso State Park and the 5,600 ha Ilha Grande State Park, 450 km to the northeast. Our estimates of bird species richness was higher on Cardoso than Ilha Grande (75 versus 57 species), as was species diversity, and importance of Red List species (8 versus 2 species). The contribution of various families to the avifauna differed between the islands with Columbidae and Pipridae more common on Ilha Grande, and Trochilidae, Picidae and Formicariidae more dominant on Cardoso. Noteworthy were the abundance of Turdidae and the rarity of Psittacidae on both islands as compared to other sites in the region. Abundance of individual species on the two islands was uncorrelated. In fact, 34% and 49% of the species were recorded exclusively on Ilha Grande and Cardoso respectively. The avifauna, particularly on Ilha Grande, is depauperate and dominated by a few species with density estimates generally exceeding those found elsewhere in the neotropics. On Ilha Grande, these dominant species were mainly edge and secondary forest species.
KEY WORDS: Atlantic forest, bird communities, bird diversity, Brazil, islands, population densities.

The Atlantic Forest has one of the highest concentrations of endemic birds in the world, and with only 5% of the original forest cover remaining, is one of the world's most threatened ecosystems (Goerck 1997, Myers *et al.* 2000). While there have been recent studies of the bird communities of some important mainland Atlantic forest sites (e.g. Aleixo and Galetti 1997, Parker and Goerck 1997, Anjos and Boçon 1999, Goerck 1999, Marsden *et al.* 2001), little work has been carried out on the inshore islands located off Brazil's Atlantic coast in Rio de Janeiro, São Paulo, Paraná and Santa Catarina states (figure 1). Nevertheless, some of these islands have been identified as key areas for bird conservation, and/or designated as conservation units. Ilha do Cardoso, in the south of São Paulo state, has been well explored ornithologically, and is now known to hold 16 threatened species and 13 near-threatened species (Wege and Long 1995, M. Galetti unpubl. data, Marsden 2001). This is more than any other lowland Atlantic Forest area. Others such as Ilha Grande and Ilhabela have received much less attention from ornithologists (published studies include Olmos 1994, Guix *et al.* 1999, Avanzo and Sanfilippo 2000).

We used a point count method to census birds on Ilha Grande State Park (5,600 ha) and Ilha do Cardoso State Park (22,500 ha). We aimed to describe the avifaunas of the two areas in terms of species abundance, richness, diversity, species and family composition. We also compare these results with findings from elsewhere in the Atlantic forest and from Amazonian forests. Finally, we discuss the results in the context of the islands' importance in conserving populations of threatened species.

Figure 1. Map of the southeastern section of Brazil's Atlantic forest coast. Shown are the positions of Ilha Grande and Ilha do Cardoso and other inshore islands important for bird conservation.

STUDY AREAS AND METHODS

Study sites. Bird surveys were conducted on Ilha Grande (figure 1) in the Baía da Ilha Grande, close to the shore of Rio de Janeiro State, in June and August 1999. Fieldwork was restricted to Ilha Grande State Park (23º09'S, 44º10'W) which covers 5,600 ha of the total island area of 17,400 ha. The highest point on the island is 1,033 m but all bird surveys were carried out below 300 m a.s.l. The main habitat within the state park is lowland Atlantic forest, accessible via a network of trails leading to beaches around the island (the island is a popular holiday resort for residents of Rio de Janeiro and São Paulo).

Bird surveys were conducted on Ilha do Cardoso, in southernmost São Paulo State (25º04'S, 47º55'W) during July 1999. Most of the island is protected within Ilha do Cardoso State Park which covers an area of 22,500 ha. The island rises to 800 m, with habitat comprising sand-plain forest through to humid montane forest. Bird surveys were done along the network of narrow trails cut especially for researchers and were restricted to forest below 200 m.

Bird census. A point count distance sampling method was used to estimate bird densities within forest (Reynolds *et al.* 1980). The field methods used were the same as those described in Marsden *et al*. (2001). One month was spent on the islands practising bird identification and distance estimation before the formal census began. During the previous year the surveyors had spent three months surveying birds using the same method elsewhere in the Atlantic forest. All bird surveying was done by a pair of observers (MW was always primary recorder). The method used allows for unidentified bird contacts, so long as all birds encountered at, and very close to, the recorder are identified (Buckland *et al.* 2001, Marsden 1998).

Census stations were positioned along paths of width < 2 m, at intervals of 200 paces (around 200 m). Birds were counted at each point twice, on different days, points being visited in reverse order on the second visit. Bird surveys were carried out between 0700 and 1130 h and only in the absence of rain or heavy mist. We avoided the 30 minutes directly after dawn, principally because the problem of bird movement may be excessive during this period (Marsden 1999). Bird encounter rates may decline during the morning and it might be intuitive that surveying up to 1130 h may include periods of very low encounter rates. However, encounter rates of both understorey and canopy tropical birds can be remarkably stable through the period 0700 to 1100 h (e.g. Blake 1992). In any case, the same census period was used on both islands so our results are, at least, comparable with each other. Birds were counted at each census station for a period of 10 minutes. The census period commenced immediately upon arrival at the station. Altogether, there were 76 census plots on Ilha Grande, most were counted twice, giving a total of 152 point counts (table 1). On Cardoso, there were 105 plots, each counted twice (210 point counts).

Data analyses. Census data were analysed using the DISTANCE v. 3.5 program (http://www.ruwpa.st-and.ac.uk/distance; Buckland *et al.* 2001). For all species, records from both islands were combined to produce a single detection function, from which island-specific density estimates were calculated (Marsden *et al.* 1997). In some cases, we also combined data from the islands with bird records from the Sooretama/Linhares reserve, Espírito Santo, collected the previous year (Marsden *et al.* 2001). Note that including records of the same species from elsewhere allows more precise modelling of detection probabilities, hence allowing density estimates to be calculated for species recorded on the islands themselves on few occasions (Marsden *et al.* 1997). These extralimital records do in no way contribute to the encounter rate for an island. Records of birds in flight at census stations were omitted from the density calculations. For contacts where birds were heard only, the mean group size for visual contacts with that species was substituted for the missing group size values.

Species richness on the two islands was described by plotting curves of the cumulative number of species accumulated during sets of ten point counts (counts 1-10, 11-20 etc.). In addition, Simpson's index ($D = S\ p_i^2$, where p_i is the proportion of individuals in the ith species), measures the dominance of the most abundant species in the community (Magurran 1988), was calculated for each island. For species where density estimation was possible on each of the two islands, we examined whether densities on Ilha Grande were positively correlated with densities on Cardoso. To do this we used Spearman's rank correlation analysis to relate the ranked order of abundances on one island to that on the other.

For each island, the number of bird groups comprising each of the major bird families was divided by the total number of bird groups recorded (identified and unidentified) to calculate the percentage of the total avifauna comprising each family. Some smaller families were omitted from the analysis, and Vireonidae were lumped with Parulidae.

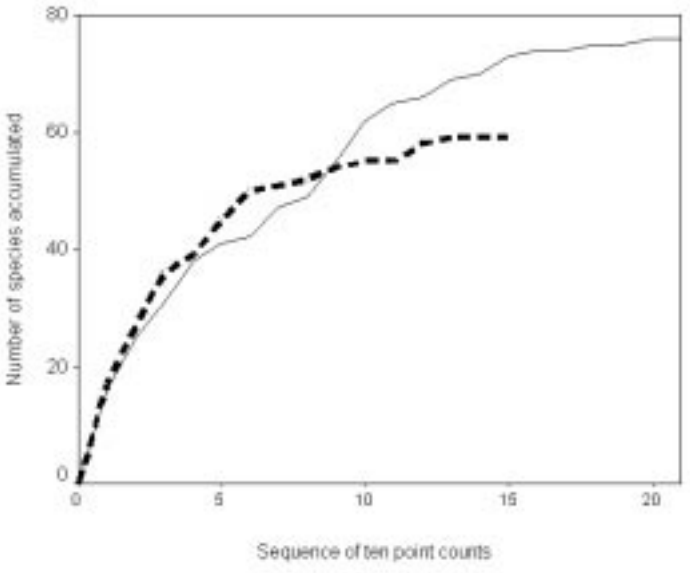

Figure 2. Species accumulation curves for Ilha Grande (broken line) and Ilha do Cardoso (solid line). There were 150 point counts considered for Ilha Grande (i.e. 15 groups of ten points) and 210 points for Cardoso.

Table 1. Summary statistics of bird surveys on the two islands.

	Ilha Grande	Cardoso
Number of point counts[1]	152 (76)	210 (105)
Number of identified bird groups	376	502
Number of unidentified records	46	68
Identified groups per count	2.48	2.39
Number of species	57	75
Number species not shared	19	37
Number of Red List species[2]	2	8
Simpson's index	0.956	0.968

[1] Figures outside parentheses indicate numbers of counts (including repeats), those in parentheses the number of stations.
[2] Red List species are those defined as Threatened or Near-threatened by BirdLife International (2000).

Differences in the contribution of each family to the total avifauna on the two islands were examined with a chi-square test.

The relationship between number of species in each family on the two islands, and the relationship between number of bird records contributed by families and the number of species within those families was investigated using Spearman's rank correlation analysis.

Table 2. Proportions of bird records comprising the different major bird families on the two islands. *n* = total bird groups recorded including records of birds not identified to species (see Appendix 1).

	Ilha Grande *n* = 422		Cardoso *n* = 570	
	No. of Species	Percentage of records	No. of Species	Percentage of records
Columbidae	3	8.3	2	0.9
Psittacidae	3	2.1	4	2.3
Trochilidae	1	5.7	2	10.9
Trogonidae	2	5.0	2	4.6
Picidae	3	1.9	2	5.6
Furnariidae	3	2.4	3	3.0
Dendrocolaptidae	3	2.6	5	2.5
Formicariidae	6	15.3	8	21.1
Tyrannidae	7	7.5	11	4.2
Pipridae	1	8.7	2	2.1
Cotingidae	4	1.7	2	0.7
Turdidae	5	12.3	5	8.2
Vireonidae/Parulidae	3	2.1	3	4.4
Thraupidae	8	16.8	15	13.2

RESULTS

Species richness and diversity. Table 1 shows summary statistics of the bird dataset. A total of 992 bird groups were recorded at point counts on the two islands and 89% of these records were identified to species. There was no significant difference in the proportions of records identified to species on the two islands ($c^2_1 = 0.14$, $P > 0.7$). Appendix 1 gives density estimates and the number of records of each bird species on the two islands.

The species accumulation curve for Ilha Grande rises first more steeply than that for Cardoso but starts to flatten earlier (figure 2). This shape suggests both a lower number of species expected to be accumulated at asymptote on Ilha Grande, and a higher degree of dominance by the commonest species on that island. By 150 point counts, neither curve has reached asymptote but accumulation of new species is slow. Simpson's index of diversity was higher on Cardoso than Ilha Grande. Amongst the 24 species where density estimation was possible on both islands, there was no significant correlation between the population densities on the two islands ($r_s = + 0.24$, $P > 0.2$).

Bird community composition. Almost half (49%) of the species recorded at points on Cardoso were not recorded at points on Ilha Grande, and 34% of those from Ilha Grande were not recorded at points on Cardoso. Table 2 shows the proportions of total bird group records in each area made up of the main bird families. The four most important bird families made up 53.1% of bird records on Ilha Grande and 53.4% on Cardoso. There was a strong correlation between the number of species in each family on the two islands ($r_s = 0.78$, $n = 14$, $P = 0.001$). On both islands, bird families containing many recorded species contributed higher proportions of bird records than small bird families but in neither case was this relationship significant (Ilha Grande: $r_s = 0.31$, $n = 14$, $P = 0.28$, Cardoso $r_s = 0.42$, $n = 14$, $P = 0.13$). The percentage of total bird records that belonged to the different families differed significantly between islands ($c^2_{13} = 88.6$, $P < 0.001$). Columbidae and Pipridae composed a much greater proportion of the avifauna on Ilha Grande than Cardoso, while the opposite was the case with Trochilidae, Picidae and Formicariidae. Formicariidae made up 15% and 21% of the avifauna of the two islands.

Species abundance. Density estimates were calculated for 24 species on Ilha Grande and 27 species on Cardoso (appendix 1). Six species had density estimates greater than 100 individuals per km^2 (equivalent to one bird per hectare) and all were from Ilha Grande. The single species of Pipridae identified on Ilha Grande made up four times the percentage of total bird records as did two species on Cardoso. Likewise, 15 species of Thraupids on Cardoso contributed 13% of the avifauna while just eight species on Ilha Grande made up 17% (most of this is accounted for by high densities of Palm Tanager (*Thraupis palmarum*) and Brazilian Tanager (*Ramphocelus bresilius*)). Some species were similarly 'over-represented' on Cardoso. These include Red-crowned Ant-tanager (*Habia rubica*), Red-rumped Cacique (*Cacicus haemorrhous*), Saw-billed Hermit (*Ramphodon naevius*), White-spotted Woodpecker (*Celeus flavescens*), Rufous-capped Antthrush (*Formicarius colma*) and White-shouldered Fire-eye (*Pyriglena leucoptera*).

DISCUSSION

Despite being composed of much the same bird families, the avifaunas of these two islands within the same zone of the Atlantic forest were very different in species composition and the abundances of individual species. The types of species that were commoner on Cardoso than on Ilha Grande indicate that the latter has something of an impoverished primary forest avifauna. The rarity/absence on Ilha Grande of birds such as Squamate Antbird *Myrmeciza squamosa*, Rufous-capped Ant-thrush *Formicarius colma*, White-shouldered Fire-eye *Pyriglena leucoptera* (the last two are ant-followers), and the abundance of birds such as Short-crested Flycatcher *Myiarchus ferox*, Palm Tanager *Thraupis palmarum* and Brazilian Tanager *Ramphocelus bresilius* which are edge/secondary forest species (e.g. Ridgely and Tudor 1989; Ridgely and Tudor 1994) do seem to indicate this.

While between-island differences in species composition make it difficult to identify general patterns of bird community composition on the Atlantic forest islands, some trends do emerge. The large mainland reserve of Sooretama/Linhares was surveyed by the same team using the same method and the proportions of records comprising different families was in some cases very different to that on the islands (Marsden *et al.* 2001). Tyrannidae comprised almost 17% of 1002 bird records in Sooretama/Linhares, but only 7.5% and 4.2% on the islands. As striking was the relative rarity of Thraupidae (8.4%) and Turdidae (2.3%) in the mainland reserve as compared to the islands.

Of particular concern is the comparative rarity of parrots (parrots made up only 2% of the avifauna of both islands). This is low compared to other sites in the Atlantic forest e.g. nearby Ilhabela (Guix *et al.* 1999), and the large mainland reserve of Sooretama/Linhares, where 15% of bird records were parrots of twelve species (Marsden *et al.* 2001). Several bird species restricted to this part of the Brazilian coastline include the Endangered Red-tailed Parrot *Amazona brasiliensis*, which has a total global range of only 3,000 km^2 (Martuscelli 1995). Even on Cardoso, one of its main strongholds, *A. brasiliensis* was not common.

The avifauna of Ilha Grande was dominated by several edge and secondary forest species. These attained much higher densities than any birds on Cardoso, which has a richer avifauna not so much dominated by a few species (only three from 43 species had densities greater than 100 per km^2). Compared in turn with highly species-rich forests in Amazonian Peru and French Guiana but maximum densities of individual species were just 20-40 individuals per km^2 (Terborgh *et al.* 1990, Thiollay 1994).

Unfortunately, outside our own studies, population density data are available for birds in very few Atlantic forest sites. Consequently, analysis of the value of sites/conservation units is usually restricted to the presence or absence of important bird species, or a subjective assessment of commonness (Wege and Long 1995, Parker *et al.* 1997, Aleixo and Galetti 1997) rather than the likely size of bird populations held within them. More studies enumerating bird populations, particularly from the endemic-rich Atlantic forest would certainly benefit wildlife managers. What we can expect is quite striking differences in the densities of individual species between sites. Only with population data can we start to assess properly the protection offered to individual taxa in conservation units.

What is clear from both species presence and abundance data is that the much larger Cardoso is much the more important of the two islands for conservation of the region's Red List birds. In fact, it can be seen as a stronghold for lowland forest and restinga species in the south of the Atlantic forest, as Sooretama/Linhares is for lowland forest birds in the north (Marsden *et al.* 2000). As such, it does require disproportionate attention from conservation biologists both to monitor its bird populations in the long term, and to scrutinise threats to bird species from land use and human developments within the state park. Most important on Cardoso may be the translocation, from the Misiones region of Argentina, of an indigenous Indian community numbering around 200, which have been resettled within the state park. On Cardoso, as elsewhere (Redford 1989, Galetti *et al.* 1997), there may be a potential conflict between the needs of the conservation unit's wildlife and those of the Indian communities settled on the island.

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Appendix 1. Density estimates (± % standard errors) and, in parentheses, number of encounters for birds on Ilha Grande and Ilha do Cardoso. *EN* denotes Endangered, *VU* Vulnerable, and *NT* Near-threatened *following* BirdLife International (2000). Systematic order and nomenclature follow Monroe and Sibley (1993).

Species	Ilha Grande	Cardoso
Brown Tinamou *Crypturellus obsoletus*	(1)	(4)
White-barred Piculet *Picumnus cirratus*	(4)	
Ochre-collared Piculet *Picumnus temminckii*		(8)
Little Woodpecker *Veniliornis spilogaster*	(1)	
White-spotted Woodpecker *Celeus flavescens*	2.5 ± 104 (1)	18.2 ± 44.8 (13)
Unidentified Picidae	(2)	(11)
Channel-billed Toucan *Ramphastos vitellinus*	(2)	(3)
Unidentified Rampastidae		(8)
White-tailed Trogon *Trogon viridis*	46.4 ± 29.5 (20)	28.6 ± 30.5 (17)
Black-throated Trogon *Trogon rufus*	(1)	(2)
Unidentified Trogonidae		(7)
Squirrel Cuckoo *Piaya cayana*	(1)	(1)
Maroon-bellied Parakeet *Pyrrhura frontalis*		(5)
Blue-winged Parrotlet *Forpus xanthopterygius*	(1)	
Plain Parakeet *Brotogeris tirica*	(5)	(2)
Scaly-headed Parrot *Pionus maximiliani*		(1)
Red-tailed Parrot *Amazona brasiliensis EN*		(4)
Orange-winged Parrot *Amazona amazonica*	(3)	
Unidentified Psittacidae		(1)
Saw-billed Hermit *Ramphodon naevius NT*		87.6 ± 28.3 (18)
Violet-capped Woodnymph *Thalurania glaucopis*	149 ± 42.5 (13)	97.0 ± 33.8 (22)
Unidentified Trochilidae	(11)	(22)
Plumbeous Pigeon *Columba plumbea*	20.7 ± 27.9 (22)	0.75 ± 100 (1)

Appendix 1. Cont'd

Species	Ilha Grande	Cardoso
Ruddy Ground Dove *Columbina talpacoti*	(1)	
White-tipped Dove *Leptotila verreauxi*	(1)	
Ruddy Quail dove *Geotrygon montana*		(2)
Unidentified Columbidae	(11)	(2)
White-necked Hawk *Leucopternis lacernulata VU*		(2)
Roadside Hawk *Buteo magnirostris*		(4)
Yellow-headed Caracara *Milvago chimachima*	(1)	
Grey-hooded flycatcher *Mionectes rufiventris*	(1)	(1)
Sepia-capped Flycatcher *Leptopogon amaurocephalus*		(1)
Grey-capped Tyrannulet *Phyllomyias griseocapilla*	(3)	
Oustalet's Tyrannulet *Phylloscartes oustaleti NT*		(2)
White-throated Spadebill *Platyrinchus mystaceus*		(5)
Sulphur-rumped flycatcher *Myiobius barbatus*		(2)
Long-tailed Tyrant *Colonia colonus*		(1)
Grey-hooded Attila *Attila rufus*		(1)
Grayish Mourner *Rhytipterna simplex*	(5)	
Swainson's Flycatcher *Myiarchus swainsoni*		(1)
Short-crested Flycatcher *Myiarchus ferox*	79.5 ± 32.5 (14)	13.3 ± 59.7 (3)
Boat-billed Flycatcher *Megarhynchus pitangua*	(1)	
Great Kiskadee *Pitangus sulphuratus*	(5)	(2)
Crested Becard *Pachyramphus validus*	(1)	
Black-tailed Tityra *Tityra cayana*		(2)
Unidentified Tyrannidae	(2)	(3)
Black-headed Berryeater *Carpornis melanocephalus VU*		(2)
Red-ruffed Fruitcrow *Pyroderus scutatus*	(3)	
Bare-throated Bellbird *Procnias nudicollis NT*	(1)	
Sharpbill *Oxyrunchus cristatus*	(1)	(2)
Swallow-tailed Manakin *Chiroxiphia caudata*	135 ± 35.5 (29)	16.9 ± 53.5 (5)
White-bearded Manakin *Manacus manacus*		(5)
Unidentified Pipridae	(8)	(2)
Spot-backed Antshrike *Hypoedaleus guttatus*		(1)
Variable Antshrike *Thamnophilus caerulescens*	131 ± 21.3 (42)	96.8 ± 20.8 (43)
Plain Antvireo *Dysithamnus mentalis*		(7)
Unicolored Antwren *Myrmotherula unicolor VU*	(5)	
Rufous-winged Antwren *Herpsilochmus rufimarginatus*	(3)	(6)
Scaled Antbird *Drymophila squamata*	41.2 ± 37.5 (12)	73.2 ± 28.4 (33)
White-shouldered Fire-eye *Pyriglena leucoptera*	14.1 ± 73.5 (2)	66.2 ± 52.0 (13)
Squamate Antbird *Myrmeciza squamosa*		(6)
Unidentified Formicariidae	(1)	
Buff-fronted Foliage-gleaner *Philydor rufus*		(4)
Black-capped Foliage-gleaner *Philydor atricapillus*	20.8 ± 63.8 (4)	30.1 ± 43.5 (8)
White-eyed Foliage-gleaner *Automolus leucophthalmus*		(6)
Black-tailed Leaftosser *Sclerurus caudacutus*	(1)	(3)
Unidentified Furnaridae	(1)	
Plain-brown Woodcreeper *Dendrocincla fuliginosa*		(2)
Olivaceous Woodcreeper *Sittasomus griseicapillus*		(3)

Appendix 1. Cont'd

Species	Ilha Grande	Cardoso
White-throated Woodcreeper *Xiphocolaptes albicollis*		(1)
Scaled Woodcreeper *Lepidocolaptes squamatus*	29.8 ± 43.7 (7)	15.4 ± 45.9 (5)
Lesser Woodcreeper *Lepidocolaptes fuscus*	(1)	
Unidentified Dendrocolaptidae	(3)	(3)
Rufous-capped Ant-thrush *Formicarius colma*	3.0 ± 101 (1)	30.4 ± 36.5 (10)
Black-cheeked Gnateater *Conopophaga melanops*	(3)	
Red-eyed Vireo *Vireo olivaceus*	(2)	
Azure Jay *Cyanocorax caeruleus NT*		(4)
Yellow-legged Thrush *Platycichla flavipes*	40.3 ± 27.7 (13)	4.5 ± 70.4 (2)
Rufous-bellied Thrush *Turdus rufiventris*	114 ± 42.5 (14)	44.8 ± 45.8 (8)
Pale-breasted Thrush *Turdus leucomelas*	(4)	(1)
Creamy-bellied Thrush *Turdus amaurochalinus*	(1)	(8)
White-necked Thrush *Turdus albicollis*	36.1 ± 41.1 (12)	43.6 ± 30.8 (20)
Unidentified Turdidae	(8)	(8)
Long-billed Wren *Thryothorus longirostris*	67.9 ± 32.2 (17)	75.2 ± 32.9 (26)
Tropical Parula *Parula pitiayumi*	17.8 ± 72.7 (2)	64.3 ± 38.3 (10)
Masked Yellowthroat *Geothlypis aequinoctialis*		(1)
Golden-crowned Warbler *Basileuterus culicivorus*	23.6 ± 72.4 (5)	47.9 ± 45.3 (14)
Bananaquit *Coereba flaveola*	116 ± 45.6 (9)	93.0 ± 46.4 (10)
Rufous-headed Tanager *Hemithraupis ruficapilla*		(5)
Chestnut-headed Tanager *Pyrrhocoma ruficeps*		(1)
Black-goggled Tanager *Trichothraupis melanops*	15.8 ± 52.8 (5)	11.4 ± 53.0 (5)
Red-crowned Ant-tanager *Habia rubica*	3.0 ± 101 (1)	30.4 ± 36.5 (14)
Flame-crested Tanager *Tachyphonus cristatus*	73.2 ± 42.6 (12)	48.6 ± 48.1 (11)
Ruby-crowned Tanager *Tachyphonus coronatus*	(1)	(1)
Brazilian Tanager *Ramphocelus bresilius*	184 ± 37.8 (28)	10.7 ± 75.8 (2)
Azure-shouldered Tanager *Thraupis cyanoptera NT*		(3)
Palm Tanager *Thraupis palmarum*	(11)	
Violaceous Euphonia *Euphonia violacea*		(2)
Chestnut-bellied Euphonia *Euphonia pectoralis*		(3)
Green-headed Tanager *Tangara seledon*		75.4 ± 49.1 (13)
Red-necked Tanager *Tangara cyanocephala*	(5)	(1)
Black-backed Tanager *Tangara peruviana VU*		(4)
Blue Dacnis *Dacnis cayana*	61.8 ± 50.8 (7)	57.5 ± 47.0 (9)
Green Honeycreeper *Chlorophanes spiza*		(1)
Unidentified Thraupinae	(1)	
Blue-black Grassquit *Volatina jacarina*		(3)
Red-rumped Cacique *Cacicus haemorrhous*		24.4 ± 22.7 (29)

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