

Continued bird surveys in southeastern coastal Brazilian Atlantic forests and the importance of conserving elevational gradients

Vagner Cavarzere^{1,2,4}, Thiago Vernaschi Vieira da Costa^{1,2}, Giulyana Althmann Benedicto³,
Luciano Moreira-Lima^{1,2} and Luís Fábio Silveira²

¹ Pós-Graduação, Departamento de Zoologia, Instituto de Biociências, Universidade de São Paulo. Rua do Matão, travessa 14, 101, CEP 05508-900, São Paulo, SP, Brazil.

² Seção de Aves, Museu de Zoologia da Universidade de São Paulo. Avenida Nazaré, 481, CEP 04218-970, São Paulo, SP, Brazil.

³ Rua Tiro Onze, 04, CEP 11013-040, Santos, SP, Brazil.

⁴ Corresponding author: cavarzere@usp.br

Received on 15 January 2014. Accepted on 18 November 2014.

ABSTRACT: Although the Atlantic forest is the best-studied Brazilian phytogeographic domain, few coastal municipalities of the state of São Paulo can count on published and critically revised bird species list, which are important initial steps to organize conservation initiatives. Here we present historical records from Bertioga, a northern coastline municipality of the state of São Paulo, as well as recent records obtained in surveys during the past years within the municipality. Surveying methods, carried out between 2008-2011, included point counts, 10-species lists, transect counts and mist nets. This compendium resulted in 330 documented species, 90 of which still await documentation. Of these 420 bird species, 85 (20.4%) are Atlantic forest endemic species and as many as eight, six and 23 are threatened at the global, national and state levels, respectively. Seventeen species are reported from Bertioga for the first time. Some records based exclusively on sightings must be carefully considered, whereas the species richness reflects the diversity of the habitats we visited, which varied from lowland and montane forests, to slopes and fluvial and tidal-influenced environments. We highlight that every habitat of the region should be continuously inventoried and that the absence of legal protection of lowland forests (which are not considered under the elevational threshold of the Serra do Mar State Park) must be reevaluated, as they harbor a greater number of endemic and threatened species than do other elevational bands.

KEY-WORDS: Bird species richness, Bertioga, *restingas*, species lists, survey methods.

INTRODUCTION

The Brazilian Atlantic forest occupies a vast heterogeneous region (1,481,946 km², approximately 17.4% of the Brazilian territory). It includes a large variety of forest physiognomies and compositions distributed throughout > 3,300 km along the Brazilian Atlantic coast, within latitudes from 3° S to 30° S, and elevations from sea level up to 2,700 m. These forests are distributed in different topographical and climatic conditions, encompassing lowlands and coastal mountains with high levels of rainfall, as well as interior high plateaus with seasonally dry seasons (Câmara 2003).

The Atlantic forest is recognized worldwide for its high diversity (1-8% of the world's total species, Silva & Casteleti 2003) and high rates of endemism (Myers *et al.* 2000). A recent assessment highlighted the large number of endemic species in several groups, such as 8,000 tree species (40% of the total species richness within the

phytogeographic domain), 199 birds (16%), 71 mammals (27%), 94 reptiles (31%), and 286 amphibians (60%, Mittermeier *et al.* [2005]). Despite this biological richness, the Atlantic forest is probably one of the most threatened tropical forests, within the hottest of hotspots (Laurance 2009). Almost 90% of the original Atlantic forest has been lost, and less than 12% of the original vegetation remains. The best preserved biogeographical sub-region of this phytogeographic domain is the Serra do Mar Mountain Range, which runs in parallel with the Atlantic Ocean and encompasses 36.5% of its original vegetation (Ribeiro *et al.* 2009). This mountainous complex also holds the highest levels of bird endemism in the Atlantic forest (Haffer 1985). In the state of São Paulo, lowland forests, which lie in narrow bands at the base of coastal mountains, are unprotected throughout most of their extension because the Serra do Mar State Park rarely includes forests below a 100 m elevational threshold. Due to the absence of protection as well as real-estate speculation, lowland

forests are probably the most threatened Atlantic forest habitats in the state (Câmara 1991). As a consequence of a long history of deforestation, more than 80% of the 199 endemic bird species are threatened or endangered (Goerck 1997, IUCN 2012).

Although the Serra do Mar has a stunning diversity, we still know little about its birds. Since the first investigations carried out at the Serra do Mar at the turn of the 20th century by Helmuth Pinder in Alto de Paranapiacaba (Camargo 1998), as well as Luederwaldt's (1925) scientific expeditions to Ilhabela (both localities in São Paulo), and later Davis' (1946) in Teresópolis, state of Rio de Janeiro, several bird inventories conducted along this region have been published (*e.g.* Willis & Oniki 1981, Olmos 1996, Goerck 1999, Naka & Rodrigues 2000, Willis & Oniki 2003, Develey 2004, Nores *et al.* 2005, Straube & Urben-Filho 2005, Cunha & Rajão 2007, Alves & Vecchi 2009, Lima 2010, Cavarzere *et al.* 2010, Mallet-Rodrigues *et al.* 2010), especially in the states of São Paulo and Rio de Janeiro. Recently a paper gathered all documented records of bird species from the municipality of Ubatuba (Simpson *et al.* 2012), but entire municipalities of São Paulo's northern shore, which primarily constitute the Serra do Mar, remain without published and critically revised checklists,

such as Bertioga, São Sebastião and Caraguatatuba. These lists represent an important means of gathering data that will initially organize and eventually lead to conservation initiatives. Here we present a birdlist for the municipality of Bertioga, São Paulo, based on museum specimens, published literature and recent field expeditions, highlighting noteworthy records, endemic and endangered species and the importance of continued surveys in order to document and produce the most updated and reliable bird checklist for this municipality. We further discuss about the need of extending conservation priority to lowland forests, which remain mostly unprotected although harboring extremely high bird richness and endemism.

MATERIAL AND METHODS

Study site

We carried out bird censuses and observations in Bertioga (centered at 23°51' S / 46°08' W), a northern coastline municipality in the state of São Paulo, southeastern Brazil (Figure 1). Bertioga has about 480 km² of evergreen Atlantic forest, 85% of which constitutes areas under

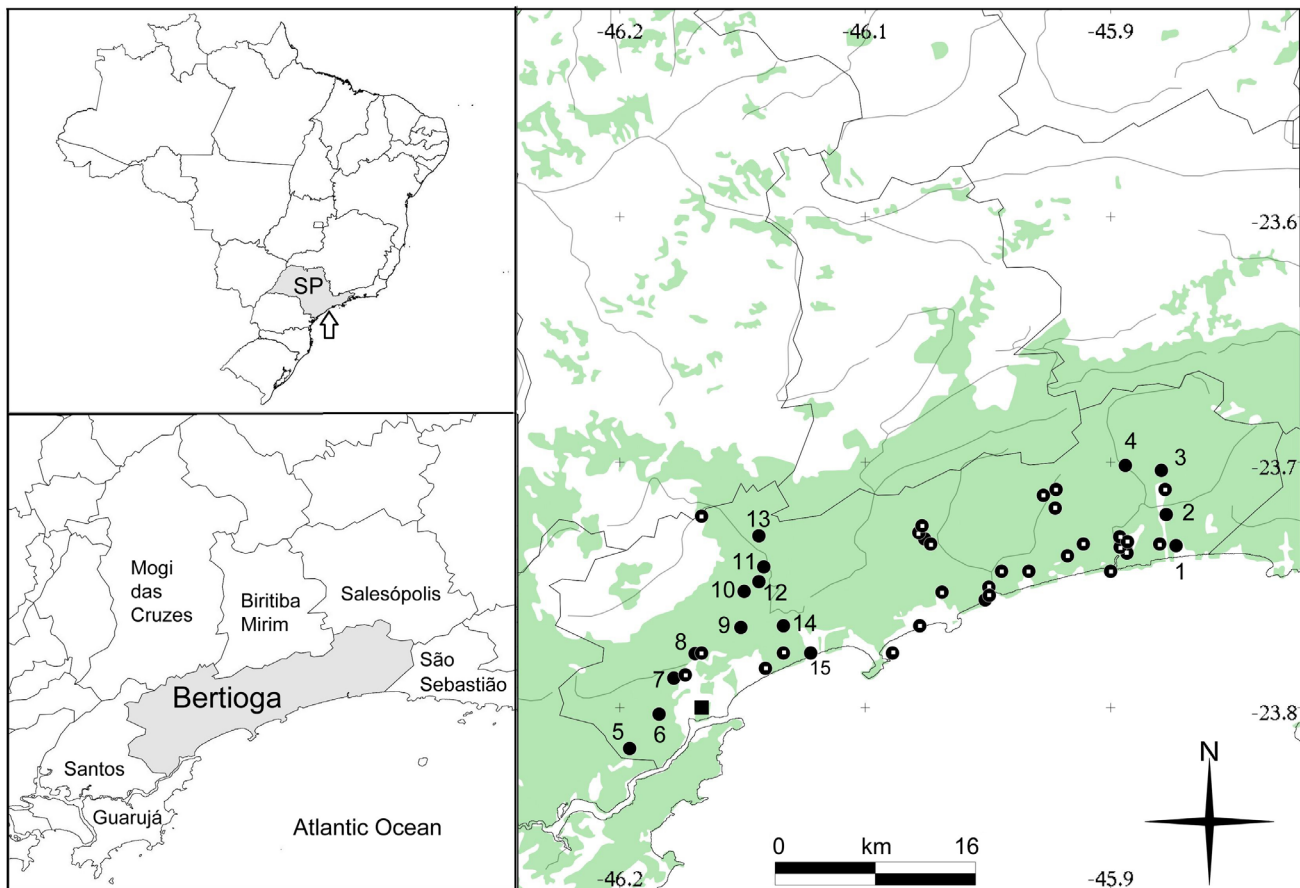


FIGURE 1: Map showing the remaining Atlantic forest (green) in the municipality of Bertioga, southeastern Brazil, where recent bird surveys have been carried out (numbered black circles, cross-referenced with Table 1). Locations where records of birds have been made within Bertioga by several other sources are depicted as un-numbered black circles with white dots. A black square shows the city of Bertioga.

protection (Maia *et al.* 2008). According to Köppen's classification, the climate of the region is Af, humid or super humid tropical, with rains distributed throughout the year (Nascimento & Pereira 1988). Climatologic data monitored between 1941 and 1970, indicates mean annual temperatures of 24.8°C, with lowest and highest monthly means of 20.7°C in July and 28.3°C in February, respectively. Bertioga is one of the most humid regions in Brazil, with mean annual rainfall of more than 3,200 mm, with lowest mean rainfalls in July (111 mm) and highest, in February (410 mm, Martins *et al.* 2008).

We cleared up existing (sometimes quite steep) narrow (< 1 m wide) trails in distinct zones within the municipality. At lower elevations they presented signs of human disturbance, such as selective logging (especially the

palm tree *Euterpe edulis*) and hunter trails, while elevations above 300 m constituted of mature secondary forests (\geq 20 m canopy) and seemed slightly disturbed, with scarce understory. We surveyed sites at several latitudes along elevational transects: (1) habitats around the Guaratuba River (hitherto Guaratuba), which included 15 point counts distributed along five elevational bands between 0 and 400 m; (2) habitats around the Itatinga River (hitherto Itatinga) between 0 and 500 m, surveyed with 10-species lists; and (3) restingas between da Prata River (hitherto Prata), one of the tributaries of the Itapanhaú River, as well as the adjacent Bertioga beach, between 0 and 50 m. These latter locations were surveyed with point counts and mist nets. For coordinates and locations refer to Table 1 and Figure 1, respectively.

TABLE 1: List of locations where recent bird surveys have been carried out within the municipality of Bertioga, São Paulo, Brazil. Dates of surveys (detailed in methods) are indicated for each site, to which decimal latitude and longitude are given. The main vegetation types are shown, including mean elevations and type of surveying method and effort. Total sampling effort for mist nets are represented in h.m², while the effort for other methods are indicated in hours. *Ad* = *ad libitum*, L = 10-species lists, MN = mist nets, PC = point counts, T = transect counts.

Location number	Sampling period	Location name	Habitat	Latitude	Longitude	Altitude	Method	Total sampling effort
1	2008-2009	Boraceia beach	Beach	-23.751	-45.860	4	<i>Ad</i>	32
2	2008-2009	Condomínio Morada da Praia I	Lowland forest	-23.732	-45.866	20	PC	30
3	2008-2009	Condomínio Morada da Praia II	Submontane forest	-23.705	-45.869	98	PC	20
4	2008-2009	Condomínio Morada da Praia III	Submontane forest	-23.702	-45.891	290	PC	10
5	2010	Segunda Estrada	Lowland forest	-23.875	-46.194	31	L	5
6	2010	Alambique road	Lowland forest	-23.854	-46.176	35	L	5
7	2010	Vicente's road	Lowland forest	-23.832	-46.167	9	L	5
8	2010	Mangue road	Mangrove	-23.817	-46.154	4	L	5
9	2010	K3 trail	Lowland forest	-23.801	-46.126	10	L	5
10	2010	Restinga trail	<i>Restinga</i>	-23.779	-46.124	109	L	5
11	2010	Rio trail	Lowland forest	-23.764	-46.112	46	L	5
12	2010	Pedra trail	Submontane forest	-23.773	-46.115	189	L	5
13	2010	Represa trail	Submontane forest	-23.745	-46.115	491	L	5
14	2010-2011	Prata river	Lowland forest	-23.8	-46.1	5	MN,T	2,304/5
15	2010-2011	Bertioga beach	<i>Restinga</i>	-23.82	-46.08	12	MN,T	2,304/5

Bird counts

We surveyed birds with auditory-visual methods and mist nets. VC conducted unlimited-distance 10-min point counts (Bibby *et al.* 2000, Vielliard & Silva 1990). There were three points 200 m apart in each of the four elevational bands, which were separated vertically by *ca.* 100 m. Each point was visited for six non-continuous days and the observer managed to intersperse the sequence of conducting points so that each point was the first to be sampled. Complementarily, TVVC used 10-species lists, in which case 10 species were noted in a list, without repeating the same species in the same list; it was possible to mark a repeated species again only in a subsequent one. The observer took descriptions or sound recordings of any bird not immediately identified but that was seen or heard sufficiently well for identification. These individuals were later identified using standard reference works (Herzog *et al.* 2002, MacKinnon & Phillips 1993). GAB and LML surveyed birds with unlimited-distance transect counts during mornings and afternoons. All observations began 15 min before sunrise, while afternoon counts usually took place after 15h00. Bird records consisted of individuals heard and/or seen with the help of 8 x 20 and 8 x 40 binoculars. We avoided surveying birds on rainy or windy days. Individuals were recorded with tape (Panasonic RQ-L31) and digital (Zoom H4n) recorders with a Sennheiser ME-66 directional microphone. Recordings were deposited at the Seção de Aves do Museu de Zoologia da Universidade de São Paulo (MZUSP).

Mist nets were also used to complement our inventories. Eight mist nets (12 x 3 m x 30 mm) were placed in six 100 m trails, one trail for each of the six sites located at the Prata restingas. Nets touched bottom and were kept open from 05h00-12h00 for two consecutive mornings and one afternoon (15h00-17h00). We also conducted pre-dawn observations (03h00-05h00) and walked randomly in different elevations around our study areas and distinct habitats such as restingas and nearby marshes and reed beds, while including stops at flowering and fruiting trees to observe hummingbirds and canopy-dwelling frugivores, many of which are difficult to detect, especially during point counts (Robinson 1999). On many occasions we conducted afternoon counts *ca.* 2 h before sunset until nightfall. We surveyed sites during four reproductive seasons: 31 August-1 September 2008; 24 October-8 November 2008; 25-28 November 2008; 14-29 November 2009 (Guaratuba), 11, 15-22 December 2010 (Itatinga) and 8-12 September 2010, 31 March, 2 and 5 April 2011 (Prata), accumulating a total of 90 point counts (15 h), 42 10-species lists (~ 12 km), 58 h of transect counts (~ 10 km) and a net effort (E) of 4,608 h.m². The net effort was calculated according to $E = area \cdot h \cdot n$, where *area* is the area of each mist net (height

multiplied by width), *h* is the time of exposure and *n* is the number of mist nets (Roos 2010). Free observations summed up 87 h and another 110 h were spent walking in nearby marshes and restingas, for a total of 197 hours and *ca.* 190 km of quantitative and *ad libitum* observations.

For a complete compendium we searched for Bertioga bird records in the literature in Web of knowledge (<http://wokinfo.com/>) and Google Scholar (<http://www.scholar.google.com/>), and for “Santos” (which encompassed this municipality in past decades), “Bertioga”, and “Varjão do Rio Guaratuba” specimens in the MZUSP bird collection. Santos specimens were critically examined individually regarding their precise location, and only those unequivocally collected within the current Bertioga municipality were considered. In addition, skins deposited at the Instituto Adolfo Lutz (IAL) and Museu de Zoologia da Universidade Estadual de Campinas (ZUEC) and recordings available at the Fonoteca Neotropical Jacques Vielliard (FNJV) were accessed in <http://www.splink.org.br/>. Specialized World Wide Web sites were consulted for additional documented records within the municipality (<http://www.xeno-canto.org> and <http://www.wikiaves.com.br>), bearing in mind some questionable identifications. Therefore, all records based on these websites were critically examined. We are aware that many species recorded from the literature and that we considered as undocumented may have documentation. However, because we had no access to these vouchers (photographs and recordings), we treated them as such. Taxonomic arrangements follow the Comitê Brasileiro de Registros Ornitológicos (CBRO 2014) and Atlantic forest endemic species are according to Moreira-Lima (2013). Threatened species are reported for global (IUCN 2012), national (Silveira & Straube 2008) and state (Silveira *et al.* 2009) levels.

RESULTS

Over a total of 71 non-continuous days of surveys and random observations we documented 217 bird species of 22 orders and 61 families. Another 30 species were recorded aurally and/or seen only, lacking further documentation. The use of mist nets resulted in 215 individuals captured. These corresponded to 21 species, which were also detected with other surveying methods, belonging to three orders and 14 families.

The first published account on Bertioga birds was Camargo's (1946) who mentioned six species from Varjão do Guaratuba, which consists of mangroves and marshes adjacent to that river. Lopes *et al.* (1980) mist netted 18 species in lowland forests around the Guaratuba River and later, Bennett & Lopes (1980) mist netted birds at Varjão do Rio Guaratuba, as well as other municipalities

in the state (Itapetininga and Salesópolis) without teasing apart species recorded by individual locality. The Bertioga Polygon avifauna inventory yielded 87 species, for none of which Beyer (2008) mentioned the type of documentation obtained. The SESC Bertioga bird project recorded 135 species, most of them documented with photographs (Sanfilippo & Demétrio 2004). Willis & Oniki (2003), in which Stotz & Willis' (1992) records in Guaratuba are included, mentioned 233 species from Bertioga. The most recent published avifaunal inventory conducted in Bertioga surveyed birds with point counts in montane Atlantic forests at the Parque das Neblinas, lying on 700-1,200 m terrains (Donatelli *et al.* 2011). This list included 221 species. The authors, however, did not specify the types of documentation for each species, except for the Hangnest Tody-Tyrant *Hemitriccus nidipendulus*, the identification of which consisted of its diagnosable nest.

The MZUSP collection accounted for 116 specimens of 64 species whereas the IAL and ZUEC collections accounted for 20 species each, although the IAL specimen of an *Elaenia* sp. was omitted here since its identification was not provided and could not be personally examined. Recordings from xeno-canto included 17 species, and from the 2,806 photographs and 51 recordings as of 22 October 2014 on the Wiki Aves database (261 species), we excluded two single photographed individuals because

of the following: *Myiarchus tyrannulus* is a poor-quality photograph of a ferruginous-tailed *Myiarchus*. As no comments by the photographer referred to its vocalization, but rather to its ferruginous wing and tail feathers, we decided to exclude this record because this genus is not easily recognizable by plumage alone. In addition, VC photographed a ferruginous-tailed singing *M. ferox* at Emas National Park on 27 November 2013, rendering the feature used to identify this *M. tyrannulus* from Bertioga unreliable. *Sula leucogaster* were photographed during a boat crossing from Bertioga to Guarujá, so their precise locality (municipality) cannot be assumed.

All documented records (including literature, museum specimens, recordings and photographs) from Bertioga accounted for 330 species of 25 orders and 73 families. Of these, 55 are endemic to the Atlantic forest (including another 11 "almost endemic" species, Moreira-Lima 2013), and six are considered globally endangered or vulnerable, whereas six are endangered in Brazil and another 23 in the state, including the critically endangered *Aburria jacutinga* (Appendix I). Seventeen species are reported from Bertioga for the first time (Appendix I and II). Should we consider elevational bands separately, the lowest band (0-99 m) accounts for three times (or even more) the number of species recorded in any other elevational band (Table 2).

TABLE 2: Number of species recorded per elevational band within the municipality of Bertioga, São Paulo, Brazil.

Elevation	Documented species	Undocumented species	Total
0-99	177	21	198
100-199	60	6	66
200-299	60	9	69
300-399	41	5	46
400-499	47	3	50

DISCUSSION

Novel species added to the municipality of Bertioga are mostly represented by conspicuous, yet vagrant species, or those, which have recently colonized the area due to habitat alterations. Some common forest species should be recorded and documented with continued surveys.

Some 90 undocumented records (of which 28 are Atlantic forest endemics) include many species found at higher elevations of the Serra do Mar, not surveyed by us. Among these there are three vulnerable and two critically endangered species in the state, as well as 30 species, which can be found at the nearby Boraceia Biological Station (Appendix II, Cavarzere *et al.* 2010). While the Scaled Woodcreeper *Lepidocolaptes squamatus* represents a misidentification (in Bertioga its southern

counterpart Scalloped Woodcreeper *L. falcinellus* should occur in montane forests) there are many other sightings that must be fully documented either due to their unlikely range within the Serra do Mar or discrete plumage to be identified only by sight. Species such as the Planalto Slaty Antshrike *Thamnophilus pelzelni*, Pale-breasted Spinetail *Synallaxis albescens*, Southern Antpipit *Corythopis delalandi* and Mouse-coloured Tyrannulet *Phaeomyias murina* (Donatelli *et al.* 2011) are not found along the coast or in highland evergreen Atlantic forests in the state (Willis & Oniki 2003). They may have been misidentified since these records relied on sightings only (Donatelli *et al.* 2011).

VC saw on two consecutive days (25 and 26 October 2008) one lone, quite striated *Tigrisoma* standing on large rocks in the middle of the river while crossing the

Guaratuba River deep in lowland forest in a point where it bears characteristic features (fast-flowing small- to medium-sized clear water rivers surrounded by undisturbed vegetation) of the habitat of the Fasciated Tiger-Heron *T. fasciatus*, a critically endangered species in São Paulo. There was no time to observe the diagnosable characters that distinguish it from its congenier's youngsters as the bird flew away to the forest on both occasions at the moment it was sighted. However, we strongly believe it was not a young Rufescent Tiger-Heron *T. lineatum*, for this latter species was commonly and only observed, in adult and juvenile plumage, in marshes bordering, or even completely isolated from, forest edges. VC also heard the Rusty-barred Owl *Strix hylophila* on 3 November 2008 at ca. 200 m at a steep slope at Guaratuba. This owl is more common at higher elevations at the Serra do Mar and especially at the Serra da Mantiqueira (Antunes *et al.* 2006). This undocumented record illustrates how some typical high-elevation species move along elevational gradients as long as the vegetation is continuous between lowland and montane forests (Simpson *et al.* 2012).

Noteworthy records

Our compilation resulted in 420 bird species (93, or 22.6%, Atlantic forest endemics), 324 of which are documented in the form of skins, photographs or recordings. Some of these records are quite interesting and we briefly comment on them below.

Solitary Tinamou *Tinamus solitarius*. Vulnerable in São Paulo and sought after by poachers. The species was perhaps less common in the lowlands, but regularly found along the entire elevational gradient at Guaratuba, even in the steepest terrains, indicating low hunting pressure in that area (Sick 1997). Its vocalization was heard on every survey, apparently with no temporal or seasonal correlation. On few occasions when birds were seen, only one individual was sighted.

Black-fronted Piping-Guan *Aburria jacutinga*. Critically endangered in São Paulo and globally endangered. This species is extremely rare outside protected areas, especially in the Serra do Mar, due to hunting and palm harvesting (Galetti *et al.* 1997). We saw two individuals around the 100 m elevational band at Guaratuba, which is the limit threshold of the Serra do Mar State Park boundaries. One individual flew away the moment it was sighted, but the other remained calm on a canopy branch for several minutes. Residents reported the species as somewhat regularly seen in the area, and although it is not common at all at the Boraceia Biological Station (contiguous higher elevation forests on the same elevational gradient), the species has also been recently recorded there at 830 m (Cavarzere *et al.* 2010). There is a record of breeding activity in Bertioiga (Casadei 2013),

where a bird in young plumage was seen besides an adult individual. This elevational gradient may be a promising location for studying *A. jacutinga* at the Serra do Mar.

Hook-billed Kite *Chondrohierax uncinatus*. Near threatened in São Paulo. An uncommon hawk in the state, especially in coastal areas (Willis & Oniki 2003). At least nine individuals were reported from three different localities at the Baixada Santista, a southern coastal locality in São Paulo (Silva & Olmos 2007), suggesting a resident population which commonly form conspecific groups. Here it is reported for Bertioiga (Itatinga) for the first time, but we saw no indications of social aggregations.

Mantled Hawk *Pseudastur polionotus*. Vulnerable in São Paulo. This species is typically found at higher altitudes at the Serra do Mar, but we saw one bird soaring over the 200 m elevational band at Itatinga, just 100 m higher than our record of the White-necked Hawk *Amadonastur lacernulatus*, a coastal lowland species in the state.

Black-and-white Hawk-Eagle *Spizaetus melanoleucus*. Critically endangered in São Paulo. A rare species in the state, it depends on large areas to hunt. We saw one bird soaring over a small fragment, which was not far from continuous lowland forests, near the city of Bertioiga.

American Oystercatcher *Haematopus palliatus*. Vulnerable in São Paulo. New for the municipality, this species has no historical records in São Paulo northern coastlines. Because dogs are a menace to the nidification of the species, it would be important to control the entrance of such pets in protected environments (F. Olmos, pers. com.). In addition, the deforestation of restingas, as well as uncontrolled tourism and pollution constitute a severe threat to this species (Barbieri 2009). Hopefully, recently protected restingas (see below) will warrant its constant presence in Bertioiga.

Mearly Parrot *Amazona farinosa*. Critically endangered in São Paulo. This represents one of the few populations in the state's northern coasts. The species is much more abundant in São Sebastião and Ilha Bela, immediately northeast of Bertioiga (Olmos 1992), but can reach both Caraguatatuba (E. Pacífico pers. obs.) and Ubatuba (Simpson *et al.* 2012) to the north. The species is typically seen in small flocks of ca. six individuals, which fly from lower slopes to lowland forests during the mornings and to the opposite direction on late afternoons (São Sebastião, R. S. Marconde pers. obs.). Although common in lowlands, it can be also spotted above 700 m, in preserved montane forests at Ilha Bela, in the highest part of the dirt road to the Castelhanos beach (pers. obs.).

Salvadori's Antwren *Myrmotherula minor*. Vulnerable in São Paulo and globally vulnerable. We saw one adult male in mature and tall forest at sea level at Guaratuba. Much less common than its congener *M.*

unicolor, this species may be easily overlooked because of its cryptic plumage and behavior. There is also a male collected at Varjão do Rio Guaratuba by E. Dente in 30 June 1971 (MZUSP 43457).

Tawny-throated Leaf-tosser *Sclerurus macconnelli*. Vulnerable in São Paulo. The only record of the species for Bertioga is a mist netted male (MZUSP 62446) on 24 October 1972 around Varjão do Rio Guaratuba. Uncommon at the northward coastal municipality of Ubatuba (Simpson *et al.* 2012), no other records have been made for this species in Bertioga since then, nor has the species been recorded in Caraguatatuba (between Bertioga and Ubatuba), where we suspect the species will be found with increasing surveying efforts. There is also a record from Saibadela/Sete Barras, within the Serra de Paranapiacaba (Aleixo & Galetti 1997), which is supposedly the southernmost range of this species in eastern Brazil.

Wren-like Rushbird *Phleocryptes melanops*. Vulnerable in São Paulo. One of three records for the state. There is a female specimen in MZUSP (61066) from Rio Guaratuba. Like *S. macconnelli*, no other record of the species has been made in Bertioga, although it has been recorded in Cubatão (Olmos & Silva 2001).

Shrike-like Cotinga *Laniisoma elegans*. Vulnerable in São Paulo. A species hard to detect, with only a few records in the state, most of them at higher elevations (Boraceia Biological Station, Cavarzere *et al.* [2010]). A previous undocumented sighting at the Varjão do Rio Guaratuba lowlands by Camargo (1946) is now confirmed by a recent photograph (Balieiro 2012).

Chestnut-bellied Seed-Finch *Sporophila angolensis*. Vulnerable in São Paulo. A sought-after cage bird found especially in Coco-grass *Cyperus rotundus* and Cattail *Typha* ssp. dominated marshes in the interior of the state (Willis & Oniki 2003). Apparently its populations are recovering in some parts of São Paulo, becoming more common even in disturbed areas. We saw and heard a singing adult male at Itatinga.

Correlates of species richness

The high species richness detected at Bertioga clearly reflects the environmental diversity in our study areas, such as lowland and montane forests, and riverine and marine habitats. There are other species that will eventually be encountered within the municipality as additional surveys and observations are carried out. Recently, the successful implementation of a 9,264 ha restinga protected area (Restinga de Bertioga State Park) has been achieved, although this excluded Itaguapé beach, an important resting area for sea and shorebirds. The adjoining Hércules Florence Private Natural Reserve adds another 1,440 ha to this large restinga *continuum*,

making this area one of the last large protected restingas remaining in the country. Despite these initiatives, we caution about the conservation of lowland forests along other coastline municipalities within São Paulo. As the Serra do Mar State Park does not protect lowland habitats, we strongly believe these forests will be destined for real-estate speculation and, as already seen in Bertioga and elsewhere, occupation by slums in the near future.

Although some species seem restricted to lowlands, such as the Yellow-legged Tinamou *C. noctivagus*, Glittering throated Emerald *Amazilia fimbriata*, Tawny-throated Leaf-tosser *S. macconnelli*, Whiskered Flycatcher *Myiobius barbatus*, Black-headed Berryeater *Carpornis melanocephala*, the conservation of complete elevational gradients are just as important. As fully documented, there are cases of elevational replacements and migrations at both the Serra do Mar and Serra de Paranapiacaba (e.g. Rajão & Cerqueira 2006, Simpson *et al.* 2012). Migrations exist in some high elevation species which can descend to sea level, or species that have been suggested to depend on the palm heart *E. edulis*, which fruits at different times and elevations, during periods of general fruit scarcity (Laps 1996, but see Galetti & Aleixo 1998). Therefore, such communities can only thrive in entire Atlantic forest elevational gradients, from lowlands to montane forests.

Recently, the polytypic species *Sclerurus mexicanus* was proven paraphyletic (d'Horta *et al.* 2012), meaning that the subspecies *S. m. macconnelli* should eventually be regarded as a full species ranging from the Guiana Shield to the Atlantic forest in eastern Brazil (CBRO 2014). The Yellow-legged Tinamou *Crypturellus n. noctivagus* may also prove to be a separate species (endemic of the Atlantic forest) from its northern counterpart, *C. n. zabele*, of drier caatinga and semideciduous forests (B. Tamotami pers. com.). For harboring a greater species richness than other elevational band, exclusive and threatened species as well as several Atlantic forest endemics, we highlight the importance of continuous efforts to study and survey low elevation forest and restinga habitats, suggesting their immediate inclusion within the Serra do Mar State Park, a Category II protected area (see IUCN protected area categories).

ACKNOWLEDGEMENTS

G. P. Moraes helped on a few field expeditions. IdeaWild supported us with field equipment. VC benefitted from a Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) scholarship. We extend many thanks to Andrés Calonge-Méndez for inviting TVVC to survey these forests. F. K. Ubaid is thanked for inviting VC to collaborate with his research at Emas National

Park. LFS receives a grant from Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq, 313818/2009-6). F. Olmos, A. Aleixo and an anonymous reviewer contributed with important suggestions, literature and information to an earlier draft of this manuscript.

REFERENCES

- Aleixo, A. & Galetti, M. 1997.** The conservation of the avifauna in a lowland Atlantic forest in south-east Brazil. *Bird Conservation International*, 7: 235-261.
- Alves, M. A. S. & Vecchi, M. B. 2009.** Birds, Ilha Grande, state of Rio de Janeiro, southeastern Brazil. *Check List*, 5:300-313.
- Antunes, A. Z.; Eston, M. R.; Santos, A. S. R.; Menezes, G.V. & Santos, A. M. R. 2006.** Presença da coruja-listrada *Strix hylophila* Temminck, 1825 (Aves: Strigidae) no Parque Estadual Carlos Botelho, São Miguel Arcanjo, Estado de São Paulo. *Revista do Instituto Florestal*, 18: 167-171.
- Balheiro, G. 2012.** [WA721190, *Laniisoma elegans* (Thunberg, 1823)]. www.wikiaves.com/721190 (access on 18 June 2013).
- Barbieri, E. 2009.** *Haematopus palliatus* Temminck, 1820. Charadriiformes, Haematopodidae, pp. 151. In Bressan, P.M.; Kierulff, M.C.M. & Sugieda, A.M. (eds.). Fauna ameaçada de extinção no Estado de São Paulo: Vertebrados. Fundação Parque Zoológico de São Paulo e Secretaria do Meio Ambiente, São Paulo.
- Bennet, G. F. & Lopes, O.S. 1980.** Blood parasites of some birds from São Paulo state, Brazil. *Memórias do Instituto Oswaldo Cruz*, 75: 117-134.
- Beyer, D. D. 2008.** Diagnóstico socioambiental para criação de unidades de conservação. Polígono Bertiooga. Unpublished report to World Wildlife Fund for Nature. www.wwf.org.br/informacoes/?uNewsID=23280. (access on 23 March 2012).
- Bibby, C. J.; Burgess, N. D.; Hill, D. A. & Mustoe, S. H. 2000.** *Bird census techniques*. London: Academic Press.
- Câmara, I. G. 1991.** *Plano de ação para a Mata Atlântica*. São Paulo: SOS Mata Atlântica.
- Câmara, I. G. 2003.** Brief history of conservation in the Atlantic Forest, pp. 31-42. In: Galindo-Leal, C. & Câmara, I.G. (eds.). The Atlantic Forest of South America: biodiversity status, threats and outlook. Washington: Island Press.
- Camargo, H. F. A. 1946.** Sobre uma pequena coleção de aves de Boracéia e do Varjão do Guaratuba (Estado de São Paulo). *Papéis Avulsos de Zoologia*, 7: 143-164.
- Camargo, H. F. A. 1998.** Hellmuth Pinder, o primeiro coletor e taxidermista de aves do Museu Paulista. *Ararajuba*, 6:54-57.
- Casadei, L. O. 2013.** [WA964784, *Aburria jacutinga* (Spix, 1825)]. www.wikiaves.com/964784 (access on 08 June 2013).
- Cavarzere, V.; Moraes, G. P. & Silveira, L.F. 2010.** Boracéia Biological Station: an ornithological review. *Papéis Avulsos de Zoologia*, 50: 189-201.
- CBRO – Comitê Brasileiro de Registros Ornitológicos. 2014.** *Lista das aves do Brasil*, 11ª edição. www.cbro.org.br. (access on 14 January 2014).
- Cunha, A. A. & Rajão, H. 2007.** Terrestrial mammals and birds of Sapukai Indigenous Area (Aldeia Guarani do Bracui), Angra dos Reis, RJ, Brazil. *Boletim do Museu de Zoologia Mello Leitão*, 21: 19-34.
- Davis, D. E. 1946.** A seasonal analysis of mixed flocks of birds in Brazil. *Ecology*, 27: 168-181.
- Develey, P. F. 2004.** As aves da Estação Ecológica Juréia-Itatins, pp. 278-295. In: Marques, O.A.V. & Duleba, W. (eds.). Estação Ecológica Juréia-Itatins. Ambiente físico, flora e fauna. Ribeirão Preto: Holos.
- d’Horta, F. M.; Cuervo, A. M.; Ribas, C.C.; Brumfield, R. T. & Miyaki, C. Y. 2012.** Phylogeny and comparative phylogeography of *Sclerurus* (Aves: Furnariidae) reveal constant and cryptic diversification in an old radiation of rain forest understorey specialists. *Journal of Biogeography*, 40: 37-49.
- Donatelli, R. J.; Ferreira, C. D. & Costa, T. V. V. 2011.** Avian communities in woodlots at the Parque das Neblinas, Bertiooga, São Paulo, Brazil. *Revista Brasileira de Biociências*, 9: 187-199.
- Galetti, M. & Aleixo, A. 1998.** Effects of palm heart harvesting on avian frugivores in the Atlantic rain forest of Brazil. *Journal of Applied Ecology*, 35: 286-293.
- Galetti, M.; Martucelli, P.; Olmos, F. & Aleixo, A. 1997.** Ecology and conservation of the jacutinga *Pipile jacutinga* in the Atlantic forest of Brazil. *Biological Conservation*, 82: 31-39.
- Goerck, J. 1997.** Patterns of rarity in the birds of the Atlantic forest of Brazil. *Conservation Biology*, 11: 112-118.
- Goerck, J. 1999.** Distribution of birds along an elevational gradient in the Atlantic forest of Brazil: implications for the conservation of endemic and endangered species. *Bird Conservation International*, 9: 235-253.
- Haffer, J. 1985.** Avian zoogeography of the neotropical lowland. *Ornithological Monographs*, 36: 113-146.
- Herzog, S. K.; Kessler, M. & Cahill, T. M. 2002.** Estimating species richness of tropical bird communities from rapid assessment data. *Auk*, 119: 749-769.
- IUCN – The World Conservation Union. 2012.** *IUCN Red List of Threatened Species*. www.redlist.org. (access on 11 January 2012).
- Laps, R. R. 1996.** *Frugivoria e dispersão de sementes de palmito (Euterpe edulis, Martius, Arecaceae) na Mata Atlântica, sul do Estado de São Paulo*. M.Sc. dissertation. Campinas: Instituto de Biologia.
- Laurance, W. F. 2009.** Conserving the hottest of the hotspots. *Biological Conservation*, 142: 1137.
- Lima, B. 2010.** A avifauna das florestas de restinga de Itanhaém/Mongaguá, Estado de São Paulo, Brasil. *Atualidades Ornitológicas*, 153: 50-54.
- Lopes, O. S.; Sacchetta, L. A. & Dente, E. 1980.** Longevity of wild birds during a banding program in São Paulo, Brasil. *Journal of Field Ornithology*, 51: 144-148.
- Luederwaldts, H. 1929.** Resultados de uma excursão científica à Ilha de São Sebastião no litoral norte do Estado de São Paulo em 1925. *Revista do Museu Paulista*, 16: 3-79.
- MacKinnon, S. & Phillips, K. 1993.** *A Field Guide to the Birds of Borneo, Sumatra, Java and Bali*. Oxford: Oxford University Press.
- Maia, V. C.; Magenta, M. A. G. & Martins, S. E. 2008.** Ocorrência e caracterização de galhas de insetos em áreas de restinga de Bertiooga, São Paulo, Brasil. *Biota Neotropica*, 8: 167-197.
- Mallet-Rodrigues, F.; Parrini, R. & Pimentel, L. M. S. 2010.** Altitudinal distribution of birds in a mountainous region in southeastern Brazil. *Zoologia*, 27: 503-522.
- Martins, S. E.; Rossi, L.; Sampaio, P. S. P. & Magenta, M. A. G. 2008.** Caracterização florística de comunidades vegetais de restinga em Bertiooga, SP, Brasil. *Acta Botanica Brasilica*, 22: 249-274.
- Mittermeier, R. A.; Gil, P. R.; Hoffmann, M.; Pilgrim, J.; Brooks, J.; Mittermeier, C. G.; Lamourux, J. & Fonseca, G. A. B. 2005.** *Hotspots Revisited: Earth’s Biologically Richest and Most Endangered Terrestrial Ecoregions*. Cemex, Washington.
- Moreira-Lima, L. 2013.** *Aves da Mata Atlântica: riqueza, composição, status, enemismos e conservação*. M.Sc. dissertation. São Paulo: Instituto de Biociências.
- Myers, N.; Mittermeier, R. A.; Mittermeier, C.G.; Fonseca, G. A. B. & Kent, J. 2000.** Biodiversity hotspots for conservation priorities. *Nature*, 403:853-858.
- Naka, L. & Rodrigues, M. 2000.** *As aves da Ilha de Santa Catarina*. Florianópolis: Ed. Da UFSC.

- Nascimento, C. M. & Pereira, M. A. M. G. 1988.** *Atlas climatológico do Estado de São Paulo: 1977-1986*. Campinas: Fundação Cargill.
- Nores, M.; Cerana, M. M. & Serra, D. A. 2005.** Dispersal of forest birds and trees along the Uruguay River in southern South America. *Diversity and Distributions*, 11: 205-217.
- Olmos, F. 1996.** Missing species in São Sebastião Island, southeastern Brazil. *Papéis Avulsos de Zoologia*, 39: 329-349.
- Olmos, F. & Silva, R. S. 2001.** The avifauna of a southeastern Brazilian mangrove swamp. *International Journal of Ornithology*, 4: 135-205.
- Rajão, H. & Cerqueira, R. 2006.** Distribuição altitudinal e simpatria das aves do gênero *Drymophila* Swainson (Passeriformes, Thamnophilidae) na Mata Atlântica. *Revista Brasileira de Zoologia*, 23: 597-607.
- Ribeiro, M. C.; Metzger, J. P.; Martensen, A.C.; Ponzoni, F. J. & Hirota, M. M. 2009.** The Brazilian Atlantic forest: how much is left, and how is the remaining forest distributed? Implications for conservation. *Biological Conservation*, 142: 1141-1153.
- Robinson, W. D. 1999.** Long-term changes in the avifauna of Barro Colorado Island, Panama, a tropical forest isolate. *Conservation Biology*, 13: 85-97.
- Roos, A. L. 2010.** Capturando aves, p. 77-104. In: Matter, S.; Straube, F. C.; Accordi, I.; Piacentini, V. & Cândido-Jr, J. F. (orgs.). *Ornitologia e Conservação. Ciência aplicada, técnicas de pesquisa e levantamento*. Rio de Janeiro: Technical Books.
- Sanfilippo, L. & Demétrio, C. 2004.** *Aves do SESC Bertoga*. São Paulo: SESC.
- Sick, H. 1997.** *Ornitologia brasileira*. Rio de Janeiro: Nova Fronteira.
- Silva, J. M. C. & Castelleti, C. H. M. 2003.** Status of the biodiversity of the Atlantic forest of Brazil, pp. 43-59. In: Galindo-Leal, C. & Câmara, I.G. (eds.). *The Atlantic Forest of South America: biodiversity, status, threats and outlook*. Washington: Island Press.
- Silva, R. S. & Olmos, F. 2007.** Adendas e registros significativos para a avifauna dos manguezais de Santos e Cubatão, SP. *Revista Brasileira de Ornitologia*, 15: 551-560.
- Silveira, L. F.; Benedicto, G. A.; Schunck, F. & Sugieda, A. M. 2009.** Aves, pp. 87-284. In: Bressan, P.M.; Kierulff, M.C.M. & Sugieda, A.M. (eds.). *Fauna ameaçada de extinção no Estado de São Paulo: Vertebrados*. Fundação Parque Zoológico de São Paulo e Secretaria do Meio Ambiente, São Paulo.
- Silveira, L. F. & Straube, F. 2008.** Aves, pp. 378-678.. In: Machado, A.B.M.; Drummond, G.M. & Paglia, A.P. (eds.). *Livro Vermelho da fauna brasileira ameaçada de extinção*. Ministério do Meio Ambiente, Brasília
- Simpson, R.; Cavarzere, V. & Simpson, E. 2012.** List of documented bird species from the municipality of Ubatuba, state of São Paulo. *Papéis Avulsos de Zoologia*, 52: 233-254.
- Stotz, D. F. & Willis, E. O. 1992.** Guaratuba, São Paulo, Brazil (Christmas Count). *American Birds*, 46: 1020-1021.
- Straube, F. C. & Urben-Filho, A. 2005.** Avifauna da Reserva Natural Salto Morato (Guaraqueçaba, Paraná). *Atualidades Ornitológicas*, 124: 12-32.
- Vielliard, J. M. E. & Silva, W. R. 1990.** Nova metodologia de levantamento quantitativo e primeiros resultados no interior do Estado de São Paulo. In: *Anais do IV Enave*. Universidade Federal de Pernambuco, Recife.
- Willis, E. O. & Oniki, Y. 1981.** Levantamento preliminar de aves em treze áreas do Estado de São Paulo. *Revista Brasileira de Biologia*, 41: 121-135.
- Willis, E. O. & Oniki, Y. 2003.** *Aves do Estado de São Paulo*. Divisa, Rio Claro.

Associate Editor: Marco Aurélio Pizo

APPENDIX I

List of 330 bird species documented within the municipality of Bertioga, state of São Paulo, southeastern Brazil. Evidence: A = aural, N = nest, P = photograph, R = recording, Sk = skin, V = visual. Sources: Skins - Museu de Zoologia da Universidade de São Paulo (MZUSP), Museu de Zoologia da Universidade Estadual de Campinas (ZUEC) and Instituto Adolfo Lutz (IAL); Recordings - Fonooteca Neotropical Jacques Viellard (FNJV), xeno-canto database (XC) and Wiki Aves (Wk*), exclusively registered on Wiki Aves as recordings; Literature - A = this study, C = Camargo (1946), D = Donatelli *et al.* (2011), L = Lopes *et al.* (1980), P = Beyer (2008), S = Sanfilippo & Demétrio (2004), W = Willis & Oniki (2003); on line photographs - Wk = Wiki Aves. Elevation: B = 0-99 m, 1 = 100-199 m, 2 = 200-299 m, 3 = 300-399 m, 4 = 400-499 m. Threats: GL = global (IUCN 2012), BR = Brazil (Silveira & Straube 2008), SP = state of São Paulo (Silveira *et al.* 2009). AE = species almost endemic to the Atlantic forest (Moreira-Lima 2013).

Taxa	English name	Evidence	Elevation	Source	GL	BR	SP	Endemism
Tinamiformes								
Tinamidae (3)								
<i>Tinamus solitarius</i>	Solitary Tinamou	A,P,Sk,V	1234	A,D,P,W,Wk			VU	E
<i>Crypturellus obsoletus</i>	Brown Tinamou	A,R	B	A,D,P,Wk				
<i>Crypturellus noctivagus</i>	Yellow-legged Tinamou	A,R,Sk	B	A,MZUSP,W,Wk*		EN	EN	
Anseriformes								
Anatidae (5)								
<i>Dendrocygna viduata</i>	White-faced Whistling-Duck	P		S,Wk				
<i>Dendrocygna autumnalis</i>	Black-bellied Whistling-Duck	P,V	B	A				
<i>Cairina moschata</i>	Muscovy Duck	P,V	B	A,W,Wk				
<i>Amazonetta brasiliensis</i>	Brazilian Teal	V,P	B	A,S,Wk				
<i>Nomonyx dominica</i>	Masked Duck	V,P	B	A,Wk			NT	
Galliformes								
Cracidae (2)								
<i>Penelope obscura</i>	Dusky-legged Guan	A,P,R,Sk,V	B	A,C,D,MZUSP,S,W,Wk			NT	
<i>Aburria jacutinga</i>	Black-fronted Piping-Guan	P,V	13	A,Wk	EN	EN	CR	E
Podicipediformes								
Podicipedidae (1)								
<i>Podilymbus podiceps</i>	Pied-billed Grebe	V,P	B	A,Wk				

Taxa	English name	Evidence	Elevation	Source	GL	BR	SP	Endemism
Sphenisciformes								
Spheniscidae (1)								
<i>Spheniscus magellanicus</i>	Magellanic Penguin	Sk		W				
Procellariiformes								
Procellariidae (3)								
<i>Pachyptila belcheri</i>	Slender-billed Prion	Sk		W				
<i>Procellaria aequinoctialis</i>	White-chinned Petrel	Sk		W	VU	EN		VU
<i>Calonectris borealis</i>	Cory's Shearwater	Sk		W				
Suliformes								
Fregatidae (1)								
<i>Fregata magnificens</i>	Magnificent Frigatebird	P,Sk,V	B	A,D,S,W,Wk				
Phalacrocoracidae (1)								
<i>Phalacrocorax brasilianus</i>	Neotropical Cormorant	P,V	B	A,D,P,S,W,Wk				
Pelecaniformes								
Ardeidae (13)								
<i>Tigrisoma lineatum</i>	Rufescent Tiger-Heron	P,Sk,V	B	A,MZUSP,W,Wk				
<i>Cochlearius cochlearius</i>	Boat-billed Heron	P		S				
<i>Ixobrychus exilis</i>	Least Bittern	P		Wk				
<i>Nycticorax nycticorax</i>	Black-crowned Night-Heron	P,V	B	A,S,W,Wk				
<i>Nyctanassa violacea</i>	Yellow-crowned Night-Heron	P		W,Wk				
<i>Butorides striata</i>	Striated Heron	P,V	B	A,S,W,Wk				
<i>Bubulcus ibis</i>	Cattle Egret	P,V	B	A,S,Wk				
<i>Ardea cocoi</i>	Cocoi Heron	P,V	B	A,D,W,Wk				
<i>Ardea alba</i>	Great Egret	P,V	B	A,P,S,W,Wk				
<i>Syrigma sibilatrix</i>	Whistling Heron	P,V	B	A,S,Wk				
<i>Pilherodius pileatus</i>	Capped Heron	V,P	B	A,Wk				VU
<i>Egretta thula</i>	Snowy Egret	P,V	B	A,P,S,W,Wk				
<i>Egretta caerulea</i>	Little Blue Heron	P		P,W,Wk				
Threskiornithidae (2)								
<i>Threskiornis caudatus</i>	Buff-necked Ibis	P		S				

Taxa	English name	Evidence	Elevation	Source	GL	BR	SP	Endemism
<i>Platalea ajaja</i>	Roseate Spoonbill	P		Wk				
Cathartiformes								
Cathartidae (3)								
<i>Cathartes aura</i>	Turkey Vulture	P,Sk,V	B	A,D,C,MZUSP,PS,W,Wk				
<i>Cathartes burrovianus</i>	Lesser Yellow-headed Vulture	P		Wk				
<i>Coragyps atratus</i>	Black Vulture	P,V	B	A,D,P,S,W,Wk				
Accipitriformes								
Pandionidae (1)								
<i>Pandion haliaetus</i>	Osprey	P		W,Wk				
Accipitridae (12)								
<i>Leptodon cayanensis</i>	Gray-headed Kite	A,P,V	B	A,W,Wk				
<i>Chondrohierax uncinatus</i>	Hook-billed Kite	P,V	B	A,Wk			NT	
<i>Harpagus diodon</i>	Rufous-thighed Kite	P,Sk,V	B	A,W,Wk				
<i>Accipiter superciliosus</i>	Tiny Hawk	P		Wk				
<i>Accipiter bicolor</i>	Bicolored Hawk	P		W,Wk				
<i>Rostrhamus sociabilis</i>	Snail Kite	A,P,R,V	B	A,Wk				
<i>Geranospiza caerulescens</i>	Crane Hawk	P,V	B	A,Wk				
<i>Heterospizias meridionalis</i>	Savanna Hawk	P		S				
<i>Amadonastur lacernulatus</i>	White-necked Hawk	P,V	I	A,Wk	VU	EN	VU	E
<i>Urubitinga urubitinga</i>	Great Black-Hawk	Sk	B	MZUSP;W				
<i>Rapornis magnirostris</i>	Roadside Hawk	A,P,R,V	B	A,D,FNJV,PS,W,Wk				
<i>Buteo brachyurus</i>	Short-tailed Hawk	P,V		D,Wk				
Gruiformes								
Aramidae (1)								
<i>Aramus guarauna</i>	Limpkin	A,P,R,V	B	A,Wk				
Rallidae (8)								
<i>Aramides cajaneus</i>	Gray-necked Wood-Rail	P		W,Wk				
<i>Aramides saracura</i>	Slaty-breasted Wood-Rail	A,P,R,V	B	A,D,P				E
<i>Laterallus melanophaius</i>	Rufous-sided Crane	A,P,R	B	A,W,Wk				
<i>Pardirallus maculatus</i>	Spotted Rail	R		XC				

Taxa	English name	Evidence	Elevation	Source	GL	BR	SP	Endemism
<i>Pardirallus nigricans</i>	Blackish Rail	A,P,R,V	B	A,D,P,Wk				
<i>Gallinula galeata</i>	Common Gallinule	A,P,R,V	B	A,Wk				
<i>Porphyrio martinicus</i>	Purple Gallinule	P,V	B	A,Wk				
<i>Fulica armillata</i>	Red-gartered Coot	P		Wk			NT	
Charadriiformes								
Charadriidae (4)								
<i>Vanellus chilensis</i>	Southern Lapwing	A,P,V	B	A,D,P,S,W,Wk				
<i>Pluvialis dominica</i>	American Golden-Plover	P		Wk				
<i>Charadrius semipalmatus</i>	Semipalmated Plover	P,V	B	A,W,Wk				
<i>Charadrius collaris</i>	Collared Plover	P,V	B	A,P,S,W,Wk				
Charadriiformes								
Haematopodidae (1)								
<i>Haematopus palliatus</i>	American Oystercatcher	P		Wk			VU	
Recurvirostridae (1)								
<i>Himantopus melanurus</i>	White-backed Stilt	P		Wk				
Scolopacidae (6)								
<i>Actitis macularia</i>	Spotted Sandpiper	P		P,W,Wk				
<i>Fringa solitaria</i>	Solitary Sandpiper	P		Wk				
<i>Fringa melanoleuca</i>	Greater Yellowlegs	P		W,Wk				
<i>Fringa flavipes</i>	Lesser Yellowlegs	P		Wk				
<i>Calliatis alba</i>	Sanderling	P,Sk,V	B	A,MZUSP,W,Wk				
<i>Calliatis fuscicollis</i>	White-rumped Sandpiper	P,V	B	A,W,Wk				
Jacaniidae (1)								
<i>Jacana jacana</i>	Wattled Jacana	A,P,R,V	B	A,S,Wk				
Stercorariidae (1)								
<i>Stercorarius longicaudus</i>	Long-tailed Jaeger	P		Wk				
Laridae (1)								
<i>Larus dominicanus</i>	Kelp Gull	A,P,V	B	A,P,S,Wk				
Sternidae (5)								
<i>Sterna birundo</i>	Common Tern	P		Wk				

Taxa	English name	Evidence	Elevation	Source	GL	BR	SP	Endemism
<i>Sterna hirundinacea</i>	South American Tern	P		W,Wk				
<i>Thalasseus acyflavivus</i>	Cabot's Tern	P		W,Wk				
<i>Thalasseus maximus</i>	Royal Tern	P		Wk		EN	VU	
Rynchopidae (1)								
<i>Rynchops niger</i>	Black Skimmer	P		Wk				
Columbiformes								
Columbidae (9)								
<i>Columbina talpacoti</i>	Ruddy Ground-Dove	A,P,Sk,V	B	A,D,IAL,S,W,Wk				
<i>Claravis pretiosa</i>	Blue Ground-Dove	Sk		S,W				
<i>Columba livia</i>	Rock Dove	P,V	B	A,S,Wk				
<i>Patagioenas picazuro</i>	Picazuro Pigeon	A,P,V	B	A,D,S,Wk				
<i>Patagioenas cayennensis</i>	Pale-vented Pigeon	P,V	1	A,P,S,W,Wk				
<i>Zenaidura auriculata</i>	Eared Dove	A,P,V	B	A,S				
<i>Leptotila verreauxi</i>	White-tipped Dove	A,R	B	A,D,P,W				
<i>Leptotila rufaxilla</i>	Gray-fronted Dove	A,P,Sk	B	A,D,MZUSP,Wk				
<i>Geotrygon montana</i>	Ruddy Quail-Dove	A,P,R,Sk	234	A,D,W,Wk				
Cuculiformes								
Cuculidae (5)								
<i>Piaya cayana</i>	Squirrel Cuckoo	A,P,Sk,V	B	A,D,MZUSP,W,Wk				
<i>Coccyzus melacoryphus</i>	Dark-billed Cuckoo	Sk		W				
<i>Crotophaga ani</i>	Smooth-billed Ani	P,Sk,V	B	A,D,IAL,P,S,W,Wk				
<i>Guira guira</i>	Guira Cuckoo	A,P,V	B	A,P,S,Wk				
<i>Tapera naevia</i>	Striped Cuckoo	A,R,Sk,V	B	A,D,W				
Strigiformes								
Tytonidae (1)								
<i>Tyto furcata</i>	Barn Owl	P		S				
Strigidae (4)								
<i>Megascops choliba</i>	Tropical Screech-Owl	A,P		D,S				
<i>Pulsatrix koeniswaldiana</i>	Tawny-browed Owl	A,P	123	A,Wk				
<i>Athene cunicularia</i>	Burrowing Owl	A,P,V	B	A,D,S,Wk				E

Taxa	English name	Evidence	Elevation	Source	GL	BR	SP	Endemism
<i>Asio stygius</i>	Stygian Owl	P		S, Wk				
Nyctibiiformes								
Nyctibiidae (1)								
<i>Nyctibius griseus</i>	Common Potoo	A, P, R, V	B	A, D, S, W, Wk				
Caprimulgiformes								
Caprimulgidae (4)								
<i>Luroclis semitorquatus</i>	Short-tailed Nighthawk	A, R, Sk, V	12	A, W				
<i>Hydropsalis albicollis</i>	Pauraque	A, P, V	B	A, D, S, Wk				
<i>Hydropsalis forcipata</i>	Long-trained Nightjar	Sk, V		D, W				E
<i>Chordeiles acutipennis</i>	Lesser Nighthawk	P	B	S, W				
Apodiformes								
Apodidae (4)								
<i>Gypseloides fumigatus</i>	Sooty Swift	P, V	B	A, W				
<i>Streptoprocne zonaris</i>	White-collared Swift	P, V	1	A, D, S, W, Wk				
<i>Chaetura cinereiventris</i>	Gray-rumped Swift	A, P, Sk, V	123	A, MZUSP, W, Wk, ZUEC				
<i>Chaetura meridionalis</i>	Sick's Swift	A, P, V	B	A, P, S, W, Wk				
Trochilidae (16)								
<i>Ramphodon naevius</i>	Saw-billed Hermit	A, P, R, Sk, V	1234	A, C, D, MZUSP, W, Wk, ZUEC				E
<i>Phaethornis ruber</i>	Reddish Hermit	A, P, R, Sk, V	B4	A, P, XC, W, Wk				
<i>Eupetomena macroura</i>	Swallow-tailed Hummingbird	P, V	B	A, D, P, S, Wk				
<i>Aphantochroa cirrochloris</i>	Sombre Hummingbird	P		S, Wk				AE
<i>Florisuga fusca</i>	Black Jacobin	A, P, Sk, V	B12	A, D, MZUSP, P, S, W, Wk				
<i>Anthracothorax nigricollis</i>	Black-throated Mango	P, V	B	A, S, Wk				
<i>Lophornis chalybeus</i>	Festive Coquette	P, Sk, V		W, Wk, ZUEC				
<i>Chlorostilbon lucidus</i>	Glittering-bellied Emerald	P, V	B	A, D, S, Wk				
<i>Thalurania glaucopis</i>	Violet-capped Woodnymph	A, P, Sk, V	B1	A, D, MZUSP, P, S, W, Wk				
<i>Hylocharis cyanus</i>	White-chinned Sapphire	A, P, Sk, V	B	A, MZUSP, S, W, Wk, ZUEC				
<i>Leucochloris albicollis</i>	White-throated Hummingbird	P	B	D, S				
<i>Amazilia versicolor</i>	Versicolored Emerald	P, V	B	A, D, S, Wk				
<i>Amazilia fimbriata</i>	Glittering-throated Emerald	P, Sk, V	B	A, S, W, Wk, ZUEC				

Taxa	English name	Evidence	Elevation	Source	GL	BR	SP	Endemism
<i>Amazilia lactea</i>	Sapphire-spangled Emerald	P,R,Sk		FNJV,S,W,Wk				
<i>Clytolaema rubricauda</i>	Brazilian Ruby	V,Sk		D,W				E
Trogoniformes								
Trogonidae (2)								
<i>Trogon viridis</i>	White-tailed Trogon	A,P,R,Sk,V	134	A,MZUSP,W,Wk				
<i>Trogon surrucura</i>	White-tailed Trogon	A,P,V		D,W,Wk				
Coraciiformes								
Alcedinidae (5)								
<i>Megasceryle torquata</i>	Ringed Kingfisher	P,Sk,V	B	A,P,S,W,Wk				
<i>Chloroceryle amazona</i>	Amazon Kingfisher	P,Sk,V	B	A,D,S,W				
<i>Chloroceryle aenea</i>	American Pygmy Kingfisher	P,Sk	B	MZUSP,W,Wk				
<i>Chloroceryle americana</i>	Green Kingfisher	P,Sk,V		D,W,Wk				
<i>Chloroceryle inda</i>	Green-and-rufous Kingfisher	Sk		W,ZUEC				
Momotidae (1)								
<i>Baryphthengus ruficapillus</i>	Rufous-capped Motmot	A,R,Sk,V	1234	A,MZUSP,W				AE
Galbuliformes								
Bucconidae (2)								
<i>Notharchus swainsoni</i>	Buff-bellied Puffbird	P,Sk		W,Wk			NT	E
<i>Malacoptila striata</i>	Crescent-chested Puffbird	Sk		L,MZUSP,W				
Piciformes								
Ramphastidae (4)								
<i>Ramphastos toco</i>	Toco Toucan	P		Wk				
<i>Ramphastos vitellinus</i>	Channel-billed Toucan	A,P,R,Sk,V	12	A,D,P,W,Wk				
<i>Ramphastos dicolorus</i>	Red-breasted Toucan	P,V		D,S,Wk				E
<i>Selenidera maculirostris</i>	Spot-billed Toucanet	A,P,Sk,V	1	A,MZUSP,W,Wk			NT	E
Picidae (9)								
<i>Picumnus cirratus</i>	White-barred Piculet	A,Sk,V	B	A,MZUSP,W,Wk				
<i>Picumnus temminckii</i>	Ochre-collared Piculet	A,P,R,V	B	A,D, FNJV,L,P,S,Wk				E
<i>Melanerpes flavifrons</i>	Yellow-fronted Woodpecker	A,P,R,V	124	A,W,Wk				AE
<i>Veniliornis spilogaster</i>	White-spotted Woodpecker	A,P,R,V	B23	A,D,P,S,W,Wk				

Taxa	English name	Evidence	Elevation	Source	GL	BR	SP	Endemism
<i>Piculus flavigula</i>	Yellow-throated Woodpecker	A,P,Sk,V	1	A,MZUSP,W,Wk,ZUEC				
<i>Colaptes campestris</i>	Campo Flicker	P,V	B	A,D,S,Wk				
<i>Ceuleus flavescens</i>	Blond-crested Woodpecker	A,P,R,Sk,V	B1234	A,D,MZUSP,RS,XC,W,Wk				
<i>Dryocopus lineatus</i>	Lineated Woodpecker	P,R,V	B	A,D,FNJV,S,W,Wk			NT	E
<i>Campephilus robustus</i>	Robust Woodpecker	Sk		MZUSP,W				
Falconiformes								
Falconidae (8)								
<i>Caracara plancus</i>	Southern Caracara	P,V	B	A,D,P,S,W,Wk				
<i>Milvago chimachima</i>	Yellow-headed Caracara	A,P,R,V	B	A,D,P,S,W,Wk				
<i>Herpethores cachinnans</i>	Laughing Falcon	A,P,V	B	A,D,W,Wk				
<i>Micrastur ruficollis</i>	Barred Forest-Falcon	A,R	1	A,D, FNJV				
<i>Micrastur semitorquatus</i>	Collared Forest-Falcon	A,R	B	A,W				
<i>Falco sparverius</i>	American Kestrel	P		S				
<i>Falco femoralis</i>	Aplomado Falcon	P		S,Wk				
<i>Falco peregrinus</i>	Peregrine Falcon	P		Wk				
Psittaciformes								
Psittacidae (9)								
<i>Anatinga auricapillus</i>	Golden-capped Parakeet	P		Wk	NT			
<i>Pyrrhura frontalis</i>	Maroon-bellied Parakeet	A,P,R,Sk,V	B1234	A,D,MZUSP,W,Wk				AE
<i>Forpus xanthopterygius</i>	Blue-winged Parrotlet	A,P,R,Sk,V	B12	A,S,P,S,XC,W,Wk				
<i>Brotogeris tirica</i>	Plain Parakeet	A,P,R,Sk,V	B134	A,D,MZUSP,RS,W,Wk				
<i>Pionopsitta pileata</i>	Pileated Parrot	A,R,V	B	A,D,W				E
<i>Pionus maximiliani</i>	Scaly-headed Parrot	A,P,R,Sk,V	12	A,D,FNJV,MZUSP,RS,W,Wk				
<i>Amazona farinosa</i>	Mealy Parrot	A,R,V	B	A,Wk*			CR	
<i>Amazona amazonica</i>	Orange-winged Parrot	P,V	B	A,Wk			NT	
<i>Tricharia malachitacea</i>	Blue-bellied Parrot	Sk		W			VU	E
Passeriformes								
Thamnophilidae (12)								
<i>Terenura maculata</i>	Streak-capped Antwren	A,Sk	2	A,MZUSP,W				E
<i>Myrmotherula minor</i>	Salvadori's Antwren	Sk,V	B	A,MZUSP,W	VU	EN	VU	E

Taxa	English name	Evidence	Elevation	Source	GL	BR	SP	Endemism
<i>Myrmotherula unicolor</i>	Unicolored Antwren	A,P,R,Sk,V	B13	A,MZUSP,XC,W,Wk,ZUEC			VU	E
<i>Rhopias gularis</i>	Star-throated Antwren	A,R,V	B123	A,W				E
<i>Dysithamnus stictothorax</i>	Spot-breasted Antwren	A,R,V	1	A,W			NT	E
<i>Dysithamnus mentalis</i>	Plain Antwren	A,P,R,V	B1234	A,D,Wk				
<i>Herpsilochmus rufimarginatus</i>	Rusty-backed Antwren	A,P,R,Sk,V	B12	A,D,FNJVP,W,Wk				
<i>Thamnophilus caerulescens</i>	Variable Antshrike	A,P,R	B	A,D,W,Wk				E
<i>Hypodaidelus guttatus</i>	Spot-backed Antshrike	A,R,V	1234	A,D,W,Wk*				E
<i>Myrmoderus squamosus</i>	Squamate Antbird	A,P,Sk	4	A,D,W,Wk				E
<i>Pyriglena leucoptera</i>	White-shouldered Fire-eye	A,R,Sk,V	234	A,D,FNJVP,W,Wk*				
<i>Drymophila squamata</i>	Scaled Antbird	A,P,R,Sk,V	B134	A,L,MZUSPP,XC,W,Wk				E
Conopophagidae (2)								
<i>Conopophaga lineata</i>	Rufous Gnateater	A,P,Sk,V		D,W,Wk				
<i>Conopophaga melanops</i>	Black-cheeked Gnateater	A,P,R,Sk,V	1234	A,MZUSPP,XC,W,Wk				E
Rhinocryptidae (2)								
<i>Merulaxis ater</i>	Slaty Bristlefront	A,P,R,V	134	A,D,XC,W			NT	E
<i>Eleoscytalopus indigoticus</i>	White-breasted Tapaculo	A,R,Sk	B	A,D,XC,W,Wk*				E
Formicariidae (1)								
<i>Formicarius colma</i>	Rufous-capped Anthrush	A,P,R,Sk,V	B	A,C,MZUSP,S,W,Wk,ZUEC				
Scleruridae (2)								
<i>Sclerurus macconnelli</i>	Tawny-throated Leafhopper	A,P,R,Sk,V	B	MZUSP,W			VU	
<i>Sclerurus scansor</i>	Rufous-breasted Leafhopper	A,P,R,Sk	23	A,D,MZUSP,S,W,Wk				E
Dendrocolaptidae (5)								
<i>Dendrocincla turdina</i>	Plain-winged Woodcreeper	A,R,Sk,V	1234	A,L,MZUSP,XC,W,Wk				E
<i>Xiphorhynchus fuscus</i>	Lesser Woodcreeper	A,P,R,Sk,V	B234	A,D,MZUSPP,W,Wk				AE
<i>Lepidocolaptes angustirostris</i>	Narrow-billed Woodcreeper	P		S,Wk				
<i>Dendrocolaptes platyrostris</i>	Planalto Woodcreeper	A,R,Sk,V	1234	A,D,W,Wk				
<i>Xiphocolaptes albicollis</i>	White-throated Woodcreeper	A,P,Sk	1234	A,D,MZUSP,W,Wk				AE
Xenopidae (2)								
<i>Xenops minutus</i>	Plain Xenops	A,P,R,Sk,V	2	A,D,MZUSP,PS,W,Wk				
<i>Xenops rutilans</i>	Streaked Xenops	P		Wk				

Taxa	English name	Evidence	Elevation	Source	GL	BR	SP	Endemism
Furnariidae (13)								
<i>Furnarius figulus</i>	Wing-banded Hornero	P,V		D, Wk				
<i>Furnarius rufus</i>	Rufous Hornero	A,P,V	B	A,D,S,W,Wk				
<i>Pheocryptes melanops</i>	Wren-like Rushbird	Sk		MZUSP,W			VU	
<i>Automolus leucophthalmus</i>	White-eyed Foliage-gleaner	A,P,R,Sk,V	24	A,D,FNJV,L,W,Wk				AE
<i>Anabacerrhia lichtensteini</i>	White-browed Foliage-gleaner	Sk,V	2	A,D,MZUSP,W				E
<i>Philydor atricapillus</i>	Black-capped Foliage-gleaner	A,P,R,Sk,V	1234	A,D,MZUSP,XC,W,Wk				E
<i>Philydor rufum</i>	Ochre-breasted Foliage-gleaner	A,Sk,V	12	A,C,D,MZUSP,W				E
<i>Cichocolaptes leucophrus</i>	Pale-browed Treeshunter	A,R,V	1234	A,W				E
<i>Phacelodanus erythrophthalmus</i>	Red-eyed Thornbird	A,N,V		D				E
<i>Phacelodanus ferrugineigula</i>	Orange-eyed Thornbird	A,P,R,V	B	A				E
<i>Certhiaxis cinnamomus</i>	Yellow-chinned Spinetail	A,P,R,V	B	A,Wk				
<i>Synallaxis ruficapilla</i>	Rufous-capped Spinetail	A,P,R,V	B	A,D,S,Wk				E
<i>Synallaxis spixi</i>	Gray-bellied Spinetail	A,P,R,Sk,V	B	A,D,FNJV,MZUSP,W,Wk				
Pipridae (2)								
<i>Manacus manacus</i>	White-bearded Manakin	A,P,R,Sk,V	B	A,D,FNJV,L,MZUSP,XC,W,Wk				
<i>Chiroxiphia caudata</i>	Blue Manakin	A,P,R,Sk,V	B24	A,D,FNJV,L,MZUSP,W,Wk				E
Oxyruncidae (1)								
<i>Oxyruncus cristatus</i>	Sharpbill	A,R	234	A,D,W				
Onychorhynchidae (2)								
<i>Myiobius barbatus</i>	Black-tailed Flycatcher	A,P,R,Sk,V	B	A,MZUSP,XC,W,Wk				
<i>Myiobius atricaudus</i>	Black-tailed Flycatcher	P		Wk				
Tityridae (7)								
<i>Schiffornis virescens</i>	Greenish Schiffornis	A,R,Sk,V	B	A,D,P,W				E
<i>Laniisoma elegans</i>	Shrike-like Cotinga	P,Sk		C,W,Wk			VU	
<i>Tityra inquisitor</i>	Black-crowned Tityra	P,V	1	A,D,S,Wk				
<i>Tityra cayana</i>	Black-tailed Tityra	A,P,R,Sk,V	2	W,Wk				
<i>Pachyrhamphus polychopterus</i>	White-winged Becard	A,R,Sk,V	2	A,D,P,W				
<i>Pachyrhamphus marginatus</i>	Black-capped Becard	A,P,R,Sk,V	2	A,FNJV,MZUSP,W,Wk				NT
<i>Pachyrhamphus validus</i>	Crested Becard	A,P,R,Sk,V	1	A,D,FNJV,L,S,W,Wk				

Taxa	English name	Evidence	Elevation	Source	GL	BR	SP	Endemism
Cotingidae (2)								
<i>Procnias nudicollis</i>	Bare-throated Bellbird	A,P,R,Sk	B2	A,D,FNJV,J,P,S,W,Wk	VU		VU	E
<i>Pyroderus scutatus</i>	Red-ruffed Fruitcrow	A,P,R,V	B	A,D,J,W,Wk			VU	AE
Platyrinchidae (1)								
<i>Platyrinchus mystacens</i>	White-throated Spadebill	A,Sk,V	B	A,D,MZUSP,P,W				
Rhynchocyclidae (8)								
<i>Mionectes rufiventris</i>	Gray-hooded Flycatcher	A,P,R,Sk,V	B	A,D,L,P,S,W,Wk				AE
<i>Leptopogon amaurocephalus</i>	Sepia-capped Flycatcher	A,P,R,Sk,V	B4	A,D,FNJV,W,Wk				
<i>Tolmomyias sulphureus</i>	Yellow-olive Flycatcher	A,P,R,V	B124	A,D,P,W,Wk				
<i>Todirostrum poliocephalum</i>	Yellow-lored Tody-Flycatcher	A,P,R,Sk	B	A,FNJV,MZUSP,P,S,W,Wk,ZUEC				E
<i>Todirostrum cinereum</i>	Common Tody-Flycatcher	P		S,Wk				
<i>Poecilatriccus plumbeiceps</i>	Ochre-faced Tody-flycatcher	R,V		D,FNJV				
<i>Hemitriccus orbitatus</i>	Eye-ringed Tody-Tyrant	A,PR	124	A,D,P,XC,W,Wk				E
<i>Hemitriccus furcatus</i>	Fork-tailed Pygmy-Tyrant	A,R,V	B	A,XC,Wk*	VU		VU	E
Tyrannidae (33)								
<i>Hirundinea ferruginea</i>	Cliff Flycatcher	A,P,R,V	B	A,P,Wk				
<i>Camptostoma obsoletum</i>	Southern Beardless-Tyrannulet	A,P,R,V	B	A,D,FNJV,P,S,W,Wk				
<i>Elaenia flavogaster</i>	Yellow-bellied Elaenia	A,P,R,V	B	A,D,S,W,Wk				
<i>Elaenia chilensis</i>	Chilean Elaenia	Sk		W				
<i>Elaenia mesoleuca</i>	Olivaceous Elaenia	Sk		ZUEC				AE
<i>Phyllomyias fasciatus</i>	Planalto Tyrannulet	Sk		L,P,W,Wk,ZUEC				
<i>Phyllomyias griseicapilla</i>	Gray-capped Tyrannulet	Sk		W				E
<i>Attila phoenicurus</i>	Rufous-tailed Attila	A,R,V	1234	A,D,W				
<i>Attila rufus</i>	Gray-hooded Attila	A,P,R,Sk,V	B124	A,D,P,S,W,Wk				E
<i>Legatus leucophaeus</i>	Piratic Flycatcher	A,P,R,Sk,V	B134	A,D,S,W,Wk				
<i>Myiarchus swainsoni</i>	Swainson's Flycatcher	A,P,R,Sk	B	A,D,IAL,P,S				
<i>Myiarchus ferox</i>	Short-crested Flycatcher	A,P,V	B	A,D,S,W,Wk				
<i>Rhytipterna simplex</i>	Grayish Mourner	A,P,R,Sk,V	B	A,P,W,Wk				
<i>Pitangus sulphuratus</i>	Great Kiskadee	A,P,R,Sk,V	B2	A,D,IAL,P,S,W,Wk				
<i>Philohydor lictor</i>	Lesser Kiskadee	P,V	B	A,D				

Taxa	English name	Evidence	Elevation	Source	GL	BR	SP	Endemism
<i>Machetornis rixosa</i>	Cattle Tyrant	A,P,V	B	A,P,S,W,Wk				
<i>Myiodynastes maculatus</i>	Streaked Flycatcher	A,P,R,Sk,V	B1234	A,D,P,S,W,Wk				
<i>Megarynchus pitangua</i>	Boat-billed Flycatcher	A,P,V	B	A,D,W,Wk				
<i>Myiozetetes similis</i>	Social Flycatcher	A,P,R,Sk,V	B	A,D,IAL,P,S,W,Wk				
<i>Tyrannus melancholicus</i>	Tropical Kingbird	A,P,R,V	B	A,D,P,S,W,Wk				
<i>Tyrannus savana</i>	Fork-tailed Flycatcher	P,V	B	A,D,S,Wk				
<i>Empidonomus varius</i>	Variiegated Flycatcher	A,P,R,Sk,V	B	S,W,Wk,ZUEC				
<i>Conopias trivirgatus</i>	Three-striped Flycatcher	R		FNJV,W				
<i>Colonia colonus</i>	Long-tailed Tyrant	A,P,V	B	A,W,Wk				
<i>Myiophobus fasciatus</i>	Bran-colored Flycatcher	A,P,R,Sk,V	B	A,D,FNJV,IAL,L,S,W,Wk				
<i>Pyrocephalus rubinus</i>	Vermilion Flycatcher	P,Sk,V	B	A,IAL,S,W,Wk				
<i>Fluvicola nengeta</i>	Masked Water-Tyrant	A,P,V	B	A,D,S,Wk				
<i>Arundinicola leucocephala</i>	White-headed Marsh-Tyrant	P,V	B	A,S,Wk				
<i>Cnemotriccus fuscatus</i>	Fuscous Flycatcher	A,P,Sk		D,P,W,Wk				
<i>Lathrotriccus euleni</i>	Euler's Flycatcher	A,P,R,Sk	B1234	A,D,P,W,Wk,ZUEC				
<i>Contopus cinereus</i>	Tropical Peewee	A,P,R,Sk,V		D,FNJV,MZUSI,W,Wk				
<i>Hymenops perspicillatus</i>	Spectacled Tyrant	P		Wk				
<i>Satrapa icterophrys</i>	Yellow-browed Tyrant	P,V	B	A,D,S,W,Wk				
Vireonidae (2)								
<i>Cyclarhis gujanensis</i>	Rufous-browed Peppershrike	A,P,V	234	A,D,W,Wk				
<i>Vireo olivaceus</i>	Red-eyed Vireo	A,P,V	12	A,D,S,W,Wk				
Corvidae (2)								
<i>Cyanocorax caeruleus</i>	Azure Jay	P,R		Wk,XC				E
<i>Cyanocorax cristatellus</i>	Curl-crested Jay	P		Wk				
Hirundinidae (5)								
<i>Pygochelidon cyanoleuca</i>	Blue-and-white Swallow	A,P,Sk,V	B	A,D,IAL,P,S,W,Wk				
<i>Atticora tibialis</i>	White-thighed Swallow	Sk		MZUSI,W				
<i>Stelgidopteryx ruficollis</i>	Southern Rough-winged Swallow	A,P,R,V	B	A,D,S,W,Wk				
<i>Progne chalybea</i>	Grey-breasted Martin	A,P,R,Sk,V	B	A,D,IAL,S,W,Wk				
<i>Hirundo rustica</i>	Barn Swallow	P		Wk				

Taxa	English name	Evidence	Elevation	Source	GL	BR	SP	Endemism
Troglodytidae (2)								
<i>Troglodytes musculus</i>	Southern House-Wren	A,P,R,Sk,V	B	A,D,IAL,PS,W,Wk				
<i>Cantorchilus longirostris</i>	Long-billed Wren	A,P,R,Sk,V	B1	A,FNJV,IAL,L,MZUSPP,S,XC,W,Wk				
Donacobiidae (1)								
<i>Donacobius atricapilla</i>	Black-capped Donacobius	A,P,V	B	A				
Polioptilidae (1)								
<i>Ramphocaelus melanurus</i>	Long-billed Gnatwren	A,Sk		D,W				
Turdidae (6)								
<i>Turdus flavipes</i>	Yellow-legged Thrush	A,P,R,Sk,V	B24	A,D,MZUSPP,S,W,Wk				
<i>Turdus leucomelas</i>	Pale-breasted Thrush	A,P,R,Sk,V	B	A,D,IAL,Wk				
<i>Turdus rufoventris</i>	Rufous-bellied Thrush	A,P,R,Sk,V	B14	A,D,FNJV,L,PS,W,Wk				
<i>Turdus amaurochalinus</i>	Creamy-bellied Thrush	A,P,R,Sk,V	B	A,D,MZUSPP,S,W,Wk				
<i>Turdus subalaris</i>	Eastern Slaty Thrush	A		D				
<i>Turdus albicollis</i>	White-necked Thrush	A,P,R,Sk,V	B1234	A,D,IAL,L,W,Wk				
Mimidae (1)								
<i>Mimus saturninus</i>	Chalk-browed Mockingbird	P,V	B	A,D,S,Wk				
Motacillidae (1)								
<i>Anthus lutescens</i>	Yellowish Pipit	A,P,R,V	B	A,S,Wk				
Passerellidae (1)								
<i>Zonotrichia capensis</i>	Rufous-collared Sparrow	A,P,Sk,V	B	A,D,IAL,PS,W,Wk				
Parulidae (5)								
<i>Setophaga pitiayumi</i>	Tropical Parula	A,P,R,Sk,V	B1234	A,D,FNJV,MZUSPP,S,W,Wk,ZUEC				
<i>Setophaga striata</i>	Blackpoll Warbler	Sk		W				
<i>Geothlypis aequinoctialis</i>	Masked Yellowthroat	A,P,R,V	B	A,D,FNJV,PS,W,Wk				
<i>Basileuterus culicivorus</i>	Golden-crowned Warbler	A,R,V	12	A,D,W,Wk*				
<i>Myiothlypis rivularis</i>	Neotropical River Warbler	A,P,R,Sk,V	B	A,D,MZUSPP,S,XC,W,Wk,ZUEC				E
Icteridae (7)								
<i>Cacicus haemorrhous</i>	Red-rumped Cacique	A,P,R,Sk,V	B	A,PS,W,Wk				
<i>Gnorimopsar chopi</i>	Chopi Blackbird	P,V		D,Wk				
<i>Agelaius cyanopus</i>	Unicolored Blackbird	P,V	B	A,W				NT

Taxa	English name	Evidence	Elevation	Source	GL	BR	SP	Endemism
<i>Chrysomus ruficapillus</i>	Chestnut-capped Blackbird	P		Wk				
<i>Molothrus oryzivorus</i>	Giant Cowbird	P,Sk		W,Wk				
<i>Molothrus bonariensis</i>	Shiny Cowbird	A,P,Sk,V	B	A,D,IAL,S,W,Wk				
<i>Sturnella superciliosa</i>	White-browed Blackbird	P		S,W				
Mitrospingidae (1)								
<i>Orthogonyx chloricterus</i>	Olive-green Tanager	A,P,R,Sk,V	34	A,MZUSP,W,Wk				E
Thraupidae (30)								
<i>Coereba flaveola</i>	Bananaquit	A,P,R,Sk,V	B	A,D,IAL,L,MZUSP,PS,W,Wk				
<i>Salpator fuliginosus</i>	Thick-billed Saltator	A,P,R,V	B1234	A,D,W,Wk				E
<i>Thlypopsis sordida</i>	Orange-headed Tanager	P,Sk,V		D,S,W,Wk				
<i>Pyrrhocomma ruficeps</i>	Chestnut-headed Tanager	Sk		W				AE
<i>Tachyphonus coronatus</i>	Ruby-crowned Tanager	A,P,R,Sk,V	124	A,D,FNJVL,PS,W,Wk				E
<i>Ramphocelus bresilius</i>	Brazilian Tanager	A,P,R,Sk,V	B	A,D,IAL,MZUSP,PS,W,Wk				E
<i>Lanio cristatus</i>	Flame-crested Tanager	A,P,R,Sk,V	B	A,L,MZUSP,PS,W,Wk				
<i>Lanio cucullatus</i>	Red-crested Finch	P		Wk				
<i>Lanio melanops</i>	Black-goggled Tanager	A,P,Sk,V	2	A,D,W,Wk				
<i>Tangara seledon</i>	Green-headed Tanager	A,P,R,Sk,V	B1	A,D,FNJV,MZUSP,PS,W,Wk,ZUEC				E
<i>Tangara cyanocephala</i>	Red-necked Tanager	A,P,R,Sk,V	B234	A,D,MZUSP,PS,W,Wk				E
<i>Tangara sayaca</i>	Sayaca Tanager	A,P,R,Sk,V	B	A,D,IAL,S,W,Wk				
<i>Tangara cyanoptera</i>	Azure-shouldered Tanager	P,Sk,V		D,MZUSP,W,Wk				E
<i>Tangara palmarum</i>	Palm Tanager	A,P,R,Sk,V	B	A,MZUSP,PS,W,Wk				
<i>Tangara ornata</i>	Golden-chevroned Tanager	A,P,R,Sk,V	1234	A,D,PS,W,Wk				E
<i>Tangara peruviana</i>	Black-backed Tanager	P		Wk				E
<i>Tangara cayana</i>	Burnished-buff Tanager	P,V	B	D,Wk				
<i>Pipraeidea melanonota</i>	Fawn-breasted Tanager	P,V		D,S,W				
<i>Tersina viridis</i>	Swallow Tanager	P,V		D,S,Wk				
<i>Dacnis cayana</i>	Blue Dacnis	A,P,Sk,V	B	A,D,PS,W,Wk				
<i>Chlorophanes spiza</i>	Green Honeycreeper	P,Sk		MZUSP,PS,W,Wk				
<i>Hemithraupis ruficapilla</i>	Rufous-headed Tanager	A,P,Sk,V	1234	A,D,W,Wk				E
<i>Conirostrum bicolor</i>	Bicolored Conebill	P		P,W,Wk				

Taxa	English name	Evidence	Elevation	Source	GL	BR	SP	Endemism
<i>Sicalis flaveola</i>	Saffron Finch	A,P		D,S,Wk				
<i>Volatinia jacarina</i>	Blue-black Grassquit	A,P,Sk,V	B	A,D,S,W,Wk				
<i>Sporophila falcirostris</i>	Temminck's Seedeater	P		Wk				E
<i>Sporophila lineola</i>	Lined Seedeater	P		S,Wk				
<i>Sporophila caerulescens</i>	Double-collared Seedeater	A,P,V	B	A,D,S,W,Wk				
<i>Sporophila angolensis</i>	Chestnut-bellied Seed-Finch	P,V	B	A,Wk			VU	
<i>Tiaris fuliginosus</i>	Sooty Grassquit	Sk		W				
Cardinalidae (3)								
<i>Habia rubica</i>	Red-crowned Ant-Tanager	A,P,R,Sk,V	B1234	A,D,MZUSPP,W,Wk,ZUEC				
<i>Cyanoloxia glaucocaeerulea</i>	Glaucous-blue Grosbeak	P,Sk,V	B	W,ZUEC				
<i>Cyanoloxia brissonii</i>	Ultramarine Grosbeak	P		Wk				
Fringillidae (5)								
<i>Sporagra magellanica</i>	Hooded Siskin	A,Sk		D,W				
<i>Euphonia chlorotica</i>	Purple-throated Euphonia	A,P		D,S				
<i>Euphonia violacea</i>	Violaceous Euphonia	A,P,R,Sk,V	B12	A,D,L,S,W,Wk,ZUEC				
<i>Euphonia pectoralis</i>	Chestnut-bellied Euphonia	A,P,R,Sk,V	B1234	A,D,FNJV,MZSUP,PS,XC,W,Wk				E
<i>Chlorophonia cyanea</i>	Blue-naped Chlorophonia	Sk		W				
Estrildidae (1)								
<i>Estrilda astrild</i>	Common Waxbill	A,P,V	B	A,P,S,W,Wk				
Passeridae (1)								
<i>Passer domesticus</i>	House Sparrow	A,P,Sk,V	B	A,D,IAL,S,W,Wk				

APPENDIX II

List of 90 undocumented bird species recorded within the municipality of Bertioiga, São Paulo, Brazil. Abbreviations are according to Appendix I. BBS = Boraceia Biological Station, municipality of Salesópolis, São Paulo, Brazil. FO = Fabio Olmos' personal records.

Taxa	English name	Evidence	Elevation	Source	GL	BR	SP	Endemism	BBS
<i>Crypturellus tataupa</i>	Tataupa Tinamou	A	B	A,D					
<i>Odontophorus capueira</i>	Spot-winged Wood-Quail	A,V	1	A,D,P,W				E	
<i>Sula leucogaster</i>	Brown Booby	V	B	FO					
<i>Endocimus ruber</i>	Scarlet Ibis	V	B	FO			EN		
<i>Elanoides forficatus</i>	Swallow-tailed Kite	V		D					
<i>Ictinia plumbea</i>	Plumbeous Kite	V		D					
<i>Pseudastur polionotus</i>	Mantled Hawk	V	2	A	NT		VU	E	x
<i>Spizaetus tyrannus</i>	Black Hawk-Eagle	V	?	FO					
<i>Spizaetus melanoleucus</i>	Black-and-white Hawk-Eagle	V	B	A			CR		
<i>Tringa melanoleuca</i>	Greater Yellowlegs	?		W					
<i>Sterna paradisaea</i>	Arctic Tern	?		W					
<i>Patagioenus plumbea</i>	Plumbeous Pigeon	A	1,2,3	A,D					
<i>Coccyzus americanus</i>	Yellow-billed Cuckoo	V	B	A					
<i>Megascops atricapilla</i>	Black-capped Screech-Owl	A	B	A,W				E	
<i>Strix hylophila</i>	Rusty-barrred Owl	A	1	A	NT			E	
<i>Strix virgata</i>	Mottled Owl	A	B	A					
<i>Glaucidium minutissimum</i>	Least Pygmy-Owl	A	B	A				E	
<i>Nyctiphrynus ocellatus</i>	Ocellated Poorwill	A		D					
<i>Antrostomus rufus</i>	Rufous Nightjar	A		D					
<i>Hydropsalis torquata</i>	Scissor-tailed Nightjar	V		D					
<i>Panyptila cayennensis</i>	Lesser Swallow-tailed Swift	V	B	A			DD		
<i>Glaucis hirsutus</i>	Rufous-breasted Hermit	V		D					
<i>Phaethornis pretrei</i>	Planalto Hermit	V		D					
<i>Phaethornis eurynome</i>	Scale-throated Hermit	V		D				E	x
<i>Stephanoxis lalandi</i>	Plovercrest	V		D				E	x
<i>Hylocharis chrysura</i>	Gilded Hummingbird	V		D					
<i>Polybrynum guainumbi</i>	White-tailed Goldenthrout	V		J					

Taxa	English name	Evidence	Elevation	Source	GL	BR	SP	Endemism	BBS
<i>Heliothryx auritus</i>	Black-eared Fairy	V	B	A			NT		
<i>Nystalus chacuru</i>	White-eared Puffbird	A,V		D					
<i>Peroglossus bailloni</i>	Saffron Toucanet	V		J			VU		
<i>Melanerpes candidus</i>	White Woodpecker	A,V		D					
<i>Colaptes melanochloros</i>	Green-barred Woodpecker	A	B	A					
<i>Herpetotheres cachinnans</i>	Laughing Falcon	A,V	B	A,D,W					
<i>Amazona farinosa</i>	Mealy Parrot	A,V	B	A			CR		
<i>Thamnophilus doliatus</i>	Barred Antshrike	A,V		D					
<i>Thamnophilus ruficapillus</i>	Rufous-capped Antshrike	V		D					x
<i>Thamnophilus pelzelni</i>	Planalto Slaty Antshrike	A,V		D					
<i>Batara cinerea</i>	Giant Antshrike	A,V		D					x
<i>Mackenziaena leachii</i>	Large-tailed Antshrike	A,V		D				E	x
<i>Mackenziaena severa</i>	Tufted Antshrike	A		D				E	x
<i>Drymophila ferruginea</i>	Ferruginous Antbird	A,V		D				E	
<i>Drymophila genii</i>	Rufous-tailed Antbird	V		D			NT	E	x
<i>Drymophila ochropyga</i>	Ochre-rumped Antbird	A		D	NT		NT	E	x
<i>Drymophila malura</i>	Dusky-tailed Antbird	A,V		A,D				E	x
<i>Grallaria varia</i>	Variagated Antpitta	A	1234	A,D					
<i>Hylopezus nattereri</i>	Speckled-breasted Antpitta	A,V		D				E	x
<i>Chamaeza campanisona</i>	Short-tailed Antthrush	A		D					x
<i>Chamaeza meruloides</i>	Cryptic Antthrush	A		D				E	x
<i>Sittasomus griseicapillus</i>	Olivaceous Woodcreeper	A,V	B	A,D,W				E	
<i>Lepidocolaptes squamatus</i>	Scaled Woodcreeper	A,V		D				E	x
<i>Furnarius figulus</i>	Wing-banded Hornero	P,V		D,W,k					
<i>Lochmias nematura</i>	Sharp-tailed Streamcreeper	A,V	B	A,D,P					
<i>Anabazenops fuscus</i>	White-collared Foliage-gleaner	A,V		D				E	x
<i>Heliobletus contaminatus</i>	Sharp-billed Treehunter	V		D,W				E	x
<i>Syndactyla rufosuperciliata</i>	Buff-browed Foliage-gleaner	V		D					
<i>Synallaxis albescens</i>	Pale-breasted Spinetail	V		D			NT		
<i>Cranioleuca pallida</i>	Pallid Spinetail	V		D,W				E	x
<i>Neopelma chrysolophum</i>	Serra Tyrant-manakin	A,V		D				E	x

Taxa	English name	Evidence	Elevation	Source	GL	BR	SP	Endemism	BBS
<i>Ilicura militaris</i>	Pin-tailed Manakin	V		D					
<i>Pachyrhamphus viridis</i>	Green-backed Becard	A		D					
<i>Pachyrhamphus castaneus</i>	Chestnut-crowned Becard	V		D,W					
<i>Corybopsis delalandi</i>	Southern Antpiper	A		D					
<i>Phylloscartes ventralis</i>	Mottled-cheeked Tyrannulet	V		D					x
<i>Phylloscartes paulista</i>	Sao Paulo Tyrannulet	?		W	NT		VU	E	
<i>Phylloscartes onstaleti</i>	Oustalet's Tyrannulet	A,V	23	A	NT			E	
<i>Poecilatriccus plumbeiceps</i>	Ochre-faced Tody-flycatcher	V		D					x
<i>Hemitriccus orbitatus</i>	Eye-ringed Tody-Tyrant	A	124	A,D,P,W	NT			E	
<i>Hemitriccus nidipendulus</i>	Hangnest Tody-Tyrant	V		D				E	
<i>Tyranniscus burmeisteri</i>	Rough-legged Tyrannulet	V		D					x
<i>Elaenia obscura</i>	Highland Elaenia	V		D					
<i>Phaeomyias murina</i>	Mouse-coloured Tyrannulet	V		D					
<i>Myiarchus tyrannulus</i>	Brown-crested Flycatcher	V		D					
<i>Sirystes sibilator</i>	Sirystes	A		D					
<i>Megarynchus pitangua</i>	Boat-billed Flycatcher	A,P,V	B	A,D,Wk					
<i>Conopias trivirgatus</i>	Three-striped Flycatcher	?		W					
<i>Knipolegus nigerrimus</i>	Velvety Black-Tyrant	V		D					x
<i>Muscipipra vetula</i>	Shear-tailed Grey Tyrant	A,V		D				E	x
<i>Cyclarhis gujanensis</i>	Rufous-browed Peppershrike	A,P,V	234	A,D,W,Wk				E	
<i>Hypophilus poicilotis</i>	Rufous-crowned Greenlet	A	B	A,D					x
<i>Progne tapera</i>	Brown-chested Martin	V	B	A					
<i>Tachycineta leucorhoa</i>	White-rumped Swallow	A,V	B	A,W					
<i>Myiothlypis leucoblephara</i>	White-browed Warbler	A,V		D					x
<i>Cacicus chrysopterus</i>	Golden-winged Caciue	V		D					x
<i>Gnorimopsar chopi</i>	Chopi Blackbird	P,V		D,Wk			NT		
<i>Saltator similis</i>	Green-winged Saltator	A	2	A,D,W					x
<i>Orchesticus abeillei</i>	Brown Tanager	V		D	NT			E	x
<i>Tangara desmaresti</i>	Brassy-breasted Tanager	V		D				E	
<i>Tangara cayana</i>	Burnished-buff Tanager	P,V	B	A,D,Wk					x
<i>Stephanophorus diadematus</i>	Diademed Tanager	V		D					
<i>Emberizoides herbicola</i>	Wedge-tailed Grass-Finch	V	B	A					x