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ARTICLE

An overlooked hotspot for birds in the Atlantic Forest

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Abstract. Montane and submontane forest patches in the state of Bahia, Brazil, are among the few large and preserved Atlantic Forests remnants. They are strongholds of an almost complete elevational gradient, which harbor both lowland and highland bird taxa. Despite being considered a biodiversity hotspot, few ornithologists have surveyed these forests, especially along elevational gradients. Here we compile bird records acquired from systematic surveys and random observations carried out since the 1980s in a 7,500 ha private protected area: Serra Bonita private reserve. We recorded 368 species, of which 143 are Atlantic Forest endemic taxa. Some 16 and 13 species are threatened at the global and national levels, respectively. If one accounts for subspecies, the number of Brazilian threatened taxa raises to 21. Species composition differs between lower and higher elevations, in which case lowlands harbor Amazonia-related taxa, whereas highlands are the home of Atlantic Forest-related taxa.

Key-Words. Aves; Bahia; Elevational gradient; Serra Bonita.

INTRODUCTION

The Atlantic Forest originally comprised 150 million hectares of vegetation in highly heterogeneous environmental conditions. Its forests (the predominant type of vegetation within the domain) extend into tropical and subtropical regions due to a wide latitudinal range (*ca.* 30°). The structure of these forests is quite distinct as one leaves Brazilian eastern shores into the interior of the country mostly because of the decreased rainfall away from the coasts. Coastal areas receive as much as 4,000 mm of rain year-round, while inland forests receive *ca.* 1,000 mm/year (Câmara, 2005). These features, combined with elevational gradients, resulted in high diversity and endemism for several groups of plants and animals (Goerck, 1997; Myers *et al.,* 2000; Silva & Casteleti, 2005). Currently, most of the remaining lowland (below about 500 meters elevation) Atlantic Forest is represented by small (< 50 ha) and isolated fragments composed predominantly by secondary growth in early to medium stages of succession (Ribeiro *et al.,* 2009). Large fragments almost entirely remained in locations where steep terrains made human occupation particularly difficult (Silva *et al.,* 2007).

Among the largest and best-preserved blocks of Atlantic Forests are montane and submontane forests in northern Espírito Santo and southern Bahia, Brazil (Ribeiro *et al.,* 2009). Land cover in the region is a mosaic of native forest patches and areas of shade cocoa plantations interspersed with low-yield pastures, small farms and large forestry properties, the latter established mainly in the last three decades. Southern Bahia is the country's main cocoa (*Theobroma cacao*) production area (Alger & Caldas, 1996; May & Rocha, 1996; Cerqueira Neto, 2012). Nearly 70% of its cocoa production originates from the agroforestry system locally known as *cabruca* (Araújo *et al.,* 1998), in which the cocoa trees, introduced from the Brazilian Amazon in 1746 (see Pacheco *et al.,* 1996) replace the original understory and grow under

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the shade of a layer of native canopy species. This scenario is alarming since *cabruca* these poorly studied systems harbor great numbers of forest specialists (Pardini *et al.,* 2009), including the Pink-legged Graveteiro (*Acrobatornis fonsecai*), a new genus and species unknown to science until the 1990s (Pacheco *et al.,* 1996).

However, both the cocoa agroforests as forest remnants are still under intense threat. A severe socioeconomic crisis, caused by the devastation of cocoa farming by the Witches' Broom Disease and the falling price of cocoa on the international market, has triggered a sharp rise in pressure on these areas. This has led to the clearing of forest remnants and the replacement of *cabruca* areas for crops that interrupted the landscape connectivity, such as coffee and pasture. The region also became a major focus of illegal trade in native wood of the Central Atlantic Forest Corridor leading to serious erosion of biodiversity of forest areas that have not been cleared. In addition to habitat loss, high levels of hunting and illegal extraction of palm heart result in loss of biodiversity (Fonseca *et al.,* 2004).

The remaining forests of southern Bahia, although small, fragmented and inserted into a mosaic of secondary vegetation, harbor some of the highest levels of biodiversity and endemism on the planet (Silva & Casteleti, 2005). It is also unique in sharing lowland Amazonia-related taxa such as the Cinereous Antshrike *Thamnomanes caesius* and the Screaming Piha *Lipaugus vociferans* (Aguiar *et al.,* 2005). Although vegetation of this region is still poorly known from a floristic viewpoint, recent studies demonstrate extraordinary biological richness and species endemism (Thomas *et al.,* 1998; Thomas, 2003). For this reason, it is one of the areas of highest priority within the Central Corridor of the Atlantic Forest. To reinforce its biological importance and high rates of endemism, the scientific crew created by the Ministry of the Environment to identify and propose areas for the creation of new protected areas recommended the creation of the Wildlife Refuge Serra do Baixão-Serra Bonita with an area of 33,000 hectares (Timmers, 2006).

According to the Instituto de Estudos Socioambientais do Sul da Bahia, Una-Serra do Baixão, which encompass the Serra Bonita complex, has a total area of 330,295 hectares. There are only two federal protected areas within this forest continuum: Una Biological Reserve (recently expanded to 18,500 ha) and the Una Wildlife Refuge (23,400 ha). However, in its current form, the public system of protected areas is not enough to reverse this situation nor to ensure the conservation and sustainable use of biodiversity in the long term. The main factors are two-fold: (1) the absolute area of the integral protected region is inadequate and (2) the distribution of protected areas through geographic and biological viewpoints is irregular and are concentrated in the region of Una (Descobrimento, Monte Pascoal and Pau-Brasil national parks). Thus, there are significant gaps in the remaining mountains, particularly in sub montane rainforests. Current protected areas suffer severe staff and financial resources limitations to ensure their effective management and supervision and despite its expansion into 7,100 ha, the land tenure of more than 50% of the Una Biological Reserve is not regularized (Diniz da Cruz, *pers. com.*).

Considering that southern Bahia suffered a severe forest clearing in the state between 2015 and 2016 (SOS Mata Atlântica & INPE, 2017), protected areas are of paramount importance to biodiversity. Within this context, Private Natural Heritage Reserves (PNHR) become crucial to strengthen the public protected areas system by filling gaps, increasing absolute areas under protection, conserving unique unprotected habitats and increasing connectivity in the landscape (Pinto *et al.,* 2004). Within the Serra do Baixão, Serra Bonita PNHR is a key core area that has a significant role in increasing the absolute area of the region under full protection including a significant portion of sub montane and montane forests, a unique habitat still not represented by public protected areas. Serra Bonita is also exceptionally important for bird conservation, considered an Important Bird Area (BA 23, BR 111), with globally threatened and range-restricted species (Bencke *et al.,* 2006; IUCN, 2016). This is the third largest number of endangered and endemic species out of the 31 Important Bird Areas (IBA) in Bahia (Bencke *et al.,* 2006). Serra Bonita represents > 50% of the total area of the protected PNHR in southern Bahia and the incorporation of 725 ha of land already acquired by third parties as well as the acquisition of 1,045 ha through the Instituto Uiraçu will eventually expand it area to 2,700 ha (V. Becker, *pers. com.*).

Hellmayr's (1929) and Pinto's (1935) are still the main authorities regarding the Bahian ornithological state of the art. Few recent studies have gathered significant information on birds from this state, including southern Bahia (Gonzaga *et al.,* 1995; Silveira *et al.,* 2005). The absence of a state-level threatened species list is a consequence of the lack of studies within this region. Despite its biological representativeness, there are still significant gaps in knowledge of faunal groups, particularly regarding terrestrial vertebrates. Since the knowledge of composition of groups of vertebrates in any given area is a prime factor to define measures for their conservation (Heyer *et al.,* 1994), the implementation of targeted and applied studies on amphibians, mammals and birds of the Serra Bonita and its surroundings proves decisive for the success of the area to conserve biodiversity in the long term. We surveyed the birds of Serra Bonita to provide basic elements for defining and monitoring measures to significantly enhance the ornithological knowledge of this PNHR.

MATERIAL AND METHODS

Serra Bonita PNHR is located south of Una-Serra do Baixão, in the municipalities of Camacan and Pau Brasil, southeastern Bahia, northeastern Brazil (Fig. 1). A significant part of this IBA, which has *ca.* 7,500 ha, is included in PNHR Serra Bonita I, II, III and IV, forming a 2,700 ha forest block. Well-preserved forests cover the elevational gradient (from 200 to 950 m) of the mountains with rainforests richly covered in epiphytes. Above 600 m, there

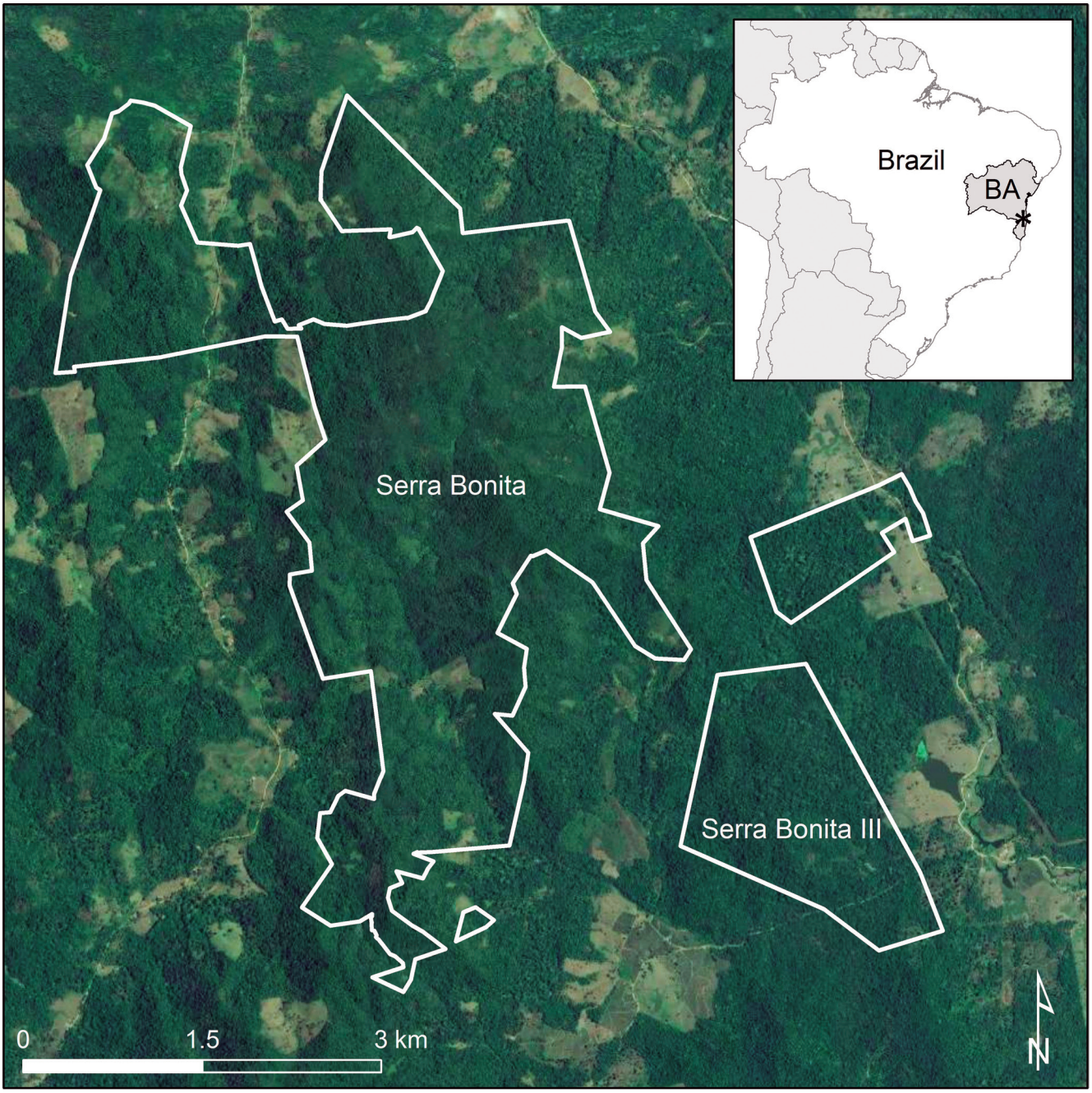

Figure 1. Location of Serra Bonita NHPR in northeast Brazil.

is frequent formation of dense fog, which renders montane forests a wetter aspect than the adjacent lowlands (BirdLife International, 2016). The latter include semideciduous forests whereas montane rainforests are typically found on higher elevations. This whole area is part of a mountain range that stands out in the landscape of south-eastern Bahia, contiguous to Serra das Lontras (currently a National Park), Serra do Javi and Serra do Teimoso (BA 20 and BA 22, BirdLife International, 2016).

Since 1980, authors have unsystematically surveyed birds at several farms that compose the Serra Bonita PNHR. We performed more concentrated efforts between 12-22 December 2010, when we visited two trails in Serra Bonita I (15°23'30"S, 39°34'06"W, alt. 930 m, and 15°23'44"S, 39°24'25"W, alt. 890 m) and two sites in Serra Bonita III (15°25'29" S, 39°32'31"W, alt. 174 m, and 15°25'06"S, 39°32'38"W, alt. 208 m). Lower elevations include Fazenda Paris and Santo Antônio (15°25'07"S, 39°32'44"W, alt. 268 m), part of the reserve. For five months (June-October 2017), one of us (CA) also walked all trails of all farms on a weekly basis. In those areas, we walked randomly at a constant speed of about 1.5 km/h on several environments to record the largest number of species possible. We visually identified birds with the aid of binoculars and recorded vocalizations with a TASCAM DR-40 and shotgun microphones. These are deposited at Seção de Aves do Museu de Zoologia da Universidade de São Paulo (MZUSP), where we also deposited some collected specimens. We included non-systematic crepuscular observations to register nocturnal species.

We began transect counts *ca.* 15 minutes before sunrise and lingered, at the minimum, for 2 hours when weather conditions permitted, *i.e.,* when there was no rain or intense winds. It allowed us to ensure that the detectability of the birds would not be significantly affected. We conducted surveys along trails, secondary growth and forest edges. The total number of census resulted in over 100 days. In addition, in 2010 we used 20-30 mist nets (12 m × 3 m, mesh 36 mm) along the same trails used for surveys. We opened mist nets, mounted at ground level, at 06h00 and closed them around 17h00 or earlier in accordance with climatic conditions. Standardization of capture effort is in accordance with the following equation: $E=area.h.n$ (1), where E is capture effort, area corresponds to the area of each net (height multiplied by width), h is exposure time (number of hours multiplied by the number of days) and n is the number of nets. We expressed results in h.m^2 (Roos, 2010) and accumulated 19,584 h.m^2 of net effort. We followed Straube's *et al.* (2010) suggestions for the standardization of environmental impact studies surveys, which also apply for our own objectives. Hence, database (rather than secondary data) are records from literature and museums (and in this case, previous visits by CA, LFS, JFP and BMW to Serra Bonita). In addition, we searched and critically revised Wikiaves (http://wikiaves.com.br) database from Serra Bonita private reserve and Camacan and Pau Brasil municipalities as of 12 December 2018 which resulted in some additions to the species list. We obtained field data, synonymous with primary data, *in situ*.

We used a Jaccard similarity index to compare species richness similarity between highlands and lowlands based on species present on both environments, as follows: $J' = \frac{c}{a+b+c}$ (2), where J' is the actual index, a equals the number of exclusive species on a given site, b equals the number of exclusive species on a different given site and c equals the number of shared species between sites (Krebs, 1999). Taxonomic arrangements follow the most recent list of the Comitê Brasileiro de Registros Ornitológicos (Piacentini *et al.,* 2015).

RESULTS

We recorded a total of 368 species, 276 at Serra Bonita (I and III) and 244 at Fazenda Paris (as well as another 56 only on surroundings). This corresponds to 45% of all bird species of the state of Bahia (Souza & Borges, 2008). As of 12 December 2018, the Wikiaves site reported one species from Pau Brasil and 258 species from Camacan, including three species we had not recorded *in situ: Pseudoseisura cristata, Progne chalybea* and *Tangara brasiliensis.* Combined with colleagues' records, Serra Bonita is the stronghold for 371 species of birds. Of this total, 13 species are under threat categories in Brazil (ICMBio, 2016), and as many as 16 species are either globally vulnerable or endangered (Appendix; IUCN, 2016).

Some 67 (18%) species recorded at Serra Bonita PNHR are Atlantic Forest endemic species according to Bencke *et al.* (2006; Appendix). If one includes subspecies, then another 143 are Atlantic forest endemic taxa, in which case Serra Bonita harbors 108 taxa exclusive to this domain. Of these, the Olivaceous Woodcreeper *Sittasomus griseicapillus olivaceus,* inhabits southern Bahia only, and another six subspecies are threatened in Brazil. Because IUCN does not yet denote global extinction risk at the subspecies level, we call attention for a major gap in the knowledge of such taxa, which should be the objective of future taxonomic revisions.

We detected 93 (25%) species exclusively in the highlands (above 500 m), while 61 (22%) were only recorded in lowlands. The similarity index between the bird community in distinct elevational ranges was $J' = 0.54$, with 183 shared species.

DISCUSSION

Serra Bonita PNHR is the single locality with the highest species richness in all available inventories in Bahia. Not only the absolute number of species is remarkable, but also the percentage of endemic and threatened species has no parallel in the state (see Pinto, 1993; Gonzaga *et al.,* 1995; Parrini *et al.,* 1999; Silveira *et al.,* 2005; Laps, 2006; Vasconcelos *et al.,* 2012; Morante-Filho *et al.,* 2015, 2016, 2018). From southern Bahia south to northern Rio de Janeiro, the lowlands harbor Amazonia-related taxa, whereas, in the highlands, Atlantic Forest-related elements are typically found (*e.g.,* Willis & Oniki 2002; Silveira *et al.,* 2005; Mallet-Rodrigues *et al.,* 2010). Serra Bonita is no exception. Lowland Amazonian taxa include *Thamnomanes caesius* and *Lipaugus vociferans.* Like Serra das Lontras (Silveira *et al.,* 2005), the entire elevational gradient, which in Serra Bonita is largely preserved, is necessary to maintain this biodiversity.

Due to the continuity and preservation of these forests, Serra Bonita PNHR may be a promising location to find some rare and threatened Atlantic Forest endemic taxa not yet recorded. In Bahia such species can be found almost exclusively at Una Biological Reserve or Pau-Brasil/Trancoso, Monte Pascoal and Descobrimento National Parks, situated within a 100 km radius (*e.g.,* Laps, 2006), such as the Red-billed Curassow *Crax blumenbachii.* At Serra Bonita NHPR recent records of the Harpy Eagle *Harpia harpyja,* with breeding pairs and still relatively common in Amazonia but now very rare in the Atlantic forest (Galetti *et al.,* 1997) also indicate the pristine conditions of local forests. There are a few recent records from southern Bahia as well, such as Serra das Lontras (Silveira *et al.,* 2005), Estação Experimental Pau-Brasil, municipality of Porto Seguro, and a photograph of a young Harpy Eagle at Serra Bonita I (Sánchez-Lalinde *et al.,* 2011). At Serra Bonita, V. Becker sighted a couple on forest border August 2015, and saw one individual close to the research facility August 2016. LFS also heard one individual calling at Fazenda Santa Antônio in May 2016 and an active nest was discovered in February 2018 (V. Becker, *pers. comm.*). We found as fairly common in the highlands a treehunter *Heliobletus* sp. which is being scientifically described (Whitney *et al.* in prep.). The taxon

also occurs at Serra das Lontras (Silveira *et al.,* 2005) and is only found at higher elevations. This isolated population is currently under description and will be endemic to these southern Bahian mountains.

For harboring the greatest species richness, Atlantic Forest endemic species and globally threatened birds in Bahia, and because even more endemic and threatened species are likely to be found with increasing surveys, we urge that unprotected areas surrounding Serra Bonita be immediately incorporated into a permanent protection conservation unit. This act will enhance the survival of this entire ecosystem, already almost completely extirpated and fragmented, found nowhere else on Earth. In addition, *cabrucas* support high species richness of birds but do not act as surrogates for intact forests. The presence and representativeness of some forest species seem to depend on the existence of nearby native forests (Faria *et al.,* 2006, 2007; Pardini *et al.,* 2009). Pacheco *et al.* (1996) recognized the dire interface of cocoa growers in southern Bahia being forced to abandon their livelihoods in favor of cutting old cabruca canopies and planting other crops (such as bananas and coffee) with preservation of forests. To the point, they called for the immediate preservation of two blocks of land covering the elevational range from the lowlands to the tops of the highest peaks, one in the Serra das Lontras and the other in the Serra Bonita. As integral parts of the conservation plan, they recommended inclusion of extensive blocks of cabruca canopies; removal of the introduced cocoa trees; and planting of native seedling trees while ancient native "shade" trees were still present and dropping seeds annually. They further recommended that local people, especially large land owners, be integrally involved in the creation and maintenance of these forest reserves. Now, some 20 years later, good progress has been made in both the Serra das Lontras and Serra Bonita, and we still have the chance to follow through with these important directives.

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APPENDIX

List of bird taxa recorded within Serra Bonita. Subspecific nomenclature are tentatively placed according to location and follow Piacentini et al. (2015) and MZUSP data when specimens are available. An asterisk indicates a taxa endemic of Atlantic Forest (n = 143). Paris and Santo Antônio Farms (< 500 m) and Serra Bonita I and III (> 500 m); S stands for surroundings. Acronyms refer to authors who recorded some species during initial observations. WA indicates records deposited online. The last two columns refer to endangered taxa globally (IUCN) and in Brazil (ICMBio).

Taxa	English name	< 500 m	> 500 m	S	WA	IUCN	ICMBio
Tinamiformes							
Tinamidae							
*Tinamus solitarius**	Solitary Tinamou		x				
Crypturellus soui albigularis	Little Tinamou	x	jfp		x		
*Crypturellus o. obsoletus**	Brown Tinamou	lfs	x		x		
Crypturellus tataupa lepidotus	Tataupa Tinamou	x					
Rhynchotus r. rufescens	Red-winged Tinamou			x			
Anseriformes							
Anatidae							
Cairina moschata	Muscovy Duck			x			
Amazonetta b. brasiliensis	Brazilian Teal			x	x		
Galliformes							
Cracidae							
Penelope superciliaris jacupemba	Rusty-margined Guan		x		x		
*Ortalis araucuan**	East Brazilian Chachalaca	x	x				
Odontophoridae							
*Odontophorus c. capueira**	Spot-winged Wood-Quail		x				
Podicipediformes							
Podicipedidae							
Tachybaptus dominicus brachyrhynchus	Least Grebe			x			
Podilymbus podiceps antarcticus	Pied-billed Grebe			x			
Suliformes							
Phalacrocoracidae							
Nannopterum b. brasilianus	Neotropic Cormorant			x			
Pelecaniformes							
Ardeidae							
Tigrisoma lineatum marmoratum	Rufescent Tiger-Heron			x	x		
Nycticorax nycticorax hoactli	Black-crowned Night-Heron			x			
Butorides s. striata	Striated Heron			x			
Bubulcus i. ibis	Cattle Egret			x			
Ardea cocoi	Cocoi Heron			x			
Ardea alba egretta	Great Egret			x			
Pilherodius pileatus	Capped Heron			x	x		
Egretta t. thula	Snowy Egret			x			
Cathartiformes							
Cathartidae							
Cathartes aura ruficollis	Turkey Vulture	x	x		x		
Cathartes burrovianus urubutinga	Lesser Yellow-headed Vulture	x	x		x		
Coragyps atratus brasiliensis	Black Vulture	x	x		x		
Sarcoramphus papa	King Vulture	x	x		x		
Accipitriformes							
Accipitridae							
Leptodon cayanensis	Gray-headed Kite	x					
Elanoides forficatus ssp.	Swallow-tailed Kite	x	jfp				
Harpagus diodon	Rufous-thighed Kite	x			x		
Ictinia plumbea	Plumbeous Kite	x			x		
Geranospiza caerulescens gracilis	Crane Hawk	x			x		
Heterospizias meridionalis	Savanna Hawk			x			
Urubitinga u. urubitinga	Great Black Hawk	x					
Rupornis magnirostris nattereri	Roadside Hawk	x	lfs		x		
Geranoaetus a. albicaudatus	White-tailed Hawk	x	lfs		x		

Taxa	English name	< 500 m	> 500 m	S	WA	IUCN	ICMBio
Pseudastur polionotus	Mantled Hawk	x	x		x		
Buteo nitidus pallidus	Gray-lined Hawk	x					
Buteo albonotatus	Zone-tailed Hawk	x	x		x		
Harpia harpyja	Harpy Eagle	x					VU
Spizaetus t. tyrannus	Black Hawk-Eagle	x	x		x		
Spizaetus melanoleucus	Black-and-white Hawk-Eagle		x		x		
Spizaetus o. ornatus	Ornate Hawk-Eagle			jfp			
Gruiformes							
Rallidae							
Aramides cajaneus	Gray-necked Wood-Rail	x					
*Aramides saracura**	Slaty-breasted Wood-Rail		jfp				
Amaurolimnas concolor castaneus	Uniform Crake	x			x		
Laterallus m. melanophaius	Rufous-sided Crake			x			
Mustelirallus a. albicollis	Ash-throated Crake			x	x		
Pardirallus n. nigricans	Blackish Rail		x				
Gallinula g. galeata	Common Gallinule		lfs	x			
Porphyrio martinicus	Purple Gallinule			x	x		
Charadriiformes							
Charadriidae							
Vanellus chilensis lampronotus	Southern Lapwing	lfs		x			
Scolopacidae							
Gallinago p. paraguaiae	South American Snipe			x			
Gallinago undulata gigantea	Giant Snipe			x			
Jacanidae							
Jacana j. jacana	Wattled Jacana	lfs	lfs	x			
Columbiformes							
Columbidae							
Columbina t. talpacoti	Ruddy Ground-Dove	lfs	lfs	x			
Claravis pretiosa	Blue Ground-Dove	x	x				
Patagioenas speciosa	Scaled Pigeon	x	jfp		x		
Patagioenas picazuro marginalis	Picazuro Pigeon	x					
*Patagioenas p. plumbea**	Plumbeous Pigeon	x	x		x		
Leptotila verreauxi decipiens	White-tipped Dove	x	x				
Leptotila rufaxilla bahiae	Gray-fronted Dove	x	x		x		
Geotrygon m. montana	Ruddy Quail-Dove	x	x		x		
Cuculiformes							
Cuculidae							
Piaya cayana macroura	Squirrel Cuckoo	x	x		x		
Coccyzus euleri	Pearly-breasted Cuckoo		x		x		
Crotophaga ani	Smooth-billed Ani	x	lfs				
Guira guira	Guira Cuckoo	x	lfs				
Tapera n. naevia	Striped Cuckoo	x	jfp		x		
Strigiformes							
Tytonidae							
Tyto furcata tuidara	American Barn Owl	x					
Strigidae							
Megascops choliba decussatus	Tropical Screech-Owl	x	x		x		
*Megascops atricapilla**	Black-capped Screech-Owl	x	x		x		
*Pulsatrix perspicillata pulsatrix**	Spectacled Owl	x			x		
*Strix virgata borelliana**	Mottled Owl	x	x		x		
*Strix huhula albomarginata**	Black-banded Owl	x					
*Glaucidium minutissimum**	Least Pygmy-Owl	x	x		x		
Glaucidium b. brasilianum	Ferruginous Pygmy-Owl	x	lfs		x		
Athene cunicularia grallaria	Burrowing Owl			x			
Nyctibiiformes							
Nyctibiidae							
Nyctibius g. grandis	Great Potoo	x			x		
*Nyctibius a. aethereus**	Long-tailed Potoo	x					
Nyctibius g. griseus	Common Potoo	x			x		

Taxa	English name	< 500 m	> 500 m	S	WA	IUCN	ICMBio
Caprimulgiformes							
Caprimulgidae							
Nyctiphrynus o. ocellatus	Ocellated Poorwill		x		x		
Lurocalis semitorquatus nattereri	Short-tailed Nighthawk	x	x		x		
Nyctidromus a. albicollis	Common Pauraque	x	x		x		
Hydropsalis t. torquata	Scissor-tailed Nightjar		x				
Apodiformes							
Apodidae							
Streptoprocne z. zonaris	White-collared Swift	x	x		x		
*Chaetura c. cinereiventris**	Gray-rumped Swift	x	x		x		
Chaetura meridionalis	Sick's Swift			jfp			
Panyptila c. cayennensis	Lesser Swallow-tailed Swift	x	x		x		
Trochilidae							
*Glaucis dohrnii**	Hook-billed Hermit	x	x		x	EN	EN
Glaucis h. hirsutus	Rufous-breasted Hermit	x	x		x		
*Phaethornis squalidus**	Dusky-throated Hermit		jfp				
Phaethornis ruber pygmaeus	Reddish Hermit	x	x		x		
*Phaethornis e. eurynome**	Scale-throated Hermit	lfs	x		x		
Eupetomena macroura simoni	Swallow-tailed Hummingbird	x	x		x		
Aphantochroa cirrochloris	Sombre Hummingbird		x		x		
Florisuga fusca	Black Jacobin		x		x		
Anthracothorax nigricollis	Black-throated Mango	x	x		x		
Lophornis magnificus	Frilled Coquette		x		x		
*Discosura l. langsdorffi**	Black-bellied Thorntail		x		x		
Chlorestes n. notata	Blue-chinned Sapphire	x			x		
Chlorostilbon lucidus pucherani	Glittering-bellied Emerald		jfp	x	x		
*Thalurania glaucopis**	Violet-capped Woodnymph	x	x		x		
Hylocharis sapphirina	Rufous-throated Sapphire	x			x		
*Hylocharis c. cyanus**	White-chinned Sapphire	x	jfp				
Amazilia l. lactea	Sapphire-spangled Emerald		x				
*Heliodoxa rubricauda**	Brazilian Ruby		x		x		
Heliothryx auritus auriculatus	Black-eared Fairy	x	x		x		
Calliphlox amethystina	Amethyst Woodstar		x		x		
Trogoniformes							
Trogonidae							
*Trogon viridis melanopterus**	Green-backed Trogon	x	x		x		
Trogon s. surrucura	Surucua Trogon		x		x		
*Trogon rufus chrysochloros**	Black-throated Trogon		x		x		
Coraciiformes							
Alcedinidae							
Megaceryle t. torquata	Ringed Kingfisher			x			
Chloroceryle amazona	Amazon Kingfisher			x		EN	
Chloroceryle a. americana	Green Kingfisher			x			
Galbuliformes							
Galbulidae							
Galbula ruficauda rufoviridis	Rufous-tailed Jacamar	x	jfp		x		
Bucconidae							
*Notharchus swainsoni**	Buff-bellied Puffbird	x	x		x		
Nystalus maculatus	Spot-backed Puffbird	x	lfs				
*Malacoptila s. striata**	Crescent-chested Puffbird		x		x		
Monasa m. morphoeus	White-fronted Nunbird	x			x		
*Chelidoptera tenebrosa brasiliensis**	Swallow-winged Puffbird	x	jfp		x		
Piciformes							
Ramphastidae							
Ramphastos vitellinus ariel	Channel-billed Toucan	x	x		x		
*Ramphastos dicolorus**			lfs				
*Selenidera maculirostris**	Spot-billed Toucanet	x	x		x		
*Pteroglossus bailloni**	Saffron Toucanet	x	jfp		x		
Pteroglossus a. aracari	Black-necked Aracari	x	x		x		

Taxa	English name	< 500 m	> 500 m	S	WA	IUCN	ICMBio
Picidae							
*Picumnus exilis**	Bahia Piculet	x	x		x		
Picumnus pygmaeus	Spotted Piculet	x	x		x		
Picumnus albosquamatus guttifer	White-wedged Piculet	x	x		x		
Melanerpes candidus	White Woodpecker	x			x		
*Melanerpes flavifrons**	Yellow-fronted Woodpecker	x	lfs		x		
*Veniliornis a. affinis**	Red-stained Woodpecker	x	x		x		
*Piculus flavigula erythropis**	Yellow-throated Woodpecker	x	x		x		
*Piculus polyzonus**	Atlantic Woodpecker	x			x		EN
Colaptes melanochloros nattereri	Green-barred Woodpecker	x					
*Celeus torquatus tynnunculus**	Ringed Woodpecker	x			x		
*Celeus f. flavescens**	Blond-crested Woodpecker	x			x		
Celeus flavus subflavus	Cream-colored Woodpecker	x			x		
Dryocopus l. lineatus	Lineated Woodpecker	x	lfs		x		
Falconiformes							
Falconidae							
Caracara plancus	Southern Caracara	x	x		x		
Milvago c. chimachima	Yellow-headed Caracara	x	lfs				
Herpetotheres c. cachinnans	Laughing Falcon	x	jfp		x		
Micrastur r. ruficollis	Barred Forest-Falcon		x		x		
Micrastur s. semitorquatus	Collared Forest-Falcon	x		jfp	x		
Falco sparverius cearae	American Kestrel			x	x		
Falco rufigularis ophryophanes	Bat Falcon	x	lfs				
Falco peregrinus ssp.	Peregrine Falcon		jfp				
Psittaciformes							
Psittacidae							
Primolius maracana	Blue-winged Macaw	x					
Psittacara l. leucophthalmus	White-eyed Parakeet	x					
Aratinga auricapillus	Golden-capped Parakeet	x	x		x		
Eupsittula aurea	Peach-fronted Parakeet	x	lfs		x		
*Pyrrhura cruentata**	Ochre-marked Parakeet	x			x		EN
*Pyrrhura f. frontalis**	Maroon-bellied Parakeet	x	x		x		
*Pyrrhura leucotis**	Maroon-faced Parakeet	x		jfp	x		VU
Forpus xanthopterygius	Blue-winged Parrotlet	x	x				
*Brotogeris tirica**	Plain Parakeet	x	x				
*Touit melanonotus**	Brown-backed Parrotlet	x	x		x	EN	VU
*Touit surdus**	Golden-tailed Parrotlet	x	x		x	VU	VU
*Pionopsitta pileata**	Pileated Parrot		x		x		
Pionus m. maximiliani	Scaly-headed Parrot	x			x		
*Amazona rhodocorytha**	Red-browed Parrot	x					VU
Passeriformes							
Thamnophilidae							
*Terenura maculata**	Streak-capped Antwren		x				
*Myrmotherula axillaris luctuosa**	White-flanked Antwren	x	lfs		x		
*Myrmotherula minor**	Salvadori's Antwren		x		x	VU	VU
*Thamnomanes c. caesius**	Cinereous Antshrike	x	x		x		
*Rhopias gularis**	Star-throated Antwren		x		x		
*Dysithamnus stictothorax**	Spot-breasted Antvireo		x		x		
*Dysithamnus m. mentalis**	Plain Antvireo		jfp				
*Dysithamnus plumbeus**	Plumbeous Antvireo	x	x		x	VU	
*Herpsilochmus rufimarginatus scapularis**	Rufous-winged Antwren	x	x		x		
Thamnophilus torquatus	Rufous-winged Antshrike		x		x		
*Thamnophilus palliatus vestitus**	Chestnut-backed Antshrike	x	x		x		
Taraba major stagurus	Great Antshrike	x			x		
*Hypoedaleus guttatus**	Spot-backed Antshrike	x	x		x		
*Mackenziaena severa**	Tufted Antshrike		x		x		
*Myrmoderus loricatus**	White-bibbed Antbird		x		x		
*Pyriglena leucoptera**	White-shouldered Fire-eye	x	x		x		
*Cercomacra brasiliana**	Rio de Janeiro Antbird		x				

Taxa	English name	< 500 m	> 500 m	S	WA	IUCN	ICMBio
*Drymophila ferruginea**	Ferruginous Antbird		x		x		
*Drymophila ochropyga**	Ochre-rumped Antbird		x		x		
*Drymophila squamata stictocorypha**	Scaled Antbird	x	x		x		
Conopophagidae							
Conopophaga l. lineata	Rufous Gnateater		x		x		
Rhinocryptidae							
Scytalopus aff. *gonzagai**	Boa Nova Tapaculo		lfs		x		
Grallariidae							
*Grallaria varia intercedens**	Variegated Antpitta		x		x		
Formicariidae							
*Formicarius colma ruficeps**	Rufous-capped Antthrush	x	lfs		x		
*Chamaeza c. campanisona**	Short-tailed Antthrush		x		x		
*Chamaeza meruloides**	Such's Antthrush		x		x		
Dendrocolaptidae							
*Dendrocincla turdina**	Plain-winged Woodcreeper	x	x		x		
*Sittasomus griseicapillus olivaceus**	Olivaceous Woodcreeper	x	lfs		x		
*Xiphorhynchus fuscus tenuirostris**	Lesser Woodcreeper	x	x		x		
*Xiphorhynchus g. guttatus**	Buff-throated Woodcreeper	x	jfp		x		
*Campylorhamphus falcularius**	Black-billed Scythebill		x		x		
*Campylorhamphus t. trochilirostris**	Red-billed Scythebill		x		x		
*Lepidocolaptes squamatus**			lfs				
Dendrocolaptes platyrostris	Planalto Woodcreeper	x	x		x		
*Xiphocolaptes albicollis bahiae**	White-throated Woodcreeper	x	x		x		
Xenopidae							
*Xenops m. minutus**	Plain Xenops		x		x		
*Xenops r. rutilans**	Streaked Xenops	x	x		x		
Furnariidae							
Furnarius f. figulus	Wing-banded Hornero	x		jfp	x		
Furnarius rufus albogularis	Rufous Hornero	x		lfs			
Lochmias n. nematura	Sharp-tailed Streamcreeper		x				
*Automolus l. leucophthalmus**	White-eyed Foliage-gleaner	x	x		x		
*Anabazenops fuscus**	White-collared Foliage-gleaner		x		x		
*Anabacerthia lichtensteini**	Ochre-breasted Foliage-gleaner		x		x		
*Philydor atricapillus**	Black-capped Foliage-gleaner		x		x		
Heliobletus sp. nov.*	Bahia Treehunter		x		x		
*Cichlocolaptes l. leucophrus**	Pale-browed Treehunter	x	x		x		
Pseudoseisura cristata	Caatinga Cacholote				x		
Phacellodomus r. rufifrons	Rufous-fronted Thornbird	x		lfs			
Certhiaxis cinnamomeus russeolus	Yellow-chinned Spinetail	x			x		
*Synallaxis cinerea**	Bahia Spinetail		x		x	VU	
Synallaxis frontalis	Sooty-fronted Spinetail	x			x		
Synallaxis spixi	Spix's Spinetail		x		x		
*Acrobatornis fonsecai**	Pink-legged Graveteiro	x	x		x	VU	
*Cranioleuca pallida**	Pallid Spinetail		x		x		
*Thripophaga macroura**	Striated Softtail		x		x	VU	
Pipridae							
Ceratopipra rubrocapilla	Red-headed Manakin	x	x		x		
*Manacus manacus gutturosus**	White-bearded Manakin	x	x		x		
*Machaeropterus regulus**	Striped Manakin	x	x		x		
*Ilicura militaris**	Pin-tailed Manakin	lfs	x		x		
Chiroxiphia p. pareola	Blue-backed Manakin		jfp				
*Chiroxiphia caudata**	Swallow-tailed Manakin		x		x		
Oxyruncidae							
*Oxyruncus c. cristatus**	Sharpbill		x		x		
Onychorhynchidae							
*Myiobius atricaudus ridgwayi**		lfs					
Tityridae							
Schiffornis t. turdina	Trush-like Schiffornis	lfs					
*Iodopleura p. pipra**	Buff-throated Purpletuft	lfs	x		x		

Taxa	English name	< 500 m	> 500 m	S	WA	IUCN	ICMBio
Tityra i. inquisitor	Black-crowned Tityra	x			x		
Tityra cayana braziliensis	Black-tailed Tityra	x	jfp		x		
Pachyramphus v. viridis	Green-backed Becard	x	x		x		
*Pachyramphus c. castaneus**	Chestnut-crowned Becard		x		x		
*Pachyramphus m. marginatus**	Black-capped Becard	x	x		x		
Pachyramphus v. validus	Crested Becard		jfp				
Cotingidae							
*Phibalura flavirostris**	Swallow-tailed Cotinga		x		x		
*Pyroderus s. scutatus**	Red-ruffed Fruitcrow		x				
*Lipaugus lanioides**	Cinnamon-vented Piha	x	x		x		
*Procnias nudicollis**	Bare-throated Bellbird	x	x		x	VU	
*Cotinga maculata**	Banded Cotinga	x			x	EN	CR
*Xipholena atropurpurea**	White-winged Cotinga	x	jfp		x	EN	VU
Platyrinchidae							
Platyrinchus mystaceus cancromus	White-throated Spadebill	x	x		x		
Rhynchocyclidae							
Mionectes o. oleagineus	Ochre-bellied Flycatcher	x	x		x		
Leptopogon a. amaurocephalus	Sepia-capped Flycatcher	x	x		x		
*Phylloscartes beckeri**	Bahia Tyrannulet		x		x	EN	EN
*Phylloscartes sylviolus**	Bay-ringed Tyrannulet		jfp				
Rhynchocyclus o. olivaceus	Olivaceous Flatbill	x	x		x		
Tolmomyias sulphurescens pallescens	Yellow-olive Flycatcher		x		x		
Tolmomyias poliocephalus sclateri	Gray-crowned Flycatcher	x	jfp		x		
Tolmomyias f. flaviventris	Yellow-breasted Flycatcher	x	lfs		x		
*Todirostrum poliocephalum**	Gray-headed Tody-Flycatcher	lfs	x				
Todirostrum cinereum coloreum	Common Tody-Flycatcher	x		jfp			
*Myiornis auricularis cinereicollis**	Eared Pygmy-Tyrant	x	lfs		x		
*Hemitriccus diops**	Drab-breasted Pygmy-Tyrant		x		x		
*Hemitriccus furcatus**	Fork-tailed Pygmy-Tyrant		x		x	VU	VU
Tyrannidae							
Hirundinea ferruginea bellicosa	Cliff Flycatcher	x	x		x		
Tyranniscus burmeisteri	Rough-legged Tyrannulet		x		x		
Ornithion inerme	White-lored Tyrannulet	x			x		
Camptostoma obsoletum cinerascens	Southern Beardless-Tyrannulet	x	x				
Elaenia f. flavogaster	Yellow-bellied Elaenia	x	x				
Elaenia spectabilis	Large Elaenia	x					
Elaenia chilensis	Chilean Elaenia		x		x		
Elaenia mesoleuca	Olivaceous Elaenia		x				
Myiopagis c. caniceps	Gray Elaenia	x	x				
Capsiempis f. flaveola	Yellow Tyrannulet	x	x		x		
*Phyllomyias fasciatus brevirostris**	Planalto Tyrannulet	x	x		x		
*Phyllomyias griseocapilla**	Gray-capped Tyrannulet		x		x		
*Attila rufus hellmayri**	Gray-hooded Attila	x	x		x		
*Attila spadiceus uropygiatus**	Bright-rumped Attila	x	jfp		x		
Legatus l. leucophaius	Piratic Flycatcher	x	x				
*Ramphotrigon m. megacephalum**	Large-headed Flatbill		x		x		
Myiarchus t. tuberculifer	Dusky-capped Flycatcher	x			x		
Myiarchus s. swainsoni	Swainson's Flycatcher		jfp				
Myiarchus f. ferox	Short-crested Flycatcher	x	x				
Myiarchus tyrannulus bahiae	Brown-crested Flycatcher			lfs			
Sirystes s. sibilator	Sibilant Sirystes	x			x		
*Rhytipterna s. simplex**	Grayish Mourner	x	x		x		
Pitangus sulphuratus maximiliani	Great Kiskadee	x	x		x		
Philohydor l. lictor	Lesser Kiskadee	x			x		
Machetornis r. rixosa	Cattle Tyrant			x			
Myiodynastes maculatus solitarius	Streaked Flycatcher	x	x				
Megarynchus p. pitangua	Boat-billed Flycatcher	x	x				
Myiozetetes similis pallidiventris	Social Flycatcher	x	x		x		
Tyrannus melancholicus despotes	Tropical Kingbird	x	x		x		

Taxa	English name	< 500 m	> 500 m	S	WA	IUCN	ICMBio
Empidonomus varius rufinus	Variegated Flycatcher	x	x		x		
*Conopias t. trivirgatus**	Three-striped Flycatcher	lfs	x		x		
Colonia c. colonus	Long-tailed Tyrant		x		x		
Myiophobus fasciatus flammiceps	Bran-colored Flycatcher	x	x				
Fluvicola n. nengeta	Masked Water-Tyrant	x	jfp		x		
Arundinicola leucocephala	White-headed Marsh Tyrant			x	x		
*Cnemotriccus f. fuscatus**	Fuscous Flycatcher		lfs				
Lathrotriccus e. euleri	Euler's Flycatcher	x	x		x		
Contopus cooperi	Olive-sided Flycatcher		x		x		
*Contopus c. cinereus**	Tropical Pewee	x	x		x		
Vireonidae							
Cyclarhis gujanensis cearensis	Rufous-browed Peppershrike	x	x		x		
*Hylophilus t. thoracicus**	Lemon-chested Greenlet		x		x		
Vireo chivi agilis	Chivi Vireo	x	x				
Hirundinidae							
Pygochelidon c. cyanoleuca	Blue-and-white Swallow	x	x		x		
Stelgidopteryx r. ruficollis	Southern Rough-winged Swallow	x	x				
Progne t. tapera	Brown-chested Martin	x	jfp	lfs	x		
Progne s. subis	Purple Martin				x		
Progne chalybea macrorhamphus	Gray-breasted Martin	x	x		x		
Tachycineta albiventer	White-winged Swallow			x			
Troglodytidae							
Troglodytes m. musculus	Southern House Wren	x	x		x		
Campylorhynchus t. turdinus	Thrush-like Wren	x	x		x		
Pheugopedius g. genibarbis	Moustached Wren	x	x		x		
Donacobiidae							
Donacobius a. atricapilla	Black-capped Donacobius	x		jfp	x		
Polioptilidae							
*Ramphocaenus m. melanurus**	Long-billed Gnatwren		x				
Turdidae							
*Cichlopsis l. leucogenys**	Rufous-brown Solitaire	lfs	x		x		
*Turdus f. flavipes**	Yellow-legged Thrush	x	x		x		
Turdus l. leucomelas	Pale-breasted Thrush	x	x				
Turdus r. rufiventris	Rufous-bellied Thrush	x	x		x		
Turdus amaurochalinus	Creamy-bellied Thrush		x				
*Turdus albicollis crotopezus**	White-necked Thrush	x	x		x		
Mimidae							
Mimus saturninus arenaceus	Chalk-browed Mockingbird			x			
Passerellidae							
Zonotrichia capensis matutina	Rufous-collared Sparrow	x	lfs				
Arremon t. taciturnus	Pectoral Sparrow	x	x		x		
Parulidae							
Setophaga p. pitiayumi	Tropical Parula	x	x				
Setophaga striata	Blackpoll Warbler		x				
Geothlypis aequinoctialis velata	Masked Yellowthroat		jfp				
Basileuterus culicivorus auricapilla	Golden-crowned Warbler	x	x		x		
*Myiothlypis rivularis**	Neotropical River Warbler	lfs	x				
Icteridae							
Psarocolius d. decumanus	Crested Oropendola	x	jfp		x		
Cacicus haemorrhous affinis	Red-rumped Cacique	x	x		x		
Cacicus c. cela	Yellow-rumped Cacique	x	lfs		x		
Icterus jamacaii	Campo Troupial	x			x		
Gnorimopsar chopi sulcirostris	Chopi Blackbird	lfs		x			
Chrysomus ruficapillus frontalis	Chestnut-capped Blackbird	x					
Molothrus o. oryzivorus	Giant Cowbird	x		lfs	x		
Molothrus b. bonariensis	Shiny Cowbird	x	jfp	lfs			
Sturnella superciliaris	White-browed Meadowlark			x	x		
Thraupidae							
Pipraeidea m. melanonota	Fawn-breasted Tanager	lfs	x		x		

Taxa	English name	< 500 m	> 500 m	S	WA	IUCN	ICMBio
Cissopis leverianus major	Magpie Tanager	x	x		x		
Paroaria dominicana	Red-cowled Cardinal	x					
*Tangara brasiliensis**	White-bellied Tanager				x		
*Tangara cyanomelas**	Silver-breasted Tanager	x		jfp	x		
*Tangara seledon**	Green-headed Tanager	x	x		x		
*Tangara cyanocephala corallina**	Red-necked Tanager		x		x		
Tangara s. sayaca	Sayaca Tanager	x	x				
*Tangara cyanoptera**	Azure-shouldered Tanager		x		x		
Tangara p. palmarum	Palm Tanager	x	x		x		
*Tangara ornata**	Golden-chevroned Tanager	lfs	x		x		
Tangara cayana flava	Burnished-buff Tanager	x	x				
Nemosia pileata caerulea	Hooded Tanager	x		jfp			
Conirostrum s. speciosum	Chestnut-vented Conebill	x	lfs				
Sicalis flaveola brasiliensis	Saffron Finch	x			x		
*Haplospiza unicolor**	Uniform Finch		x		x		
*Chlorophanes spiza axillaris**	Green Honeycreeper	x	x		x		
*Hemithraupis flavicollis melanoxantha**	Yellow-backed Tanager	x	lfs				
*Hemithraupis ruficapilla bahiae**	Rufous-headed Tanager		x		x		
Volatinia j. jacarina	Blue-black Grassquit	x		lfs	x		
Coryphospingus pileatus	Pileated Finch			jfp			
Lanio cristatus brunneus	Flame-crested Tanager	x	x		x		
Tachyphonus rufus	White-lined Tanager		lfs				
*Ramphocelus bresilius dorsalis**	Brazilian Tanager	x	x	lfs	x		
Tersina v. viridis	Swallow Tanager	x	x		x		
*Cyanerpes cyaneus holti**	Red-legged Honeycreeper	x	x		x		
*Dacnis nigripes**	Black-legged Dacnis		x		x		
Dacnis cayana paraguayensis	Blue Dacnis	x	x		x		
Coereba flaveola chloropyga	Bananaquit	x	x		x		
Tiaris fuliginosus	Sooty Grassquit	lfs	x		x		
*Sporophila frontalis**	Buffy-fronted Seedeater		x		x	VU	
*Sporophila falcirostris**	Temminck's Seedeater	x	x		x	VU	
Sporophila n. nigricollis	Yellow-bellied Seedeater	x	x				
Sporophila ardesiaca	Dubois's Seedeater	x	x		x		
Sporophila c. caerulescens	Double-collared Seedeater	x	jfp		x		
Sporophila albogularis	White-throated Seedeater	x			x		
Sporophila leucoptera cinereola	White-bellied Seedeater	x	jfp				
Emberizoides h. herbicola	Wedge-tailed Grass-Finch			x	x		
Saltator m. maximus	Buff-throated Saltator	x	x		x		
Saltator s. similis			lfs				
Saltator fuliginosus	Black-throated Grosbeak		x		x		
Cardinalidae							
*Habia rubica bahiae**	Red-crowned Ant-Tanager	x	x		x		
*Caryothraustes brasiliensis**	Yellow-green Grosbeak	x	x		x		
Fringillidae							
Euphonia c. chlorotica	Purple-throated Euphonia	x	lfs		x		
*Euphonia violacea aurantiicollis**	Violaceous Euphonia	x	x		x		
Euphonia c. cyanocephala	Golden-rumped Euphonia		x		x		
*Euphonia x. xanthogaster**	Orange-bellied Euphonia	x	x		x		
*Euphonia pectoralis**	Chestnut-bellied Euphonia	x	x		x		
*Chlorophonia c. cyanea**	Blue-naped Chlorophonia		x		x		
Passeridae							
Passer domesticus	House Sparrow		lfs	x			

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