A bird survey in a transitional area between two major conservation hotspots in southeastern Brazil

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Abstract
Transitional areas may have higher species richness than those located within established environments, as these ecotones provide a variety of resources that facilitate the maintenance of specific fauna. However, they tend to be overlooked in wildlife surveys. In this context, the western region of the state of São Paulo in Brazil is important because it contains areas of ecological transition between 2 major conservation hotspots in Brazil: the Atlantic Forest and the Cerrado. We surveyed the avifauna in a transitional area between these domains, using qualitative and quantitative methods between December 2016 and February 2019. We documented 220 species, of which 7 are endemic to the Atlantic Forest and 4 are endemic to the Cerrado. In addition, we documented 9 species that are threatened at some level (regional, national, or global), demonstrating the high conservation value of this area for birds. Therefore, our results show the potential of transitional areas for maintaining regional biodiversity.

Keywords
Avian community, Atlantic Forest, bird assemblage, Cerrado, ecotone.

Introduction
Transitional areas between communities tend to receive less attention in biodiversity research than distinct ecosystems. Studies at the global level tend to assess biodiversity across delimited areas to manage resources efficiently (Myers et al. 2000). However, this approach overlooks transitional areas as valuable biodiversity refuges, despite the relevance of such areas as centers of ecological variability and speciation (Schilthuizen 2000).
Mirkin 2001, Baker et al. 2002, Dangerfield et al. 2003, Kark et al. 2007). In addition, transitional areas may contain unique richness (Odum 1953) because the combined diversity of adjacent sites facilitates the maintenance of rare morphological, genetic, and ecological features of biological taxa (Kark and van Rensburg 2006). In addition, some authors hypothesized that transitional areas are zones where new species could emerge more quickly (Moritz et al. 2000), especially in bird taxa (Kark et al. 2007).

In this context, the southeastern region of Brazil plays an important role in the maintenance of bird diversity because it contains several ecotones of Cerrado and Atlantic Forest ecoregions (São Paulo 2017). Both...
Ecoregions support high biodiversity and high degree of endemisms, with several species being threatened by the high rates of habitat loss in them (Myers et al. 2000). Consequently, this region could be fundamental for the conservation of both ecoregions biodiversity. Information on bird distribution and community structure in such environments is crucial to conservation and management (Kark and van Rensburg 2006) and fauna inventories are critical for understanding the composition and dynamics of such communities (Santos 2003). Therefore, our work presents a detailed inventory of avian taxa in an important ecotone of southeastern Brazil and emphasizes the occurrence of those species that present high conservation value, such as endemic, threatened, or migratory species.

Methods

The Jardim Botânico Municipal de Bauru (hereafter JBMB) is located at Bauru Municipality (22°19′S, 049°04′W) in the midwestern region of São Paulo state (Fig. 1). According to Alvares et al. (2013), this region climate is defined as Cwa by Köppen classification, with 2 well-defined seasons of hot and wet summers versus cold and dry winters. JBMB covers a total area of 321 ha and is one of three conservation units that integrates the Vargem Limpa-Campo Novo Area of Environmental Protection (Bauru 2000), along with the São Paulo State University Legal Reserve (265 ha) and the Ecological Reserve of “Sociedade Beneficente Enéas Carvalho de Aguiar” (217 ha). Together, these three conservation units encompasses more than 800 ha of native vegetation (Cavassan 2013).

There are different vegetal formations (or phytophysiognomies) in JBMB that belong to the Atlantic Forest and Cerrado domains (Cavassan 2013). For instance, Forest Savanna (which is known locally as Cerradão) occupies 280 ha; Semideciduous Forest (Veloso 1992) occupies 7 ha; and Riparian Semideciduous Forest with permanent fluvial influence (which is known as Semideciduous Flooded Forest) occupies 11 ha (Rodrigues 2000). In addition, the JBMB contains about 15 ha Regenerating Forest Savanna (Weiser 2007) (Fig. 2). All these phytophysiognomies are distributed in an area of more than 300 ha, which makes this remnant one of the most important fragments of high priority for conservation in the midwestern state of São Paulo (Kronka et al. 1998, Durigan et al. 2004).

To document avifauna in the JBMB, we used 10-min point counts, which had no sampling distance limit (Blondel et al. 1981) and were adapted to tropical regions (Vielliard and Silva 1990). We sampled 30 points...
separated by a minimum distance of 200 m from each other, distributing them between the phytogeographical
mies of JBMB (Table 1). We surveyed the points twice a
month, in the mornings (06:00–10:00) and in the after-
noons (15:00–19:00). Sampling was conducted monthly
in 2 stages. Stage 1 was conducted from December 2016
to December 2017 in the Forest Savanna, Semideciduous
Forest, and Regenerating area. Stage 2 was conducted
from February 2018 to February 2019 in the Riparian
Forest. In total, we completed 120 h of avian surveys.

Visual records were made using Nikon PROSTAFF
7S 10 × 42 binoculars, while sound records were made
with a Marantz PMD-667 recorder coupled to a Yoga
HT-81 directional microphone. Photographic records
of the species were obtained using a Canon Powershot
Superzoom 40× digital camera whenever possible. Pairs
of researchers (GSC, RMV, RWG) carried out the obser-
vations to avoid observation bias. To complement the
bird survey, we recorded sporadic contacts occurring
outside sampling period, both within the JBMB and
adjacent areas. We did not record the abundance of spe-
cies, because this survey was descriptive in nature. In
addition, we integrated the internal database of JBMB
species to our list to complement our own recordings.

Patterns of migratory activity were classified accord-
ing to Somenzari et al. (2018), with some changes. We
considered migratory species (MGT) as those that leave
their territory after the reproductive season and return
to the same area after a cyclical period. Partially migratory
species (MPR) included populations with some migrat-
ory individuals, while others remained resident in certain
regions. The endemism status of each species was based
on Bencke et al. (2006) for the Atlantic Forest and on Silva
and Bates (2002) for the Cerrado. The Red List category
of each species was defined at a global level based on the
International Union for Conservation of Nature (IUCN
2019), at a national level based on Livro Vermelho da
Fauna Brasileira Ameaçada de Extinção (ICMBIO/MMA
2018), and at a regional level based on the State Decree No.
63.853 (São Paulo 2018). We also identified species sub-
ject to capture and traffic pressure according to Costa
and Monteiro (2016). Taxonomic ordering and nomencla-
ture followed the recommendations of the Brazilian Ornithol-
ological Records Committee (Piacentini et al. 2015).

Results
Across all surveys and data sources, we recorded 220
species (Table 2) belonging to 22 orders and 54 fami-
lies. Thirty-six species (16.4% of the total) were docu-
mented by photographs (Figs 3–8). Of the 54 families, 23
belonged to the order Passeriformes and 31 belonged

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Table 1. List of point counts used in the avifaunal survey of the Jardim Botânico Municipal de Bauru (JBMB), with the sampling period, the geographic coordinates and the predominant vegetation of each point.

| Point no. | Sampling period | Latitude   | Longitude | Vegetation       |
|-----------|-----------------|------------|-----------|------------------|
| 01        | Dec. 2016–Dec. 2017 | 22° 20' 35" S | 49° 00' 57" W | Semideciduous Forest |
| 02        | Dec. 2016–Dec. 2017 | 22° 20' 35" S | 49° 00' 50" W | Semideciduous Forest |
| 03        | Dec. 2016–Dec. 2017 | 22° 20' 40" S | 49° 00' 55" W | Semideciduous Forest |
| 04        | Dec. 2016–Dec. 2017 | 22° 20' 48" S | 49° 00' 55" W | Semideciduous Forest |
| 05        | Dec. 2016–Dec. 2017 | 22° 20' 48" S | 49° 00' 48" W | Forest Savanna     |
| 06        | Dec. 2016–Dec. 2017 | 22° 20' 41" S | 49° 00' 46" W | Forest Savanna     |
| 07        | Dec. 2016–Dec. 2017 | 22° 20' 43" S | 49° 00' 40" W | Forest Savanna     |
| 08        | Dec. 2016–Dec. 2017 | 22° 20' 48" S | 49° 00' 37" W | Forest Savanna     |
| 09        | Dec. 2016–Dec. 2017 | 22° 20' 44" S | 49° 00' 29" W | Forest Savanna     |
| 10        | Dec. 2016–Dec. 2017 | 22° 20' 36" S | 49° 00' 42" W | Forest Savanna     |
| 11        | Dec. 2016–Dec. 2017 | 22° 20' 31" S | 49° 00' 41" W | Semideciduous Forest |
| 12        | Dec. 2016–Dec. 2017 | 22° 20' 28" S | 49° 00' 47" W | Semideciduous Forest |
| 13        | Dec. 2016–Dec. 2017 | 22° 20' 28" S | 49° 01' 02" W | Forest Savanna     |
| 14        | Dec. 2016–Dec. 2017 | 22° 20' 26" S | 49° 00' 55" W | Flooded Field      |
| 15        | Dec. 2016–Dec. 2017 | 22° 20' 18" S | 49° 00' 54" W | Flooded Field      |
| 16        | Dec. 2016–Dec. 2017 | 22° 20' 21" S | 49° 00' 46" W | Flooded Field      |
| 17        | Dec. 2016–Dec. 2017 | 22° 20' 15" S | 49° 00' 44" W | Regenerating Area  |
| 18        | Dec. 2016–Dec. 2017 | 22° 20' 14" S | 49° 00' 36" W | Regenerating Area  |
| 19        | Dec. 2016–Dec. 2017 | 22° 20' 15" S | 49° 00' 27" W | Regenerating Area  |
| 20        | Dec. 2016–Dec. 2017 | 22° 20' 19" S | 49° 00' 17" W | Regenerating Area  |
| 21        | Dec. 2016–Dec. 2017 | 22° 20' 14" S | 49° 00' 19" W | Regenerating Area  |
| 22        | Dec. 2016–Dec. 2017 | 22° 20' 08" S | 49° 00' 28" W | Regenerating Area  |
| 23        | Dec. 2016–Dec. 2017 | 22° 19' 60" S | 49° 00' 34" W | Regenerating Area  |
| 24        | Dec. 2016–Dec. 2017 | 22° 20' 07" S | 49° 00' 39" W | Regenerating Area  |
| 25        | Feb. 2018–Feb. 2019 | 22° 20' 12" S | 49° 00' 53" W | Riparian Forest    |
| 26        | Feb. 2018–Feb. 2019 | 22° 20' 12" S | 49° 00' 48" W | Riparian Forest    |
| 27        | Feb. 2018–Feb. 2019 | 22° 20' 08" S | 49° 00' 48" W | Riparian Forest    |
| 28        | Feb. 2018–Feb. 2019 | 22° 20' 05" S | 49° 00' 53" W | Riparian Forest    |
| 29        | Feb. 2018–Feb. 2019 | 22° 20' 01" S | 49° 00' 50" W | Riparian Forest    |
| 30        | Feb. 2018–Feb. 2019 | 22° 19' 57" S | 49° 00' 46" W | Riparian Forest    |
to other orders. We observed 190 species (86.3% of the total) in quantitative surveys and 26 species (11.8% of the total) in qualitative surveys. Just 4 species (1.9% of the total) were only found in the JBMB database. Among non-Passeriformes families, the Accipitridae, Columbidae, and Trochilidae had the highest richness (9 species each, 4.1% of the total), followed by Ardeidae and Rallidae (7 species each, 3.2% of the total). Among the Passeriformes, 30 species represented the Tyrannidae (13.7% of the total) and 27 species represented the Thraupidae (12.4% of the total) families. We recorded 31 species (14.2% of the total) with migratory activity, with 2 species being considered migratory and 29 species being considered partially migratory. In addition, we documented 36 species (16.5% of the total) subjected to capture and traffic pressure (Costa and Monteiro 2016). We also documented 2 exotic species, *Estrilda astrild* (Common Waxbill) and *Passer domesticus* (House Sparrow).

Some species that were documented are considered of conservation relevance. Among the species classified as endemic, we recorded 7 taxa restricted to the Atlantic Forest and 4 restricted to the Cerrado.
Table 2. List of birds recorded at Jardim Botânico Municipal de Bauru (JBMB), with the scientific name and English names. We also display
the method of detection (Quan. = Quantitative survey, Qual. = Qualitative survey, Data. = JBMB databases); the predominant physiognomy (Phys.) where the taxa have been found (SEM = Semideciduous Forest, REG = Regenerating area, SAV = Forest Savanna, WET = Wetlands, UBQ = Ubiquitous); the migratory behavior (Mig.) of each taxa (MGT = migratory species, MPR = partially migratory species); the conservation status at the global (IUCN 2019), national (ICMBIO/MMA 2018) and regional (São Paulo 2018) levels, respectively (LC = least concern, NT = near threatened, VU = vulnerable, EN = endangered); and the taxa that suffers from risk of capture and traffic pressures (Traf.) according to Costa and Monteiro (2016).

| Taxon                | English name                | Quan. | Qual. | Data. | Phys. | Mig. | Conserv. status | Traf. |
|----------------------|-----------------------------|-------|-------|-------|-------|------|-----------------|-------|
| **TINAMIFORMES**     |                             |       |       |       |       |      |                 |       |
| Tinamidae            |                             |       |       |       |       |      |                 |       |
| Crypturellus obsoletus (Temminck, 1815) | Brown Tinamou | X     |       |       | SEM   |      | LC/ LC/ LC      |       |
| Crypturellus parvirostris (Wagler, 1827) | Small-billed Tinamou | X     |       |       | REG   |      | LC/ LC/ LC      |       |
| Crypturellus tataupa (Temminck, 1815) | Tataupa Tinamou | X     |       |       | SEM/REG |     | LC/ LC/ LC      |       |
| Rhynochotus rufescens (Temminck, 1815) | Red-winged Tinamou | X     |       |       | REG   |      | LC/ LC/ LC      |       |
| **ANSERIFORMES**     |                             |       |       |       |       |      |                 |       |
| Anatidae             |                             |       |       |       |       |      |                 |       |
| Cairina moschata (Linnaeus, 1758) | Muscovy Duck | X     |       |       | WET   |      | LC/ LC/ LC      |       |
| Amazonetta brasiensis (Gmelin, 1789) | Brazilian Teal | X     |       |       | WET   |      | LC/ LC/ LC      |       |
| **GALLIFORMES**      |                             |       |       |       |       |      |                 |       |
| Cracidae             |                             |       |       |       |       |      |                 |       |
| Penelope supercilialis Temminck, 1815 | Rusty-margined Guan | X     |       |       | SEM   |      | LC/ LC/ NT      |       |
| **PODICIPEDIFORMES** |                             |       |       |       |       |      |                 |       |
| Podiomybus podiceps (Linnaeus, 1758) | Pied-billed Grebe | X     |       |       | WET   |      | LC/ LC/ LC      |       |
| **SULIFORMES**       |                             |       |       |       |       |      |                 |       |
| Phalacrocoracidae    |                             |       |       |       |       |      |                 |       |
| Nannopterus brasilianus (Gmelin, 1789) | Neotropic Cormorant | X     |       |       | WET   |      | LC/ LC/ LC      |       |
| Anhingidae           |                             |       |       |       |       |      |                 |       |
| Anhinga anhinga (Linnaeus, 1766) | Anhinga | X     |       |       | WET   |      | LC/ LC/ LC      |       |
| Ardeidae             |                             |       |       |       |       |      |                 |       |
| Tigrisoma lineatum (Boddaert, 1783) | Rufescent Tiger-Heron | X     |       |       | WET   |      | LC/ LC/ LC      |       |
| Butorides striata (Linnaeus, 1758) | Striated Heron | X     |       |       | WET   |      | LC/ LC/ LC      |       |
| Babulcus ibis (Linnaeus, 1758) | Cattle Egret | X     |       |       | WET   |      | LC/ LC/ LC      |       |
| Ardea cocoi Linnaeus, 1766 | Cocii Heron | X     |       |       | WET   |      | LC/ LC/ LC      |       |
| Ardea alba Linnaeus, 1758 | Great Egret | X     |       |       | WET   |      | LC/ LC/ LC      |       |
| Syndra sibilatrix (Temminck, 1824) | Whistling Heron | X     |       |       | WET   |      | LC/ LC/ LC      |       |
| Egretta thula (Molina, 1782) | Snowy Egret | X     |       |       | WET   |      | LC/ LC/ LC      |       |
| Threskiornithidae    |                             |       |       |       |       |      |                 |       |
| Mesembrinibis cayennensis (Gmelin, 1789) | Green Ibis | X     |       |       | WET   |      | LC/ LC/ LC      |       |
| Phimosus infuscatus (Lichtenstein, 1823) | Bare-faced Ibis | X     |       |       | WET   |      | LC/ LC/ LC      |       |
| Theristicus caudatus (Boddaert, 1783) | Buff-necked Ibis | X     |       |       | WET   |      | LC/ LC/ LC      |       |
| **CATHARTIFORMES**   |                             |       |       |       |       |      |                 |       |
| Cathartidae          |                             |       |       |       |       |      |                 |       |
| Cathartes aura (Linnaeus, 1758) | Turkey Vulture | X     |       |       | REG   |      | LC/ LC/ LC      |       |
| Coragyps atratus (Bechstein, 1793) | Black Vulture | X     |       |       | UBQ   |      | LC/ LC/ LC      |       |
| **ACCIPITRIFORMES**  |                             |       |       |       |       |      |                 |       |
| Accipitridae         |                             |       |       |       |       |      |                 |       |
| Chondrohierax uncinatus (Temminck, 1822) | Hook-billed Kite | X     |       |       | WET   |      | LC/ LC/ LC      |       |
| Gampsonyx swainsoni Vigors, 1825 | Pearl Kite | X     |       |       | SAVE/SEM |     | LC/ LC/ LC      |       |
| Elanus leucurus (Vieillot, 1818) | White-tailed Kite | X     |       |       | SAVE/SEM |     | LC/ LC/ LC      |       |
| Ictinia plumbea (Gmelin, 1788) | Plumbeous Kite | X     |       |       | SAVE/SEM |     | LC/ LC/ LC      |       |
| Rostrhamus sociabilis (Vieillot, 1817) | Snail Kite | X     |       |       | MPR   |      | LC/ LC/ LC      |       |
| Heterophasia meridionalis (Latham, 1790) | Savanna Hawk | X     |       |       | REG   |      | LC/ LC/ LC      |       |
| Rupornis magnirostris (Gmelin, 1788) | Roadside Hawk | X     |       |       | UBQ   |      | LC/ LC/ LC      |       |
| Genanoeetus albicollis (Vieillot, 1816) | White-tailed Hawk | X     |       |       | REG   |      | LC/ LC/ LC      |       |
| Buteo brachyrurus Vieillot, 1816 | Short-tailed Hawk | X     |       |       | SAVE/SEM |     | LC/ LC/ LC      |       |
| **GRUIFORMES**       |                             |       |       |       |       |      |                 |       |
| Aramidae             |                             |       |       |       |       |      |                 |       |
| Aramus guarauna (Linnaeus, 1766) | Limpkin | X     |       |       | WET   |      | LC/ LC/ LC      |       |
| Rallidae             |                             |       |       |       |       |      |                 |       |
| Aramides cajaneus (Status Müller, 1776) | Gray-necked Wood-Rail | X     |       |       | WET   |      | LC/ LC/ LC      |       |
| Laterallus viridis (Status Müller, 1776) | Russet-crowned Crane | X     |       |       | WET   |      | LC/ LC/ LC      |       |
| Laterallus melanophaius (Vieillot, 1819) | Rufous-sided Crane | X     |       |       | WET   |      | LC/ LC/ LC      |       |
| Taxon                                      | English name           | Quan. | Qual. | Data. | Phys. | Mig. | Conserv. status | Traf. |
|-------------------------------------------|------------------------|-------|-------|-------|-------|------|-----------------|-------|
| Muscelirallus albigollis (Vieillot, 1819) | Ash-throated Crane     | X     |       |       | WET   |      | LC/ LC/ LC      |       |
| Pardirallus nigricans (Vieillot, 1819)    | Blackish Rail          | X     |       |       | WET   |      | LC/ LC/ LC      |       |
| Gallinula goleata (Lichtenstein, 1818)    | Common Gallinule       | X     |       |       | WET   |      | LC/ LC/ LC      |       |
| Porphyrio martinicus (Linnaeus, 1766)     | Purple Gallinule       | X     |       |       | WET   | MPR  | LC/ LC/ LC      |       |
| Heliornithidae                            |                        |       |       |       |       |      |                 |       |
| Heliornis fulica (Bonodraart, 1783)       | Sungrebe               | X     |       |       | WET   |      | LC/ LC/ EN      |       |
| Charadriiformes                           |                        |       |       |       |       |      |                 |       |
| Charadriidae                              |                        |       |       |       |       |      |                 |       |
| Vanellus chilensis (Molina, 1762)         | Southern Lapwing       | X     |       |       | REG   |      | LC/ LC/ LC      |       |
| Jacanidae                                 |                        |       |       |       |       |      |                 |       |
| Jacana jacana (Linnaeus, 1766)            | Wattled Jacana         | X     |       |       | WET   |      | LC/ LC/ LC      |       |
| Columbiformes                             |                        |       |       |       |       |      |                 |       |
| Columbidae                                |                        |       |       |       |       |      |                 |       |
| Columbina talpaci (Temminck, 1810)        | Ruddy Ground-Dove      | X     |       |       | REG   |      | LC/ LC/ LC      |       |
| Columbina squamata (Lesson, 1831)         | Scaled Dove            | X     |       |       | REG   |      | LC/ LC/ NT      |       |
| Claravis pretiosa (Ferrari-Perez, 1886)   | Blue Ground-Dove       | X     |       |       | SEM   |      | LC/ LC/ LC      |       |
| Patagioenas picazuro (Temminck, 1813)     | Picazo Pigeon          | X     |       |       | UBQ   |      | LC/ LC/ LC      |       |
| Patagioenas cayennensis (Bonnaterre, 1792)| Pale-vented Pigeon     | X     |       |       | SAV/REG |     | LC/ LC/ LC      |       |
| Zenaida auriculata (Des Murs, 1847)       | Eared Dove             | X     |       |       | UBQ   |      | LC/ LC/ LC      |       |
| Leptotila verreauxi Bonaparte, 1855       | White-tipped Dove      | X     |       |       | SAV/REG |     | LC/ LC/ LC      |       |
| Leptotila rufatrix (Richard & Bernard, 1792)| Gray-fronted Dove     | X     |       |       | SAV/REG |     | LC/ LC/ LC      |       |
| Geotrygon montana (Linnaeus, 1758)        | Ruddy Quail-Dove       | X     |       |       | REG   |      | LC/ LC/ LC      |       |
| Cuculiformes                              |                        |       |       |       |       |      |                 |       |
| Cuculidae                                 |                        |       |       |       |       |      |                 |       |
| Piaya cayana (Linnaeus, 1766)             | Squirrel Cuckoo        | X     |       |       | UBQ   |      | LC/ LC/ LC      |       |
| Crotaphaga major Gmelin, 1788             | Greater Ani            | X     |       |       | WET   |      | LC/ LC/ NT      |       |
| Crotaphaga ani Linnaeus, 1758             | Smooth-billed Ani      | X     |       |       | REG   |      | LC/ LC/ LC      |       |
| Guira guira (Gmelin, 1788)                | Guira Cuckoo           | X     |       |       | REG   |      | LC/ LC/ LC      |       |
| Tapera novea (Linnaeus, 1766)             | Striped Cuckoo         | X     |       |       | REG   |      | LC/ LC/ LC      |       |
| Strigiformes                              |                        |       |       |       |       |      |                 |       |
| Tytonidae                                 |                        |       |       |       |       |      |                 |       |
| Tyto furcata (Temminck, 1827)             | American Barn Owl      | X     |       |       | SAV/REG |     | LC/ LC/ LC      |       |
| Strigidae                                 |                        |       |       |       |       |      |                 |       |
| Megascops choliba (Vieillot, 1817)        | Tropical Screech-Owl   | X     |       |       | SAV/REG |     | LC/ LC/ LC      |       |
| Bubo virginianus (Gmelin, 1788)           | Great Horned Owl       | X     |       |       | SAV/REG |     | LC/ LC/ EN      |       |
| Athene cunicularia (Molina, 1782)         | Burrowing Owl          | X     |       |       | REG   |      | LC/ LC/ LC      |       |
| Asio stygius (Wagler, 1832)               | Stygian Owl            | X     |       |       | SAV   |      | LC/ LC/ LC      |       |
| Nyctibiiformes                            |                        |       |       |       |       |      |                 |       |
| Nyctibidae                                |                        |       |       |       |       |      |                 |       |
| Nyctibius griseus (Gmelin, 1789)          | Common Potoo           | X     |       |       | SAV   |      | LC/ LC/ LC      |       |
| Caprimulgiformes                          |                        |       |       |       |       |      |                 |       |
| Caprimulgidae                             |                        |       |       |       |       |      |                 |       |
| Lurocolis semitorquatus (Gmelin, 1789)    | Short-tailed Nighthawk | X     |       |       | REG   | MPR  | LC/ LC/ LC      |       |
| Nyctidromus albicollis (Gmelin, 1789)     | Common Pauraque        | X     |       |       | REG   |      | LC/ LC/ LC      |       |
| Hydropais parvula (Gould, 1837)           | Little Nightjar        | X     |       |       | SAV   | MPR  | LC/ LC/ LC      |       |
| Chordeiles minor (Forster, 1771)          | Common Nighthawk       | X     |       |       | SAV   | MGT  | LC/ LC/ LC      |       |
| Apodiformes                               |                        |       |       |       |       |      |                 |       |
| Apodidae                                  |                        |       |       |       |       |      |                 |       |
| Chaetura meridionalis Hellmayr, 1907      | Sick’s Swift           | X     |       |       | REG   | MGT  | LC/ LC/ LC      |       |
| Trochilidae                               |                        |       |       |       |       |      |                 |       |
| Phaethornis pretrei (Lesson & Delattre, 1839)| Planalto Hermit     | X     |       |       | UBQ   |      | LC/ LC/ LC      |       |
| Eupetomena macoura (Gmelin, 1788)         | Swallow-tailed Hummingbird | X   |       |       | UBQ   |      | LC/ LC/ LC      |       |
| Florisuga fusca (Vieillot, 1817)          | Black Jacobin          | X     |       |       | UBQ   | MPR  | LC/ LC/ LC      |       |
| Colibri serrirrostis (Vieillot, 1816)     | White-vented Violetear | X     |       |       | SEM   |      | LC/ LC/ LC      |       |
| Chlorostilbon lucidus (Shaw, 1812)        | Glittering-bellied Emerald | X |       |       | UBQ   |      | LC/ LC/ LC      |       |
| Thalurania glaucops (Gmelin, 1788)        | Violet-capped Woodnymph | X   |       |       | SEM   |      | LC/ LC/ LC      |       |
| Hylocharis chrysura (Shaw, 1812)          | Gilded Hummingbird     | X     |       |       | SEM   |      | LC/ LC/ LC      |       |
| Amazilia lactea (Lesson, 1832)            | Sapphire-spangled Emerald | X |       |       | UBQ   |      | LC/ LC/ LC      |       |
| Heliomaster squamosus (Temminck, 1823)    | Stripe-breasted Starthroat | REG |       |       |      |      | LC/ LC/ LC      |       |
| Coraciiformes                             |                        |       |       |       |       |      |                 |       |
| Alcedinidae                               |                        |       |       |       |       |      |                 |       |
| Megaceryle torquata (Linnaeus, 1766)      | Ringed Kingfisher      | X     |       |       | WET   |      | LC/ LC/ LC      |       |
| Taxon                                      | English name                          | Quan. | Qual. | Data. | Phys. | Mig. | Conserv. status | Traf. |
|-------------------------------------------|---------------------------------------|-------|-------|-------|-------|------|----------------|-------|
| Chloroceryle amazona (Latham, 1790)       | Amazon Kingfisher                     | X     |       | WET   |       |      | LC/ LC/ LC     |       |
| Chloroceryle americana (Gmelin, 1788)     | Green Kingfisher                      | X     |       | WET   |       |      | LC/ LC/ LC     |       |
| Momotidae                                 |                                       |       |       |       |       |      |                |       |
| *Baryphthengus ruficapillus* (Vielliot, 1818) | Rufous-capped Motmot                 | X     |       | SEM   |       |      | LC/ LC/ LC     |       |
| GALBULIFORMES                             |                                       |       |       |       |       |      |                |       |
| Galbulidae                                |                                       |       |       |       |       |      |                |       |
| *Galbula rufascuda* Cuvier, 1816          | Rufous-tailed Jacamar                 | X     |       | UBQ   |       |      | LC/ LC/ LC     |       |
| Buccinidae                                |                                       |       |       |       |       |      |                |       |
| *Nystalus chacuru* (Vielliot, 1816)       | White-eared Puffbird                  | X     |       | REG   |       |      | LC/ LC/ LC     |       |
| PICIFORMES                                |                                       |       |       |       |       |      |                |       |
| Ramphastidae                              |                                       |       |       |       |       |      |                |       |
| *Ramphastos toco* Statius Müller, 1776    | Toco Toucan                           | X     |       | UBQ   |       |      | LC/ LC/ LC     |       |
| Picidae                                   |                                       |       |       |       |       |      |                |       |
| *Picumnus albosquamatus* d’Orbigny, 1840 | White-wedged Piculet                  | X     |       | UBQ   |       |      | LC/ LC/ LC     |       |
| Melanerpes candidus (Otto, 1796)          | White Woodpecker                      | X     |       | UBQ   |       |      | LC/ LC/ LC     |       |
| Veniliornis passerinus (Linnaeus, 1766)   | Little Woodpecker                     | X     |       | UBQ   |       |      | LC/ LC/ LC     |       |
| Colaptes melanochloros (Gmelin, 1818)     | Green-barred Woodpecker               | X     |       | UBQ   |       |      | LC/ LC/ LC     |       |
| Colaptes campestris (Vielliot, 1818)      | Campo Flicker                         | X     |       | REG   |       |      | LC/ LC/ LC     |       |
| Dryocopus lineatus (Linnaeus, 1766)       | Lineated Woodpecker                   | X     |       | REG   |       |      | LC/ LC/ LC     |       |
| CARIAMIFORMES                             |                                       |       |       |       |       |      |                |       |
| Cariama cristata (Linnaeus, 1766)         | Red-legged Seriema                    | X     |       | REG   |       |      | LC/ LC/ LC     |       |
| FALCONIFORMES                             |                                       |       |       |       |       |      |                |       |
| Falconidae                                |                                       |       |       |       |       |      |                |       |
| *Caracara plancus* (Miller, 1777)         | Southern Caracara                     | X     |       | REG   |       |      | LC/ LC/ LC     |       |
| Milvago chimachima (Vielliot, 1816)       | Yellow-headed Caracara                | X     |       | REG   |       |      | LC/ LC/ LC     |       |
| Herpetotheres cachinnans (Linnaeus, 1758) | Laughing Falcon                       | X     |       | REG   |       |      | LC/ LC/ LC     |       |
| Micrastur semitorquatus (Vielliot, 1817)  | Collared Forest-Falcon                | X     |       | SAV   |       |      | LC/ LC/ LC     |       |
| Falco sparverius Linnaeus, 1758            | American Kestrel                      | X     |       | REG   |       |      | LC/ LC/ LC     |       |
| PSITTACIFORMES                            |                                       |       |       |       |       |      |                |       |
| Psittacidae                               |                                       |       |       |       |       |      |                |       |
| *Primolius maracana* (Vielliot, 1816)     | Blue-winged Macaw                     | X     |       | SEM   |       |      | NT/ NT/ VU     | X     |
| Psittaca leucophthalma (Status Müller, 1776) | White-eyed Parakeet                   | X     |       | UBQ   |       |      | LC/ LC/ LC     | X     |
| Forpus xanthopterygius (Spix, 1824)       | Blue-winged Parrotlet                 | X     |       | UBQ   |       |      | LC/ LC/ LC     | X     |
| Brotogeris chiriri (Vielliot, 1818)       | Yellow-chevroned Parakeet             | X     |       | UBQ   |       |      | LC/ LC/ LC     | X     |
| Pionus maximiliani (Kuhl, 1820)           | Scaly-headed Parrot                   | X     |       | SEM   |       |      | LC/ LC/ LC     | X     |
| Amazona aestiva (Linnaeus, 1758)          | Turquoise-fronted Parrot              | X     |       | SEM   |       |      | LC/ NT/ NT     | X     |
| PASSERIFORMES                             |                                       |       |       |       |       |      |                |       |
| Thamnophilidae                            |                                       |       |       |       |       |      |                |       |
| *Herpsilochmus atricapillus* Pelzeln, 1868 | Black-capped Antwren                  | X     |       | SAV/ SEM |       |      | LC/ LC/ LC     |       |
| *Herpsilochmus longirostris* Pelzeln, 1868 | Large-billed Antwren                  | X     |       | SEM   |       |      | LC/ LC/ NT     |       |
| Thamnophilus doliotis (Linnaeus, 1764)    | Barred Antshrike                      | X     |       | UBQ   |       |      | LC/ LC/ LC     |       |
| Thamnophilus pelzeli Hellmayr, 1924       | Planalto Slaty-Antshrike              | X     |       | CER   |       |      | LC/ LC/ LC     |       |
| Taraba major (Vielliot, 1816)             | Great Antshrike                       | X     |       | SAV/ SEM |       |      | LC/ LC/ LC     |       |
| Conopophagidae                            |                                       |       |       |       |       |      |                |       |
| Conopophaga lineata (Wied, 1831)          | Rufous Gnateater                      | X     |       | SEM   |       |      | LC/ LC/ LC     |       |
| Dendrocolaptidae                          |                                       |       |       |       |       |      |                |       |
| Sittasomus griseicapillus (Vielliot, 1818) | Olivaceous Woodcreeper                | X     |       | SEM   |       |      | LC/ LC/ LC     |       |
| Lepidocolaptes angustirostris (Vielliot, 1818) | Narrow-billed Woodcreeper            | X     |       | UBQ   |       |      | LC/ LC/ LC     |       |
| Furnariidae                               |                                       |       |       |       |       |      |                |       |
| Furnarius rufus (Gmelin, 1788)            | Rufous Hornero                        | X     |       | UBQ   |       |      | LC/ LC/ LC     |       |
| Automolus leucomelas (Wied, 1821)         | White-eyed Foliage-gleaner           | X     |       | SEM   |       |      | LC/ LC/ LC     |       |
| Certhiaxis cinnamomeus (Gmelin, 1878)     | Yellow-chinned Spinetail              | X     |       | WET   |       |      | LC/ LC/ LC     |       |
| Synallaxis frontalis Pelzeln, 1859        | Sooty-fronted Spinetail              | X     |       | REG   |       |      | LC/ LC/ LC     |       |
| Synallaxis albescens Temminck, 1823       | Pale-breasted Spinetail               | X     |       | CER   |       |      | LC/ LC/ LC     |       |
| Pipridae                                  |                                       |       |       |       |       |      |                |       |
| Neopelma pallescens (Lafresnaye, 1853)    | Pale-bellied Tyrant-Manakin           | X     |       | CER   |       |      | LC/ LC/ NT     |       |
| Antilophia galeata (Lichtenstein, 1823)   | Helmeted Manakin                      | X     |       | CER/ SEM |       |      | LC/ LC/ LC     |       |
| Tityridae                                 |                                       |       |       |       |       |      |                |       |
| Pachyrhamphus viridis (Vielliot, 1816)    | Green-backed Becard                   | X     |       | REG   |       |      | LC/ LC/ LC     |       |
| Pachyrhamphus validus (Lichtenstein, 1823) | Crested Becard                       | X     |       | REG   |       |      | MPR LC/ LC/ LC |       |
| Taxon                        | English name                  | Quan. | Qual. | Data. | Phys. | Mig. | Conserv. status | Traf. |
|-----------------------------|-------------------------------|-------|-------|-------|-------|-----|----------------|-------|
| **Platyrinchidae**          |                               |       |       |       |       |     |                |       |
| *Platyrinchus mystaceus*    | White-throated Spadebill      | X     | SEM   | LC/LC/LC |     |     |                |       |
| **Rynchocyclidae**          |                               |       |       |       |       |     |                |       |
| *Leptopogon amauraephalus*  | Sepia-capped Flycatcher       | X     | SEM   | LC/LC/LC |     |     |                |       |
| *Corythopus delalandi*      | Ringed Antipipit              | X     | SEM   | LC/LC/LC |     |     |                |       |
| *Tolmomyias sulphurensis*   | Yellow-olive Flycatcher       | X     | SEM   | LC/LC/LC |     |     |                |       |
| *Todirostrum poliocephalum* | Gray-headed Tody-Flycatcher    | X     | SEM   | LC/LC/LC |     |     |                |       |
| *Todirostrum cinereum*      | Common Tody-Flycatcher        | X     | UBQ   | LC/LC/LC |     |     |                |       |
| *Poecilotricus latirostris* | Rusty-fronted Tody-Flycatcher |       | CER   | LC/LC/LC |     |     |                |       |
| *Hemitriccus margentaceivent*   | Pearly-vented Tody-tyrant     |       | CER   | LC/LC/LC |     |     |                |       |
| **Tyrannidae**              |                               |       |       |       |       |     |                |       |
| *Hirundinea ferruginea*     | Cliff Flycatcher              | X     | REG   | LC/LC/LC |     |     |                |       |
| *Camptosoma obsoletum*      | Southern Beardless-Tyrannulet | X     | UBQ   | LC/LC/LC |     |     |                |       |
| *Elasania flavogaster*      | Yellow-bellied Elaenia        | X     | UBQ   | LC/LC/LC |     |     |                |       |
| *Elasania mesoleuca*        | Olivaceous Elaenia            |       | REG   | LC/LC/LC |     |     |                |       |
| *Elasania obscura*          | Highland Elaenia              |       | CER   | LC/LC/LC |     |     |                |       |
| *Myiopagis viridicata*      | Greenish Elaenia              |       | SEM   | MPR   | LC/LC/LC |     |     |                |       |
| *Phaeomyias murnia*         | Mouse-colored Tyrannulet      |       | CER   | LC/LC/LC |     |     |                |       |
| *Serophaga subcrassata*     | White-crested Tyrannulet      |       | UBQ   | MPR   | LC/LC/LC |     |     |                |       |
| *Legatus leucophaeus*       | Piratic Flycatcher            |       | REG   | MPR   | LC/LC/LC |     |     |                |       |
| *Myiarchus swainsoni*       | Swainson’s Flycatcher         |       | UBQ   | MPR   | LC/LC/LC |     |     |                |       |
| *Myiarchus ferox*           | Short-crested Flycatcher      |       | UBQ   | MPR   | LC/LC/LC |     |     |                |       |
| *Syrystes sibilator*        | Sibilant Srystes              |       | REG   | MPR   | LC/LC/LC |     |     |                |       |
| *Casiornis rufus*           | Rufous Casiornis              |       | REG   | MPR   | LC/LC/LC |     |     |                |       |
| *Pitangus sulphuratus*      | Great Kiskadee                |       | UBQ   | MPR   | LC/LC/LC |     |     |                |       |
| *Myiodynastes maculatus*    | Streaked Flycatcher           |       | UBQ   | MPR   | LC/LC/LC |     |     |                |       |
| *Megarynchus pitangus*      | Boat-billed Flycatcher        |       | UBQ   | MPR   | LC/LC/LC |     |     |                |       |
| *Myiozetetes similis*       | Social Flycatcher             |       | UBQ   | MPR   | LC/LC/LC |     |     |                |       |
| *Tyrannus melancholicus*    | Tropical Kingbird             |       | UBQ   | MPR   | LC/LC/LC |     |     |                |       |
| *Tyrannus savana*           | Fork-tailed Flycatcher        |       | REG/GER | MPR | LC/LC/LC |     |     |                |       |
| *Griseotyrranys aurantioatracristatus* | Crowned Slaty Flycatcher    |       | REG   | MPR   | LC/LC/LC |     |     |                |       |
| *Empidonous varius*         | Variegated Flycatcher         |       | REG/GER | MPR | LC/LC/LC |     |     |                |       |
| *Colonia colonus*           | Long-tailed Tyrant            |       | REG/CER | MPR | LC/LC/LC |     |     |                |       |
| *Myiophobus fasciatus*      | Bran-colored Flycatcher       |       | REG/CER | MPR | LC/LC/LC |     |     |                |       |
| *Pyrocephalus rubinus*      | Vermilion Flycatcher          |       | REG/CER | MPR | LC/LC/LC |     |     |                |       |
| *Fluvicola nengeta*         | Masked Water-Tyrant           |       | WET   | LC/LC/LC |     |     |                |       |
| *Gubernetes yetapa*         | Streamer-tailed Tyrant        |       | WET   | LC/LC/LC |     |     |                |       |
| *Cnemotricus fuscatus*      | Fuscous Flycatcher            |       | REG/CER | MPR | LC/LC/LC |     |     |                |       |
| *Lathrotriccus euneri*      | Euler's Flycatcher            |       | REG/CER | MPR | LC/LC/LC |     |     |                |       |
| *Xolmis cinereus*           | Gray Monjita                  |       | REG   | LC/LC/LC |     |     |                |       |
| *Xolmis velatus*            | White-rumped Monjita          |       | REG   | LC/LC/LC |     |     |                |       |
| **Vireonidae**              |                               |       |       |       |       |     |                |       |
| *Cyclarhis gujanensis*      | Rufous-browed Peppershrike    |       | UBQ   | LC/LC/LC |     |     |                |       |
| *Hylophilus amauraephalus*  | Gray-eyed Greenlet            |       | CER   | LC/LC/LC |     |     |                |       |
| *Vireo chivi*               | Chivi Vireo                   |       | UBQ   | MPR   | LC/LC/LC |     |     |                |       |
| **Corvidae**                |                               |       |       |       |       |     |                |       |
| *Cyanocorax cristatellus*   | Curl-crested Jay              |       | CER   | LC/LC/LC |     |     |                | X     |
| *Cyanocorax chrysops*       | Plush-crested Jay             |       | UBQ   | MPR   | LC/LC/LC |     |     |                | X     |
| **Hirundinidae**            |                               |       |       |       |       |     |                |       |
| *Pygochelidon cyanoleuca*   | Blue-and-white Swallow        |       | UBQ   | MPR   | LC/LC/LC |     |     |                |       |
| *Stelgidopteryx ruficollis* | Southern Rough-winged Swallow |       | REG   | MPR   | LC/LC/LC |     |     |                |       |
| *Pragre tapera*             | Brown-cheeked Martin          |       | REG   | MPR   | LC/LC/LC |     |     |                |       |
| *Pragre chalybea*           | Gray-breasted Martin          |       | REG   | MPR   | LC/LC/LC |     |     |                |       |
| **Troglodytidae**           |                               |       |       |       |       |     |                |       |
| *Troglodytes musculus*      | Southern House Wren           |       | REG   | LC/LC/LC |     |     |                |       |
| **Donacobididae**           |                               |       |       |       |       |     |                |       |
| *Donacobius atricapilla*    | Black-capped Donacobius       |       | WET   | LC/LC/LC |     |     |                |       |
| **Turdidae**                |                               |       |       |       |       |     |                |       |
| *Turdus leucomelas*         | Pale-breasted Thrush          |       | UBQ   | LC/LC/LC |     |     |                | X     |
| Taxon                                      | English name                        | Quan. | Qual. | Data. | Phys. | Mig. | Conserv. status | Traf. |
|-------------------------------------------|-------------------------------------|-------|-------|-------|-------|------|-----------------|-------|
| *Turdus rufigventris* Vieillot, 1818       | Rufous-bellied Thrush                | X     |       |       | SEM   |      | LC/ LC/ LC       | X     |
| *Turdus amaurochalinus* Cabanis, 1850      | Creamy-bellied Thrush                | X     |       |       | UBQ   |      | LC/ LC/ LC       | X     |
| *Turdus subalaris* (Seebohm, 1887)         | Eastern Slaty Thrush                 | X     |       |       | SEM   |      | MPR             | LC/ LC/ LC |
| *Turdus albicollis* Vieillot, 1818         | White-necked Thrush                  | X     |       |       | SEM   |      | MPR             | LC/ LC/ LC |
| **Mimidae**                               |                                     |       |       |       |       |      |                 |       |
| *Mimus satunrinus* (Lichtenstein, 1823)    | Chalk-browed Mockingbird             | X     |       |       | REG   |      | LC/ LC/ LC       |       |
| **Passerellidae**                         |                                     |       |       |       |       |      |                 |       |
| *Zonotrichia capensis* (Statius Müller, 1776) | Rufous-collared Sparrow             | X     |       |       | REG   |      | LC/ LC/ LC       | X     |
| *Ammodramus humeralis* (Bosc, 1792)        | Grassland Sparrow                    | X     |       |       | REG   |      | LC/ LC/ LC       | X     |
| *Arremann flaviostris* Swainson, 1838      | Saffron-billed Sparrow               | X     |       |       | SEM   |      | LC/ LC/ LC       | X     |
| **Passeridae**                            |                                     |       |       |       |       |      |                 |       |
| *Setophaga pisiayumi* Vieillot, 1817       | Tropical Parula                      | X     |       |       | SEM   |      | LC/ LC/ LC       |       |
| *Geothlypis aequinoctialis* (Gmelin, 1789)| Masked Yellowthroat                  | X     |       |       | WET   |      | LC/ LC/ LC       |       |
| *Basileuterus culicivorus* (Deppe, 1830)   | Golden-crowned Warbler               | X     |       |       | UBQ   |      | LC/ LC/ LC       |       |
| *Myioplys flaveola* Baird, 1865            | Flavescent Warbler                   | X     |       |       | UBQ   |      | LC/ LC/ LC       |       |
| **Icteridae**                             |                                     |       |       |       |       |      |                 |       |
| *Cacicus haemorrhous* (Linnaeus, 1766)     | Red-rumped Cacique                   | X     |       |       | SEM   |      | LC/ LC/ LC       | X     |
| *Icterus pyrrhopterus* Vieillot, 1819      | Variable Oriole                      | X     |       |       | REG   |      | LC/ LC/ LC       | X     |
| *Gnorimopsar chopi* Vieillot, 1819         | Ch opi Blackbird                     | X     |       |       | REG   |      | LC/ LC/ LC       | X     |
| *Amblyramphus holosericeus* (Scopoli, 1786)| Scarlet-headed Blackbird             | X     |       |       | WET   |      | LC/ LC/ LC       | X     |
| *Chrysos murcapillus* Vieillot, 1819       | Chestnut-capped Blackbird            | X     |       |       | WET   |      | LC/ LC/ LC       | X     |
| *Pseudoletistes guirahuro* Vieillot, 1819  | Yellow-rumped Marshbird              | X     |       |       | REG/WET |    | LC/ LC/ LC       | X     |
| *Malolthus banariensis* (Gmelin, 1789)     | Shiny Cowbird                        | X     |       |       | REG   |      | LC/ LC/ LC       | X     |
| **Thraupidae**                            |                                     |       |       |       |       |      |                 |       |
| *Pipraeidea melanonota* Vieillot, 1819     | Fawn-breasted Tanager                | X     |       |       | SEM   |      | LC/ LC/ LC       | X     |
| *Schistochlamys melanopis* (Latham, 1790)  | Black-faced Tanager                  | X     |       |       | REG   |      | LC/ LC/ LC       | X     |
| *Schistochlamys ruficapillus* Vieillot, 1817 | Cinnamon Tanager                    |       |       |       | REG   |      | LC/ LC/ LC       | X     |
| *Paroaria capitata* (d'Orbigny & Lafresnaye, 1837) | Yellow-billed Cardinal | X     |       |       | REG   |      | LC/ LC/ LC       | X     |
| *Tangara sayaca* (Linnaeus, 1766)          | Sayaca Tanager                       | X     |       |       | REG   |      | LC/ LC/ LC       | X     |
| *Tangara palmorum* (Wied, 1821)            | Palm Tanager                         | X     |       |       | UBQ   |      | LC/ LC/ LC       | X     |
| *Tangara sayaca* (Linnaeus, 1766)          | Burnished-buff Tanager               | X     |       |       | UBQ   |      | LC/ LC/ LC       | X     |
| *Nemosia pileata* (Boddart, 1783)          | Hooded Tanager                       | X     |       |       | UBQ   |      | LC/ LC/ LC       | X     |
| *Conirostrum speciosum* Temminck, 1824     | Chestnut-vented Conebill             | X     |       |       | UBQ   |      | LC/ LC/ LC       | X     |
| *Sicalis flaveola* (Linnaeus, 1766)        | Saffron Finch                        | X     |       |       | REG   |      | LC/ LC/ LC       | X     |
| *Hemithraupis guina* (Linnaeus, 1766)      | Guira Tanager                        | X     |       |       | SEM   |      | LC/ LC/ LC       | X     |
| *Volatinia jacarina* (Linnaeus, 1766)      | Blue-black Grassquit                 | X     |       |       | REG   |      | LC/ LC/ LC       | X     |
| *Eucromis penicillata* (Spix, 1825)        | Gray-headed Tanager                  | X     |       |       | SEM   |      | LC/ LC/ LC       | X     |
| *Trichothraupis melanopis* Vieillot, 1818  | Black-goggled Tanager                | X     |       |       | SEM   |      | LC/ LC/ LC       | X     |
| *Coryphoegus cucullatus* (Statius Müller, 1817) | Red-crested Finch                  | X     |       |       | REG   |      | LC/ LC/ LC       | X     |
| *Tachyphonus coronatus* (Vieillot, 1822)   | Ruby-crowned Tanager                 | X     |       |       | SEM   |      | LC/ LC/ LC       | X     |
| *Ramphocelus carbo* (Pallas, 1764)         | Silver-beaked Tanager                | X     |       |       | SEM/CER |   | LC/ LC/ LC       | X     |
| *Tersina viridis* (Illiger, 1811)          | Swallow Tanager                      | X     |       |       | UBQ   |      | MPR             | LC/ LC/ LC |
| *Dacnis cayana* (Linnaeus, 1766)           | Blue Dacnis                          | X     |       |       | UBQ   |      | LC/ LC/ LC       | X     |
| *Coereba flaveola* (Linnaeus, 1758)        | Bananaquit                           | X     |       |       | UBQ   |      | LC/ LC/ LC       | X     |
| *Sporophila lineola* (Linnaeus, 1758)      | Lined Seedeeater                     | X     |       |       | REG   |      | MPR             | LC/ LC/ LC |
| *Sporophila caerulescens* (Vieillot, 1823) | Double-collared Seedeeater           | X     |       |       | REG   |      | MPR             | LC/ LC/ LC |
| *Sporophila leucoptera* (Vieillot, 1817)   | White-bellied Seedeeater             | X     |       |       | REG   |      | LC/ LC/ LC       | X     |
| *Sporophila angolensis* (Linnaeus, 1766)   | Chestnut-bellied Seed-Finch          | X     |       |       | REG   |      | LC/ LC/ LC       | X     |
| *Emberizoides herbicola* Vieillot, 1817    | Wedge-tailed Grass-Finch             | X     |       |       | REG   |      | LC/ LC/ LC       | X     |
| *Saltatricula atricollis* (Vieillot, 1817) | Black-throated Saltator              | X     |       |       | REG   |      | LC/ LC/ LC       | X     |
| *Saltator similis d'Orbigny & Lafresnaye, 1837* | Green-winged Saltator               | X     |       |       | SEM   |      | LC/ LC/ LC       | X     |
| **Fringillidae**                          |                                     |       |       |       |       |      |                 |       |
| *Spinus magellanicus* (Vieillot, 1805)     | Hooded Siskin                        | X     |       |       | REG   |      | LC/ LC/ LC       | X     |
| *Euphonia chlorotica* (Linnaeus, 1766)     | Purple-throated Euphonia             | X     |       |       | UBQ   |      | LC/ LC/ LC       | X     |
| *Euphonia violacea* (Linnaeus, 1758)       | Violaceous Euphonia                  | X     |       |       | SEM   |      | LC/ LC/ LC       | X     |
| **Estrildidae**                           |                                     |       |       |       |       |      |                 |       |
| *Estrilda astrild* (Linnaeus, 1758)        | Common Waxbill                       | X     |       |       | REG   |      | LC/ LC/ LC       | X     |
| **Passeridae**                            |                                     |       |       |       |       |      |                 |       |
| *Passer domesticus* (Linnaeus, 1758)       | House Sparrow                        | X     |       |       | REG   |      | LC/ LC/ LC       | X     |
Species endemic to the Atlantic Forest

*Thalurania glaucopis* (Gmelin, 1788). This species inhabits primary forest, forest edges, scrub, and suburban areas, such as parks and gardens (Weller 2018). It is an active nectarivore hummingbird and its presence is associated with the phenology of several plant species. During our surveys, we had only documented this species once, in April 2017, in a Semideciduous Forest area, at point no. 02.

*Baryphthengus ruficapillus* (Vieillot, 1818). *B. ruficapillus* is associated with primary and Gallery Forests, and is usually found in pairs or mixed flocks (Snow and Kirwan 2018). We documented it in a Semideciduous Forest near the Vargem Limpa River. Although there is evidence of population decline (BirdLife International 2018), it is abundant in the Semideciduous Forests of the surveyed area. We recorded it at points no. 02, 03, and 04.

*Conopophaga lineata* (Wied, 1831). The species is mostly associated with Ombrophilous Forest, and is regularly found in well-developed secondary growth and Gallery Forests. In São Paulo state, it is associated with humid
forests and preferentially inhabits bamboo thickets and dense growth (Whitney 2018). In the JBMB, we observed a pair of birds near a nest next to the main trail, which were observed for several months in 2017 at point no. 03. *Automolus leucophthalmus* (Wied, 1821). This species inhabits closed and humid areas, and is found in understory branches near the ground up to the midcanopy. *A. leucophthalmus* plays an important role in the formation of mixed flocks, and it is one of the species responsible for the maintenance of group cohesion (Remsen Jr and Kirwan 2018). It is quite common in Brazil, Paraguay, and Argentina (Sick 1997) and it was observed over several months during our surveys, mostly in the humid areas of the Semideciduous Forest, at points no. 02, 25, and 26.

*Todirostrum poliocephalum* (Wied, 1831). *T. poliocephalum* inhabits the canopy (Sick 1997) and the edges of humid forests, adjacent clearings, and even gardens (Walther 2018). It forages near the ground and in the canopy of low-growing trees. It is not dependent on...
preserved environments, and it might inhabit human-dominated areas with significant tree cover (Sick 1997). We observed it in the JBMB once (December 2016), near flooded fields associated with the Vargem Limpa River. It was recorded at point no. 03.

*Turdus subalaris* (Seebohm, 1887). *T. subalaris* inhabits Subtropical Humid Forests, secondary forests, eucalyptus plantations with understory native vegetation, and Riparian Forests with dense shrub vegetation (Sick 1997). This species is omnivorous, feeding mainly on fruits and supplement its diet with insect prey. It is a migratory species, arriving in southeastern Brazil in mid-September and departing in April (del Hoyo and Collar 2018). In the JBMB, we observed this species in Semideciduous Forest and Forest Savanna during March and April of 2016 and 2017. The species was recorded at points no. 05 and 06.

*Tachyphonus coronatus* (Vieillot, 1822). This is a species typical from southeastern Brazil, and inhabits humid forests, clearings, and parks. This species visits

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**Figure 6.** Birds recorded during our survey at the JBMB. A. Turquoise-fronted Parrot *Amazona aestiva* (point no. 16). B. Yellow-chevroned Parakeet *Brotogeris chiriri* (point no. 13). C. Blue-winged Parrotlet *Forpus xanthopterygius* (point no. 17). D. Barred Antshrike *Thamnophilus doliatus* (point no. 06). E. Cliff Flycatcher *Hirundinea ferruginea* (point no. 01). F. Rufous Hornero *Furnarius rufus* (point no. 19).
fruiting plants and lives near them, avoiding the need for long flights. It forages both in the higher strata and close to the ground (Hilty 2018). This species was observed in the Riparian Forest near the entrance to the main trail and was recorded at point no. 03.

Cerrado endemic species

*Herpsilochmus longirostris* Pelzeln, 1868. This species is found in Bolivia and Brazil, and occupies forests from the understory to canopy in Gallery, Deciduous, and Semideciduous Forests. It is generally found in fragments surrounded by Savanna vegetation. It forages with mixed flocks and exhibits systematical behavior, searching for insects over a whole tree before moving on to the next one. This species is regionally threatened in São Paulo state (São Paulo 2018). In the JBMB, we observed this species in the Semideciduous Flooded Forest at points no. 26 and 27.

*Antilophia galeata* (Lichtenstein, 1823). This species is found in Gallery Forests and Savannas, and is

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**Figure 7.** Birds recorded during our survey at the JBMB. A. Eastern White-throated Spadebill *Platyrinchus mystaceus* (point no. 03). B. Yellow-chinned Spinetail *Certhiaxis cinnamomeus* (point no. 13). C. Chalk-browed Mockingbird *Mimus saturninus* (point no. 19). D. Flavescent Warbler *Myiodytes flaveola* (point no. 5). E. Helmeted Manakin *Antilophia galeata* (point no. 08). F. Variegated Flycatcher *Empidonax varius* (point no. 18).
common in Deciduous Forests, buriti (*Mauritia flexuosa* L.f.) palm grooves, and swampy woodland (Snow and de Juana 2018). It has an abundant population in the JBMB, as it is found from primary forests to regeneration areas. It was recorded at points no. 06, 07, 08, and 09.

*Cyanocorax cristatellus* (Temminck, 1823). *C. cristatellus* inhabits dry Cerrado forests, but it is also associated with riparian woods, forest edges, and clearing areas with sparse vegetation. It is found in many modified landscapes, including eucalyptus plantations, borders, and gardens (Anjos 2018). Although it is considered endemic to the Cerrado domain, the distribution of this species has expanded to areas of Atlantic Forest (Dário et al. 2002). We observed this species over several months on Forest Savanna edges at point no. 21.

*Saltatricula atricollis* (Vieillot, 1817). This is a Cerrado-endemic species that possibly also dwells in the Cerrado enclaves in the Pantanal and Caatinga domains (Pacheco 2003). In São Paulo state, it is mainly threatened by fragmentation and the loss of native areas.

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**Figure 8.** Birds recorded during our survey at the JBMB. **A.** Silver-beaked Tanager *Ramphocelus carbo* (point no. 3). **B.** Purple-throated Euphonia *Euphonia chlorotica* (point no. 10). **C.** Swallow Tanager *Tersina viridis* (point no. 06). **D.** White-browed Meadowlark *Sturnella superciliaris* (point no. 16). **E.** Chestnut-capped Blackbird *Chrysomus ruficapillus* (point no. 13). **F.** Hooded Siskin *Spinus magellanicus* (point no. 19).
which are transformed into pastures and agricultural areas. This species was found in several different months during our surveys, and was mostly observed in areas undergoing regeneration, near to points no. 20 and 21.

**Threatened species.** We found 1 species threatened at a global (IUCN 2019), 2 at a national (ICMBio/MMA 2018), and 8 at a regional level (São Paulo 2018).

**Primolius maracana** (Vieillot, 1816). Globally and nationally Near Threatened, and regionally Vulnerable. This species lives in Tropical Evergreen Forests, palm groves, and gallery woodlands (Collar et al. 2018a). However, in São Paulo state, the native forest vegetation is restricted to small fragments (Nunes and Galetti 2007), decreasing its area of occurrence. *P. maracana* also has low genetic variability (Craveiro and Miyaki 2000), which further threatens its survival. Natural habitat loss and traffic activities are the main factors increasing its risk of extinction (Juniper and Parr 1998). In the JBMB, we directly observed and heard the species only once, in a wetland near the Vargem Limpa River in August 2016, outside the point counts (22°20′39″S, 049°00′54″W).

**Amazona aestiva** (Linnaeus, 1758). Nationally and regionally Near Threatened. This species inhabits Cerrado, Chacos, and subtropical forests, and is restricted to primary forests with sufficiently tall trees for nesting (Collar et al. 2018b). It has been affected by illegal capture and traffic since the 1980s (BirdLife International 2018) and has suffered population decline due to fragmentation and deforestation (Collar et al. 2018b). It was recorded next to the JBMB main trail, at point no. 02.

**Rhynchotus rufescens** (Temminck, 1815). Regionally Endangered. The species inhabits areas up to 2500 m above sea level. In tropical lowlands, it shows preference for wet grasslands and Savanna woodland. It is primarily an insectivore, but it also feeds on seeds, fruits, roots, and bulbs when insects are scarce. *R. rufescens* is considered sedentary and is subject to poaching for its meat. Populations in Brazil are in steady decline due to hunting pressures associated with habitat loss and poisoning by insecticides (Cabot et al. 2019). In the JBMB, we found this species in open grasslands in the regenerating area, especially at points no. 20–23.

**Penelope superciliaris** (Temminck, 1815). Regionally Near Threatened. *P. superciliaris* occupies a wide range of vegetal physiognomies, from Cerrado to dense and humid forests. It is a large generalist frugivore that forages in flocks of up to 10 individuals, maintaining a sedentary habit. It exhibits no major movement patterns throughout its life (del Hoyo and Kirwan 2018). In the JBMB, the species is abundant in Semideciduous Forest and was recorded at points no. 02–04.

**Heliornis fulica** (Boddart, 1783). Regionally Endangered. This species lives in dense vegetation on the margins of water bodies (Bertram and Kirwan 2018), and the loss of riparian habitats is the main threat to its survival (Bressan 2009). There are few records of this species in São Paulo state, which makes its presence in the JBMB extremely valuable. We found one individual in a lake located on the western border of the JBMB, in its limit with the Municipal Zoological Garden of Bauru (22°20′31″S, 049°01′02″W).

**Crotaphaga major** Gmelin, 1788. Regionally Near Threatened. This species is relatively demanding regarding habitat quality, with few records existing in the state, because it is commonly found in aquatic macrophytes and hanging vegetation above water (Payne and de Juana 2018). The loss of most Riparian Forests due to construction of hydroelectric power plants in São Paulo state led to a significant decrease in its populations. This species was recorded in the JBMB surveys, in which 2 researchers reported the presence of 3 individuals in an area adjacent to Semideciduous Flooded Forest in November 2016 (22°20′40″S, 049°01′04″W).

**Bubo virginianus** (Gmelin, 1788). Regionally Endangered. *B. virginianus* occupies forested habitats, such as Semideciduous Forests, secondary forests, and urban city parks. *B. virginianus* usually forages in open areas and feeds on insects, fishes, amphibians, birds, and small mammals. It is a resident species, although it includes some outlier subspecies populations migrating from North America when resources are scarce (Holt et al. 2018). Although it is not threatened at a global scale, it is considered Endangered in São Paulo due to population decline (São Paulo 2018). We recorded this species over several months, both in Forest Savanna and Semideciduous Forest, at points no. 03 and 12.

**Herpsilochmus longirostris** Pelzeln, 1868. Regionally Near Threatened and a Cerrado endemic. See the previous section on endemic species.

**Neopelma pallescens** (Lafresnaye, 1853). Regionally Near Threatened. This species is common in dense and tangled vegetation (Snow 2018), especially in Semideciduous and Gallery Forests. It inhabits the midstory stratum of Forest Savanna (1–5 m from the ground) and feeds mainly on insects and fruits (Willis and Oniki 2003). Because the species has narrowly defined habitat preferences, the main threats to it are related to fragmentation and habitat loss in São Paulo state. Therefore, *N. pallescens* is considered Endangered on the São Paulo Red List (São Paulo 2018). We recorded this species over 2 consecutive months (August and September 2017) in Forest Savanna remnants at points no. 08 and 09.

**Discrimination between congeneric taxa.** We recorded some congeneric species that are difficult to differentiate during surveys. Here, we list the diagnostic features that allowed these species to be distinguished, based on Grantsau (2010).
Crypturellus obsoletus, Crypturellus parvirostris, and Crypturellus tataupa. We identified these species based on song. C. tataupa has a vocalization with trilled notes descending in frequency, which tends to be shorter than the songs of the other two species. C. parvirostris has long songs with whistled notes that are repeated in acceleration, ending in a decline in frequency and with repeated trilled notes at the end of the vocalization. C. obsoletus produces vocalizations with structure similar to C. parvirostris, but the final portion of its vocalization ends abruptly, with no repetition of notes. C. obsoletus was recorded at point no. 02, C. parvirostris was recorded at point no. 12, and C. tataupa was recorded at point no. 16.

Laterallus viridis and Laterallus melanophaius. Both species were identified by their songs. While L. melanophaius has a fast-trilling vocalization, L. viridis songs have introductory notes, with a slower pace of elements. L. melanophaius was found at point no. 15, while L. viridis was found at point no. 01.

Leptotila verreauxi and Leptotila rufaxilla. L. verreauxi has a crown and neck with a greenish glow, olive-brown upper part, and a pale gray undertail that becomes white on the belly, and vocalizations with 2 low-frequency notes. In contrast, L. rufaxilla has a bluish gray crown, nape, and hindneck with a grayish purple glow, dark-brown upper part, and a greyish pink under part that becomes white on the belly, and low-pitched vocalizations with just 1 descending note. Both species were found at points no. 02–07.

Crotophaga major and Crotophaga ani. While C. ani has a uniform black color from the bill to the tail, C. major has dark-blue underparts and upper parts with a greenish sheen, prominent culmen, and white iris. We found C. major in a flooded field (22°20′40″S, 049°01′04″W) and C. ani in the open area of Savanna in regeneration, at points 17–24.

Herpsilochmus atricapillus and Herpsilochmus longirostris. We found each species in distinct habitats. H. atricapillus was only present in Forest Savanna, while H. longirostris was only present in a fragment of Semideciduous Flooded Forest. Female individuals of H. atricapillus have a black crown streaked with white dots, and a buff tinge on the breast, flank, and crissum. Meanwhile, females of H. longirostris have a bright orange head and neck, and bright-cinnamon underparts. We found H. atricapillus at points no. 03 and 07, while H. longirostris was found at points no. 25–28.

Todirostrum poliocephalum and Todirostrum cinereum. Both species are distinguished by the bright yellow suproral mark, which is present in T. poliocephalum and absent in T. cinereum. Furthermore, songs of T. poliocephalum have slower trill rates than those of T. cinereum. We found T. poliocephalum at point no. 03 and T. cinereum at points no. 03–07.

Elaenia flavogaster, Elaenia mesoleuca, and Elaenia obscura. These species have similar morphology. E. obscura was only found in a forest area, while E. flavogaster and E. mesoleuca were found in a regeneration area. Morphologically, E. mesoleuca and E. flavogaster are quite similar, differing in the crest (present only in E. flavogaster) and in the color of their undertails (greyish olive breast and pale yellow belly in E. flavogaster, and dull olive breast and greyish white belly in E. mesoleuca). In contrast, E. obscura is noticeably bigger than the other species, and has a remarkably short bill and darker upper parts than the other species. We recorded E. flavogaster at points no. 13–24, E. mesoleuca at points no. 23–24, and E. obscura at point no. 09.

Myiarchus ferox and Myiarchus swainsoni. Like the Elaenia spp., Myiarchus spp. have similar external morphology. Therefore, these congeners were distinguished based on their vocalizations. M. ferox has trilled elements in its song, while M. swainsoni produces short and frequency-modulated notes that sounds like a “hiccup.” We recorded M. ferox at the edges of Semideciduous Forest (points no. 01 and 02), in the Forest Savanna (points 05–10), and in the regenerating area (points 17–24). We recorded M. swainsoni in the last points of the regenerating area (points 20–24).

Euphonia chlorotica and Euphonia violacea. These species are distinguished by the color of their throats. E. chlorotica has a dark-metallic blue throat, while E. violacea has a golden yellow throat. E. chlorotica was found at points no. 02–10, while E. violacea was only found at point no. 05.

Discussion

Our results demonstrate that JBMB have a high species richness, which might be related to its location in the transitional area between the Atlantic Forest and Cerrado domains. We identified 9 species that are subject to some degree of threat and 11 endemic species (7 from Atlantic Forest and 4 from Cerrado). In addition, 31 species exhibited some degree of migratory behavior.

When comparing our results to other surveys in Semideciduous Forests, it is evident that the richness of the JBMB is greater than that in the more extensive areas of the interior Atlantic Forests of São Paulo. Donatelli et al. (2007) reported the presence of 65 and 64 species in fragments of 350 and 480 ha of Semideciduous Forest, respectively. We must take into account that their sampling effort was smaller than ours, as they spent 80 h using point counts in secondary-growth forests. However, our study documented higher richness, even when compared to other studies with longer sampling efforts, such as Aleixo and Vielliard (1995), who recorded 97 species in a 251 ha remnant over 235 h using point counts. The elevated richness (220 bird species) in our study could be due to the diverse habitats of the JBMB, which encompasses Semideciduous Forests and other...
Atlantic forest phytophysionomies. Moreover, the high degree of anthropogenic activities in the surrounding areas might also enhance species richness by the inclusion of some resilient taxa to disturbed environments, especially in tropical environments (Alexio 1999, Mulwa et al. 2012, Asefa et al. 2017).

Few studies have been conducted in Forest Savanna and have recorded much lower richness, with fewer than 100 species being associated exclusively with this physiognomy (Caverzere et al. 2011). More species were detected in studies that included other Savanna physiognomies, such as grasslands and shrublands. Manica et al. (2010) recorded 160 bird species in 472 ha Cerrado fragment over 95 h using qualitative surveys. However, of all of these species, only 28 were found in Forest Savanna physiognomy. Other studies encompassing more extensive areas over longer sampling periods obtained a similar number of species to our study. For instance, Motta-Júnior et al. (2008) recorded 231 species over 580 h of sampling in 2,300 ha of Cerrado grasslands using point counts. Lucindo et al. (2015) recorded 226 species in 380 h of sampling 2,712 ha mixed physiognomies of Cerrado using transect counts.

Of the non-passerines, the greatest number of species were represented by the families Trochilidae, Accipitridae, and Columbidae. Their presence is associated with the fragmented areas and their conspicuous behavior makes them easy to be detected during sampling (Sick 1997). Columbidae are predominantly granivores, while Accipitridae are carnivores. Such feeding behaviors are favored in open habitats, such as Forest Savanna and the regenerating areas of the JBMB (Chettri et al. 2004, Winkler et al. 2015). The richness of the Trochilidae is indicative of the abundance of floral resources, because species of this family are predominantly nectarivores (Wilman et al. 2014). The presence of several physiognomies in the study area might provide diverse flowering plants at different times of the year, especially in the transition periods between dry and rainy seasons (Pirani et al. 2009). Finally, the presence of a network of wetlands, lakes, and rivers in the study area favored the presence of species dependent on aquatic environments, such as those of the families Ardeidae and Rallidae (7 species each).

Among Passeriformes, Tyrannidae and Thraupidae had more species than the other families, greatest number of species were represented by the families Both are typical of Neotropical bird communities, and the family Tyrannidae is one of the largest groups in the region (Ridgely and Tudor 1994, Sick 1997). This phenomenon might be associated with the generalist habit of several species in this family (Sick 1997), which allows them to access several types of habitats. On the other hand, several species of Thraupidae feed on fruits and act as seed dispersers (Ridgely and Tudor 1989) and are important for maintaining plant diversity. The richness of Thraupidae can also be associated with recent taxonomic changes proposed by Piacentini et al. (2015) which subsumed the formerly separate Emberizidae and Coerebidae as subfamilies within Thraupidae. This fusion increased the number of species of Thraupidae from 99 species to 173 species. Nonetheless, the richness of frugivorous and granivorous birds could indicate the variety of the habitats available in the region.

When comparing our survey to a previous survey on Forest Savanna in the JBMB area, we found 28 species that were not reported by Caverzere et al. (2011). Of these, we recorded 8 endemic species (5 to Atlantic Forest and 3 for Cerrado), and 2 threatened taxa, which are noteworthy records. However, these authors reported 10 species that we did not find during our study. Yet, we observed 8 of these species in other environments near the JBMB. The 2 other species unique to the survey by Caverzere et al. (2011) were Leptodon cayanensis and Hylophilus poicilotis. The absence of records on L. cayanensis in our survey might be related to its tendency to occupy a large territory (Brown and Amadon 1989). Its movement across the landscape might make it difficult to record this species in the study area. In contrast, the record of H. poicilotis seems to be questionable, since we recorded only Hylophilus amaurocephalus, a very similar congeneric species. H. amaurocephalus was also recorded by Rangel de Almeida et al. (2010) at the Bauru Ecological Station, with this being the only record of the genus in the vicinity of our survey site. In addition, citizen science databases also show records of only H. amaurocephalus in Bauru (Wikiaves 2019). The nearest record of H. poicilotis is from the city of Campinas, located more than 200 km away from the JBMB (eBird 2019). In comparison, H. amaurocephalus is quite common in the meso-region of Bauru, with records in the nearby cities (eBird 2019). Therefore, we suggest that the record of H. poicilotis in the JBMB is incorrect, because the songs of these 2 species are similar. Because H. poicilotis is endemic to the Atlantic Forest (Bencke et al. 2006), it is not likely to inhabit an area of Forest Savanna, even in a transitional area such as the JBMB.

According to Somenzari et al. (2018), Brazil has 198 migratory species, which corresponds to approximately 10% of all species found in the country. In our surveys, we observed 31 species (14.1%) exhibiting migratory behavior. For species defined as migrants, the records of Chordeiles minor and Chaetura meridionalis are of note. C. minor reproduces in North and Central America, migrates to South America in September, and returns to its locations of origin in April (Cleere 2018). C. meridionalis reproduces in Brazil during the austral summer and migrates north to Panama, Venezuela, and French Guiana in the winter (del Hoyo et al. 2018).

Records of endemic species is important because they are negatively affected by habitat fragmentation and loss (Alexio and Vielllard 1995, Anjos 2001). These species can be considered habitat specialists, and their presence in our survey can be an indicative of the quality of forest remnants. In the Semideciduous Forest, we recorded 7 Atlantic Forest endemics. Few endemic species were
recorded in our survey compared to other surveys: 33 spp. by Faria et al. (2006), 43 spp. by Ubaid (2009), and 22 spp. by Vianna et al. (2017). Antunes (2007) recorded the disappearance of 9 endemic species over 30 years in a fragment of Semideciduous Forest, while the abundance of another 9 species significantly declined. Alternatively, we recorded 4 Cerrado endemic species, which was more than that recorded by Cavarzere et al. (2011) at the same location; Cavarzere et al. recorded only Antilophia galeata as endemic to the Cerrado. Both Cyanocorax cristatellus and Saltator atricollis are Cerrado endemic species that we found exclusively in the regenerating area, which is because they normally inhabit open physiognomies of savanna. Cavarzere et al. (2011) did not find these species because they restricted their survey to closed physiognomies (forest savanna and semideciduous forest). Our study obtained a similar richness of endemic Cerrado taxa when compared to previous studies: 6 spp. by Motta-Júnior et al. (2008), 6 spp. by Manica et al. (2010), and 6 spp. by Lucindo et al. (2015). The presence of such endemic taxa could point to the capacity of the environment to provide sufficient resources across seasons (Antunes 2007) and might be related to the different stages of vegetation regeneration.

The richness of birds recorded in the JBMB might be related to the large area of continuous native forest (803 ha) and the presence of areas at different stages of forest regeneration. The number of species in a given location is associated with habitat heterogeneity, which is an important predictor of bird richness (Stein et al. 2014, Stirnemann et al. 2015) and is important for local community maintenance (Develey et al. 2010). A greater diversity of habitats is related to a greater diversity of resources, which supports a greater number of species. Thus, the regenerating area of the JBMB supports species exclusive to open areas, which dominate such places. Meanwhile, the savanna remnants surrounding the regenerating area could also contribute to increase the number of the species in this location, which could improve the regional richness by landscape supplementation (Dunning et al. 1992). Birds dwelling in closed environments could use the regeneration area to gather supplementary resources in adjacent boundaries (Tubelis et al. 2004, Brotons et al. 2005), which could explain the presence of forest-dwelling species in an open area.

In conclusion, the JBMB is an important area with a richness of bird species higher than other surrounding conservation units. Such richness is attributed to the transition between the Atlantic Forest and Cerrado, as well as to the variety of physiognomies and successional stages in the area favoring the distribution of several taxa within a restricted area. Although we only recorded few endemic and threatened species, these records demonstrate the capacity of the local environment to support species that require specific ecological resources. Our findings also contribute to the knowledge of avian richness in transitional areas, demonstrating the importance of this type of environment for the maintenance of bird diversity.

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GSC, RMV, and RWG contributed equally with the study design, data collection, discussion, and writing of the manuscript. RJD contributed with the supervision of this project, and with the correction of the final manuscript.

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