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## FIRST ASSESSMENT OF THE AVIFAUNA OF *ARAUCARIA* FORESTS AND OTHER HABITATS FROM EXTREME SOUTHERN MINAS GERAIS, SERRA DA MANTIQUEIRA, BRAZIL, WITH NOTES ON BIOGEOGRAPHY AND CONSERVATION

MARCELO FERREIRA DE VASCONCELOS<sup>1,4</sup>  
SANTOS D'ANGELO NETO<sup>2,3</sup>

### ABSTRACT

*The avifauna of the Araucaria forests in the higher reaches of the Serra da Mantiqueira massif is little known and poorly documented. This region is recognized as an important area of differentiation of birds in southeastern Brazil. Here, we present the first ornithological survey of the Araucaria forests and associated habitats in the mountains of extreme southern Minas Gerais state, near the southern tip of the Serra da Mantiqueira. The study area comprises the Serra do Juncal region and several adjacent sites, located in the municipalities of Gonçalves and Camanducaia. We recorded 206 bird species, of which 57 (27.7%) are endemic to the Atlantic forest. Several records represent the first specimens for Minas Gerais, in the hinterlands of Serra da Mantiqueira, proving that many Atlantic species also occur in the intern most slope of this mountain range. Examples are: Dysithamnus xanthopterus, Chamaeza ruficauda, Leptasthenura setaria, Heliobletus contaminatus, Hemitriccus obsoletus, Phylloscartes difficilis, Piprites pileata, Poospiza thoracica, and Cacicus chrysopterus. The region is also a previously unknown area of sympatry of other closely related species: Scytalopus notorius and S. speluncae, Lepidocolaptes squamatus and L. falcinellus, and Basileuterus culicivorus and B. hypoleucus. Both species of Lepidocolaptes and Basileuterus hybridize in the region. We also comment on the avifauna conservation, which have been threatened by eco-tourism, building of new styles of houses, domestic animals, forest fragmentation, and plantations.*

KEYWORDS: Avifauna; *Araucaria* forests; Serra da Mantiqueira; Minas Gerais; Brazil.

1. Departamento de Zoologia, ICB, Universidade Federal de Minas Gerais, Caixa Postal 486, 30161-970, Belo Horizonte, MG, Brasil. E-mail: mfvasconcelos@gmail.com

2. Departamento de Biologia Geral, Universidade Estadual de Montes Claros, Avenida Doutor Ruy Braga, s/nº, 39401-089, Montes Claros, MG, Brasil.

3. Current address: Pós-graduação em Engenharia Florestal, Departamento de Ciências Florestais, Campus da Universidade Federal de Lavras, 37200-000, Lavras, MG, Brasil.

4. Corresponding author: Marcelo Ferreira de Vasconcelos. Current address: Rua Paraíba, 740, apartamento 501, 30130-140, Belo Horizonte, MG, Brasil. Telephone: +55 31 3425-4673. E-mail: mfvasconcelos@gmail.com

## INTRODUCTION

Only 7.26% of the original cover of the Atlantic forest still persists in form of fragments (Ranta *et al.*, 1998; Mittermeier *et al.*, 1999; Fundação SOS Mata Atlântica & Instituto Nacional de Pesquisas Espaciais, 2008). In this region, c. 660 bird species have been recorded, of which approximately 200 are endemic and 68% rare (Scott & Brooke, 1985; Goerck, 1997; Brooks *et al.*, 1999). Within the Atlantic forest region, the *Araucaria* forests occur mainly in southern Brazil, with isolated patches in northeastern Argentina and in higher altitudes on the mountains of southeastern Brazil, such as the Serras da Mantiqueira, de Paranapiacaba, and da Bocaina (Ruschi, 1950; Hueck, 1953, 1972; Cozzo, 1960; Segadas-Viana, 1965; Bigarella *et al.*, 1975; Moura, 1975; Rizzini *et al.*, 1991; Morrone, 2001; Giraudo *et al.*, 2005). The Serra da Mantiqueira, located along the borders of the states of Minas Gerais, São Paulo, and Rio de Janeiro, is a mountain range extending in a southwest-northeast direction, parallel to the Paraíba do Sul river valley. This is one of the highest regions in Brazil, where several peaks reach over 2,500 m (Martinelli & Orleans e Bragança, 1996).

The avifauna from the *Araucaria* forests has been surveyed in some detail in southern Brazil and northeastern Argentina (e.g., Rodrigues *et al.*, 1981; Anjos, 1990, 1992, 1994; Berndt, 1992; Pichorim & Boçon, 1996; Anjos & Schuchmann, 1997; Anjos *et al.*, 1997; Anjos & Boçon, 1999; Bencke & Kindel, 1999; Lima *et al.*, 2001; Krauczuk & Baldo, 2004; Straube *et al.*, 2005; Bodrati & Cockle, 2006a, b; Straube & Di Giacomo, 2007; Favretto *et al.*, 2008), but this habitat has been little sampled in the Serra da Mantiqueira. Ornithological surveys in this region have been concentrated in São Paulo state, highlighting a bird collection from Campos do Jordão made by Hermann Lüderwaldt between 1905 and 1906, now housed in the Museu de Zoologia da Universidade de São Paulo (MZUSP) (Pinto, 1945). Further avifaunal surveys were also conducted in the Campos do Jordão State Park, although with no or little documentation for many species (Willis & Oniki, 1981; Barbosa, 1992). Only a few sparse ornithological records exist for some bird species in the *Araucaria* forests occurring in the states of Minas Gerais and Rio de Janeiro (e.g., Holt, 1928; Pinto, 1951, 1952, 1954; Mattos *et al.*, 1991; Andrade, 1996; Andrade *et al.*, 1997; Vasconcelos, 1999, 2008), and the avifauna of these areas has never been properly surveyed.

Further, the region comprising the Serra da Mantiqueira, Paraíba do Sul river valley, and Serra da

Bocaina has experienced marked geological and vegetational changes since the Pliocene due to tectonic activity and climatic fluctuations (Petri & Fúlfaro, 1986; Ab'Sáber, 1990; Behling, 1997, 1998, 2002; Safford, 1999, 2007; Garcia *et al.*, 2004). For this reason, this region was recognized as an important area of differentiation of birds in southeastern Brazil (Pinto, 1978; Sick, 1985; Silva & Stotz, 1992; Willis, 1992a; Silva & Straube, 1996; Silva *et al.*, 2004) and was included in an endemic bird area (EBA 076 – Atlantic forest mountains) by Stattersfield *et al.* (1998). Nevertheless, knowledge on geographic variation and taxonomy of many species from the higher areas of Serra da Mantiqueira is still very poor due to the lack of ornithological surveys and collections. Thus, the aim of this paper is to present the first ornithological survey of the *Araucaria* forests and associated habitats from the mountains of extreme southern Minas Gerais state, part of the southern tip of Serra da Mantiqueira. We also comment on distribution, geographic variation, hybridization, and conservation of some species.

## MATERIAL AND METHODS

The study area comprises the mountain ridge known as Serra do Juncal and several adjacent sites, in the municipalities of Gonçalves and Camanducaia, Minas Gerais (Fig. 1). Elevation is between 1,250 and 2,050 m. Climate is temperate and rainy with cool summers (type Cwb of Köppen classification) (Ayoade, 1998). Temperatures vary between the averages of 14° and 19°C, reaching less than 0°C during the winter (DER/MG, 1998; pers. obs.). Mean annual precipitation vary between 1,600 and 1,800 mm (DER/MG, 1998). The main vegetation type in the study area is mixed montane forest (“floresta ombrófila mista altimontana”) with “pinheiro-do-paraná” (*Araucaria angustifolia*) and “pinho-bravo” (*Podocarpus lambertii*). On the highest elevations the dominant vegetation is cloud and elfin forest (“floresta ombrófila densa altimontana”), with fewer *A. angustifolia* and many more bamboo stands (especially from the genera *Chusquea* and *Merostachys*). The upper stratum of these forests vary between 17 and 25 m, represented principally by *Ocotea lancifolia*, *Cabralea canjerana*, *Myrcia fallax*, *Drimys brasiliensis*, *Prunus myrtifolia*, *Lamanonia ternata*, *Weinmania paulliniifolia*, *Sapium glandulosum*, *Myrceugenia alpigena*, *Myrsine umbellata*, *Calyptanthus concinna*, *Macropeplus dentatus*, *Meliosma sellowii*, *Ilex paraguariensis*, *Croton urucurana*, *Citronella paniculata*, and *Maytenus evonymoides*

(França & Stehmann, 2004). Epiphyte (especially bromeliads and orchids) species richness is high and ferns are also common (Melo & Salino, 2007; pers. obs.). The highest peaks harbor a typical vegetation of high-altitude grasslands (“campos de altitude”) associ-

ated with rock outcrops (see Martinelli & Orleans e Bragança, 1996; Safford, 1999, 2007). Some forested areas of the study area have been partially converted for agricultural purposes, especially by commercial plantations of potato, *Pinus*, *Araucaria*, and *Euca-*

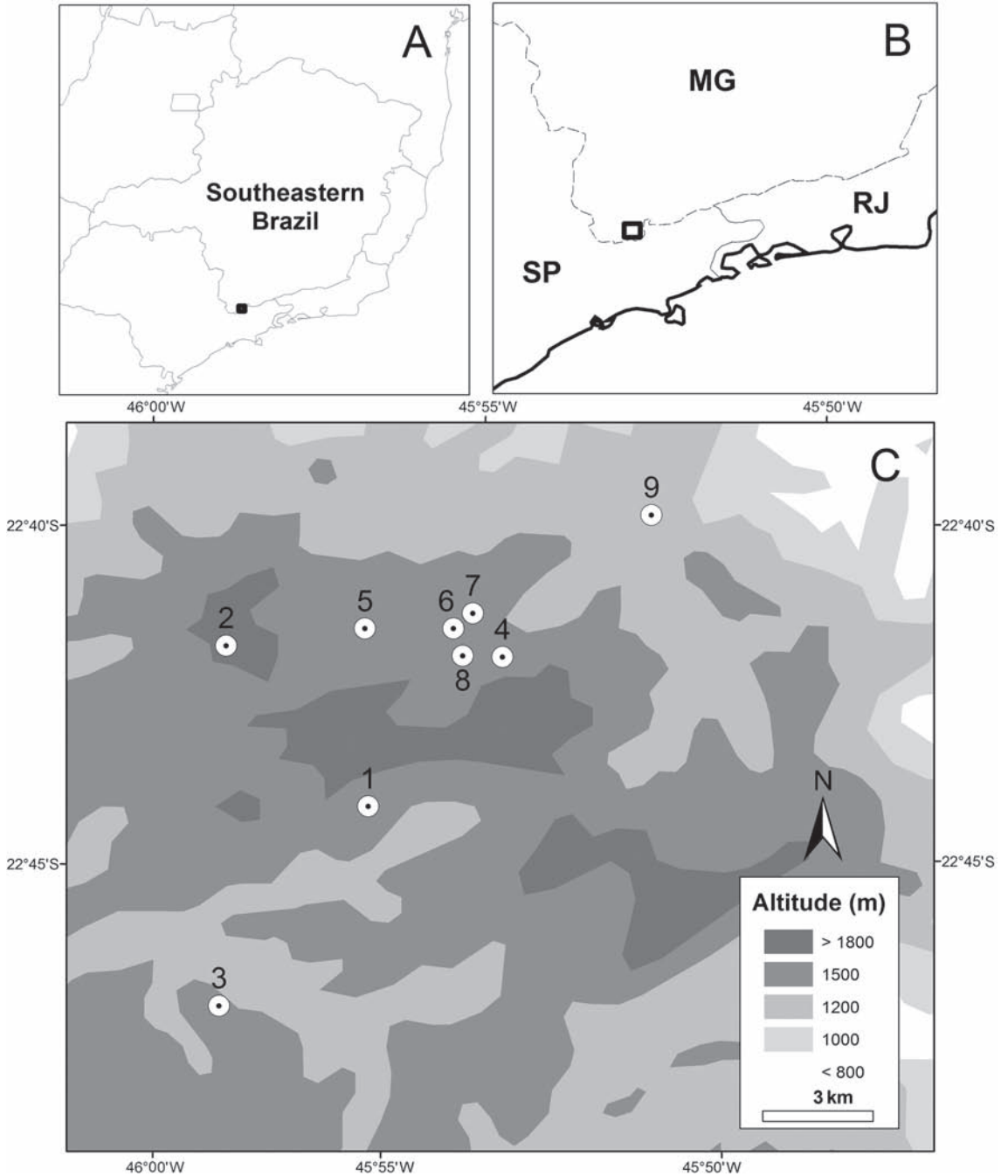


FIGURE 1: Map of the study area in southeastern Brazil (A and B) and the surveyed sites (C): 1 = Serra do Juncal, 2 = Pedra de São Domingos, 3 = Taperinha, 4 = Bicho do Mato, 5 = Lua de Pedra, 6 = Sebastião Lauriano I, 7 = Sebastião Lauriano II, 8 = Sertão do Cantagalo, 9 = Gonçalves city. Brazilian states: MG = Minas Gerais, RJ = Rio de Janeiro, SP = São Paulo.

*lyptus*, besides artificial pastures for cattle ranching (Moreira *et al.*, 2002).

Our survey was conducted along 51 days, totaling 392 h of fieldwork, between the years of 2006 and 2008 in the following localities:

1. Serra do Juncal: a 2,700 ha forest fragment, between 22°42'10" and 22°45'29"S, 45°51'42" and 45°58'26"W. Elevation ranges between 1,460 and 2,000 m. Montane forest ("floresta ombrófila densa altimontana") is the dominant vegetation in this area. These forests are associated with several tracts of *Araucaria* forests ("floresta ombrófila mista"), small marshes, artificial pastures and plantations (potato, *Araucaria*, *Pinus*, and *Eucalyptus*). This area was surveyed in 2006: 1 June; 2007: 18 January, between 4 and 7 March, 26 and 28 March, between 5 and 7 May, 11 and 31 May, 1 June, 9 July, and 27, 28, and 30 September; and 2008: 9 and 11 January, totaling 122 h of sampling effort. This area is locally known as "matão".

2. Pedra de São Domingos and adjacent forests: Pedra de São Domingos is the highest peak in the region (22°41'28"S, 45°57'35"W), reaching 2,050 m. The main vegetation on the mountaintop is "campo de altitude" with rock outcrops associated to cloud and elfin forests in different regeneration stages on the mountain slopes. Forest and grassland habitat types were surveyed between 22°41'10" and 22°42'27"S, 45°56'43" and 45°58'28"W, between 1,600 and 2,050 m. Forest habitats are in direct contact with pastures and plantations in several places. These forests sum c. 350 ha. This area was sampled on 2 June 2006 and along 2007 on 17 January, 4 and 27 March, 8 and 10 May, 13 July and 29 September, totaling 35 h of sampling.

3. Taperinha: a 70 ha forest fragment represented by *Araucaria* forest between 1,495 and 1,615 m (centered at 22°46'47"S, 45°57'41"W). The surveyed area also included adjacent pastures and plantations. This area was sampled in 2007 on 2 June, between 9 and 12 July, and 27 September, totaling 45 h of sampling effort.

4. Bicho do Mato: a small forest fragment of c. 20 ha (centered at 22°41'38"S, 45°53'32"W) between 1,550 and 1,610 m and connected to the larger forest of Serra do Juncal by two narrow forested corridors of c. 15-70 m width. This area also includes areas subject to the use of people, such as a hotel, pastures and orchards. Surveys were conducted on 1 June 2006 and

along 2007: 17 January, 3 March, 8 and 9 May, 1 June, 28 and 29 September, totaling 50 h of sampling effort.

5. Lua de Pedra: a 260 ha forest fragment (centered at 22°41'13"S, 45°55'33"W) between 1,685 and 1,740 m located nearby the village of Sertão do Cantagalo. This area was surveyed on 25 and 26 September 2007 and between 9 and 10 January 2008, totaling 20 h of sampling effort.

6. Sebastião Lauriano I: a small forest fragment of c. 9 ha (centered at 22°41'13"S, 45°54'15"W) between 1,600 and 1,660 m. This fragment is completely isolated from other forests by pastures and potato plantations. This area was surveyed on 16 January, and between 27 February and 2 March 2007, totaling 42 h of sampling effort.

7. Sebastião Lauriano II: a very small forest fragment of 0.9 ha (centered at 22°40'59"S, 45°53'58"W) between 1,640 and 1,665 m. This fragment is isolated from others and is subject to cattle entrance, where the understorey was completely removed. This area was surveyed on 16 January, 28 February and 1 March 2007, totaling 5 h of observations.

8. Sertão do Cantagalo and surroundings: a small village in the municipality of Gonçalves at 1,550 m (22°41'37"S, 45°54'07"W). It is surrounded by second-growth, potato plantations, pastures and marshy areas. This area was sampled in 2006: 1 June; 2007: 18 January, 5, 9, and 11 May, 1 June, 9, and 13 July; and 2008: 9 January, totaling 20 h of observations.

9. Gonçalves city and surroundings: centered at 22°39'32"S, 45°51'21"W, this city is located at c. 1,250 m among a matrix of pastures, small forest fragments, and plantations of potato and *Araucaria*. Opportunistic observations were carried out in this area in the years of 2006: 31 May and 2 June; 2007: between 15 and 19 January, between 26 February and 8 March, between 26 and 28 March, between 5 and 11 May, between 30 May and 3 June, between 8 and 14 July, between 25 and 30 September; and 2008: between 9 and 12 January, totaling 53 h of observations.

The avifaunal survey was conducted especially in *Araucaria* forests and in other habitat types of the study area. Bird species were identified by observations with binoculars and/or by recognizing their vocalizations. Whenever possible, bird vocalizations were

tape-recorded with Sony TCM-5000EV and Panasonic RQ-L31 tape-recorders and Sennheiser ME66 microphones. Copies of these vocalizations were deposited in the Arquivo Sonoro Prof. Elias Coelho (ASEC), Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil. Some voucher-specimens were also collected with mist-nets and carabines, and they have been deposited in the Coleção Ornitológica do Departamento de Zoologia da Universidade Federal de Minas Gerais (DZUFMG), Belo Horizonte, Minas Gerais, Brazil.

Taxonomy follows the Brazilian Committee of Ornithological Records (CBRO, 2007). Bird species were classified following their conservation status, endemism and forest dependence following several authors (Ridgely & Tudor, 1989, 1994; Silva, 1995; Stotz *et al.*, 1996; Sick, 1997; Machado *et al.*, 1998, 2005; Stattersfield *et al.*, 1998; Brooks *et al.*, 1999; BirdLife International, 2007).

## RESULTS AND DISCUSSION

### Species composition

We recorded a total of 206 bird species in the region (Appendix 1). Among them, 57 species (27.7%) are endemic to the Atlantic forest, one is endemic to the Cerrado region (a possible invader, see Lopes, 2008), one is threatened in Brazil and globally vulnerable, 12 are threatened in Minas Gerais state, eight are globally near-threatened, and three are near-threatened in Brazil (Appendix 1). A total of 138 species (67%) is forest dependent or semi-dependent, the remaining being represented by species typical of open habitats of the region ("campos de altitude" and marshes) or by species that have expanded their range due to deforestation (invaders) (Appendix 1).

### Species accounts

Below, we present comments on distribution, geographic variation, hybridization, and conservation of some noteworthy, regionally rare, threatened, and endemic species. Several records represent the first specimens for Minas Gerais state, in the hinterlands of Serra da Mantiqueira, proving that many Atlantic species also occur on the northwestern slope of this mountain range.

*Percnohierax leucorrhous* – Despite being widely distributed in mountainous and subtropical areas of South

America (Pinto, 1964; Fjeldså & Krabbe, 1990; Sick, 1997), it is known in Minas Gerais only by a single specimen collected in 1906 by J.B. Godoy in the municipality of Mariana (MZUSP 6060) (Pinto, 1952). Furthermore, there are records for the state borders in the Serra do Caparaó (Espírito Santo state), Itatiaia National Park (Rio de Janeiro state), and Campos do Jordão (São Paulo state) (Pinto, 1951, 1954; Willis & Oniki, 1981; Barbosa, 1992; Bauer, 1999). On 10 May 2007, one individual was observed perched on an isolated tree in a pasture close to a montane forest, beside the dirt road to Pedra de São Domingos (22°40'40"S, 45°57'13"W, c. 1,795 m). On 9 July 2007, another one was seen flying over forested areas of Serra do Juncal (22°44'19"S, 45°56'04"W, c. 1,615 m).

*Veniliornis spilogaster* – Pinto (1952) included *V. spilogaster* as a putative taxon in Minas Gerais avifauna based on records of Holt (1928) from Itatiaia, Rio de Janeiro state. Later, the species was recorded at Poços de Caldas plateau, Serra do Papagaio and Ibitipoca State Park (Lara *et al.*, 1990; Vasconcelos, 2008; Pacheco *et al.*, 2008), but there are not known specimens collected in Minas Gerais (Mattos *et al.*, 1993). There are also records from the borders of São Paulo and Minas Gerais states without precise localities (Bencke *et al.*, 2006). On 27 February 2007, a couple (DZUFMG 5303, 5304) was collected in the largest forest fragment of Mr. Sebastião Lauriano (22°41'09"S, 45°54'12"W, c. 1,640 m). Gonad measurements of these specimens were (in mm): testes 3.2 x 1.1 (DZUFMG 5303) and ovary 7.7 x 5.2, with largest ova reaching 0.8 mm (DZUFMG 5304). Both specimens presented skull 100% pneumatized. These are the first specimens of *V. spilogaster* from Minas Gerais.

*Piculus aurulentus* – Recorded in Minas Gerais without specimen record at Poços de Caldas plateau, Ibitipoca State Park, Serra do Brigadeiro State Park, Serra do Caraça, and in the borders with São Paulo state, the last one without any precise information on locality (Lara *et al.*, 1990; Mattos *et al.*, 1993; Andrade, 1997; Simon *et al.*, 1999; Vasconcelos & Melo-Júnior, 2001; Bencke *et al.*, 2006; Pacheco *et al.*, 2008). Thus, the first state specimen appears to be a male (DZUFMG 5644) collected on 7 March 2007 at Serra do Juncal (22°43'07"S, 45°53'40"W, c. 1,940 m). This specimen had skull 100% pneumatized and testes measurements (in mm): 3.1 x 2.3.

*Dysithamnus xanthopterus* – This species was only recently recorded in Minas Gerais, at Itatiaia National



Park, municipality of Itamonte, and also in the borders of São Paulo state, but without any data on the precise locality (Parrini & Pacheco, 1997; Bencke *et al.*, 2006). Several individuals were tape-recorded in three localities in our study area (Appendix 1). On 28 September 2007, a female (DZUFMG 5650) was collected at Serra do Juncal (22°43'07"S, 45°53'40"W, c. 1,940 m). This specimen had skull fully pneumatized and ovary measurements (in mm): 7 x 4.1, with largest ova reaching 1.6 mm. This is the first specimen of *D. xanthopterus* for Minas Gerais. In the study area, the species was observed foraging principally in the middle and upper strata of the forests.

*Drymophila rubricollis* – This species is known from a few localities in southeastern Minas Gerais (Parrini & Pacheco, 1997; Vasconcelos & Melo-Júnior, 2001; Rajão & Cerqueira, 2006; Vasconcelos *et al.*, 2008). On 9 July 2007, a male was tape-recorded in a dense scrub of “carafá” bamboo (*Chusquea* aff. *ibiramae*) in an *Araucaria* forest at Taperinha (22°46'44"S, 45°57'29"W, c. 1,575 m). This specimen was collected the next day (DZUFMG 5611). It presented skull 100% pneumatized and testes measurements (in mm): 1.7 x 1. This appears to be the first confirmed record of *D. rubricollis* for the Minas Gerais slope of the Serra da Mantiqueira (see Willis, 1988; Rajão & Cerqueira, 2006).

*Scytalopus notorius* – Despite this species was treated as *S. speluncae* for many years, it was recently described as a new taxon (Raposo *et al.*, 2006). It is fairly common in several habitats of the study area, including interior and edge of forests, especially with the “carafá” bamboo and close to montane streams. Several individuals were tape-recorded in different localities (Appendix 1). On 27 March 2007, an adult male (DZUFMG 5321) was collected in the elfin forest of Pedra de São Domingos (22°41'34"S, 45°57'33"W, c. 1,950 m). On 11 January 2008, a subadult male was also tape-recorded and collected (DZUFMG 5718) in a forest edge in the base of Serra do Juncal (22°44'56"S, 45°56'00"W, c. 1,460 m) (Fig. 2). Both specimens had skull 10% pneumatized. Testes measurements of these specimens were (in mm): 2.1 x 1.2 (DZUFMG 5321) and 3 x 2.1 (DZUFMG 5718).

*Scytalopus speluncae* – Raposo *et al.* (2006) presented records for this species from south-central Minas Gerais (São João Del Rey) to central Bahia (Chapada Diamantina region). Nevertheless, the taxon from Chapada Diamantina proved to be a different species, recently described by Bornschein *et al.* (2007). On 27

March 2007, a subadult female (DZUFMG 5322) was collected in the elfin forest of Pedra de São Domingos (22°41'30"S, 45°57'32"W, c. 1,990 m), only c. 100 m from where a specimen of *S. notorius* was collected on the same day (Fig. 2). This specimen had skull 8% pneumatized and ovary measurements (in mm): 5.4 x 2, with largest ova reaching 0.8 mm. On 27 September 2007, one individual of *S. speluncae* was tape-recorded at the same site as another individual of *S. notorius* in a forest edge in the base of Serra do Juncal (22°44'52"S, 45°56'00"W, c. 1,460 m). On 11 January 2008, an adult male was tape-recorded and collected (DZUFMG 5719) in the border of a marsh/second growth of *Araucaria* forest at the base of Serra do Juncal (22°44'58"S, 45°56'00"W, c. 1,450 m), only 80 m from where a specimen of *S. notorius* was collected on the same day (Fig. 2). It presented skull 10% pneumatized and testes measurements (in mm): 3.3 x 2.1. This is the second record of sympatry of these two species, besides the Ibitipoca State Park region (Pacheco *et al.*, 2008), where both species occur in high altitude areas (above 1,100 m) in forest edges and small clumps of shrubs in the “campos de altitude”.

*Chamaeza ruficauda* – Despite being mentioned in the checklist of birds of Minas Gerais (Mattos *et al.*, 1993), we did not find any previous documented record or any specific published locality for *C. ruficauda* in this state (e.g., Raposo & Teixeira, 1992; Willis, 1992b). Recent state records are: a male specimen (DZUFMG 3463) collected by M.F.V. and H.M.F. Alvarenga in the base of Marins Peak, Delfim Moreira municipality, on 6 July 2002, and sightings in the Serra do Papagaio (Vasconcelos, 2008). There are also records from the borders of the states of Minas Gerais and São Paulo, but without any precise locality, being impossible to know in which state the records were conducted (see Bencke *et al.*, 2006). In the study area, *C. ruficauda* is a very common species in forest edges, especially in stands of “carafá” bamboo, but also inside *Araucaria* forests with stands of “taquara-poca” bamboo (*Merostachys* sp.). This species also appears to prefer habitats with bamboos in Misiones, Argentina (Bodrati & Cockle, 2006a). It was observed and tape-recorded in four localities (Appendix 1). In the study area, its voice was also heard throughout the year, as mentioned by Bodrati & Cockle (2006a) in Argentina. On 10 May 2007, an unsexed specimen (DZUFMG 5319) presenting skull 50% pneumatized was collected at Pedra de São Domingos (22°41'34"S, 45°57'33"W, c. 1,950 m) in a dense stand of “carafá”. These are the first documented records for *C. ruficauda* from Minas Gerais.

*Lepidocolaptes squamatus* and *L. falcinellus* – Silva & Straube (1996) found that the region around 22°S in southeastern Brazil is represented by changing of characters of two populations of *Lepidocolaptes*. *L. squamatus* occurs from the north of this region to the right bank of São Francisco river, and *L. falcinellus* is the southern form. Theoretically, there is no contact between these two species (Silva & Straube, 1996; Marantz *et al.*, 2003). Nevertheless, there are no known specimens from the Minas Gerais north slope of Serra da Mantiqueira. Thus, it was impossible to know if the form that occurs in this region was in an intergradation zone between both forms or if it represents the supposed taxa to occur in the hin-

terlands (*L. squamatus*). On 9 January 2008, two unsexed specimens (DZUFMG 5760, 5761) were collected at Serra do Juncal (22°43'07"S, 45°53'40"W, c. 1,940 m). They were compared to the entire series (17 specimens) of the *L. squamatus/falcinellus/wagleri* complex held in DZUFMG and with descriptions for the three forms (Silva & Straube, 1996; Marantz *et al.*, 2003). One of them (DZUFMG 5760) presents the typical head of *L. falcinellus*, with broad buffy streaks on crown (Fig. 3). The other specimen (DZUFMG 5761) has the head with pattern intermediate between *L. squamatus* and *L. falcinellus*, with narrower buffy streaks in the centre of crown feathers but with blackish borders (Fig. 3). Tails of both specimens are



FIGURE 2: From left to right, specimens of *Scytalopus speluncae* (DZUFMG 5719, 5322) and *S. notorius* (DZUFMG 5321, 5718) collected in the study area. Note the whitish underparts and the barred flanks of *S. speluncae*.



chestnut brown, typical of *L. falcinellus*. Furthermore, the underparts of DZUFMG 5760 are whiter, similar to *L. squamatus*, whilst the underparts of DZUFMG 5761 present buffy streaks, resembling the pattern of *L. falcinellus*. This is the first record of intergradation between these two species (see Silva & Straube, 1996; Marantz *et al.*, 2003). Furthermore, *L. falcinellus* was known only from southern bank of Paraíba do Sul river (see Marantz *et al.*, 2003) and these records show that at least phenotypes of this species occurs north of this river. The occurrence of phenotypes of *L. falcinellus* in the *Araucaria* forests of the north slopes of Serra da Mantiqueira can be related to palaeoecological connections to the nucleus of *Araucaria* forests from southern Brazil (where *L. falcinellus* is the only species of this complex – see Marantz *et al.*, 2003). In the Serra da Mantiqueira and adjacent regions, expansion of *Araucaria* forests is hypothesized to have occurred between 9,700-8,200 years before present and, later, after c. 3,500-3,000 years before present, when climate became cooler and moister than today

(Behling, 1997, 1998, 2002; Garcia *et al.*, 2004). Curiously, *L. squamatus* is the taxa recorded at Itatiaia, in the Atlantic (south) slope of this mountain range (Pinto, 1951, 1954). This could be explained by the occurrence of *Araucaria* forests in the north slopes of Serra da Mantiqueira, whilst the Atlantic slope is mostly covered by montane and cloud forests (see Hueck, 1972) and should has different zoogeographical affinities.

*Leptasthenura setaria* – This species is strongly associated to *A. angustifolia*, where it forages and nests almost exclusively (Andrade, 1996; Sick, 1997; Antunes *et al.*, 2007). In Minas Gerais, it is known only from the following municipalities: Camanducaia, Barbacena, Aiuruoca, Delfim Moreira, and Marmelópolis (Mattos *et al.*, 1991; Andrade, 1996; Andrade *et al.*, 1997; Sick, 1997; Olmos, 2007). There are also records from the limits between this state and São Paulo, but without any precise locality, being impossible to know in which state the species was recorded



FIGURE 3: From left to right, head patterns of: *Lepidocolaptes falcinellus* (DZUFMG 684) from Casa Grande, Salesópolis, São Paulo; *L. falcinellus* (DZUFMG 5760) from Serra do Juncal, Gonçalves, Minas Gerais; *L. falcinellus* x *L. squamatus* (DZUFMG 5761) from Serra do Juncal, Gonçalves, Minas Gerais; *L. squamatus* (DZUFMG 679) from Santa Teresa, Espírito Santo.



(Bencke *et al.*, 2006). Although it is a common species in *Araucaria* forests and plantations of this pine tree, specimens of *L. setaria* are very scarce (Straube & Scherer-Neto, 2001; Antunes *et al.*, 2007). In the study area, it is one of the commonest species, occurring from native *Araucaria* forests to plantations of *A. angustifolia* or even in pastures dotted with this pine species. In Argentina its range expanded to the east and south of its original distribution, following plantations of *A. angustifolia* (Krauczuk, 2001; Cabanne *et al.*, 2007) where it is one of the commonest bird species (A. Bodrati, pers. com.). On 1 March 2007, a male specimen (DZUFMG 5300) was collected in a pasture with *A. angustifolia* and *P. lambertii* close to the forest fragments of Mr. Sebastião Lauriano (22°41'05"S, 45°53'57"W, c. 1,610 m). It had skull 15% pneumatized and testes measurements (in mm): 1.1 x 0.8. This appears to be the first specimen of *L. setaria* from Minas Gerais.

*Heliobletus contaminatus* – Despite being mentioned in the bird checklist of Minas Gerais (Mattos *et al.*, 1993), geographic known state records are only in the borders with São Paulo, without any specific locality (Bencke *et al.*, 2006), and also in the region of Serra do Papagaio, Aiuruoca, northern Serra da Mantiqueira (Vasconcelos, 1999, 2008). There were no specimens of *H. contaminatus* collected in the Minas Gerais slope of Serra da Mantiqueira. Specimens from this mountain range were assigned to represent nominate form (Itatiaia, Rio de Janeiro state) or intermediate between nominate and *H. c. camargoi* (Campos do Jordão, São Paulo state) (Silva & Stotz, 1992). On 9 January 2008, a male (DZUFMG 5754) was collected at Serra do Juncal (22°43'07"S, 45°53'40"W, c. 1,940 m). It presented skull 30% pneumatized and testes measurements (in mm): 1.6 x 1. This specimen matches the description of nominate form (Silva & Stotz, 1992; Remsen, 2003), since it has a completely plain back, without any buffy streak, and underparts not extensively streaked. Nevertheless, since we collected only a single specimen, it is even possible that our study area is in the intergradation zone. Campos do Jordão (where an intermediate male specimen was collected – see Silva & Stotz, 1992) is only c. 30 km to the east from our study area. *H. contaminatus* was observed and tape-recorded in six localities in the study area. It is frequently associated to mixed-species flocks, foraging mainly in the forest middle or upper strata.

*Hemitriccus obsoletus* – This species was only recently recorded in Minas Gerais, at Itatiaia National Park,

municipality of Itamonte (Parrini & Pacheco, 1997), in the borders of São Paulo state without any specific locality (Bencke *et al.*, 2006), and in the Itagararé Peak (Olmos, 2007). These records were based on sightings, without specimen collection. The only record for *H. obsoletus* in our study area is a female (DZUFMG 5320) collected on 27 March 2007 at Pedra de São Domingos (22°41'34"S, 45°57'33"W, c. 1,950 m), in an elfin forest with dense stands of "carafá" bamboo. It had skull 15% pneumatized and ovary measurements (in mm): 3 x 2.1, with largest ova reaching 0.6 mm. This appears to be the first specimen of *H. obsoletus* from Minas Gerais. Bodrati & Areta (2006) found this species in *Chusquea tenella* (= *uruguayensis*) bamboo in Argentina.

*Phylloscartes difficilis* – Despite being present in the bird checklist of Minas Gerais without specimen record (Mattos *et al.*, 1993), Pacheco & Bauer (1998) mentioned three specimens of *P. difficilis* collected by E. Snelthage and H. Sick in the Serra do Caparaó, but it is impossible to know in which state the birds were taken (Minas Gerais or Espírito Santo). Records in the borders of São Paulo and Minas Gerais without any precise locality (Bencke *et al.*, 2006) represent the same problem. Further, there is an unpublished female specimen (DZUFMG 3477) collected by M.F.V. and H.M.F. Alvarenga in the base of Marins Peak, Delfim Moreira municipality, on 6 July 2002, and tape-recordings from Serra do Papagaio region, northern Mantiqueira (Vasconcelos, 2008). In the study area, *P. difficilis* proved to be very common in forest edges, foraging principally in the understorey, especially in and close to stands of bamboo from the genus *Chusquea*. Three specimens were obtained: a female (DZUFMG 5315) collected on 7 May 2007 at Serra do Juncal (22°43'07"S, 45°53'40"W, c. 1,940 m) and a couple (DZUFMG 5631, 5632) taken on 12 July 2007 at Taperinha (22°46'44"S, 45°57'29"W, c. 1,575 m). Gonad measurements of these specimens were (in mm): testes 1.7 x 1.3 (DZUFMG 5631); ovary 2.4 x 1.5, with largest ova reaching 0.4 mm (DZUFMG 5315); and ovary 4.3 x 2.4, with largest ova reaching 1 mm (DZUFMG 5632). Skull ossification of these specimens ranged between 10 and 20%.

*Piprites pileata* – This species is known in Minas Gerais from scarce records along the Serra da Mantiqueira, in the following localities: Alagoa, Bocaina de Minas, Mirantão, Passa Vinte, Itamonte, Serra do Papagaio, and trail to Itagararé and Marins Peaks (Collar *et al.*, 1992; Machado *et al.*, 1998; Vasconcelos, 1999, 2008; Olmos, 2007). In the study area, it was

recorded in three localities (Appendix 1). It was commonly observed alone or in pairs while foraging associated to mixed-species flocks, especially with *Lepidocolaptes squamatus* x *L. falcinellus*, *Philydor rufum* and *Heliobletus contaminatus*. Two of these species (*P. rufum* and *H. contaminatus*) were also observed foraging together with *P. pileata* in Misiones, Argentina (Maders *et al.*, 2007). In the study area, it forages frequently in *Araucaria* forest and high altitude montane forests, including edges. Once, one individual was observed eating an unidentified insect. Several birds were tape-recorded, responding promptly to playback. On 6 March 2007, a female hit a window of a house close to Serra do Juncal. It broke its bill and died two hours later. This female was prepared as a study skin (DZUFMG 5306). It presented skull 20% pneumatized and ovary measurements (in mm): 3.4 x 2.7, with largest ova reaching 1 mm.

*Hylophilus poicilotis* – This species has scarce records in Minas Gerais. It is known from Serra do Caparaó, Viçosa, Serra do Brigadeiro State Park, Serra do Papagaio, Ibitipoca State Park, and the borders with São Paulo state (Ruschi, 1978; Raposo *et al.*, 1998; Bauer, 1999; Simon *et al.*, 1999; Ribon *et al.*, 2003; Bencke *et al.*, 2006; Vasconcelos, 2008; Pacheco *et al.*, 2008). Nevertheless, in the majority of these localities, *H. poicilotis* occurs sympatrically with *H. amaurocephalus* (Raposo *et al.*, 1998; Simon *et al.*, 1999; Ribon *et al.*, 2003; Pacheco *et al.*, 2008). Furthermore, a record for *H. poicilotis* from Baependi (Pinto, 1952) appears to be later corrected as being *H. amaurocephalus* (see Raposo *et al.*, 1998). In the study area, it was the only species of this genus. It proved to be very common, occurring even in small and isolated forest fragments (Appendix 1). On 27 February 2007, a male (DZUFMG 5305) was tape-recorded and collected in the largest fragment of Mr. Sebastião Lauriano (22°41'13"S, 45°54'13"W, c. 1,620 m). It had skull 100% pneumatized and testes measurements (in mm): 2.8 x 1.6. *H. poicilotis* is the only species found in the Atlantic slope of Serra da Mantiqueira (Pinto, 1951, 1954; Willis, 1991; Barbosa, 1992; Raposo *et al.*, 1998), although *H. amaurocephalus* has been frequently recorded in its northern slopes in Minas Gerais (Vasconcelos *et al.*, 2002; Lopes, 2006; Lombardi *et al.*, 2007).

*Basileuterus culicivorus* and *B. hypoleucus* – Although the majority of records of this complex in the Serra da Mantiqueira is represented by *B. culicivorus* (e.g., Silva, 1991; Barbosa, 1992), there are some contact zones in the following localities of southeastern Minas

Gerais: Poços de Caldas plateau, Viçosa, and Ibitipoca State Park (Monteiro *et al.*, 1983; Lara *et al.*, 1990; Pacheco *et al.*, 2008). In the study area, we collected specimens of *B. culicivorus* (DZUFMG 5312, 5641, 5656), *B. hypoleucus* (DZUFMG 5311, 5655), and a hybrid between both species (DZUFMG 5642). The Serra da Mantiqueira appears to be a geographical barrier to *B. hypoleucus*, since this species has never been recorded in its Atlantic slope. *B. culicivorus* occurs predominantly in the Atlantic slope (Pinto, 1951, 1954; Barbosa, 1992), but also in the northern slopes (Vasconcelos, 2008), where it meets *B. hypoleucus* (this study). On the other hand, *B. hypoleucus* is the commonest form occurring in the hinterlands of southern Minas Gerais (Pinto, 1952; Silva, 1991; Ribon, 2000; Vasconcelos *et al.*, 2002; Lopes, 2006; Lombardi *et al.*, 2007). Thus, the study area is a contact zone between both species, with the occurrence of hybridization. This contact zone was still unknown and had not been mapped in the Serra da Mantiqueira by Silva (1991), although this author presented records for both species in Atibaia, São Paulo state, in the southernmost part of this mountain range.

*Cacicus chrysopterus* – This species has been recorded in Minas Gerais, although lacking specimen record (Mattos *et al.*, 1993) and with a single published specific locality of record at Serra do Papagaio (Vasconcelos, 2008). The species is extremely common in the study area, being found even in the smallest and most degraded forest fragments (Appendix 1). On 28 September 2007, a female (DZUFMG 5649) was collected inside a forest at Serra do Juncal (22°43'01"S, 45°53'39"W, c. 1,900 m). It presented skull 100% pneumatized and ovary measurements (in mm): 11.7 x 4.6, with largest ova reaching 1.4 mm. This appears to be the first specimen of *C. chrysopterus* from Minas Gerais.

### Conservation

Although the region still harbors a rich avifauna, with several endemic and threatened species, some of them are very rare (e.g., *Lipaugus lanioides*) and can disappear in the near future if the native forests continue to be destroyed. We failed to find *Amazona vinacea*, a vulnerable species found in other nearby areas in the Serra da Mantiqueira, such as Baependi, Campos do Jordão, and the region of Monte Verde/São Francisco Xavier (Willis & Oniki, 1981; Barbosa, 1992; Wege & Long, 1995; Melo-Júnior, 1996; Andrade *et al.*, 1997; Bencke *et al.*, 2006).

Besides the effects of forest loss and fragmentation, it is important to stress that a new system of land use has started in the study area: eco-tourism. This activity led to the building of luxury hotels, restaurants and weekend cottages. Although the majority of these new land-owners are interested in the conservation of the local biodiversity, many of them build their modern houses with large windows. This kind of house is a lethal trap for several forest birds, especially if they are built close to native forests. Besides the threatened *Piprites pileata*, we found several other dead or hurt birds after striking against these large windows. Furthermore, the growth of tourist activities can also lead to higher levels of forest fragmentation since an old land-owner can sell a large original forest property to several new ones, and this has happened in the region in the last years. Another threat to the native avifauna are domestic animals of these new land-owners (especially dogs), which prey on several birds. For example, we never found *Macropsalis forcipata* close to properties where there are dogs and cats, probably because they hunt this nightjar that forages and nests on the ground (Morales & Krul, 1995; Pichorim, 2002). Dogs were also mentioned as predators of another species of nightjar in an Atlantic forest fragment in São Paulo state (Galetti & Sazima, 2006). Similar threats to the avifauna of other montane areas in Serra da Mantiqueira and Serra dos Órgãos have been reported, especially due to the recent forest loss and fragmentation by human settlements or luxury buildings (Bencke *et al.*, 2006; Mallet-Rodrigues *et al.*, 2007). Eco-tourism also represents a serious threat to the conservation of the avifauna in other high mountains in southeastern Brazil, especially in the Serras do Caraça and do Caparaó (Vasconcelos, 2000, 2003). In Itatiaia and Caparaó National Parks, the uncontrolled tourism have been reported as a serious problem causing accidental wildfires and degradation of the native vegetation used by several endemic bird species (Vasconcelos, 2003; Bencke *et al.*, 2006). In this context, Marini & Garcia (2005) stress the importance of the southeastern Brazilian mountains for the conservation of the threatened and restricted range taxa.

Another problem in the region is the large areas subject to plantations of potato, carrot or monocultures of *Araucaria*, *Pinus*, and *Eucalyptus*. Nevertheless, we could find some endemic species in the understorey and canopy of plantations of *Araucaria* (e.g., *Scytalopus notorius*, *Chamaeza ruficauda* and *Leptasthenura setaria*). Perhaps the *Araucaria* growth in an area where it is a native tree is less damaging to the avifauna in comparison to other exotic species, especially if there is an understorey.

Finally, the study area was considered a priority area for biodiversity conservation in the highest category of biological importance in Minas Gerais state due to its high richness of rare, endemic, and threatened species of plants and animals (Drummond *et al.*, 2005). This region is inside an "Área de Proteção Ambiental" (APA Fernão Dias), a kind of conservation unit that cannot guarantee the integral protection of biodiversity (Camargos, 2001). For this reason, we recommend the creation of two reserves in the study area in order to protect populations of several restricted-range or threatened birds. One of these reserves should be created in the Serra do Juncal, the largest forest fragment of the region, with many threatened and endemic bird species. The other reserve should be created in the Pedra de São Domingos and adjacent forests. This region harbors one of the most representative areas of elfin forest and "campos de altitude" in the region, where typical species of both kinds of habitats are still common. Fortunately, there are plans to establish a reserve in part of this area (Instituto Oikos, 2008), but this should also include the southern slope of Serra do Juncal, where well preserved forests still persist.

## RESUMO

*A avifauna das florestas de Araucaria das partes mais elevadas da Serra da Mantiqueira é pouco conhecida e documentada. Esta região é reconhecida como uma importante área de diferenciação de aves no sudeste do Brasil. Apresentamos o primeiro levantamento ornitológico das florestas de Araucaria e ambientes associados nas montanhas do extremo sul de Minas Gerais, Serra da Mantiqueira. A área de estudo compreende a região da Serra do Juncal e diversas localidades adjacentes nos municípios de Gonçalves e Camanducaia. Foram registradas 206 espécies de aves, das quais 57 (27,7%) são endêmicas da Mata Atlântica. Diversos registros representam os primeiros espécimes para Minas Gerais, provando que muitas espécies Atlânticas também ocorrem na vertente interiorana da Mantiqueira. Exemplos são: Dysithamnus xanthopterus, Chamaeza ruficauda, Leptasthenura setaria, Heliobletus contaminatus, Hemitriccus obsoletus, Phylloscartes difficilis, Piprites pileata, Poospiza thoracica e Cacicus chrysopterus. A região também é uma área de simpatria, anteriormente desconhecida, para algumas espécies, tais como: Scytalopus notorius e S. speluncae, Lepidocolaptes squamatus e L. falcinellus, Basileuterus culicivorus e B. hypoleucus. As espécies de Lepidocolaptes e de Basileuterus híbridam na região. Também comentamos*



sobre a conservação da avifauna, ameaçada pelo ecoturismo, construção de um novo estilo de edificações, animais domésticos, fragmentação florestal e plantações.

PALAVRAS-CHAVE: Avifauna; Florestas de *Araucaria*; Serra da Mantiqueira; Minas Gerais; Brasil.

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## APPENDIX 1

Species list of birds recorded in *Araucaria* forests and other habitats from extreme southern Minas Gerais, Serra da Mantiqueira, Brazil. Locality: 1 = Serra do Juncal, 2 = Pedra de São Domingos and adjacent forests, 3 = Tapereinha, 4 = Bicho do Mato, 5 = Lua de Pedra, 6 = Sebastião Lauriano I, 7 = Sebastião Lauriano II, 8 = Sertão do Cantagalo and surroundings, 9 = Gonçalves city and surroundings. Forest dependence: D = dependent, S = semi-dependent, I = non-dependent. Habitat: A = aerial (in flight), C = "campo de altitude", E = forest edge, F = forest, M = marsh, P = pastures and plantations, U = urban. Endemism and/or conservation status: BR = threatened in Brazil, QA = near-threatened in Brazil, MG = threatened in Minas Gerais state, NT = near-threatened, VU = vulnerable, AF = endemic to the Atlantic forest, CE = endemic to the Cerrado. Type of record: s = specimen, p = photograph, pn = photograph of nest, t = tape-recording, f = feather collected, o = observation (sight record), v = record of vocalization.

Family/Species	English names	Locality	Forest dependence	Habitat	Endemism and/or conservation status	Type of record
Tinamidae						
<i>Crypturellus obsoletus</i>	Brown Tinamou	1,2,3,4,5,6,9	D	F		t,v
Anatidae						
<i>Amazonetta brasiliensis</i>	Brazilian Teal	9	I	M		o,v
Cracidae						
<i>Penelope obscura</i>	Dusky-legged Guan	1,2,3,4,5,6,8,9	D	E,F,P	MG	s,t,f,o,v
Odontophoridae						
<i>Odontophorus capueira</i>	Spot-winged Wood-Quail	1,5,8	D	F	MG,AF	t,o,v
Ardeidae						
<i>Bubulcus ibis</i>	Cattle Egret	1,9	I	P		o
<i>Ardea alba</i>	Great Egret	1,9	I	P		o
<i>Syrigma sibilatrix</i>	Whistling Heron	1,2,3,4,5,6,9	I	M,P		t,o,v
Cathartidae						
<i>Cathartes aura</i>	Turkey Vulture	4,9	I	A		o
<i>Coragyps atratus</i>	Black Vulture	1,2,3,4,6,8,9	I	A,P		o
Accipitridae						
<i>Accipiter striatus</i>	Sharp-shinned Hawk	6	D	E,F		o
<i>Heterospizias meridionalis</i>	Savanna Hawk	1,2,8,9	I	A,E,P		o,v
<i>Pernohierax leucorrhous</i>	White-rumped Hawk	1,2	D	A,E,P		o
<i>Rupornis magnirostris</i>	Roadside Hawk	1,2,3,4,6,7,8,9	I	A,C,E,F,P,U		t,o,v
<i>Buteo albicaudatus</i>	White-tailed Hawk	1,2,9	I	A,P		o
<i>Spizaetus tyrannus</i>	Black Hawk-Eagle	1,8	D	A,F	QA,MG	t,o,v
Falconidae						
<i>Caracara plancus</i>	Southern Caracara	1,3,4,5,6,8,9	I	A,E,P		t,o,v
<i>Milvago chimachima</i>	Yellow-headed Caracara	1,2,3,4,6,7,8,9	I	A,E,F,P		t,o,v
<i>Micrastur ruficollis</i>	Barred Forest-Falcon	1,5,8	D	F		t,o,v
<i>Falco sparverius</i>	American Kestrel	4,9	I	P,U		o
<i>Falco femoralis</i>	Aplomado Falcon	4,9	I	P		o
Rallidae						
<i>Aramides saracura</i>	Slaty-breasted Wood-Rail	1,2,3,4,5,6,8,9	S	E,F,M,P	AF	t,o,v

Family/Species	English names	Locality	Forest dependence	Habitat	Endemism and/or conservation status	Type of record
<i>Laterallus leucopyrrhus</i>	Red-and-white Crake	8	I	M		v
<i>Pardirallus nigricans</i>	Blackish Rail	3,6,8,9	I	M,P		o,v
Cariamidae						
<i>Cariama cristata</i>	Red-legged Seriema	1,2,3,4,5,6,8,9	I	P,U		t,o,v
Charadriidae						
<i>Vanellus chilensis</i>	Southern Lapwing	1,3,4,5,6,8,9	I	A,P,U		t,o,v
Columbidae						
<i>Columbina talpacoti</i>	Ruddy Ground-Dove	8,9	I	P,U		o,v
<i>Columba livia</i>	Rock Dove	9	I	U		o,v
<i>Patagioenas picazuro</i>	Picazuro Pigeon	1,2,3,4,5,6,7,8,9	S	A,E,P,U		t,o,v
<i>Patagioenas cayennensis</i>	Pale-vented Pigeon	3	S	F		t,o,v
<i>Patagioenas plumbea</i>	Plumbeous Pigeon	1	D	F		o,v
<i>Leptotila verreauxi</i>	White-tipped Dove	1,3,4,6	S	E,F,P		t,o,v
<i>Leptotila rufaxilla</i>	Gray-fronted Dove	1,5,6	D	F		s,t,o,v
Psittacidae						
<i>Aratinga leucophthalma</i>	White-eyed Parakeet	1,4,9	S	A,F,U		t,o,v
<i>Aratinga aurea</i>	Peach-fronted Parakeet	4,9	I	E,F,P,U		t,o,v
<i>Pyrrhura frontalis</i>	Maroon-bellied Parakeet	1,2,3,4,5,6,7,8,9	D	A,E,F,P	AF	s,t,o,v
<i>Pionopsitta pileata</i>	Pileated Parrot	1,2,3,4,5,6,8,9	D	A,F	MG,AF	t,f,o,v
<i>Pionus maximiliani</i>	Scaly-headed Parrot	1,2,3,4,5,6,8,9	S	A,E,F,M,P,U		t,o,v
Cuculidae						
<i>Piaya cayana</i>	Squirrel Cuckoo	1,2,3,4,5,6,9	S	E,F,U		t,o,v
<i>Crotophaga ani</i>	Smooth-billed Ani	1,3,4,6,9	I	E,P,U		o,v
<i>Guira guira</i>	Guira Cuckoo	1,2,3,4,6,9	I	P,U		t,o,v
Tytonidae						
<i>Tyto alba</i>	Barn Owl	1,9	I	P,U		o,v
Strigidae						
<i>Megascops choliba</i>	Tropical Screech-Owl	4,9	S	E,F,U		v
<i>Strix hylophila</i>	Rusty-barred Owl	1,2,4,5,8	D	E,F	NT,AF	s,t,f,o,v
<i>Athene cunicularia</i>	Burrowing Owl	1,4,9	I	P,U		o,v
Caprimulgidae						
<i>Nyctidromus albicollis</i>	Pauraque	9	S	E		o
<i>Caprimulgus longirostris</i>	Band-winged Nightjar	2	I	C		o,v
<i>Macropsalis forcipata</i>	Long-trained Nightjar	1,2,5	S	E,F	MG,AF	o,v
Apodidae						
<i>Streptoprocne zonaris</i>	White-collared Swift	9	I	A		o
<i>Chaetura meridionalis</i>	Sick's Swift	9	I	A,U		o,v
Trochilidae						
<i>Phaethornis pretrei</i>	Planalto Hermit	9	S	E,U		o,v
<i>Phaethornis eurynome</i>	Scale-throated Hermit	1,2,3,4,5,6,8	D	E,F,M	AF	s,t,o,v
<i>Eupetomena macroura</i>	Swallow-tailed Hummingbird	1,2,8,9	I	E,P,U		o,v



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<i>Colibri serrirostris</i>	White-vented Violet-ear	1,2,6,9	I	C,B,U		o,v
<i>Stephanoxis lalandi</i>	Plovercrest	1,2,3,4,8,9	S	C,E,F,P	AF	s,t,o,v
<i>Chlorostilbon lucidus</i>	Glittering-bellied Emerald	2,4,7,9	I	E,B,U		o,v
<i>Thalurania glaucopis</i>	Violet-capped Woodnymph	2,3,4	D	C,F	AF	s,o,v
<i>Leucochloris albicollis</i>	White-throated Hummingbird	1,2,3,4,5,6,8,9	D	C,E,F,P	AF	s,t,o,v
<i>Amazilia lactea</i>	Sapphire-spangled Emerald	3,9	S	F,U		o,v
<i>Clytolaema rubricauda</i>	Brazilian Ruby	1,2,3,4,6	D	E,F	AF	s,t,o,v
Alcedinidae						
<i>Megaceryle torquata</i>	Ringed Kingfisher	9	I	M,B,U		o,v
<i>Chloroceryle amazona</i>	Amazon Kingfisher	9	S	M,P		o
Momotidae						
<i>Baryphthengus ruficapillus</i>	Rufous-capped Motmot	1,5	D	F	AF	v
Ramphastidae						
<i>Ramphastos toco</i>	Toco Toucan	2,4,6,9	S	E,P		o,v
<i>Ramphastos dicolorus</i>	Red-breasted Toucan	1,2,3,4,5,6,7,8	D	E,F	AF	t,o,v
Picidae						
<i>Picumnus</i> sp.	Piculet	1,2,3,4,6,8	S	E,F		t,v
<i>Melanerpes candidus</i>	White Woodpecker	3,4,6,9	I	E,P		t,o,v
<i>Veniliornis spilogaster</i>	White-spotted Woodpecker	1,2,3,4,5,6,8,9	D	E,F,P	AF	s,o,v
<i>Piculus aurulentus</i>	Yellow-browed Woodpecker	1,3,4,5,6	D	E,F	NT,AF	s,t,o,v
<i>Colaptes melanochlorus</i>	Green-barred Woodpecker	4,7	S	E,F,P		t,o,v
<i>Colaptes campestris</i>	Campo Flicker	1,2,3,4,5,6,9	I	E,B,U		t,o,v
<i>Celeus flavescens</i>	Blond-crested Woodpecker	1	D	F		o,v
<i>Dryocopus lineatus</i>	Lineated Woodpecker	1,2,3,4,6	S	E,F,P		t,o,v
<i>Campephilus robustus</i>	Robust Woodpecker	1,4	D	F	MG,AF	s,t,o,v
Thamnophilidae						
<i>Batara cinerea</i>	Giant Antshrike	1,3,6	D	F		o,v
<i>Mackenziaena leachii</i>	Large-tailed Antshrike	1,3,5	S	E,F	AF	t,o,v
<i>Thamnophilus caeruleus</i>	Variable Antshrike	1,2,3,4,5,6,7,8	D	E,F		s,t,o,v
<i>Thamnophilus ruficapillus</i>	Rufous-capped Antshrike	1,4,6,8	I	E,P		t,o,v
<i>Dysithamnus mentalis</i>	Plain Antvireo	4	D	F		t,v
<i>Dysithamnus xanthopterus</i>	Rufous-backed Antvireo	1,3,5	D	F	AF	s,t,f,o,v
<i>Drymophila rubricollis</i>	Berton's Antbird	3	D	F	AF	s,t,o,v
<i>Drymophila geni</i>	Rufous-tailed Antbird	2,5	D	E,F	MG,NT,AF	s,t,o,v

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<i>Drymophila malura</i>	Dusky-tailed Antbird	1,3,4,6	D	E,F	AF	s,t,o,v
<i>Pyriglena leucoptera</i>	White-shouldered Fire-eye	1	D	F	AF	v
Conopophagidae						
<i>Conopophaga lineata</i>	Rufous Gnateater	1,2,3,4,5,6	D	F	AF	s,t,o,v
Grallariidae						
<i>Grallaria varia</i>	Variiegated Antpitta	1,3	D	F	MG	t,o,v
<i>Hylopezus nattereri</i>	Speckle-breasted Antpitta	1	D	F	AF	v
Rhinocryptidae						
<i>Scytalopus notorius</i>	Serra do Mar Tapaculo	1,2,3,5	D	C,E,F,P	AF	s,t,o,v
<i>Scytalopus speluncae</i>	Mouse-colored Tapaculo	1,2	S	C,E,M		s,t,o,v
Formicariidae						
<i>Chamaeza ruficauda</i>	Rufous-tailed Antthrush	1,2,3,5	D	E,F,P	AF	s,t,o,v
Scleruridae						
<i>Sclerurus scansor</i>	Rufous-breasted Leaf-tosser	1,3	D	F	AF	s,o,v
Dendrocolaptidae						
<i>Sittasomus griseicapillus</i>	Olivaceous Woodcreeper	1,2,3,4,5,6,7,8	D	E,F		s,t,o,v
<i>Xiphocolaptes albicollis</i>	White-throated Woodcreeper	1,3,4,5	D	F		o,v
<i>Dendrocolaptes platyrostris</i>	Planalto Woodcreeper	1,2,3,4,5,6	D	F		s,t,o,v
<i>Lepidocolaptes squamatus</i> x <i>Lepidocolaptes falcinellus</i>	Scaled x Scalloped Woodcreepers	1,2,3,4,5,6	D	E,F,P	AF	s,t,o,v
<i>Campylorhamphus falcularius</i>	Black-billed Scythebill	3	D	F	AF	t,o,v
Furnariidae						
<i>Furnarius rufus</i>	Rufous Hornero	1,2,4,8,9	I	RU		t,o,v
<i>Leptasthenura setaria</i>	Araucaria Tit-Spinetail	1,2,3,4,5,6,7,8,9	S	E,F,P	NT,AF	s,t,o,v
<i>Synallaxis cinerascens</i>	Gray-bellied Spinetail	1,3	D	F	AF	s,o,v
<i>Synallaxis spixi</i>	Spix's Spinetail	1,2,3,4,6,8,9	S	E,F,M,R,U	AF	t,o,v
<i>Cranioleuca pallida</i>	Pallid Spinetail	1,2,3,4,5,6,7,8	D	E,F,P	AF	t,o,v
<i>Phacellodomus ferrugineigula</i>	Orange-eyed Thornbird	1	S	M	AF	v
<i>Syndactyla rufosuperciliata</i>	Buff-browed Foliage-gleaner	1,3,4,5	D	F		s,t,o,v
<i>Philydor rufum</i>	Buff-fronted Foliage-gleaner	1,2,3,4,5,6	D	E,F		s,t,o,v
<i>Lochmias nematura</i>	Sharp-tailed Streamcreeper	1,2,3,4,5,6,8,9	S	E,F,M		t,o,v
<i>Heliobletus contaminatus</i>	Sharp-billed Treehunter	1,2,3,4,5,6	D	E,F	AF	s,t,o,v
<i>Xenops rutilans</i>	Streaked Xenops	1,3,4,6,8	D	E,F		o,v
Tyrannidae						
<i>Mionectes rufiventris</i>	Gray-hooded Flycatcher	1,3,4,6	D	F	AF	s,o,v

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<i>Hemitriccus obsoletus</i>	Brown-breasted Bamboo-Tyrant	2	D	F	AF	s,o,v
<i>Hemitriccus nidipendulus</i>	Hangnest Tody-Tyrant	6	S	E,F	AF	o,v
<i>Poecilotriccus plumbeiceps</i>	Ochre-faced Tody-Flycatcher	1,2,3,4,5,6	D	E,F		s,t,o,v
<i>Todirostrum poliocephalum</i>	Yellow-lored Tody-Flycatcher	2,4,9	S	E,P	AF	o,v
<i>Phyllomyias burmeisteri</i>	Rough-legged Tyrannulet	5	D	F		v
<i>Phyllomyias fasciatus</i>	Planalto Tyrannulet	1,2,3,4,5,6,8,9	S	E,F,P		t,o,v
<i>Phyllomyias griseocapilla</i>	Gray-capped Tyrannulet	1	D	E,F	NT,AF	t,o,v
<i>Elaenia flavogaster</i>	Yellow-bellied Elaenia	3,4,6,8,9	S	E,P,U		o,v
<i>Elaenia mesoleuca</i>	Olivaceous Elaenia	1	D	E,F		s,t,o,v
<i>Elaenia obscura</i>	Highland Elaenia	1,2,4,5,6,9	S	C,E,F,P,U		s,o,v
<i>Camptostoma obsoletum</i>	Southern Beardless-Tyrannulet	1,2,3,4,8,9	I	E,F,P,U		t,o,v
<i>Serpophaga subcristata</i>	White-crested Tyrannulet	1,2,3,4,6,8,9	S	E,F,P,U		s,t,o,v
<i>Capsiempis flaveola</i>	Yellow Tyrannulet	1	D	F		v
<i>Phylloscartes ventralis</i>	Mottle-cheeked Tyrannulet	1,2,3,4,5,6,7,8,9	D	E,F,P		s,t,o,v
<i>Phylloscartes difficilis</i>	Serra do Mar Tyrannulet	1,2,3,4	D	E,F	NT,AF	s,t,o,v
<i>Tolmomyias sulphurescens</i>	Yellow-olive Flycatcher	1,3,4,5,6,7,8	D	E,F		t,o,v
<i>Platyrinchus mystaceus</i>	White-throated Spadebill	1,3,4	D	F		v
<i>Myiophobus fasciatus</i>	Bran-colored Flycatcher	1,6,8,9	I	M,P,U		t,o,v
<i>Hirundinea ferruginea</i>	Cliff Flycatcher	1,2,3,4,8,9	I	C,E,P,U		t,o,v
<i>Lathrotriccus euleri</i>	Euler's Flycatcher	1,3,4,6,7,8	D	E,F		t,o,v
<i>Knipolegus cyanirostris</i>	Blue-billed Black-Tyrant	1,2,3,4,6	S	E,F,P		o,v
<i>Knipolegus nigerrimus</i>	Velvety Black-Tyrant	1,2	I	C,E		o
<i>Xolmis cinereus</i>	Gray Monjita	9	I	P		o
<i>Xolmis velatus</i>	White-rumped Monjita	1,3,4,8,9	I	P		o
<i>Muscipipra vetula</i>	Shear-tailed Gray Tyrant	1,2,3,4,5,6,9	S	C,E,F,P	AF	t,o,v
<i>Fluvicola nengeta</i>	Masked Water-Tyrant	1,5,9	I	M,P,U		o,v
<i>Colonia colonus</i>	Long-tailed Tyrant	1,2	S	E,F		o,v
<i>Machetornis rixosa</i>	Cattle Tyrant	1,2,4,9	I	P,U		t,o,v
<i>Legatus leucophaeus</i>	Piratic Flycatcher	1	S	E,F		t,v
<i>Myiozetetes similis</i>	Social Flycatcher	1,3,4,9	S	E,P,U		t,o,v
<i>Pitangus sulphuratus</i>	Great Kiskadee	1,2,3,4,5,6,7,8,9	I	E,F,P,U		t,o,v
<i>Myiodynastes maculatus</i>	Streaked Flycatcher	4	S	F		o,v
<i>Megarynchus pitangua</i>	Boat-billed Flycatcher	1,4,9	S	E,P,U		t,o,v

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<i>Empidonomus varius</i>	Variegated Flycatcher	4	S	E		o,v
<i>Tyrannus melancholicus</i>	Tropical Kingbird	1,2,3,4,6,9	I	E,P,U		t,o,v
<i>Tyrannus savanna</i>	Fork-tailed Flycatcher	4,8	I	P		s,o,v
<i>Myiarchus swainsoni</i>	Swainson's Flycatcher	1,2,3,4,6	S	E,FP		s,t,o,v
<i>Myiarchus ferrox</i>	Short-crested Flycatcher	2,6	S	E		o,v
Cotingidae						
<i>Lipaugus lanioides</i>	Cinnamon-vented Piha	1,4	D	F	QA,MG,NT,AF	v
<i>Pyroderus scutatus</i>	Red-ruffed Fruitcrow	1,3,4,6	D	F	QA,MG	t,v
Pipridae						
<i>Piprites pileata</i>	Black-capped Piprites	1,3,4	D	E,F	BR,MG,VU,AF	s,t,o,v
<i>Chiroxiphia caudata</i>	Blue Manakin	1,2,3,4,5,6,8	D	E,F	AF	s,t,o,v
Tityridae						
<i>Schiffornis virescens</i>	Greenish Schiffornis	3	D	F	AF	v
<i>Pachyrampus castaneus</i>	Chestnut-crowned Becard	1,3,4,5	D	E,F		t,o,v
<i>Pachyrampus polychopterus</i>	White-winged Becard	1,2,4,6	S	F		v
Vireonidae						
<i>Cyclarhis gujanensis</i>	Rufous-browed Peppershrike	1,2,3,4,5,6,8,9	S	E,FP,U		t,o,v
<i>Vireo olivaceus</i>	Red-eyed Vireo	1,3	D	F		t,v
<i>Hylophilus poicilitoris</i>	Rufous-crowned Greenlet	1,2,3,4,5,6,8	D	E,F	AF	s,t,o,v
Corvidae						
<i>Cyanocorax cristatellus</i>	Curl-crested Jay	1,2,3,4,5,6,8,9	I	E,FP,U	CE	t,o,v
<i>Cyanocorax chrysops</i>	Plush-crested Jay	1,9	S	E,P		t,o,v
Hirundinidae						
<i>Progne tapera</i>	Brown-chested Martin	9	I	A,U		o,v
<i>Progne chalybea</i>	Gray-breasted Martin	9	I	A,U		o,v
<i>Pygochelidon cyanoleuca</i>	Blue-and-white Swallow	1,2,3,4,8,9	I	A,C,E,P,U		t,o,v
<i>Stelgidopteryx ruficollis</i>	Southern Rough-winged Swallow	1	I	P		o
Troglodytidae						
<i>Troglodytes musculus</i>	Southern House-Wren	1,2,3,4,6,7,8,9	I	C,E,P,U		t,o,v
Turdidae						
<i>Turdus flavipes</i>	Yellow-legged Thrush	1,3	D	E,F		t,v
<i>Turdus rufiventris</i>	Rufous-bellied Thrush	1,2,3,4,5,6,8,9	S	E,FP,U		s,t,o,v
<i>Turdus leucomelas</i>	Pale-breasted Thrush	1,2,3,5,6,8,9	S	E,FP,U		t,o,v
<i>Turdus amaurochalinus</i>	Creamy-bellied Thrush	1,6	S	E,F		t,o,v
<i>Turdus albicollis</i>	White-necked Thrush	1,2,3,5,6	D	E,F		t,o,v
Mimidae						
<i>Mimus saturninus</i>	Chalk-browed Mockingbird	1,4,8,9	I	P,U		o,v



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Coerebidae						
<i>Coereba flaveola</i>	Bananaquit	1,2,3,9	S	E,U		o,v
Thraupidae						
<i>Orchesticus abellei</i>	Brown Tanager	1	D	F	NT,AF	v
<i>Tachyphonus coronatus</i>	Ruby-crowned Tanager	1,3,6,8	D	E,F	AF	s,t,o,v
<i>Thraupis sayaca</i>	Sayaca Tanager	1,2,3,4,6,7,8,9	S	E,F,P,U		t,o,v
<i>Thraupis ornata</i>	Golden-chevroned Tanager	1	S	E,F	AF	o,v
<i>Stephanophorus diadematus</i>	Diademed Tanager	1,2,3,4,5,6,7,8,9	S	C,E,F,P		t,o,v
<i>Pipraeidea melanonota</i>	Fawn-breasted Tanager	1,2,4	S	E,F		t,o,v
<i>Tangara desmaresti</i>	Brassy-breasted Tanager	1,2,3,4,6,7	S	E,F	AF	t,o,v
<i>Tangara cayana</i>	Burnished-buff Tanager	1,2,3,4,6,9	I	C,E,F,P,U		t,o,v
<i>Tersina viridis</i>	Swallow Tanager	1,3,4,6,7,9	S	E,F,P,U		t,o,v
<i>Dacnis cayana</i>	Blue Dacnis	1,3,4	S	E,F		o,v
<i>Hemithraupis ruficapilla</i>	Rufous-headed Tanager	1	D	F	AF	o,v
Emberizidae						
<i>Zonotrichia capensis</i>	Rufous-collared Sparrow	1,2,3,4,5,6,7,8,9	I	C,E,P,U		s,t,o,v
<i>Haplospiza unicolor</i>	Uniform Finch	3,5,8	D	E,F	AF	s,o,v
<i>Poospiza thoracica</i>	Bay-chested Warbling-Finch	1,2	S	C,E,F	AF	s,t,o,v
<i>Poospiza lateralis</i>	Red-rumped Warbling-Finch	1,2,3,4,5,6,7,8	S	C,E,F,P	AF	s,t,f,o,v
<i>Sicalis citrina</i>	Stripe-tailed Yellow-Finch	2	I	C		t,o,v
<i>Sicalis flaveola</i>	Saffron Finch	1,6,9	I	P,U	MG	t,o,v
<i>Emberizoides herbicola</i>	Wedge-tailed Grass-Finch	9	I	P		o,v
<i>Volatinia jacarina</i>	Blue-black Grassquit	8,9	I	P,U		o,v
<i>Sporophila lineola</i>	Lined Seed-eater	9	I	U		t,o,v
<i>Sporophila caerulescens</i>	Double-collared Seed-eater	1,4,5,6,9	I	E,M,P,U		o,v
Cardinalidae						
<i>Saltator similis</i>	Green-winged Saltator	1,2,3,4,5,6,7,8	S	E,F		t,o,v
Parulidae						
<i>Parula pitiayumi</i>	Tropical Parula	1,3,8	D	E,F		t,o,v
<i>Geothlypis aequinoctialis</i>	Masked Yellowthroat	8,9	I	M		v
<i>Basileuterus culicivorus</i>	Golden-crowned Warbler	1,2,3,4,5,6	D	E,F		s,t,o,v
<i>Basileuterus hypoleucus</i>	White-bellied Warbler	1,2,3,4,5,6	D	E,F		s,t,o,v
<i>Basileuterus leucoblepharus</i>	White-browed Warbler	1,2,3,4,5,6,7,8	D	E,F	AF	s,t,o,v

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Icteridae						
<i>Cacicus chrysopterus</i>	Golden-winged Cacique	1,2,3,4,5,6,7,8	D	E,FP		s,pn,t,o,v
<i>Gnorimopsar chopi</i>	Chopi Blackbird	1,3,4,7,8,9	I	E,P,U		t,o,v
<i>Pseudoleistes guiraburo</i>	Yellow-rumped Marshbird	2	I	P		o,v
<i>Molothrus bonariensis</i>	Shiny Cowbird	1,9	I	P,U		o,v
Fringillidae						
<i>Carduelis magellanica</i>	Hooded Siskin	1,2,3,4,5,8,9	I	E,M,P,U		t,o,v
<i>Euphonia chlorotica</i>	Purple-throated Euphonia	1,4,6	S	E,F		o,v
<i>Euphonia cyanocephala</i>	Golden-rumped Euphonia	1	S	F	AF	o,v
<i>Chlorophonia cyanea</i>	Blue-naped Chlorophonia	1,4	S	E,F		p,o,v
Passeridae						
<i>Passer domesticus</i>	House Sparrow	8,9	I	P,U		t,o,v