



# Diversity of birds in the Mata do Junco State Wildlife Refuge, a remnant of the Atlantic Forest of Northeastern Brazil

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**Abstract:** This study presents an inventory of the bird fauna of the Mata do Junco State Wildlife Refuge in Capela, in the northeastern Brazilian state of Sergipe. Monthly samples were collected between January 2011 and May 2012. Each 3-day sample was based on mist-netting (100 m) in two areas and the compilation of MacKinnon lists of 10 species. During the 17 months of the study period, the occurrence of 129 bird species belonging to 41 families was confirmed for the study area. In the mist-nets, a total of 469 individuals representing 58 species were captured in 3400 net-hours of sampling effort. A total of 100 MacKinnon lists were compiled, resulting in an inventory of 119 bird species. Eight of the species are endemic to Brazil, of which, five are restricted to the Brazilian Atlantic Forest. Three of the species are included in the IUCN Red List, at different levels of concern. Overall, the results of the study indicate that the Mata do Junco represents an important area for the protection of the region's avian fauna and the habitats they rely on.

**Key words:** avian inventory, bird conservation, protected areas, Sergipe

## INTRODUCTION

The Brazilian Atlantic Forest is one of the world's 34 conservation hotspots (Conservation International 2012), which together account for more than 60% of the terrestrial species found on the planet (Lagos and Muller 2007). The northern extreme of the Atlantic Forest in the Brazilian Northeast originally covered an area of 255,245 km<sup>2</sup>, or almost 29% of its original extension, but in 2006 this had been reduced to only 19,427 km<sup>2</sup> (Tabarelli et al. 2006). The remnants of the original forest are distributed in relatively small fragments surrounded by agricultural matrix composed primarily of sugar cane plantations (Pereira and Alves 2006).

At least 400 fragments of Atlantic Forest can be found in the Brazilian state of Sergipe, covering a total area of approximately 36,000 ha, representing around 7% of the original forest cover of the state (Santos et al. 2013). The vast majority of these fragments are relatively small (20–450 ha), although there is one much larger fragment, of 1,000 ha, in the south of the state.

The creation of protected areas represents an important strategy for the conservation of natural resources, and in the state of Sergipe, a total of 19 reserves has been established by federal, state, and municipal governments. However, surveys of the avian fauna are available for only three of these areas (D'Horta et al. 2005; Ruiz-Esparza et al. 2011; Lyra-Neves et al. 2012). In 2007, the state government decreed the Mata do Junco Wildlife Refuge in the municipality of Capela, with the primary objective of protecting the local populations of endangered species endemic to the Atlantic Forest of northeastern Brazil, in particular the Coimbra Filho's Titi Monkey (*Callicebus coimbrai*) and the Fringe-backed Fire-eye (*Pyriglena atra*).

Almost seven hundred bird species are known to occur in the Atlantic Forest (Cordeiro 2003), of which 124 are endemic (Brooks et al. 1999), and 83 endangered (Olmos 2005). The care with possible future extinctions and maintaining the integrity and biological dynamics of ecosystems depends on scientific information about threatened species (Bencke et al. 2006) and species inventories (Farias et al. 2009). Here we present a bird inventory of Mata do Junco State Wildlife Refuge, Sergipe, within in the Atlantic Forest biome, and discuss the conservation importance of its avifauna.

## MATERIALS AND METHODS

### Study site

The Mata do Junco State Wildlife Refuge (10°32'20" S, 037°03'20" W) is located in the municipality of Capela,

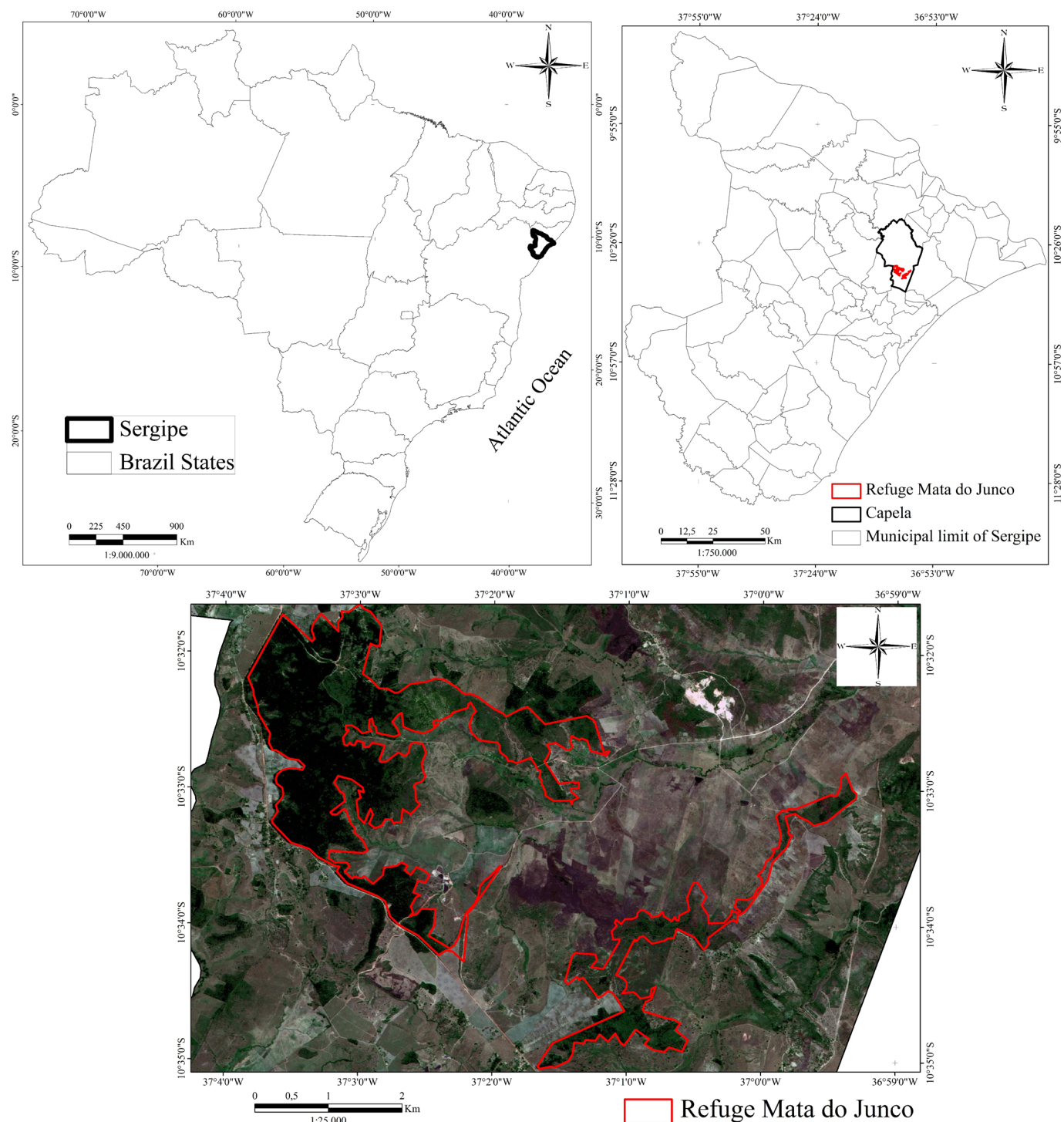
in the state of Sergipe, Brazil (Figure 1). The refuge has a total area of approximately 900 ha, and is located within the basin of the Japarutuba River, which flows into the Atlantic. The vegetation is typical plateau Atlantic rainforest, with some areas of laterized soil, on which a more open type of vegetation is found, dominated by sclerophyllous shrubs. Natural clearings are characterized by the presence of pioneer trees, such as *Cecropia* spp., *Tapirira guianensis*, and *Sclerolobium paniculata*, which are typical of different stages of regeneration (SEMARH 2011).

The region's climate is semi-humid tropical (As),

characterized by a rainy season in the austral winter and a dry season in the summer (Köppen 1936). Mean temperatures are above 18°C, with maxima of between 21°C and 38°C and minima of 18–22.2°C (SEPLANTEC/SRH 2009). The study area is based on rocks of the Cretaceous Riachuelo group of the Barreiras formation, with Holocene alluvial deposits at the surface (SEMARH 2011).

### Data collection

Data were collected using two complementary approaches — mist-netting and MacKinnon lists. Ten 10 m × 2.5 m mist-nets were set in line along trails in two



**Figure 1.** Location of the Mata do Junco State Wildlife Refuge in Capela, Sergipe (Brazil).

areas of the refuge, one representing the typical open habitat and the other an area of closed vegetation. Each area was surveyed during three consecutive days on alternating months between January 2011 and May 2012.

One area was located in an open area (Figure 2) at the forest edge along an established trail (10°31'56" S, 037°03'34" W). Sampling at this site began in January 2011, and was then conducted every two months until the penultimate month of the study. The second area is located within the forest proper (10°32'05" S, 037°03'33" W) at a straight-line distance of approximately 300 m from the first area. Sampling began in February 2011 and continued every two months until the end of the study period.

The nets were opened during the morning (05:00–10:00 h) and late afternoon (15:00–18:00 h) and checked every 20 minutes to impede the predation of captured birds (Bonter 1999; Ruiz-Esparza et al. 2012). The collection of specimens was authorized by ICMBio (Federal Environment Institute), through scientific license 27020-1, issued by SISBIO.

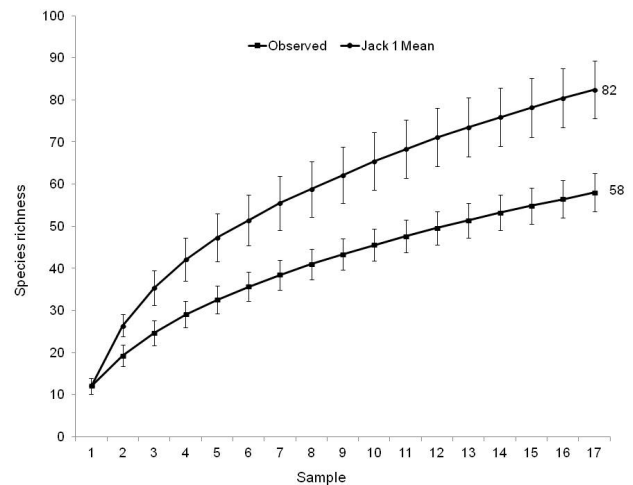
The inventory of species was complemented with MacKinnon lists (MacKinnon and Phillips 1993), which are based on standardized surveys of the principal trails within the refuge, using 8 × 40 binoculars and a field identification guide (Sigrist 2007). During each survey, the observer recorded the first ten species encountered, which constitute one MacKinnon list (Ribon 2010). Five MacKinnon lists (10 species) were collected each month, with an overall total of 100 lists being recorded during the study period. Nomenclature follows the Brazilian Committee of Ornithological Records (CBRO, 2014).

## RESULTS

A total of 129 bird species were recorded in the present study, representing 41 families, the most abundant of which were Tyrannidae ( $n = 18$ ; 13.9% of the total number of species), Thraupidae ( $n = 14$ ; 10.8%), Thamnophilidae



**Figure 2.** Location of the mist-nets in the open forest habitat at the RVS Mata do Junco.



**Figure 3.** Sample rarefaction (Mao tau) of the observed species richness and expected richness estimated by Jackknife 1 for the bird species captured in mist-nets (January 2011–May 2012) at the Mata do Junco State Wildlife Refuge in Sergipe, Brazil.

( $n = 9$ ; 6.9%), Trochilidae ( $n = 8$ ; 6.2%), and Rhynchocyclidae ( $n = 7$ ; 5.4%). Together, these five families correspond to 43.4% of the total number of species recorded.

Sampling effort for mist-netting totaled 3400 net-hours (12 m of net = 1 net-hour) over the 17 months of fieldwork, which resulted in the capture of 469 specimens (49 of which were recaptured) belonging to 58 species. The Jackknife 1 analysis estimated a total of 82 bird species for the study area, 24 more than the actual number captured in the mist-nets (Figure 3).

The most abundant species captured in the mist-nets were *Manacus manacus* ( $n = 166$  or 35.3% of the total number of individuals captured), *Chiroxiphia pareola* ( $n = 45$ ; 9.5%), *Myiothlypis flaveola* ( $n = 23$ ; 4.9%), *Arremon taciturnus* ( $n = 18$ ; 3.8%), *Neopelma pallescens*, and *Thamnophilus pelzelni* ( $n = 16$ ; 3.4%). Together, these species account for 57% of all the specimens captured in the mist-nets.

Five MacKinnon lists were collected each month, with an overall total of 100 lists being recorded during the study period. A total of 119 species were recorded in these lists, although the Jackknife 1 analysis estimated a total of 149 species for the study area (Figure 4). The most common species recorded in the MacKinnon lists were *Chiroxiphia pareola*, *Manacus manacus*, *Vireo chivi*, *Columbina talpacoti*, *Arremon taciturnus* and *Stelgidopteryx ruficollis*, which together contributed just over one-quarter (26.3%) of the individual records ( $n = 1632$ ).

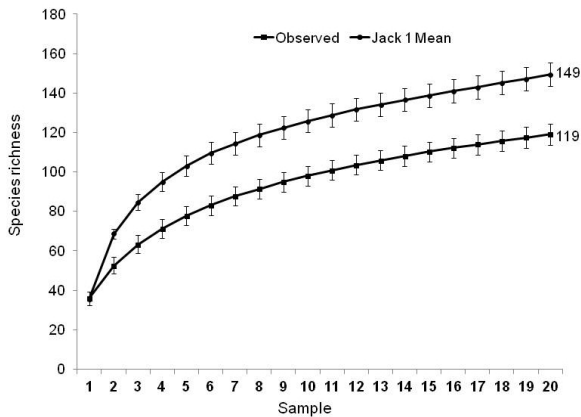
Eight of the species recorded in the present study are endemic to Brazil (Appendix 1), of which five—*Pyriglena atra*, *Hemitriccus nidipendulus*, *Ramphocelus bresilius*, *Hylophilus poicilotis* and *Thalaurania glaucopsis*—are endemic to the Brazilian Atlantic Forest (Brooks et al. 1999). Three of the species are red-listed by the IUCN (2013). *Thalaurania watertoni* is listed as Near-Threatened, *Herpsilochmus pectoralis* as Vulnerable and *Pyriglena atra*

(Figure 5) as Endangered.

Based on the classification of Stotz et al. (1999), 48 of the species recorded in the present study can be characterized as specialists or indicators of specific types of habitat. Three of the species (*Herpsilochmus pectoralis* (Figure 6A, B), *Picumnus pygmaeus* (Figure 6C) and

*Formicivora melanogaster*) can be considered to be specialized for the occupation of deciduous tropical forests, and are endemic to central South America.

Eight other species are seen as typical of the Atlantic Forest. Two species—*Xenops rutilans* (Figure 7A) and *Platyrrinchus mystaceus* (Figure 7B)—are found primarily



**Figure 4.** Sample rarefaction (Mao tau) and expected species richness estimated by Jackknife 1 for the bird species recorded in the MacKinnon lists at the Mata do Junco State Wildlife Refuge in Sergipe, Brazil. Each sample corresponds to five lists.



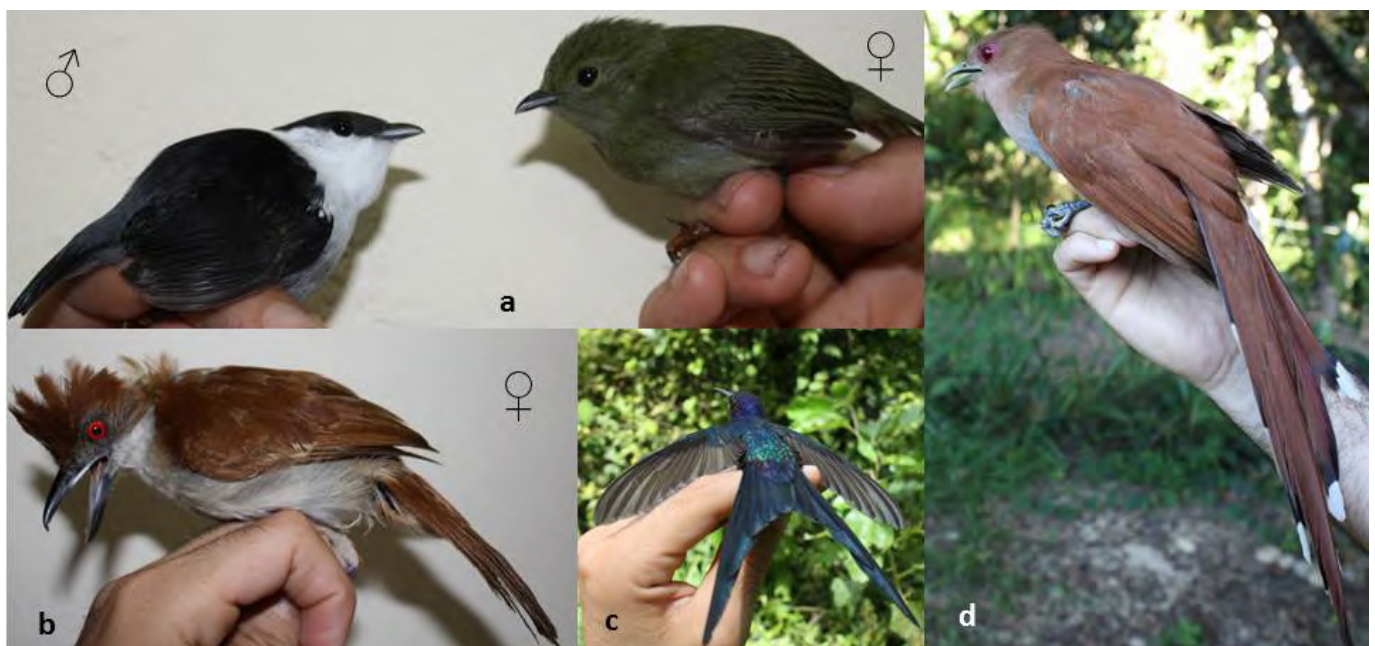
**Figure 5.** Pair of Fringe-backed Fire-eye (*Pyriglena atra*) captured in the mist-nets at the Mata do Junco State Wildlife Refuge in Sergipe, Brazil.



**Figure 6.** Specialist species captured in the mist-nets at the Mata do Junco State Wildlife Refuge, Sergipe, Brazil: a) and b) pair of Pectoral Antwren (*Herpsilochmus pectoralis*) and c) Spotted Piculet (*Picumnus pygmaeus*).



**Figure 7.** Species considered to be typical of the Atlantic Forest captured in the mist-nets at the Mata do Junco State Wildlife Refuge, Sergipe, Brazil: a) Streaked Xenops (*Xenops rutilans*), b) White-throated Spadebill (*Platyrinchus mystaceus*), c) Fuscous Flycatcher (*Cnemotriccus fuscatus*), d) Flame-crested Tanager (*Lanio cristatus*), e) Whiskered Flycatcher (*Myiobius barbatus*) and f) Red-crowned Ant-Tanager (*Habia rubica*).



**Figure 8.** Species indicative of habitat disturbance captured in the mist-nets at the Mata do Junco State Wildlife Refuge, Sergipe, Brazil: a) Pair of White-bearded Manakin (*Manacus manacus*), b) Great Antshrike (*Taraba major*), c) Swallow-tailed Hummingbird (*Eupetomena macroura*) e d) Squirrel Cuckoo (*Piaya cayana*).

in montane evergreen forests, while four others—*Penelope superciliaris*, *Formicivora grisea*, *Cnemotriccus fuscatus* (Figure 7C) and *Lanio cristatus* (Figure 7D)—are considered to be white sand specialists. *Myiobius barbatus* (Figure 7E) and *Habia rubica* (Figure 7F) are typical of lowland evergreen habitats.

Thirty seven other species—*Coragyps atratus*, *Vanellus chilensis*, *Columbina talpacoti*, *Manacus manacus* (Figure 8A), *Crotophaga ani*, *Guira guira*, *Tyto furcata*, *Hydropsalis albicollis*, *Taraba major* (Figure 8B), *Eupetomena macroura* (Figure 8C), *Todirostrum cinereum*, *Piaya cayana* (Figure 8D), *Camptostoma obsoletum*, *Elaenia flavogaster*, *Phaeomyias murina*, *Serpophaga subcristata*, *Myiarchus ferox*, *Pitangus sulphuratus*, *Megarynchus pitangua*, *Myiozetetes similis*, *Tyrannus melancholicus*, *Stelgidopteryx ruficollis*, *Progne tapera*, *Turdus rufiventris*, *Turdus leucomelas*, *Turdus amaurochalinus*, *Coereba flaveola*, *Saltator maximus*, *Saltator similis*, *Ramphocelus bresilius*, *Tangara sayaca*, *Tangara palmarum*, *Dacnis cayana*, *Cyanerpes cyaneus*, *Volatinia jacarina*, *Molothrus bonariensis* and *Euphonia chlorotica*—are considered to be indicators of disturbed habitats, such as secondary forests.

Twenty-two of the species recorded in the present study are classified as full or partial migrants by Stotz et al. (1996). Most of these species (*Vanellus chilensis*, *Nyctibius griseus*, *Anrostomus rufus*, *Pachyrhamphus polychopterus*, *Camptostoma obsoletum*, *Elaenia flavogaster*, *Myiopagis viridicata*, *Phaeomyias murina*, *Serpophaga subcristata*, *Pitangus sulphuratus*, *Megarynchus pitangua*, *Myiophobus fasciatus*, *Sublegatus modestus*, *Progne tapera*, and *Hemithraupis guira*) are partial austral migrants, which undertake regional movements according to seasonal shifts in the distribution of tropic resources. One other species, *Turdus amaurochalinus*, is classified as an austral migrant.

Two Nearctic migrants—*Egretta thula* and *Falco sparverius*—breed in the Neotropics. *Buteo albonotatus* is a partial Nearctic migrant.

## DISCUSSION

Over the course of the present study, a total of 129 bird species were recorded in the RVS Mata do Junco, representing the first systematic survey of birds of the Atlantic Forest for Sergipe. Eight of the species are endemic to Brazil, of which, five are restricted to the Brazilian Atlantic Forest. Three of the species are included in the IUCN Red List, at different levels of concern and 22 of the species recorded are classified as full or partial migrants by Stotz et al. (1996).

Five endemic species were recorded occasionally during the study. *Anopetia gounellei* was captured in October, 2011, for example, whereas *Ramphocelus bresilius* was observed between March and May, and *Thalurania watertonii* was seen on two occasions, in March 2011 and January 2012. *Picumnus pygmaeus* was observed in

March 2011, and a specimen was captured in June 2011, while *Hemitriccus nidipendulus* was captured in February 2011, and observed in June 2011 and April 2012.

Other species were recorded more frequently. For example, while only two specimens of *Herpsilochmus pectoralis* were captured, in June 2011, the species was observed and heard throughout the year. *Thamnophilus pelzelni* was also present throughout the year, and 16 specimens were captured. *Pyriglena atra* was observed and heard during the 10 months between April and January, and six males and two females were captured, with brood patches being found in both sexes in November, February, April, and May. While Lima and Neto (2007) reported that the breeding season of this species began at the end of October, it lasted only until March, two months earlier than the evidence found in the present study.

While the Brazilian Atlantic Forest has a unique biota, with many endemic genera and species (Myers et al. 2000), the present study recorded species endemic to the Caatinga and other open formations, such as *Picumnus pygmaeus*, *Anopetia gounellei*, and *Herpsilochmus pectoralis*. This may be related to the geographic position of the Mata do Junco State Wildlife Refuge, which, while representative of the Atlantic Forest, is located marginally within the Atlantic Forest–Caatinga ecotone.

The results of the present study indicate that the MacKinnon lists are a relatively effective approach for the inventory of birds in comparison with mist-netting, although each method has its specific advantages. In particular, the MacKinnon lists provide data on canopy-dwelling species that are rarely or never captured in mist-nets. Thus, 71 of the species recorded in the MacKinnon lists were not captured in the mist-nets, while 11 of the species collected in the nets were not observed during the observation-based surveys (Appendix 1).

In a previous survey of the Mata do Junco, Sousa (2009) recorded eight species that were not observed during the present study. These species are the Speckled Chachalaca (*Ortalis guttata*), Short-tailed Hawk (*Buteo brachyurus*), Rufous-capped Antthrush (*Formicarius colma*), Grayish Mourner (*Rhytipterna simplex*), Long-billed Gnatwren (*Ramphocaenus melanurus*), Yellow-backed Tanager (*Hemithraupis flavicollis*), Cinnamon Tanager (*Schistochlamys ruficapillus*), and to the Brazilian Atlantic Forest endemic Black-cheeked Gnatcatcher (*Conopophaga melanops*).

Together with the species recorded in the present study, this would bring the total number of bird species known to occur in this protected area to 127. The management plan published for this conservation unit (SEMARH 2011) refers to a further 37 bird species not recorded in either study that may potentially occur in the area (unpublished data), although it is unclear which of these taxa may actually occur in the refuge.

Overall, then, the available evidence indicates that at

least 127 bird species, and possibly as many as 164, occur in the Mata do Junco State Wildlife Refuge. This total is comparable with that recorded (123) at the Serra de Itabaiana National Park in central Sergipe by D’Horta et al. (2005), located within an Atlantic Forest transition zone, but slightly lower than the 140 species recorded in the Grota do Angico Natural Monument in the Caatinga scrub of northern Sergipe by Ruiz-Esparza et al. (2011). The presence of a diverse avian fauna at Mata do Junco, which includes three rare or threatened species, represents an important resource for the conservation of the region’s biota, given the decimation of local ecosystems in recent decades. More information on the status of these populations and their ecological relationships will be required, however, to develop adequate management strategies over the long term.

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## LITERATURE CITED

- Bencke, G. A., G. N. Maurício, P. F. Develey and J. M. Goerck .2006. Áreas importantes para a conservação das aves no Brasil. Parte I — Estados do domínio da Mata Atlântica. São Paulo: SAVE Brasil. 494 pp.
- Bonter, D. 1999. Migration Monitoring Protocol. Standard guidelines for migration monitoring research at Braddock Bay Bird Observatory’s Kaiser - Manitou Beach Research Station. Version 2.1. <http://www.bbbo.org/research/protocol.pdf>
- Brooks, T., J. Tobias and A. Balford. 1999. Deforestation and Bird Extinction in the Atlantic Forest. *Animal Conservation* 2: 211–222. <http://journals.cambridge.org/action/displayAbstract?fromPage=online&aid=52227&fileId=S1367943099000542>
- Comitê Brasileiro de Registros Ornitológicos (CBRO). 2014. Listas das aves do Brasil. 11ª Edição. Accessed at <http://www.cbro.org.br>, 24 July 2014.
- Conservation International. 2012. Accessed at <http://www.conservation.org/Pages/default.aspx>, 13 October 2012.
- Cordeiro, P. H. C. 2003. Padrões de distribuição geográfica da avifauna, com ênfase nas espécies endêmicas e ameaçadas, nos remanescentes de Mata Atlântica no sul da Bahia. Instituto de Estudos Sócio-Ambientais do Sul da Bahia e Conservation International do Brasil. 1-12 [http://ibama.angelfire.com/analise\\_avifauna.pdf](http://ibama.angelfire.com/analise_avifauna.pdf)
- D’Horta, F.M., S.F. Gouveia, and P.A. Rocha. 2005. Aves; pp. 63-76, in C.M. Carvalho and J.C. Vilar (eds.). Parque Nacional Serra de Itabaiana—Levantamento da Biota. Aracaju, IBAMA, Biologia Geral e Experimental—UFS.
- Farias, G. B., G.A. Pereira, S.M. Dantas, E.S.T. Vasconcelos, K. Burgos, M.T. Brito, G.L. Pacheco and E. Guimaraes. 2009. Aves observadas no município de Bonito, Pernambuco, Brasil. *Atualidades Ornitológicas* 150: 41-45. [http://www.ao.com.br/download/AO150\\_41.pdf](http://www.ao.com.br/download/AO150_41.pdf)
- IUCN. 2013. The IUCN Red List of threatened species. Version 2013.2. International Union for Conservation of Nature. Accessed at <http://www.iucnredlist.org>, 12 December 2013.
- Köppen, W. 1936. Das geographische system der klimate; pp. 5–44, in: W. Köppen and R. Geiger (eds.). *Handbuch der Klimatologie*. Vol 3. Berlin: Gebrüder Borntraeger.
- Lagos, A.E. and B.L.A. Muller. 2007. Hotspot Brasileiro Mata Atlântica. Saúde & Ambiente em Revista. Duque de Caxias 2: 35-45. <http://publicacoes.unigranrio.br/index.php/sare/article/viewFile/244/233>
- Lima, P.C. and T.N.C.L. Neto. 2007. Comportamento reprodutivo do olho-de-fogo-rendado *Pyryglena atra* no litoral norte da Bahia. *Atualidades ornitológicas* 140: 33-50. [http://www.ao.com.br/download/ao140\\_33.pdf](http://www.ao.com.br/download/ao140_33.pdf)
- Lyra-Neves R. M., S. M. Azevedo-Júnior, W. R., Telino-Júnior and M. E. L. Larrazábal. 2012. The birds of the Talhado do São Francisco Natural Monument in the semi-arid Brazilian northeast. *Revista Brasileira de Ornitologia* 20(3): 268-289. <http://www4.museu-goeldi.br/revistabronito/revista/index.php/BJO/article/view/4908>
- MacKinnon, J. and K. Phillips. 1993. A field guide to the birds of Borneo, Sumatra, Java and Bali, the Greater Sunda Islands. Oxford University Press, Oxford. 491 pp.
- Myers, N., R. A. Mittermeier, C. G. Mittermeier, G. A. B. Fonseca and J. Kent. 2000. Biodiversity hotspots for conservation priorities. *Nature* 403: 853-858. doi: 10.1038/35002501
- Olmos, F. 2005. Aves ameaçadas, prioridades e políticas de conservação no Brasil. *Natureza & Conservação* 3(1): 21–42.
- Pereira, M.S. and R.R.N. Alves. 2006. Composição florística de um remanescente de Mata Atlântica na Área de Proteção Ambiental Barra do Rio Mamanguape, Paraíba, Brasil. *Revista de Biologia e Ciências da Terra* 6: 357–366.
- Ribon, R. 2010. Amostragem de aves pelo método das listas de MacKinnon; pp. 33-44 in: S.V. Matter, F.C. Straube, I. Accordi, V. Piacentini and J.F. Cândido-Jr. (eds.). *Ornitologia e Conservação*. 1ª edição. Editora: Technical Books. Rio de Janeiro.
- Ruiz-Esparza, J., S.F. Gouveia, P.A. Rocha, R. Beltrão-Mendes, A.R. Souza, and S.F. Ferrari. 2011. Aves do Monumento Natural Grota de Angico na região de Caatinga ao Nordeste do Brasil. *Biota Neotropica* 11: 1-8. doi: 10.1590/S1676-06032011000200027
- Ruiz-Esparza, J., P.A. Rocha, A.R. Souza, and S.F. Ferrari. 2012. Predation of birds trapped in mist nets by raptors in the Brazilian Caatinga. *North American Bird Bander* 37: 11–17.
- Santos, A.L., C.M. Carvalho and T.M. Carvalho. 2013. Importância de remanescentes florestais para conservação da biodiversidade: estudo de caso na Mata Atlântica em Sergipe através de sensoriamento remoto. *Geográfica Acadêmica*, 7: 58-84. [http://rga.ggf.br/index.php?journal=rga&page=article&op=viewArticle&path\[\]=215](http://rga.ggf.br/index.php?journal=rga&page=article&op=viewArticle&path[]=215)
- Secretaria de Estado do Planejamento e da Ciência e Tecnologia e Superintendência de Recursos Hídricos (SEPLANTEC E SRH). 2009. Normais de temperaturas. Electronic Database. Accessed at <http://www.seplantec-srh.se.gov.br/>, 21 November 2012.
- SEMARH. 2011. Secretaria de Estado do Meio Ambiente e dos Recursos Hídricos. Plano de Manejo do Refúgio de Vida Silvestre Mata do Junco. Versão Final Aracaju/Sergipe. Setembro/2011.
- Sigrist, T. 2007. Guia de campo, aves do Brasil Oriental. 1ª ed. São Paulo, Avisbrasils, 448 pp.
- Sousa, M.C. 2009. As aves de oito localidades do estado de Sergipe. *Atualidades Onitológicas* 149: 33–57. [http://www.ao.com.br/download/ao149\\_33.pdf](http://www.ao.com.br/download/ao149_33.pdf).
- Stotz, D.F., J.W. Fitzpatrick, III, T.A. Parker and D.K. Moskovits. 1996. Neotropical birds ecology and conservation. The Uni-

versity of Chicago Press. 502 pp.

Tabarelli, M., J.A. Siqueira Filho and A.M.M. Santos. 2006. A floresta Atlântica ao norte do Rio São Francisco. pp. 21–35, in: K.C. Pôrto, J.A. Cortez and M. Tabarelli (eds.). Diversidade biológica e conservação da floresta Atlântica ao norte do Rio São Francisco. Brasília: Ministério do Meio Ambiente, Coleção Biodiversidade.

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**APPENDIX 1.** Bird species recorded at RVS Mata do Junco, Sergipe, during the present study. The classification and nomenclature follows the Brazilian Committee for Ornithological Records (CBRO 2014). Type of record: O = observation; C = specimen collected in mist-nets.

Family	Species	English Name	Type of record
Tinamidae Gray, 1840	<i>Crypturellus soui</i> (Hermann, 1783)	Little Tinamou	O
	<i>Rhynchotus rufescens</i> (Temminck, 1815)	Red-winged Tinamou	O
Cracidae Rafinesque, 1815	<i>Penelope supercilialis</i> Temminck, 1815	Rusty-margined Guan	O
Ardeidae Leach, 1820	<i>Butorides striata</i> (Linnaeus, 1758)	Striated Heron	O
	<i>Bubulcus ibis</i> (Linnaeus, 1758)	Cattle Egret	O
	<i>Egretta thula</i> (Molina, 1782)	Snowy Egret	O
Cathartidae Lafresnaye, 1839	<i>Cathartes aura</i> (Linnaeus, 1758)	Turkey Vulture	O
	<i>Cathartes burrovianus</i> Cassin, 1845	Lesser Yellow-headed Vulture	O
	<i>Coragyps atratus</i> (Bechstein, 1793)	Black Vulture	O
Accipitridae Vigors, 1824	<i>Rupornis magnirostris</i> (Gmelin, 1788)	Roadside Hawk	O
	<i>Buteo albonotatus</i> Kaup, 1847	Zone-tailed Hawk	O
Rallidae Rafinesque, 1815	<i>Aramides cajaneus</i> (Statius Muller, 1776)	Gray-necked Wood-rail	O
Charadriidae Leach, 1820	<i>Vanellus chilensis</i> (Molina, 1782)	Southern Lapwing	O
Jacanidae Chenu & Des Murs, 1854	<i>Jacana jacana</i> (Linnaeus, 1766)	Wattled Jacana	O
Columbidae Leach, 1820	<i>Columbina talpacoti</i> (Temminck, 1811)	Ruddy Ground-dove	C, O
	<i>Patagioenas picazuro</i> (Temminck, 1813)	Picazuro Pigeon	O
	<i>Patagioenas cayennensis</i> (Bonnaterre, 1792)	Pale-vented Pigeon	O
	<i>Leptotila verreauxi</i> Bonaparte, 1855	White-tipped Dove	O
Cuculidae Leach, 1820	<i>Piaya cayana</i> (Linnaeus, 1766)	Squirrel Cuckoo	O
	<i>Crotophaga ani</i> Linnaeus, 1758	Smooth-billed Ani	C, O
	<i>Guira guira</i> (Gmelin, 1788)	Guira Cuckoo	O
Tytonidae Mathews, 1912	<i>Tyto furcata</i> (Scopoli, 1769)	American Barn Owl	O
Strigidae Leach, 1820	<i>Megascops choliba</i> (Vieillot, 1817)	Tropical Screech-owl	O
	<i>Pulsatrix perspicillata</i> (Latham, 1790)	Spectacled Owl	O
Nyctibiidae Chenu & Des Murs, 1851	<i>Nyctibius griseus</i> (Gmelin, 1789)	Common Potoo	O
Caprimulgidae Vigors, 1825	<i>Antrostomus rufus</i> (Boddaert, 1783)	Rufous Nightjar	C, O
	<i>Hydropsalis albicollis</i> (Gmelin, 1789)	Pauraque	C, O
	<i>Hydropsalis torquata</i> (Gmelin, 1789)	Scissor-tailed Nightjar	C, O
Trochilidae Vigors, 1825	<i>Anopetia gounellei</i> (Boucard, 1891)	Broad-tipped Hermit	C
	<i>Phaethornis ruber</i> (Linnaeus, 1758)	Reddish Hermit	C, O
	<i>Phaethornis pretrei</i> (Lesson & Delattre, 1839)	Planalto Hermit	O
	<i>Eupetomena macroura</i> (Gmelin, 1788)	Swallow-tailed Hummingbird	C, O
	<i>Chlorostilbon notatus</i> (Reich, 1793)	Blue-chinned Sapphire	C, O
	<i>Chlorostilbon lucidus</i> (Shaw, 1812)	Glittering-bellied Emerald	O
	<i>Thalurania watertonii</i> (Bourcier, 1847)	Long-tailed Woodnymph	O
	<i>Thalurania glaucopsis</i> (Gmelin, 1788)	Violet-capped Woodnymph	C, O
Trogonidae Lesson, 1828	<i>Trogon curucui</i> Linnaeus, 1766	Blue-crowned Trogon	C, O
Galbulidae Vigors, 1825	<i>Galbula ruficauda</i> Cuvier, 1816	Rufous-tailed Jacamar	C, O
Picidae Leach, 1820	<i>Picumnus pygmaeus</i> (Lichtenstein, 1823)	Spotted Piculet	C, O
	<i>Veniliornis passerinus</i> (Linnaeus, 1766)	Little Woodpecker	O
	<i>Campephilus melanoleucos</i> (Gmelin, 1788)	Crimson-crested Woodpecker	O
Falconidae Leach, 1820	<i>Caracara plancus</i> (Miller, 1777)	Southern Caracara	O
	<i>Milvago chimachima</i> (Vieillot, 1816)	Yellow-headed Caracara	O
	<i>Herpotheres cachinnans</i> (Linnaeus, 1758)	Laughing Falcon	O
	<i>Micrastur semitorquatus</i> (Vieillot, 1817)	Collared Forest-falcon	O
	<i>Falco sparverius</i> Linnaeus, 1758	American Kestrel	O
Psittacidae Rafinesque, 1815	<i>Eupsittula aurea</i> (Gmelin, 1788)	Peach-fronted Parakeet	O
	<i>Forpus xanthopterygius</i> (Spix, 1824)	Blue-winged Parrotlet	O
Thamnophilidae Swainson, 1824	<i>Myrmotherula axillaris</i> (Vieillot, 1817)	White-flanked Antwren	C, O
	<i>Formicivora grisea</i> (Boddaert, 1783)	White-fringed Antwren	C, O
	<i>Formicivora melanogaster</i> Pelzeln, 1868	Black-bellied Antwren	C

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Appendix 1. *Continued.*

Family	Species	English Name	Type of record
	<i>Herpsilochmus atricapillus</i> Pelzeln, 1868	Black-capped Antwren	O
	<i>Herpsilochmus pectoralis</i> Sclater, 1857	Pectoral Antwren	C, O
	<i>Herpsilochmus longirostris</i> Pelzeln, 1868	Large-billed Antwren	O
	<i>Thamnophilus pelzelni</i> Hellmayr, 1924	Planalto Slaty-antshrike	C, O
	<i>Taraba major</i> (Vieillot, 1816)	Great Antshrike	C, O
	<i>Pyriglena atra</i> (Swainson, 1825)	Fringe-backed Fire-eye	C, O
Dendrocolaptidae Gray, 1840	<i>Dendroplex picus</i> (Gmelin, 1788)	Straight-billed Woodcreeper	C, O
Furnariidae Gray, 1840	<i>Xenops rutilans</i> Temminck, 1821	Streaked Xenops	C, O
	<i>Furnarius rufus</i> (Gmelin, 1788)	Rufous Hornero	O
	<i>Synallaxis albescens</i> Temminck, 1823	Pale-breasted Spinetail	O
Pipridae Rafinesque, 1815	<i>Neopelma pallescens</i> (Lafresnaye, 1853)	Pale-bellied Tyrant-manakin	C
	<i>Manacus manacus</i> (Linnaeus, 1766)	White-bearded Manakin	C, O
	<i>Chiroxiphia pareola</i> (Linnaeus, 1766)	Blue-backed Manakin	C, O
Onychorhynchidae Tello, Moyle, Marchese & Cracraft, 2009	<i>Myiobius barbatus</i> (Gmelin, 1789)	Whiskered Flycatcher	C, O
Tityridae Gray, 1840	<i>Pachyrhamphus polychopterus</i> (Vieillot, 1818)	White-winged Becard	C, O
Platyrinchidae Bonaparte, 1854	<i>Platyrinchus mystaceus</i> Vieillot, 1818	White-throated Spadebill	C, O
Rhynchocyclidae Berlepsch, 1907	<i>Leptopogon amaurocephalus</i> Tschudi, 1846	Sepia-capped Flycatcher	C
	<i>Tolmomyias sulphurescens</i> (Spix, 1825)	Yellow-olive Flycatcher	C
	<i>Tolmomyias flaviventris</i> (Wied, 1831)	Yellow-breasted Flycatcher	C, O
	<i>Todirostrum cinereum</i> (Linnaeus, 1766)	Common Tody-flycatcher	O
	<i>Hemitriccus striaticollis</i> (Lafresnaye, 1853)	Stripe-necked Tody-tyrant	C
	<i>Hemitriccus nidipendulus</i> (Wied, 1831)	Hangnest Tody-tyrant	C, O
	<i>Hemitriccus margaritaceiventer</i> (d'Orbigny & Lafresnaye, 1837)	Pearly-vented Tody-tyrant	O
Tyrannidae Vigors, 1825	<i>Camptostoma obsoletum</i> (Temminck, 1824)	Southern Beardless-tyrannulet	O
	<i>Elaenia flavogaster</i> (Thunberg, 1822)	Yellow-bellied Elaenia	C, O
	<i>Elaenia mesoleuca</i> (Deppe, 1830)	Olivaceous Elaenia	C, O
	<i>Elaenia cristata</i> Pelzeln, 1868	Plain-crested Elaenia	C
	<i>Myiopagis viridicata</i> (Vieillot, 1817)	Greenish Elaenia	C
	<i>Capsiempis flaveola</i> (Lichtenstein, 1823)	Yellow Tyrannulet	C, O
	<i>Phaeomyias murina</i> (Spix, 1825)	Mouse-colored Tyrannulet	O
	<i>Phyllomyias fasciatus</i> (Thunberg, 1822)	Planalto Tyrannulet	O
	<i>Serpophaga subcristata</i> (Vieillot, 1817)	White-crested Tyrannulet	O
	<i>Legatus leucophaeus</i> (Vieillot, 1818)	Piratic Flycatcher	O
	<i>Myiarchus ferox</i> (Gmelin, 1789)	Short-crested Flycatcher	C, O
	<i>Pitangus sulphuratus</i> (Linnaeus, 1766)	Great Kiskadee	C, O
	<i>Megarynchus pitangua</i> (Linnaeus, 1766)	Boat-billed Flycatcher	O
	<i>Myiozetetes similis</i> (Spix, 1825)	Social Flycatcher	O
	<i>Tyrannus melancholicus</i> Vieillot, 1819	Tropical Kingbird	O
	<i>Myiophobus fasciatus</i> (Statius Muller, 1776)	Bran-colored Flycatcher	C
	<i>Sublegatus modestus</i> (Wied, 1831)	Southern Scrub-flycatcher	C, O
	<i>Cnemotriccus fuscatus</i> (Wied, 1831)	Fuscous Flycatcher	C
Vireonidae Swainson, 1837	<i>Cyclarhis gujanensis</i> (Gmelin, 1789)	Rufous-browed Peppershrike	C, O
	<i>Vireo chivi</i> (Vieillot, 1817)	Chivi Vireo	O
	<i>Hylophilus poicilotis</i> Temminck, 1822	Rufous-crowned Greenlet	O
Hirundinidae Rafinesque, 1815	<i>Stelgidopteryx ruficollis</i> (Vieillot, 1817)	Southern Rough-winged Swallow	O
	<i>Progne tapera</i> (Vieillot, 1817)	Brown-chested Martin	O
Troglodytidae Swainson, 1831	<i>Troglodytes musculus</i> Naumann, 1823	Southern House Wren	O
	<i>Pheugopedius genibarbis</i> (Swainson, 1838)	Moustached Wren	C, O
Poliptilidae Baird, 1858	<i>Poliptila plumbea</i> (Gmelin, 1788)	Tropical Gnatcatcher	O
Turdidae Rafinesque, 1815	<i>Turdus flavipes</i> Vieillot, 1818	Yellow-legged Thrush	O
	<i>Turdus rufiventris</i> Vieillot, 1818	Pale-breasted Thrush	C
	<i>Turdus leucomelas</i> Vieillot, 1818	Cocoa Thrush	C, O
	<i>Turdus fumigatus</i> Lichtenstein, 1823	Rufous-bellied Thrush	O
	<i>Turdus amaurochalinus</i> Cabanis, 1850	Creamy-bellied Thrush	C, O
Passerellidae Cabanis & Heine, 1850	<i>Arremon taciturnus</i> (Hermann, 1783)	Pectoral Sparrow	C, O
Parulidae Wetmore, Friedmann, Lincoln, Miller, Peters, van Rossem, Van Tyne & Zimmer 1947	<i>Setophaga pitiayumi</i> (Vieillot, 1817)	Tropical Parula	O
	<i>Myiothlypis flaveola</i> Baird, 1865	Flavescent Warbler	C, O
Icteridae Vigors, 1825	<i>Molothrus bonariensis</i> (Gmelin, 1789)	Shiny Cowbird	O

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Appendix 1. *Continued.*

Family	Species	English Name	Type of record	
Thraupidae Cabanis, 1847	<i>Coereba flaveola</i> (Linnaeus, 1758)	Bananaquit	C, O	
	<i>Saltator maximus</i> (Statius Muller, 1776)	Buff-throated Saltator	C, O	
	<i>Saltator similis</i> d'Orbigny & Lafresnaye, 1837	Green-winged Saltator	C, O	
	<i>Nemosia pileata</i> (Boddaert, 1783)	Hooded Tanager	O	
	<i>Tachyphonus rufus</i> (Boddaert, 1783)	White-lined Tanager	C, O	
	<i>Ramphocelus bresilius</i> (Linnaeus, 1766)	Brazilian Tanager	O	
	<i>Lanio cristatus</i> (Linnaeus, 1766)	Flame-crested Tanager	C, O	
	<i>Tangara sayaca</i> (Linnaeus, 1766)	Sayaca Tanager	O	
	<i>Tangara palmarum</i> (Wied, 1823)	Palm Tanager	C, O	
	<i>Tangara cayana</i> (Linnaeus, 1766)	Burnished-buff Tanager	C, O	
	<i>Dacnis cayana</i> (Linnaeus, 1766)	Blue Dacnis	O	
	<i>Cyanerpes cyaneus</i> (Linnaeus, 1766)	Red-legged Honeycreeper	O	
	<i>Chlorophanes spiza</i> (Linnaeus, 1758)	Green Honeycreeper	O	
	<i>Hemithraupis guira</i> (Linnaeus, 1766)	Guira Tanager	O	
	<i>Conirostrum speciosum</i> (Temminck, 1824)	Chestnut-vented Conebill	O	
	<i>Volatinia jacarina</i> (Linnaeus, 1766)	Blue-black Grassquit	O	
	Cardinalidae Ridgway, 1901	<i>Habia rubica</i> (Vieillot, 1817)	Red-crowned Ant-tanager	C
	Fringillidae Leach, 1820	<i>Euphonia chlorotica</i> (Linnaeus, 1766)	Purple-throated Euphonia	O
<i>Euphonia violacea</i> (Linnaeus, 1758)		Violaceous Euphonia	C, O	
Passeridae Rafinesque, 1815	<i>Passer domesticus</i> (Linnaeus, 1758)	House Sparrow	O	