A Cerrado bird community in the northernmost portion of northeastern Brazil - recommendations for conservation

Mauro Pichorim1,3, Marcelo da Silva2, Bruno Rodrigo de Albuquerque França2, Tonny Marques de Oliveira-Júnior1 and Marcelo Câmara Rodrigues1

1 Universidade Federal do Rio Grande do Norte, Departamento de Botânica, Ecologia e Zoologia, Campus Universitário, Lagoa Nova, CEP 59078-900, Natal, RN, Brazil.
2 Universidade Potiguar, Escola da Saúde, Curso de Ciências Biológicas, Laureate International Universities, Av. Senador Salgado Filho, 1610, Lagoa Nova, CEP 59056-000, Natal, RN, Brazil.
3 Corresponding author: mauropichorim@yahoo.com.br

Received on 27 April 2014. Accepted on 10 November 2014.

ABSTRACT: The Cerrado is the largest savanna in South America and it is rich in fauna and flora and considered a biodiversity hotspot. Its contact with the surrounding Amazon, Atlantic Forest and Caatinga is irregular, forming large diffuse ecotones in some regions and disjointed patches in others. The Cerrado patches located in the Amazon are relatively studied, but little is known about those in the Atlantic Forest and Caatinga. This article presents information on the composition of a bird community in a savanna formation on the coast of the northernmost portion of northeast Brazil (5°23′25″S / 35°30′25″W). This site was visited 17 times between October 2006 and August 2013. The total richness was 87 species distributed into 32 families. The following Cerrado endemics were recorded: Charitospiza eucosma and Porphyrospiza caerulescens. Other species recorded associated mainly with the Cerrado biome were Heliactin bilophus, Cypsnagra hirundinacea and Coryphaspiza melanotis. Some vulnerable and near threatened species were also recorded for the first time in the northernmost portion of northeastern Brazil, with some of these more than 1,000 km from their previously known localities. The results broaden the knowledge on the distribution of various species, in addition to providing information on seasonality and reproduction of others and revealing an overall lack of information on the composition of avian communities in little studied areas of Brazil.

KEY-WORDS: Charitospiza eucosma, Coryphaspiza melanotis, Cypsnagra hirundinacea, Porphyrospiza caerulescens, Rio Grande do Norte, threatened species.

INTRODUCTION

The Cerrado is the largest savanna in South America, encompassing approximately 1.8 million km² of its central part (Oliveira-Filho & Ratter 2002, Silva & Santos 2005). It is rich in fauna and flora and considered a biodiversity hotspot (Mittermeier et al. 1999, Silva & Bates 2002, Klink & Machado 2005, Proença et al. 2010). It has undergone rapid transformations primarily due to increased agriculture, with only 20% of the original area still intact (Myers et al. 2000, Ritter et al. 2010). The evolution of its biota was influenced by the expansion and retraction of forest caused by past climatic changes (Prado & Gibbs 1993, Pennington et al. 2000, Prado 2000, Fernandes 2003), where gallery forests played a key role in dispersing and altering biodiversity (Rodrigues 2005, Silva & Santos 2005). The current result is a complex region of dry and humid forests, arboreal savannas, bushy areas and fields (Eiten 1993, Ratter et al. 2003). Its contact with the surrounding Amazon, Atlantic Forest and Caatinga is irregular, forming large diffuse ecotones in some regions and disjointed patches in others (Eiten 1972, Capobianco et al. 2001). Islands of Cerrado in the Amazon contain relatively well studied avifauna (e.g., Silva et al. 1997, Brac et al. 1997, Henriques & Oren 1997, Sanaiotti & Cintra 2001, Aleixo & Poletto 2007, Mittermeier et al. 2010), but little is known about isolated Cerrado areas in the Atlantic Forest and Caatinga. In northeastern Brazil savanna formations occur at low altitudes near the coast (Castro 1999, Sarmento & Soares 1971, Tavares 1988, Oliveira-Filho & Carvalho 1993, Figueiredo 1989, Costa et al. 2004, Oliveira et al. 2012). These areas have received scant attention in terms of conservation and biogeographic investigation, and are currently significantly impacted. This article presents information on the composition of bird communities in a savanna formation on the coast of...
the northernmost portion of northeast Brazil and discusses the need for conservation. In the area that we studied we confirmed the presence of birds endemic to the Cerrado and threatened with extinction, broadened the knowledge on the distribution of other taxa and suggested biogeographic studies to better understand the current distribution of Cerrado forest patches on the northeast coast of Brazil.

METHODS

The main sampling site (5° 23' 25" S and 35° 30' 25" W) is located near Punã in the township of Rio do Fogo. We investigated an area within a 10 km radius, encompassing the cities of Pureza and Touros in Rio Grande do Norte state, northeastern Brazil (Figure 1). This consists of a flat area (~30,000 ha) near the coast at an altitude ranging between ~30 and 100 m in the east-west direction. The soil is sandy and derived from the Barreiras Group formation (IDEMA 2002). The vegetation is primarily herbaceous/sub-bushy, harboring species of the families Poaceae, Fabaceae, Cyperaceae, Rubiaceae and Convolvulaceae, with sparse bushy-arboreal components composed of Fabaceae, Myrtaceae, Chrysobalanaceae and Rubiaceae, where genera often associated with Cerrado vegetation are found (e.g., Byssonima, Eugenia, Anacardium, Erythroxylum and Tocoyena) (Oliveira et al. 2012).

Between October 2006 and August 2013 we visited the area 17 times (2006 - 9, 20-21, 28-29 Oct, 11-12 Nov, 21 Dec; 2007 - 17 Jan, 1 May, 10-11 Aug, 10-11 Nov; 2008 - 1-2 Mar, 16 Aug; 2009 - 1-2 May, 15-16 Aug; 2012 - 10 Jun; 2013 - 21 Apr, 9-11 Aug, 16 Nov). We used conventional bird survey methods (active search, playback, listening points and occasional mist nets). The observations were made through binoculars (10 x 42), scope (60 x), and a camera fitted with a 500 mm lens. We also recorded a number of songs and calls with a Marantz PMD-661. The number of individuals sighted, type of recording (audio or visual) and signs of reproduction such as nests and/or immature birds being fed by their parents were also registered. We concentrated the surveys in the Cerrado, with marginal investigations in the lagoons and gallery forest. The taxonomy and nomenclature of the species follow Comité Brasileiro de Registros Ornitológicos (CBRO 2014).

RESULTS

We recorded 87 bird species distributed into 32 families, Tyrannidae being the most represented (15 species) followed by Thraupidae (11 species) (Appendix). As endemic Cerrado species we recorded Porphyrospiza caerulescens and Charitospiza eucosma (following Silva 1997, Silva & Santos 2005). Other species distributed mainly in the Cerrado region were Heliactin bilophus, Gypsagra hirundinaceae and Coryphaspiza melanotis. These records are the first in the northernmost portion of northeastern Brazil. Some of these are distributed more than 1,000 km from their previously known localities. Among the species recorded, Coryphaspiza melanotis is considered vulnerable and Charitospiza eucosma as near threatened (BirdLife International 2014). All these records were in open physiognomy Cerrado with herbaceous or sub-bushy vegetation characterized mainly as Poaceae, Fabaceae, Cyperaceae (Figure 2, see Oliveira et al. 2012). The details of the most important records are described below.

Peach-fronted Parakeet - Eupsittula aures. Recorded on 29 October and 21 December 2006, and 11 November 2007. On all occasions we saw two specimens in flight and vocalizing. This species is mainly recorded in southeastern and central Brazil, Paraguay and Bolivia (Stotz et al. 1996). In the Caatinga it occurs marginally, mainly in transition areas with the Cerrado (Pacheco 2004, Santos 2004, Vasconcelos et al. 2012, Schunck et al. 2012). It has recently been recorded along a thin strip of the northeast coast from Bahia to Pernambuco (WikiAves 2014), and there are two records on the south coast of Rio Grande do Norte (Duarte 2013, Silva 2011). Our records extend the distribution of the species -150 km northwards. We did not observe any sign of reproduction in the area, but on 16 May 2009 we witnessed a young specimen being sold at a street fair in the city of Macaiba, near Natal, Rio Grande do Norte. The species is listed under CITES Appendix II and has been heavily traded (BirdLife International 2014).

Horned Sungem - Heliactin bilophus. Recorded on 21 October and 12 November 2006 and 17 January 2007. Only one male was sighted on each occasion. This species is common in central Brazil, extending to Bolivia in the west (BirdLife International 2014), but there have been recent records on the coast of Bahia, Sergipe and Paraíba (Lima & Buzzetti 2006, Sonntag 2011, Mendonça 2013, Silva 2013). Our records extend the distribution of the species ~200 km northwards.

Rusty-backed Antwren - Formicivora rafa. Recorded on 13 occasions between 2006 and 2013 in January, March, May, August, October and November, where at least one couple was observed (Appendix). On 5 May 2009 we observed a couple followed by a possible fledgling, indicating the breeding period in the region. This species occurs mainly in central and southeast Brazil, Bolivia, Paraguay and some disjunct populations around the Amazon (BirdLife International 2014). There are also some recent records along the coastline of northeast Brazil (França 2008, Holderbaum 2012, Sonntag 2012, Beleza 2013, Jones 2014a). Our observations widen the knowledge on species distribution and indicate that it is resident in the study area.
FIGURE 1. *Cerrado* area surveyed for birds in northeastern Brazil. A: localization in South America and northeastern Brazil (the grey polygon represents the core area of *Cerrado*). B: Aerial image of the studied site (the black square represents the core of the studied area, which was samples within a 10 km radius). C and D: general aspects of the vegetation. E: some typical tree species. F: Gallery forest vegetation impacted by agriculture. G: recent burned areas. H: impacted area by fire and coconut plantation in the background. Photos by Mauro Pichorim.
FIGURE 2. Some bird species recorded at the study site between 2006 and 2013. A and B: Male and female of the Near Threatened Coal-crested Finch - *Charitospiza eucosma*. C: White-rumped Tanager - *Cypsnagra hirundinacea*. D: Cinnamon Tanager - *Schistochlamys ruficapillus*. E: Grey Monjita - *Xolmis cinereus*. F and G: Male and female of the Near Threatened Blue Finch - *Porphyrospiza caerulescens*. H: Male and female of the Vulnerable Black-masked Finch - *Coryphospiza melanotis*. I: White-tailed Hawk - *Geranoaetus albicaudatus* (young). Photos by Ricardo Duarte de Araújo, Bruno Rodrigo de Albuquerque França and Mauro Pichorim.
Lesser Elaenia - *Elaenia chilensis*. Visual and sound records were made on 12 November and 21 December 2006, 11 November 2007, 16 August 2008, 1 May 2009 and 10 June 2012. This species seems to undertake seasonal movements in the region since it occurs from late spring through fall. We saw no sign of reproduction during our observations, perhaps because the species is only transient in the study area. This species is common in the *Cerrado* of central Brazil and Bolivia, and in northern South America with well-known south-north movements (Stotz et al. 1996, BirdLife International 2014). It is poorly known in the Caatinga and the northeastern portion of the Atlantic Rainforest. The records nearest to our area were in Paraíba (Medcraft 2009, Holderbaum 2013), but the photographs and songs shown by these authors are more similar to *Elaenia chilensis*. Our records extend the knowledge on this species’ distribution and the time of occurrence in the northernmost portion of northeastern Brazil.

Gray Monjita - *Xolmis cinereus*. Single individuals were recorded on 29 October and 21 December 2006, 16 August 2008 and 16 November 2013 in recently burned areas. This species is common in central and southeastern Brazil, and open areas of Argentina, Paraguay, Uruguay and Bolivia (Ridgely & Tudor 1994, BirdLife International 2014). It has recently been observed on the west coast of Ceará (Lopes 2012, Teixeira 2012), and the north coast of Bahia (Lima 2006). Our records are noteworthy because they extend species distribution at least 650 km to the northeast. The short period of occurrence in our area may indicate some movement, perhaps as a result of winter migration to the south.

Cinnamon Tanager - *Schistochlamys ruficapillus*. A common resident species recorded in 16 expeditions with more than three specimens per day observed (Appendix). This species is common in the *Cerrado*, but also occurs at the edge of the Caatinga and Atlantic Forest (BirdLife International 2014). In northeastern Brazil it is known in the south of Ceará, south coast of Paraíba, eastern Pernambuco, Alagoas and Bahia (Lima 2006, Albano 2009, Hilty 2011, Fernandes 2013, Jones 2014b). Recent records in Rio Grande do Norte state extend this species’ distribution -200 km northward. The individuals observed had light plumage in line with the subspecies *S. r. capistrata*. Additional morphological studies are needed to determine possible differences between coastal and inland specimens.

White-rumped Tanager - *Gypsnagra hirundinacea*. Pairs were recorded on 14 expeditions between 2006 and 2013 in January, March, April, May, June, August, October, November and December (Appendix, Figure 2). On 2 March 2008 and 1 May 2009, we observed groups of four specimens possibly involving family groups, since they were flying and foraging together. Thus, the breeding period of the species in the region may occur from summer to fall. This species is common in the *Cerrado* of central Brazil, but it was also recorded on the north coast of Bahia (Lima 2006, Cedraz 2012) and cited without any information on the south coast of Sergipe (Bencke et al. 2006), the nearest point to our records (~650 km). The specimens observed were tape recorded and photographed, exhibiting a pale chin and throat, similar to *C. h. pallidigula* (Figure 2). We have captured a number of individuals to measure and record their songs to determine possible taxonomic differences in the Rio Grande do Norte population. These analyses are currently underway and the results will be released shortly.

Blue Finch - *Porphyrospiza caeruleascens*. A common resident species recorded in all surveys conducted between 2006 and 2013 (Appendix, Figure 2). We sighted lone individuals, pairs and family groups. On 1 May 2007 we recorded a pair and a fledgling with low flight capacity. On 16 August 2009 we observed a couple with one offspring and on 10 August 2013 we sighted two immature males, four males and six females. Thus, the local breeding period likely occurs from March to August. There is probably no species movement in the area since it was observed during all seasons. This species was also recorded on the north coast of Bahia and in southern Sergipe (Lima 2006, Lima & Buzzetti 2006, Sousa 2011). Our observations are ~650 km north of the nearest previously known location. The specimens observed were quite similar to those from other sites, but we are investigating possible morphological and biological differences in this new population. This near threatened species has become rare in many areas, owing to the conversion of its *Cerrado* habitats to agriculture (Jaramillo 2011a, BirdLife International 2014).

Coal-crested Finch - *Charitospiza eucosma*. Recorded in 15 surveys conducted between 2006 and 2013 (Appendix, Figure 1). The species seems relatively abundant in the area, and is normally encountered in flocks of 4-10 individuals (possibly involving family groups). On some occasions we observed lone individuals and on 21 December 2006 we recorded a group of 15 individuals. On 1 May 2007 and on 10 August 2013 we recorded pairs with one offspring each. The breeding period in the area likely occurs from March to August. Local migrations do not occur since specimens were observed during all seasons. This is a near threatened species that occurs mainly in the *Cerrado* of Brazil (BirdLife International 2014). It was also recently recorded in the Caatinga in northern Bahia and eastern Piauí (Nascimento 2011, Mota 2012, Santos 2012, Melo 2013, Caranha 2013). These are the nearest records to our observations (~650 km). There are no apparent morphological differences between the specimens from Rio Grande do Norte and central Brazil, but this deserves further investigation. This species is declining due to
habitat loss (conversion of Cerrado to agriculture) and the illegal bird trade (Jaramillo 2011b).

Black-masked Finch - Coryphaspiza melanotis. This species was observed mainly in couples and is relatively abundant in the area, since it was observed in all surveys (Appendix, Figure 2). On 16 August 2008, 1 May 2009 and 10 August 2013 we recorded three, four and five pairs respectively, and on each of these occasions one pair had a fledgling. The breeding period in the area likely occurs from March to August. Species movement does not occur given that it was observed in all seasons. This is a vulnerable species that occurs mainly in the Cerrado of Brazil, Peru, Bolivia, Paraguay and Argentina (BirdLife International 2014). In Brazil there is an isolated population at the mouth of the Amazon River described as C. m. marajoara (Sick 1967), with recent photographic records in eastern Pará (Lees 2011, Thompson 2011). The northernmost records of C. m. melanotis are from northern Goiás (Braz 2008, Cavalcante 2013, Timm 2013). These previous distribution limits are more than 1,600 km from our records. We are studying the morphology and ecology of this new population, focusing on possible geographic variations. This species is uncommon to rare and has experienced habitat destruction (Jaramillo 2011c).

DISCUSSION

Our results broaden the knowledge on the distribution of various species, indicate the seasonality and reproduction of some and reveal a lack of information on the composition of the communities in little or unstudied areas of Brazil. Birds from the Cerrado have been studied in the core region and a number of Amazon enclaves (e.g., Henriques & Oren 1997, Silva et al. 1997, Tubelis & Cavalcanti 2000, Aleixo & Poletto 2007, Mittermeier et al. 2010), but little or no attention has been given to Cerrado enclaves in the Caatinga and Atlantic Forest. Distribution projections using niche modeling show low or medium probability of the occurrence of a number of Cerrado birds (e.g., C. hilundinacea, Neothraupis fasciata, Saltatricula atricollis, Melanopareia torquata, Cyaconox cristatellus) for part of the northeast coast of Brazil (Leite 2006, Corrêa et al. 2010). Our records confirm the presence of at least one of these species in the region. Even though these projections have been considered flaws in the models generated (see Corrêa et al. 2010), we believe that there are concrete indications of environmental similarities among the open areas on the northeast coast and the Cerrado of central Brazil. The lack of records for some species may be due to inadequate samplings of these formations on the northeastern coast. It is important to underscore that a number of species that we recorded have been linked to highland areas of central Brazil (Parker et al. 1996, Sick 1997). P. caerulescens is recognized as a riparian species from highland areas (BirdLife International 2014). The occurrence of these species on the coast of northeastern Brazil reveals they have a higher niche range than previously thought. Thus, it is important to reconstruct these potential distribution models with the addition of all the occurrence points on the northeastern coast of Brazil. These techniques are essential for optimizing the search effort of new occurrence areas for the species, as well as for understanding the biogeographic processes that led to their current distribution.

Considering the five structural types of Cerrado recognized by botanists (see Eiten 1972, 1993), the species we recorded are more common in open physiognomies known as “campo limpo” (grassland with few or no shrubs or tall woody plants) and “campo sujo” (grassland with scattered shrubs). Elements of “Cerrado sensu stricto”, “cerradão” and “matas de galeria” (riparian forests) are lacking (e.g., Cyaconox cristatellus, Antilophia galeata, Myiathlypis leucophrys, Herpsilochmus longirostris). This is likely due to the fact that our study site has a physiognomy with a low density of typical Cerrado trees (Oliveira et al. 2012), decreasing the availability of structure and resources for a number of birds, in addition to the absence of gallery forests, border streams and lagoons in the region with typical “veredas” (tall gallery forests with stands of a species of palm, Mauritia flexuosa). In the study area the forests near rivers and lagoons are different from those of Central Brazil, in that they are mainly tropical semideciduous forests associated with the Atlantic Forest. Moreover, they are significantly affected by subsistence agriculture or coconut plantations. Thus, the lack of birds typical of Cerrado forest areas may be a result of environmental restrictions, due to differences in composition and/or local extinctions caused by the use of these areas.

We also did not found birds typical of open areas (e.g., M. torquata, N. fasciata, S. atricollis and Poospiza cinerea). The reasons for this are difficult to ascertain at the moment, and more field surveys and increased knowledge of species biology are needed. In general, the study area seems to be relictual, representing the distribution limit of the Cerrado formation with low richness, likely related to historical extinction processes. However, this characteristic does not diminish the importance of the area, since it reveals clues of evolutionary processes in central and northeastern Brazil, in addition to harboring endemic species and those near or threatened with extinction. It is also important to consider that open physiognomies of the Cerrado must be more protected due to their increased vulnerability to agriculture, pastures and biological invasions (Tubelis & Cavalcanti 2000). The conservation of open habitats is essential in protecting threatened or little known Brazilian grassland birds (Marini & Garcia 2005, Lopes et al. 2010).
These *Cerrado* formations along the coast of Brazil seem to be distributed from the north coast of Bahia to Rio Grande do Norte. Some typical species of the *Cerrado*, such as *C. hirundinacea* and *P. caerulescens*, were previously cited for this narrow strip in the states of Bahia and Sergipe (Bencke et al. 2006, Lima & Buzzetti 2006, Sousa 2011). These formations occur on sandy soils originating in the *Arenito Barreirino* outcrop, which extends over a large part of northeastern Brazil.

Considering the sea-level variation through the Late Pleistocene and Holocene, these areas may have undergone a series of expansion and coalescence. Most biogeographic patterns of the biotic diversity of the *Cerrado* occurred during the Pleistocene (Cracraft 1985, Silva 1995a, b, Silva 1997, Silva & Bates 2002). It is known that the sea level in the Late Pleistocene was -100 m below current levels (Hearty 1998). For the coast of Rio Grande do Norte state, which is shallow and has a wide continental shelf, these events may have expanded the shoreline 50 km to the east, widening the coastal strip of open formations. The biogeography of savannas in the northern and southern Amazon has been studied in recent years (Haffer 1967, 1974, Webb 1991, Silva 1995b, c, Henriques & Oren 1997, Silva et al. 1997, Silva 1998), suggesting an Atlantic coast savanna corridor (Silva & Bates 2002). A similar process may have occurred on the northeast coast of Brazil. This process and the age of these *Cerrado* relicts need to be better understood and these areas must be protected, since they preserve the memory of the evolution of these biotas and the dynamics of the environments involved.

We observed that the study area has been affected by fire, agriculture and military activities. Although fires are uncommon, they must be controlled, since several *Cerrado* grassland species are highly sensitive to regular fires (Tubelis & Cavalcanti 2000). Agriculture has had a greater impact, completely altering the local physiognomy. At the margins of watercourses vegetation has been almost completely altered. Moreover, in recent years a number of monocultures have been established in the northern portion of the area, including irrigated agriculture (Figure 1). Some extensive coconut plantations (*Cocos nucifera*) have recently appeared (Figure 1). The major threats to Brazilian birds are habitat loss, degradation and fragmentation (Marini & Garcia 2005). Controlling these impacts is essential in maintaining the threatened endemic species that we found in the area. Therefore, new agriculture projects should be temporarily banned until their impacts on the flora and fauna can be assessed and conservation measures implemented. Furthermore, an Integral Protection Conservation Unit (ICU) must be urgently established to guarantee effective conservation. This ICU should be large (~20,000 ha) in order to protect viable populations, given that it is an open isolated area where species have low density and occupy an extensive area. There are still areas available to create an ICU of this size, including a section used as a military area and other conserved areas. However, decisions must be made immediately, since this situation will not continue for long. The parks and ecological stations in the *Cerrado* are vital to the conservation of this habitat (Silva & Bates 2002).

It is unknown whether the species found are totally isolated from the central areas of Brazil. Isolation is most likely be taking place since there is no indication of seasonal displacement, with most species found throughout the year. The time of this possible isolation cannot be estimated yet. For this reason, and considering the distance of these records, some geographic variation (morphological and/or genetic) probably occurred in these populations from the northernmost portion of the northeast. We observed some plumage variation in *C. hirundinacea* and *C. melanotis* and are acquiring more data on the subject. However, extensive morphological, bioacoustics and molecular studies are needed for these species, in order to clarify all the taxonomic and phylogeographic aspects in the region. Some of these initiatives are underway and we will present more information on *Cerrado* fragments on the northeast coast shortly. However, we cannot wait for this information to protect these *Cerrado* fragments on the northeastern coast; conservation measures must be immediate.

With respect to endemism in the *Cerrado*, we found *C. eucosma* and *P. caerulescens* (following Silva & Bates 2002, Silva & Santos 2005). However, the criteria adopted by Silva & Santos (2005) to define endemism in this region were the overlap between geographic distribution of the species and the central region of the *Cerrado* (minimum of 95%) and isolated populations in savanna-like habitats up to 430 km from the *Cerrado*. Considering this last criterion, these species must no longer be considered endemic to the *Cerrado*, given that new records presented here are farther than those previously established. Vasconcelos (2008) considered the “430-km rule” inaccurate and biased and its application can create unrealistic or obscure biogeographic patterns. We agree with this idea mainly due to the peculiarities of species distribution in open areas and the fragmented pattern of the relictual occurrence of *Cerrado* patches in the Amazon, Atlantic Forest and Caatinga at large distances from the central region. As such, we suggest adopting only distribution overlapping with the central area as criterion, that is, the first criterion proposed by Silva & Santos (2005). Therefore, the aforementioned species are endemic and others have regained this status (e.g., *N. fasciata* and *C. hirundinacea*). It is important to underscore that Vasconcelos (2008) also suggested not considering some species restricted to the eastern Brazilian highlands as endemic to the *Cerrado* (e.g., *Augastes scutatus*, *N. fasciata*, and *C. eucosma*).
A Cerrado bird community in the northernmost portion of northeastern Brazil - recommendations for conservation

Mauro Pichorim, Marcelo da Silva, Bruno Rodrigo de Albuquerque França, Tonny Marques de Oliveira-Júnior and Marcelo Câmara Rodrigues

ACKNOWLEDGEMENTS

The staff of the Laboratory of Ornithology of UFRN helped with field work, especially Guilherme S. Toledo de Lima, Damião Valdenor de Oliveira, Honara Morgana da Silva, Nícolas Luciano Ruiz, Ricardo Duarte de Araújo, Poeve Macário, Priscilla S. Amorim de Araújo, José V. Fernandes de Lima. Tânia França helped in some fields trip. We thank the RBO Editor in Chief, Prof.D Alexandre L. P. Aleixo, for his constructive comments, which helped us to improve the manuscript. This work was supported in part by the CNPq - Conselho Nacional de Desenvolvimento Científico e Tecnológico (grant MCT/CNPq n.° 474945/2010-3).

REFERENCES

Albano, C. 2009. [WA322225, Schistoclanys ruficapillus (Vieillot, 1817)]. www.wikiaves.com/322225 (access on 08 February 2014).

Aleixo, A. & Poletto, F. 2007. Birds of an open vegetation enclave in southern Brazilian Amazonia. Wilson Journal of Ornithology, 119: 610-630.

Beleza, A. J. 2013. [WA1067157, WA1082541, WA1174235, WA1186523, WA1186531, Formicivora rufa (Wied, 1831)]. www.wikiaves.com (access on 09 February 2014).

Bencke, G. A.; Mauricio, G. N.; Develey, P. F. & Goerck, J. M. 2006. Areas Importantes para a Conservação das aves no Brasil, Parte I – Estudos do Domínio da Mata Atlântica. São Paulo: SAVE Brasil.

BirdLife International. 2014. Species factsheets: Aratinga aurea, Helicax bilobus, Formicivora rufa, Elaenia chiriquensis, Xolmis cinereus, Schistoclanys ruficapillus, Porphyrospiza caerulescens, Charipitiza eucomsa, Charipitiza melanotis. www.birdlife.org (access on 09 February 2014).

Brace, R. C.; Hornbuckle, J. & Pearce-Higgins, J. W. 1997. The avifauna of the Beni Biological Station, Bolivia. Bird Conservation International, 7: 117-159.

Braz, V. S. 2008. Ecologia e conservação das aves campestres do bioma Cerrado. Ph.D. dissertation. Brasília: Universidade de Brasília.

Capobianco, J. P. R.; Verissimo, A.; Moreira, A.; Sawyer, D.; Santos, I. & Pinto, L. P. 2001. Biodiversidade na Amazônia brasileira: avaliação e ações prioritárias para a conservação, uso sustentável e repartição de benefícios. São Paulo: Editora ISA.

Castro, A. A. J. F. 1999. Cerrados no nordeste do Brasil: caracterização, biodiversidade e desastres. Publicações Avulsas em Ciências Ambientais, 1: 1-19.

Caranha, L. 2013. [WA1083192, Charipitiza eucomsa Oberholser, 1905]. www.wikiaves.com/1083192 (access on 08 February 2014).

Cavalcante, E. P. 2013. [WA1148635, WA1153080, Coryphapiza melanotis (Temminck, 1822)]. www.wikiaves.com (access on 08 February 2014).

CBRO 2014. Listas das aves do Brasil do Comité Brasileiro de Registros Ornitológicos - 11ª Edição. www.cbro.org.br (access on 20 April 2014).

Cedraz, R. S. 2012. [WA944464, WA845632, WA629269, WA633601, WA629011, Cypsnagra hirundinacea (Lesson, 1831)]. www.wikiaves.com (access on 08 February 2014).

Correia, J. S.; Leite, L. O.; Garcia, F. I. & Marini, M. Â. 2008. Modelagem de nicho ecológico (GARP) para aves endêmicas do Cerrado: uma análise crítica, p. 377-414. In: Diniz, I. R.; Marinho-Filho, J.; Cavalcanti, R. B. & Machado, R. B. (eds.). Informações quantitativas sobre a biodiversidade do cerrado. Brasília: Thesaurus Editora.

Costa, I. R.; Araújo, F. S. & Lima-Verde, L. W. 2004. Flora e Conexões florísticas do Brasil. Fortaleza: Banco do Nordeste.

Coss, F. 2013. [WA1177256, Schistoclanys ruficapillus (Vieillot, 1817)]. www.wikiaves.com/1177256 (access on 08 February 2014).

Figueiredo, M. A. 1989. Nordeste do Brasil - Relíquias vegetacionais no semi-árido cearense (Cerrados). Coleção Mosorense, B 646.

Haffer, J. 1967. Speciation in Colombian forest birds west of the Andes. American Museum Novitates, 294: 1-57.

Haffer, J. 1974. Avian speciation in tropical South America. Bulletin of the Nutall Ornithological Club, 14: 1-390.

Hearty, P. J. 1998. The geology of Eleuthera Island, Bahamas: a Rosetta stone of Quaternary stratigraphy and sea-level history. Quaternary Science Reviews, 17: 333-35.

Henriques, L. M. P. & Oren, D. C. 1997. The avifauna of Marajó, Cavanha and Mexiana islands, Amazon River estuary, Brazil. Revista Brasileira de Biologia, 57: 357-382.

Hilty, S. L. 2011. Family Thraupidae (Tanagers), p. 46-329. In: del Hoyo, J.; Elliott, A. & Christie, D. A. (eds.). Handbook of the Birds of the World. Vol. 16. Tanners to New World Blackbirds. Barcelona: Lynx Edicions.

Holnderbaum, J. M. 2012. [WA620576, Formicivora rufa (Wied, 1831)]. www.wikiaves.com/620576 (access on 09 February 2014).

Holnderbaum, J. M. 2013. [WA1068254, Elaenia chiriquensis Lawrence, 1865]. www.wikiaves.com/1068254 (access on 08 February 2014).

IDEMA 2002. Perfil do Estado do Rio Grande do Norte. Natal: Secretaria de Estado do Planejamento e as Finanças do Rio Grande do Norte.

Jaramillo, A. 2011a. Blue Finch. Porphyrospiza caerulescens, p. 605. In:
R. C. & Fonseca-Neto, F. P. 2012. Birds of the Lower Middle São Francisco River. *Revista Brasileira de Ornitologia*, 20: 350-364.

Sick, H. 1967. *Coryphaspiza melanotis marajoara* subsp. nov. *Journal fuer Ornithologie*, 108: 218-220.

Sick, H. 1997. *Ornitologia brasileira: uma introdução*. Rio de Janeiro: Editora Nova Fronteira.

Silva, A. R. 2011. [WA480165, *Eupsittula aurea* (Gmelin, 1788)]. www.wikiaves.com/480165 (access on 09 February 2014).

Silva, C. 2013. [WA918398, *Heliactin bilophus* (Temminck, 1820)]. www.wikiaves.com/918398 (access on 09 February 2014).

Silva, J. M. C. 1995a. Biogeographic analysis of the South American avifauna. *Steenstrupia*, 21: 69-92.

Silva, J. M. C. 1995b. *Avian inventory of the Cerrado Region, South America. Steenstrupia*, 21: 69-92.

Silva, J. M. C. 1995c. *Avian inventory of the Cerrado Region, South America: Implications for biological conservation. Bird Conservation International*, 5: 291-304.

Silva, J. M. C. 1997. Endemic bird species and conservation in the Cerrado Region, South America. *Bird Conservation International*, 4: 435-450.

Silva, J. M. C. 1998. *Bird Conservation International, 5: 225-233.

Silva, J. M. C. & Bates, J. M. 2002. Conservation in the South American Cerrado: A Tropical Savanna Hotspot. *BioScience*, 52: 225-233.

Silva, J. M. C. & Santos, M. P. D. 2005. A importância relativa dos processos biogeográficos na formação da avifauna do Cerrado e de outros biomas brasileiros, p. 221-233. In: Scarlott, A.; Sousa-Silva, J. C. & Fellini, J. M. (eds.). Cerrado: ecologia, biodiversidade e conservação. Brasília: Ministério do Meio Ambiente.

Silva, J. M. C.; Oren, D. C.; Roma, J. C. & Henriques, L. M. P. 1999. Composition and distribution patterns of the avifauna of an Amazonian upland savanna, Amapá, Brazil. *Ornithological Monographs*, 48: 743-762.

Sonntag, F. A. 2011. [WA404964, WA404965, *Heliactin bilophus* (Temminck, 1820)]. www.wikiaves.com (access on 08 February 2014).

Sonntag, F. A. 2012. [WA542736, *Fornicivora rufa* (Wied, 1831)]. www.wikiaves.com/542736 (access on 08 February 2014).

Sousa, M. C. 2011. [WA448840, *Porphyropiza cayra* (Wied, 1830)]. www.wikiaves.com/448840 (access on 08 February 2014).

Stotz, D. F.; Fitzpatrick, J. W.; Parker, T. A. & Moskovits, D. K. 1996. *Neotropical birds: ecology and conservation*. Chicago: University of Chicago Press.

Tavares, S. 1988. Contribuição para o estudo da cobertura vegetal dos tabuleiros do nordeste. *Colecão Mossoroense*, B 494.

Teixeira, P. M. 2012. [WA734986, *Xolmis cinereus* (Vieillot, 1816)]. www.wikiaves.com/734986 (access on 08 February 2014).

Thompson, I. S. 2011. [WA532074, *Coryphaspiza melanotis* (Temminck, 1822)]. www.wikiaves.com/532074 (access on 09 February 2014).

Timm, C. D. 2013. [WA1148945, *Coryphaspiza melanotis* (Temminck, 1822)]. www.wikiaves.com (access on 09 February 2014).

Tubelis, D. P. & Cavalcanti, R. B. 2000. A comparison of bird communities in natural and disturbed non-wetland open habitats in the Cerrado’s central region, Brazil. *Bird Conservation International*, 10: 331-350.

Vasconcelos, M. F. 2008. Mountaintop endemism in eastern Brazil: why some bird species from campos rupestres of the Espinhaço Range are not endemic to the Cerrado region? *Revista Brasileira de Ornitologia*, 16: 348-362.

Vasconcelos, M. F.; Souza, L. N.; Duca, C.; Pacheco, J. F.; Parrini, R.; Serpa, G. A.; Albano, C.; Abreu, C. R. M.; Santos S. S. & Fonseca-Neto, F. P. 2012. The avifauna of Brejinho das Ametistas, Bahia, Brazil: birds in a caatinga-cerrado transitional zone, with comments on taxonomy and biogeography. *Revista Brasileira de Ornitologia*, 20: 246-267.

Webb, S. D. 1991. Ecogeography and the Great American Interchange. *Paleobiology*, 17: 266-280.

WikiAves 2014. [Mapa de registros da espécie periquito-rei *Eupsittula aurea* (Gmelin, 1788)]. www.wikiaves.com/mapaRegistros_periquito-rei (access on 09 February 2014).
**APPENDIX**

Birds recorded in the *Cerrado* area near Punaú, Rio do Fogo, Rio Grande do Norte, Northeastern Brazil between 2006 and 2013. The taxonomy follows CBRO (2014).

| Families and species | Records (date and between parentheses the amount of individuals observed in each occasion) |
|----------------------|-----------------------------------------------------------------------------------------------|
| **TINAMIDAE**        |                                                                                               |
| Crypturellus parvirostris Small-billed Tinamou                                              | 17Jan2007(2), 02Mar2008(2), 01May2007(2), 01May2009(3), 10Aug2013(1)                         |
| Notura maculosa Sported Nothura                                                            | 17Jan2007(1), 02Mar2008(2), 16Aug2008(1), 01May2009(3), 16Nov2013(1)                        |
| **ANATIDAE**          |                                                                                               |
| Dendrocygna viduata White-faced Whistling-duck                                             | 21Oct2006(~500), 10Aug2013(5)                                                               |
| **ARDEIDAE**          |                                                                                               |
| Butorides striata Striated Heron                                                           | 21Oct2006(1)                                                                                 |
| **CATHARTIDAE**       |                                                                                               |
| Cathartes aura Turkey Vulture                                                              | 21Oct2006(2), 12Nov2006(2), 01May2007(2), 01May2009(1), 15Aug2009(2), 15Aug2009(2), 10Jun2012(1), 21Apr2013(2), 10Aug2013(2) |
| Cathartes burrovianus Lesser Yellow-headed Vulture                                         | 21Oct2006(5), 16Aug2009(1), 16Aug2009(1), 10Aug2013(2), 16Nov2013(1)                        |
| Coragyps atratus Black Vulture                                                             | 09Oct2006(2), 21Oct2006(5), 17Jan2007(2), 01May2007(5), 11Aug2007(1), 11Nov2007(2), 15Aug2009(10), 15Aug2009(3), 10Jun2012(5), 21Apr2013(6), 10Aug2013(5), 16Nov2013(2) |
| **ACCIPITRIDAE**       |                                                                                               |
| Heteropizias meridionalis Savanna Hawk                                                    | 15Aug2009(1)                                                                                 |
| Rupornis magnirostris Roadside Hawk                                                        | 21Oct2006(3), 01May2007(1), 01May2009(2)                                                    |
| Geranoaetus albicaudatus White-tailed Hawk                                                 | 21Oct2006(2), 29Oct2006(3), 29Oct2006(1), 12Nov2006(2), 21Dec2006(1), 17Jan2007(2), 01May2007(3), 11Aug2007(3), 10Nov2007(2), 11Nov2007(1), 02Mar2008(3), 01May2009(2), 10Jun2012(2), 10Aug2013(1), 16Nov2013(1) |
| Buteo brachyurus Short-tailed Hawk                                                        | 15Aug2009(1)                                                                                 |
| **CHARADRIIDAE**        |                                                                                               |
| Vanellus chilensis Southern Lapwing                                                        | 21Oct2006(1)                                                                                 |
| **COLUMBIDAE**          |                                                                                               |
| Columbina passerina Common Ground-dove                                                     | 01May2009(2), 10Aug2013(3)                                                                   |
### Families and species

| Records (date and between parentheses the amount of individuals observed in each occasion) |
|---|
| **Columbina minuta** Plain-breasted Ground-dove | 09Oct2006(2), 21Oct2006(9), 29Oct2006(2), 12Nov2006(6), 01May2007(2), 11Nov2007(1), 02Mar2008(2), 16Aug2009(1), 10Jun2012(1), 16Nov2013(1) |
| **Columbina squammata** Scaled Dove | 11Nov2007(2) |
| **Patagioenas picazuro** Picazuro Pigeon | 21Oct2006(1), 29Oct2006(1), 10Aug2013(1) |
| **Zenaida auriculata** Eared Dove | 21Apr2013(2) |
| **CUCULIDAE** | |
| **Piaya cayana** Squirrel Cuckoo | 21Oct2006(1), 10Aug2013(1) |
| **Crotophaga ani** Smooth-billed Ani | 21Oct2006(1) |
| **STRIGIDAE** | |
| **Glaucidium brasilianum** Ferruginous Pygmy-owl | 10Aug2013(1) |
| **Athene cunicularia** Burrowing Owl | 09Oct2006(3), 01May2007(2), 10Jun2012(1), 10Aug2013(2) |
| **CAPRIMULGIDAE** | |
| **Hydropsalis parvula** Little Nightjar | 21Oct2006(2), 21Dec2006(1), 17Jan2007(1), 11Aug2007(1), 16Nov2013(1) |
| **Hydropsalis torquata** Scissor-tailed Nightjar | 16Aug2009(1) |
| **Chordeiles pusillus** Least Nighthawk | 21Dec2006(1), 17Jan2007(20), 01May2007(8), 11Aug2007(3), 10Nov2007(1), 11Nov2007(3), 02Mar2008(7), 16Aug2008(2), 01May2009(5), 15Aug2009(2), 16Aug2009(4), 10Aug2013(8) |
| **TROCHILIDAE** | |
| **Eupetomena macroura** Swallow-tailed Hummingbird | 21Dec2006(3), 17Jan2007(1), 01May2007(2), 11Nov2007(1), 02Mar2008(3), 16Aug2008(1), 15Aug2009(3), 16Aug2009(1), 10Aug2013(1) |
| **Polytmus guainumbi** White-tailed Goldenthroat | 21Apr2013(1), 10Aug2013(1) |
| **Heliactin bilophus** Horned Sungem | 21Oct2006(1), 12Nov2006(1), 17Jan2007(1) |
| **ALCEDINIDAE** | |
| **Megaceryle torquata** Ringed Kingfisher | 21Apr2013(2) |
| **BUCCONIDAE** | |
| **Nystalus maculatus** Spot-backed Puffbird | 21Oct2006(7), 12Nov2006(2), 11Nov2007(2), 02Mar2008(2), 15Aug2009(2), 16Aug2009(2), 21Apr2013(2), 10Aug2013(1) |
| **PICIDAE** | |
| **Veniliornis passerinus** Little Woodpecker | 10Aug2013(2) |
### Families and species

| Families and species        | Records (date and between parentheses the amount of individuals observed in each occasion) |
|-----------------------------|------------------------------------------------------------------------------------------|
| **CARIAMIDAE**              |                                                                                          |
| *Cariama cristata* Red-legged Seriema | 21Oct2006(3), 21Dec2006(6), 01May2007(3), 11Aug2007(1), 11Nov2007(2), 02Mar2008(2), 01May2009(2), 16Aug2009(4), 10Jun2012(2), 21Apr2013(1), 10Aug2013(4) |
| **FALCONIDAE**              |                                                                                          |
| *Caracara plancus* Southern Caracara | 21Dec2006(8), 17Jan2007(2), 02Mar2008(1), 01May2009(2), 16Aug2009(1), 16Aug2009(1), 10Jun2012(5), 21Apr2013(3), 10Aug2013(2) |
| *Milvago chimachima* Yellow-headed Caracara | 29Oct2006(1), 12Nov2006(1), 21Dec2006(1), 02Mar2008(1), 21Apr2013(1), 10Aug2013(1) |
| *Falco sparverius* American Kestrel | 09Oct2006(1), 02Mar2008(1) |
| *Falco femoralis* Aplomado Falcon | 01May2007(3), 15Aug2009(2), 16Aug2009(1), 21apr2013(1) |
| **PSITTACIDAE**             |                                                                                          |
| *Eupsitta aurea* Peach-fronted Parakeet | 29Oct2006(2), 21Dec2006(2), 11Nov2007(2) |
| *Eupsitta cactorum* Cactus Parakeet | 10Aug2013(2) |
| **THAMNOPHILIDAE**          |                                                                                          |
| *Formicivora grisea* White-fringed Antwren | 21Oct2006(2), 01May2007(2), 11Aug2007(1), 11Nov2007(2), 02Mar2008(2), 16Aug2008(2), 16Aug2009(1) |
| *Formicivora melanogaster* Black-bellied Antwren | 15Aug2009(1) |
| *Formicivora rufa* Rusty-backed Antwren | 09Oct2006(4), 21Oct2006(4), 12Nov2006(2), 17Jan2007(4), 01May2007(2), 11Nov2007(1), 02Mar2008(6), 16Aug2008(3), 01May2009(3), 15Aug2009(1), 16Aug2009(3), 10Jun2012(1), 10Aug2013(1) |
| *Thamnophilus torquatus* Rufous-winged Antshrike | 21Oct2006(4), 17Jan2007(1), 11Nov2007(1), 16Aug2008(2), 15Aug2009(1), 16Aug2009(2), 10Jun2012(1), 10Aug2013(1) |
| **FURNARIIDAE**             |                                                                                          |
| *Synallaxis frontalis* Sooty-fronted Spinetail | 11Nov2007(1) |
| *Synallaxis albescens* Pale-breasted Spinetail | 01May2007(6), 10Nov2007(2), 11Nov2007(1), 02Mar2008(1), 16Aug2008(1), 16Aug2009(3), 10Aug2013(1) |
| *Synallaxis scutata* Ochre-cheeked Spinetail | 21Apr2013(1) |
| **RHYNCHOCYCLIDAE**         |                                                                                          |
| *Todirostrum cinereum* Common Tody-flycatcher | 12Nov2006(1), 01May2007(2), 11Nov2007(1), 10Aug2013(1) |
| *Hemitriccus margaritaceiventer* Pearly-vented Tody-tyrant | 21Oct2006(2), 11Nov2007(2), 02Mar2008(3), 16Aug2008(3), 01May2009(2), 15Aug2009(1), 10Jun2012(1), 21Apr2013(3), 10Aug2013(1) |
| **TYRANNIDAE**              |                                                                                          |
| *Stigmatura napensis* Lesser Wagtail-tyrant | 12Nov2006(1), 17Jan2007(1), 11Nov2007(4), 02Mar2008(2), 01May2009(2), 15Aug2009(2), 16Aug2009(1) |
### Families and species

| Species | Records (date and between parentheses the amount of individuals observed in each occasion) |
|---------|----------------------------------------------------------------------------------------|
| *Euscarthmus meloryphus* Tawny-crowned Pygmy-tyrant | 11Nov2007(1) |
| *Campstoma obsoletum* Southern Beardless-tyrannulet | 21Oct2006(2) |
| *Elaenia flavogaster* Yellow-bellied Elaenia | 21Oct2006(2), 21Dec2006(1), 01May2007(2), 11Aug2007(3), 10Nov2007(1), 11Nov2007(4), 02Mar2008(3), 01May2009(4), 15Aug2009(1), 10Aug2013(2) |
| *Elaenia spectabilis* Large Elaenia | 21Oct2006(1), 11Nov2007(1), 16Aug2008(2), 16Aug2009(2), 10Aug2013(3) |
| *Elaenia chilensis* Chilean Elaenia | 17Jan2007(1), 10Aug2013(1) |
| *Elaenia cristata* Plain-crested Elaenia | 12Nov2006(1), 21Dec2006(4), 11Nov2007(3), 02Mar2008(4), 16Aug2008(1), 01May2009(4), 15Aug2009(1), 16Aug2009(8), 21Apr2013(5), 10Aug2013(8), 16Nov2013(3) |
| *Elaenia chiriquensis* Lesser Elaenia | 12Nov2006(4), 21Dec2006(1), 11Nov2007(1), 16Aug2008(2), 01May2009(2), 10Jun2012(2) |
| *Myiopagis viridicata* Greenish Elaenia | 11Nov2007(1) |
| *Pitangus sulphuratus* Great Kiskadee | 21Oct2006(1) |
| *Tyrannus melancholicus* Tropical Kingbird | 21Oct2006(9), 12Nov2006(3), 21Dec2006(1), 17Jan2007(3), 01May2007(4), 10Nov2007(3), 11Nov2007(2), 02Mar2008(4), 16Aug2008(2), 01May2009(3), 15Aug2009(2), 16Aug2009(2), 10Jun2012(2), 21Apr2013(2), 10Aug2013(3) |
| *Tyrannus savana* Fork-tailed Flycatcher | 29Oct2006(5), 12Nov2006(1), 21Dec2006(1), 21Apr2013(1) |
| *Sublegatus modestus* Southern Scrub-flycatcher | 11Nov2007(1) |
| *Cnemotriccus fuscatus* Fuscous Flycatcher | 21Oct2006(3) |
| *Xolmis cinereus* Gray Monjita | 29Oct2006(2), 21Dec2006(1), 16Aug2008(1), 16Nov2013(1) |

#### VIREONIDAE

| Species | Records (date and between parentheses the amount of individuals observed in each occasion) |
|---------|----------------------------------------------------------------------------------------|
| *Cyclarhis gujanensis* Rufous-browed Peppershrike | 21Oct2006(2), 29Oct2006(1), 11Nov2007(2) |

#### HIRUNDINIDAE

| Species | Records (date and between parentheses the amount of individuals observed in each occasion) |
|---------|----------------------------------------------------------------------------------------|
| *Stelgidopteryx raficolis* Southern Rough-winged Swallow | 21Apr2013(1) |
| *Progne chalybea* Gray-breasted Martin | 02Mar2008(2) |
| *Tachycineta albiventer* White-winged Swallow | 21Oct2006(2), 10Aug2013(2) |
| *Hirundo rustica* Barn Swallow | 29Oct2006(4) |

#### TROGLODYTIDAE

| Species | Records (date and between parentheses the amount of individuals observed in each occasion) |
|---------|----------------------------------------------------------------------------------------|
| *Troglodytes musculus* Southern House Wren | 21Oct2006(2), 12Nov2006(1), 17Jan2007(1), 01May2007(1), 10Jun2012(1) |
| *Cantorchilus longirostris* Long-billed Wren | 21Oct2006(1) |
### Families and species

| Families and species | Records (date and between parentheses the amount of individuals observed in each occasion) |
|----------------------|--------------------------------------------------------------------------------------------|
| **POLIOPTILIDAE**    |                                                                                             |
| *Polioptila plumbea*  | Tropical Gnatchanger 09Oct2006(2), 21Oct2006(4), 12Nov2006(1), 21Dec2006(1), 01May2007(2), 11Aug2007(3), 11Nov2007(1), 01May2009(2), 21Apr2013(2) |
| **TURDIDAE**         |                                                                                             |
| *Turdus leucomelas*   | Pale-breasted Thrush 09Oct2006(1), 21Oct2006(2), 11Nov2007(2)                                |
| **MIMIDAE**           |                                                                                             |
| *Mimus saturninus*    | Chalk-browed Mockingbird 21Oct2006(1), 12Nov2006(2), 21Dec2006(1), 15Aug2009(3), 15Aug2009(3), 10Jun2012(5), 10Aug2013(2) |
| **MOTACILLIDAE**      |                                                                                             |
| *Anthus lutescens*    | Yellowish Pipit 10Jun2012(1)                                                                |
| **PASSERELLIDAE**     |                                                                                             |
| *Ammodramus humeralis*| Grassland Sparrow 09Oct2006(5), 21Oct2006(5), 12Nov2006(1), 21Dec2006(5), 17Jan2007(2), 01May2007(6), 11Nov2007(2), 02Mar2008(1), 01May2009(4), 15Aug2009(3), 16Aug2009(1), 10Jun2012(4), 10Aug2013(8) |
| **ICTERIDAE**         |                                                                                             |
| *Proacicus solitarius*| Solitary Black Cacique 17Jan2007(1), 11Nov2007(1)                                             |
| **THRAUPIDAE**        |                                                                                             |
| *Coereba flaveola*    | Bananaquit 21Dec2006(1), 02Mar2008(2), 01May2009(2), 15Aug2009(2)                            |
| *Cyanopsitta hirundinacea* | White-rumped Tanager 21Oct2006(7), 12Nov2006(7), 21Dec2006(3), 17Jan2007(2), 01May2007(6), 11Aug2007(4), 11Nov2007(4), 02Mar2008(4), 16Aug2008(2), 01May2009(4), 16Aug2009(4), 10Jun2012(2), 21Apr2013(2), 10Aug2013(4) |
| *Tachyphonus rufus*   | White-lined Tanager 21Oct2006(2), 10Jun2012(1)                                               |
| *Tangara cayana*      | Burnished-buff Tanager 21Oct2006(4), 12Nov2006(1), 21Dec2006(3), 11Aug2007(1), 10Nov2007(2), 11Nov2007(2), 02Mar2008(1), 16Aug2008(1), 16Aug2009(2), 10Jun2012(1), 21Apr2013(1), 10Aug2013(4), 16Nov2013(2) |
| *Schistochlamys ruficapillus* | Cinnamon Tanager 09Oct2006(4), 21Oct2006(5), 29Oct2006(3), 12Nov2006(3), 21Dec2006(3), 17Jan2007(4), 01May2007(3), 11Aug2007(3), 11Nov2007(5), 02Mar2008(5), 16Aug2008(3), 01May2009(5), 16Aug2009(3), 10Jun2012(3), 21Apr2013(3), 10Aug2013(4), 16Nov2013(1) |
| *Porphyrospiza caerulescens* | Blue Finch 09Oct2006(2), 21Oct2006(8), 29Oct2006(1), 12Nov2006(3), 21Dec2006(1), 17Jan2007(1), 01May2007(3), 11Aug2007(1), 11Nov2007(2), 02Mar2008(2), 16Aug2008(2), 01May2009(3), 15Aug2009(3), 16Aug2009(6), 10Jun2012(1), 21Apr2013(2), 10Aug2013(12), 16Nov2013(1) |
| *Sicalis luteola*      | Grassland Yellow-finch 21Dec2006(14), 17Jan2007(15), 01May2007(25), 11Aug2007(3), 11Nov2007(2), 02Mar2008(5), 01May2009(5), 16Aug2009(1), 16Aug2009(1), 21Apr2013(5), 10Aug2013(6) |
### Families and species

| Record | Date          | Amount                        |
|--------|---------------|-------------------------------|
| **Emberizoides herbicola** Wedge-tailed Grass-finch | 29 Oct 2006 (5), 12 Nov 2006 (2), 21 Dec 2006 (2), 01 May 2007 (3), 11 Aug 2007 (2), 10 Nov 2007 (2), 01 May 2009 (3), 16 Aug 2009 (1), 10 Jun 2012 (3), 21 Apr 2013 (2), 10 Aug 2013 (1) |
| **Volatinia jacarina** Blue-black Grassquit | 02 Mar 2008 (1), 01 May 2009 (3), 10 Jun 2012 (1), 10 Aug 2013 (5) |
| **Charitospiza eucosma** Coal-crested Finch | 09 Oct 2006 (8), 21 Oct 2006 (15), 29 Oct 2006 (1), 12 Nov 2006 (4), 21 Dec 2006 (15), 17 Jan 2007 (5), 01 May 2007 (3), 11 Aug 2007 (3), 11 Nov 2007 (2), 02 Mar 2008 (1), 16 Aug 2008 (1), 01 May 2009 (3), 15 Aug 2009 (1), 16 Aug 2009 (14), 21 Apr 2013 (1), 10 Aug 2013 (13), 16 Nov 2013 (2) |
| **Coryphaspiza melanotis** Black-masked Finch | 09 Oct 2006 (1), 21 Oct 2006 (4), 29 Oct 2006 (1), 12 Nov 2006 (1), 21 Dec 2006 (2), 17 Jan 2007 (3), 01 May 2007 (3), 11 Aug 2007 (3), 11 Nov 2007 (2), 02 Mar 2008 (2), 16 Aug 2008 (7), 01 May 2009 (9), 15 Aug 2009 (1), 16 Aug 2009 (10), 10 Jun 2012 (6), 21 Apr 2013 (1), 10 Aug 2013 (10), 16 Nov 2013 (3) |

**FRINGILLIDAE**

| Record | Date          | Amount                        |
|--------|---------------|-------------------------------|
| **Euphonia chlorotica** Purple-throated Euphonia | 09 Oct 2006 (1), 01 May 2009 (2), 16 Aug 2009 (1), 21 Apr 2013 (2), 10 Aug 2013 (1) |