

Distribution of *Cichlopsis leucogenys* (Aves: Turdidae) in Brazil and its relation to protected areas

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Abstract. Vogel HF, Bernardon MM, Zawadzki CH. 2017. Distribution of *Cichlopsis leucogenys* (Aves: Turdidae) in Brazil and its relation to protected areas. *Biodiversitas* 18: 1116-1121. The Rufous-brown Solitaire (*Cichlopsis leucogenys* Cabanis, 1851) is endangered in Brazil, and the demarcation of priority areas is needed for its *in situ* conservation. Accordingly, we reviewed the distribution of *C. leucogenys* and assessed its association with protected areas (PAs) by analyzing 70 occurrence records from 1942 to 2014 that were collected from online datasets. Of these records, 38 (54.4%) were from Bahia State, 27 (38.5%) were from Espírito Santo State, and five (7.1%) were from Minas Gerais State, and the Biological Reserve Augusto Ruschi (Espírito Santo State), State Park Serra do Conduru (Bahia State), and Serra do Ouro Environmental Protected Area (Bahia) were identified as key PAs. One record described an observation of the species at 45 m above sea level, which is lower than expected. We verified the potential occurrence of the species in 31 PAs that were located in southern Bahia to the mountains in both Espírito Santo and Minas Gerais. The Ilhéus-Itabuna region should be given special attention during conservation efforts, owing to records of species presence outside PAs, which should also be considered by management plans.

Keywords: Atlantic Forest, Neotropical birds, Passeriformes, Thrushes

INTRODUCTION

The Turdidae (i.e., thrushes) is a cosmopolitan family of passerine birds that comprises 177 species, including 34 that are globally threatened and four that have possibly been extinct since the 1600s (Collar 2017). In general, thrushes are relatively uniform in shape, exhibit relatively little variation in size (Sclater 1861; Vogel et al. 2012), occupy forested and semi-forested habitats, and play important roles in seed dispersal (Gasperin and Pizo 2009). In addition, even though thrush species respond differently to landscape changes, they generally benefit from recurrent environmental disturbance (Vogel 2012). However, some species have been negatively affected by anthropogenic landscape changes and have suffered declines in population sizes (Peach et al. 2004). In South America, most thrush species are less susceptible than other Brazilian thrushes to environmental changes. Of the 19 species that occur in Brazil (Piacentini et al. 2015), only the Rufous-brown Solitaire (*Cichlopsis leucogenys* Cabanis, 1851) is highly sensitive to habitat changes. However, the species remains poorly studied (Vogel et al. 2013).

The Rufous-brown Solitaire comprises four known subspecies, including *C. l. peruviana* in Peru, *C. l. chubby* in southeast Colombia and northwest Ecuador, *C. l. gularis* in southeast Venezuela and Guiana, and *C. l. leucogenys* in Brazil (Chapman 1924), where it is endangered at the national level (Silveira and Straube 2008; MMA 2014). Indeed, there are few records of *C. l. leucogenys* in Brazil,

and these are also restricted to the states of Espírito Santo, Minas Gerais, and Bahia. In this area, the subspecies occurs in both primary- and advanced second-growth forests in a narrow area of the Atlantic Forest (Sick 1997; Clement and Hathway 2000; Machado et al. 2005; Nascimento and Campos 2011). However, intense fragmentation of the Atlantic Forest is causing the decline of the subspecies (Stotz et al. 1996). The Atlantic Forest originally occupied 15% of Brazilian territory (1,363,000 km²), ranging from Rio Grande do Sul State to Piauí, along the Atlantic coast (Lagos and Muller 2007), and the biome represents one of the 34 global biodiversity hotspots, owing to its high level of endemism and large number of threatened species (Myers et al. 2000). However, the Atlantic Forest has been reduced to 7-8% of its original distribution, and 80% of the remaining area exists as fragments of <50 hectares (Ribeiro et al. 2009; Tabarelli et al. 2010).

In fact, the total population of this subspecies does not exceed 2500 mature individuals, and the population continues to decline, as a result of habitat loss, since the species depends on preserved forest (MMA 2014). Therefore, to conserve the Rufous-brown Solitaire, it is essential to establish priority areas for conservation and management plans. Accordingly, the present study aimed to (i) obtain data on the geographic distribution of *C. l. leucogenys* in Brazil, (ii) assess the immediate importance of protected areas (PAs) to conservationist efforts, and (iii) explore the ecology of the species, such as its altitudinal distribution and ecoregion preference.

MATERIALS AND METHODS

Occurrence data

A list of *Cichlopsis l. leucogenys* records from up until December 2014 was obtained from the following databases: (i) Xeno-canto [www.xeno-canto.org]; (ii) Wiki Aves [www.wikiaves.com.br]; (iii) Species Link [www.splink.org.br], which was used particularly to search for records in museums; (iv) Ebird [www.ebird.org]; and (v) Taxeus [www.taxeus.com.br]. Only records with precise location information, up to the municipality level, were considered. Care was also taken to avoid collecting duplicate data records.

Data analyses

The potential extent of occurrence was estimated using the Minimum Convex Polygon (MCP) method to draw the smallest polygon possible, without assuming concavities (Odum and Kuenzler 1955). This method allows to estimate the extent of occurrence based on records of known extremes of the species' distribution. The occurrence records were plotted considering the limits of the Atlantic Forest Protected Areas (MMA 2010; ICMBIO 2014) and to detail the distribution, the records were specialized on Brazil's Atlantic Rainforest ecoregions according to Olson et al. (2001). The polygon of the species' original expected distribution was based on that described by BirdLife International and NatureServe (2015).

We classified priority areas for the conservation of *C. l. leucogenys*, as follows: (1) PAs containing confirmed records of the species; (2) PAs with potential records, as the location of occurrence was restricted to the municipality but with a buffer distance up to 20 km of each PA. A buffer distance of 20 km was considered to be the maximum dispersive movement that the species could reach, based on dispersion data of the wood thrush (*Hylocichla mustelina* Gmelin, 1789; Lang et al. 2002), which is a phylogenetically related species (Klicka et al. 2004).

RESULTS AND DISCUSSION

Results

Seventy observation records (Table 1) that were recorded over a 72-year period from 1942 to 2014 (~0.98 records per year) were obtained (Appendix 1). Most records (54.4%) were from Bahia State, whereas 38.5% and 7.1% were from Espírito Santo and Minas Gerais states, respectively. The extreme records obtained from the southern areas were from the municipality of Santa Teresa, Espírito Santo State, whereas the extreme records obtained from the northern areas were from the municipality of Boa Nova, Bahia State (Figure 1). The total extent of the MCP was 43,420 km², which corresponds to 42.4% of the known extent of the species' distribution, and 55 records (78.57%)

were found in the Bahia Coast Forests ecoregion and 15 (21.43%) were found in Bahia Interior Forests.

The altitudinal distribution of the species was 458.2 ± 266.7 m above sea level ($n = 70$), with 75% of the records below 725 m and extreme records at 45 and 837 m. A total of 31 PAs possessed confirmed ($n = 3$) or presumed ($n = 28$) *C. l. leucogenys* populations (Figure 2), with occurrence, confirmed in the Biological Reserve Augusto Ruschi, State Park Serra do Conduru, and Serra do Ouro Environmental PA. Of all the occurrence records, 25.9% were from Natural Heritage Private Reserves.

Discussion

Records were found to have been documented at a rate of <1 per year, which is a direct indication of the rarity of *Cichlopsis l. leucogenys* (Collar 2017), and the species' rarity is also corroborated by the paucity of records in the literature (e.g., Simon 2000; Silveira et al. 2005). Widening the area of *C. l. leucogenys* occurrence in the city of Boa Nova (Bahia), as highlighted in the present study, has been reported previously (Albano 2013), although the record did not note its biogeographical importance. Similarly, the distribution of *C. l. gularis* was also widened recently, up to Suriname (Zyskowski et al. 2011). This demonstrates that the distribution of the Rufous-brown Solitaire is incompletely understood. The MCP indicated that less than half (42.4%) of the potentially inhabitable area contains records, and the records were restricted to only nine localities. In Brazil, part of the distribution gap arises from a lack of records from northern and northeastern Espírito Santo State, as well as from the extreme south of Bahia State. The biome in this region, which is called the Atlantic Forest Central Corridor, has suffered intense fragmentation, mainly due to the impact of *Theobroma cacao* L. (Cocoa) cultivation, extensive cattle breeding, and forestry (Schiavetti et al. 2012).

The mean altitudinal distribution observed for *C. l. leucogenys* in the present study was similar to that of previous studies (Zyskowski et al. 2011), which suggests that the species is less dependent on mountain environments than was previously assumed. The occurrence recorded at 45 m above sea level probably represents an outlier, possibly a vagrant, since the species generally occurs in high-altitude environments (Mee et al. 2002). However, future records could confirm that consistent populations occur at lower altitudes, as well, which would be important, since conservation efforts are primarily directed toward Atlantic Forest PAs in coastal mountains.

In Espírito Santo State, specifically in the Santa Teresa, Fundão, and Aracruz municipalities, *C. l. leucogenys* has been confirmed to occur in the Biological Reserve Augusto Ruschi, and presumed to occur in the Biological Reserve Santa Lúcia, São Lourenço Municipal Natural Park, and Environmental Protected Area Pico-do-Goiapaba-Açu (Table 1).

Table 1. List of protected areas (PAs) that are potentially inhabited by the Rufous-brown Solitaire (*Cichlopsis l. leucogenys*). The tags (+) and (-) represent species presence and absence, respectively. Record types: (C) confirmed and (P) presumed.

Category*		Name of the	Location	State	Records	
IUCN	SNUC	PA	City		C	P
V	APA	Pico do Goiapaba-Açu	Fundão and Santa Teresa	Espírito Santo	-	+
V	APA	Lagoa Encantada and Rio Almada	Ilhéus, Uruçuca, Itajuípe, Coaraci and Almadina	Bahia	-	+
V	APA	Costa de Itacaré/Serra Grande	Uruçuca and Itacaré	Bahia	-	+
V	APA	Baía do Camamu	Camamu, Maraú and Itacaré	Bahia	-	+
V	APA	Pratigi	Nilo Peçanha, Ituberá, Igrapiúna, Pirai do Norte and Ibirapitanga	Bahia	-	+
V	APA	Ilhas de Tinharé and Boipeba	Cairú	Bahia	-	+
V	APA	Caminhos Ecológicos da Boa Esperança	Ubaíra, Jiquiriça, Teolândia, Wenceslau, Guimarães, Nilo Peçanha, Taperoá, Cairú and Valença	Bahia	-	+
V	APA	Serra do Ouro	Iguaí	Bahia	+	+
	EB	Santa Lúcia	Santa Teresa	Espírito Santo	-	+
II	PE	Alto do Cariri	Santa Maria do Salto and Salto da Divisa	Minas Gerais	-	+
II	PN	Serra das Lontras	Arataca and Una	Bahia	-	+
	PN	Serra do Conduru	Itacaré, Ilhéus and Uruçuca	Bahia	+	-
II	PN	Do Alto Cariri	Guaratinga	Bahia	-	+
II	PN	Boa Nova	Boa Nova, Manoel Vitorino and Dario Meira	Bahia	-	+
II	PNM	Pico do Goiapaba-Açu	Fundão and Santa Teresa	Espírito Santo	-	+
II	PNM	Aricanga Waldemar Devens	Aracruz	Espírito Santo	-	+
II	PNM	São Lourenço	Santa Teresa	Espírito Santo	-	+
II	PNM	Horto Florestal	Santa Maria de Jetibá	Espírito Santo	-	+
Ia	RB	Augusto Ruschi	Santa Teresa	Espírito Santo	+	+
VI	RDS	Piraquê-Açu e Piraquê-Mirim	Aracruz	Espírito Santo	-	+
IV	RPPN	Guanandi	Ilhéus	Bahia	-	+
IV	RPPN	Canto do Senhor	Uruçuca	Bahia	-	+
IV	RPPN	Araçari	Uruçuca	Bahia	-	+
IV	RPPN	Reserva Capitão	Uruçuca	Bahia	-	+
IV	RPPN	Rio Capitão	Itacaré	Bahia	-	+
IV	RPPN	Arte Verde	Itacaré	Bahia	-	+
IV	RPPN	Pedra do Sabiá	Itacaré	Bahia	-	+
III	RPPN	Reserva Natural da Serra do Teimoso	Jussari	Bahia	-	+
III	RVS	Mata dos Muriquis	Santa Maria do Salto and Salto da Divisa	Minas Gerais	-	+
III	RVS	Boa Nova	Boa Nova, Manoel Vitorino and Dario Meira	Bahia	-	+
IV	RVS	Una	Una	Bahia	-	+

Note: *PAs are categorized according to the International Union for Conservation of Nature (IUCN) and Brazilian National System of Protected Areas (SNUC). Nomenclature: (APA) Environmental Protected Area, (RPPN) Natural Heritage Private Reserve, (PNM) Municipal Natural Park, (PN) National Park, (PE) State Park, (RB) Biological Reserve, (RVS) Wildlife Refuge, (EB) Biological Station, and (RDS) Sustainable Development Reserve

The city of Santa Teresa is also referenced in ornithological studies performed by a scientific research institution founded by the naturalist Augusto Ruschi (Mendes and Padovan 2000). Thus, studies performed here document the dynamics of the bird assemblage (e.g., Simon 2000; Willis and Oniki 2002). Little is known about the integrity of the PAs where Rufous-brown Solitaire occurrence has been documented. However, for those that have been studied these results highlight a worrying scenario. For example, the Biological Reserve Augusto Ruschi is situated beside an area of urban landfill (Mendes and Padovan 2000). Furthermore, the PAs in the city of Santa Teresa, which are historically important for *in situ* conservation of the species, are surrounded by plantations of coffee (Pinto et al. 1993), eucalyptus, and banana (Gatti et al. 2014).

Another example of disturbance occurs in the city of Aracruz, at the Reserve of Sustainable Development Piraquê-Açu and Piraquê-Mirim. Although the state of Espírito Santo is ecologically important and contains several estuaries, the region faces problems related to the severe exploitation of wood for cellulose production (Pazolin et al. 2007).

In Minas Gerais State, the cities of Santa Maria do Salto and Salto da Divisa contain PAs, including the State Park Alto Cariri and Wildlife Refuge Mata dos Muriquis, with potential *C. l. leucogenys* records. Of the PAs categorized as parks by the state, only 3% are managed at a level that satisfies the standards of the Ecologic Stations and Biological Reserves, and only 9% are adequately managed (Lima et al. 2005).

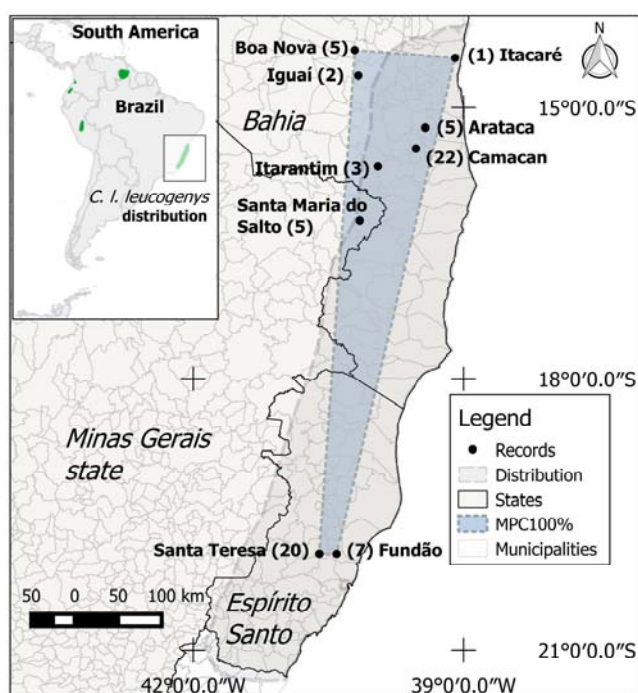


Figure 1. *Cichlopsis leucogenys leucogenys* distribution. Numbers indicate the total of overlapping records at each locality. Source: The historical distribution is based on that described by BirdLife International and NatureServe (2015). The states and municipalities according IBGE (2010).

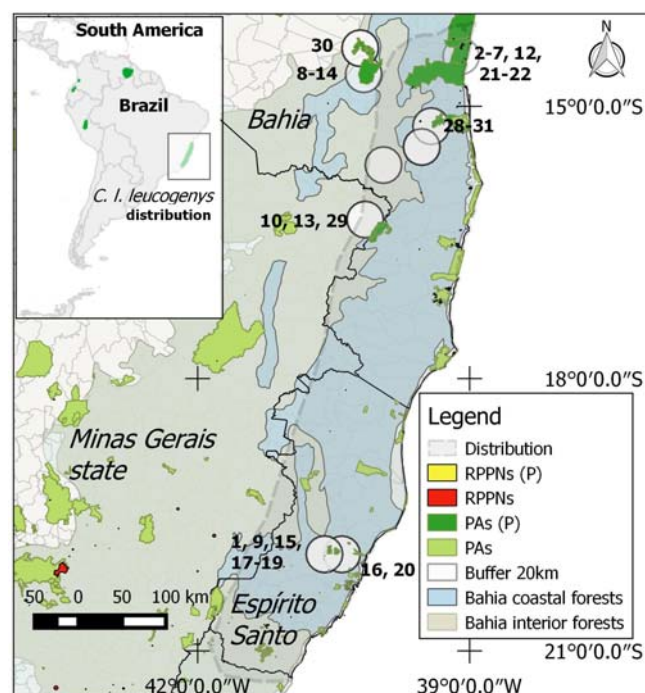


Figure 2. *Cichlopsis leucogenys leucogenys* historical distribution in the protected areas (PAs), and ecoregions. Numbers correspond to the PA' codes in Table 1. Source: adapted from Olson et al. (2001), MMA (2010), BirdLife International and NatureServe (2015), and ICMBIO (2014).

In Bahia State, most part of PAs are concentrated in large complexes, which include different cities such as Itacaré, Ilhéus, Uruçuca, Cairú, Nilo Peçanha, Iguai, and Boa Nova. Previously, 17 records of *C. l. leucogenys* occurrence was documented in Bahia State, 12 in PAs (Vieira 2007). The results of the present study indicate that *C. l. leucogenys* is either presumed or confirmed to occur in 31 PAs, 21 of which are in Bahia State, thereby widening the potential distribution of the species in the state. In Bahia, occurrence records of the species have been confirmed in the National Park Serra do Conduru, which is located in the cities of Itacaré, Ilhéus, and Uruçuca and within the Itacaré/Serra Grande Environmental Protection Area (APA). This APA is impacted by deforestation, which degrades the soil and water bodies and reduces the primary vegetation (Macedo and Drummond 2012) needed for the conservation of *C. l. leucogenys*. Other records of the species have been confirmed in PAs in Iguai, at the Serra do Outro APA, which is impacted by intense exploitation of vegetation coverage, i.e., pastures and forestry (Rocha and Hadlich 2011).

The Boa Nova National Park and Wildlife Refuge are located in the same city, which is where the potential distribution of Rufous-brown Solitaire was widened, and there were potential records of occurrence of the species in both areas. Both PAs are located in a fragmented forest matrix and are surrounded by anthropized areas, where

activities, such as agriculture, cattle breeding, and wood extraction take place (Santos 2014).

In the cities of Camacan and Itarantim, occurrence records were also distant from PAs, so the region should be prioritized for the creation of new PAs. Finally, the Natural Heritage Private Reserves with potential records of the Rufous-brown Solitaire are concentrated in the Brazilian micro-region of Ilhéus-Itabuna. Such reserves serve as important ecological corridors between PAs (Schiavetti et al. 2010). However, based on our review of the literature, the ornithological studies needed for the *in situ* conservation of the species are still lacking. Fortunately, a quantitative study of avian diversity at the Biological Reserve Augusto Ruschi demonstrated that *C. l. leucogenys* is abundant (Novaes et al. 2016), thereby making the habitat even more important for the *in situ* conservation of the species.

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Appendix 1. List of Rufous-brown Solitaire records analyzed by the present study. Vouchers are listed as “database acronym + corresponding voucher number”, e.g., XC46264 means voucher 46264 from Xeno-canto. XC (Xeno-canto), WA (Wiki Aves), AR (Species Link), and TX (Taxeus). Albano, C. (2010) XC46264, XC43063; Jacomelli, J. A. (2009) XC37399, XC32146, XC31889. Rennó, B. (2009) WA159581, WA159571, WA161671, WA161670; Bessa, R. (2009) WA42876, WA193070; Ribenboim, L. (2010) WA190810; Albano, C. (2010) WA109931 (2009) WA42294; Magnago, G. (2008) WA6311 (2010) WA172111 (2012) WA608189; Gregorio, S. (2013) WA1083131; Ávila, P. (2009) WA183498; Silveira, J. (2013) WA1222154 (2010) WA227723, WA227724; Jacomelli, J.A. (2013) WA1009270; Oliveira, G.S. (2014) WA1346576; Macarrão, A. (2009) WA41308; Quental, J. (2009) WA29353; Candeias, M. (2014) WA1345098; Messias, S. (2013) WA1076373; Tavares, F. (2012) WA624752; Serpa, G. (2012) WA787893; Sattler, D. (2014) WA1341654; Costa, F. (2009) WA103936; Alves, A. (2010) WA253646; Merçon, L. (2014) WA1346927; Luiz, A.D. (2013) WA1134671; Patrial, E. (2013) WA856067 (2014) WA1267103; Carvalho, G. D. (2011) WA340659; Fernandes, E. (2013) WA1178034; Alves, F. (2014) WA1342550; Carvalho, E.P. (2011) WA340649; Kverno, D. (2013) WA1064415; Luiz, E. (2013) WA1133220; Gussoni, C. (2010) WA356391; Patrial, L. (2010) WA238177; Calil, T. (2013) WA1423878; Souto, L. (2014) WA1401753; Guedes, M. (2014) WA1375772; Silva, L.A. (2014) WA1408656; Pacheco, F. (1995) WA1433655; Farias, F. (2014) WA1497714; Linhares, S. F. (2014) WA1486701; Marques, A. (2014) WA1552935; Espeschit, W. (2014) WA1564547; Licco, S. (2014) WA1534491; Campos, B. (2014) WA1536385; Nogueira, W. (2014) WA1577253; Julio, R. (2014) WA1574765; Couto, P. (2014) WA1568429; Gentil, R. (2014) WA1562298; Machado, C. (2014) WA1541454; Araujo, F. (2014) WA1580446; Maia, T. (2014) WA1552274; Nogueira, W. (2014) WA1574951; Vielliard, J. (1942) AR4105, AR4102, AR4106, AR4107 (1963) AR4103; Gabriel, P.M. (2014) TX.