



BIRDS OF PARQUE ESTADUAL DO BIRIBIRI, CENTRAL ESPINHAÇO RANGE, BRAZIL

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Abstract: The Central Espinhaço Range forms a large biogeographical barrier that contains areas of ecological transition between two important conservation hotspots in Brazil: the Atlantic Forest and the Cerrado. This research aims to present the first consolidated list of bird species from Parque Estadual do Biribiri (PEBI) located in the Central Espinhaço Range at Minas Gerais state, southeastern Brazil. We recorded 172 bird species between August/November 2018 and January/April 2019, of which 15 are associated with the surrounding biomes (Caatinga, Cerrado and Atlantic Forest) and three species restricted to the southeastern Brazilian mountain tops. Among those species, four are considered globally Near Threatened and 41 species are listed under wildlife trafficking species, indicating the importance of conserving this area. Therefore, our results highlight the importance of PEBI and stress the importance of such transitional areas for maintaining diversity of birds in the Espinhaço Range.

Keywords: ecotone; endemic areas; mountain top birds; Neotropical birds.

Transitional areas, as the Central Espinhaço Range, tend to harbor higher species richness and abundance, because they support overlapping communities that would normally be restricted to isolated ecosystems (Kark *et al.* 2007, Vitorino *et al.* 2018, Sementili-Cardoso *et al.* 2019). However, these transitional areas tend to receive less attention in biodiversity research than distinct ecosystems (Sementili-Cardoso *et al.* 2019).

Parque Estadual do Biribiri (PEBI) lies in the Central Espinhaço Mountain Range, which is a large biogeographical barrier (Rodrigues *et al.* 2011) that separates two hotspots Brazilian biomes: the forest areas of the Atlantic Forest on its eastern slope, and the savanna-like vegetation

of the Cerrado on its western slope (Giulietti *et al.* 1997). Despite the occurrence of some endemic birds in this montane open-habitats of southeastern Brazil (Vasconcelos *et al.* 2009), their biogeography is poorly known, with only sparse surveys and checklists (Vasconcelos & Rodrigues 2010, Rodrigues *et al.* 2011). Here we present a list of bird species from PEBI at Minas Gerais state, southeastern Brazil. This is the first consolidated list based on standardized criteria of bird species at this area.

The PEBI (16,998 ha) is located at the Central Espinhaço range with a mosaic of vegetation physiognomies, which includes *campos rupestres* (predominant in the park), *campos limpos*,

semideciduous seasonal forests and Cerrado *stricto sensu*. To cover different types of habitats in PEBI we carried out bird surveys at three sampling sites, identified as: Mandanha (ME: 18°5'20.65"S; 43°33'7.89"W) – predominant vegetation is Cerrado *stricto sensu* and semideciduous seasonal forests; Guinda (GI: 18°10'13.42"S; 43°35'25.83"W) – a vegetation mosaic comprising semideciduous seasonal forests surrounded by *campos limpos* and small areas of *campos rupestres*; and Fazenda Duas Pontes (DP: 18°8'23.73"S; 43°35'25.83"W) – predominant vegetation is *campos limpos* and *campos rupestres* with small areas of semideciduous seasonal forests (Figure 1).

We considered systematic and non-systematic (bird species recorded during the transit between the sampling sites) data collected between August/November 2018 and January/April 2019. We identified bird species by sight and sound using Simmons 10 × 42 binoculars and a digital audio recorder Sony PX440, and whenever possible they were photographed (archived on

Wikiaves, supplementary material). We used the Brazilian Red Book of Threatened Species of Fauna (ICMBio 2018) for the national conservation status and the Red List of Threatened Species (IUCN 2020) for the international conservation status. For migratory status, we followed the classification of Somenzari *et al.* (2018). We also identified species subjected to animal trafficking (cinegetic and xerimbabo species) according to Costa & Monteiro (2016). The endemism status of each species was based on Bencke *et al.* (2006) for Atlantic Forest and on Silva & Bates (2002) for Cerrado. Taxonomic ordering and nomenclature followed the Brazilian Ornithological Records Committee (Piacentini *et al.* 2015).

We surveyed the birds using 20 min point counts (Vielliard *et al.* 2010) with a 50 m fixed radius to record all individuals seen and/or heard. At each site (ME, GI, DP) we conducted six point counts, separated by a minimum distance of 200 m from one another. We surveyed each point for three consecutive days per month, in

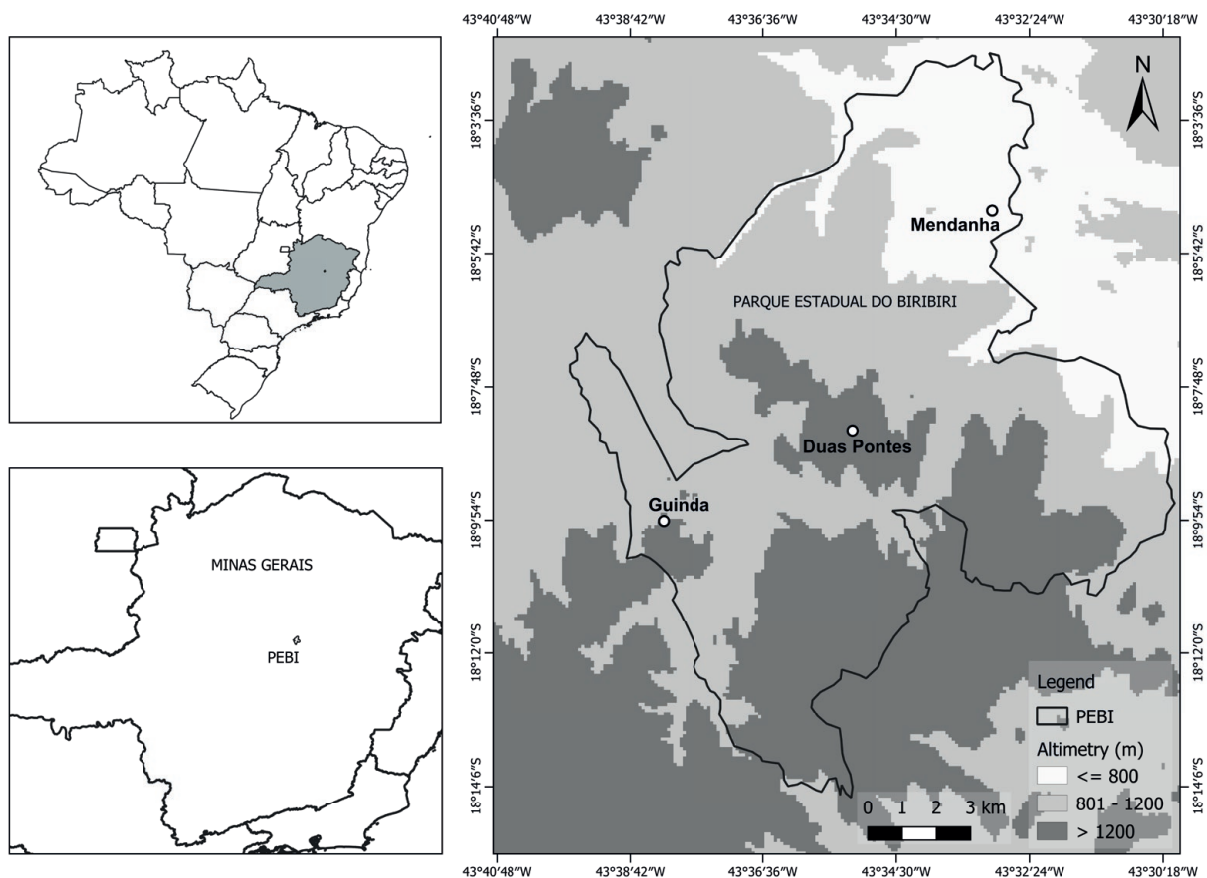


Figure 1. Location of the three sampling sites (Mendanha, Guinda, and Duas Pontes) at the Parque Estadual do Biribiri (PEBI), Minas Gerais state, Brazil.

the mornings (06:00 – 10:00) and in the afternoons (15:00 – 19:00), totaling 144 hours of sampling effort. Species richness was estimated for the systematic data using Jackknife 1 estimator. These analyses were performed using the software EstimateS, version 9.1 (Colwell 2013). We defined frequency of species occurrence (FO) as the number of samples where a given species was recorded divided by the total number of samples. Then, we classified the species according to their FO, following Frota *et al.* (2020): very frequent (100 - 75%); frequent (74 - 50%); reasonably frequent (49 - 25%); less frequent (<25%), and infrequent for non-systematic data.

We recorded a total of 172 bird species belonging to 20 orders and 47 families, 153 through systematic sampling and 19 through non-systematic observations (Table S1). We recorded 16 species (9% of the total) known to exhibit migratory behavior, of which two species were considered migratory and 14 species partially migratory (Table S1). Species accumulation curve, based on 153 species sampled systematically, shows that asymptote has not yet been attained

(estimated richness \pm SD = 192 ± 7.78 species; sample completeness = 80%) (Figure 2).

We documented three species characterized as restricted to the eastern Brazilian mountain tops (Rodrigues *et al.* 2011): *Augastes scutatus* (Temminck, 1824) (Figure 3a), *Embernagra longicauda* Strickland, 1844, (Figure 3b) and *Polystictus superciliaris* (Wied-Neuwied, 1831) (Figure 3c). We also recorded two taxa restricted to Caatinga biome (Vasconcelos and Rodrigues, 2010): *Sakesphorus cristatus* (Wied-Neuwied, 1831) (Figure 3d) and *Myrmorchilus strigilatus* (Wied-Neuwied, 1831) (Figure 3e); six restricted to the Cerrado: *Melanopareia torquata* (Wied-Neuwied, 1831) (Figure 3f), *Antilophia galeata* (Lichtenstein, 1823) (Figure 3g), *Cyanocorax cristatellus* (Temminck, 1823) (Figure 3h), *Porphyrospiza caerulescens* (Wied, 1830) (Figure 4a), *Neothraupis fasciata* (Lichtenstein, 1823) (Figure 4b); and eight restricted to the Atlantic Forest: *Conopophaga lineata* (Wied-Neuwied, 1831) (Figure 4c), *Lepidocolaptes squamatus* (Lichtenstein, 1822) (Figure 4d), *Ilicura militaris* (Shaw, 1809) (Figure 4e), *Knipolegus nigerrimus*

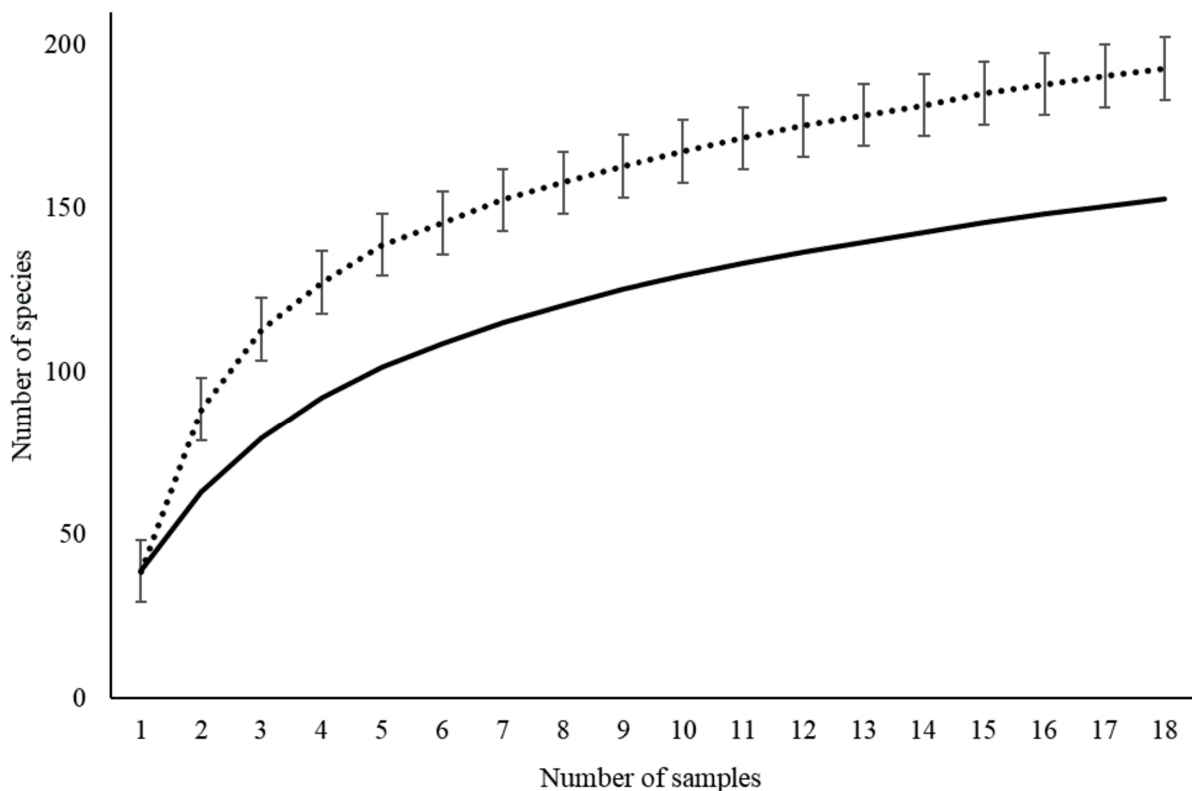


Figure 2. Species accumulation curve (continuous line) and estimation curve (dashed line) for the systematic data of the avifauna of Parque Estadual do Biribiri, Minas Gerais state, Brazil.



Figure 3. Birds recorded at Parque Estadual do Biribiri, Minas Gerais state, Brazil: a) *Augastes scutatus*, b) *Embornagra longicauda*, c) *Polystictus superciliaris*, d) *Sakesphorus cristatus*, e) *Myrmorchilus strigilatus*, f) *Melanopareia torquata*, g) *Antilophia galeata*, and h) *Cyanocorax cristatellus*. (Photos: Lima, ELP).



Figure 4. Birds recorded at Parque Estadual do Biribiri, Minas Gerais state, Brazil: a) *Porphyospiza caerulescens*, b) *Neothraupis fasciata*, c) *Conopophaga lineata*, d) *Lepidocolaptes squamatus*, e) *Ilicura militaris*, f) *Knipolegus nigerrimus*, g) *Tangara cyanoventris*, and h) *Colibri serrirostris*. (Photos: Lima, ELP except for *C. serrirostris* photographed by Carvalho, RF).

(Vieillot, 1818) (Figure 4f), and *Tangara cyanoventris* (Vieillot, 1817) (Figure 4g).

Colibri serrirostris (Vieillot, 1816) was very frequent (FO = 79%) and recorded in all sampling sites (Figure 4h, Table S1). Other frequent species (FO = 67% - 50%) and quite common in PEBI were *Elaenia flavogaster* (Thunberg, 1822), *Eupsittula aurea* (Gemelin, 1788), *Troglodytes musculus* J.F. Naumann, 1823, *Saltator similis* d'Orbigny & Lafresnaye, 1837 and *Zonothrichia capensis* (Statius Muller, 1776). For the less frequent category (FO = 19% - 2%), we highlight species also classified as Near Threatened globally such as *Aratinga auricapillus* (Kuhl, 1820), *Amazona aestiva* (Linnaeus, 1758), *Porphyrospiza caerulescens* (Wied, 1830) and *Neothraupis fasciata* (Lichtenstein, 1823). We also recorded 41 species (24% of the total) subjected to animal trafficking (Table S1).

PEBI species richness (172 bird species) is similar to other surveys carried out in Cerrado areas in Brazil, which generally present between 151 - 287 species (see Rodrigues *et al.* 2005, Marçal Júnior *et al.* 2009, Rodrigues *et al.* 2011, Vitorino *et al.* 2018), corresponding to approximately 20% of the bird species of Cerrado (Silva & Santos 2005). Habitat diversity in the study area is distributed in a mosaic landscape (Marques & Nakajima 2015), that offer a variety of habitat types for animal and plant species inserted in an ecotone between the two major hotspots in Brazil: the Cerrado and the Atlantic Forest (Myers *et al.* 2000, Pereira *et al.* 2015). The species accumulation curve presented here suggests that future studies combining different methodologies could add more species to this list (Sutherland *et al.* 2005; Somenzari *et al.* 2011).

Endemic species are usually negatively affected by habitat loss and fragmentation (Sementili-Cardoso *et al.* 2019), thus records of endemic species can be an indicative of the quality of the habitats in the study area. Among the typical Caatinga birds recorded in the PEBI, *M. strigilatus* and *S. cristatus* (Vasconcelos & D'Angelo Neto 2018) were observed with reasonably frequency in semideciduous forests (FO = 29 and 31% of the total, respectively). Both, *M. strigilatus* and *S. cristatus*, are Caatinga endemic species, whose original ranges known so far, are associated with the limits of this

biogeographic province (Vasconcelos *et al.* 2012, Vasconcelos & D'Angelo Neto 2018).

We highlight the presence of three species (*A. scutatus*, *E. longicauda* and *P. superciliaris*), which were considered endemic to the *campos rupestres* as well as to the Cerrado biome in previous studies (Silva & Bates 2002, Rodrigues *et al.* 2005). However, according to Vasconcelos (2018), these species would be better characterized as endemic to the eastern Brazilian mountaintops than to any specific morphoclimatic domain. Among the endemic species of the Cerrado observed in the PEBI, two are considered globally Near Threatened: *P. caerulescens* and *N. fasciata*, both are open Cerrado dwellers (Bencke *et al.* 2006) and little is known about the biology of these species (but see Duca and Marini (2014) that investigates the territorial system of *N. fasciata* in central's Brazil savanna). We also highlight the presence of birds typical of Atlantic Forests (Bencke *et al.* 2006), especially in forested habitats in the PEBI, nonetheless observed less frequently (FO < 19%). In the Cerrado domain, woodland areas support many species not found in any other habitats, particularly the Atlantic Forest endemic species (Rodrigues *et al.* 2011). In this context, endemic species from the Cerrado, such as *Antilophia galeata*, were only recorded in forested habitats in the PEBI, as this species is restricted to woodland areas (Silva & Bates 2002; Rodrigues *et al.*, 2011).

We call attention to the number of species (24% of the total) with potential to be used by the local population as food, kept as pets or sold. Some species are possibly subjected to poaching, such as *Rhynchotus rufescens* (Temminck, 1815), *Nothura maculosa* (Temminck, 1815), and *Columbina squammata* (Lesson, 1831), together with birds that may be kept as pets or sold, such as *A. auricapillus*, *A. aestiva* and *S. similis*, were observed frequently in the PEBI and adjacent areas. Bird-keeping activities are common throughout Brazil in both rural and urban settings (Alves 2012), but rarely come from legalized breeders, been mostly captured in the wild (Soares *et al.* 2018).

Our findings highlight the importance of PEBI for maintaining diversity of birds in the central portion of the Espinhaço Mountain range, in southeastern Brazil. This way, we also stress the importance of transitional areas, demonstrating

the status of this type of environment for the maintenance of bird diversity.

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Supplementary Material

Table S1. List of birds recorded at Parque Estadual do Biribiri, Minas Gerais state, Brazil. Legend: Migratory Status (Somenzari *et al.* 2018): Migratory (MGT), Partially Migratory (MPR), Resident (R); Sites: Mendanha (1), Guinda (2), Duas Pontes (3); Frequency of species occurrence (FO) (Frota *et al.* 2020): very frequent (100 - 75%), frequent (74 - 50%), reasonably frequent (49 - 25%), less frequent (<25%), and infrequent for non-systematic data

(IN); Conservation status at global level (IUCN 2020) NT.*; Taxa that suffer pressures (Costa & Monteiro 2016): Cinegetic (Ci) and Xerimbabo (Xe) species (Pressure); Endemic species (Silva & Bates 2002, Bencke *et al.* 2006): Caatinga (Ca), Cerrado (Ce), and Atlantic Forest (AF). Numbers of voucher and links to the online database WikiAves are also presented.

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