



Avifauna of the Serra de Itabaiana National Park revisited: additions and deletions in a period of 15 years

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ABSTRACT. The Serra de Itabaiana National Park (PARNASI) is known as an important conservation area in the ecotone between the Atlantic Forest and Caatinga in Northeast Brazil and is one of the main areas of fauna and flora studies in Sergipe. For this reason, there are some studies on its avifauna, which date back to its creation in 2005. However, after 15 years of establishment of PARNASI, an update of the inventory of birds is necessary due to adjustments in the management of the park. The present study aimed to update the bird inventory of the Serra de Itabaiana National Park, chronologically comparing the new ornithological records obtained, aiming to contribute to the knowledge and conservation of Sergipe's avifauna. The data were compiled from scientific publications, personal files and from documented records on a specialized website. The resulting list includes 227 bird species belonging to 49 families, including Thraupidae (28 species; 12.4%), Tyrannidae (25 species; 11.1%) and Accipitridae (17 species; 7.5%) as the most representative. The most representative guilds were insectivorous (87 species; 38.3%) and omnivorous (60 species; 26.4%), and by species independent of the forest environment (87 species; 38.3%). Fourteen bird species are threatened with extinction. Nine species are endemic to the Caatinga biome, eight to the Atlantic Forest and one to the Cerrado. We added 104 species to the first checklist produced for the PARNASI created in 2005, including *Nyctibius grandis* (Nyctibiidae), a new record for the state of Sergipe. PARNASI's updated list of bird species allows for a better assessment of its effectiveness in the conservation of the local avifauna, facilitating management actions that allow the coexistence and perpetuation of species over time.

Keywords: Birds; ecotone; inventory; Sergipe.

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Introduction

In Brazil, conservation units have been created to ensure the existence of minimum areas for the protection of biodiversity (Bensusan, 2006). The Serra de Itabaiana National Park conservation unit (PARNASI), located in the central region of the Sergipe State (Northeast Brazil), when created in 2005 became part of the National System of Conservation Units (SNUC) and, consequently, brought with it the obligations to: preserve ecosystems; enable scientific research; the development of environmental education; and ecological tourism activities (Brasil, 2005).

The unique characteristics of PARNASI relate in part to its situation in a transition zone between the Atlantic Forest and the Caatinga (Carvalho & Vilar, 2005). This allows the occurrence of a rich avifauna composed of species belonging to both ecosystems, including endangered and endemic species (D'Horta, Gouveia, & Rocha, 2005). For this reason, the Serra de Itabaiana National Park is considered an important area for the preservation of birds (Important Bird Area or IBA) (Bencke, Maurício, Develey, & Goerck, 2006). However, despite its importance, the park suffers from several anthropogenic activities that may compromise its biodiversity, including: the risk of burning due to inappropriate agricultural practices in its surroundings; biological contamination by agrochemicals; removal of wood, sand and clay; introduction of exotic species and poaching; the recreational use of trails without visitation control; and inappropriate garbage disposal by tourists (Sobral et al., 2007).

Despite the considerable level of information on Brazilian biodiversity, there are still many gaps that need to be filled for effective conservation action (Brandon, Fonseca, Rylands, & Silva, 2005). As

PARNASI is one of the main areas for scientific study in Sergipe, some studies on aspects of its avifauna have been published (D'Horta et al., 2005; Sousa, 2009; Silva, Gois, Santos, & Almeida, 2014; Silva & Carmo, 2015, 2016; Silva, Dias, & Carmo, 2016; Silva, Azevedo, Ruiz-Esparza, & Ribeiro, 2020). However, an update of the PARNASI bird list is necessary to better understand its avifauna and to allow an assessment of the park's role in protecting the birds and what management measures are necessary to protect the local avifauna. The present study, thus reviews and updates the bird inventory of the Serra de Itabaiana National Park from 2005.

Material and methods

Study area

Located in the central region of Sergipe State the PARNASI (10° 46' 9.174" S, 37° 20' 12.113" W) is formed by a complex of three mountain ranges (Serra do Cajueiro, Serra Comprida and Serra de Itabaiana) (Figure 1), which together form an area of approximately 8,000 ha, presenting 659 m of maximum altitude, in the Serra de Itabaiana (Carvalho & Vilar, 2005). The matrix surrounding PARNASI is composed of an anthropogenic landscape, formed mainly by pastures and agriculture (Instituto Chico Mendes de Conservação da Biodiversidade [ICMBio], 2016). The predominant climate in the region is tropical with dry summer and moderate hydric surplus in winter, with an average temperature ranging from 21°C to 26°C and annual rainfall between 900 to 1200 mm (Alvares, Stape, Sentelhas, Gonçalves, & Sparovek, 2013).

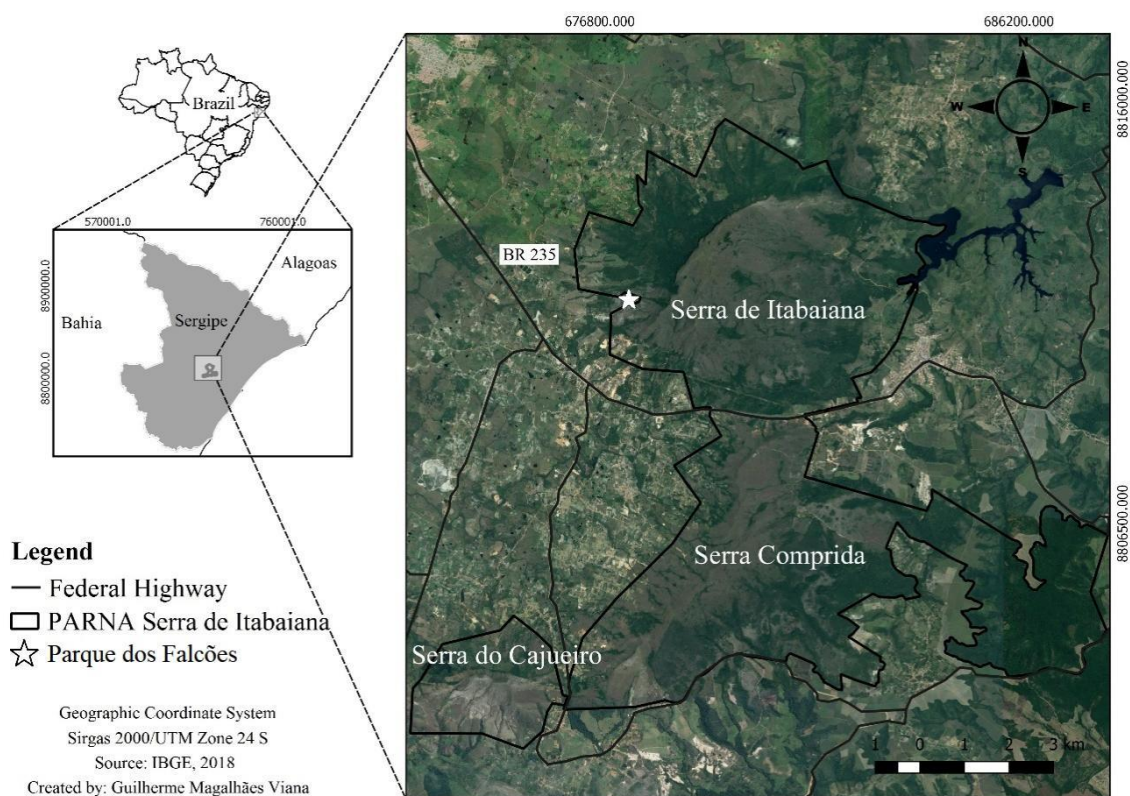


Figure 1. Location of the Serra de Itabaiana National Park (PARNASI) in the state of Sergipe, Northeastern Brazil. PARNASI is formed by the Serra de Itabaiana, Serra Comprida and Serra do Cajueiro mountain ranges.

In PARNASI, contact between the Atlantic Forest and the semiarid Caatinga establishes an ecotone in which species of fauna and flora of both ecosystems coexist, in these closed and more open vegetational formations, respectively (Carvalho & Villar, 2005). The closed areas are constituted by secondary forests, located mainly on the slopes and streams (riparian forests) of the mountains (Dantas & Ribeiro, 2010). The open areas, which also occur on the slopes and in the higher altitudinal areas, develop on sandy soils and have vegetation composed mainly of grasses, shrubs and small and medium-sized trees, which, when grouped together, resemble the vegetation of Cerrado, rupestrian fields, and restingas (Carvalho & Vilar, 2005; Dantas & Ribeiro, 2010).

Sampling

The first checklist list of birds of the Serra de Itabaiana National Park (D'Horta et al., 2005) served as a starting point for this review. In this publication, 123 bird species were registered occurring in PARNASI. Based on this source, new records from scientific publications were incorporated, based on scientific publications (Sousa, 2009; Silva et al., 2014, 2016, 2020; Ruiz-Esparza et al., 2015a; Silva & Carmo, 2016), personal bird observation records of local ornithologists and records documented on the WikiAves website (www.wikiaves.com) up to 2020. Although no specimens of PARNASI birds were found in scientific museum collections and no recordings were found in sound archives from the Xeno-Canto website (www.xeno-canto.org), these sources were also consulted.

Data analysis

Bird species were categorized according to their dependence on forested areas, into three categories: 1) forest-independent (species associated with open areas); 2) semi-dependent (species that occur in mosaics formed by the contact between forested and open and semi-open areas); and 3) forest-dependent (species that occur predominantly in forested, closed areas) (Silva, 1995). The taxonomic and systematic sequence of bird species follows the recommendations of the Brazilian Ornithological Records Committee (Pacheco et al., 2021). The species diet was determined through literature searches (Motta Junior, 1990; Sick, 1997; Toledo-Lima et al., 2004; Telino-Júnior, Dias, Azevedo Júnior, Lyra-Neves, & Larrazábal, 2005). The diets considered were: Carnivorous (CAR): the bird feeds mainly on vertebrate animals (e.g., rodents, birds, lizards, snakes); Detritivorous (DET): the bird feeds mainly on carrion; Frugivorous (FRU): the bird feeds mainly on fruits; Granivorous (GRA): the bird feeds mainly on seeds; Frugivorous/Granivorous (FRU/GRA): the bird feeds mainly on fruits and/or seeds; Insectivorous (INS): the bird feeds mainly on insects and other invertebrates, except snails; Nectarivorous (NEC): the bird feeds mainly on nectar; Omnivorous (ONI): the bird feeds on a wide variety of foods; Malacophagous (MAL): the bird feeds mainly on snails; Piscivorous (PIS): the bird feeds mainly on fish. The categorization of endangered species followed the Red Book of Brazilian fauna threatened with extinction (Instituto Chico Mendes de Conservação da Biodiversidade [ICMBio], 2018) and the list of the International Union for Conservation of Nature (International Union for Conservation of Nature [IUCN], 2020). The list of endemic species from the Caatinga, Atlantic Forest and Cerrado was compiled according to Stotz, Fitzpatrick, Parker III, and Moskovits (1996), Pacheco and Bauer (2000), Silva and Bates (2002) and Pacheco (2004).

To verify if the additions made to the list of birds of PARNASI resulted in a significant increase in the number of bird species recorded between the years 2005 and 2020, a paired t-test was used in the PAST version 3.07 software (Hammer, Harper, & Ryan, 2001).

Results

This compilation of the birds of PARNASI resulted in a list of 227 bird species belonging to 49 families (Table S1), of which Thraupidae (28 species; 12.4%), Tyrannidae (25 species; 11.1%) and Accipitridae (17 species; 7.5%) were dominant in terms of number of species.

Regarding the trophic structure of the avifauna, a predominance of insectivorous species (89 species; 39.2%) was observed, followed by omnivores (58 species; 25.5%) and granivores (23 species; 10.1%) (Table S1). Nearly thirty-two per cent (31.7%; 72 species) of the species were classified as dependent on forested areas, 29.9% (68 species) were semi-dependent on forest, and 38.3% (87 species) were independent of forest (Table S1).

Fourteen species (6.2%) were threatened with extinction, according to the ICMBio (2018) and IUCN (2020) lists of endangered species (Table S1). Of the total bird species registered in 2020 (227 species), nine (4%) were endemic to the Caatinga, eight (3.5%) to the Atlantic Forest and one to the Cerrado biomes (Table S1).

Scientific publications were the sources that contributed most to the registering of new species, with 98 documented new species (94.2%); the data published in WikiAves contributed three species (2.8%) and the data obtained from personal files contributed three species (2.8%) (Figure 2).

During the update and revision of the bird species registered for PARNASI, some species needed to be corrected: (1) the species *Leptodon forbesi* (Swann, 1922), recorded in 2016 by Silva and Lima (2016), was not considered because it was not properly identified; in fact, it is the Gray-headed Kite (*Leptodon cayanensis* Latham, 1790) (Lima, Menq, & Pallinger, 2020), later confirmed by Silva et al. (2020); (2) *Ortalis guttata* (Spix,

1825) was considered in the list because it was registered for the state of Sergipe by Pacheco and Whitney (1995) and for PARNASI by Sousa (2009); (3) the identification and inclusion of *Thamnophilus pelzelni* (Hellmayr, 1924) and *Thamnophilus ambiguus* (Swainson, 1825), two species of Thamnophilidae with subtle differences in vocal and plumage patterns, by analyzing the sonograms and photo records available on the WikiAves website and in personal files; (4) the replacement of *Polioptila plumbea* (Gmelin, 1788) by *Polioptila atricapilla* (Swainson, 1831), previously considered a subspecies of the first (Pacheco et al., 2021); and (5) the replacement of *Hylophilus poicilotis* (Temminck, 1822), recorded only in D'Horta et al. (2005), by *Hylophilus amaurocephalus* (Nordmann, 1835), because PARNASI is not part of the occurrence area of *H. poicilotis* (Raposo, Parrini, & Napoli, 1998).

There was a significant increase in the number of species and bird families recorded for PARNASI between the first published list in 2005 and the present updated list in 2020 (species: $t = -13.82$, $p < 0.005$, $N = 227$; families: $t = -3.06$, $p < 0.005$, $N = 49$) (Figure 3).

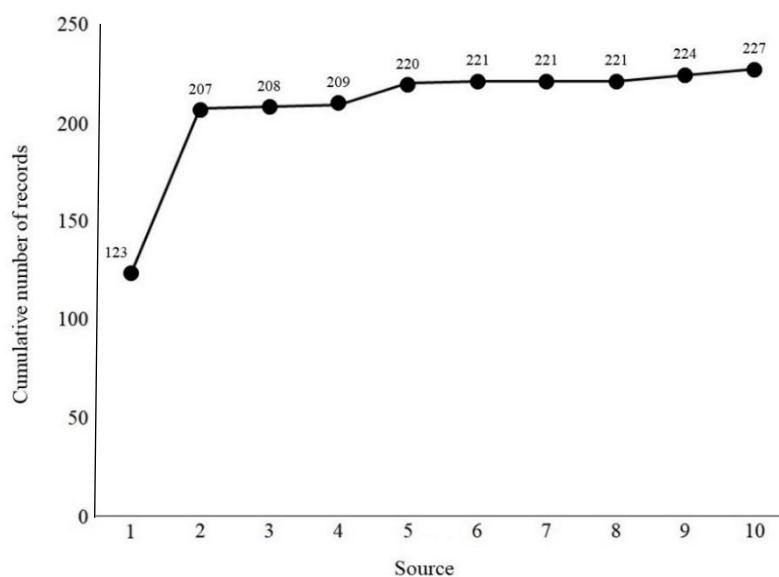


Figure 2. Accumulation curve of bird records for the Serra de Itabaiana National Park (Sergipe, Brazil). Source: 1 - D'Horta et al. (2005), 2 - Sousa (2009), 3 - Silva et al. (2014), 4 - Ruiz-Esparza et al. (2015a), 5 - Silva and Carmo (2016), 6 - Silva et al. (2016), 7 - Silva and Lima (2016), 8 - Silva et al. (2020), 9 - WikiAves, 10 - Personal archives.

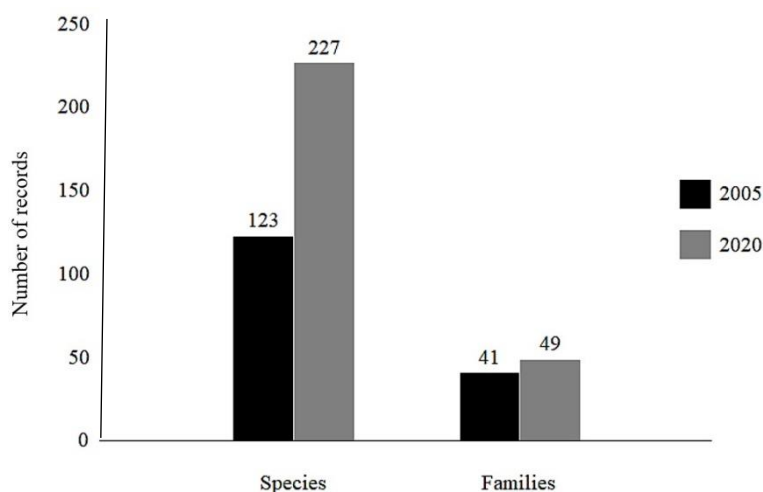


Figure 3. Comparison between the number of bird species and bird families records for the Serra de Itabaiana National Park (PARNASI), between the years of 2005 and 2020.

Discussion

The total number of bird records for the Serra de Itabaiana National Park in this review (227 species) is significantly higher than that of the first study carried out in the area by D'Horta et al. (2005) (123 species), and also differs from the data in the management plan for PARNASI, which records 205 bird species (ICMBio,

2016), based on D'Horta et al. (2005) and Sousa (2009). PARNASI's management plan list includes a bird species without any local record, *Xipholena atropurpurea* (Wied, 1820). Although *X. atropurpurea* occurs in other Atlantic Forest remnants in the state of Sergipe in the municipalities of Santa Luzia do Itanhhy (Sousa, 2009) and Itaporanga d'Ajuda (WikiAves), it has not been reported in PARNASI and was thus deleted from this updated list.

The 227 bird species recorded for the PARNASI area correspond to 33.2% of the total avifauna of Sergipe (682 species) (Avibase, 2020). PARNASI's species richness is higher than that of the Mata do Junco Wildlife Refuge (129 species) (Ruiz-Esparza et al., 2015b) and that of the Grota do Angico Natural Monument (140 species) (Ruiz-Esparza et al., 2011), two other important areas for the preservation of birds in Sergipe State (Bencke et al., 2006). This result reinforces the importance of PARNASI for the conservation of Sergipe's avifauna.

Of the bird species incorporated in the new list, *Asio stygius* (Wagler, 1832) and *Nyctibius grandis* (Gmelin, 1789) called attention. *Asio stygius* was identified at the Instituto Parque dos Falcões (Intangible Cultural Heritage of Sergipe), located near PARNASI (Figure 1) based on two eggs in PARNASI by local residents taken to the Institute. There, the eggs were incubated, and the chicks were hatched and developed (Ruiz-Esparza et al., 2015a). *Nyctibius grandis* (Figure 4), on the other hand, is a new record for the state of Sergipe. Its geographic distribution covers regions of Mesoamerica and the Amazon, where inhabits humid forests, lowland and upland forests, the Central Brazil, in the riparian forests, and in the states of southeastern Brazil, in the Atlantic Forest (Del Hoyo, Elliott, Sargatal, Christie, & De Juana, 2020).



Figure 4. Great Potoo (*Nyctibius grandis*) recorded at Serra de Itabaiana National Park, Sergipe State, Northeast Brazil.

Source: personal archive.

The dominance of the families Thraupidae and Tyrannidae at PARNASI, both in areas of the Atlantic Forest and in other environments, is a common pattern in the broader region (Fitzpatrick, 1980; Hasui et al., 2018). The great richness of the Accipitridae family (17 species) illustrates how important is PARNASI for bird conservation, since these species are of great biological value, since they are at the top of the food chain and contribute to the balance of the ecosystems they inhabit, controlling the populations of numerous species of vertebrates and invertebrates (Donázar et al., 2016; Buechley et al., 2019). The presence of raptors, especially forest-dependent and anthropogenic-sensitive species, such as *Leptodon cayanensis* (Latham, 1790), *Accipiter bicolor* (Vieillot, 1817) and *Spizaetus ornatus* (Daudin, 1800) (Silva, 1995; Stotz et al., 1996), reinforces the importance of the conservation of PARNASI for the maintenance of these populations (Silva et al., 2020).

Similar data regarding the predominance of insectivorous and omnivorous bird species in the Neotropical region were found by Pereira and Azevedo-Júnior (2011), Silveira and Machado (2012), Ruiz-Esparza, Rocha, Ribeiro, and Ferrari (2012), Toledo-Lima et al. (2014) and Ruiz-Esparza et al. (2015b). The predominance of insectivorous species seems to be a pattern in the Neotropics (Sick, 1997). According to Sekercioglu et al.

(2002), some insectivorous birds are sensitive to environmental changes, as is the case with some representatives of the Picidae and Dendrocolaptidae families. Some species of these families tend to disappear more quickly than other insectivorous birds, as their foraging area decreases (Anjos, 1998). Thus, due to the large number of insectivorous birds recorded in the present study, especially species of Picidae and Dendrocolaptidae, PARNASI shows itself as an important conservation area that still allows the occurrence of families more sensitive to environmental disturbances.

Granivorous birds appeared as the third most rich avian group at PARNASI, and this may be related to the vegetation structure found in the study area. Among the vegetation formations found in PARNASI, open formations and grassy fields are the most abundant, occupying 41% (3,289 ha) of the area (Dantas & Ribeiro, 2010). The abundant presence of grasses in these areas contributes to the greater presence of some granivorous birds which use these areas for foraging (Anjos 1998), such as *Columbina* spp., *Volatinia jacarina* (Peale, 1848), *Sporophila* spp. and *Ammodramus humeralis* (Bosc, 1792).

Large frugivorous birds were recorded in PARNASI, such as *Crypturellus soui* (Hermann, 1783), *Ortalis aracuan* (Spix, 1825), *Penelope superciliaris* (Temminck, 1815) and *Ramphastos vitellinus* (Lichtenstein, 1823). These species are demanding in terms of the conservation status of habitat and food resources, in addition of being sensitive to environmental (Morante-Filho, Faria, Mariano-Neto, & Rhodes, 2015, Bovo et al., 2018) and hunting pressure (Bernardo et al., 2011; Vidal et al., 2014).

PARNASI's vegetation cover is formed by remnants of forest formations and open areas (Dantas & Ribeiro, 2010). Thus, the avifauna is heterogeneously distributed in this landscape, in relation to their forest dependence and to the ecological characteristics of each species (D'Horta et al., 2005). Forest-dependent and semi-dependent bird species represented over half (61.6%, 140 species) of the total species. Although altered, the forested areas of PARNASI still supported bird species typical of these types of environments, which are now very scarce in the nearby areas (Tabarelli, Aguiar, Ribeiro, Metzger, & Peres, 2010).

In addition, that the geographical position of PARNASI supports the occurrence of birds from different biomes, like Atlantic Forest and Caatinga. Endemic species from the Atlantic Forest, such as *Thalurania watertonii* (Bourcier, 1847), from the Caatinga, like *Penelope jacucaca* (Spix, 1825) and *Herpsilochmus pectoralis* (Sclater, 1857), and from the Cerrado, such as *Porphyrospiza caeruleascens* (Wied, 1830), were registered for PARNASI. Of the 18 endemic bird species recorded for PARNASI, nine corresponded to Caatinga endemic species (39.1% of the 23 endemic species that occur in the Caatinga biome; Olmos, Silva, & Albano, 2005); eight correspond to Atlantic Forest endemic species (3.7% of the 213 endemic species occur in the Atlantic Forest; Moreira-Lima & Silveira, 2017); and one is a Cerrado endemic species (3.1% of the 32 endemic species occurs in the Cerrado; Silva & Bates, 2002).

Although the number of bird species recorded has increased significantly for PARNASI from 2005 to 2020, it is important to highlight the possibility that many of these species have had their populations reduced or may have already become extinct locally, especially due to habitat fragmentation, hunting and capture. Species of Tinamidae and Cracidae, *Spizaetus ornatus* (Daudin, 1800), *Paroaria dominicana* (Linnaeus, 1758), *Cyanoloxia brissonii* (Lichtenstein, 1823), *Sporophila* spp. and *Spinus yarrellii* (Audubon, 1839) are candidates for local extinction. To confirm this information, long-term and frequent avifauna inventories should be conducted at PARNASI.

Conclusion

The review of the bird species lists of the Serra de Itabaiana National Park has increased significantly since the publication of the first list in 2005. This result corroborates the important role of PARNASI for the conservation of birds. However, further field studies are needed to allow a temporal assessment of bird species that may have had their populations reduced or that have already disappeared from the park, mainly due to habitat fragmentation and hunting. In the meantime, this study provides subsidies for better management of the park, as well as material for researchers to consult for future studies in the area.

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Supplementary material

Table S1. Revised list of birds of the Serra de Itabaiana National Park (PARNASI), Sergipe, Brazil. Diet: CAR = carnivorous, DET = detritivorous, FRU = frugivorous, GRA = granivorous, FRU/GRA = frugivorous/granivorous, INS = insectivorous, NEC = nectarivorous, ONI = omnivorous, MAL = malacophagous, PIS = piscivorous, according to Motta Junior (1990), Sick (1997), Toledo-Lima et al. (2004), Telino-Júnior et al. (2005). DFA (Dependence of Forested Areas): DEP = dependent, SEM = semidependent, IND = independent. Status [threatened of extinction according to Brazilian Red List (ICMBio, 2018) and IUCN's Red List (IUCN, 2020)]: NT = near threatened; VU = vulnerable; EN = endangered; CR = critically endangered; Absence = not threatened. Endemism: ATF = Atlantic Forest; CAA = Caatinga; CER = Cerrado; Absence = not endemic.

Taxon	Diet	DFA	Status		Endemism
			ICMBio	IUCN	
Tinamidae Gray, 1840					
<i>Crypturellus soui</i> (Hermann, 1783)	FRU	DEP			
<i>Crypturellus parvirostris</i> (Wagler, 1827)	ONI	IND			
<i>Crypturellus tataupa</i> (Temminck, 1815)	ONI	DEP			
<i>Rhynchotus rufescens</i> (Temminck, 1815)	ONI	IND			
<i>Nothura boraquira</i> (Spix, 1825)	ONI	IND			
<i>Nothura maculosa</i> (Temminck, 1815)	ONI	IND			
Cracidae Rafinesque, 1815					
<i>Penelope superciliaris</i> Temminck, 1815	FRU	DEP	CR		
<i>Penelope jacucaca</i> Spix, 1825	FRU	DEP	VU	VU	CAA
<i>Ortalis guttata</i> (Spix, 1825)	FRU	SEM	CR		ATF
<i>Ortalis araucuan</i> (Spix, 1825)	FRU	SEM			
Ardeidae Leach, 1820					
<i>Tigrisoma lineatum</i> (Boddaert, 1783)	ONI	IND			
<i>Butorides striata</i> (Linnaeus, 1758)	PIS	IND			
<i>Bubulcus ibis</i> (Linnaeus, 1758)	ONI	IND			
<i>Ardea alba</i> Linnaeus, 1758	PIS	IND			
Cathartidae Lafresnaye, 1839					
<i>Cathartes aura</i> (Linnaeus, 1758)	DET	IND			
<i>Cathartes burrovianus</i> Cassin, 1845	DET	IND			ATF
<i>Coragyps atratus</i> (Bechstein, 1793)	DET	IND			
Accipitridae Vigors, 1824					
<i>Leptodon cayanensis</i> (Latham, 1790)	ONI	DEP			
<i>Chondrohierax uncinatus</i> (Temminck, 1822)	MAL	SEM			
<i>Elanoides forficatus</i> (Linnaeus, 1758)	INS	IND			
<i>Gampsonyx swainsonii</i> Vigors, 1825	CAR	IND			
<i>Elanus leucurus</i> (Vieillot, 1818)	CAR	IND			
<i>Accipiter striatus</i> Vieillot, 1808	CAR	SEM			
<i>Accipiter bicolor</i> (Vieillot, 1817)	CAR	DEP			
<i>Ictinia plumbea</i> (Gmelin, 1788)	INS	SEM			
<i>Geranoospiza caerulescens</i> (Vieillot, 1817)	CAR	SEM			
<i>Heterospizias meridionalis</i> (Latham, 1790)	CAR	IND			
<i>Rupornis magnirostris</i> (Gmelin, 1788)	ONI	IND			
<i>Parabuteo unicinctus</i> (Temminck, 1824)	CAR	IND			
<i>Geranoaetus albicaudatus</i> (Vieillot, 1816)	CAR	IND			
<i>Buteo nitidus</i> (Latham, 1790)	CAR	SEM			
<i>Buteo brachyurus</i> Vieillot, 1816	CAR	SEM			
<i>Buteo albonotatus</i> Kaup, 1847	CAR	IND			
<i>Spizaetus ornatus</i> (Daudin, 1800)	CAR	DEP			NT
Rallidae Rafinesque, 1815					
<i>Aramides cajaneus</i> (Statius Muller, 1776)	ONI	SEM			
<i>Rufirallus viridis</i> (Statius Muller, 1776)	ONI	SEM			
Charadriidae Leach, 1820					
<i>Vanellus chilensis</i> (Molina, 1782)	ONI	IND			
Columbidae Leach, 1820					
<i>Columbina passerina</i> (Linnaeus, 1758)	GRA	IND			
<i>Columbina talpacoti</i> (Temminck, 1810)	GRA	IND			
<i>Columbina squammata</i> (Lesson, 1831)	GRA	IND			
<i>Columbina picui</i> (Temminck, 1813)	GRA	IND			
<i>Columba livia</i> Gmelin, 1789	ONI	IND			
<i>Patagioenas picazuro</i> (Temminck, 1813)	GRA	SEM			
<i>Zenaida auriculata</i> (Des Murs, 1847)	GRA	IND			

<i>Leptotila verreauxi</i> Bonaparte, 1855	GRA	SEM			
<i>Leptotila rufaxilla</i> (Richard & Bernard, 1792)	GRA	IND			
<i>Geotrygon montana</i> (Linnaeus, 1758)	ONI	DEP			
Cuculidae Leach, 1820					
<i>Piaya cayana</i> (Linnaeus, 1766)	INS	SEM			
<i>Crotophaga ani</i> Linnaeus, 1758	INS	IND			
<i>Guira guira</i> (Gmelin, 1788)	INS	IND			
<i>Tapera naevia</i> (Linnaeus, 1766)	INS	IND			
Tytonidae Mathews, 1912					
<i>Tyto furcata</i> (Temminck, 1827)	CAR	IND			
Strigidae Leach, 1820					
<i>Megascops choliba</i> (Vieillot, 1817)	INS	SEM			
<i>Pulsatrix perspicillata</i> (Latham, 1790)	CAR	DEP		VU	
<i>Glaucidium brasilianum</i> (Gmelin, 1788)	CAR	SEM			
<i>Athene cunicularia</i> (Molina, 1782)	INS	IND			
<i>Asio clamator</i> (Vieillot, 1808)	CAR	IND			
<i>Asio stygius</i> (Wagler, 1832)	CAR	SEM			
Nyctibiidae Chenu & Des Murs, 1851					
<i>Nyctibius griseus</i> (Gmelin, 1789)	INS	SEM			
<i>Nyctibius grandis</i> (Gmelin, 1789)*	INS	SEM			
Caprimulgidae Vigors, 1825					
<i>Antrostomus rufus</i> (Boddaert, 1783)	INS	SEM			
<i>Lurocalis semitorquatus</i> (Gmelin, 1789)	INS	DEP			
<i>Nyctidromus albicollis</i> (Gmelin, 1789)	INS	SEM			
<i>Hydropsalis parvula</i> (Gould, 1837)	INS	IND			
<i>Hydropsalis torquata</i> (Gmelin, 1789)	INS	SEM			
Trochilidae Vigors, 1825					
<i>Glaucis hirsutus</i> (Gmelin, 1788)	NEC	DEP			
<i>Phaethornis ruber</i> (Linnaeus, 1758)	NEC	DEP			
<i>Phaethornis pretrei</i> (Lesson & Delattre, 1839)	NEC	SEM			
<i>Eupetomena macroura</i> (Gmelin, 1788)	NEC	IND			
<i>Colibri serrirostris</i> (Vieillot, 1816)	NEC	SEM			
<i>Anthracothorax nigricollis</i> (Vieillot, 1817)	NEC	SEM			
<i>Chrysolampis mosquitos</i> (Linnaeus, 1758)	NEC	IND			
<i>Chlorostilbon lucidus</i> (Shaw, 1812)	NEC	SEM			
<i>Thalurania watertonii</i> (Bourcier, 1847)	NEC	DEP	EN	EN	ATF
<i>Thalurania glaucopis</i> (Gmelin, 1788)	NEC	DEP			ATF
<i>Heliactin bilophus</i> (Temminck, 1820)	NEC	IND			
<i>Heliomaster squamosus</i> (Temminck, 1823)	NEC	DEP			
Trogonidae Lesson, 1828					
<i>Trogon curucui</i> Linnaeus, 1766	ONI	DEP			
Alcedinidae Rafinesque, 1815					
<i>Chloroceryle amazona</i> (Latham, 1790)	PIS	SEM			
<i>Chloroceryle americana</i> (Gmelin, 1788)	PIS	SEM			
Galbulidae Vigors, 1825					
<i>Galbula ruficauda</i> Cuvier, 1816	INS	SEM			
Bucconidae Horsfield, 1821					
<i>Nystalus maculatus</i> (Gmelin, 1788)	INS	SEM			
Ramphastidae Vigors, 1825					
<i>Ramphastos vitellinus</i> Lichtenstein, 1823	FRU	DEP		VU	
Picidae Leach, 1820					
<i>Picumnus exilis</i> (Lichtenstein, 1823)	INS	DEP			
<i>Picumnus pygmaeus</i> (Lichtenstein, 1823)	INS	DEP			CAA
<i>Veniliornis passerinus</i> (Linnaeus, 1766)	INS	SEM			
<i>Colaptes melanochloros</i> (Gmelin, 1788)	INS	SEM			
<i>Dryocopus lineatus</i> (Linnaeus, 1766)	INS	SEM			
Cariamidae Bonaparte, 1850					
<i>Cariama cristata</i> (Linnaeus, 1766)	ONI	IND			
Falconidae Leach, 1820					
<i>Caracara plancus</i> (Miller, 1777)	ONI	IND			
<i>Milvago chimachima</i> (Vieillot, 1816)	ONI	IND			
<i>Herpetotheres cachinnans</i> (Linnaeus, 1758)	CAR	SEM			
<i>Micrastur semitorquatus</i> (Vieillot, 1817)	CAR	SEM			
<i>Falco sparverius</i> Linnaeus, 1758	ONI	IND			
<i>Falco ruficularis</i> Daudin, 1800	CAR	DEP			
<i>Falco femoralis</i> Temminck, 1822	ONI	IND			

Psittacidae Rafinesque, 1815					
<i>Eupsittula aurea</i> (Gmelin, 1788)	FRU/GRA	IND			
<i>Forpus xanthopterygius</i> (Spix, 1824)	FRU/GRA	IND			
<i>Pionus maximiliani</i> (Kuhl, 1820)	FRU/GRA	SEM			
Thamnophilidae Swainson, 1824					
<i>Myrmotherula axillaris</i> (Pelzeln, 1868)	INS	DEP			
<i>Formicivora grisea</i> (Boddaert, 1783)	INS	SEM			
<i>Formicivora rufa</i> (Wied, 1831)	INS	SEM			
<i>Herpsilochmus atricapillus</i> Pelzeln, 1868	INS	DEP			
<i>Herpsilochmus pectoralis</i> Sclater, 1857	INS	DEP	VU		CAA
<i>Thamnophilus torquatus</i> Swainson, 1825	INS	IND			
<i>Thamnophilus pelzelni</i> Hellmayr, 1924	INS	DEP			
<i>Thamnophilus ambiguus</i> Swainson, 1825	INS	DEP			
<i>Thamnophilus caerulescens</i> Vieillot, 1816	INS	DEP	VU		
<i>Taraba major</i> (Vieillot, 1816)	INS	SEM			
<i>Pyriglena atra</i> (Swainson, 1825)	INS	DEP	EN		EN
Conopophagidae Sclater & Salvin, 1873					
<i>Conopophaga melanops</i> (Vieillot, 1818)	INS	DEP			
Formicariidae Gray, 1840					
<i>Formicarius colma</i> Boddaert, 1783	INS	DEP			
Dendrocolaptidae Gray, 1840					
<i>Sittasomus griseicapillus</i> (Vieillot, 1818)	INS	DEP			
<i>Dendroplex picus</i> (Gmelin, 1788)	INS	SEM			
Xenopidae Bonaparte, 1854					
<i>Xenops minutus</i> (Sparrman, 1788)	INS	DEP	VU		
<i>Xenops rutilans</i> Temminck, 1821	INS	DEP			
Furnariidae Gray, 1840					
<i>Furnarius leucopus</i> Swainson, 1838	INS	SEM			
<i>Furnarius rufus</i> (Gmelin, 1788)	INS	IND			
<i>Pseudoseisura cristata</i> (Spix, 1824)	INS	SEM			CAA
<i>Phacellodomus rufifrons</i> (Wied, 1821)	INS	SEM			
<i>Synallaxis frontalis</i> Pelzeln, 1859	INS	DEP			
<i>Synallaxis albescens</i> Temminck, 1823	INS	IND			
Pipridae Rafinesque, 1815					
<i>Neopelma pallescens</i> (Lafresnaye, 1853)	ONI	DEP			
<i>Ceratopipra rubrocapilla</i> (Temminck, 1821)	FRU	DEP			
<i>Manacus manacus</i> (Linnaeus, 1766)	FRU	DEP			
<i>Chiroxiphia pareola</i> (Linnaeus, 1766)	FRU	DEP			
Onychorhynchidae Tello, Moyle, Marchese & Cracraft, 2009					
<i>Myiobius barbatus</i> (Gmelin, 1789)	INS	DEP			
Tityridae Gray, 1840					
<i>Pachyrhamphus polychopterus</i> (Vieillot, 1818)	INS	SEM			
Platyrrhynchidae Bonaparte, 1854					
<i>Platyrrhynchus mystaceus</i> Vieillot, 1818	INS	DEP	VU		ATF
Rhynchocyclidae Berlepsch, 1907					
<i>Mionectes oleagineus</i> (Lichtenstein, 1823)	INS	DEP			
<i>Leptopogon amaurocephalus</i> Tschudi, 1846	INS	DEP			
<i>Tolmomyias flaviventris</i> (Wied, 1831)	INS	DEP			
<i>Todirostrum cinereum</i> (Linnaeus, 1766)	INS	SEM			
<i>Poecilotriccus fumifrons</i> (Hartlaub, 1853)	INS	SEM			
<i>Myiornis auricularis</i> (Vieillot, 1818)	INS	DEP			ATF
<i>Hemitriccus striaticollis</i> (Lafresnaye, 1853)	INS	SEM			
<i>Hemitriccus nidipendulus</i> (Wied, 1831)	INS	SEM			ATF
<i>Hemitriccus margaritaceiventer</i> (d'Orbigny & Lafresnaye, 1837)	INS	SEM			
Tyrannidae Vigors, 1825					
<i>Hirundinea ferruginea</i> (Gmelin, 1788)	INS	SEM			
<i>Ornithion inerme</i> Hartlaub, 1853	INS	DEP			
<i>Camptostoma obsoletum</i> (Temminck, 1824)	INS	IND			
<i>Elaenia flavogaster</i> (Thunberg, 1822)	ONI	SEM			
<i>Elaenia cristata</i> Pelzeln, 1868	ONI	IND			
<i>Myiopagis caniceps</i> (Swainson, 1835)	INS	DEP			
<i>Myiopagis viridicata</i> (Vieillot, 1817)	INS	DEP			
<i>Capsiempis flaveola</i> (Lichtenstein, 1823)	INS	DEP			
<i>Phaeomyias murina</i> (Spix, 1825)	ONI	IND			
<i>Phyllomyias fasciatus</i> (Thunberg, 1822)	INS	SEM			
<i>Legatus leucophaeus</i> (Vieillot, 1818)	ONI	DEP			
<i>Myiarchus swainsoni</i> Cabanis & Heine, 1859	INS	IND			

<i>Myiarchus ferox</i> (Gmelin, 1789)	INS	SEM		
<i>Rhytipterna simplex</i> (Lichtenstein, 1823)	INS	DEP		
<i>Pitangus sulphuratus</i> (Linnaeus, 1766)	ONI	IND		
<i>Machetornis rixosa</i> (Vieillot, 1819)	INS	IND		
<i>Myiodynastes maculatus</i> (Stadius Muller, 1776)	ONI	DEP		
<i>Megarynchus pitangua</i> (Linnaeus, 1766)	ONI	SEM		
<i>Myiozetetes similis</i> (Spix, 1825)	ONI	SEM		
<i>Tyrannus melancholicus</i> Vieillot, 1819	INS	IND		
<i>Empidonomus varius</i> (Vieillot, 1818)	INS	SEM		
<i>Fluvicola nengeta</i> (Linnaeus, 1766)	INS	IND		
<i>Arundinicola leucocephala</i> (Linnaeus, 1764)	INS	IND		
<i>Cnemotriccus fuscatus</i> (Wied, 1831)	INS	DEP		
<i>Lathrotriccus euleri</i> (Cabanis, 1868)	INS	DEP		
Vireonidae Swainson, 1837				
<i>Cyclarhis gujanensis</i> (Gmelin, 1789)	INS	SEM		
<i>Hylophilus amaurocephalus</i> (Nordmann, 1835)	INS	DEP		ATF
<i>Vireo chivi</i> (Vieillot, 1817)	INS	DEP		
Hirundinidae Rafinesque, 1815				
<i>Pygochelidon cyanoleuca</i> (Vieillot, 1817)	INS	IND		
<i>Stelgidopteryx ruficollis</i> (Vieillot, 1817)	INS	IND		
<i>Progne tapera</i> (Vieillot, 1817)	INS	IND		
<i>Progne chalybea</i> (Gmelin, 1789)	INS	IND		
Troglodytidae Swainson, 1831				
<i>Troglodytes musculus</i> Naumann, 1823	INS	IND		
<i>Pheugopedius genibarbis</i> (Swainson, 1838)	INS	DEP		
<i>Cantorchilus longirostris</i> (Vieillot, 1819)	INS	SEM		
Polioptilidae Baird, 1858				
<i>Ramphocaenus melanurus</i> Vieillot, 1819	INS	DEP		
<i>Polioptila atricapilla</i> (Swainson, 1831)	INS	SEM		
Turdidae Rafinesque, 1815				
<i>Turdus flavipes</i> Vieillot, 1818	FRU	DEP		
<i>Turdus leucomelas</i> Vieillot, 1818	ONI	SEM		
<i>Turdus rufiventris</i> Vieillot, 1818	ONI	IND		
Mimidae Bonaparte, 1853				
<i>Mimus saturninus</i> (Lichtenstein, 1823)	ONI	IND		
Passerellidae Cabanis & Heine, 1850				
<i>Zonotrichia capensis</i> (Stadius Muller, 1776)	GRA	IND		
<i>Ammodramus humeralis</i> (Bosc, 1792)	GRA	IND		
<i>Arremon taciturnus</i> (Hermann, 1783)	ONI	DEP		
Parulidae Wetmore, Friedmann, Lincoln, Miller, Peters, van Rossem, Van Tyne & Zimmer, 1947				
<i>Setophaga pitiayume</i> (Vieillot, 1817)	INS	DEP		
<i>Geothlyps aequinoctialis</i> (Gmelin, 1789)	INS	IND		
<i>Myiothlyps flaveola</i> Baird, 1865	INS	DEP		
Icteridae Vigors, 1825				
<i>Cacicus haemorrhous</i> (Linnaeus, 1766)	ONI	SEM		
<i>Icterus pyrrhopterus</i> (Vieillot, 1819)	ONI	SEM		
<i>Icterus jamacaii</i> (Gmelin, 1788)	ONI	SEM		CAA
<i>Gnorimopsar chopi</i> (Vieillot, 1819)	ONI	IND		
<i>Chrysomus ruficapillus</i> (Vieillot, 1819)	ONI	IND		
<i>Agelaioides fringillarius</i> (Spix, 1824)	ONI	IND		CAA
<i>Molothrus bonariensis</i> (Gmelin, 1789)	ONI	IND		
Thraupidae Cabanis, 1847				
<i>Porphyrospiza caerulescens</i> (Wied, 1830)	ONI	IND	NT	CER
<i>Schistochlamys ruficapillus</i> (Vieillot, 1817)	ONI	IND		
<i>Paroaria dominicana</i> (Linnaeus, 1758)	GRA	IND		CAA
<i>Thraupis sayaca</i> (Linnaeus, 1766)	ONI	SEM		
<i>Thraupis palmarum</i> (Wied, 1821)	ONI	SEM		
<i>Stilpnia cayana</i> (Linnaeus, 1766)	FRU	IND		
<i>Nemosia pileata</i> (Boddaert, 1783)	ONI	DEP		
<i>Conirostrum speciosum</i> (Temminck, 1824)	ONI	DEP		
<i>Sicalis flaveola</i> (Linnaeus, 1766)	GRA	IND		
<i>Sicalis luteola</i> (Sparrman, 1789)	GRA	IND		
<i>Hemithraupis flavicollis</i> (Vieillot, 1818)	ONI	DEP		
<i>Hemithraupis guira</i> (Linnaeus, 1766)	ONI	DEP		
<i>Volatinia jacarina</i> (Linnaeus, 1766)	GRA	IND		
<i>Coryphospingus pileatus</i> (Wied, 1821)	GRA	SEM		

<i>Loriotus cristatus</i> (Linnaeus, 1766)	ONI	DEP		
<i>Tachyphonus rufus</i> (Boddaert, 1783)	ONI	DEP		
<i>Ramphocelus bresilia</i> (Linnaeus, 1766)	ONI	DEP		
<i>Tersina viridis</i> (Illiger, 1811)	FRU	DEP		
<i>Cyanerpes cyaneus</i> (Linnaeus, 1766)	FRU	DEP		
<i>Dacnis cayana</i> (Linnaeus, 1766)	ONI	SEM		
<i>Coereba flaveola</i> (Linnaeus, 1758)	ONI	SEM		
<i>Sporophila nigricollis</i> (Vieillot, 1823)	GRA	IND		
<i>Sporophila ardesiaca</i> (Dubois, 1894)	GRA	IND		
<i>Sporophila albogularis</i> (Spix, 1825)	GRA	IND		CAA
<i>Sporophila angolensis</i> (Linnaeus, 1766)	GRA	IND		
<i>Emberizoides herbicola</i> (Vieillot, 1817)	ONI	IND		
<i>Saltator maximus</i> (Statius Muller, 1776)	ONI	DEP		
<i>Thlypopsis sordida</i> (d'Orbigny & Lafresnaye, 1837)	ONI	SEM		
Cardinalidae Ridgway, 1901				
<i>Piranga flava</i> (Vieillot, 1822)	ONI	IND		
<i>Cyanoloxia brissonii</i> (Lichtenstein, 1823)	GRA	IND		
Fringillidae Leach, 1820				
<i>Spinus yarrellii</i> (Audubon, 1839)	GRA	IND	VU	VU
<i>Euphonia chlorotica</i> (Linnaeus, 1766)	ONI	SEM		
<i>Euphonia violacea</i> (Linnaeus, 1758)	FRU	DEP		
Estrildidae Bonaparte, 1850				
<i>Estrilda astrild</i> (Linnaeus, 1758)	GRA	IND		
Passeridae Rafinesque, 1815				
<i>Passer domesticus</i> (Linnaeus, 1758)	ONI	IND		

*New record for Sergipe State.