

# Avifauna of the Catimbau National Park in the Brazilian state of Pernambuco, Brazil: species richness and spatio-temporal variation

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**ABSTRACT:** The present study focused on the Catimbau National Park in the municipality of Buíque, in the Brazilian state of Pernambuco, during the dry (October, 2008) and rainy seasons (April, 2011). The objective was to evaluate the species richness and the spatial-temporal variation of the park's avifauna. Data were collected by mist-netting, line transect surveys, and the MacKinnon list method. A total of 179 species were recorded, of which 45 had not been reported previously for the park, raising the total number of bird species known to occur in this conservation unit to 202. A comparative analysis was used to verify differences between the São José plateau and the semi-arid lowlands, as well as the variation between the dry and rainy seasons. The phytogeographic heterogeneity of the Catimbau National Park, associated with a marked altitudinal gradient and the presence of aquatic habitats appear to be the main ecological factors determining the considerable species richness of the avifauna of this conservation unit.

**KEY-WORDS:** Altitudinal gradient; birds; *caatinga*; conservation unit; species richness.

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## INTRODUCTION

The *caatinga* domain encompasses 55.6% of the Brazilian Northeast and despite the traditional view of the region as a homogeneous environment dominated by arid conditions, recent studies have revealed a rich diversity of habitats and landscapes (Sá *et al.* 2004). This marked diversity of environments hampers the definition of the limits of the *caatinga*-complex (Fernandes & Bezerra, 1990), which also impedes the identification of the bird species that are endemic to this biome (Cracraft, 1985; Haffer, 1985; Stotz *et al.*, 1996). Considering that the *caatinga* includes not only dry forests, but also liana forests and upland enclaves of rainforest (*brejos de altitude*), 23 species may be considered to be endemic (Olmos *et al.* 2005).

The most important recent reviews of the bird fauna of this biome include that of Pacheco (2004), who identified a total of 348 species in the *caatinga sensu stricto*. Silva *et al.* (2003) identified a much larger number of species – 510 – but included a more ample range of *caatinga* landscapes, including the *brejos de altitude* of the Brazilian Northeast.

At the end of the 19th Century, the ornithologist William Forbes surveyed the avifauna of the Atlantic Forest and “Agreste” ecotone of the Brazilian state of Pernambuco. It was only 50 years later that the birds of the state's *caatinga* habitats were studied by Emil Kaempfer, who deposited the specimens collected at the American Museum of Natural History in New York (Olmos *et al.* 2005). In recent years, a number of surveys have focused on the avifauna of the *caatinga* of Pernambuco, including Farias *et al.* (2005), Olmos *et al.* (2005), Farias (2007, 2009), and Pereira & Azevedo Júnior (2011).

The Catimbau National Park was created by federal decree on December 13th, 2002, and is located in the central portion of Pernambuco, within a region considered to be of extreme biological importance by the Brazilian Ministry of the Environment (MMA, 2002) due to the large number of endemisms. Bencke *et al.* (2006) also considered the park to be an important area for the conservation of Brazilian birds. Despite its importance, few data are available on the park's avifauna. The non-governmental organization OAP (Pernambuco Birdwatchers Association) confirmed the occurrence of 71 bird species in the park between 2000 and 2004

(OAP 2004). Farias (2009) recorded 139 species in the park based on a sampling effort of 26 hours during the rainy season, using visual observation with binoculars and records of vocalizations.

The present study provides an update on the composition of the avifauna of this important *caatinga* conservation unit. In addition to increasing the number of species known to occur in the area, it focuses on variation in the distribution and abundance of the species in relation to seasonal fluctuations in resources and the altitudinal gradient found within the park.

## MATERIAL AND METHODS

### Study Area

The Catimbau National Park is located in the central portion of the Brazilian state of Pernambuco, in a region known as the “Chapada de São José” (São José plateau), which includes parts of the municipalities of Ibimirim, Tupanatinga, and Buíque, and covers a total area of 62,300 hectares (Brasil 2002). Four principal types of vegetation can be distinguished within the area of the park (Rodal *et al.*, 1998) – shrubby *caatinga* (on leeward slopes at altitudes of between 600 and 800 m asl), *campos rupestres* or rock fields (at the highest altitudes, of between 900 and 1000 m), *brejos de altitude*, or remnants of humid forest, generally in upland areas (these habitats have been mostly replaced with pastures and orchards, although some patches of this vegetation survive at the foot of the escarpment), and evergreen shrubby *caatinga* (on the windward slopes at altitudes of between 600 and 800 m). In addition to its biological diversity, which is still relatively poorly known, the region is also rich in rock paintings and prehistoric artifacts dating back at least 6000 years, with approximately 25 archeological sites already identified (Bencke *et al.* 2006).

For the present study, data were collected at nine different points (Figure 1) representing the four types of habitat described above, as well as aquatic environments. All sites were georeferenced using a Garmin Etrex Vista GPS.

Area 1: Fazenda Brejo de São José (08°31'51.7" S, 37°13'58.0" W; mean altitude = 700 m) – area located at the foot of the escarpment, with flat to slightly undulating terrain, gallery forest along temporary creeks, shrubby-arboreal *caatinga* and evergreen forest, with a predominance of the plant species *Caesalpinia ferrea* Mart. ex Tul., *Zizyphus joazeiro* Mart., *Anadenanthera macrocarpa* (Benth.) Brenan, *Schinopsis brasiliensis* Engl., *Bursera leptophloeos* (Mart.) J.B Gillet, and *Orbignya phalerata* Mart. The exotic *Prosopis juliflora* (Swartz) D.C., known locally as *algaroba*, is also present in dense tracts;

Area 2: Sítio Breu (08°30'54.5" S, 37°16'26.7" W;

mean altitude = 953 m) – anthropogenic habitat, with flat to slightly undulating terrain and a predominance of evergreen shrubby vegetation, forming enclaves of vegetation formed by *caatinga* forest, stone field, and *cerrado* species (Rodal *et al.* 1998). Main plant species include *Caesalpinia microphylla* Mart., *Hymenaea courbaril* L., *Piptadenia obliqua* (Pers.) J.F. Macbr., *Eremanthus capitatus* (Spreng.) MacLeish, *Mimosa lewisii* Barneby, and *Eugenia puniceifolia* Humb., Bonpl. & Kunth.;

Area 3: Açude (08°24'58.7" S, 37°22'9.5" W; mean altitude = 530 m) – located in the northern extreme of the park, with flat terrain and gallery forest, with a predominance of the plant species *A. macrocarpa*, *Cobretum leprosum* Mart., *Aspidosperma pyriforme* Mart., *Caesalpinia pyramidalis* Tul., *Inga* sp., and *P. juliflora*. Aquatic species such as *Juncus* sp. and *Eichhornia crassipes* (Mart.) Solms. are also found at this site;

Area 4: Lagoa do Puiú (08°36'12" S, 37°27'45" W; mean altitude = 475m) – located in the southwest of the park, with terrain and vegetation similar to that observed in Area 3;

Area 5: Serra do Brocotó (08°29'13" S, 37°15'31" W – mean altitude = 805 m) – flat to slightly undulating terrain on the plateau and scarped on the slope. The vegetation is made up of shrub *caatinga* and rock fields. Plant species include *Anacardium occidentale* L., *M. lewisii*, *C. microphylla*, *Croton* sp., a variety of grasses (Gramineae) and sedges (Cyperaceae), as well as a dense tract of the licuri palm, *Syagrus coronata* (Martius) Beccari;

Area 6: Trilha do Alcobaça (08°32'6" S, 37°11'48" W; mean altitude = 710 m) – area with flat to slightly undulating terrain and shrubby-arboreal *caatinga*, similar to that found in Area 1, but with more cacti and an absence of *O. phalerata* and *P. juliflora*. The access trail leads to the park's main archeological site, known as Alcobaça, which is one of the most important in Brazil;

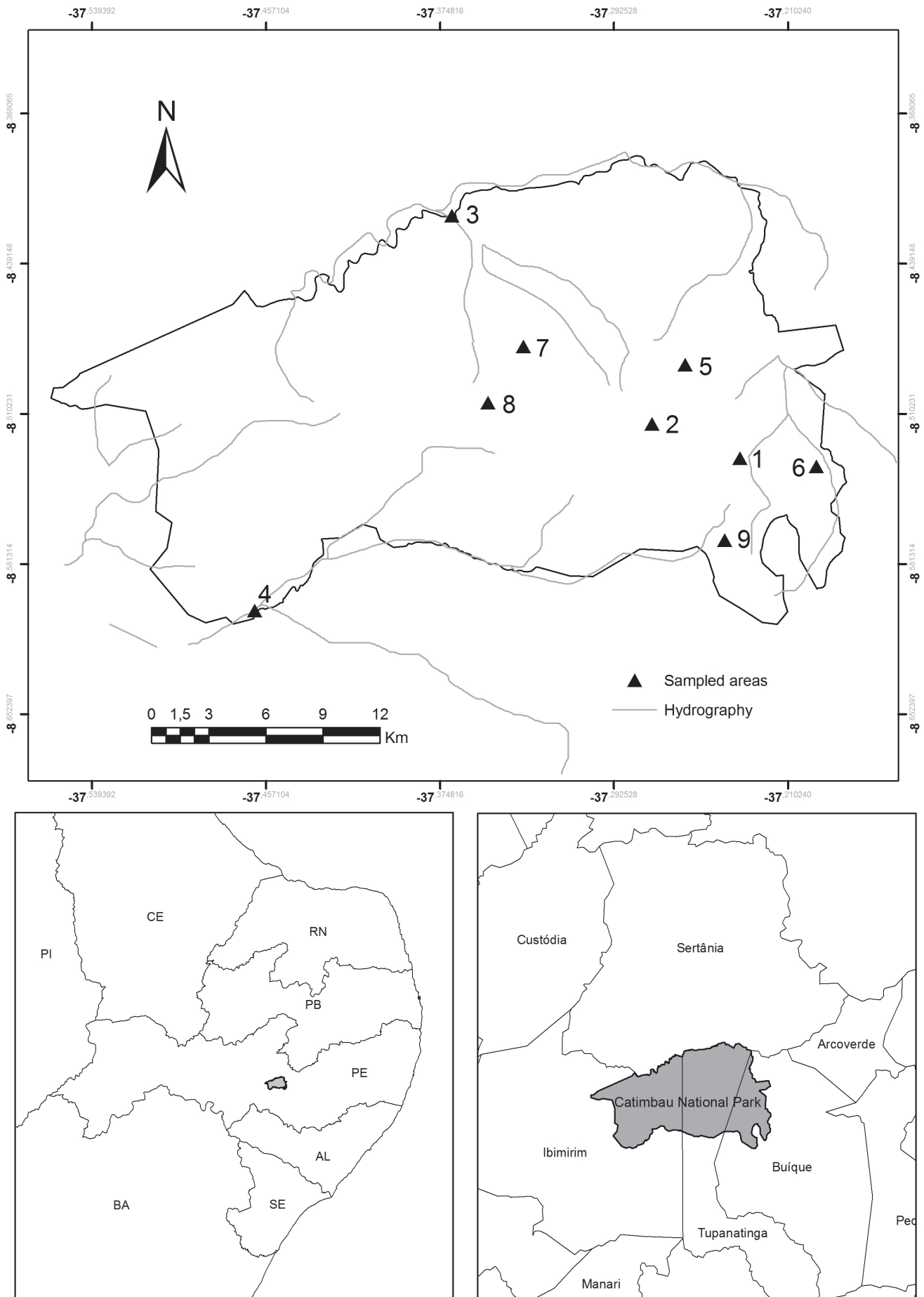
Area 7: Estrada do Gado (08°28'42" S, 37°20'7" W; mean altitude = 650 m) – area with flat terrain and well-preserved shrubby-arboreal *caatinga*, with a predominance of the same plant species found in Area 1;

Area 8: Trilha do Cumbre (08°30'18" S, 37°21'7" W; mean altitude = 687 m) – area with terrain and vegetation very similar to those of Area 7;

Area 9: Pedra do Cachorro (08°34'12" S, 37°14'24" W; mean altitude = 760 m) – area extensively impacted by human occupation, which has resulted in the almost total substitution of its original vegetation (evergreen forest) by orchards, pastures, and plantations. Dense tracts of *O. phalerata* are interspersed with the cultivated plots. The terrain is slightly undulating.

### Data collection and analysis

The present study was conducted between September 30th and October 10th, 2008 (representing the dry



**FIGURE 1.** Location of the Catimbau National Park within Pernambuco and in relation to the neighboring municipalities, and the distribution of the sampling points surveyed in October, 2008, and April, 2011.

season), and April 4th-15th, 2011 (rainy season). The avifauna of the park was surveyed using complementary qualitative and quantitative procedures in the different habitats found within the area of the Catimbau National Park. Four sampling techniques were used – mist-netting, transect sampling, MacKinnon lists, and random observations (Anjos *et al.* 2010, Ribon 2010).

The qualitative data were collected using MacKinnon lists, with 10 species as the sampling unit, as described by Herzog *et al.* (2002). This procedure was applied in all the park's different vegetation types, but only during the rainy season, when a total of 95 lists were compiled with the aim of increasing sample size (and the number of points covered by the mist-netting and line transects) and thus, the number of species recorded. Random observations consisted on non-systematic observations conducted during the crepuscular period, at night, and in the aquatic habitats found within the area of the park, with the objective of increasing the number of species recorded.

The quantitative data were derived from the results of the line transect surveys and the mist-netting. Transect data were collected at two sites – Area 1 during the dry season (2.2 km of transect, with a total of 3.67 hours of observation) and Area 2 during the rainy season (4.5 km of transect, with 4.67 hours of observation). During this technique, trails and access roads within the area of the park were walked during the early part of the day – dawn through 08:00 h – when birds are most active. The observers attempted to maintain a constant velocity, with regular stops for the recording of data. Direct observations were conducted using binoculars (7 x 35 and 8 x 42), and vocalizations were also identified, whenever appropriate.

All the birds sighted or heard during the transect walks were recorded for the subsequent calculation of the relative species abundance, based on a standard rate – number of individuals recorded per 10 hours of observation (Olmos & Brito 2007) – within a maximum perpendicular distance of 50 m on each side of the transect (strip width). Individuals observed outside this strip were not included in the calculation of relative abundance, although these records were included in the qualitative inventory. Some of the birds were photographed or had their vocalizations recorded, using a Marantz PMD671 recorder and Sennheiser ME66 unidirectional microphone.

Specimens were captured using twenty 12 x 2.5 m mist-nets with a 31 mm mesh, which were set between 05:30 h and 17:30 h except for the hottest hours of the day. Mist-netting was carried out only in Areas 1 and 2, with a similar sampling effort at the two sites (608.75 and 603.25 hours, respectively). During the dry season (2008), 294.25 net-hours were sampled in Area 1 and 293.4 net-hours in Area 2, whereas a slightly higher sampling effort was conducted in both Area 1 (314.5 net-hours) and Area 2 (309.75 net-hours), during the rainy season

(2011). Once processed and identified, the birds were ringed with metallic CEMAVE bands. Specimens that died during capture were deposited in the ornithological collection of the Zoology Museum at the Feira de Santana State University (UEFS) and the teaching collection of the Animal Biology Laboratory of the Federal Rural University of Pernambuco (UFRPE) in Garanhuns.

Species were identified based on the specialized literature (Ridgely & Tudor 1989 and 1994, Sick 1997, Souza 2004, Sigrist 2006, van Perlo 2009). The vocalizations recorded in the field were compared with the sound files available on specialized sites ([www.wikiaves.gov.br](http://www.wikiaves.gov.br) and [www.xeno-canto.org](http://www.xeno-canto.org)) and in Minnis *et al.* (2010).

Given the potential effects of the altitudinal gradient that characterizes the study area, the records collected on the São José plateau (Areas 2, 5, and 9) were analyzed separately from those collected in the semi-arid lowlands (all other areas). The analysis of potential differences between these areas were based on the full data set, considering the use of complementary survey methods, except for the non-systematic surveys used to compile the check-lists. The Jaccard index of similarity (Wolda 1981) was used to compare the species lists of the plateau and lowlands, as well as the dry and rainy seasons.

Estimates of species richness were based on the MacKinnon lists, using the Jackknife 1 and CHAO 2 estimators, which Araujo (2009) has recommended for the analysis of ornithological data. The analyses were run in EstimateSWin 8.20 (Colwell 2006).

The taxonomic classification of the birds recorded in the present study was based on the Brazilian Committee for Ornithological Records, CBRO (CBRO 2011). The identification of threatened species was derived from the Brazilian List of Animal Species threatened with Extinction (MMA 2003). Species endemic to the *caatinga* were identified according to the classification of Pacheco (2004).

## RESULTS

A total of 179 bird species were recorded in the Catimbau National Park (Table 1), of which 45 had not been registered previously in the park. The species belong to 49 families, of which the most important were the Tyrannidae (represented by 29 species), the Furnariidae and Thraupidae (11 species each), and the Accipitridae and Emberizidae (10 species each).

Table 1 provides a full inventory of the species recorded in the park to date, including the fieldwork reported here – dry (2008) and rainy (2011) seasons – and the species recorded by OAP (2004) and Farias (2009). Including all these data, a total of 202 bird species have been recorded for the park, representing 50 families.

Two of the species – *Penelope jacucaca* and *Sporagra yarrellii* – are classified as vulnerable in the Brazilian list of threatened species (MMA 2003). A number of other species – *Crypturellus noctivagus zabele*, *Primolius maracana*, *Picumnus fulvescens*, *Gyalophylax bellmayri*, and *Hylopezus ochroleucus* – are considered to be near threatened by Bencke *et al.* (2006). The list also includes eight species considered to be endemic to the *caatinga* biome (see Pacheco, 2004) – *Aratinga cactorum*, *Anopetia gounellei*, *Picumnus fulvescens*, *Sakesphorus cristatus*, *Hylopezus ochroleucus*, *Gyalophylax bellmayri*, *Sporophila albogularis*, and *Paroaria dominicana*.

During the dry season, a total of 296 individuals were captured, representing 53 species. Of this total, 125 specimens (38 species) were captured in Area 1, and 171 specimens (36 species) in Area 2. In the rainy season, a total of 393 individuals were captured, representing 56 species. During this period, slightly more birds (219 individuals in 44 species) were captured in Area 1 in comparison with Area 2 (174 individuals), where only 26 species were recorded. Some specimens died during capture and their skins were taxidermized. Three specimens (*Thamnophilus capistratus* – catalog number D.A 00278, *Cyanoloxia brissonii* – catalog number D.A 00274 and *Hemitriccus margaritaceiventer* – not catalogued) were deposited in the UEFS Zoology Museum. The other specimens (*Anopetia gounellei*, *Sakesphorus cristatus*, *Synallaxis frontalis*, *Todirostrum cinereum*, *Euphonia chlorotica*, and

*Zonotrichia capensis*) were deposited in the teaching collection of the UFRPE Animal Biology Laboratory in Garanhuns. The data gathered during mist-netting were included here only for the calculation of species richness.

During line transect surveys, a total of 70 species was recorded during the dry season, and 77 during the rainy season. The most abundant species during the dry season at Area 1 were *Lanio pileatus*, *Polioptila plumbea*, *Thamnophilus capistratus*, *Columbina picui*, *H. margaritaceiventer*, and *Paroaria dominicana* (Figure 2). During the rainy season, the species with the highest relative abundance at Area 2 were *Z. capensis*, *T. capistratus*, *L. pileatus*, *Euscarthmus meloryphus*, *Elaenia chilensis*, and *Cantorchilus longirostris* (Figure 3). However, the abundance data for the two seasons are not directly comparable because they were collected at different sites.

The surveys based on the MacKinnon lists method resulted in the compilation of 95 lists of 10 species, with a total of 123 species. Species richness was estimated at 161 species by CHAO 2 and 157 by Jackknife 1 (Figure 3).

The similarity between the São José plateau and the semi-arid lowlands was  $J = 61.5\%$ . A total of 30 species were recorded exclusively on the plateau and 32 only in the lowlands. A similar scenario was observed between seasons, with  $J = 59.2\%$ , 35 species being recorded only in the rainy season, and 38 exclusively in the dry season.

**TABLE 1** – Bird species recorded in the Catimbau National Park, Pernambuco, in October, 2008, and April, 2011. Type of record: A = Auditory; V = Visual; M = Captured in mist-net; C = Specimen collected; P = Photograph; R = Vocalization recorded. Habitats: Aq = Aquatic; Pt = Plateau; L = Lowlands. The values correspond to the number of individuals recorded per 10 hours of transect survey. x = record obtained during non-systematic surveys or outside the 50-m transect strip. X = record obtained in previous studies (OAP 2004; Farias 2009). (\*) = species not recorded previously at Catimbau. VU = vulnerable to extinction. EN = endemic. Taxonomic classification follows CBRO (2011).

Taxon	Season:		Habitats	Type of record	Recorded in:	
	Dry	Rainy			OAP (2004)	Farias (2009)
Tinamiformes Huxley, 1872						
Tinamidae Gray, 1840						
<i>Crypturellus noctivagus zabele</i> (Wied, 1820)*	x		L	A		
<i>Crypturellus parvirostris</i> (Wagler, 1827)*	2.7	19.2	PT,L	A		
<i>Crypturellus tataupa</i> (Temminck, 1815)	x	62.1	PT	A,M,P,R	X	X
<i>Rhynchotus rufescens</i> (Temminck, 1815)	x		L	A	X	
<i>Nothura boraquira</i> (Spix, 1825)	2.7	x	PT,L	A,V		X
<i>Nothura maculosa</i> (Temminck, 1815)*	2.1	2.1	PT,L	A		
Anseriformes Linnaeus, 1758						
Anatidae Leach, 1820						
<i>Dendrocygna viduata</i> (Linnaeus, 1766)*		x	Aq	V		
<i>Cairina moschata</i> (Linnaeus, 1758)*	x	x	Aq	V		
<i>Amazonetta brasiliensis</i> (Gmelin, 1789)*	x		Aq	V		
Galliformes Linnaeus, 1758						
Cracidae Rafinesque, 1815						
<i>Ortalis guttata</i> (Spix, 1825)		4.3	PT	A,V		X
<i>Penelope jacucaca</i> Spix, 1825 <sup>EN, VU</sup>	x		L	A		X

Taxon	Season:		Habitats	Type of record	Recorded in:	
	Dry	Rainy			OAP (2004)	Farias (2009)
Podicipediformes Fürbringer, 1888						
Podicipedidae Bonaparte, 1831						
<i>Podilymbus podiceps</i> (Linnaeus, 1758)*	2.7		Aq	V		
Suliformes Sharpe, 1891						
Phalacrocoracidae Reichenbach, 1849						
<i>Phalacrocorax brasilianus</i> (Gmelin, 1789)*	2.7		Ap	V		
Pelecaniformes Sharpe, 1891						
Ardeidae Leach, 1820						
<i>Tigrisoma lineatum</i> (Boddaert, 1783)*	2.7		Aq	V		
<i>Nycticorax nycticorax</i> (Linnaeus, 1758)*		x	Aq	V,P		
<i>Butorides striata</i> (Linnaeus, 1758)*	2.7		Aq	V		
<i>Bubulcus ibis</i> (Linnaeus, 1758)	x	x	PT,L	V	X	
<i>Ardea alba</i> Linnaeus, 1758*	2.7		Aq	V		
<i>Egretta thula</i> (Molina, 1782)	x		Aq	V	X	
Cathartiformes Seebohm, 1890						
Cathartidae Lafresnaye, 1839						
<i>Cathartes aura</i> (Linnaeus, 1758)	5.4	x	PT,L	V	X	X
<i>Cathartes burrovianus</i> Cassin, 1845	x	x	PT,L	V	X	X
<i>Coragyps atratus</i> (Bechstein, 1793)	x	x	PT, L	V	X	X
Accipitriformes Bonaparte, 1831						
Accipitridae Vigors, 1824						
<i>Gampsonyx swainsonii</i> Vigors, 1825	2.7		L	V		X
<i>Elanus leucurus</i> (Vieillot, 1818)	x	2.1	PT,L	V		X
<i>Ictinia plumbea</i> (Gmelin, 1788)*		x	PT	V		
<i>Geranoospiza caerulescens</i> (Vieillot, 1817)						X
<i>Rupornis magnirostris</i> (Gmelin, 1788)	x	2.7	PT,L	V,M,F	X	X
<i>Geranoaetus albicaudatus</i> (Vieillot, 1816)					X	X
<i>Geranoaetus melanoleucus</i> (Vieillot, 1819)					X	X
<i>Buteo nitidus</i> (Latham, 1790)*		x	PT	V		
<i>Buteo brachyurus</i> Vieillot, 1816*	x	x	L	V		
<i>Buteo albonotatus</i> Kaup, 1847						X
Falconiformes Bonaparte, 1831						
Falconidae Leach, 1820						
<i>Caracara plancus</i> (Miller, 1777)	5.4	x	PT,L	V	X	X
<i>Milvago chimachima</i> (Vieillot, 1816)	x		PT	V	X	X
<i>Herpetotheres cachinnans</i> (Linnaeus, 1758)	2.7		L	A,V	X	X
<i>Micrastur ruficollis</i> (Vieillot, 1817)						X
<i>Falco sparverius</i> Linnaeus, 1758	x	x	PT,L	V		X
<i>Falco rufifigularis</i> Daudin, 1800*	x		L	V		
<i>Falco femoralis</i> Temminck, 1822	x		L	V		X
Gruiformes Bonaparte, 1854						
Rallidae Rafinesque, 1815						
<i>Aramides mangle</i> (Spix, 1825)*		2.1	PT	V		
<i>Aramides cajanea</i> (Statius Muller, 1776)*	2.7		L	A,V		
<i>Pardirallus nigricans</i> (Vieillot, 1819)						X
<i>Gallinula galeata</i> (Lichtenstein, 1818)*	2.7		Aq	V		
<i>Gallinula melanops</i> (Vieillot, 1819)*	2.7		Aq	V		
<i>Porphyrio martinica</i> (Linnaeus, 1766)*	x		Aq	V		
Cariamiformes Fürbringer, 1888						
Cariamidae Bonaparte, 1850						
<i>Cariama cristata</i> (Linnaeus, 1766)	5.4		L	A		X
Charadriiformes Huxley, 1867						

Taxon	Season:		Habitats	Type of record	Recorded in:	
	Dry	Rainy			OAP (2004)	Farias (2009)
Charadriidae Leach, 1820						
<i>Vanellus chilensis</i> (Molina, 1782)	x	x	PT,L	V	X	X
Jacaniidae Chenu & Des Murs, 1854						
<i>Jacana jacana</i> (Linnaeus, 1766)*	5.4		Aq	V		
Columbiformes Latham, 1790						
Columbidae Leach, 1820						
<i>Columbina minuta</i> (Linnaeus, 1766)*	2.7	8.6	PT,L	A,V		
<i>Columbina talpacoti</i> (Temminck, 1811)		2.1	PT, L	A,V	X	X
<i>Columbina squammata</i> (Lesson, 1831)	x	2.1	PT	A,V		X
<i>Columbina picui</i> (Temminck, 1813)	19.1	8.6	PT,L	A,V,M,R	X	X
<i>Patagioenas picazuro</i> (Temminck, 1813)	x		L	V		X
<i>Zenaida auriculata</i> (Des Murs, 1847)		10.7	PT	V	X	X
<i>Leptotila verreauxi</i> Bonaparte, 1855	5.4	2.1	L	V,M,R		X
<i>Leptotila rufaxilla</i> (Richard & Bernard, 1792)	2.7	x	L	V,M,F	X	
Psittaciformes Wagler, 1830						
Psittacidae Rafinesque, 1815						
<i>Primolius maracana</i> (Vieillot, 1816)		x	L	V		X
<i>Aratinga acuticaudata</i> (Vieillot, 1818)	x	x	PT,L	V		X
<i>Aratinga cactorum</i> (Kuhl, 1820) <sup>EN</sup>	x	4.3	PT,L	A,V,R	X	X
<i>Forpus xanthopterygius</i> (Spix, 1824)	13.6	6.4	PT,L	V,M,F,R	X	X
<i>Amazona aestiva</i> (Linnaeus, 1758)						X
Cuculiformes Wagler, 1830						
Cuculidae Leach, 1820						
<i>Piaya cayana</i> (Linnaeus, 1766)	x	2.1	PT,L	V	X	X
<i>Coccyzus melacoryphus</i> Vieillot, 1817		6.4	PT	V,M,F		X
<i>Crotophaga major</i> Gmelin, 1788*	x		PT	V		
<i>Crotophaga ani</i> Linnaeus, 1758	x	x	PT,L	V	X	X
<i>Guira guira</i> (Gmelin, 1788)	x	2.1	PT,L	V	X	X
<i>Tapera naevia</i> (Linnaeus, 1766)	5.4	x	PT,L	A		X
Strigiformes Wagler, 1830						
Tytonidae Mathews, 1912						
<i>Tyto alba</i> (Scopoli, 1769)	x		L	V	X	
Strigidae Leach, 1820						
<i>Megascops choliba</i> (Vieillot, 1817)	x	x	PT,L	A	X	X
<i>Glaucidium brasilianum</i> (Gmelin, 1788)	x	x	PT,L	A		X
<i>Athene cunicularia</i> (Molina, 1782)	x		L	V		X
Caprimulgiformes Ridgway, 1881						
Nyctibiidae Chenu & Des Murs, 1851						
<i>Nyctibius griseus</i> (Gmelin, 1789)	x	x	PT,L	A		X
Caprimulgidae Vigors, 1825						
<i>Antrostomus rufus</i> (Boddaert, 1783)						X
<i>Hydropsalis albicollis</i> (Gmelin, 1789)	x	x	PT,L	A		X
<i>Hydropsalis hirundinacea</i> (Spix, 1825)*	x	x	L	A		
<i>Hydropsalis torquata</i> (Gmelin, 1789)	x	x	PT,L	V		X
<i>Chordeiles pusillus</i> Gould, 1861						X
<i>Chordeiles acutipennis</i> (Hermann, 1783)*	x		L	V		
Apodiformes Peters, 1940						
Apodidae Olphe-Galliard, 1887						
<i>Tachornis squamata</i> (Cassin, 1853)	x	x	PT,L	V	X	
Trochilidae Vigors, 1825						
<i>Anopetia gounellei</i> (Boucard, 1891) <sup>EN</sup>	2.7	2.1	PT,L	V,M,F, C		X
<i>Phaethornis pretrei</i> (Lesson & Delattre, 1839)	x	x	L	V,M,F		X

Taxon	Season:		Habitats	Type of record	Recorded in:	
	Dry	Rainy			OAP (2004)	Farias (2009)
<i>Eupetomena macroura</i> (Gmelin, 1788)	2.7	2.1	PT,L	V	X	X
<i>Anthracothonax nigricollis</i> (Vieillot, 1817)	2.7	2.1	PT,L	V		X
<i>Chrysolampis mosquitus</i> (Linnaeus, 1758)	x	2.1	PT	V,M,F	X	X
<i>Chlorostilbon lucidus</i> (Shaw, 1812)	8.2	12.8	PT,L	V,M,F		X
<i>Polytmus guainumbi</i> (Pallas, 1764)*	x		PT	V		
<i>Heliomaster squamosus</i> (Temminck, 1823)	x		L	V		X
Trogoniformes A. O. U., 1886						
Trogonidae Lesson, 1828						
<i>Trogon curucui</i> Linnaeus, 1766*	x	x	PT,L	A,M,F		
Coraciiformes Forbes, 1844						
Alcedinidae Rafinesque, 1815						
<i>Chloroceryle americana</i> (Gmelin, 1788)*	2.7		Aq	V		
Galbuliformes Fürbringer, 1888						
Bucconidae Horsfield, 1821						
<i>Nystalus maculatus</i> (Gmelin, 1788)	x	2.1	PT,L	A,V,R	X	X
Piciformes Meyer & Wolf, 1810						
Picidae Leach, 1820						
<i>Picumnus fulvescens</i> Stager, 1961 <sup>EN</sup>	x	x	PT,L	V		X
<i>Veniliornis passerinus</i> (Linnaeus, 1766)*	x	x	PT,L	V,M,F		
<i>Piculus chrysochloros</i> (Vieillot, 1818)						X
<i>Colaptes melanochloros</i> (Gmelin, 1788)		x	L	V,M,F		X
Passeriformes Linnaeus, 1758						
Thamnophilidae Swainson, 1824						
<i>Myrmorchilus strigilatus</i> (Wied, 1831)	10.9	53.5	PT,L	A,V,M,F,R	X	X
<i>Formicivora melanogaster</i> Pelzeln, 1868	8.2	38.5	PT,L	A,V,M,F,R	X	X
<i>Herpsilochmus atricapillus</i> Pelzeln, 1868*	2.7		PT	A,V		
<i>Sakesphorus cristatus</i> (Wied, 1831) <sup>EN</sup>	5.4	62.1	PT,L	A,V,M,F,R,C		X
<i>Thamnophilus capistratus</i> Lesson, 1840	24.5	107.1	PT,L	A,V,M,F,R,C		X
<i>Thamnophilus torquatus</i> Swainson, 1825*		2.1	PT	A		
<i>Thamnophilus pelzelni</i> Hellmayr, 1924*	13.6		PT,L	A,V,M,F		
<i>Taraba major</i> (Vieillot, 1816)	2.7	2.1	PT,L	A,V,M,F,R	X	X
Grallariidae Sclater & Salvin, 1873						
<i>Hylopezus ochroleucus</i> (Wied, 1831) <sup>EN</sup>	x	44.9	PT,L	A,M,F,R		X
Dendrocolaptidae Gray, 1840						
<i>Sittasomus griseicapillus</i> (Vieillot, 1818)		x	PT	A,V		X
<i>Campylorhynchus trochilirostris</i> (Lichtenstein, 1820)						X
<i>Lepidocolaptes angustirostris</i> (Vieillot, 1818)	x	x	PT,L	A,V,M,F		X
Furnariidae Gray, 1840						
<i>Furnarius figulus</i> (Lichtenstein, 1823)		x	PT	A		X
<i>Furnarius leucopus</i> Swainson, 1838		x	Aq	A,V		X
<i>Pseudoseisura cristata</i> (Spix, 1824)						X
<i>Phacellodomus rufifrons</i> (Wied, 1821)		2.1	PT	A,V,F		X
<i>Certhiaxis cinnamomeus</i> (Gmelin, 1788)	2.7	x	Aq,L	A,V	X	X
<i>Gyalophylax hellmayri</i> (Reiser, 1905) <sup>EN</sup>	5.4	49.2	PT,L	A,V,M,F,R		X
<i>Synallaxis frontalis</i> Pelzeln, 1859	5.4	17.1	PT,L	A,V,M,F,C	X	X
<i>Synallaxis albescens</i> Temminck, 1823*	x	2.1	PT	A,V,M		
<i>Synallaxis hypospodia</i> Sclater, 1874*	x	2.1	PT	A,V,M		
<i>Synallaxis scutata</i> Sclater, 1859						X
<i>Cranioleuca semicinerea</i> (Reichenbach, 1853)*	x	x	L	M,F		
Tityridae Gray, 1840						
<i>Pachyramphus viridis</i> (Vieillot, 1816)						X
<i>Pachyramphus polychopterus</i> (Vieillot, 1818)		2.1	PT, L	A,V,M,F		X



Taxon	Season:		Habitats	Type of record	Recorded in:	
	Dry	Rainy			OAP (2004)	Farias (2009)
<i>Pachyramphus validus</i> (Lichtenstein, 1823)		x	PT,L	A,V		X
<i>Xenopsaris albinucha</i> (Burmeister, 1869)						X
Rhynchocyclidae Berlepsch, 1907						
<i>Tolmomyias flaviventris</i> (Wied, 1831)	8.2	x	PT,L	V,M,F	X	X
<i>Todirostrum cinereum</i> (Linnaeus, 1766)	8.2	27.8	PT,L	A,V,R,C	X	X
<i>Hemitriccus margaritaceiventer</i> (d'Orbigny & Lafresnaye, 1837)	19.1	15	PT,L	A,V,M,F,C	X	X
Tyrannidae Vigors, 1825						
<i>Hirundinea ferruginea</i> (Gmelin, 1788)	5.4	x	PT,L	A,V,F		X
<i>Stigmatura napensis</i> Chapman, 1926	8.2	32.1	PT,L	A,V,M,F		X
<i>Euscarthmus meloryphus</i> Wied, 1831	x	81.4	PT,L	A,V,M,R		X
<i>Campostoma obsoletum</i> (Temminck, 1824)	10.9	2.1	PT,L	A,V,M,F,R		X
<i>Elaenia flavogaster</i> (Thunberg, 1822)	x	2.1	PT	A,V	X	X
<i>Elaenia spectabilis</i> Pelzeln, 1868		15	PT,L	A,V,M		X
<i>Elaenia chilensis</i> Hellmayr, 1927*	x	81.4	PT,L	A,V,M,F		
<i>Elaenia cristata</i> Pelzeln, 1868*	x	17.1	PT,L	A,V,M,F		
<i>Myiopagis viridicata</i> (Vieillot, 1817)*		2.1	PT,L	A,M,F		
<i>Phaomyias murina</i> (Spix, 1825)*		21.4	PT,L	A,M		
<i>Phyllomyias fasciatus</i> (Thunberg, 1822)		8.6	PT,L	A,M,F	X	
<i>Myiarchus ferox</i> (Gmelin, 1789)	2.7	x	L	A,V,M	X	X
<i>Myiarchus tyrannulus</i> (Statius Muller, 1776)	5.4	x	PT,L	A,V,M,F		X
<i>Casiornis fuscus</i> Sclater & Salvin, 1873	x	x	PT,L	V,M	X	X
<i>Pitangus sulphuratus</i> (Linnaeus, 1766)	10.9	4.3	PT,L	A,V	X	X
<i>Machetornis rixosa</i> (Vieillot, 1819)*	x	x	PT,L	A,V		
<i>Myiodynastes maculatus</i> (Statius Muller, 1776)		x	PT	A,V		X
<i>Megarynchus pitangua</i> (Linnaeus, 1766)	2.7	x	PT,L	A,V,M,F		X
<i>Myiozetetes similis</i> (Spix, 1825)		x	PT,L	A,V	X	
<i>Tyrannus melancholicus</i> Vieillot, 1819	5.4	17.1	PT,L	A,V	X	X
<i>Empidonomus varius</i> (Vieillot, 1818)		25.7	PT,L	A,V,M,F		X
<i>Myiophobus fasciatus</i> (Statius Muller, 1776)*	x	x	PT	A,V		
<i>Sublegatus modestus</i> (Wied, 1831)*	2.7	x	PT	A,V		
<i>Fluvicola albiventer</i> (Spix, 1825)*	2.7		L, Aq	V		
<i>Fluvicola nengeta</i> (Linnaeus, 1766)		x	PT,L	A,V	X	X
<i>Arundinicola leucocephala</i> (Linnaeus, 1764)		x	Aq	A,V		X
<i>Cnemotriccus fuscatus</i> (Wied, 1831)*	2.7	2.1	PT,L	A,V,M,F		
<i>Knipolegus nigerrimus</i> (Vieillot, 1818)*	x	2.1	PT	A,V		
<i>Xolmis irupero</i> (Vieillot, 1823)	2.7	x	PT,Aq	V	X	X
Vireonidae Swainson, 1837						
<i>Cyclarhis gujanensis</i> (Gmelin, 1789)	x	19.3	PT,L	A,V,M,F	X	X
<i>Vireo olivaceus</i> (Linnaeus, 1766)		x	PT	A		X
<i>Hylophilus amaurocephalus</i> (Nordmann, 1835)	5.4	62.1	PT,L	A,V,M,F		X
Corvidae Leach, 1820						
<i>Cyanocorax cyanopogon</i> (Wied, 1821)		x	PT,L	A,V,M,F	X	X
Hirundinidae Rafinesque, 1815						
<i>Stelgidopteryx ruficollis</i> (Vieillot, 1817)*	x		L,Aq	V		
<i>Progne chalybea</i> (Gmelin, 1789)	x		L	V	X	
<i>Tachycineta albiventer</i> (Boddaert, 1783)		x	Aq	V	X	
Troglodytidae Swainson, 1831						
<i>Troglodytes musculus</i> Naumann, 1823	2.7	21.8	PT,L	A,V,M,R	X	X
<i>Pheugopedius genibarbis</i> (Swainson, 1838)					X	
<i>Cantorchilus longirostris</i> (Vieillot, 1819)	8.3	72.8	PT,L	A,V,M,F,R		X
Poliophtilidae Baird, 1858						
<i>Poliophtila plumbea</i> (Gmelin, 1788)	29.9	38.5	PT,L	A,V,M,F	X	X

Taxon	Season:		Habitats	Type of record	Recorded in:	
	Dry	Rainy			OAP (2004)	Farias (2009)
Turdidae Rafinesque, 1815						
<i>Turdus rufiventris</i> Vieillot, 1818	2.7	x	PT,L	A,V,M,F		X
<i>Turdus leucomelas</i> Vieillot, 1818	x	2.1	PT,L	A,V,M		X
<i>Turdus amaurochalinus</i> Cabanis, 1850	x	6.4	PT,L	A,V,M,F		X
Mimidae Bonaparte, 1853						
<i>Mimus saturninus</i> (Lichtenstein, 1823)	x	10.7	PT,L	A,V,F	X	X
Motacillidae Horsfield, 1821						
<i>Anthus lutescens</i> Pucheran, 1855					X	
Coerebidae d'Orbigny & Lafresnaye, 1838						
<i>Coereba flaveola</i> (Linnaeus, 1758)	2.7	x	PT,L	A,V,M,F	X	X
Thraupidae Cabanis, 1847						
<i>Saltator similis</i> d'Orbigny & Lafresnaye, 1837		2.1	PT	A,V,M,F		X
<i>Compsothraupis loricata</i> (Lichtenstein, 1819)						X
<i>Nemosia pileata</i> (Boddaert, 1783)						X
<i>Thlypopsis sordida</i> (d'Orbigny & Lafresnaye, 1837)	x	2.1	PT	V,M		X
<i>Tachyphonus rufus</i> (Boddaert, 1783)	x	2.1	PT,L	A,V,M,F		X
<i>Lanio pileatus</i> (Wied, 1821)	40.8	102.8	PT,L	A,V,M,F,R	X	X
<i>Tangara sayaca</i> (Linnaeus, 1766)	5.4	19.3	PT,L	A,V,M,F,R	X	X
<i>Tangara palmarum</i> (Wied, 1823)	x	x	L	V	X	
<i>Tangara cayana</i> (Linnaeus, 1766)	10.8	4.3	PT,L	A,V,M,F	X	X
<i>Paroaria dominicana</i> (Linnaeus, 1758) <sup>EN</sup>	19.1	23.5	PT,L	A,V,M	X	X
<i>Conirostrum speciosum</i> (Temminck, 1824)	x	5.4	PT,L	A,V		X
Emberizidae Vigors, 1825						
<i>Zonotrichia capensis</i> (Statius Muller, 1776)	x	239.8	PT,L	A,V,M,R,C	X	X
<i>Ammodramus humeralis</i> (Bosc, 1792)	x	x	PT,L	A	X	X
<i>Sicalis flaveola</i> (Linnaeus, 1766)	x		L	A,V,F		X
<i>Sicalis luteola</i> (Sparrman, 1789)						X
<i>Volatinia jacarina</i> (Linnaeus, 1766)	x	25.7	PT,L	A,V,F	X	X
<i>Sporophila lineola</i> (Linnaeus, 1758)	x		L	A,V		X
<i>Sporophila nigricollis</i> (Vieillot, 1823)	x	x	PT,L	A,V	X	X
<i>Sporophila albogularis</i> (Spix, 1825) <sup>EN</sup>	x	19.3	PT	A,V,M,F		X
<i>Sporophila leucoptera</i> (Vieillot, 1817)	2.7		L	A,V		X
<i>Sporophila bowreuil</i> (Statius Muller, 1776)						X
Cardinalidae Ridgway, 1901						
<i>Cyanoloxia brissonii</i> (Lichtenstein, 1823)	8.1	12.8	PT,L	A,V,M,C	X	X
Parulidae Wetmore, Friedmann, Lincoln, Miller, Peters, van Rossem, Van Tyne & Zimmer 1947						
<i>Parula pitaiayumi</i> (Vieillot, 1817)		x	PT	V		
<i>Basileuterus flaveolus</i> (Baird, 1865)		4.3	PT,L	A,V,M,F,R		
Icteridae Vigors, 1825						
<i>Icterus cayanensis</i> (Linnaeus, 1766)	5.4	x	PT,L	A,V		X
<i>Icterus jamacaii</i> (Gmelin, 1788)	2.7	8.6	PT,L	A,V,M,F		X
<i>Chrysomus ruficapillus</i> (Vieillot, 1819)					X	
<i>Agelaioides fringillarius</i> (Spix 1824)						X
<i>Molothrus bonariensis</i> (Gmelin, 1789)		4.2	PT,L	A,V		X
<i>Sturnella supercilii</i> (Bonaparte, 1850)						X
Fringillidae Leach, 1820						
<i>Sporagra yarrellii</i> (Audubon, 1839)		x	PT	A,V	X	
<i>Euphonia chlorotica</i> (Linnaeus, 1766)	8.2	17.1	PT,L	A,V,M,C	X	X
Passeridae Rafinesque, 1815						
<i>Passer domesticus</i> (Linnaeus, 1758)	x		L	v	X	

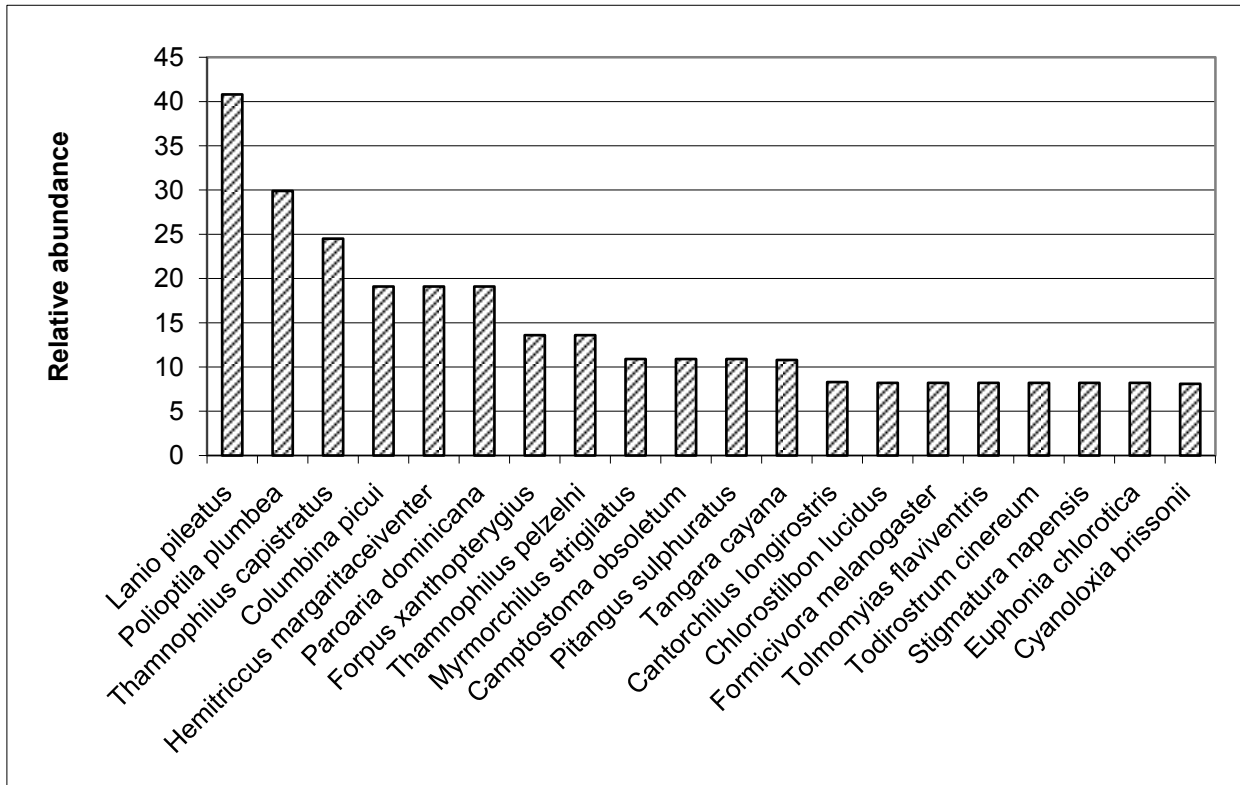


FIGURE 2. Species with the highest relative abundance (individuals recorded per 10 hours of survey) recorded during the surveys conducted in the Catimbau National Park during the dry season of October, 2008.

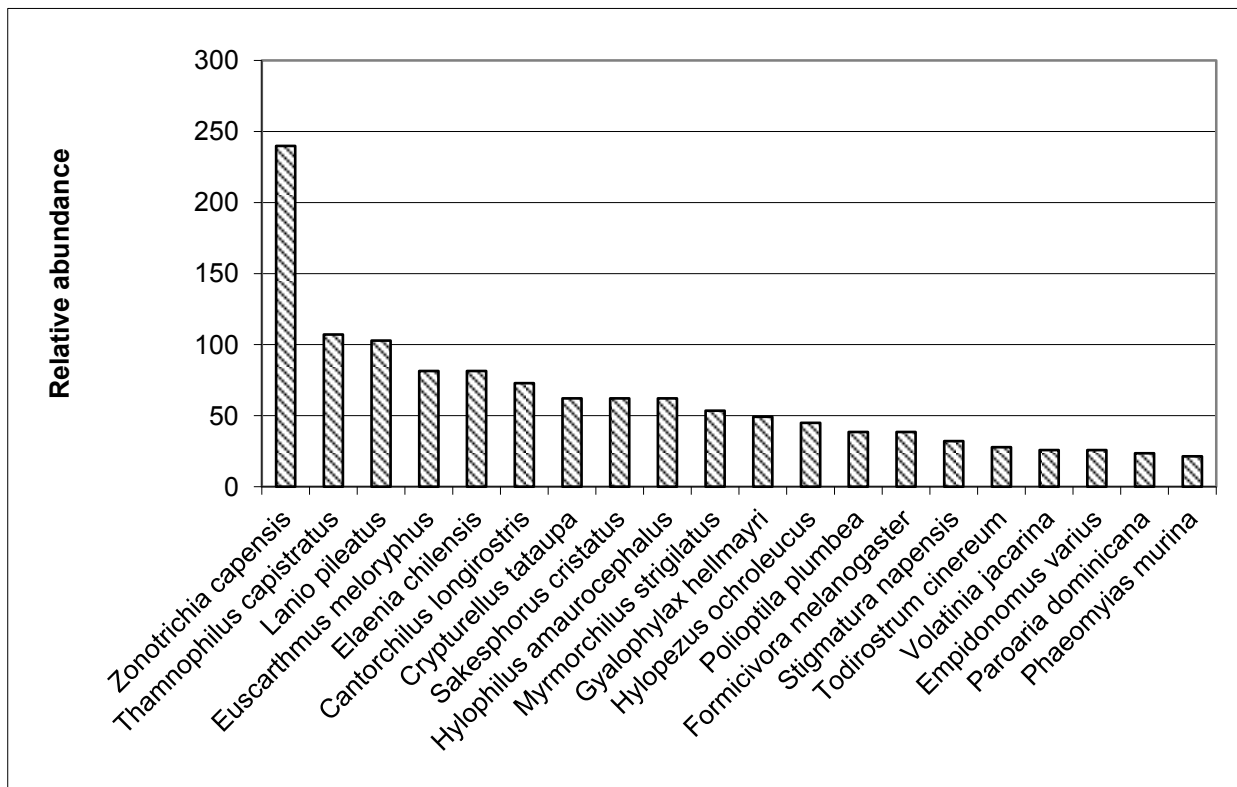


FIGURE 3. Species with the highest relative abundance (individuals recorded per 10 hours of survey) recorded during the surveys conducted in the Catimbau National Park during the rainy season of April, 2011.

## DISCUSSION

The relative abundance of the main bird families recorded in the present study was similar to that reported from other *caatinga* sites, with some minor variation. At all sites, however, the Tyrannidae was the family with the highest species richness (e.g. Olmos *et al.* 2005, Telino Júnior *et al.* 2005, Roos *et al.* 2006, Farias 2007, Araújo & Rodrigues 2011, Pereira & Azevedo Júnior 2011).

The total bird species richness recorded in the Catimbau National Park (202 species) represents 58.05% of the total of 348 species recorded for the *caatinga* by Pacheco (2004), and 39.2% of the 510 species listed by Silva *et al.* (2003). Most other studies in the *caatinga* (e.g. Nascimento 2000, Telino Júnior *et al.* 2005, Roos *et al.* 2006, Araújo & Rodrigues 2011) have recorded smaller numbers of species, although they were conducted in the *caatinga* scrublands *sensu stricto*. It seems likely that the different habitat types sampled in the Catimbau National Park, together with the different methods used for the collection of data, contributed to the relatively large number of bird species recorded in the present study. This is supported by the larger numbers of species recorded in other *caatinga* surveys which have included different habitat configurations, such as Olmos (1993), who recorded 208 species in the Serra da Capivara, in the Brazilian state of Piauí, Olmos *et al.* (2005) who registered 209 species in different habitats in the *caatinga* of Pernambuco and Ceará, and Nascimento *et al.* (2000) who recorded 193 species in the Chapada do Araripe.

During the rainy season, many of the most abundant species recorded in the surveys were those that have far-reaching or constant vocalizations, such as *Zonotrichia capensis*, *Thamnophilus capsitratus*, *Euscarthmus meloryphus*, *Elaenia chilensis*, and *Cantorchilus longirostris*. A greater abundance of granivorous species, such as *Zonotrichia capensis*, *Lanio pileatus*, *Paroaria dominicana*, and *Columbina picui*, was recorded in both seasons, as well as insectivorous species, including *Thamnophilus capsitratus*, *Euscarthmus meloryphus*, *Cantorchilus longirostris*, *Polioptila plumbea*, and *Hemitriccus margaritaceiventer*. All these species are able to exploit a wide variety of habitats, including anthropogenic environments (Olmos *et al.* 2005).

The cumulative species curve presented an upward trend (Figure 4), indicating that a number of additional species would have been recorded if more 10-species lists had been elaborated. If the species richness recorded in all the different procedures in both seasons is considered, however, that is, 179 species, the overall total was higher than that indicated by the theoretical estimators. This would be accounted for by the fact that the MacKinnon lists were compiled only during the rainy season, whereas all the other procedures encompassed both seasons.

A number of species were recorded only during the rainy season, including *Zenaida auriculata*, which migrates seasonally within the semi-arid Brazilian Northeast (Azevedo Júnior & Antas 1990), and *Myiodinastes maculatus* and *Empidonomus varius*, which increase in abundance and their distribution in the *caatinga* during

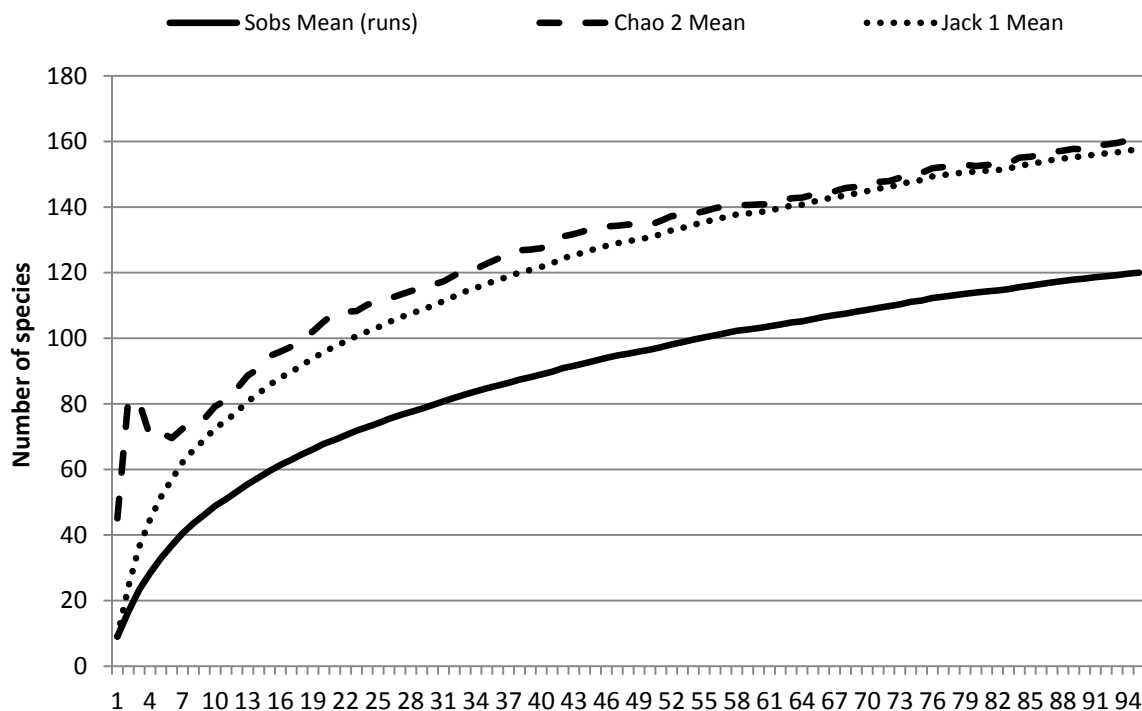


FIGURE 4. Observed species richness (Sobs) in the Catimbau National Park in April, 2011, based on 95 MacKinnon lists, and the richness estimates provided by Jackknife I and CHAO 2.

this part of the year. During a two-year study of an area of *caatinga* in the Brazilian state of Paraíba, Araujo (2009) also recorded some species only during the rainy season, including *Coccyzus melacoryphus*, *Pachyramphus polychopterus*, *Pachyramphus validus*, *Elaenia spectabilis*, *Myiopagis viridicata*, *Phaeomyias murina*, *Myiodynastes maculatus*, *Empidonomus varius*, *Vireo olivaceus*, and *Molothrus bonariensis*, which were also restricted to the rainy season in the present study. Araujo (2009) postulates that some species, such as *Myiopagis viridicata*, *Pachyramphus validus*, and *Molothrus bonariensis*, may be engaging in seasonal movements within the *caatinga*, although this phenomenon is poorly understood.

Similarly, 38 species were recorded only during the dry season, including many aquatic birds. These species were recorded due to the reduction in the number of bodies of water during this period, which facilitated observation through the concentration of individuals at specific points within the study area. In addition to the increase in the availability of lentic habitats during the rainy season, which facilitates migration in many aquatic species, others form breeding pairs, which tend to hide in dense vegetation, impeding their detection (Pereira 2010, Passos Filho 2011).

A larger number of forest-dependent (cf. Silva *et al.* 2003) species ( $n = 8$ ) was recorded on the plateau in comparison with the lowlands ( $n = 5$ ), although both areas had the same number of semi-dependent species ( $n = 11$ ). Most of the vegetation on the plateau is low-lying, reaching only 2-6 m in height, and similar in structure to a *carrasco* (montane deciduous scrub), but which Rodal *et al.* (1998) classified as evergreen shrub *caatinga*. This vegetation maintained its foliage throughout the dry season, probably as a result of the more humid conditions found on the plateau. These conditions likely favored the presence of forest-dependent species such as *Crypturellus tataupa*, *Herpsilochmus atricapillus*, *Sittasomus griseicapillus*, *Myiodynastes maculatus*, *Vireo olivaceus*, *Parula pitiayumi*, and *Sporagra yarrellii*. The evergreen forest is also found on this plateau, even though most of the original cover has been replaced by orchards and pastures. However, a small band of *Crotophaga major*, which is considered to be semi-dependent on forest habitats, was observed in one small remnant of the original habitat.

While *caatinga* scrub predominates in lowland areas, some forest-dependent species were recorded in these habitats, although the records were obtained in more arboreal habitats, such as gallery forests along seasonal creeks and the evergreen forest at the foot of the escarpment in Area 1. The vocalizations of *Crypturellus noctivagus zabele* and *Penelope jacucaca* were recorded in the latter area during the dry season of 2008.

## Noteworthy records

*Crypturellus noctivagus zabele* – this subspecies is considered to be rare due to the intense hunting pressure it suffers. Its conservation status was recently reviewed, and the taxon was included in the National Action Plan for the Conservation of *caatinga* Birds (ICMBio 2012). The zabelê had not been recorded previously in the Catimbau National Park, nor at other *caatinga* localities in Pernambuco, such as those surveyed by Farias *et al.* (2005, 2007) and Olmos *et al.* (2005). In the present study, the characteristic vocalization of the species was recorded in the dry season, in October, 2008, in Area 1 in evergreen forest at the foot of the escarpment. The presence of this species, together with *Penelope jacucaca* (see below), is a good indicator of habitat quality, given that they are ecologically specialized and require relatively large areas of forest in which to forage for specific dietary items, and are thus relatively sensitive to habitat disturbance (Parker III *et al.* 1996).

*Crypturellus parvirostris* and *Nothura maculosa* – we present herein the first records of these two species for the Catimbau National Park. The species were identified based on the vocalizations of a number of different individuals recorded in both the rainy and the dry seasons, on the São José plateau, and in the lowland scrub of the park.

*Penelope jacucaca* – a lone individual was heard vocalizing in Area 1 during the dry season. This species had been recorded in the park by Farias (2009), and is considered to be vulnerable to extinction (MMA 2003). This species has also been included in the National Action Plan for the Conservation of *caatinga* Birds (ICMBio 2012).

*Falco rufigularis* – one individual was observed during the dry season at the Fazenda Brejo São José (Area 1). This is a new record for both the park and the *caatinga* of Pernambuco, given that the species is absent from the inventories of Farias *et al.* (2005, 2007), Olmos *et al.* (2005), Pacheco (2004), Pereira *et al.* (2008), and Coelho (1987). According to OAP (2002), the only record of the species in the state is from the municipality of Chã Grande.

*Aramides mangle* – this species was observed in Area 2 during the rainy season in shrubby humid vegetation, although it is more usually found on mudflats associated with mangroves and adjacent forest along most of the Brazilian coast between the state of Pará and southwestern Paraná (Sick 1997, Sigrist 2009). However, a number of recent studies, such as those of Redies (2010) and Lima *et al.* (2005) have confirmed the occurrence of breeding populations in the semi-arid Northeast. These records from *caatinga* habitats in Ceará, Bahia, and now Pernambuco, emphasize the fact that the species is not restricted to mangrove and mudflat environments.

*Hydropsalis hirundinacea* and *Chordeiles acutipennis* – the auditory records of these species were collected during the crepuscular and nocturnal surveys in Area 1, in an area of gallery forest associated with a seasonal creek and shrubby-arboreal *caatinga*. These represent the first records of those species in the Catimbau National Park.

*Polytmus guainumbi* – in a study of hummingbird pollination in the *caatinga* of Pernambuco, Leal *et al.* (2006) recorded a greater number of flowering ornithophilous species during the dry season. This is consistent with the findings of the present study, which recorded a larger number of hummingbird species during the dry season. These species include *Polytmus guainumbi*, which had not been recorded previously in the Catimbau National Park. The species was observed in Area 2, in evergreen shrubby vegetation.

*Thamnophilus torquatus* – this species was recorded vocalizing in shrubby vegetation during the rainy season at Area 2. This is the first record of the species for the Catimbau National Park, although it has been recorded in *caatinga* habitats in Pernambuco by Naumburg (1935), Hellmayr, (1909), and Cory (1919), and in other areas by Coelho (1987).

*Thamnophilus pelzelni* – this species was recorded only during the dry season, both in the lowlands (Area 1) and on the plateau (Area 2). Silva *et al.* (2003) considered *T. pelzelni* to be dependent on forested habitats, such as the arboreal *caatinga*. The record from Area 1, where a specimen was captured in an area of *caatinga* adjacent to a gallery forest, is consistent with this classification. However, *T. pelzelni* was also recorded in the present study in shrubby humid vegetation on the plateau, an environment similar to that in which Farias (2007) recorded the species in the forest reserve of a São Francisco Hydroelectric Company irrigation project in Pernambuco.

*Herpsilochmus atricapillus* – this species was observed in shrubby-arboreal vegetation on the plateau during the dry season. Olmos *et al.* (2005) and Farias (2007) also recorded the species in typical arboreal *caatinga*.

*Synallaxis albescens* – there is a historical record of this species in Pernambuco, in the municipality of Brejão (Forbes 1881), and more recent records have been obtained in Petrolina (Olmos *et al.* 2005) and the municipalities of Santa Cruz do Capibaribe, Petrolândia, Surubim, Lagoa Grande, and Garanhuns (Pereira *et al.* 2008). In the Catimbau National Park, a specimen was captured in Area 2 during the dry season, and a second individual was observed in the same area during the rainy season.

*Synallaxis hypospodia* – a specimen was captured in Area 2 during the dry season. A second individual was heard vocalizing in Area 7 during the rainy season, in a well-preserved area of shrubby-arboreal *caatinga*. In Pernambuco, the species has been recorded by Coelho

(1978) and OAP (2002) in Caruaru, in the João Vasconcelos Sobrinho Ecological Park.

*Elaenia cristata* – this species was recorded in both seasons on the transects in Area 2, and was captured at Area 1 in the shrubby-arboreal *caatinga* at the foot of the escarpment. A number of studies (Fry 1970, Ridgely & Tudor 1989, Sick 1997) have indicated that this species may be partly migratory or at least nomadic. It is common in *cerrado* savannas and open secondary forest, and has been recorded in the *caatinga* of Bahia state (Lima *et al.* 2003, Lima *et al.* 2011), but not previously in the *caatinga* of Pernambuco.

*Knipolegus nigerrimus* – This species was observed in the dry season at Area 5, in rock field vegetation. This species has been recorded at two sites in Pernambuco – the Maurício Dantas Private Natural Heritage Reserve (Farias *et al.* 2005) and in hyperxerophilous *caatinga* in the municipality of Santa Cruz do Capibaribe (Las-Casas & Azevedo-Júnior 2008).

The phytogeographic heterogeneity of the Catimbau National Park, associated with a marked altitudinal gradient and the presence of aquatic habitats appear to be the main ecological factors determining the considerable species richness of the avifauna of this conservation unit.

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