

# The avifauna of Viruá National Park, Roraima, reveals megadiversity in northern Amazonia

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**ABSTRACT:** While many published maps of avian species richness indicate northern Amazonia to be somewhat species-poor, recent surveys reveal that this area actually possesses one of the most species-rich avifaunas in the Neotropical lowlands. Our surveys indicate that at least 520 bird species occur in Viruá National Park (VNP) and adjacent areas, which is located in the Brazilian state of Roraima (northern Amazonia). Here, we present the results of our ornithological efforts since 2001, based on audio-visual and mist-netting surveys, vouchered by tape and digital recordings, photographs, and collected specimens. VNP is dominated by Amazonian white-sand forest (locally known as *campina* and *campinarana*) on an extensive floodplain influenced by muddy-, clear-, and black-water rivers, forming a complex mosaic of habitats that includes *várzea*, *igapó*, and hilltop “islands” with *terra-firme* forest. The high avian diversity found at VNP is likely due to both biogeographic- and local-scale processes. Each habitat contains a particular avian assemblage. Patches of *terra-firme* forest have a typical Guianan avifauna. *Campina* and *campinarana* contain unique species, including some poorly known and range-restricted (e.g., *Aprositornis disjuncta*), as well as species typical of the northern Roraiman savannas (e.g., *Icterus nigrogularis*). The *várzea* of the Rio Branco (with its associated river islands) is particularly species-rich, including the endemic *Cercomacra carbonaria* and isolated populations of white-river-island specialists (e.g., *Mazaria propinqua*). VNP protects important ecological ecotones and biogeographical contact zones, as well as 27 threatened and 45 migratory bird species. On the other hand, 71 species reported for our study area have been found outside the current boundaries of the park. Ongoing proposals of expanding the limits of the park would absorb most of these species. With its outstanding bird species richness and wide variety of habitats, VNP emerges as an important site for Amazonian avian research, tourism, and conservation. Despite the park’s protected status, the Brazilian government plans to build a hydroelectric dam in the region, representing the main threat to its avifauna and overall biodiversity.

**KEY-WORDS:** ornithological inventory; species richness; threatened species; white sand forest; Rio Branco

## INTRODUCTION

Viruá National Park (VNP), located in the center of the Brazilian state of Roraima, represents an environmentally complex, relatively intact, and until recently, poorly known region of the Amazon basin. White-sand forests (*campinas* and *campinaranas*) dominate the landscape. Perched just above these waterlogged habitats, scattered hills support lowland *terra firme* forest. The entire region is drained by muddy-, clear-, and black-water rivers,

forming a complex mosaic of riparian habitats (including *várzeas* and *igapós*). Despite being located in what is supposed to be one of the poorest regions of the Amazon (Rahbek & Graves 2001; Bass *et al.* 2010; Jetz *et al.* 2012), the environmental heterogeneity found at the park fosters high avian species richness.

The sandy, waterlogged soils of the park sustain low-stature forests, of low logging worth, and are generally considered too poor for agriculture. This has resulted in a very low human impact in the park, which is virtually

uninhabited and almost entirely pristine (Schaeffer *et al.* 2009). On the other hand, a large hydroelectric dam imminently planned for the Rio Branco 30 km north of the park (MME 2011), represents a serious threat to the park's natural hydrological cycle and, consequently, to the biodiversity of the entire region (Campos 2011).

Biodiversity inventories are vital to understanding ecological and biogeographical processes, and are especially urgent when an entire ecosystem is under threat. Avifaunal surveys, in particular, are useful to establish conservation priorities. Many species are habitat specialists and can be good indicators of habitat integrity (Stotz *et al.* 1996). Birds are also better known than most other animal groups and a list of the birds recorded in a given area provides baseline data that can be monitored and followed in the future (Lees *et al.* 2014). Recent avian inventories conducted throughout Amazonia have resulted in a better understanding of the association between birds and vegetation types, regional variation in species abundance, and significant range extensions for many species (e.g., Cohn-Haft *et al.* 1997, 2007a; Naka 2004; Robbins *et al.* 2007; Whittaker 2009; Aleixo *et al.* 2011; Borges & Almeida 2011; Lees *et al.* 2012). Furthermore, extensive bird inventories have helped recognize and delimitate areas of endemism (Naka 2011; Borges & Silva 2012). Finally, avian inventories offer distribution data to support better delimitations of protected areas and Important Bird Areas (De Luca *et al.* 2009), both of which are important to protect more habitat and encourage ecotourism (Laranjeiras & Naka 2014), which supports economic development.

Here, we present the results of several years of ornithological surveys at VNP and adjacent areas. Our results include a comprehensive list of the park's avifauna, its distribution across habitats, and notes and commentaries on some highlighted species of biogeographic and conservation concern. This study will improve our understanding of avian distribution patterns in Roraima and northern Amazonia, and will be useful for the management of one of the most diverse avian communities in the world.

## METHODS

### *Study Area*

Viruá National Park, 230,000 ha, is located in the center of the state of Roraima in northern Brazil (1°20'N; 61°10'W), nearly 150 km south of Boa Vista (Figure 1). The park is bounded by the Rio Branco to the west, the BR-174 highway to the northeast, the *Estrada Perdida* (lost road) to the east, and the Rio Anauá to the south. We have also included in our surveys some areas that are outside the current boundaries of the park, including the

village of Vista Alegre, the islands of the Rio Branco, the right margin of Rio Anauá near the confluence with the Rio Branco, and the left margin of the Rio Barauana. The two latter have been officially included in a request to expand the boundaries of the park, which is currently under consideration by the Brazilian government (see proposed VNP limits in Figure 1; MMA 2010). Four additional protected areas have been created in the region, including two Ecological Stations (Niquiá and Caracarái), a National Forest (Anauá), and a National Park (Serra da Mocidade), forming a 1,200,000-ha network of protected land.

The climate at VNP is warm and wet, with a mean annual temperature of 26°C, with mean annual precipitation ranging from 2,000-2,300 mm in the south and 1,700-2,000 mm in the north (Barbosa 1997; Schaeffer *et al.* 2009). Rainfall concentrates from May to July and the dry period occurs from December to March-April.

### Habitats

VNP is located in an ecotone area, which is mostly covered by Amazonian white-sand forests (*campinas* and *campinaranas*; Figure 1). Other habitats present in the park are seasonally flooded riverine forests, such as *várzeas* and *igapós*; *terra-firme* forests on more elevated areas, forming forested hilltop "islands"; aquatic environments; and a small extent of open savanna on the park's northern limit. Small human-altered areas are also present. Elevation ranges from 50-60 m at the margin of the Rio Branco to 360 m at the Serra do Viruá. Bird habitat characterization and terminology follow Naka *et al.* (2006). More details on the vegetation and soil types present at VNP are available elsewhere (Schaeffer *et al.* 2009; Adeney 2009; Gribel *et al.* 2009; Mendonça 2011; Rossetti *et al.* 2012; Damasco *et al.* 2013).

***Campina* and *campinarana*.** These habitats represent the dominant vegetation type in the park, covering ~45% of the area (Schaeffer 2009). We have included here more open (*campina*) and more forested (*campinarana*) areas, which share similar poorly drained sandy soils. Plant species richness is very variable between these vegetation types. Typical elements in the *campina* are the endemic small palm *Barcella odora*, species of Cyperaceae (*Lagenocarpus* spp.), and several species in the family Poaceae. In the *campinarana*, the canopy is taller and generally more uniform, reaching up to 15 m. It is formed predominantly by trees of the Vochysiaceae family, especially *Ruizterania retusa* and *Vochysia ferruginea* (Gribel *et al.* 2009).

***Terra-firme*.** Although this represents the dominant forest type in Amazonia, it covers only ~6% of the park (Schaeffer 2009). *Terra-firme* forests are more species rich than *campina* or *campinarana*, but are restricted in the park to the slopes of two hilly areas (Serra do Viruá and Serra do Preto) and to areas that do not flood along

the Rio Branco and Rio Baruana. The plant species composition is considerably variable between localities, and plant richness is higher along the Rio Baruana. The canopy is tall, with emergent trees that can reach 40-45 m in height. The understory is generally open and rich in palms, such as *inajá* (*Maximiliana maripa*) and *bacaba* (*Oenocarpus bacaba*; Gribel et al. 2009).

**Várzea.** This represents the main habitat found along the Rio Branco and river islands, but is only present within the boundaries of the park along a thin stretch on the western side of VNP, covering only ~5% of the park's area (Schaeffer 2009). The *várzea* is composed of a series of successional vegetation types that are seasonally flooded by white-water rivers in Amazonia. It includes grassy sandbars, sandbar scrubs, river-edge forest (dominated by *Cecropia* spp.), and tall forests with well-developed canopy (transitional forest). There are no studies on the floristic composition of these habitats at VNP, but *jauari* palms (*Astrocaryum jauari*) and *jacareúva* trees (*Calophyllum brasiliense*) are common in these areas.

**Igapó.** This forested habitat occurs in areas that are seasonally flooded by black-water and nutrient-poor rivers, and covers ~40% of the park's area (Schaeffer 2009). The stature, plant species richness, and composition are very variable at different sites and rivers. Along the Rio Iruá, *igapós* are floristically diverse but lower in stature, resembling *campinarana*, with palms virtually absent; the *igapós* of the Anauá and Baruana rivers seem to be more structured, with a common presence of trees in the family Fabaceae (Gribel et al. 2009).

**Savanna.** This open vegetation type in VNP is restricted to the surroundings of Vista Alegre at the northern edge of the park, covering only 170 ha (less than 0.1% of the study area). This region is currently outside the boundaries of the park, but has been included in a proposed expansion of the park's area (MMA 2010). The savannas are characterized by the sparse presence of small trees, with predominance of *caimbé* (*Curatella americana*) and *murici* (*Byrsonima* spp.), over continuous grassland.

**Aquatic environments.** Water-related habitats, including rivers, lakes with floating vegetation, and sandbanks, cover ~4% of the park (Schaeffer 2009). At VNP, natural lakes appear a few kilometers inland from the margin of the Branco, Anauá, and Baruana rivers and in low-lying areas in some *campinas*. Along the Estrada Perdida and the main highway (BR-174), the removal of soil for road construction has formed extensive artificial ponds.

**Human-altered areas.** These areas include pastures and other human land uses that have caused deforestation or degradation of natural habitats. In our study area, human-altered areas are limited to the park's administrative buildings on the Serra do Viruá, the village of Vista Alegre, the Rio Baruana access, the margins of the BR-174 highway, and along the *Estrada Perdida*.

## Survey localities

We concentrated our ornithological surveys at nine major localities (Table 1).

**1. Serra do Viruá.** A small hill (maximum elevation 360 m above sea level) with slopes covered mainly by *terra-firme* forest. Administrative buildings and a 60-km trail system across a 25-km<sup>2</sup> area (5 x 5 km) are located in this section of the park. The trail system also crosses *igapós*, *campinas*, and *campinaranas*. We concentrated our surveys on this trail system, and also along a 5-km road that gives access to the administrative buildings (*Estrada do Portão*), covered by secondary forests, and another 2-km road that borders the hill (*Estrada do Neri*).

**2. Estrada Perdida.** An abandoned stretch of the BR-174 highway that crosses ~40 km of *campinas* and *campinaranas*, but also a few human-altered areas, *igapós*, and Moriche palm swamps (*buritizais*). There are some trails, including the *Estrada do Preto* (that gives access to the *Serra do Preto*), that cross a mosaic of all these vegetation types.

**3. Igarapé do Aliança.** This site includes mainly seasonally flooded forests, including *igapós* along the Aliança stream and *várzeas* in the confluence with the Rio Branco, but also patches of adjacent *terra-firme* forest and aquatic habitats. Two 5-km trails run next to the stream. We also surveyed early-successional vegetation and *várzea* forest in the Aliança, Pascoal, Inajatuba, Muriru, and Ajarani islands on the Rio Branco.

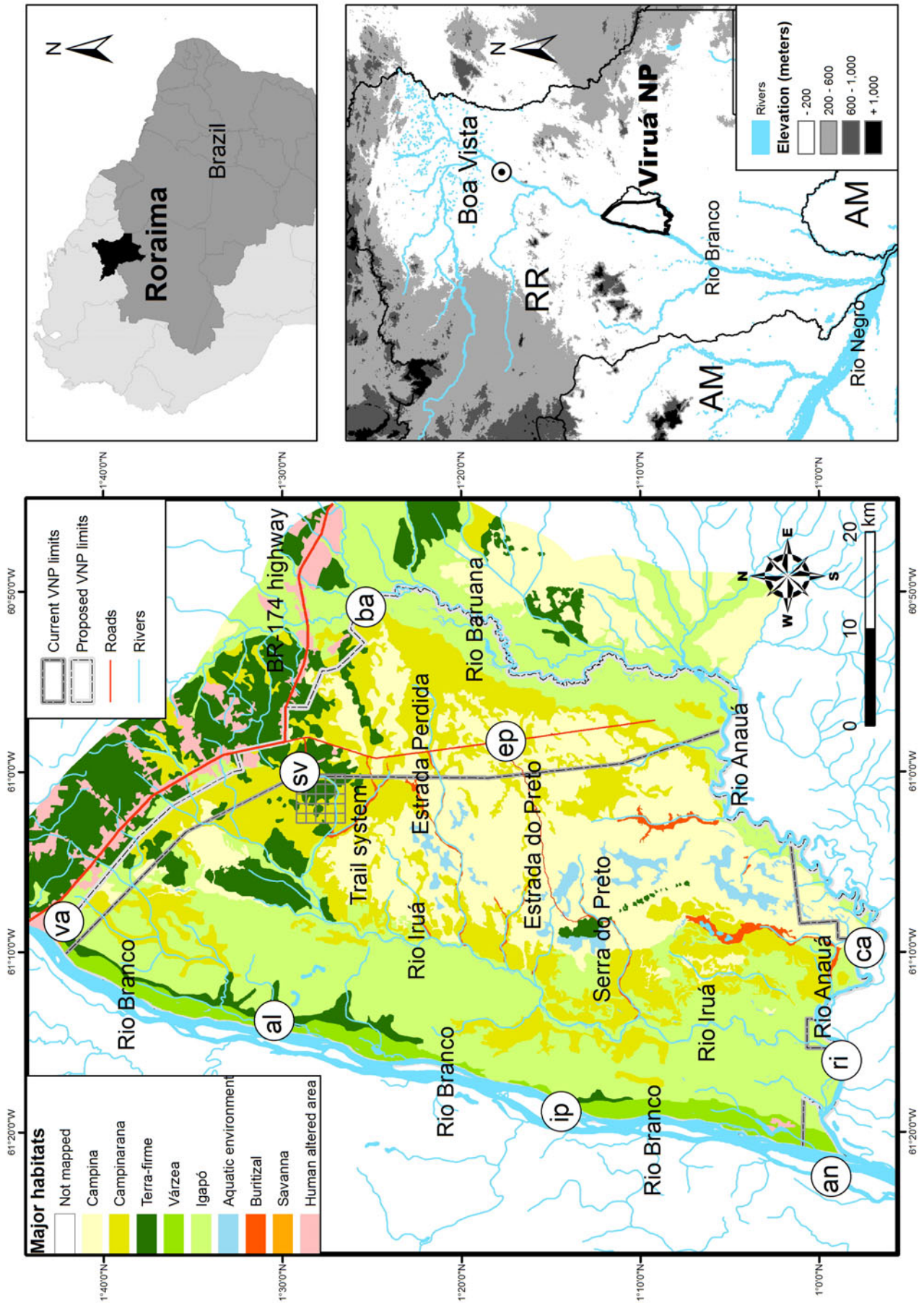
**4. Ilha do Palhal.** An island on the Rio Branco covered with early-successional vegetation and tall *várzea* forest. Our surveys also included other aquatic environments nearby and along the margins of the Rio Branco.

**5. Boca do Anauá.** A group of riverine islands with early-successional vegetation and tall *várzea* forests in the confluence of the Branco and Anauá rivers. We also surveyed other aquatic environments near these islands, and the lower course of the Rio Anauá.

**6. Rio Iruá.** The main watercourse inside VNP, which drains most of its territory. This river crosses several different vegetation types, mainly *campinaranas*, forming low *igapós*. We concentrated our surveys along the lower course of the river, near the confluence with the Rio Anauá.

**7. Campinho do Rio Anauá.** An open area with *campinas* along the margins of the Rio Anauá, surrounded by *campinaranas*, *igapós*, and other aquatic environments. A 5-km trail from the river crosses and borders these vegetation types.

**8. Trilha do Baruana.** This is a highly heterogeneous 5-km trail, which encounters *igapós*, *terra-firme* forests, and *campinaranas*, ending at an open *campina*. In this site, we also surveyed the aquatic environments and *igapó* surrounding the entrance of the trail in the river, as well as human altered areas around the campsite.



**FIGURE 1.** Location of Viruá National Park in northern South America (upper right) and in Roraima (lower right) and the distribution of major habitats along rivers and main roads (left). va – Vila de Vista Alegre; sv – Serra do Viruá; ep – Estrada Perdida; ba – Trilha do Baruana; al – Ilha do Palhal; an – Boca do Anauá; ri – Rio Iruá; ca – Campinho do Rio Anauá.

**9. Vila de Vista Alegre.** A small village located along the Rio Branco, where the BR-174 bridge crosses the river. We surveyed mainly the savanna, but also the *várzeas* along the Rio Branco, small patches of *terra-firme* forest, artificial ponds, and open areas near the bridge.

### Fieldwork

Fieldwork involved a series of complementary bird surveying techniques in order to detect a maximum number of species in different habitat types. We conducted auditory and sight observations, playback trials, and mist-net surveys. Birds were documented with vocalization recordings, photographs, and specimens. Surveys took place usually in the early morning (05:00 – 12:00 h) and late afternoon (15:00 – 18:00 h) and sporadically at night (18:00 – 21:00 h).

MCH, LNN, and MFT first visited VNP in May 2001. Subsequently, we conducted major expeditions in 2002, 2006, and 2008, sampling most habitats and localities, and using all bird sampling techniques described above. Some of us also visited the park for short periods (< 2 days) during these years, for a total of ~30 days of opportunistic observations, mainly around the park's headquarters and the Estrada Perdida. In August 2009, TOL started identifying areas for birdwatching purposes, and since then he has visited the park periodically. Also, since 2012, LNN and TOL began conducting systematic surveys along the Rio Branco. Survey effort totals > 134 days (see Table 2 for all surveying periods and efforts).

### Species list

We present a list of all bird species recorded at VNP and adjacent areas, which includes data obtained

predominantly during our fieldwork (see above), but also data gathered from unpublished sources (visitor reports). We tentatively assign species to their main habitats, and provide their local status (qualitative abundance categories), based on our own observations in the park. Qualitative abundance was determined subjectively, combining number of detections during our main expeditions in 2006 and 2008 and our impressions in the field. Species believed to be widespread in the appropriate habitat were assigned as common; species believed to occur in most, but not all seemingly appropriate habitat, were assigned as uncommon; and species observed in less than four occasions (including records obtained through visitor reports) were assigned as rare. Our abundance assignments are clearly dependent on survey effort and methods in each habitat, and our ratings should be interpreted as hypotheses of abundance that can be tested by quantitative census techniques (Cerqueira *et al.* 2013). Information on regional occurrence, seasonality, and conservation status is based on published sources (Stattersfield *et al.* 1998; Naka *et al.* 2006; ICMBio 2014; CBRO 2014; BirdLife International 2014). We also present the physical evidence used for the inclusion of each species in the list (specimen, audio recordings, and photographs), including the catalog number of at least one voucher, when available. Species lacking evidence refer to lack of visual or auditory records during our surveys. Taxonomy and species nomenclature follow the Brazilian Ornithological Records Committee (CBRO 2014), except for the Caprimulgidae, the genus *Cercomacra*, the species *Mazaria* (*Synallaxis*) *propinqua*, and the genus *Tachyphonus* and *Eucometis*, where we follow, respectively, Sigurdsson & Cracraft (2014), Tello *et al.* (2014), Claramunt (2014), and Burns *et al.* (2014).

**TABLE 1.** Ornithological survey effort and sampled habitats in each main study locality at Viruá National Park and adjacent areas.

Locality	General geographic coordinates	Effort	Habitats <sup>1</sup>
Serra do Viruá	1°29'30.46"N; 61°00'21.33"W	47	tf, ig, cp, cm, at
Estrada Perdida	1°24'34.72"N; 60°59'15.97"W	29	cp, cm, at, ig
Igarapé do Aliança	1°27'46.20"N; 61°14'51.04"W	26	vz, ig, tf, wa
Ilha do Palhal	1°14'19.91"N; 61°19'16.10"W	10	vz, aq
Boca do Anauá	0°57'59.06"N; 61°21'56.40"W	5	vz, aq
Rio Iruá	0°59'37.39"N; 61°15'23.93"W	5	ig, cm, aq
Campinho do Rio Anauá	0°57'32.19"N; 61°09'33.25"W	5	ig, cp, cm, aq
Rio Baruana	1°25'02.40"N; 60°50'46.30"W	5	ig), tf, cp, cm, at, aq
Vila de Vista Alegre	1°42'42.37"N; 61°08'46.27"W	2	sa, vz, tf, at

<sup>1</sup>Habitats: cp – *campina*; cm – *campinarana*; tf – *terra-firme* forest; vz – *várzea*; ig – *igarapé*; sv – savanna; aq – aquatic environment; at – human-altered areas

**TABLE 2.** Dates of ornithological surveys at Viruá National Park and adjacent areas, including effort (in days) and localities.

Period	Team	Effort	Localities <sup>1</sup>
May 2001	MCH, LNN, MFT	2	sv, ep
Oct 2001	LNN, JMB	7	an
Aug 2002	MPDS	15	sv, ep, al, ip
May 2006	TOL	8	sv, ep
Oct 2006 <sup>2</sup>	LNN, MCH, CB	20	All except ba, va
Mar-Apr 2008 <sup>2</sup>	AMFP, CBA, CFV, CHS, GLR, MCC, MCH, MFT, TOL, TVVC	23	All
Aug 2009	TOL	6	sv
Jan 2010	TOL, MFT	4	ep
Apr 2010	TOL, MFT, LNN	4	sv
Jul 2010	TOL	5	sv, ep, al
Jan 2011	TOL, LNN	4	sv, ep, ba
Jul 2011	TOL	3	ri, ca
Jan 2012	TOL, MFT	3	sv, ep
Apr 2012	TOL	3	sv, ep
Mar 2012	LNN	5	al <sup>3</sup>
Sep 2012	LNN, TOL	4	al, ip <sup>3</sup>
Nov-Dec 2012	TOL	9	sv, ep, al
Ago-Sep 2013	TOL	5	sv, ep
Oct 2013	LNN, TOL	4	ip <sup>3</sup>
		<b>Total effort</b>	<b>134 days</b>

<sup>1</sup>Localities: sv – Serra do Viruá; ep – Estrada Perdida; al – Igarapé do Aliança; ip – Ilha do Palhal; an – Boca do Anauá; rb – Rio Branco; ri – Rio Iruá; ca – Campinho do Rio Anauá; ba – Trilha do Baruana; va – Vila de Vista Alegre. <sup>2</sup>Main expeditions. <sup>3</sup>includes other sites along Rio Branco near the locality.

## RESULTS

We recorded 520 bird species for VNP and adjacent areas, which are distributed over 70 bird families (Appendix A). A total of 71 species (~13%) were found exclusively in areas outside the park boundaries (including 16 that were found exclusively on islands on the Rio Branco). The most representative families were Tyrannidae, Thamnophilidae, and Thraupidae, with 48, 44, and 41 species, respectively. For the non-passerines, the most represented families were Accipitridae, Trochilidae, and Psittacidae, with 23, 22, and 21 species, respectively.

We documented the presence of ~83% (431 species) of the bird species included on the list. The presence of 339 species (~65%) was documented with photographs; 303 species (~58%) with audio recordings, and 245 species (~47%) with specimens (Appendix A). The remaining ~17% (89 species) were listed for VNP based on sight and/or auditory records. Most of the species recorded without physical evidence are widespread and common taxa, which are expected to occur in the region and do not represent any identification challenges.

Six bird species (*Gallinula galeata*, *Aratinga solstitialis*, *Pyrrhura picta*, *Tyrannetes stolzmanni*, *Leptopogon amaurocephalus*, and *Tachyphonus rufus*) have been mentioned to occur in the park, but their presence

has not been documented. Because these species are not expected to occur in the park, or at least lack records in nearby localities, we have opted to wait for additional records before including them on the list, so these species are noted as hypothetical.

Most species (~78%) occur in more than one locality (Appendix A), but nearly half of the species recorded in the park (259) were detected exclusively in a single habitat type (Table 3). The *várzeas* of the Rio Branco and the *terra-firme* forests represent the habitats where we detected the highest numbers of species, with 276 and 240 species, respectively (157 of these were detected exclusively in one of the two). As expected, sandy-soiled *campina* and *campinarana* harbour fewer species (about 185), but 37 of them were found nowhere else in the park.

A total of 27 bird species are currently considered threatened at global (BirdLife International 2014) or national (ICMBio 2014) levels, including one Critically Endangered species (*Cercomacra carbonaria*; Appendix A). One species (*Neochen jubata*) is listed as Data Deficient, and five species are considered to have restricted geographic distributions (*Aprositornis disjuncta*, *Myrmotherula klagesi*, *C. carbonaria*, *Hemitriccus inornatus*, and *Dolospingus fringilloides*). Most of the species recorded seem to be permanent residents in the park, but nearly

10% (45 species) possibly visit the park on a seasonal basis (Appendix A). From these, nearly half (24 species) represent North American or nearctic migrants; 14 species represent southern South American or austral migrants; and seven species seem to arrive from other regions within northern South America or Amazonia.

**TABLE 3.** Total avian species richness and number of exclusive species for each major habitat in Viruá National Park and adjacent areas.

Habitat	Total	Exclusive
<i>Campina</i>	88	19
<i>Campinarana</i>	130	10
Sand soil forest total <sup>1</sup>	185	37
<i>Terra-firme</i>	240	95
<i>Várzea</i>	276	62
<i>Igapó</i>	144	7
Flooded forest total <sup>2</sup>	297	93
<i>Savanna</i>	34	2
Aquatic environment	75	29
Human altered area	89	3
<b>Total single habitat species</b>		<b>259</b>

<sup>1</sup>Includes *campina* and *campinarana*.

<sup>2</sup>Includes *várzea* and *igapó*.

### Species accounts

In this section we present data on some poorly known species, records that represent range extensions and records that we consider important in biogeographical or conservation terms.

#### Orinoco Goose (*Neochen jubata*)

The Orinoco Goose (Figure 2) is a widespread but poorly known species regularly seen on sandy beaches along the Rio Branco. Although this species is known to perform seasonal movements, at least in part of its distribution in southern Amazonia (Davenport *et al.* 2012), very little is known about this species at VNP, or along the entire



**FIGURE 2.** Orinoco Goose (*Neochen jubata*) at Ilha do Palhal in the Rio Branco (T.O.L.).

Rio Branco, where it regularly occurs. Fortunately, this species seems not to be seen as a good source of food by local human communities (TOL and LNN pers. obs.). Given its reliance on sandy beaches, the construction of a dam on the Rio Branco, with its potential impacts on flooding and sedimentation regimes represents a serious threat to the survival of this species in the region.

#### Crested Bobwhite (*Colinus cristatus*)

The Crested Bobwhite (Figure 3) occurs in northern South America in arid lowlands and locally into the subtropical zone, using thickets, woodland edges, savannas, roadsides, and embankments (Carroll & Boesman 2013). It is generally considered more common in open savannas, and its presence on sandy-soiled *campinas* is poorly documented. We frequently recorded this species in the *campinas* along the Estrada Perdida and Rio Anauá. VNP seems to represent its southernmost area of occurrence in Roraima.



**FIGURE 3.** Crested Bobwhite (*Colinus cristatus*) at a human-altered area near the Estrada Perdida (T.O.L.).

#### Least Nighthawk (*Podager pusillus*)

The Least Nighthawk represents a geographically widespread species with an apparently disjunct population in northern Amazonia (Cleere & Kirwan 2013). It seems that two different forms occur within the state of Roraima (*septentrionalis* and *esmeladae*), which segregate geographically and possibly by habitat (Naka *et al.* 2006). All specimens from the park seem to be *esmeraldae*. We found this species to be fairly common along the Estrada Perdida, in *campinas* adjacent to Iruá and Anauá rivers, as well as in the open savannas of Vista Alegre.

#### Spot-tailed Nightjar (*Hydropsalis maculicaudus*)

This species is patchily distributed in South America and its seasonal movements are poorly understood; some populations are sedentary, while others are likely migratory (Cleere & Bonan 2013). In March 2008, we recorded this nightjar daily in the *campinas* along the Estrada Perdida. These represent the only known records for the park, suggesting possible seasonal movements in

the region. The same pattern has been observed in central Amazonia (MCH pers. obs.), although populations known to be resident are found along the lower Rio Amazonas (Arizmendi *et al.* 2013). While it inhabits open habitats, its presence in sandy-soil *campina* is poorly documented.

#### Barbets (*Capito* spp.)

Two species of *Capito* barbets occur in Roraima and they are thought to replace parapatrically along the Rio Branco (Naka *et al.* 2006, 2012). Similar to the pattern followed by *Pyrilia* parrots (see below), we only recorded *C. niger* (a Guianan endemic) in *terra-firme* forest around Serra do Viruá, while *C. auratus* was regularly present on islands covered with *várzea* forest along the Rio Branco, just opposite the park boundaries.

#### White-bellied Piculet (*Picumnus spilogaster*)

The White-bellied Piculet (Figure 4) has a relatively narrow range in northern South America. It only occurs in Brazil in Roraima and at the mouth of Rio Amazonas, near Belém (Winkler & Christie 2002), where the population may represent another taxon (Lees *et al.* 2014). This species was previously considered a gallery forest specialist, restricted to riparian vegetation along rivers, and patches of deciduous forests in the savannas of northern Roraima (Naka *et al.* 2007). On 23 March 2008, we collected one individual of this species at Ilha do Palhal on the Rio Branco. Another specimen was collected at Ilha do Ajarani in September 2012. These specimens represent the southernmost records of the nominate form along the Rio Branco, and the first evidence that it also occurs in *várzea* forests.



FIGURE 4. White-bellied Piculet (*Picumnus spilogaster*) at Ilha do Ajarani in the Rio Branco (T.O.L.)

#### Parrots (*Pyrilia* spp.)

Two species of *Pyrilia* parrots occur in Roraima, and although they are thought to replace parapatrically along the Rio Branco (Naka *et al.* 2006, 2012), we observed and tape-recorded both Caica *P. caica* and Orange-checked *P. barrabandi* Parrots in VNP. Nevertheless, the Caica Parrot (a Guianan endemic) was recorded exclusively in the *terra-*

*firme* forest around Serra do Viruá, whereas the Orange-cheeked Parrot (a widespread western Amazonian species) occurred in the *várzea* forest along the Rio Branco and the lower Rio Anauá. The presence of *P. barrabandi* east of the Rio Branco represents an exception to the observed pattern of western elements being restricted to the west bank of the Rio Branco (Naka *et al.*, 2006). Although both species co-occur in the park, they seem to segregate ecologically.

#### Black-throated Antshrike (*Frederickena viridis*)

The Black-throated Antshrike (Figure 5) is a relatively uncommon understory Guianan endemic, that until recently was only known from a single record for the entire state of Roraima (Naka *et al.* 2006). In 2007, we recorded a male in a *terra-firme* forest at ~7 km from the park's boundaries (1°39'20"N, 61°2'14"W), but in December 2012 and August 2013, we voice-recorded and photographed a female in the *terra-firme* forest along the Buritizal Trail, near the park headquarters, and in February 2014 we found another individual at the Estrada do Neri. These are the only records of this species in VNP, and the third known locality for Roraima.



FIGURE 5. Black-throated Antshrike (*Frederickena viridis*) around the Serra do Viruá (T.O.L.)

#### Klages's Antwren (*Myrmotherula klagesi*)

This species (Figure 6) is a range-restricted, Near Threatened (BirdLife International 2014), seasonally flooded forest specialist (Zimmer & Isler 2003). Although it was only recently added to the state of Roraima list (Naka *et al.* 2006), it is a common inhabitant of the *várzea* forests along the entire lower Rio Branco (LNN and TOL, unpublished data), where it occurs on river islands and forested margins (Naka *et al.* 2007). We documented its presence in the park along the eastern bank of the river, from Vista Alegre (possibly the northernmost locality of its entire distribution) to the mouth of the Rio Anauá (at the southern edge of the park). Despite its threatened status, there is no evidence of habitat loss or population decline in the region, although modification of the habitat by the proposed dam will reduce the *várzea* habitat upon



which it relies, and will likely have negative consequences for the Rio Branco populations of this species.



**FIGURE 6.** Klages's Antwren (*Myrmotherula klagesi*) at an unnamed island in the Rio Branco (T.O.L.)

#### **Leaden Antwren (*Myrmotherula assimilis*)**

This is a *várzea* forest specialist is restricted to the understory and mid-story of both river islands and forested river edges along some of the largest rivers in the Amazon basin (Zimmer and Isler 2003). It was only recently found to occur along the Rio Branco (Naka *et al.* 2007). We voice-recorded and collected this species on several river islands along the Rio Branco. On 6 October 2006 and 1 April 2008 we found this species in VNP, near the confluence of this river and the Rio Anauá, representing the northernmost records of this species.

#### **Rio Branco Antbird (*Cercomacra carbonaria*)**

The Rio Branco Antbird (Figure 7) is a range-restricted Rio Branco near-endemic, which is currently considered Critically Endangered (Vale *et al.* 2007; BirdLife International 2014). We commonly recorded this antbird on river islands and more rarely along the margins of the Rio Branco, from Vista Alegre to the Rio Anauá. Previous records extended its known distribution more than 300 km southward (Naka *et al.* 2007). Although it is relatively common in suitable habitat, habitat modifications



**FIGURE 7.** Rio Branco Antbird (*Cercomacra carbonaria*) at Ilha do Palhal in the Rio Branco (T.O.L.)

due to the construction of the proposed dam will have consequences on the global population of this species, which occurs along the Rio Branco and a few of its tributaries.

#### **Yapacana Antbird (*Aprositornis disjuncta*)**

This range-restricted, monotypic antbird (Figure 8) is known from a handful of localities in northern Amazonia (Zimmer & Isler 2003). We first recorded this *campina* specialist in VNP in May 2001, and it has been recorded regularly in different localities along the Estrada Perdida and near the Rio Anauá ever since. VNP remains the only known locality of this taxon in Roraima, and only the second Brazilian site.



**FIGURE 8.** Yapacana Antbird (*Aprositornis disjuncta*) in the campinaranas around the Estrada Perdida (T.O.L.)

#### **Fuscous Flycatcher (*Cnemotriccus fuscatus*)**

This widespread understory tyrant likely represents several biological species, which taxonomic status is currently under investigation (MCH and collaborators, unpublished data). Two forms of this polytypic species are present at VNP: the form *fumosus* is commonly found along the Rio Branco, particularly (although not exclusively) in *várzea* forest, whereas the form *duidae* has been found in the *campinas* along the Estrada Perdida.

#### **Pale-bellied Mourner (*Rhytipterna immunda*)**

This poorly known, sandy-soil specialist was found to be uncommon in the *campinaranas* associated with the Anauá, Iruá, and Barauana rivers, as well as along the Estrada Perdida. The species was only recently reported to occur in Roraima (Naka *et al.* 2006) and are still only a handful of records. We found this species on only five occasions, despite many days of fieldwork in apparently suitable habitat, suggesting that it is indeed uncommon (or very local) as suggested for other regions, such as neighboring Venezuela (Hilty 2003).

#### **White Bellbird (*Procnias albus*)**

This remarkable species is known to occur in northern Amazonia, but its distribution and seasonal patterns

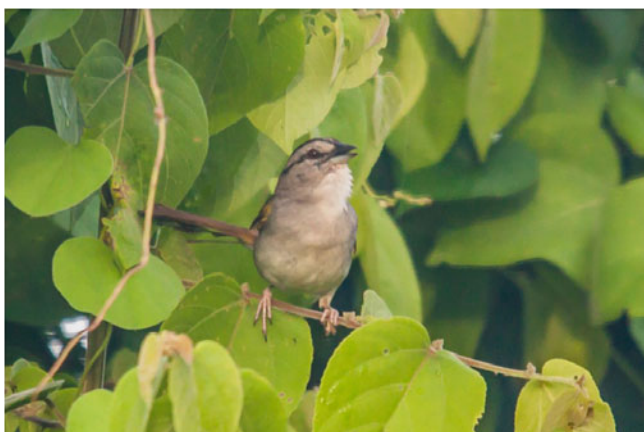
remain poorly understood (Snow 2004). We observed and heard this species in *terra-firme* forest around the Serra do Viruá and at Igarapé do Aliança in October 2006 and October 2012, respectively. The species had not been reported for the Rio Branco region before, and few records for Roraima are available (Naka et al. 2006). It seems quite possible that this species is only seasonally present in the park, but we cannot refute the hypothesis that birds are residents but go silent during the rest of the year. Year-round surveys may contribute to the understanding of this species' seasonal patterns in the region.

#### **Large-billed Seed-Finch (*Sporophila crassirostris*)**

A relatively widespread species in northern South America, yet very uncommon in Brazil (Jaramillo 2011). In the state of Roraima, it is only known from a couple of localities (Naka et al. 2006). On March and April 2008, we recorded and collected this species in an open sandy soil *campina* along the Estrada Perdida. In Brazil, there are very few recent records and the species has been up-listed to Vulnerable on the national Red List (ICMBio 2014). The species is common in captivity in Boa Vista (TOL pers. obs.).

#### **Black-striped Sparrow (*Arremonops conirostris*)**

Although this species (Figure 9) is widespread in northern South America and southern Central America, the state of Roraima represents the only known area of occurrence in Brazil. We recorded this species in VNP during our surveys in early successional vegetation on islands along the Rio Branco. The population in Roraima seems to represent the nominate form, which is isolated from the main distribution of the species in northern South America (Hilty 2003).



**FIGURE 9.** Black-striped Sparrow (*Arremonops conirostris*) at Ilha do Aliança in the Rio Branco (T.O.L.)

#### **Yellow Oriole (*Icterus nigrogularis*)**

The Yellow Oriole is known from northern South America (Hilty 2003), reaching Brazil in a few localities north of the Rio Amazonas. In Roraima, this species is quite common on the Roraima-Rupununi savannas,

but becomes rarer further south. On 22 March 2008, we voice-recorded and collected this bird in the *campinaranas* along the Estrada do Preto. This is the only record for VNP. Although it occurs in a variety of open habitats, including urban areas around Boa Vista and other towns, its presence in sandy soils remain poorly documented.

## **DISCUSSION**

### **Avian diversity**

With over 500 bird species recorded, Viruá National Park and its adjacent areas harbors an unexpectedly species-rich avifauna, which includes more than 70% of all bird species recorded in the Brazilian state of Roraima (Naka et al. 2006). This is particularly impressive, given the almost negligible altitudinal range within the park, which ranges from 50 m to 360 m, and that most of the park is located on top of sandy soils. The high avian diversity found in VNP is likely due to both biogeographic- and local-scale processes.

At a biogeographical scale, VNP is located at the confluence of different biogeographical regions (see **Biogeographical affinities** below). It includes a described contact zone for *terra-firme* forest birds (Naka 2011), an ecotone region of flooded forests (*várzea* and gallery forest; Naka et al. 2007) and a transition zone between open areas (savanna and *campina*). The Rio Branco, which dissects the state in an eastern and western half, represents one of the most important biogeographical barriers in the Amazonia for birds (Naka et al. 2012). In addition, because of its latitude, VNP receives migratory birds from both northern and southern South America, although these are responsible for only 7% (45 species) of the total.

Locally, there are extremely high levels of environmental complexity within and between habitats. *Terra-firme* forests are known to have the greatest species richness anywhere in Amazonia (Cohn-Haft et al. 1997) and *várzea* and *igapó* are also very rich (Rosenberg 1990; Cohn-Haft et al. 2007b; Borges & Almeida 2011). Seasonally flooded forests (where, in fact, we found more species; see Table 3), in particular, have a variety of successional stages that result in the occurrence of many specialized birds, which inhabit different microhabitats (Remsen & Parker 1983; Rosenberg 1990; Borges & Carvalhes 2000). Also, species from adjacent *terra-firme* forest (e.g., *Dendrocincla fuligionsa*, *Formicarius colma*) may explore tall *várzea* and *igapó* during dry periods (Beja et al. 2010). Sandy soil habitats (*campina* and *campinarana*) have a lower number of species, but add many unique ones to the park (Borges 2004). A similar pattern is observed for the savannas and aquatic environments. As the bird communities among habitats

are, in general, distinct, the total avian diversity is very high.

Our results also show that the avian richness of VNP is higher than expected (almost 100 species more) given known large-scale patterns of species richness (see Rahbek & Graves 2001; Bass *et al.* 2010; Jetz *et al.* 2012). Although avian species richness in Amazonia seems to increase westwards to the Andes (Cohn-Haft *et al.* 1997; Rahbek & Graves 2001), previous studies may have neglected the contribution of sandy soil and flooded forests to avian diversity in the Guianan Shield. In fact, areas with > 500 bird species are starting to appear throughout the Brazilian Amazon (Pacheco *et al.* 2007; Somenzari *et al.* 2011; Lees *et al.* 2013a,b), also contradicting the overall species richness pattern. More attention to microhabitats and a better knowledge of avian vocalizations may be responsible for these increasing numbers.

Despite our efforts, it is likely that the bird list of VNP will continue to grow. After 13 years since we first visited the park, we continue to find new species in the area (see Figure 10), even in heavily surveyed sites (e.g., Serra do Viruá). We believe that at least 20 more bird species are very likely to be found in the park with further sampling, and another 50-60 species could potentially be found within the park boundaries (Appendix B). Therefore, we believe that VNP and its adjacent areas will likely reach 550 bird species in the next few years.

On the other hand, some species that were expected to occur within the park seem to be absent. More than 20 species that are common and easily detectable in the

*terra-firme* forests north of Manaus (e.g., *Thamnomanes ardesiacus*, *Formicarius analis*, *Corapipo gutturalis*, *Vireolanius leucotis*, *Tangara chilensis*, *Dacnis lineata*) (Cohn-Haft *et al.* 1997), 500 km south of VNP, have not yet been recorded in the park. One possible explanation for their apparent absence is the small proportion of *terra-firme* forest and its naturally fragmented distribution within VNP. Additionally, most of our surveys in *terra-firme* forests were limited to a few sites within the park (Serra do Viruá). It is possible that exploring new areas within the park's forests, some of those absent species may finally appear. The apparent rarity of some species in VNP (e.g., *Piaya melanogaster*, *Saltator grossus*), suggests that many *terra-firme* forest birds may be indeed rare and very local, and therefore including new sampling areas may significantly enhance the chances of finding more bird species.

### Biogeographical affinities

VNP is located entirely on the eastern bank of the Rio Branco, and therefore has a typical Guianan avifauna in the *terra-firme* forest, including 71 Guianan endemic taxa (26 species and 45 subspecies). In fact, 12 endemic species and 20 endemic subspecies are restricted to the eastern side of the Rio Branco (Table 4). On the other hand, another three species not considered Guianan endemics seem to be absent west of the Rio Branco in Roraima (*Microrhopias quixensis*, *Cercomacra laeta*, and *Cercomacra nigrescens*). Whether these absences are real or a function

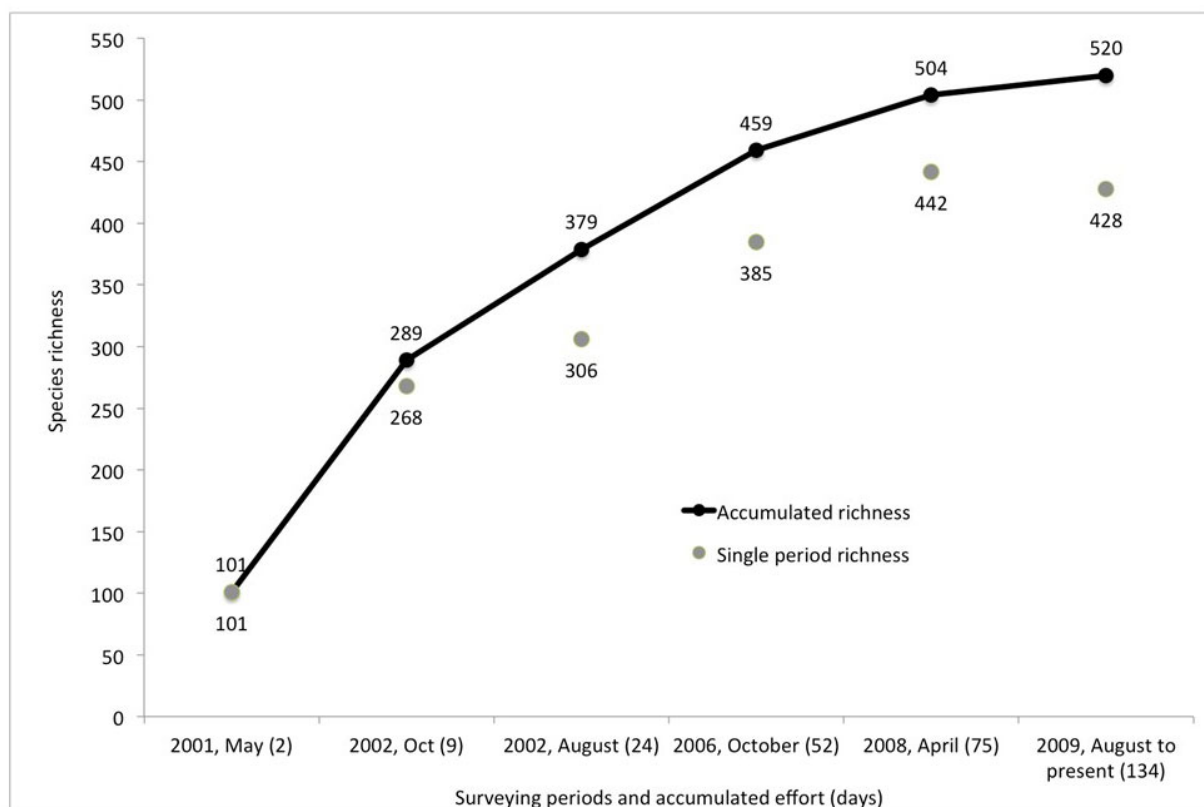


FIGURE 10. Increase in total bird species detected during key inventory dates at Viruá National Park and adjacent areas.

of lack of sampling remains to be evaluated. Despite being entirely within the Guianan Area of Endemism, we have mapped some contact zones in the study area, such as for a pair of parrots in the genus *Pyrilia* (*caica* and *barrabandi*) and a pair of barbets in the genus *Capito* (*auratus* and *niger*).

The *várzeas* along the Rio Branco are particularly interesting. Typical *várzea* species (known from most of the Amazon basin) are present, such as *Thamnophilus nigrocinereus*, *Myrmotherula assimilis*, *Myrmoborus lugubris*, and *Dendroplex kienerii* (Table 4). The avian communities found along these *várzeas* seem to be quite similar to those found on the Anavilhanas archipelago on the lower Rio Negro (Cintra et al. 2007). On the other hand, a handful of white-water (muddy) river specialists that are apparently absent from the Rio Negro are present in isolated populations along the Rio Branco (see Naka et al. 2007), as well as on the river islands just opposite the park boundaries (Table 4). For flooded-forest birds, the Rio Branco also represents an ecological ecotone, which influences bird species composition. The Rio Branco runs along a latitudinal gradient, which goes from the savannas (around Boa Vista) into the forest realm (south of Caracará). Along its margins, gallery forests on the upper Rio Branco are replaced by *várzeas* further south, and this replacement seems to occur near VNP (Naka et al. 2007). Therefore, although the vegetation of the Rio Branco is composed of *várzea* forests along VNP, some gallery forest specialists are still found near the park's boundaries, such as *Picumnus spilogaster*, *Hylophilus pectoralis*, and *Turdus nudigenis* (Table 4).

The *campinas* and *campinaranas* host a typical sandy-soil avifauna, similar to that present in other localities in northwestern Amazonia, such as Jaú NP in Brazil (Borges 2004), or Campamento Junglaven in Venezuela (Zimmer & Hilty 1997). Typical white-sand forest birds include *Myrmotherula cherriei*, *Aprositornis disjuncta*, *Elaenia ruficeps*, and *Dolospingus fringilloides*, among others (Table 4). Although savannas are virtually absent in the park, present only near the village of Vista Alegre, we found a group of species that are generally restricted to the savannas of northern Roraima inhabiting the *campinas* in the park (Naka et al. 2006; Santos & Silva 2007). The presence of savanna species such as *Colinus cristatus*, *Sporophila intermedia*, *Sporophila crassirostris*, and *Icterus nigrogularis* may simply be due to a 'leakage' from the nearby savannas. In fact, VNP may represent the southern limit of the distribution of some of these species. Other avian elements in the *campinas* include species that are widely distributed in open areas in South America and predominantly absent in Amazonia, such as *Chordeiles pusillus*, *Hemitriccus margaritaceiventer*, *Tangara cayana*, and *Geothlypis aequinoctialis*. Most of these species are polytypic and their populations in VNP deserve genetic and taxonomic studies.

### Conservation, implications for management, and future research

Although VNP is part of a large mosaic of protected areas, current agricultural and forestry developments around the park are of concern. Currently, southern Roraima is under severe threat from deforestation (Soares-Filho et al. 2006; Campos 2011). With more than 200,000 ha, VNP offers significant protection for the biodiversity found in the state, including several threatened bird species. Within the park, very few areas have been modified and the park seems to be large enough to hold stable populations of threatened and non-threatened species. However, the connectivity of the park with other healthy natural vegetation communities is necessary for maintaining large-scale ecological and evolutionary processes. The proposal to expand the park boundaries (MMA 2010) moves toward this goal and also, importantly, reinforces the protection of 55 bird species that we found exclusively in the requested expansion areas (Appendix A).

The construction of a hydroelectric dam on the Rio Branco, only 30 km north of the park's boundaries represents a serious threat to riverine bird species, some of which are range-restricted and threatened (e.g., *C. carbonaria* and *Myrmotherula klagesi*; Appendix A; Vale et al. 2008; Bird et al. 2012). Studies to assess the population status and vulnerability of these riverine bird species are urgently needed. Besides the direct loss of habitat due to flooding above the dam (which would likely not affect VNP directly), hydroelectric dams affect the flood pulse of the river, which will affect the existence and formation of river-created habitats (Junk & Mello 1990), especially river islands (Remsen and Parker 1983). River islands, which shelter a unique avifauna (Rosenberg 1990), including 16 exclusive species in the study area, are outside the boundaries of VNP, and lack any legal protection. Because of their ephemeral nature, there is an urgent need to categorically protect river islands in Amazonia, independent of their geographic location (Cohn-Haft et al. 2007b).

Maintaining habitats in VNP for threatened and range-restricted birds is also important because these species attract bird watchers and ecotourists. VNP offers easy access to sandy-soil habitats (*campinas* and *campinaranas*) and to flooded forests, where most of these rare species can be readily found (Laranjeiras & Naka 2014). Moreover, a network of trails within the Park offers access to all of the diverse habitats found within the region, allowing the observation of a great variety of birds in a single day. If promoted properly, ecotourism could become a major force helping conservation and economic development in the region.

Finally, our results show that VNP and adjacent areas represent an important site to learn more about

ecological and biogeographical processes in Amazonia. The presence of species from distinct biogeographical regions demonstrates that VNP lies in a significant contact zone for avian species (Naka *et al.* 2012). Distributions of other taxa should be explored, to determine whether the

park's region plays a similar role for groups other than birds. The park also hosts multiple large-scale ecotones, as well as a variety of habitats that influence local diversity. The absence of several *terra-firme* forest species deserves further attention. Isolated populations of *várzea*

**TABLE 4.** Species from distinct biogeographical regions found at Viruá National Park and adjacent areas, listed by their habitat association.

**Terra-firme (26 species): Guianan endemic species. \*species that are restrict to the east side of rio Branco**

<i>Crax alector</i>	<i>Veniliornis cassini</i>	<i>Xiphorhynchus pardalotus</i>
<i>Penelope marail</i>	<i>Epinecrophylla gutturalis*</i>	<i>Campylorhamphus procurvoides*</i>
<i>Psophia crepitans</i>	<i>Myrmotherula surinamensis*</i>	<i>Lepidocolaptes albolineatus*</i>
<i>Pyrilia caica*</i>	<i>Myrmotherula guttata</i>	<i>Schiffornis olivacea*</i>
<i>Notharchus macrorhynchos*</i>	<i>Frederickena viridis</i>	<i>Perissocephalus tricolor</i>
<i>Monasa atra</i>	<i>Myrmelastes leucostigma*</i>	<i>Todirostrum pictum</i>
<i>Capito niger*</i>	<i>Percnostola subcristata*</i>	<i>Zimmerius acer</i>
<i>Selenidera piperivora*</i>	<i>Hypocnemis cantator*</i>	<i>Cyanocorax cayanus</i>
<i>Pteroglossus viridis</i>	<i>Gymnopithys rufigula</i>	

**Campina (7 species): Northwestern Amazonia typical species. \*also found in scattered sites southeastward in Amazonia.**

<i>Elaenia ruficeps*</i>	<i>Myrmotherula cherriei</i>	<i>Hemitriccus inornatus*</i>
<i>Euphonia plumbea</i>	<i>Heterocercus flavivertex</i>	<i>Dolospingus fringilloides*</i>
<i>Aprositornis disjuncta</i>		

**Campina (8 species): Species from northern South America, absent in most of Amazonia but present in northern Roraima open savannas**

<i>Colinus cristatus</i>	<i>Mimus gilvus</i>	<i>Sporophila crassirostris</i>
<i>Hydropsalis cayennensis</i>	<i>Sporophila intermedia</i>	<i>Icterus nigrogularis</i>
<i>Fluvicola pica</i>	<i>Sporophila minuta</i>	

**Campina (10 species): Species that are widely or disjunctly distributed in South America (and absent in most of Amazonia)**

<i>Diopsittaca nobilis</i>	<i>Tangara cayana</i>	<i>Sporophila plumbea</i>
<i>Chordeiles pusillus</i>	<i>Schistochlamys melanopis</i>	<i>Sporophila nigricolis</i>
<i>Todirostrum cinereum</i>	<i>Emberizoides herbicola</i>	<i>Geothlypis aequinoctialis</i>
<i>Hemitriccus margaritaceiventer</i>		

**Várzea (7 species): Typical species of Amazonian seasonally flooded forest (*várzea* and *igapó*) and generally absent in northern Amazonia. \* Species exclusively present in *igapó*.**

<i>Myrmotherula klagesi</i>	<i>Myrmoborus lugubris</i>	<i>Inezia subflava*</i>
<i>Myrmotherula assimilis</i>	<i>Dendroplex kienerii</i>	
<i>Thamnophilus nigrocinereus</i>	<i>Hemitriccus minor</i>	

**Várzea (5 species): White-water river *várzea* specialists (absent in lower Rio Negro)**

<i>Mazaria propinqua</i>	<i>Stigmatura napensis</i>	<i>Conirostrum bicolor</i>
<i>Synallaxis gujanensis</i>	<i>Serpophaga hypoleuca</i>	

**Várzea (7 species): Species absent in most part of Amazonia but present in northern Roraima gallery forests**

<i>Picumnus spilogaster</i>	<i>Turdus leucomelas</i>	<i>Arremonops conirostris</i>
<i>Poecilotriccus sylvia</i>	<i>Turdus nudigenis</i>	<i>Conirostrum speciosum</i>
<i>Hylophilus pectoralis</i>		

**Várzea (9 species): Species predominantly restricted to western Amazonia, and absent east of Rio Branco. \*Also found in southeastern Amazonia**

<i>Phaethornis hispidus</i>	<i>Celeus grammicus*</i>	<i>Cyanocorax violaceus</i>
<i>Capito auratus</i>	<i>Pyrilia barrabandi</i>	<i>Dacnis flaviventer*</i>
<i>Pteroglossus pluricinctus</i>	<i>Pipra filicauda</i>	<i>Psarocolius bifasciatus*</i>

specialists along the Rio Branco also deserve further study, as they may indicate the presence of either old relictual populations or recent long-distance dispersal (Naka *et al.* 2007). Future ornithological research that will help elucidate these questions include investigating patterns of bird occupancy and movement within habitats and between seasons, surveys in isolated and yet unexplored patches of *terra firme* forest, such as Serra do Preto, and systematic surveys along the *várzeas* of the Rio Branco. VNP has great scientific and conservation potential and we hope this detailed study of its avifauna will serve as a starting point to help develop that potential.

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## APPENDIX A:

List of all bird species recorded in the Viruá National Park and adjacent areas, including habitats used, localities of records, migratory and endangered status, and documentation. Taxonomy and species nomenclature follow the Brazilian Ornithological Records Committee (CBRO 2014), except for the Caprimulgidae, the genus *Cerromacra*, the species *Mazaria* (*Synallaxis propinqua*), and the genus *Tachyphonus* and *Eucometis*, where we follow, respectively, Sigurdsson & Cracraft (2014), Tello *et al.* (2014), Claramunt (2014), and Burns *et al.* (2014).

Family / Species	Habitat <sup>1</sup>	Locality <sup>2</sup>	Abu. <sup>3</sup>	Status <sup>4</sup>	Specimen <sup>5</sup>	Voice <sup>6</sup>	Photo <sup>7</sup>
<b>Tinamidae</b>							
<i>Tinamus major</i>	Tf, Vz, Ig	sv, al, ip, an, ri, ca, ba, va	C	NT		T.O.L.	WA 51601
<i>Crypturellus cinereus</i>	Tf, Vz	sv, ep, al, ip, ca, ba	C			T.O.L.	
<i>Crypturellus soui</i>	Cm, Vz, Ig	sv, ep, al, an, ri, ca, va	C			T.O.L.	
<i>Crypturellus undulatus</i>	Vz, Ig	al, ip, an, ca, va	C			WA 417150	
<i>Crypturellus erythropus</i>	Tf	sv	U				
<b>Anatidae</b>							
<i>Dendrocygna viduata</i>	Aq	al	R				
<i>Dendrocygna autumnalis</i>	Aq	al	R				
<i>Neochen jubata</i>	Aq	ip, an, out	U	NT, (DD)		XC 138968	WA 261937
<i>Cairina moschata</i>	Aq, At	ep, al, ip, an, ri, ca, ba	C				WA 618182
<i>Anas discors</i>	Aq, At	ep, out	R	NEA			WA 570953
<b>Cracidae</b>							
<i>Penelope marai</i>	Tf	sv, al, ba	U		MPEG 56256	XC 138892	WA 827866
<i>Aburria cumanensis</i>	Vz, Ig	ip, an, ba	U	VU			WA 8875
<i>Ortalis motmot</i>	Cm, Tf, Vz, Ig, Sv	all localities	C		MPEG 56257	ML (C.B.A.)	WA 281360
<i>Grax alector</i>	Tf	sv	C	VU			WA 181578
<i>Pauxi tomentosa</i>	Cp, Cm, Tf, Vz, Ig	ep, al, ip, an, ri, ca, ba	C	NT			
<b>Odontophoridae</b>							
<i>Colinus cristatus</i>	Cp, At	ep, ca	C				WA 181253
<i>Odontophorus gujanensis</i>	Tf	sv, ba	R	NT	INPA 1453		
<b>Podicipedidae</b>							
<i>Tachybaptus dominicus</i>	Aq	va, out	R				
<b>Ciconiidae</b>							
<i>Ciconia maguari</i>	Cp, Aq, At	ep, al, ip, ri, ca	U	INT?			WA 252860
<i>Jabiru mycteria</i>	Cp, Aq, At	ep, ri, ca, ba	C	INT?			WA 72044
<i>Mycteria americana</i>	Cp, Aq, At	ep, al, ip	C	INT?			WA 825390
<b>Phalacrocoracidae</b>							
<i>Phalacrocorax brasilianus</i>	Aq	al	U				

Family / Species	Habitat <sup>1</sup>	Locality <sup>2</sup>	Abu. <sup>3</sup>	Status <sup>4</sup>	Specimen <sup>5</sup>	Voice <sup>6</sup>	Photo <sup>7</sup>
<b>Anhingidae</b>							
<i>Anhinga anhinga</i>	Aq	al, ip, an, ri, ca	C				WA 17675
<b>Ardeidae</b>							
<i>Tigrisoma lineatum</i>	Aq, At	sv, ep, an, ca, ba	C			T.O.L.	WA 252499 WA 8845
<i>Agamia agami</i>	Vz, Aq	ip, ba, out	R	VU	INPA A2254		
<i>Cochlearius cochlearius</i>	Vz, Aq	al, an, ba	U		INPA A2223		
<i>Zebrilus undulatus</i>	Aq, Vz-is	al, out	R	NT	INPA 1536		
<i>Nycticorax nycticorax</i>	Aq	ep, sv	R			JPC	
<i>Butorides striata</i>	Vz, Ig, Aq, At	sv, ep, al, ip, an, ri, ca, ba	C		MPEG A8310		WA 197826
<i>Bubulcus ibis</i>	Sv, At	sv, al, va	U				WA 252850
<i>Ardea cocoi</i>	Sv, Aq, At	ep, al, ip, an, ri, ca, ba, va	C				
<i>Ardea alba</i>	Sv, Aq, At	ep, al, ip, an, ca, ba, va	C				
<i>Pilherodius pileatus</i>	Vz, Ig, Aq	sv, ep, al, ip, an, ri, ca, ba	C				WA 818983
<i>Egretta thula</i>	Aq	ep, al, ip, an, ri, ca, ba	C				
<i>Egretta caerulea</i>	Aq	al, an, ca	U				WA 19190
<b>Threskiornithidae</b>							
<i>Mesembrinibis cayennensis</i>	Cm, Vz, Ig, Aq, At	ep, al, an, ri, ca, ba	C				WA 219890
<i>Platalea ajaja</i>	Aq	al, ca	C				WA 8876
<b>Cathartidae</b>							
<i>Cathartes aura</i>	Cp, Cm, Sv, At	all localities	C				WA 815007
<i>Cathartes burrovianus</i>	Cp, At	ep, ca, ba	C				WA 1306894
<i>Cathartes melambrotus</i>	Tf	sv, al, ba, va	C				WA 813219
<i>Coragyps atratus</i>	Cp, Cm, Vz, Ig, Sv, At	all localities	C				WA 181365
<i>Sarconampus papa</i>	Tf	sv, ba	U				WA 34400
<b>Pandionidae</b>							
<i>Pandion haliaetus</i>	Vz, Ig, Aq	sv, al, ip, an, ri, ca, ba	C	NEA			WA 825371
<b>Accipitridae</b>							
<i>Leptodon cayanensis</i>	Cm	ep, out	R				WA 618194
<i>Elanoides forficatus</i>	Tf, Vz	sv, al, ba	U	INT?			WA 781925
<i>Gampsonyx swainsonii</i>	Cp, At	ep, ba, out	U			WA 62869	WA 866635
<i>Harpagus bidentatus</i>	Tf	sv	U			T.O.L.	WA 51625
<i>Ictinia plumbea</i>	Cm, Vz, Ig, Sv	ep, al, ip, an, ba, va	C	NEA			WA 181591
<i>Busarellus nigricollis</i>	Vz, Ig, Aq, At	ep, al, an, ba	C				WA 252507
<i>Rostrhamus sociabilis</i>	Vz	al	R				
<i>Geranopsiza caerulescens</i>	Vz, Ig	ep, al, ri, ca, ba	C				

Family / Species	Habitat <sup>1</sup>	Locality <sup>2</sup>	Abu. <sup>3</sup>	Status <sup>4</sup>	Specimen <sup>5</sup>	Voice <sup>6</sup>	Photo <sup>7</sup>
<i>Buteogallus schistaceus</i>	Vz	al, ip	U		INPA 1538		WA 6070
<i>Heterospizias meridionalis</i>	Cp, Cm, Aq, At	sv, ep, ca, ba	C				WA 21336
<i>Urubitinga urubitinga</i>	Cm, Tf, Vz, Ig	sv, ep, al, ip, an, ri, ca, ba	C				WA 178577
<i>Rupornis magnirostris</i>	All habitats	all localities	C		MPEG 56253	T.O.L.	WA 284083
<i>Geranoaetus albicaudatus</i>	Cp	ep, out	R		MPEG 56252		
<i>Pseudastur albicollis</i>	Tf	sv	R				PNV
<i>Leucopternis melanops</i>	Tf	sv, ba	U			WA 48648	
<i>Buteo nitidus</i>	Vz	al, ip, an, ba	C				WA 12421
<i>Buteo platypterus</i>	Tf	sv	R	NEA			WA 820557
<i>Buteo brachyurus</i>	Cp	ca	R				WA 410906
<i>Morphnus guianensis</i>	Tf	sv, al	R	NT, (VU)			WA 35751
<i>Harpia harpyja</i>	Tf	sv	R	NT, (VU)		ML (C.B.A.)	
<i>Spizaetus tyrannus</i>	Tf, Vz	sv, ep, al, ip, ba	U				
<i>Spizaetus melanoleucus</i>	Vz	ip	R				WA 261943
<i>Spizaetus ornatus</i>	Tf	sv	R	NT			
<b>Eurypygidae</b>							
<i>Eurypyga belias</i>	Cm, Vz, Ig, Aq	ep, al, ip, an, ri, ca, ba	C			T.O.L.	WA 872563
<b>Aramidae</b>							
<i>Aramus guanana</i>	Aq, At	ep, al, an	C				WA 19191
<b>Psophidae</b>							
<i>Psophia crepitans</i>	Tf	sv, ba	C		MPEG 56259	ML (C.B.A.)	WA 202090
<b>Rallidae</b>							
<i>Aramides cajaneus</i>	Tf, Sv, Aq, At	sv, va	U			ML (C.B.A.)	WA 219856
<i>Laterallus viridis</i>	Aq, At	sv, ep	U			ML (C.B.A.)	
<i>Laterallus exilis</i>	Aq, At	ep, out	R				
<i>Porzana albicollis</i>	Aq, At	ep, al, ba	U			ML (L.N.N.)	
<i>Porphyrio martinicus</i>	Aq, Vz-is	al, out	R				
<i>Porphyrio flavirostris</i>	Aq	ep, out	R			M.C.H.	
<b>Helionithidae</b>							
<i>Helionis fulica</i>	Aq	al, ba	R		MPEG 56267		
<b>Charadriidae</b>							
<i>Vanellus cayanus</i>	Cp, Aq, At	ep, al, ip, an, ri, ca, ba	C				WA 816641
<i>Vanellus chilensis</i>	Cp, Aq, At	sv, ep, al, ca, va	C			WA 63056	
<i>Charadrius collaris</i>	Aq	al, ip, an, ca	C		INPA A2176	ML (C.B.A.)	WA 287883

Family / Species	Habitat <sup>1</sup>	Locality <sup>2</sup>	Abu. <sup>3</sup>	Status <sup>4</sup>	Specimen <sup>5</sup>	Voice <sup>6</sup>	Photo <sup>7</sup>
<b>Scolopacidae</b>							
<i>Gallinago paraguayae</i>	Cp, Aq	ep, ri	R			ML (L.N.N.)	WA 828969
<i>Gallinago undulata</i>	Cp, Aq	ep, out	R			JPC	
<i>Bartramia longicauda</i>	Cp	ba, out	R	NEA			
<i>Actitis macularius</i>	Aq, At	ep, al, ip, ri, ca, ba	U	NEA	MPEG 56268		WA 15157
<i>Tringa solitaria</i>	Aq, At	ep, ri, ca, ba	C	NEA		ML (C.B.A.)	WA 812251
<i>Tringa melanoleuca</i>	Aq, At	ep, al, ip, ri	U	NEA			WA 281359
<i>Tringa flavipes</i>	Aq, At	ip, ri	R	NEA	INPA A2202		WA 15675
<i>Calidris minutilla</i>	Aq	al, ip, ri	R	NEA			
<i>Calidris fuscicollis</i>	Aq	al	R	NEA			
<i>Calidris melanotos</i>	Aq	al, ip	R	NEA	INPA A8312		WA 866340
<b>Jacaniidae</b>							
<i>Jacana jacana</i>	Sv, Aq, At	sv, ep, al, ba, va	C				WA 195585
<b>Sternidae</b>							
<i>Sterna superciliaris</i>	Aq	ep, al, ip, an, ri, ca	C				WA 272934
<i>Phaethon simplex</i>	Aq	ep, al, ip, an, ri, ca	C				WA 252542
<b>Rynchopidae</b>							
<i>Rynchops niger</i>	Aq	al, ip, an, ri, ca	C				WA 862787
<b>Columbidae</b>							
<i>Columbina passerina</i>	Cp, Cm, Vz, At	sv, ep, ca, ba	C		INPA A1022		WA 281416
<i>Columbina minuta</i>	Cp, Cm	ep, ba, out	R				
<i>Columbina talpacoti</i>	At	ba, out	C				
<i>Claravis pretiosa</i>	Vz	ba, out	R			ML (C.B.A.)	WA 181582
<i>Patagioenas speciosa</i>	Cm, Vz, Ig, Sv	all localities	C			ML (C.B.A.)	WA 219857
<i>Patagioenas cayennensis</i>	All habitats	all localities	C			T.O.L.	WA 410882
<i>Patagioenas plumbea</i>	Tf, Vz	sv, ca, ba, va	C			ML (C.B.A.)	WA 1255218
<i>Patagioenas subvinacea</i>	Cm, Tf, Vz, Ig	sv, al, an, ri, ca, ba, va	C	VU	MPEG A8295		
<i>Leptotila verreauxi</i>	Vz	al, ip, an, ba	C		MPEG 56266		
<i>Leptotila rufaxilla</i>	Cm, Tf, Vz, Ig, At	sv, al, ip, an, ri, ca, ba	C		INPA 1527	ML (C.B.A.)	
<i>Geotrygon montana</i>	Tf, Vz	sv, al, ip	C		INPA A2110		WA 45327
<b>Opisthocomidae</b>							
<i>Opisthocomus boazin</i>	Vz	al, ca, ba	C		INPA A2080	WA 62971	WA 15158
<b>Cuculidae</b>							
<i>Coccyzus minuta</i>	Tf, Vz	sv, al, an, ca, ba	U		MPEG 56285		

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<i>Piaya cayana</i>	Cp, Cm, Tf, Vz, Ig	all localities	C			ML (C.B.A.)	WA 195582
<i>Piaya melanogaster</i>	Tf	va, out	R				WA 410881
<i>Coccyzus melacoryphus</i>	Ig	ri	R	AUS			
<i>Coccyzus americanus</i>	Cm	ca	R	NEA			WA 639970
<i>Coccyzus euleri</i>	Tf	sv	R	AUS?			WA 326669
<i>Crotophaga major</i>	Vz, Ig	sv, al, ip, ri, ca, ba	C			T.O.L.	
<i>Crotophaga ani</i>	Cp, Vz, Ig, Sv, At	sv, ep, al, ip, ca, ba, va	C			ML (C.B.A.)	WA 188425
<i>Tapera naevia</i>	Cp, Vz	ep, al, ba	C				
<b>Strigidae</b>							
<i>Megascops choliba</i>	Cm, Vz, Ig	ep, al, ip, ri, ca	C		MPEG 56815		WA 854716
<i>Megascops watsonii</i>	Tf	sv, ba, va	C				WA 351967
<i>Lophostrix cristata</i>	Tf	sv	C				
<i>Pulsatrix perspicillata</i>	Tf	sv, ba	U		MPEG 56282		
<i>Bubo virginianus</i>	Cm	ep, out	R		MZUSP 77931	WA 62750	WA 1024047
<i>Strix</i> sp. ( <i>virgata</i> )	Tf, Vz	sv, ep, ip	U			T.O.L.	
<i>Glaucidium hardyi</i>	Tf	sv, ba	U				WA 1295126
<i>Glaucidium brasilianum</i>	Cm	ir	R				
<b>Nyctibiidae</b>							
<i>Nyctibius grandis</i>	Tf	sv, ba	U			T.O.L.	WA 1256913
<i>Nyctibius griseus</i>	Cm, Tf, Ig	sv, ep, ri, ca, ba	C			XC 139202	WA 281361
<b>Carpimulgidae</b>							
<i>Aurostomus rufus</i>	Cm, Tf, Vz	sv, ep, ca	U			T.O.L.	
<i>Lurocalis semitorquata</i>	Cm, Vz	ep, al, ip, ba	C				WA 815037
<i>Nyctiprogne leucopyga</i>	Vz, Ig	al, ip, an, ri, ca, ba	C		INPA 1535	ML (C.B.A.)	WA 180933
<i>Nyctidromus nigrescens</i>	Tf	sv, ba	U			XC 138999	WA 181087
<i>Nyctidromus albicollis</i>	Tf, Aq, At	sv, ep, al, ip, an, ri, ca, ba	C		INPA 1455	ML (C.B.A.)	
<i>Hydropsalis maculicauda</i>	Cp	ep, out	R	AUS?	INPA A1800	ML (C.B.A.)	
<i>Hydropsalis cayennensis</i>	Cp	ep, out	C		INPA 1454	WA 47137	WA 640068
<i>Hydropsalis climacocerca</i>	Vz	al, ip, an, ca, ba	C		INPA 1456	ML (C.B.A.)	WA 9745
<i>Podager nacunda</i>	Aq	ri	R				PNV
<i>Podager pusillus</i>	Cp, Sv, At	sv, ep, ri, ca, va	C		INPA 1533	ML (C.B.A.)	WA 18050
<i>Chordeiles acutipennis</i>	Vz	al	R		INPA 1531		
<b>Apodidae</b>							
<i>Streptoprocne zonaris</i>	Vz	al	R				
<i>Chaetura spinicaudus</i>	Tf, Ig	sv, ca, ba	C				
<i>Chaetura cinereiventris</i>	Ig	al, ri, ba	U				WA 1295119

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<i>Chaetura brachyura</i>	Tf, Vz, Ig, Sv	sv, ep, an, ri, ca, ba, va	C			ML (C.B.A.)	WA 862587
<i>Tachornis squamata</i>	Ig	sv, ep, ri, ca, ba	C			T.O.L.	WA 1066541
<i>Panyptila cayennensis</i>	Tf	sv	R				
<b>Trochilidae</b>							
<i>Glaucis hirsutus</i>	Vz	al, an, ba	U		INPA 1461		
<i>Threnetes leucurus</i>	Tf	sv	R			ML (C.B.A.)	
<i>Phaethornis rufurumii</i>	Cm, Tf, Vz	sv, al, ca, ba, va	C		INPA 1131	ML (C.B.A.)	WA 806659
<i>Phaethornis ruber</i>	Cm, Tf, Vz	sv, al, ip, ca, ba, va	C			ML (C.B.A.)	WA 282800
<i>Phaethornis hispidus</i>	Vz	al, ip	U				
<i>Phaethornis bourcierii</i>	Tf	sv, va	U				
<i>Phaethornis superciliosus</i>	Tf, Vz	sv, ba, va	U		INPA 1133	XC 138943	WA 849680
<i>Campylopterus largipennis</i>	Tf, Ig	ep, al, ri	R				
<i>Florisuga mellivora</i>	Cp, Ig, At	ep, ri, ca	U				WA 205169
<i>Antracothorax nigricollis</i>	Vz, At	al, ba	R				WA 18139
<i>Chrysolampis mosquitus</i>	Cp, Vz, Ig	ep, al, ri, ca	C	INT?	INPA A2077		WA 814605
<i>Chlorostilbon notatus</i>	Cm, Vz, Ig	ep, al, ip, ri, ca	C		INPA A2083		M.F.T.
<i>Chlorostilbon mellisugus</i>	Cp, At	ep, ba, out	U				WA 813210
<i>Thalassania furcata</i>	Tf	sv, ba	U				WA 287337
<i>Hylocharis sapphirina</i>	Cm, Tf	sv, ri	U			ML (L.N.N.)	WA 862680
<i>Hylocharis cyanus</i>	Cm, Tf, Vz	sv, ep, ip, ba	C		INPA 1457	XC 138917	WA 15676
<i>Polytmus theresiae</i>	Cp, Ig	ep, ri, ca	C		INPA 1460	T.V.V.C.	WA 181096
<i>Amazilia versicolor</i>	Vz	al, ca	U		INPA A2134		WA 18140
<i>Amazilia fimbriata</i>	Cp, Cm, Tf, Vz, Ig	sv, ep, al, ri, ca, ba	C		INPA 1462	T.O.L.	WA 326725
<i>Heliothryx auritus</i>	Tf	sv, ba	U				WA 351968
<i>Heliothryx longirostris</i>	Tf	sv, ep, al	R				WA 856773
<i>Calliphlox amethystina</i>	Ig, At	ep, ba, out	R				WA 281362
<b>Trogonidae</b>							
<i>Trogon melanurus</i>	Tf, Vz	sv, va	U		INPA 1137	T.O.L.	WA 827852
<i>Trogon viridis</i>	Cm, Tf, Vz, Ig	all localities	C		INPA 1140	T.O.L.	WA 813899
<i>Trogon violaceus</i>	Cm, Tf	sv, an, ba	C			WA 50045	WA 51626
<i>Trogon rufus</i>	Tf	sv, al	R				
<b>Alcedinidae</b>							
<i>Megasceryle torquata</i>	Vz, Ig, Aq, At	sv, ep, al, ip, an, ri, ca, ba	C		MPEG A8307	T.O.L.	WA 872562
<i>Chloroceryle amazona</i>	Vz, Ig, Aq, At	sv, ep, al, ip, an, ri, ca, ba	C			ML (L.N.N.)	WA 177934
<i>Chloroceryle acnea</i>	Vz, Ig, Aq	ep, al, ip, ri, ca	C		INPA A1002	XC 138856	WA 262713
<i>Chloroceryle americana</i>	Vz, Ig, Aq, At	ep, al, an, ri, ca, ba	C		INPA 1466		WA 221242
<i>Chloroceryle inda</i>	Vz, Ig, Aq	ep, al, ip, ri, ba	U		INPA 1467		WA 219853

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<b>Momotidae</b>							
<i>Momotus momota</i>	Tf, Vz	sv, al, ip, ba, va	C			T.O.L.	WA 866361
<b>Galbulidae</b>							
<i>Brachygalba lugubris</i>	Vz	al, ca, ba	U		INPA A2244	ML (C.B.A.)	WA 8879
<i>Galbula albirostris</i>	Tf	sv	U		INPA 1145	T.O.L.	WA 818444
<i>Galbula galbula</i>	Cp, Cm, Vz, Ig, Sv	all localities	C		INPA 1471	ML (C.B.A.)	WA 6440
<i>Galbula leucogastra</i>	Cm, Tf, Ig	sv, ri, ca	C		INPA 1473	XC 138860	WA 410878
<i>Galbula dea</i>	Tf, Ig	sv, ri, ba, va	C				WA 505401
<i>Jacamerops aureus</i>	Tf	sv, ba	C		INPA 1142	XC 139195	WA 180495
<b>Bucconidae</b>							
<i>Notharchus macrorhynchos</i>	Tf, Vz, Ig	sv, al, ip	C			T.O.L.	WA 326670
<i>Notharchus tectus</i>	Tf, Vz	sv, al, ba	U			T.O.L.	WA 181581
<i>Bucco tamatia</i>	Cm, Tf, Vz, Ig	all localities	C		MPEG 56300	WA 63519	WA 44266
<i>Bucco capensis</i>	Tf, Vz	sv, al	U				WA 866551
<i>Monasa atra</i>	Cm, Tf, Vz, Ig	sv, al, ip, an, ca, ba, va	C		INPA A2108	XC 138895	WA 813265
<i>Monasa nigrifrons</i>	Vz	al	U				
<i>Chelidoptera tenebrosa</i>	Cp, Cm, Tf, Vz, Ig, At	sv, ep, al, ip, an, ri, ca, ba	C		MPEG 56303		WA 180999
<b>Capitonidae</b>							
<i>Capito niger</i>	Tf	sv	U		INPA 1477	T.O.L.	WA 862590
<i>Capito auratus</i>	Vz-is	an, out	U		INPA 1479	T.V.V.C.	
<b>Ramphastidae</b>							
<i>Ramphastos toco</i>	At	ep, out	R				
<i>Ramphastos tucanus</i>	Cm, Tf, Vz, Ig	sv, al, ip, an, ca, ba, va	C		MPEG 56306	WA 360170	WA 181366
<i>Ramphastos vitellinus</i>	Cm, Tf, Vz, Ig	sv, al, ip, an, ri, ca, ba, va	C			XC 138846	WA 262722
<i>Selenidera piperivora</i>	Tf	sv	C			WA 649302	WA 195584
<i>Pteroglossus viridis</i>	Tf, Vz, Ig	sv, al, ca, ba	C				WA 8966
<i>Pteroglossus aracari</i>	Cm, Tf, Vz, Ig	sv, al, ip, an, ca, ba, va	C		MPEG 56814		WA 50866
<i>Pteroglossus pluricinctus</i>	Vz-is	ip, out	R				
<b>Picidae</b>							
<i>Picumnus exilis</i>	Cp, Cm, Ig	sv, ep, al, ri, ca, ba	C		INPA 1482	ML (C.B.A.)	WA 854677
<i>Picumnus spilogaster</i>	Vz-is	al, out	R	VU	INPA 1481		WA 1295127
<i>Melanerpes cruentatus</i>	Tf, Vz	sv, al, ip, ba, va	C		MPEG 56312	T.O.L.	WA 866626
<i>Veniliornis cassini</i>	Tf, Vz	sv, al, ip, an, ba	C		INPA 1151	XC 139809	WA 505417
<i>Veniliornis passerinus</i>	Vz	al	R				
<i>Piculus flavigula</i>	Tf, Vz	sv, al, an, ba	C		MPEG 56310	T.O.L.	WA 273449

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<i>Piculus capistratus</i>	Tf	sv, va	U			ML (L.N.N.)	
<i>Colaptes punctigula</i>	Tf, Vz	sv, al, ba	U		MPEG 56827	ML (L.N.N.)	
<i>Celeus grammicus</i>	Tf, Vz	sv, al	U		MPEG 56309		
<i>Celeus elegans</i>	Cm, Tf, Vz	sv, ep, al, ip, ca, ba	C		INPA 1362	WA 62763	WA 180493
<i>Celeus flavus</i>	Cp, Cm, Tf, Vz, Ig	sv, ep, al, ip, ca, ba, va	C			XC 138839	WA 807515
<i>Celeus torquatus</i>	Tf, Vz	sv, al, ba, va	U		INPA 1147	T.O.L.	WA 814078
<i>Dryocopus lineatus</i>	Cp, Cm, Tf, Vz, Ig	sv, ep, al, an, ca, ba, va	C		MPEG 56315	ML (C.B.A.)	WA 866638
<i>Campephilus rubricollis</i>	Tf, Vz	sv, ip, ba	U		MPEG 56313	T.O.L.	WA 827193
<i>Campephilus melanoleucos</i>	Tf, Vz, Ig	sv, al, ip, an, ri, ca, ba	C			ML (C.B.A.)	WA 8874
<b>Falconidae</b>							
<i>Daptrius ater</i>	Vz	al, ca, ba	C			T.O.L.	WA 866606
<i>Ibycter americanus</i>	Cm, Vz	ep, al, ba	C				WA 858617
<i>Canacara cheriway</i>	At	ep, out	R				
<i>Milvago chimachima</i>	Cp, Cm, Vz, Ig, Sv, At	sv, ep, ri, ca, va	C		MPEG 56832	ML (C.B.A.)	WA 181925
<i>Herpetotheres cachimans</i>	Cm, Vz, Sv	sv, ep, al, an, va	C			ML (C.B.A.)	WA 252858
<i>Micnastur ruficollis</i>	Tf	sv	R				
<i>Micnastur gilvicolis</i>	Tf	sv, ba	U				
<i>Micnastur mirandollei</i>	Tf, Vz	sv, ca, ba	U				
<i>Micnastur semitorquatus</i>	Tf, Vz, Ig	sv, al, ca, ba	C				
<i>Falco sparverius</i>	Sv, At	ep, va, out	R				
<i>Falco rufigularis</i>	Cm, Tf, Vz, Ig	sv, ep, al, ri, ca	C		MPEG 56254		
<b>Psittacidae</b>							
<i>Ara anaranea</i>	Cm, Tf, Vz, Ig, Sv	all localities	C			T.O.L.	WA 181593
<i>Ara macao</i>	Cm, Tf, Vz	sv, ep, an, ba	U				WA 177386
<i>Ara chloropterus</i>	Tf, Vz	sv, an, ba	C			ML (L.N.N.)	WA 252839
<i>Ara severus</i>	Vz	al, an	C			ML (C.B.A.)	WA 8846
<i>Orthopsittaca manilatus</i>	Cm, Tf	sv, ep	C			XC 139203	WA 816636
<i>Diopsittaca nobilis</i>	Cm, Ig	ep, ri, ca	C			ML (C.B.A.)	WA 1334808
<i>Psittacara leucophthalma</i>	Cm, Vz, At	ep, ca	U			ML (L.N.N.)	
<i>Eupsittula pertinax</i>	Cp, Cm, Vz, Ig, Sv, At	sv, ep, al, an, ri, ca, ba, va	C		MPEG 56277	ML (C.B.A.)	WA 181278
<i>Brotogeris chrysoptera</i>	Cm, Tf, Vz	sv, an, ca, ba, va	C		INPA 1135	WA 48647	WA 287075
<i>Touit huetii</i>	Cm, Vz	sv, ba	C	VU		ML (C.B.A.)	WA 78853
<i>Touit purpuratus</i>	Cm, Tf	sv, ep	U		MPEG 56276		
<i>Pionites melanocephalus</i>	Tf, Vz	sv, ba, va	C		MPEG 56274	XC 139204	WA 8965
<i>Pyrrhula barrabandi</i>	Vz	an, out	R	NT			
<i>Pyrrhula caica</i>	Tf	sv, al	U	NT			
<i>Pionus menstruus</i>	Cm, Tf, Vz	sv, ep, al, an, ba, va	C		MPEG 56280	XC 139205	WA 866581
<i>Pionus fuscus</i>	Cm, Tf, Vz	sv, al, ip, va	C			T.V.V.C.	WA 862753



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<i>Amazona festiva</i>	Vz	al, ip, an, ca, ba	C	VU		XC 138940	WA 181590
<i>Amazona farinosa</i>	Tf	sv, ba	C			XC 139187	WA 181094
<i>Amazona amazonica</i>	Cm, Tf, Vz, Ig, Sv	all localities	C			ML (C.B.A.)	WA 181598
<i>Amazona ochrocephala</i>	Cm, Tf, Vz	sv, ep, al, ip, an, ca, ba, va	C		MPEG A8296	XC 138900	WA 283369
<i>Derophtus accipitrinus</i>	Cm, Tf, Vz	sv, ca, ba, va	C		MPEG 56279	WA 50046	WA 325113
<b>Thamnophilidae</b>							
<i>Pygoptila stellaris</i>	Tf, Vz	sv, al, ip, an, ba	C		INPA 1376	XC 139264	WA 202576
<i>Microbopias quixensis</i>	Tf, Vz	sv, al, ba	C		INPA A2104	XC 139197	WA 807882
<i>Epinecrophylla gutturalis</i>	Tf	ba, out	R				
<i>Aprositornis disjuncta</i>	Cp, Cm	ep, ca	C		INPA 780	WA 47135	WA 130462
<i>Myrmophylax atrothorax</i>	Tf	sv, ip, ba	C		INPA 1193	XC 139199	WA 180497
<i>Myrmotherula brachyura</i>	Cm, Tf, Vz	sv, al, ip, ca, ba	C		INPA 1405	XC 139806	WA 649879
<i>Myrmotherula surinamensis</i>	Vz, Ig	al, ca, ba	U	VU	INPA A2181	ML (C.B.A.)	WA 181283
<i>Myrmotherula cherriei</i>	Cp, Cm	sv, ep, ri, ba	C		INPA 1489	XC 138852	WA 351964
<i>Myrmotherula klagesi</i>	Vz	al, ip, an	C	NT, (VU)	INPA A2189	T.V.V.C.	WA 802504
<i>Myrmotherula axillaris</i>	Cm, Tf, Vz, Ig	sv, al, ip, ri, ca, ba, va	C		INPA 1191	WA 50042	WA 854693
<i>Myrmotherula longipennis</i>	Tf	sv	R				
<i>Myrmotherula assimilis</i>	Vz-is	ip, an, ba, out	U		INPA 1491	ML (C.B.A.)	WA 814481
<i>Fornicivora grisea</i>	Cp, Ig	ep, ri, ca, ba	C		INPA A2240	WA 62864	
<i>Isleria guttata</i>	Tf	ba, out	R				
<i>Thamnomanes caesiis</i>	Tf, Vz	sv, al, ba	C			WA 48660	WA 51649
<i>Herpilobmus dorsimaculatus</i>	Cm, Tf, Vz, Ig	sv, al, ip, an, ri, ca, ba, va	C		INPA 1199	XC 138988	WA 51602
<i>Herpilobmus rufimarginatus</i>	Cm, Tf, Vz, Ig	sv, ep, al, ip, an, ri, ca, ba	C		INPA A2149	ML (C.B.A.)	WA 7305
<i>Sakesphorus canadensis</i>	Cm, Vz, Ig	sv, ep, al, ip, an, ri, ca, ba	C		INPA 1484	XC 139207	WA 181002
<i>Thamnophilus doliiatus</i>	Cm, Vz, Ig	sv, ep, al, ip, an, ri, ca, ba	C		INPA 1485	T.O.L.	WA 272920
<i>Thamnophilus murinus</i>	Tf, Vz	sv, ip, ba, va	C		INPA 1180	ML (C.B.A.)	WA 827245
<i>Thamnophilus nigrocinereus</i>	Vz-is	al, ip, an, out	U	NT	INPA 1487	ML (C.B.A.)	
<i>Thamnophilus punctatus</i>	Cm, Tf, Vz	sv, al, ip, ca, ba, va	C		INPA 1185	ML (C.B.A.)	WA 51664
<i>Thamnophilus amazonicus</i>	Tf, Vz, Ig	sv, al, ip, ri, ca, ba	C		INPA 1184	ML (C.B.A.)	WA 807541
<i>Cymbilaimus lineatus</i>	Tf, Vz	sv, an, ba	U				
<i>Taraba major</i>	Tf, Vz	sv, al, ba, va	C			ML (C.B.A.)	WA 18048
<i>Frederickena viridis</i>	Tf	sv	R			WA 829047	WA 829032
<i>Myrmoderus ferrugineus</i>	Tf	sv, ba	C		INPA A1054	WA 50041	WA 51648
<i>Hypocnemoides melanopogon</i>	Cm, Vz, Ig	ep, al, ip, an, ri, ca, ba	C		INPA 1495	WA 417140	WA 262712
<i>Hylomyiops naevius</i>	Tf	sv	R				
<i>Hylomyiops punctulatus</i>	Vz	al, ip, an, ba	U		INPA 1497	WA 62901	WA 8862
<i>Sclateria naevia</i>	Vz, Ig	ip, ca, ba	U		INPA A2235	XC 138941	WA 261944
<i>Myrmelastes leucostigma</i>	Tf	sv	U			ML (C.B.A.)	WA 45344
<i>Myrmoborus leucophrys</i>	Cm, Tf, Vz	sv, al, ip, an, ca, ba	C		INPA A2174	WA 48644	WA 50869

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<i>Myrmoborus lugubris</i>	Vz-is	ip, an, out	U	VU	INPA 1494	ML (C.B.A.)	WA 1248476
<i>Percnos.T.O.L.a subcristata</i>	Cm, Tf, Vz, Ig	sv, al, ip, ri, ca, ba, va	C		INPA 1416	WA 48654	WA 813117
<i>Cercomacra cinerascens</i>	Tf	sv, al, ba	C		INPA A1731	XC 138894	
<i>Cercomacra carbonaria</i>	Vz-is	al, ip, an, out	C	CR	INPA 1505	XC 139258	WA 8861
<i>Cercomacroides tyrannina</i>	Tf	sv	C		INPA 1176	XC 139189	WA 854720
<i>Cercomacroides laeta</i>	Cm, Tf, Vz	sv, al, ip, ca, ba	C		INPA A1048	WA 48646	WA 51663
<i>Cercomacroides nigrescens</i>	Vz	al, ba	C		INPA A2076	WA 62805	WA 411490
<i>Hypocnemis cantator</i>	Cm, Tf, Vz	sv, al, ip, ba	C	NT	INPA 1197	XC 139803	WA 807533
<i>Pitohys albifrons</i>	Tf	sv, al	U				
<i>Willisornis poecilinotus</i>	Tf	sv, ba	U		INPA 1189	WA 48656	WA 854805
<i>Gymnopoibys rufigula</i>	Tf	sv, al, ip, ba	C		INPA 1434	XC 138904	WA 854012
<b>Grallariidae</b>							
<i>Myrmothera campanisona</i>	Tf	sv, al, ba, va	C		INPA 1194	WA 50428	WA 1258745
<b>Formicariidae</b>							
<i>Formicarius colma</i>	Tf, Vz	sv, al, ba	U		MPEG 56414	XC 139261	
<b>Dendrocolaptidae</b>							
<i>Dendrocincla fuliginosa</i>	Tf, Vz	sv, al, ip, ba	U		INPA 1425	ML (C.B.A.)	WA 854695
<i>Dendrocincla merula</i>	Tf	sv	U				
<i>Deconychura longicauda</i>	Tf	sv	R	NT			
<i>Sittasomus griseicapillus</i>	Tf, Vz	sv, al	R		INPA 1170		
<i>Glyphorhynchus spirurus</i>	Tf, Vz, Ig	sv, al, ip, an, ba	C		INPA 1421	XC 139009	WA 813260
<i>Xiphorhynchus pardalotus</i>	Tf	sv, ba, va	C		INPA 1165	T.O.L.	WA 51604
<i>Xiphorhynchus obsoletus</i>	Cm, Tf, Vz, Ig	all localities	C		INPA 1545	XC 138982	WA 1261649
<i>Xiphorhynchus guttatus</i>	Cm, Tf, Vz, Ig	sv, al, ip, an, ca, ba, va	C		INPA 1367	XC 139213	WA 813258
<i>Campylorhynchus trochilirostris</i>	Vz	an, out	R				
<i>Campylorhynchus procurviroides</i>	Ig	ca	R				
<i>Dendroplex picus</i>	Cm, Vz, Ig	sv, ep, al, ip, an, ri, ba	C		INPA 1543	ML (C.B.A.)	WA 814936
<i>Dendroplex kienerii</i>	Vz, Ig	al, ip, an, ri, ca	C		INPA 1544	T.V.V.C.	WA 7302
<i>Lepidocolaptes albolineatus</i>	Tf	sv, ip	R	NT	INPA 1167	ML (L.N.N.)	
<i>Nasica longirostris</i>	Vz, Ig	al, ip, an, ri, ca, ba	C		INPA A2140	XC 139201	WA 281363
<i>Dendrozetetes rufigula</i>	Tf	sv, ba	R		INPA 1166	XC 139214	WA 282812
<i>Dendrocolaptes certhia</i>	Tf, Vz	sv, an, ba, va	C		INPA 1427	ML (C.B.A.)	WA 51624
<i>Dendrocolaptes picumnus</i>	Tf, Vz	sv, al, ip, an, ba	C		INPA A1751	ML (C.B.A.)	WA 351965
<b>Xenopidae</b>							
<i>Xenops minutus</i>	Tf	sv, ba	U		MPEG 56347	T.O.L.	WA 188427

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<b>Furnariidae</b>							
<i>Furnarius leucopus</i>	Vz	al, ip, an, ba	C		INPA 1508	ML (C.B.A.)	
<i>Automolus rufipileatus</i>	Vz	al	U		MPEG 56345	WA 417154	WA 411492
<i>Automolus cervicalis</i>	Tf	sv, al	R		MPEG ?		
<i>Automolus ochrolaemus</i>	Tf	sv, al	C		INPA 1370	XC 138891	WA 45338
<i>Philydor pyrrohodes</i>	Tf, Vz	sv, al, ip, an	U		UFPE 5081	T.O.L.	WA 781991
<i>Certhiopsis cinnamomeus</i>	Cp, At	ep, out	U			WA 205165	
<i>Mazaria propinqua</i>	Vz-is	al, ip, out	C		INPA 1521	XC 138961	WA 866320
<i>Synallaxis albescens</i>	Cp	ep, ca	C		INPA 1522	WA 47145	WA 273450
<i>Synallaxis rutilans</i>	Tf, Vz	sv, ip, ba	U		INPA 1436	WA 48963	WA 50874
<i>Synallaxis guianensis</i>	Vz-is	al, an, ba, out	C		INPA 1517	XC 139211	WA 181279
<i>Cranioleuca vulpina</i>	Vz, Ig	al, ip, an, ca, ba	C		INPA 1524	ML (C.B.A.)	WA 802131
<i>Cranioleuca gutturata</i>	Vz	al, ip, ca, ba	U		INPA A989	ML (C.B.A.)	
<b>Pipridae</b>							
<i>Pipra flicauda</i>	Vz	al, ip, ca, ba	C		INPA 1565	XC 138911	WA 990976
<i>Ceratopipra erythrocephala</i>	Cm, Tf, Vz	sv, al, ip, ca	C		MPEG 56459	ML (C.B.A.)	WA 205164
<i>Manacus manacus</i>	Tf	sv	U		MPEG 56451	T.O.L.	
<i>Heterocercus flavivertex</i>	Cm, Ig	ep, al, ri, ca, ba	U		INPA A1005	WA 417144	WA 410877
<i>Dixiphia pipra</i>	Tf, Vz	sv, al, ip, ca, ba, va	C		INPA 1206	WA 48658	WA 50873
<i>Xenopipo atronitens</i>	Cm	sv, ep, ri, ca	C		INPA 1566	WA 63408	WA 261946
<i>Chiroxiphia pareola</i>	Vz	ip, va, out	R				
<b>Onychorhynchidae</b>							
<i>Onychorhynchus coronatus</i>	Tf, Vz	al, ip, ba	U		INPA 1560		T.O.L.
<i>Terenotriccus erythrurus</i>	Tf, Vz	sv, al, ip, ba	U		INPA A2097	XC 138898	WA 631432
<i>Myiobius barbatus</i>	Cm, Vz, Ig	al, ca, ba	U		MPEG 56445		
<b>Tityridae</b>							
<i>Schiffornis major</i>	Vz, Ig	sv, al, ca, ba	C		MPEG 56467	XC 138914	WA 781926
<i>Schiffornis olivacea</i>	Tf	sv	U			T.O.L.	
<i>Laniocera hypopyrra</i>	Tf	sv	U			WA 649330	WA 862785
<i>Tityra inquisitor</i>	Tf, Vz, Ig	sv, an, ba	U				WA 1295152
<i>Tityra cayana</i>	Tf, Vz	sv, al, ba	C			T.O.L.	WA 826954
<i>Pachyrhamphus rufus</i>	Cp, Cm, Vz, At	sv, ep, al, ip, an, ba, va	C		INPA 1569	T.O.L.	WA 181000
<i>Pachyrhamphus polychopterus</i>	Vz, At	sv, al, an, ba	C		INPA 1203	T.O.L.	
<i>Pachyrhamphus marginatus</i>	Tf, Vz	sv, ip	U			T.O.L.	
<i>Pachyrhamphus surinamensis</i>	Tf, Vz	sv, ip, an, ba, va	U			T.O.L.	
<i>Pachyrhamphus minor</i>	Tf	sv, va	U			XC 138896	WA 827661

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<b>Cotingidae</b>							
<i>Lipaugus vociferans</i>	Tf, Vz, Ig	sv, al, ip, ri, ba, va	C		MPEG 56468	T.O.L.	WA 195583
<i>Gymnoderus foetidus</i>	Vz	al, ip, ca	U				WA 351966
<i>Xipholena punicea</i>	Cm, Tf	sv, ri	U				
<i>Procnias albus</i>	Tf	sv, al, ba	U			ML (L.N.N.)	
<i>Cotinga cayana</i>	Tf, Ig	sv, ri, ba	R				WA 857482
<i>Querula purpurata</i>	Tf, Vz, Ig	sv, al, ip, an, ri, va	C		MPEG 56469	XC 139222	WA 352003
<i>Perissocephalus tricolor</i>	Tf, Vz	sv, ip	U				
<i>Cephalopterus ornatus</i>	Vz	al, ip, an, ba	U				
<b>Pipritidae</b>							
<i>Piprites chloris</i>	Tf	ba, out	R		INPA 1204		
<b>Platyrrinchidae</b>							
<i>Platyrrinchus saturatus</i>	Tf	sv	R				
<i>Platyrrinchus coronatus</i>	Cm	ri	R				
<i>Platyrrinchus platyrhynchos</i>	Tf	sv, ba	U			XC 139263	WA 202577
<b>Rhynchocyclidae</b>							
<i>Mionectes oleagineus</i>	Tf, Vz, Ig	sv, al, ip, ba, va	C		INPA 1547	XC 139221	WA 862784
<i>Mionectes macconnelli</i>	Vz	ca	R		INPA 1833		
<i>Rhynchocyclus olivaceus</i>	Ig	al, ba	R		MPEG 56803		WA 45329
<i>Tohnomyias sulphurescens</i>	Tf, Vz	sv, al, ip, ba	U				
<i>Tohnomyias assimilis</i>	Tf, Vz	sv, al, ip, ba, va	C		INPA 1213	XC 139212	WA 5086
<i>Tohnomyias poliocephalus</i>	Cm, Tf, Vz, Ig	all localities	C		MPEG 56436	ML (C.B.A.)	WA 854718
<i>Tohnomyias flaviventris</i>	Cm, Vz, Ig	ep, al, an, ri, ca, ba, va	U		INPA 1614	ML (C.B.A.)	WA 262705
<i>Todirostrum maculatum</i>	Vz, Ig	ep, al, ip, an, ca, ba	C		INPA A2132	ML (C.B.A.)	WA 181579
<i>Todirostrum cinereum</i>	Cp, Cm	ep, out	C			ML (C.B.A.)	WA 1334742
<i>Todirostrum pictum</i>	Tf	sv	U		INPA A2248	XC 138906	WA 820397
<i>Poecilatriccus sylvia</i>	Cm, Vz, Ig	ca, ba	U			ML (C.B.A.)	WA 862728
<i>Myiornis ecaudatus</i>	Tf, Vz	sv, al, ip, ba	C		WA 48659	WA 48659	
<i>Hemiricus minor</i>	Vz	al, ip, an	U			XC 138978	WA 67902
<i>Hemiricus zosterops</i>	Tf	sv	U			XC 138955	WA 16471
<i>Hemiricus margaritaceiventris</i>	Cp	ep, ca	C		INPA 1548	WA 62877	
<i>Hemiricus inornatus</i>	Cp, Cm	ep, ri, ba	U		INPA A999	XC 139191	
<i>Lophotriccus galeatus</i>	Tf, Vz	sv, al, ip, ca	C		INPA 1210	XC 139231	WA 181261
<b>Tyrannidae</b>							
<i>Zimmerius acer</i>	Cm, Tf, Vz, Ig	sv, al, ip, an, ca, ba, va	C		INPA 1215	WA 417148	WA 814250
<i>Stigmatura napensis</i>	Vz-is	al, ip, out	C	(VU)	INPA 1559	T.O.L.	WA 781796

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<i>Inezia subflava</i>	Cp, Ig	ep, ri	U		INPA A1876	XC 138893	WA 857469
<i>Orrhithon inerme</i>	Tf	sv, al, ba	C		MPEG 56429	WA 360177	WA 325112
<i>Campostoma obsoletum</i>	Vz, Ig	ep, al, ip, an, ca, ba	C			T.O.L.	WA 273469
<i>Elaenia flavogaster</i>	Cp	ep	C		INPA 1550	WA 62845	
<i>Elaenia parvirostris</i>	Cp	ri	R	AUS			
<i>Elaenia cristata</i>	Cp	ep, ca	C		INPA 1554		WA 272938
<i>Elaenia chiriquensis</i>	Cp	ri, ca	U		INPA A993		
<i>Elaenia ruficeps</i>	Cp	ep, ri, ca	C		INPA 1557		
<i>Myiopagis gaimardii</i>	Cm, Tf, Vz, Ig	sv, al, ip, an, ca, ba, va	C			WA 649317	WA 181255
<i>Myiopagis caniceps</i>	Tf	sv, al	U			T.O.L.	WA 411491
<i>Myiopagis flavivertex</i>	Vz, Ig	al, ip, an, ca, ba	C		INPA 1549	XC 139807	WA 8964
<i>Tyrannulus elatus</i>	Cp, Cm, Tf, Vz, Ig	all localities	C			XC 139808	WA 253388
<i>Capsiempis flavivola</i>	Vz, Ig	sv, ep, al, ip, an, ba	C		INPA 1558	XC 138942	WA 281415
<i>Phaeomyias murina</i>	Sv	va, out	R				
<i>Serpophaga hypoleuca</i>	Vz-is	ip, out	R		INPA A8302		WA 781721
<i>Attila cinnamomeus</i>	Vz, Ig	al, an, ri, ca, ba	C		INPA A1004	XC 139224	WA 197829
<i>Attila spadiceus</i>	Cm, Tf, Vz	sv, al, ip, an, ba	C		MPEG 56450	XC 138837	WA 261945
<i>Legatus leucophaeus</i>	Cm, Vz, Ig	sv, ep, an, ri, ca, ba	C			T.O.L.	WA 1271477
<i>Ramphotrigon ruficauda</i>	Tf, Vz, Ig	sv, al, ip, ba	C		MPEG 56435	WA 50050	WA 51628
<i>Myiarchus tuberculifer</i>	Cm, Tf, Vz, Ig	sv, ip, ri, ca, ba, va	C		INPA 1564	T.O.L.	WA 119848
<i>Myiarchus swainsoni</i>	Cp	ep, out	R	AUS	INPA A1854		WA 19189
<i>Myiarchus ferox</i>	Vz, Ig	al, ip, an, ba	C		INPA 1563	T.O.L.	
<i>Myiarchus tyrannulus</i>	Cp	ri	R				
<i>Sirystes sibilator</i>	Tf	sv, al	R				
<i>Rhytipterna simplex</i>	Tf, Vz, Ig	sv, al, ip, an, ri, ca, ba	C			WA 50049	WA 51627
<i>Rhytipterna immunda</i>	Cm, Ig	ri, ba	U		INPA A997	XC 138919	WA 44261
<i>Pianguis sulphuratus</i>	All habitats	all localities	C		INPA 1561	ML (C.B.A.)	T.O.L.
<i>Philohydor lictor</i>	Vz, Ig, Aq, At	sv, ep, al, ip, an, ri, ba	C			XC 139247	WA 800187
<i>Myiodynastes maculatus</i>	Vz	sv, al, ip, ba	C	AUS?		ML (C.B.A.)	
<i>Tyrannopsis sulphurea</i>	Cm, Tf	sv, ep, ri	C		INPA 1562	ML (C.B.A.)	WA 282803
<i>Megarynchus pitangua</i>	Cm, Vz, Ig	sv, ep, al, ip, an, ri, ca	C			ML (C.B.A.)	
<i>Myiozetetes cayanensis</i>	Cm, Vz, Ig, Aq, At	sv, ep, al, ip, an, ri, ba	C			ML (C.B.A.)	
<i>Tyrannus albogularis</i>	Cp	ep, out	R			T.V.V.C.	WA 814680
<i>Tyrannus melancholicus</i>	Cp, Cm, Vz, Ig, Sv, At	sv, ep, al, ip, ri, ca, ba, va	C	AUS		T.O.L.	WA 814648
<i>Tyrannus savana</i>	Cp, Vz, Ig, Aq, At	ep, al, ri	C	AUS			
<i>Empidonomus varius</i>	Cm, Sv	sv, ba, va	U	AUS			
<i>Conopias trivirgatus</i>	Vz	ip, ba, out	U				
<i>Conopias parvus</i>	Cm, Tf, Vz, Ig	sv, al, ip, ri, ca, ba, va	C		INPA A1000	ML (C.B.A.)	WA 854717
<i>Pyrocephalus rubinus</i>	Cp, At	ep, out	R	INT?			

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<i>Fluvicola pica</i>	Cp	ep, out	R				WA 272919
<i>Arundinicola leucocephala</i>	Cp, Vz, Ig, Aq, At	ep, al, ca	C		INPA A8301	WA 417151	WA 816664
<i>Ochthornis littoralis</i>	Vz, Ig	al, ca	C		INPA A2173	ML (C.B.A.)	WA 802551
<i>Cnemotriccus fuscatus</i>	Vz	al, ip, an	C		MPEG 56442	ML (C.B.A.)	
<i>Labrotriccus euleri</i>	Cm, Tf, Vz	sv, al, ip, ca, ba	U				
<i>Contopus virens</i>	Vz	al	R	NEA			
<i>Knipolegus poecilocercus</i>	Ig	ri, ba	R				WA 272929
<b>Vireonidae</b>							
<i>Cycularhis gujanensis</i>	Cp, Cm, Tf, Vz, Ig	sv, ep, al, ip, an, ri, ca, ba	C		INPA 1570	ML (C.B.A.)	WA 197791
<i>Vireo olivaceus</i>	Tf	sv	U	AUS	MPEG 56831		
<i>Hylophilus thoracicus</i>	Tf, Vz	sv, al, ip, ba	C		INPA 1220	ML (C.B.A.)	WA 857498
<i>Hylophilus semicinctus</i>	Vz, Ig	al, an, ri, ca, ba	C		INPA A994	XC 139194	WA 219840
<i>Hylophilus pectoralis</i>	Vz	al	R				
<i>Hylophilus muscicapinus</i>	Cm, Tf	sv, al, ba, va	C		INPA 1221	ML (C.B.A.)	WA 835793
<i>Hylophilus ochraceiceps</i>	Tf	ba, out	R				
<b>Corvidae</b>							
<i>Cyanocorax violaceus</i>	Vz	al, ip	U			ML (C.B.A.)	
<i>Cyanocorax cayanus</i>	Cm	sv, ri, ba, va	C			WA 376414	WA 34375
<b>Hirundinidae</b>							
<i>Pygochelidon melanoleuca</i>	Aq	va, out	R				
<i>Atticora fasciata</i>	Aq	al, ip, ca, ba	C				WA 9742
<i>Sielgidopteryx ruficollis</i>	Aq	sv, al, ri, ca	C				
<i>Progne tapera</i>	Aq	ep, al, ip, an, ri, ca	C	AUS	MPEG A8305		
<i>Progne subis</i>	Aq	ip, out	R	NEA		ML (L.N.N.)	WA 411488
<i>Progne chalybea</i>	Aq	sv, ep, al, ca, ba	C				
<i>Tachycineta albiventer</i>	Aq	ep, al, ip, an, ri, ca, ba	C				WA 221243
<i>Riparia riparia</i>	Aq	va, out	R	NEA	MPEG 56476		WA 821689
<i>Hirundo rustica</i>	Cp, Aq	ep, al, ri, ca, ba	U		INPA A2093		
<b>Troglodytidae</b>							
<i>Troglodytes musculus</i>	Vz, Ig, At	sv, ep, al, ri, ca, ba	C		MPEG 56813		
<i>Phengopedius coraya</i>	Tf	sv, al, ca, ba, va	C		INPA 1223	ML (C.B.A.)	WA 50875
<i>Cantorchilus leucotis</i>	Vz, Ig	ep, al, ip, an, ca, ba	C		INPA 1571	ML (C.B.A.)	
<b>Donacobiidae</b>							
<i>Donacobius atricapilla</i>	Aq, At	ep, out	R				

Family / Species	Habitat <sup>1</sup>	Locality <sup>2</sup>	Abu. <sup>3</sup>	Status <sup>4</sup>	Specimen <sup>5</sup>	Voice <sup>6</sup>	Photo <sup>7</sup>
<b>Poliopitidae</b>							
<i>Microbatas collaris</i>	Tf	sv	R				
<i>Ramphocaenus melanurus</i>	Tf, Vz	sv, al, ip, ba	C			XC 139804	WA 282813
<i>Poliopitila plumbea</i>	Cp, Cm, Ig	ep, ri, ca, ba	C			WA 62996	WA 1270334
<b>Turdidae</b>							
<i>Catharus fuscescens</i>	Tf	sv, ba	R	NEA	INPA A2229	ML (C.B.A.)	WA 639696
<i>Turdus leucomelas</i>	Cm, Ig, Sv	ep, ri, va	C		INPA A1839	WA 63051	T.O.L.
<i>Turdus fumigatus</i>	Tf, Vz, Ig	sv, al, ca, ba	C		INPA 1575	WA 649315	T.O.L.
<i>Turdus nudigenis</i>	Vz	al	R		INPA 1574	ML (C.B.A.)	
<i>Turdus ignobilis</i>	Cp	ep, va, out	R				
<i>Turdus albicollis</i>	Tf	sv	C			ML (C.B.A.)	
<b>Mimidae</b>							
<i>Mimus gilvus</i>	Cp, Cm	ep, ca	C		INPA 1576	WA 62940	WA 15678
<b>Passerilidae</b>							
<i>Zonotrichia capensis</i>	Sv	va, out	R				
<i>Anmodramus humeralis</i>	Cp, Sv, At	ep, va, out	R			ML (C.B.A.)	
<i>Anmodramus aurifrons</i>	Vz, Ig	al, ip, ca	C		INPA A1017		
<i>Arremonops conirostris</i>	Vz-is	al, ip, an, ba, out	U		INPA 1603	WA 174982	WA 174924
<i>Arremon taciturnus</i>	Tf	sv, al, ba	C		INPA 1605	XC 139006	WA 1334775
<b>Parulidae</b>							
<i>Parkesia noveboracensis</i>	Vz, Ig	al	R	NEA	INPA A2111	ML (L.N.N.)	T.O.L.
<i>Setophaga ruticilla</i>	Cm, Tf	sv, ba	R	NEA			
<i>Setophaga petechia</i>	Vz-is	al, out	U	NEA	INPA A2155	ML (L.N.N.)	
<i>Setophaga striata</i>	Tf, Vz	sv, al, va	U	NEA	INPA 1611		WA 294633
<i>Setophaga fusca</i>	Tf	sv	R	NEA		ML (C.B.A.)	
<i>Geothlypis aequinoctialis</i>	Cm, At	ep, out	R				WA 866293
<b>Icteridae</b>							
<i>Psarocolius viridis</i>	Tf	sv	R				
<i>Psarocolius decumanus</i>	Tf, Vz	sv, al, ip, an, ba	C			T.O.L.	WA 9746
<i>Psarocolius bifasciatus</i>	Tf, Vz, Ig	sv, al, ip, ri, ca, ba	C			WA 417149	WA 325115
<i>Procalcicus solitarius</i>	Vz	al, ba	R				
<i>Cactus haemorrhous</i>	Tf	sv	C		MPEG 56508	XC 138897	T.O.L.
<i>Cactus cela</i>	Cm, Tf, Vz, Ig, At	all localities	C		MPEG 56509	WA 417139	WA 410879
<i>Icterus cayanensis</i>	Cm	sv, ep, ba	U				WA 1063116
<i>Icterus chryscephalus</i>	Cm, Tf, At	sv, ep, ri, ba	C			ML (C.B.A.)	WA 181254

Family / Species	Habitat <sup>1</sup>	Locality <sup>2</sup>	Abu. <sup>3</sup>	Status <sup>4</sup>	Specimen <sup>5</sup>	Voice <sup>6</sup>	Photo <sup>7</sup>
<i>Icterus nigrogularis</i>	Cp, Cm	ep, out	R		INPA 1612	WA 47138	
<i>Molothrus oryzivorus</i>	Cp, Vz, Ig, At	ep, al, ri, ca, ba	U				WA 866273
<i>Molothrus bonariensis</i>	Vz, At	ep, al, ip, an, ca, va	C		INPA 1613	ML (C.B.A.)	T.O.L.
<i>Sturnella militaris</i>	Cp, At	ep, out	R				WA 281858
<b>Mitrospingidae</b>							
<i>Lamprospiza melanoleuca</i>	Vz	va, out	R			ML (L.N.N.)	
<b>Thraupidae</b>							
<i>Coereba flavola</i>	Cp, Cm, Vz, Ig, Sv, At	sv, ep, al, an, ri, ca, ba, va	C		INPA 1577	ML (C.B.A.)	T.O.L.
<i>Saltator maximus</i>	Vz	al, ip, ba, va	C			ML (C.B.A.)	
<i>Saltator azarae</i>	Cm, Vz	sv, ep, al, ip, an, ba	C		INPA 1608	WA 63003	WA 15677
<i>Saltator grossus</i>	Tf	sv	R		INPA 1231	WA 64855	WA 639973
<i>Nemosia pileata</i>	Vz	al, ip, an	C		MPEG 56846	ML (L.N.N.)	
<i>Tachyphonus phoenicius</i>	Cm	ep, ri, ca	C		INPA 1585	ML (C.B.A.)	T.O.L.
<i>Ramphocelus carbo</i>	Cp, Cm, Vz, Ig, Sv, At	sv, ep, al, ip, an, ca, ba, va	C		INPA 1587	ML (C.B.A.)	WA 817268
<i>Tachyphonus luctuosus</i>	Tf, Vz	sv, al, an, ba	C				WA 222262
<i>Tachyphonus cristatus</i>	Tf, Vz	sv, al, ip, ba	C			ML (L.N.N.)	WA 866596
<i>Tachyphonus surinamus</i>	Tf	sv, ba	U		INPA 1228	ML (C.B.A.)	
<i>Lanio penicillatus</i>	Vz, Ig	al, ip, an, ba	C		INPA 1582	XC 138956	WA 261936
<i>Tangara mexicana</i>	Tf, Vz	sv, ip	U		MPEG 56485	WA 50713	WA 181262
<i>Tangara velia</i>	Tf	sv	U				
<i>Tangara varia</i>	Tf	al, ba	R				
<i>Tangara punctata</i>	Tf	sv	R				
<i>Tangara episcopus</i>	Cm, Tf, Vz, Ig, At	sv, ep, al, ip, an, ri, ca, ba	C				
<i>Tangara palmarum</i>	Cp, Tf, Vz, Ig, Sv, At	sv, ep, al, ip, ca, ba, va	C		INPA 1589	ML (C.B.A.)	WA 51652
<i>Tangara cayana</i>	Cp, Cm, At	ep, ca	C		INPA 1591	T.O.L.	WA 273468
<i>Schistochlamys melanopis</i>	Cp, Cm	ep, ri, ca	C		INPA 1579	XC 139208	WA 326649
<i>Paroaria gularis</i>	Vz, Ig	al, ip, an, ri, ca, ba, va	C		INPA 1607	XC 139256	WA 273448
<i>Dacnis flaviventer</i>	Ig	ba, out	R			WA 417146	
<i>Dacnis cayana</i>	Cm, Tf, Vz, Ig, At	sv, ep, al, ip, ri, ba	C		MPEG 56483	XC 139805	WA 181927
<i>Cyanerpes nitidus</i>	Tf	sv	R				
<i>Cyanerpes caeruleus</i>	Cm, Tf	sv, al, ba	U			ML (C.B.A.)	WA 15673
<i>Cyanerpes cyaneus</i>	Tf	ba, out	R				
<i>Chlorophanes spiza</i>	Tf	sv, ba	U		INPA 1374	WA 50040	
<i>Hemithraupis guira</i>	Vz	al	R				
<i>Conirostrum speciosum</i>	Vz	al	R		MPEG 56812		
<i>Conirostrum bicolor</i>	Vz	al, ip, an	C	NT	INPA 1593		WA 901527
<i>Emberizoides herbicola</i>	Cp, At	ep, ca	C		INPA 1606	WA 62849	WA 272935
<i>Volatinia jacarina</i>	Cp, Vz, Sv, At	sv, ep, al, ba	C		INPA 1594		T.O.L.



Family / Species	Habitat <sup>1</sup>	Locality <sup>2</sup>	Abu. <sup>3</sup>	Status <sup>4</sup>	Specimen <sup>5</sup>	Voice <sup>6</sup>	Photo <sup>7</sup>
<i>Sporophila intermedia</i>	Cp, Vz, At	ep, al, ip, an, ca, va	C		INPA 1512	ML (L.N.N.)	WA 181252
<i>Sporophila plumbea</i>	Cp, At	ep, ca	C		INPA 1514	XC 139210	WA 846967
<i>Sporophila bouvronides</i>	Vz, At	ba, out	R	INT?			
<i>Sporophila lineola</i>	Vz	al	R	AUS		ML (L.N.N.)	WA 861786
<i>Sporophila nigricollis</i>	Cp, At	ep, ba, out	R		INPA 1596		WA 205166
<i>Sporophila minuta</i>	Cp, At	ep, an, ba, out	U		INPA A2216		
<i>Sporophila castaneiventris</i>	Vz-is	al, out	R				
<i>Sporophila angolensis</i>	Cp, Vz, Ig, Sv, Aq, At	ep, al, ca, ba	C		INPA A1860	XC 139209	WA 281859
<i>Sporophila crassirostris</i>	Cp	ep, ba, out	U		INPA 1599	WA 376425	T.O.L.
<i>Dolospingus fringilloides</i>	Cp	ep, ca	U		INPA 1601	WA 649318	WA 21329
<b>Cardinalidae</b>							
<i>Granatellus pelzelni</i>	Tf, Vz	sv, al, ba	U		INPA A2154	ML (C.B.A.)	
<i>Cyanoloxia rothschildii</i>	Tf	sv, ba	C		INPA A2237	XC 139223	WA 51646
<b>Fringillidae</b>							
<i>Euphonia plumbea</i>	Cm	ep, ri, ca	U			WA 649322	WA 806599
<i>Euphonia chlorotica</i>	Cm, Vz	ep, al	R				
<i>Euphonia violacea</i>	Tf, Vz	sv, al, ca	C			XC 139215	WA 18041
<i>Euphonia chrysopasta</i>	Tf	sv, al	U			T.O.L.	WA 50868
<i>Euphonia minuta</i>	Tf	al	R			ML (C.B.A.)	
<i>Euphonia</i> sp. ( <i>cayennensis</i> )	Tf	sv	R				

<sup>1</sup>Habitats: Cp – *campina*; Cm – *campinarana*; Tf – *terra-firme* forest; Vz – *várzea* (Vz-is – exclusively on Rio Branco islands); Ig – *igapó*; Sv – savanna; Aq – aquatic environment; At – human-altered areas.

<sup>2</sup>Localities: sv – Serra do Viruá; ep – Estrada Perdida; al – Igarapé do Aliança; ip – Ilha do Palhal; an – Boca do Anauá; ri – Rio Iruá; ca – Campinho do Rio Anauá; ba – Trilha do Baruaana; va – Vila de Vista Alegre; out – exclusively in areas that are outside the current park boundaries.

<sup>3</sup>Abundance: C – common; U – uncommon; R – rare.

<sup>4</sup>Status: NT – Near Threatened at global level; VU – Vulnerable at global level; CR – Critically Endangered at global level; (VU) – Vulnerable at national level; (DD) – Data Deficient at national level; NEA – nearctic migrants; AUS – austral migrants; INT – migrants from other regions; ? – uncertainty on the migratory behavior.

<sup>5</sup>Specimen: Catalogue number from Instituto Nacional de Pesquisas da Amazônia (INPA), Museu Paraense Emílio Goeldi (MPEG), Universidade Federal do Pernambuco (UFPE), or Museu de Zoologia da Universidade de São Paulo (MZUSP).

<sup>6</sup>Voice: Catalogue number from xeno-canto (XC) or wikiaves (WA); ML with authors initials refers to records obtained by the specified author in cataloguing process at Macaulay Library. Only authors initials refers to those of recordists of species with undeposited vouchers; IPC – undeposited vouchers obtained by Juan Pablo Cullasso.

<sup>7</sup>Photo: Catalogue number from wikiaves (WA). Only authors initials refers to those of recordists of species with undeposited vouchers; PNV – photographs obtained by other visitors and available at Viruá National Park archive.

APPENDIX B:

Bird species predicted to occur in Viruá National Park, including habitat, presence in the state of Roraima and status elsewhere. It includes species known from nearby areas, based on Naka *et al.* 2006, Borges *et al.* 2011 and unpublished data.

Species	Habitat <sup>1</sup>	Roraima	Status <sup>2</sup>	Species	Habitat <sup>1</sup>	Roraima	Status <sup>2</sup>
<i>Crypturellus variegatus</i>	Tf	X	C / W	<i>Hylexetastes perroti</i>	Tf	X	U / Lr
<i>Amazonetta brasiliensis</i>	Aq	X	C / W	<i>Microxenops milleri</i>	Tf		U / Lr
<i>Botaurus pinnatus</i>	Sv, Aq	X	C / W	<i>Clibanornis obscurus</i>	Tf	X	U / W
<i>Ixobrychus exilis</i>	Aq	X	U / W	<i>Anabacerthia ruficaudata</i>	Vz	X	C / W
<i>Ixobrychus involucris</i>	Aq	X	U / W	<i>Neopelma chrysocephalum</i>	Cp	X	C / Lr
<i>Cercibis oxycerca</i>	Sv, Aq	X	R / Lr	<i>Tyranneutes virescens</i>	Tf	X	C / Lr
<i>Theristicus caudatus</i>	Sv, Aq	X	C / W	<i>Corapipo gutturalis</i>	Tf	X	C / Lr
<i>Chondrohierax uncinatus</i>	Tf	X	U / W	<i>Iodopleura fusca</i>	Tf	X	R / Lr / Pk
<i>Helicolestes hamatus</i>	Ig		C / W	<i>Cotinga cotinga</i>	Tf	X	R / W
<i>Amaurolimnas concolor</i>	Aq		U / Lr	<i>Haematoderus militaris</i>	Tf		R / W
<i>Pluvialis dominica</i>	Aq	X	C / M	<i>Neopipo cinammomea</i>	Tf, Cm		R / W / Pk
<i>Zenaida auriculata</i>	Sv, At	X	C / W	<i>Leptopogon amaurocephalus</i>	Vz	X	C / Lr
<i>Tyto furcata</i>	At	X	C / W	<i>Lophotriccus vitiosus</i>	Tf		C / Lr
<i>Dromococcyx pavoninus</i>	Tf	X	U / W				R / Lr / Lo
<i>Nyctibius aethereus</i>	Tf	X	R / W	<i>Hemitriccus josephinae</i>	Tf		/ Pk
<i>Nyctibius leucopterus</i>	Tf		U / W / Pk	<i>Corythopsis torquatus</i>	Tf	X	C / W
			R / W / Lo	<i>Attila citriniventris</i>	Tf, Cm		U / W / Lo
<i>Nyctibius bracteatus</i>	Vz, Ig		/ Pk	<i>Empidonomus</i>			
<i>Chordeiles minor</i>	Vz, Sv	X	U / M	<i>aurantioatrocristatus</i>	Tf	X	C / W
<i>Chordeiles rupestris</i>	Aq	X	U / W	<i>Vireolanius leucotis</i>	Tf	X	C / W
<i>Topaza pella</i>	Tf	X	U / W	<i>Hylophilus brunneiceps</i>	Cp, Ig	X	C / Lr
<i>Polytmus guainumbi</i>	Sv	X	C / Lr	<i>Atticora tibialis</i>	Tf	X	R / W
<i>Amazilia brevirostris</i>	any	X	C / Lr	<i>Henicorbhina leucosticta</i>	Tf	X	C / Lr
<i>Nonnula rubecula</i>	Tf	X	U / W / E	<i>Microcerculus bambla</i>	Tf	X	U / W
<i>Celeus undatus</i>	Tf	X	C / Lr	<i>Cyphorhinus arada</i>	Tf	X	R / W
<i>Falco derioleucus</i>	Tf	X	U / W / Lo	<i>Myiothlypis mesoleuca</i>	Tf	X	C / Lr
<i>Falco femoralis</i>	Sv	X	C / W	<i>Poliophtila guianensis</i>	Tf	X	C / Lr / E
<i>Falco peregrinus</i>	Vz, Tf	X	C / M	<i>Tangara gyrola</i>	Tf	X	C / W
<i>Pyrrhura picta</i>	Tf	X	C / Lr	<i>Tangara chilensis</i>	Tf	X	C / W
<i>Terenura sspodiophtila</i>	Tf	X	U / W	<i>Cyanicterus cyanicterus</i>	Tf, Cm		R / Lr
<i>Myrmornis torquata</i>	Tf	X	U / W	<i>Dacnis lineata</i>	Tf	X	C / W
<i>Myrmeciza longipes</i>	Tf	X	C / Lr	<i>Hemithraupis flavicollis</i>	Tf	X	C / W
<i>Myrmotherula menetriesii</i>	Tf	X	C / W	<i>Sporophila schistacea</i>	Vz, Sv	X	U / Lr
<i>Thamnomanes ardesiacus</i>	Tf	X	C / W	<i>Sporophila americana</i>	Vz, Sv	X	U / Lr
<i>Conopophaga aurita</i>	Tf	X	C / W	<i>Caryothraustes canadensis</i>	Tf	X	C / W
<i>Grallaria varia</i>	Tf		C / W	<i>Peripophyrus erythromelas</i>	Tf		R / Lr / Pk
<i>Hylopezus macularius</i>	Tf	X	C / W	<i>Lampropsar tanagrinus</i>	Vz	X	C / W
<i>Formicarius analis</i>	Tf	X	C / W				
<i>Sclerurus mexicanus</i>	Tf	X	U / W				
<i>Sclerurus rufifigularis</i>	Tf	X	C / W				
<i>Sclerurus caudacutus</i>	Tf	X	C / W				
<i>Xiphocolaptes</i>							
<i>promeropirhynchus</i>	Tf, Vz	X	U / W				

<sup>1</sup>Habitats: cp – campina; cm – campinarana; tf – terra-firme forest; vz – várzea; ig – igapó; sv – savanna; aq – aquatic environment; at – human altered areas

<sup>2</sup>Status elsewhere: C – common; U – uncommon; R – rare; W – widespread; Lr – limited range in Amazonia; M – migratory; Lo – local occurrence; Pk – poorly known; E – easily overlooked