

One hundred and thirty-five years of avifaunal surveys around Santarém, central Brazilian Amazon

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ABSTRACT: We present an updated annotated avifaunal checklist for the Santarém region of central Pará state, Brazil, an area that has one of the oldest histories of ornithological exploration in South America. We combine data from a five-month quantitative survey of the birds of the municipalities of Santarém and Belterra (east of the Tapajós River) between 2010 and 2011 with an exhaustive search of material in museum collections worldwide and digital vouchers deposited online. Our own survey sampled habitats across a gradient of disturbance ranging from 'undisturbed' primary forest, through logged and burnt forest, patches of secondary forest, cattle pastures and intensive mechanized agriculture. Given the potential for species misidentifications in avian inventories, we paid special attention to obtaining voucher documentation. Here we present a collection of publicly accessible digital vouchers for all of the new species, in addition to providing museum catalogue numbers for all old records. We added 24 species to the regional list, principally species associated with anthropogenic land-uses, but also including seven species restricted to primary forest habitats which were missed from both recent published inventories and over the course of two centuries of intensive collecting efforts. The regional list now stands at 583 species for which voucher documentation is available, with an additional 26 undocumented species. Many of the species reported here are poorly known or represent notable range extensions, and we present new data on their status and distribution.

KEY-WORDS: bird survey, Amazonia, conservation, range extension, digital voucher.

INTRODUCTION

The compilation of accurate biodiversity inventories represents a critical first step for understanding natural patterns of environmental heterogeneity and species-specific responses to human-induced environmental change. Even for birds, perhaps the best studied of the Neotropical biota, such inventories remain a labor intensive and error prone task, particularly in extremely diverse tropical forest regions such as the Amazon basin (Remsen 1994, Cohn-Haft *et al.* 1997).

The Santarém region of central Pará (PA) state, south of the Amazon and east of the Tapajós Rivers, is one of the ornithologically best-studied landscapes in

Amazonian Brazil, with a history of specimen collection starting from at least 1834 (Pelzeln 1871) and avian inventories spanning over 135 years (*e.g.* Allen 1876, Sclater & Salvin 1878, Riker 1891, Griscom & Greenway 1941, Henriques *et al.* 2003). Intensive sampling effort in the 19th and early 20th centuries saw many thousands of specimens collected in the region, but this data has never been synthesized in one place. The fruits of this labour during this period included the discovery of several new birds to science including Klage's Antwren *Myrmotherula klagesi*, Bare-eyed Antbird *Rhegmatorhina gymnops* and Point-tailed Palmcreeper *Berlepschia rikeri*.

The most exhaustive contemporary inventory undertaken in the region - Henriques *et al.* (2003) -

focused on the *terra firme* forest avifauna in the Floresta Nacional do Tapajós (Tapajós National Forest, hereafter FLONA), a 560,000-ha protected area managed by the Instituto Chico Mendes de Conservação da Biodiversidade - ICMBio. Subsequent studies in the FLONA have investigated avian response to forest gaps (Wunderle *et al.* 2005) and reduced impact logging (Wunderle *et al.* 2006, Henriques *et al.* 2008). Elsewhere, the savannah enclave of Alter do Chão has been the subject of several quantitative avian studies (see *e.g.* Sanaiotti & Cintra 2001 and Cintra & Sanaiotti 2005). However, beyond the FLONA and Alter do Chão, the region has been relatively poorly inventoried, especially in non-forest landscapes.

We carried out a five month survey of the birds of the municipalities of Santarém and Belterra under the auspices of the 'Rede Amazônia Sustentável' (RAS: www.redeamazoniasustentavel.org), a collaborative research initiative focused on the study of land-use sustainability in eastern Amazonia, involving more than 30 institutional partners from Brazil, the UK, Australia and US. Coordinating institutions are the Goeldi Museum and Embrapa Amazônia Oriental (Belém), and the Universities of Cambridge and Lancaster in the United Kingdom. The overall aim of RAS is to contribute towards an improved understanding of the long-term environmental and socio-economic consequences of current land-use and land-use change processes in the eastern Brazilian Amazon (Gardner *et al. in press*). In this paper we present an updated and annotated species list derived from the avian component of RAS study region in the municipalities of Santarém/Belterra, our incidental observations from surrounding non-study landscapes *e.g.* Alter do Chão, and a critical review of old records, including a search of global museum holdings from the region.

METHODS

Study Landscape: climate and biophysical conditions

Santarém has a mean annual temperature of 25°C and a mean relative humidity of 86%, with annual rainfall averaging 1920 mm and a short dry season of 2–3 months, usually between August and October with severe droughts in El Niño years (Parrotta *et al.* 1995, Nepstad *et al.* 2002). Canopy heights of undisturbed *terra firme* forests are typically in the range of 30 to 40 m, with occasional emergent species up to 50 m tall. Most of the survey landscape is situated on a flat terrace of Tertiary sediments capped by the Belterra Clay Formation (Clapperton 1993), at least 90 m above the water level of the adjacent Tapajós and Amazon rivers. Regional soils are predominantly oxisols dominated by kaolinite clay

minerals and free of hardpan or iron oxide concretions in the upper 12 m (Nepstad *et al.* 2002). Originally the survey region was entirely covered by lowland tropical forest. By 2008 approximately one third had been deforested with much of the forest outside the FLONA having been degraded from the impacts of logging and fire (RAS *unpubl. data*).

At the extreme north-western point of the region (Figure 1), there is an enclave of about 10,000 ha of savannah habitat on a peninsula beyond the town of Alter do Chão. The vegetation here is dominated by an herbaceous stratum composed principally of tuft-forming grasses (*e.g.* *Paspalum carinatum* and *Trachypogon plumosus*) and sedges (*e.g.* *Rhynchospora hirsute*) interspersed with patches of trees and shrubs (principally the families *Myrtaceae* and *Rubiaceae*) (Miranda 1993, Magnusson *et al.* 1999, Magnusson *et al.* 2008) and some larger forest fragments. The trees are short in stature, often with tortuous trunks, a thick cortex and leathery leaves, and do not form a continuous canopy. Regular semi-annual burning can significantly reduce the area covered by the common shrub species, which then become dominated by the grass *P. carinatum* (Sanaiotti & Magnusson 1995). Such savannah formations were formerly more widespread; Griscom & Greenway (1941) states of the environs of the city: '*the built-up part is surrounded by savannahs for a distance of about two kilometres, beyond which the dense vegetation, high and savage, begins.*'

The northern border of the region is delimited by the *várzea* forests and associated series of sedimentary islands and channels resulting from constant fluvial action. Behind these, on clay soils, lie savannahs and open lakes, both of which flood seasonally. The lakes swell and retract according to the flood cycle, sometimes covering tens of square kilometers. Large grasses found on the flooded savannah include *Echinochloa polystachya*, *E. spectabilis*, *Hymenachne amplexicaulis* and *Leersia hexandra*, in addition to sedges such as *Scirpus cubensis*, *Cyperus luzulae* and *Scleria geniculata*. At the ecotone between the savannah and forest habitats dominant shrubs and small vines include *Artemisia artemisiifolia*, *Ipomoea fistulosa*, *Polygonum punctatum*, *Mimosa pigra*, *Montrichardia linifolia*, *Rhabdadenia macrostoma* and *Clitonia triquetum* (Pires & Prance 1985, Daly & Mitchell 2000).

2010-2011 survey experimental design

To develop our sampling approach the municipalities of Santarém-Belterra in the region between the Tapajós and Curuá-Una rivers, bordered to the north by the Amazon river and extending approximately 140 km south along the BR-163 highway (Figure 1), were divided up into catchments of 5,000 – 6,000 ha, which were delineated using a digital elevation model and SWAT (Soil and Water Assessment Tool) for ARCGIS 9.3

(ESRI 2008). We then selected a subset of 18 catchments (Table 1, Figure 1) to represent a gradient of accumulated forest loss from 78% (28% remaining forest cover) to 0% (100% remaining forest cover) (Figure 1). Total deforestation extent is correlated with many other factors including age of occupation, types of historical land-use change, road access as well as biophysical variables (such as topography). Once a set of candidate catchments was identified to capture the full deforestation gradient, a final selection of 18 catchments was made to ensure satisfactory representation of current land-use practices, the spatial distribution of the rural population, and major

soil types. All landowners in each catchment were visited prior to any fieldwork to introduce the RAS project and secure permissions for surveys in private properties (Gardner *et al in press*).

Within each catchment, we used a stratified-random sampling design that helped ensure that sample data provide a representative assessment of the overall environmental condition. In each catchment a standard density (1 per 400 ha) of 300 m study transects was distributed across the landscape in proportion to the percent cover of forest (including primary and secondary forests) and production areas (including agriculture,



FIGURE 1. A map of the municipality of Santarém illustrating major land-use types and the locations (and numbers) of the 18 study catchments.

pasture, fruticulture and silviculture) – such that if half of the catchment is covered by forest then it receives only half of the study transects. Within each of these major land-use categories sample transects were distributed randomly to increase the likelihood that we captured important internal heterogeneities in forest and/or production

systems. A minimum separation distance rule of 1,500 m between transects was employed to minimize dependence between points. Where forest cover fell below 1,200 ha, we maintained a minimum of three sample transects in forest (ensuring we captured a reasonable sample of the state of the forest in that catchment).

TABLE 1. Co-ordinates, total area and percentage forest cover (using using a 2008 Landsat-Palsar classified image courtesy of The Nature Conservancy) of the 18 catchments sampled during the study.

Catchment code	Latitude and Longitude of catchment centroid	Catchment size (ha)	% forest cover
69	2°32'53"S; 54°40'35"W	4299	46
81	2°37'45"S; 54°31'23"W	4659	57
99	2°40'28"S; 54°38'44"W	4546	47
103	2°40'30"S; 54°54'33"W	4105	39
112	2°42'37"S; 54°28'55"W	4795	38
125	2°45'21"S; 54°36'32"W	4852	39
129	2°44'17"S; 54°45'57"W	4963	52
157	2°49'8"S; 54°28'48"W	4321	81
160	2°47'0"S; 54°51'5"W	4841	60
165	2°49'44"S; 54°59'51"W	3447	99
199	2°51'52"S; 54°47'58"W	3228	28
236	2°57'50"S; 54°44'1"W	3681	63
260	3°1'7"S; 54°52'55"W	4219	59
261	3°1'7"S; 55°0'12"W	4654	100
307	3°9'14"S; 54°51'27"W	3451	87
357	3°16'50"S; 54°52'41"W	3518	67
363	3°19'1"S; 54°58'12"W	5166	100
399	3°27'40"S; 54°50'17"W	5215	77

Avian Sampling

Fieldwork by A. C. L., N. G. M., C. B. A., B. J. W. D. and E. V. L. was conducted from 16 October 2010 to 8 February 2011. We conducted two repetitions of three fixed width (75 m) 15-minute point counts per transect situated at 150 m intervals along a 300 m transect. All point counts (PCs) were conducted by principal observers A. C. L., N. G. M., C. B. A. and B. J. W. D. with the exception of two transects carried out independently by E. V. L. in Catchment 236 (see Figure 1 for numbering of study catchments). Surveys were not carried out on days with persistent rain and/or strong winds. Any systematic effect of seasonality (presence/absence of austral/boreal migrants and peaks and troughs in vocalization activity) was minimized by systematically rotating surveys between catchments of varying total forest cover and between habitat types.

Digital Vouchers

We have archived digital vouchers (photo and sound-recording e-vouchers) on the internet to provide documentary evidence for all species recorded (Appendix 1). Such vouchers are not intended to supplant traditional specimen vouchers (*cf.* Monk & Baker 2001), although even these can be wrongly identified, but instead are aimed at providing the opportunity for general peer-review, which is not possible if documentary vouchers such as archived museum skins, photographs or sound recordings are not also made electronically available. Minimum criteria for inclusion on the list include multiple sight records by multiple observers, of species easy to identify and considered to be biogeographically likely in the region (i.e. there are documented records at other sites close to the study region). Our images have been archived on the Brazilian avian photo archive Wikiaves (www.wikiaves.org).

wikiaves.com.br) and our sound-recordings are archived on the global avian sound library Xeno-canto (www.xeno-canto.org). Recordings on both sites are searchable by the catalogue number provided in Appendix 1, in addition we also provide catalogue numbers for 'background species' on Xeno-canto recordings. Where we are unable to provide a voucher (4% of species) we moved the species to Appendix II and also provide observer(s) names and date and details of the sighting.

Historical Analysis

We provide accession numbers for voucher specimens of species previously collected in the region in Appendix 1. We compiled a list of specimens collected by previous fieldworkers from the Museu Paraense Emílio Goeldi, Belém, Brazil (MPEG) and were provided with digital data for the holdings of the Carnegie Museum of Natural History, Pittsburgh, USA (CM) and partial data (only non-passerines available) for the Museu de Zoologia Universidade de São Paulo, São Paulo, Brazil (MZUSP). We used the digital database *Ornis* <http://www.ornisnet.org/> to search for historically-collected specimens and retrieved records from the American Museum of Natural History, New York, NY, USA (AMNH), the Academy of Natural Sciences, Philadelphia, PA, USA (ANSP), the Field Museum of Natural History, Chicago, IL, USA (FMNH), the Los Angeles County Museum of Natural History, Los Angeles, CA, USA (LACM), the Louisiana State University, Baton Rouge, LA, USA (LSU), the University of Michigan, Museum of Zoology, Ann Arbor, MI, USA (UMMZ) and the United States National Museum, Washington, D.C., USA (USNM). Collecting localities were located using Paynter & Traylor (1991).

We critically reviewed specimens and solicited photographic documentation of any specimens deemed by us and independent collaborators (Curtis Marantz & Bret Whitney) to be biogeographically unlikely. This search of museum holdings was accompanied by a review of previous published ornithological inventories from the region and we also include digital vouchers of images and sound-recordings archived on Wikiaves and Xeno-Canto by non-authors separately, coupled with voucher numbers for sound-recordings archived at the Macaulay Library <http://macaulaylibrary.org/> (principally by Curtis Marantz) of species listed in Henriques *et al.* (2003).

Our taxonomy follows the checklist of Brazilian birds compiled by the Comitê Brasileiro de Registros Ornitológicos (CBRO 2011).

RESULTS

During our 100 days of fieldwork we recorded 427 species in 70 families (Appendix I), of these we provide our

own digital vouchers for 375 species (88%, 250 species represented by images and 266 by sound-recordings). Historical collecting effort in Santarém was intense; we located records of over 10,000 specimens of 531 species in 10 collections. This in addition to a significant number of early skins deposited at the British Museum, Tring, UK which are as yet undigitalised. By totaling these historical records (and other contemporary records supported by digital vouchers) we can add a further 156 species to the total giving a total of 583 species in 70 families. Species recorded by us and missed by all previous inventories included the expected transient or scarce resident waterbirds (*e.g.* Snowy Egret *Egretta thula*), potentially colonizing non-forest species (*e.g.* Plain-breasted Ground-dove *Columbina minuta*), the poorly sampled nocturnal avifauna (*e.g.* Long-tailed Potoo *Nyctibius aethereus* but also that would be considered core members of the *terra firme* forest community such as Brown-banded Puffbird *Notharcus ordii* and Grey Elaenia *Myiopagis caniceps*. These latter species represent surprising omissions, but their canopy lifestyles probably put them 'beyond the shotgun reach' of many earlier collectors and may have been missed in contemporary surveys by a combination of local rarity and their unobtrusive habits. We retained one unvouchered species: Para Gnatcatcher *Polioptila paraensis* on the main list given multiple detections by our and past inventories; the presence of this species in the region is also supported by documented records from adjacent municipalities.

A number of species from recent inventories or unpublished observations (including our own) did not meet our minimum criteria for inclusion in the main list and these records (of 26 species) are summarized in Appendix II. In most cases we simply consider these records to be unproven and are not inferring necessarily that an identification is certainly in error. However, in the case of the report of Green-barred Woodpeckers *Colaptes melanochloros* from Alter do Chão listed in Sanaiotti & Cintra (2001) we consider it highly likely that these were misidentified Spot-breasted Woodpeckers *Colaptes punctigula* which are a common resident in that region and absent from the list of Sanaiotti & Cintra (2001). Likewise, the records of Rufous-capped Motmots *Baryphthengus ruficapillus* listed in Henriques *et al.* (2008) appeared in error and referred to Rufous Motmots *B. martii*.

We follow Silveira *et al.* (2005) in considering the presence of Sulphur-breasted Parakeet *Aratinga maculata* in the region as unproven. There are two specimen records from Santarém - one collected by E. Garbe in 1920 (MZUSP 10644) and the other by A. M. Olalla in 1935 (MZUSP 18451). The former is suspected as having come from Monte Alegre and the latter was apparently of captive origin (Silveira *et al.* 2005). In addition to these two specimen records, Silva & Willis (1986) reported a series of sight records of this species from Santarém - groups of

3, 5 and 6 in *várzea* forest at Maicá on 16 January 1984, 2 feeding on small melastomataceous fruits in seasonally flooded forest at Rodagém, Santarém on 18 October 1984 and groups of 3 and 5 in secondary forest at Urumari, in February 1985, all considered unproven by Silveira *et al.* (2005). Given that this species' distribution has recently been found to be far more extensive than previously thought, extending east to Amapá (da Costa *et al.* 2011) and north into Suriname (Mittermeier *et al.* 2010), then a confirmed record from the south bank of the Amazon river seems less far-fetched than was previously considered.

We paid particular attention to trying to validate historical records that were not supported by recent field observations and those which appeared to be biogeographically unlikely. At the top of this list was a record of Brown Tanager *Orchesticus abeillei* (UMMZ 22269) collected by Joseph Steere. We were unable to obtain images of the specimen but this record of an Atlantic Forest endemic is entirely unlikely and presumably either refers to a misidentified or mislabeled specimen. A number of skins collected by A. M. Olalla from the region were adjudged to be likely misidentified and this proved to be the case on examining images of the original skins. These included a specimen of Semipalmated Sandpiper *Calidris pusilla* which we re-identified as Least Sandpiper *Calidris minutilla* (MCZ 173283 see separate species account below); a specimen of Black-bellied Antwren *Formicivora melanogaster* (MCZ 174889) which we reidentified as a female Rusty-backed Antwren *F. rufa*; and a specimen of Black-necked Red-cotinga *Phoenicircus nigricollis* (MCZ 171158) which we reidentified as Guianan Red-cotinga *P. carnifex*. In addition we consider the identification of a female Thick-billed Euphonia *Euphonia lanirostris* (MCZ 176604) to be improbable by range and more likely to relate to a Violaceous Euphonia *E. violacea*, separation of females of these two replacement species is very difficult. Riker & Chapman (1891) list a record of an unidentified *Attila* sp. that they considered 'may be the as yet undescribed female of *A. citriniventris*' [Citron-bellied Attila]. The specimen is deposited in the collection of the National Museum of Natural History (USNM 121134) and until recently was labeled as *A. citriniventris*. However, this would be biogeographically unlikely considering that this species is restricted in Brazil to the western Guianas. T. Chesser (*in litt.*) examined the specimen on our behalf and found the plumage to be in poor condition, stained by some unknown chemical, but noted that plumage coloration (to the extent that it can be discerned) and bill morphology and coloration match those of Dull-capped Attila *A. bolivianus*. Moreover, "yellow iris" is noted on the back of the original collector's label; a yellowish-white iris is found among species of *Attila* only in *bolivianus*. An old specimen record of Peruvian Recurvebill *Simoxenops ucayalae* (MPEG 32018), purportedly from Santarém has proven rather controversial. Novaes (1978) considered

the specimen likely mislabeled, as at the time there were no records from the eastern Amazon, but the species has subsequently been found at various disjunct locations in eastern Amazonia, including as close as Altamira (230 km south-east), so although there have been no subsequent records from the region this species may occur in (or close to) the region (Aleixo *et al.* 2000). These exceptions aside we are confident that specimens labeled as 'Santarém' were taken from our study region south of the Amazon River and east of the Tapajós given the absence of specimens of common replacement *terra firme* forest species from adjacent areas of endemism (such as the west bank of the Tapajós, or north of the Amazon). However, an element of doubt remains over records of the following generalist and edge species which are typically widespread in anthropogenic habitat elsewhere in Amazonia: Rusty-fronted Tody-Flycatcher *Poecilotriccus latirostris*, Euler's Flycatcher *Lathrotriccus euleri* and Chalk-browed Mockingbird *Mimus saturninus* but which are only represented by historic specimens (and no contemporary observations). There remains the possibility that these species might have been collected from river-islands closer to the north than the south bank of the river Amazon or have simply failed to colonize *terra firme* habitats in the region.

Our own fieldwork produced several unconfirmed records (Appendix II). The most notable of these were the multiple detections of Spix's Guan *Penelope jacquacu*, which most contemporary distribution maps indicating that this species does not occur north of the Serra do Cachimbo (a significant faunal and floral barrier 600 km south of the region) in the Tapajós-Xingu interfluvium. However, this species was reported north of the Serra do Cachimbo, in Novo Progresso by Pacheco & Olmos (2005), has been collected 200 km SW of our region at Fazenda Jamaxim, Altamira, PA on 24 November 2005 by A. A., E. Portes and M. Silva (MPEG 59303) where the species was also recently recorded by C. B. A. and A. Whittaker, suggesting that our records may not be in error, despite the lack of previous reports of this large and generally conspicuous species.

Although not listed in Appendix II, a possible aural contact of Black-chested Tyrant *Taeniotriccus andrei* from secondary forest in catchment 112 is worthy of mention here given the lack of previous reports from the western half of the Tapajós-Xingu interfluvium. The distant and poorly heard single note contact call was only detected on revision of the point count recording, and therefore cannot be confirmed. Although Zimmer & Whittaker (2004) list a specimen (MPEG 49278) from 'Novo Fazenda, Jaburu, Santarém, PA' this actually refers to a bird collected at Fazenda Jaburu, Novo Santarém; confusion owing to a slightly ambiguous specimen label. Novo Santarém lies east of Belém, a region where *T. andrei* is reasonably common (*cf.* Lees & Moura 2011).

Selected species accounts for taxa of significant biogeographic or conservation interest recorded during RAS fieldwork

Brown Tinamou *Crypturellus obsoletus*

N. G. M. sound recorded several vocalising individuals in river-edge forest in catchment 165 on 14 December 2010 (Moura 2010a). This species was unrecorded by Henriques *et al.* (2003), but has previously been collected from the region by S. M. Klages who obtained three individuals at 'Colônia do Mojuí' (=Mojuí dos Campos) in November 1919 (Blake 1961). These birds pertain to the subspecies *griseiventris* which is significantly vocally and morphologically distinct from other Amazonian and Atlantic Forest populations and might be better considered a separate species.

Crested Eagle *Morphnus guianensis*

Although recorded from the first inventory, we include an account for this species given the collection of data on the species' breeding biology. João Batista Ferreira, a local landowner on whose property we had a transect (catchment 103), took us to see a nest of an 'eagle', which transpired to be the active nest of a pair of *Morphnus guianensis* with a dependent (circa 7 month old) juvenile (Andretti 2010a). The nest (Figure 2, Lees 2010a) was located within a patch of old secondary forest on the edge of the town of Belterra. The structure was quite small, 120 cm x 105 cm and 62 cm deep, positioned 30 m up in a 'morototó' tree, family Araliaceae (Programa de Conservação do Gavião-real *in litt.* 2011). This is the first report of a suburban pair of *Morphnus* from anywhere in the world and only the 7th nest of this species recorded from Brazil. This discovery parallels that of a suburban pair of Harpy Eagles *Harpia harpyja* in Alta Floresta, Mato Grosso (MT), which bred successfully for at least three consecutive years in a 270 ha forest fragment (Lees 2006). These two examples illustrate how large forest eagles may not be prey-limited in small forest fragments, but are probably extremely susceptible to being hunted should they become accustomed to prey upon small livestock (Trinca *et al.* 2008).

Apomado Falcon *Falco femoralis*

We first recorded this falcon in catchment 260 where A. C. L. observed a single adult hunting over soy bean fields on 6 December 2010 (Lees 2010b). We subsequently recorded this species on a further five occasions including an additional two catchments (99 and 125), all hunting over open farmland. In addition, E. V. L. photographed a juvenile (Lopes 2011a) at Alter do Chão on 6 March 2011; a location where this species has

previously been reported by Sanaïotti & Cintra (2001), who suspected on the basis of a single July record that this species may be a migrant in the region. Considering our records in the austral summer, we assume this species to be a rare resident in the region. There is one historical record from the region: one (MCZ 173143) collected by A. M. Olalla from 'Santarém, Tapajós river'. These records are apparently the only ones from central Amazonia, with the closest records coming from the southern savannahs of Guyana and Roraima (RO), 650 km NW (Robbins *et al.* 2004, Santos & Silva 2007), Vila Nova, AP, 520 km NE (Schunk *et al.* 2011), and Alta Floresta, MT, 815 km south (Mahood *et al.* 2012, Lees *et al.* 2013).

Plain-breasted Ground-dove *Columbina minuta*

We recorded this species on two occasions: single individuals photographed (Moura 2011a), and sound-recorded (Moura 2011b) by N. G. M. from cattle pasture in catchment 69 on 8 January 2011, and from a smallholder's fruit farm in catchment 112 on 31 January 2011. We are only aware of two previous reports from central Amazonia – an individual collected from the savannahs of Monte Alegre, PA (Vasconcelos *et al.* 2011) and sight records from the Juruti region, PA (Santos *et al.* 2011) but this species has been reported from several peri-Amazonian sites (*e.g.* Schunk *et al.* 2011, Somenzari *et al.* 2011). Our records probably relate to individuals colonizing anthropogenic habitats from these savannah enclaves rather than individuals spreading in from peri-Amazonian areas. We predict that this species will prove to be considerably more widespread in Amazonia than these scant records indicate.

Hyacinth Macaw *Anodorhynchus hyacinthinus*

We encountered this threatened macaw on two occasions from two different catchments; C. B. A. observed a single individual flying overhead on 17 October 2010 in catchment 261, and B. J. W. D. and A. C. L. independently heard and sound-recorded a single passing over the canopy in catchment 363 on 23 January 2011 (Davis 2011a). We assume that these pertain to wandering individuals from populations further south along the BR-163 (*e.g.* Pacheco & Olmos 2005) and highlight the current local rarity of the species. The species was formerly more widespread in the Santarém region; Riker (1891) obtained three specimens 'twenty-five miles back from Santarém' on 10 June 1887.

Long-tailed Potoo *Nyctibius aethereus*

We recorded this enigmatic potoo on two occasions, the first records from the Santarém region. C. B. A. sound-recorded one singing distantly (Andretti 2010b)

from catchment 261 on 20 October 2010 and B. J. W. D. sound-recorded one in catchment 363 on 24 January 2011. Despite regular night-time searches (and fairly regular aural contacts with White-winged Potoos *Nyctibius leucopterus*) we were unable to find Rufous Potoo *N. bracteatus* in the region. The closest records of this latter species are one sound-recorded 200 km south of the region from Trairão on 7 June 2008 by C. B. A. and on the west bank of the lower Tapajós at Juruti (Santos *et al.* 2011) and the Reserva Extrativista Tapajós-Arapiuns (MPEG 72300 and 72301).

Great Horned Owl *Bubo virginianus*

E. V. L. photographed a single individual day-roosting on the campus of the Universidade Federal do Oeste do Pará on 13 October 2011 (Lopes 2011b). There are few records of this species from the central Amazon, although this species is present on savannahs in Roraima (Naka *et al.* 2006) and Suriname (Mittermeier *et al.* 2010).

Streak-throated Hermit *Phaethornis rupurumii*

We recorded the *amazonicus* subspecies of this hermit on eight occasions from three different (although geographically adjacent) catchments (99, 125 and 129); most of these were secondary forest sites although we also

encountered this species in logged and burnt primary forest. A. C. L. located two different leks – one each in 125 and 129 where the birds were photographed (Figure 3, Lees 2011a) and sound recorded (Lees 2011b). This taxon is typically considered to be restricted to the *várzeas* of the river Amazon and its major tributaries. However our observations, of leks in secondary forest over 25 km from a major river, mirror those of Schunck *et al.* (2011) from Vila Nova, Amapá, who found this species ‘*in woodlots and narrow riverine forest within the mosaic of savannistic formations of Vila Nova, distant from the widest rivers*’. This confirms that this species has a broader tolerance of forest habitats than previously suspected but we cannot rule out that this expansion into non-riparian habitats may be a recent phenomenon following land-use change. We may have overlooked this species if present at a low density elsewhere in the region owing to the sympatric presence of as many as six species of *Phaethornis* hermits (and *Glaucis hirsutus*), which made identification of fly-through individuals at times difficult or impossible.

Tapajós Hermit *Phaethornis aethopyga*

This species, recently re-elevated to species status (Piacentini *et al.* 2009) is endemic to the Tapajós-Xingu interfluvium, occurring between the river Teles Pires and the river Amazon and was listed as *Phaethornis*



FIGURE 2. Nest of Crested Eagle *Morphnus guianensis* at catchment 103 in Belterra (A. C. L.).



FIGURE 3. Streak-throated Hermit *Phaethornis rufurumii* at lek in a fragment of secondary forest (A. C. L.).

longuemareus in Henriques *et al.* (2003). We found it to be the most common *Phaethornis* hermit within the FLONA, but to be uncommon or absent from most of the catchments outside of the reserve where it was largely replaced by Reddish Hermit *Phaethornis ruber* and *P. rufurumii*, although S. M. Klages collected one individual at Colônia do Mojuy on 27 October 1919. Whether this current distribution is potentially related to topographically-determined micro-habitat preferences or direct replacement by these more ruderal hermit species remains unclear, but on current evidence this species appears to be quite disturbance intolerant *cf.* Henriques *et al.* (2008) although also see Piacentini *et al.* (2009).

Brown-banded Puffbird *Notharchus ordii*

We recorded this poorly known puffbird on two occasions: C. B. A. tape-recorded (Andretti 2010c) one in catchment 399 on 1 November 2010 and saw a second individual in catchment 261 on 19 October 2010. C. B. A. also recorded this species from the region of Trairão where the species was recorded on four dates in September 2009 on the Transamazônica 80 km NE of Itaituba and on the river Cupariri 92 km east of Itaituba (PA). This species is often reported as being associated with stunted

forest on white sandy soils *e.g.* in Acre (Guilherme & Borges 2011), north-eastern Peru (Alonso & Whitney 2003), southwestern Venezuela, and the upper river Negro region of northern Brazil (Zimmer & Hilty 1997) and in dept Pando, Bolivia (Tobias & Seddon 2007). This record however, coupled with others from Alta Floresta (Zimmer *et al.* 1997), Novo Progresso (Aleixo *et al.* 2008), the Juruti region of Pará (Santos *et al.* 2011) and Tambopata, south-eastern Peru (A. C. L. & A. Whittaker) reinforces the notion that this species may be under-recorded in tall stature central Amazonian *terra firme* forests. Vasconcelos *et al.* (2011) lists a record from the opposite bank of the river Amazon at Monte Alegre, PA - a female (MPEG 4405) collected by A. Costa on 17 November which would be the first record of *N. ordii* east of the river Negro and north of the river Amazon. However, there is some uncertainty surrounding the locations of some Costa specimens from the region, which may have been taken on the south bank (F. Lima *in litt.*). Costa collected a second *N. ordii* specimen from Monte Cuçari on the south bank, seven days before collecting MPEG 4405 allegedly from Monte Alegre, this specimen is held in Berlin (ZMB 311582). Given these doubts and a lack of subsequent records, we consider the presence of *N. ordii* north of the Amazon and east of the Negro to be unproven.

Purple-throated Cotinga *Cotinga cotinga*

This spectacular cotinga was recorded on just two occasions: A. C. L. photographed (Lees 2010c) a single adult male from the LBA Tower at KM-67 on 5 December 2010; and observed a female in the canopy of old secondary forest in catchment 160 on 18 December 2010. The only other record for the region we managed to trace were two (USNM 120921 and USNM 120922) collected by C. Riker at Diamantina, one mentioned in Riker & Chapman (1891) as collected on 4 July 1887, the other listed as '1886'.

Pale-breasted Spinetail *Synallaxis albescens*

We recorded this non-forest spinetail from cattle pasture in just two transects (*e.g.* Lees 2011c) in two different catchments (129 and 157), this in sharp contrast to its abundance in our sister landscape in Paragominas where the species was a near-ubiquitous inhabitant of agropastoral landscapes (Lees *et al.* 2012). Both landscapes contain catchments with similar deforestation histories and abut areas where the species ancestrally occurred, so it remains unclear why the species has proliferated in Paragominas and not in Santarém. Aleixo *et al.* (2008) reported this species from disturbed habitats between Moraes de Almeida (50 km north of Novo Progresso) and Santarém on 11 December 2005. The only historical record we were able to find for the region concern a pair collected by S. M. Klages in April 1919, the male of which was later designated as the type of *S. a. griseonota* by Todd (1948). This proposed race was described as having a paler crown and wing-coverts and more greyish underparts than *inaequalis*, but has subsequently been synonymised with the latter (Remsen 2003).

Fiery-capped Manakin *Machaeropterus pyrocephalus*

We encountered this unobtrusive manakin twice: from catchment 157 on 2 February 2011 (A. C. L.), and from catchment 125 on 7 February 2011 (Davis 2011b). This species had been collected three times previously from the region: a male collected from the 'right bank of the Tapajós at Santarém' by A. M. Olalla on 19 June 1934; and two males collected by J. M. Cardoso da Silva at Urumari on 10 January and 2 February 1984. These scant records do not permit a confident appraisal of whether or not the lack of previous records from the FLONA (Henriques *et al.* 2003, our data) reflects a genuine absence from this site and other areas lacking sandy soils along the main Tapajós riverbank or difficulties in detecting the species on account of its relatively cryptic vocalisations and mist-net avoidance combined with its local rarity.

Yellow-crowned Elaenia *Myiopagis flavivertex*

We detected this flycatcher from three transects in two different catchments (69 and 81) between 12 and 17 January 2011 (*e.g.* Lees 2011d). *Myiopagis flavivertex* is widely considered to be a specialist of *várzea* forests, but all of our records come from logged and burnt *terra firme* forest sites on the plateau, although in all cases never more than 5 km from the river Amazon. These records might either represent wandering males which have been unable to secure 'high quality' territories in adjacent *várzea* forests or alternatively indicate a potentially new trend towards colonisation of moderately disturbed *terra firme* forests.

Gray Elaenia *Myiopagis caniceps*

This canopy flycatcher was found to be an apparently rare member of canopy mixed-species flocks and was detected just six times from five different catchments in addition to a pair regularly present at the LBA Tower at KM-67 (Figure 4). This species was missed by both historic and recent inventories owing to its unobtrusive canopy habits. The taxonomy of this species is under investigation by C. B. Andretti and collaborators, birds from Santarém are of the same vocal type as other eastern Amazonian and Atlantic Forest populations (although morphologically distinct from the latter) but are very different from populations in south-west Amazonia and northern Amazonia.

Bank Swallow *Riparia riparia*

A. C. L. photographed two individuals (Lees 2011e) within a migrating flock of c.1000 Barn Swallows *Hirundo rustica* hawking over cattle pasture in catchment 125 on 5 February 2011. This species is apparently rare in central-eastern and eastern Amazonia (Stotz *et al.* 1992), with no records from extensive surveys in the Belém centre of endemism (*e.g.* Novaes & Lima 1998, Portes *et al.* 2011) and only a single record from the Alta Floresta region (Lees *et al.* 2013), although the species was reported by Fávoro & Flores (2009) from the Estação Ecológica Terra do Meio, PA. This rarity should reinforce the notion that Neotropical migrant swallows are not uniformly distributed across the South American continent as illustrated in many published distribution maps and may be very spatiotemporally localised (*cf.* Remsen 2001).

Cocoa Thrush *Turdus fumigatus*

We include a species account for this taxon as it seems a rather odd omission from the Henriques *et al.* (2003) inventory, as it ought to be a 'core *terra firme*' species. However, we only recorded this species from three different transects in three different catchments in



FIGURE 4. Gray Elaenia *Myiopagis caniceps* photographed from the tower at KM-67 in the FLONA (A.C. L.).

addition to a relatively confiding pair that frequented the LBA Base at KM-83 (Figure 5, Lees 2010d). S. M. Klages collected four individuals in 1919, one from 'Colônia do Mojuy' and three from 'Santarém (Tapajós river; Right Bank) and Riker & Chapman (1890) collected three specimens and described the species as 'common in semi-palm growths'.

Red-crested Finch *Lanio cucullatus*

We recorded this species on two occasions from catchment 369, two different singing males (3 km apart) located on 3 December 2010 by A. C. L. (e.g. Lees 2010e). The first was singing from the edge of primary forest, bordered by a ploughed field and the second from scrubby second growth bordering primary forest. Further afield, C. B. A. photographed and sound-recorded two individuals of this species from the town of Trairão 220 km south-west of the region on 8 and 15 June 2008. These records represent substantial range extensions from the nearest sites in Alta Floresta (Lees *et al.* 2013) and Paragominas (Portes *et al.* 2011, Lees *et al.* 2012), we cannot eliminate the possibility that such records might relate to local introductions, but considering the speed at which open country species have colonized much of

the Amazon, natural colonization seems more likely (*cf.* Mahood *et al.* 2012).

Historical Records

Sharp-shinned Hawk *Accipiter striatus*

Whilst searching through the catalogue of birds collected by S. M. Klages from the region, we came across a record of a female *Accipiter striatus* (CM 72339) collected at Santarém (Tapajós river; Right Bank) on 2 May 1919 and assigned to the subspecies *erythronemius*. *Accipiter striatus* is unrecorded from the Brazilian Amazon, or indeed anywhere in lowland Amazonia, so given the importance of the record we solicited images of the original skin from S. Rogers at the Carnegie Museum. The images (Figure 6) confirm that the specimen pertains to *A. striatus* and can be further aged as a subadult female by the retained (streaked) juvenile feathers on the throat. This record represents the first confirmed record from the Brazilian Amazon. Subsequently M. Cohn-Haft (*in litt.*) collected an immature plumaged bird in savannah woodland on 7 May 2007 in Amazonas (AM) in the Madeira-Purus interfluvium on the Ramal do Mucum, 50 km west of Porto Velho at 8° 40' S; 64° 25' W. Other



FIGURE 5. Cocoa Thrush *Turdus fumigatus* at the LBA Base KM-83, FLONA forest (A. C. L.).



FIGURE 6. Composite image of the first Brazilian Amazonian record of Sharp-shinned Hawk *Accipiter striatus* (S. Rogers copyright Carnegie Museum).

sight records include two undocumented sight records from Manaus, AM in Cohn-Haft *et al.* (1997) and two sight records from Alter do Chão on 11 and 29 November 2000 (R. Cintra *in litt.*).

Least Sandpiper (*Calidris minutilla*)

A record of a 'Semipalmated Sandpiper *Calidris pusilla*' collected by A. M. Olalla on 18 November 1932 (MCZ 173283) from 'Santarém' (Griscom & Greenway 1941, Stotz *et al.* 1992) was to our knowledge the only documented record of this species in the interior of the Brazilian Amazon. We examined digital images (Figure 7) of the original specimen and reidentified the individual as a Least Sandpiper *C. minutilla* based on the thin, slightly decurved beak, extensive dark-centers to the mantle feathers and yellowish legs. Least Sandpiper is an uncommon vagrant/scarce passage migrant to the interior of Amazonia with documented records from MT, PA, RO and AM (Stotz *et al.* 1992). We consider Semipalmated Sandpiper to be an unproven vagrant to Amazonia and any future reports should preferably be documented with high quality digital images.

Gull-billed Tern *Gelochelidon nilotica*

The only record that we can trace for the region concerns a single breeding-plumaged adult photographed by Kurazo Okada (Aguiar 2010) at the Lago do Maicá on 31 July 2010. The status of this species in the interior of the Amazon basin is unclear, but circumstantial evidence suggests that this species maybe a regular seasonal visitor (breeder?) along the river Amazon. For instance, Kirwan *et al.* (2012) recorded four individuals of *Gelochelidon nilotica* associating with a mixed colony of Large-billed Terns *Phaetusa simplex* and Black Skimmers *Rhynchops niger* and exhibiting indications of breeding on the Ilha da Benta, Itacoatiara, Amazonas state (c.400 km WSW of Santarém) on 21–22 November 2011. Closer to the study region, G. M. Kirwan and C. F. Collins observed one midstream in the river Amazon c.20 km west of Monte Alegre, Pará, on 8 December 2005 (Kirwan *et al.* 2012). Further afield, this species has been collected from Marajó Island (Henriques & Oren 1997) and we (A. C. L. and N. G. M.) have recorded flocks of this species on the Pará coast at Salinópolis, Bragança and Augusto Corrêa (*e.g.* Lees 2011f).



FIGURE 7. Composite image of Least Sandpiper *Calidris minutilla* originally identified as Semipalmated Sandpiper *Calidris pusilla* (J. Trimble, copyright Museum of Comparative Zoology, Harvard University).

Scaled Ground-cuckoo *Neomorphus squamiger*

The type series of the micro-endemic *Neomorphus squamiger* comes from Colônia do Mojuy by S. M. Klages – four individuals (two males and two females) collected on three dates in October and November 1919. Klages, in Todd (1926) remarked of the habitat preferences of this taxon: “It lives on or near the ground in the dense forest, where it accompanies the hunting ants, and is rare so far as my experience goes. It was never met with in the littoral area, nor yet in the contiguous forested mesa, but only upon penetrating back into the more elevated Mojuy district. We sought for it in vain along the Tapajós.” Subsequently A. M. Olalla collected two (MCZ 173562 and MCZ 173563) at Tauary, 39 km south-west of Santarém and alongside the Tapajós. We know of no subsequent reports for the region. Although we have no evidence for its continued persistence within the FLONA, we assume that the species is likely still extant there in more isolated regions and likely also persists in extensive areas of unsurveyed upland forest in the east of the region. Elsewhere, C. B. A. briefly observed one at Trairão (PA) on 14 September 2009 following a large understorey mixed species bird flock in selectively-logged forest. The absence of a breast band was noted and the bird was observed removing loose bark from a decomposing fallen tree.

Pavonine Quetzal *Pharomachrus pavoninus*

One (MCZ 173835) was collected by A. M. Olalla at Tauary and has apparently been overlooked in subsequent publications. The nearest records from the Tapajós-Xingu interfluvium were made by Pacheco & Olmos (2005) at Vicinal Progresso (07°10'S; 55°06'W), 30 km SSE from Novo Progresso, PA (440 km south of Santarém) on 16 May 2002 and Aleixo *et al.* (2008) recorded this species from the Floresta Nacional de Altamira, near Moraes Almeida (PA) in December 2005 (370 km south of Santarém). The south-central FLONA probably represents the northern limit of the range for a species which generally occurs at low density throughout its range.

Red-billed Scythebill *Campylorhamphus trochilirostris*

Two specimens collected by S. M. Klages from Santarém (Tapajós river; Right Bank) in “swamp forest” on 26 March (CM 71504) and 13 June (73210) 1919 were originally identified as *C. procurvoides multostriatus* by Todd (1948), but later re-identified as *C. trochilirostris snethlageae* by A. A. upon direct examination of the specimens involved and comparison with dozens of *Campylorhamphus* specimens from several collections. Both specimens from Santarém possess the typical brick-reddish hue on the underparts distinguishing the várzea specialist *C. t. snethlageae* (Zimmer 1934), rather than

the distinct brownish olivaceous, which characterizes the underparts of *C. procurvoides* populations of Santarém found exclusively in upland *terra firme* forest. Despite Todd's misidentification, Klages himself had noticed that those two Santarém specimens collected in várzea belonged to a different taxon than the *Campylorhamphus* found in nearby upland *terra firme* forest as shown by his field notes, transcribed as follows: “The birds with the serial number 2436 were collected in the upland forest. I consider this series to be different from series 2401”. Both Santarém specimens mentioned above belong to Klages' series 2401, whereas all 2436 series birds included only specimens of two *C. procurvoides* taxa associated with *terra firme*: *multostriatus* and *notabilis* (A. A. pers. obs). Klages could distinguish those two sympatric (but not syntopic) species of *Campylorhamphus* from Santarém mainly by their bill color, still well preserved shortly after collection, as indicated by his field notes: “This form with the redder h. (unreadable) and less deeply curved bill seems to be restricted to the swampy-forest”.

Zimmer's Woodcreeper *Dendroplex kienerii*

S. M. Klages collected four individuals of this seasonally-flooded forest (várzea and igapó) specialist between 24 March and 8 April 1919 from Santarém (Tapajós river; Right Bank) and A. A. and J. D. Weckstein collected two females and one male on 22 July 2000 11 km south east of Santarém, in tall forest at Lago do Maicá (MPEG 55159, 55160, 55290). The distribution of this woodcreeper seems confined mostly to western Amazonia and the Negro river basin, with the easternmost records coming from the vicinity of Santarém.

White-eyed Tody-tyrant *Hemitriccus griseipectus*

S. M. Klages collected one male (Figure 8, CM 74717) as '*Hemitriccus zosterops*' at Colônia do Mojuy on 1 November 1919. At the suggestion of B. M. Whitney we solicited images of the skin to check the identification and on comparison with skins of all Amazonian *Hemitriccus* and *Lophotriccus* species can confirm that the identification is correct (identification also independently checked by M. Cohn-Haft) and we have no reason to doubt the provenance of the skin. We do not believe we missed *H. griseipectus* during our own surveys, the voice of which all observers are familiar, and suggest that this species may be restricted to tall *terra firme* only in the east of the region and its distribution may be associated with as yet undiagnosed topographical factors. The nearest records of this species come from the FLONA do Trairão 90 km east of Itaituba (C. B. A. unpubl. data). There are no confirmed records of Snethlage's Tody-tyrant *Hemitriccus minor* from any sites in the Tapajós-Xingu interfluvium north of the Teles Pires river (Cohn-Haft 2000).



FIGURE 8. Composite image of the only regional record of White-bellied Tody-tyrant *Hemmitriccus grisepectis* (S. Rogers copyright Carnegie Museum).

'Trail's Flycatcher' *Empidonax traillii/alnorum*

An *Empidonax* flycatcher (Figure 9) was collected by G. P. Silva at Vila Mojuí dos Campos, Estrada do Palhal km 5 on 24 February 1978. This individual (MPEG 32320), was identified as Willow Flycatcher *Empidonax trailli* by E. Eisenmann and A. R. Phillips (Sick 1985), the first and only Brazilian record of this species. However, without comment the same record is listed as Alder Flycatcher *Empidonax alnorum* in Stotz *et al.* (1992) and again in Vasconcelos *et al.* (2008). This has created some confusion in the subsequent literature – for instance Silva (2011) lists February records for both species for Santarém based on different sources. We re-examined the specimen (aged as a first winter based on prominent growth-bars on the tail) but unfortunately its biometrics fell within the range of overlap in the discriminant formulas of Pyle (1997) so robust identification will have to await molecular testing (A. C. L., A. A. G. Thom *in prep.*). Vasconcelos *et al.* (2008) list just three records of *Empidonax alnorum*, the aforementioned Santarém record, a singing bird at Manaus, AM on 15 December 1984 (Stotz *et al.* 1992) and an unsexed individual (DZUFMG 4580) collected by M. F. Vasconcelos on 19 November 2005 in the Pantanal at Fazenda Figueirinha (Corumbá municipality) MS. Additional records include an individual seen and sound-recorded (ML 117234) by Curtis Marantz at Igarapé Crajari, AM on 5 April 1997, a female sound-recorded and collected by M. Cohn-Haft at Igarapé Craiata, 9 km ESE of Benjamin Constant AM

on 5 April 1991, a male collected at Feijó, Envira river, Locality Novo Porto, Fóz do Igarapé Paraná do Ouro, AC by E. Guilherme and N. S. Brígida on 20 November 2011 and one collected by E. Guilherme and P. Maurício at Manoel Urbano, BR 364, Seringal "Sardinha", AC on 10 November 2004.

Gray-cheeked Thrush *Catharus minimus*

G. P. Silva collected one specimen (MPEG 47943, Figure 10) at KM-84 of the BR-163 on 15 December 1972 and LMPH captured one individual in the FLONA on 20 March 2000. Stotz *et al.* (1992) considered this species to be 'almost completely unknown from south of the Amazon'. The 1972 record is the first from the southern Brazilian Amazon. Outside of our region, subsequent southern Amazonian records include one collected by G. P. Silva from the Sena Madureira (AC) on 4 November 1976 (Novaes 1978), and a sight record from Alta Floresta (MT) by A. Lang on 12 December 2002 (Lees *et al.* 2013).

DISCUSSION

This updated checklist provides a solid baseline for future quantitative studies and we believe that the list covers all core members of the regional avifauna. However, we anticipate that the list will continue to increase in size as new open-habitat colonizers, migrants and vagrants are added, especially considering the colonization possibilities



FIGURE 9. Composite image of 'Trail's Flycatcher' *Empidonax traillii alnorum* (A. C. L. copyright Museu Paraense Emilio Goeldi).



FIGURE 10. Gray-cheeked Thrush *Catharus minimus* collected on 15 December 1972 (A. C. L. copyright Museu Paraense Emilio Goeldi)

afforded for non-forest species following extensive habitat conversion (Lees & Peres 2006, Mahood *et al.* 2012) and even the periodic incursion of pelagic vagrants into Amazonia (*cf.* Teixeira *et al.* 1986). The region is particularly rich in boreal migrant and vagrant passerines for a central Amazonian site with 12 species recorded, perhaps indicating that the Tapajós may function as a migration corridor for boreal migrants. However, species richness for shorebirds is quite low, with notable omissions including Greater Yellowlegs *Tringa melanoleuca* and White-rumped Sandpiper *Calidris fuscicollis*, more intense surveys of suitable habitats at peak migration times will no doubt plug these gaps in the pool of expected species. Our own fieldwork did not focus on river island and *várzea* habitats which are regionally of high conservation importance, recognized in the Important Bird Area PA04 'Várzeas de Monte Alegre' which includes parts of the municipalities of both Santarém and Belterra (De Luca *et al.* 2009), although historical collecting effort in these areas was quite intense.

A quantitative analysis of regional beta diversity is beyond the scope of this paper, but it is evident that even among least disturbed *terra firme* forests of the region there is considerable heterogeneity, probably driven by topographic and edaphic factors and resulting in a patchy distribution for many species (*cf.* Alonso & Whitney 2003). Nearly two hundred years of fieldwork have failed to find within the study region many *terra firme* forest bird species known from the Tapajós-Xingu interfluvium as close as Trairão 200 km SW of the region. These apparently absent species include Collared Trogon *Trogon collaris*, White-browed Antbird *Myrmoborus leucophrys*, Black-throated Antbird *Myrmeciza atrothorax* and Striped Woodhaunter *Hyloctistes subulatus*, which probably reflects different forest physiognomies between these adjacent regions. This turnover is also reflected in the absence of records of Golden Parakeet *Guaruba guarouba* (Laranjeiras & Cohn-Haft 2009) and documented records of both Band-tailed Antbird *Hypocnemoides maculicauda* and Speckled Spinetail *Cranioleuca gutturata* (B. Whitney *in litt.*) from the southern boundary of the FLONA, but outside of our study region. These absences also illustrate that published distribution maps for many Amazonian bird species are very liberal, as they are frequently based on the extent of occurrence, while the actual area of occupancy for many species is far smaller as they are extremely patchily distributed even with the same interfluvium (*cf.* Gaston & Fuller 2009).

Santarém has one of the longest histories of ornithological fieldwork in the Brazilian Amazon; that our own fieldwork added core *terra firme* birds to the regional list is testament to the low population density and patchy distribution of many rarer taxa, and the importance of thorough familiarity with vocalizations of such species which may be easily missed in rapid inventories or by inexperienced observers. Modern avian surveys (*sensu*

Aleixo 2009) are an invaluable tool for uncovering true biogeographic patterns, and forming robust baselines for conservation policies, and should include as much accessible documentary evidence as possible to allow for general peer review (Lees *et al.* 2012).

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REFERENCES

- Aguiar, K. M. 2010.** [WA176659, *Gelochelidon nilotica* (Gmelin, 1789)]. www.wikiaves.com/176659 (accessed on: 03 Jul 2012).
- Aleixo, A. 2009.** Knowledge gaps, research priorities, and future perspectives on bird conservation in the Brazilian Amazon, p. 55-69. In: De Luca, A. C.; Develey, P. E.; Bencke, G. A. & Goerck, J. M. (orgs.). Áreas importantes para a conservação das aves no Brasil, parte II, Amazônia, Cerrado e Pantanal São Paulo: SAVE Brasil.
- Aleixo, A.; Poletto, F.; Portes, E.; Silva, M. & Lima, F. 2008.** Avaliação do estado do conhecimento da avifauna na região da BR-163 no estado do Pará, v. 2, p. 73-81. In: Ferreira, L. V. (org.). Zoneamento Ecológico-Econômico da área de influência da rodovia BR-163 (baixo Amazonas, Transamazônica e Xingu) com ênfase na biodiversidade. Belém.
- Aleixo, A.; Whitney, B. M. & Oren, D. C. 2000.** Range extension of birds in southeastern Amazonia. *Wilson Bulletin*, 112: 137-142.

- Allen, J. A. 1876. List of Birds Collected by Mr. Charles Linden, Near Santarém, Brazil. *Bulletin of the Essex Institute*, 8: 78-83.
- Alonso, J. A. & Whitney, B. M. 2003. New distributional records of birds from white-sand forests of the northern Peruvian Amazon, with implications for biogeography of northern South America. *Condor*, 105: 552-566.
- Andretti, C. B. 2010a. [WA522322, *Morphnus guianensis* (Daudin, 1800)]. www.wikiaves.com/522322 (accessed on 03 July 2012).
- Andretti, C. B. 2010b. [XC94710, *Nyctibius aethereus*] www.xeno-canto.org/94710 (accessed on 03 July 2012).
- Andretti, C. B. 2010c. [XC94707, *Notharchus ordii*] www.xeno-canto.org/94707 (accessed on 03 Jul 2012).
- Blake, E.R. 1961. A new Peruvian race of *Crypturellus obsoletus Fieldiana*, *Zoology*, 39: 573-577.
- CBRO – Comitê Brasileiro de Registros Ornitológicos. 2011. Listas das aves do Brasil, 10ª ed. www.cbro.org.br (accessed on 30 October 2011).
- Cintra, R. & Sanaiotti, T. M. 2005. Fire effects on the composition of a bird community in an Amazonian Savanna (Brazil). *Brazilian Journal of Biology*, 65: 683-695.
- Clapperton, C. 1993. *Quaternary Geology of South America*. New York: Elsevier Science.
- Cohn-Haft, M. 2000. *A case study in Amazonian biogeography: Vocal and DNA-sequence variation in Hemitriccus flycatchers*. PhD. dissertation. Baton Rouge: Louisiana State University.
- Cohn-Haft, M.; Whittaker, A. & Stouffer, P. C. 1997. A new look at the “species-poor” central Amazon: the avifauna north of Manaus, Brazil. *Ornithological Monographs*, 48: 205-235.
- Daly, D. C. & Mitchell, J. D. 2000. Lowland vegetation of tropical South America, p. 391-453. In: Lentz, D. L. (ed.). *Imperfect Balance: Landscape transformations in the Precolumbian Americas*. New York: Columbia University Press.
- da Costa, T. V. V.; Andretti, C. B.; Olmos, F. & Pacheco, J. F. 2011. New records of Sulphur breasted Parakeet *Aratinga maculata* in Pará and Amapá states, Brazil. *Cotinga*, 33: 136-137
- Davis, B. J. W. 2011a. [XC91202 Hyacinth Macaw *Anodorhynchus hyacinthinus*] www.xeno-canto.org/91202 (accessed on 03 July 2012).
- Davis, B. J. W. 2011b. [XC91205, *Machaeropterus pyrocephalus*] www.xeno-canto.org/91205 (accessed on 03 July 2012).
- De Luca, A. C.; Develey, P. F.; Bencke, G. A. & Goerck, J. M. 2009. *Áreas Importantes para a Conservação das Aves no Brasil, Parte II - Amazônia, Cerrado e Pantanal*. São Paulo: SAVE Brasil.
- ESRI – ENVIRONMENTAL SYSTEMS RESEARCH INSTITUTE. 2008. ArcGIS, v. 9.3, Redlands, California. Available at: <http://www.esri.com> (last accessed 20 December 2012)
- Fávaro, F. L. & Flores, J. M. 2009. Aves da Estação Ecológica Terra do Meio, Pará, Brasil: resultados preliminares. *Ornithologia*, 3: 115-131.
- Gardner, T. A. et al. 2013. A social and ecological assessment of tropical land-uses at multiple scales: the Sustainable Amazon Network. *Philosophical Transactions of the Royal Society B: Biological Sciences*. In press, doi.org/10.1098/rstb.2012.0166
- Gaston, K. J. & Fuller, R. A. 2009. The sizes of species' geographic ranges. *Journal of Applied Ecology*, 46: 1-9.
- Griscom, L. & Greenway, J. C. Jr. 1941. Birds of lower Amazonia. *Bulletin of the Museum of Comparative Zoology*, 88: 83-344.
- Guilherme, E. & Borges, S. H. 2011. Ornithological records from a campina/campinarana enclave on the upper Juruá river, Acre, Brazil. *Wilson Journal of Ornithology*, 123: 24-32.
- Henriques, L. M. P. & Oren, D. C. 1997. The avifauna of Marajó, Caviana and Mexiana islands, Amazon River estuary, Brazil. *Revista Brasileira de Biologia*, 57: 357-382.
- Henriques, L. M. P.; Wunderle, J. M. Jr. & Willig, M. R. 2003. Birds of the Tapajós National Forest, Brazilian Amazon: A preliminary assessment. *Ornithologia Neotropical*, 14: 307-338.
- Henriques, L. M. P.; Wunderle, J.; Oren, D. C. & Willig, M. R. 2008. Efeitos da Exploração Madeireira de Baixo Impacto sobre uma Comunidade de Aves de Sub-Bosque na Floresta Nacional do Tapajós, Pará, Brasil. *Acta Amazonica*, 38: 267-289.
- Kirwan, G. M.; Bostock, N.; Hornbuckle, J.; Marshall, A. & Oxlade, M. 2012. Does Gull-billed Tern *Gelocheledon nilotica* breed in the interior of continental South America? *Bulletin of the British Ornithologists Club*, 132: 133-135.
- Laranjeiras, T. O. & Cohn-Haft, M. 2009. Where is the symbol of Brazilian Ornithology? The geographic distribution of the Golden Parakeet (*Guarouba guarouba* – Psittacidae). *Revista Brasileira de Ornithologia*, 17: 1-19.
- Lees, A. C. 2006. Gavião real: of eagles and men. *Alula*, 12: 68-71.
- Lees, A. C. 2010a. [WA356484, *Morphnus guianensis* (Daudin, 1800)]. www.wikiaves.com/356484 (accessed on 03 July 2012).
- Lees, A. C. 2010b. [WA500144, *Falco femoralis* Temminck, 1822]. www.wikiaves.com/500144 (accessed on 03 July 2012).
- Lees, A. C. 2010c. [WA356517, *Cotinga cotinga* (Linnaeus, 1766)]. www.wikiaves.com/356517 (accessed on 03 July 2012).
- Lees, A. C. 2010d. [WA358714, *Turdus fumigatus* Lichtenstein, 1823]. www.wikiaves.com/358714 (accessed on 03 July 2012).
- Lees, A. C. 2010e. [WA435508, *Lanio cucullatus* (Statius Muller, 1776)]. www.wikiaves.com/435508 (accessed on 03 July 2012).
- Lees, A. C. 2011a. [WA360065, *Phaethornis rufurumii* Boucard, 1892]. www.wikiaves.com/360065 (accessed on 03 July 2012).
- Lees, A. C. 2011b. [XC84327 *Phaethornis rufurumii*]. www.xeno-canto.org/84327 (accessed on 03 July 2012).
- Lees, A. C. 2011c. [XC87288, *Synallaxis albescens*]. www.xeno-canto.org/87288 (accessed on 03 July 2012).
- Lees, A. C. 2011d. [XC87285, *Myiopagis flavivertex*]. www.xeno-canto.org/87285 (accessed on 03 July 2012).
- Lees, A. C. 2011e. [WA360063, *Riparia riparia* (Linnaeus, 1758)]. www.wikiaves.com/360063 (accessed on 03 July 2012).
- Lees, A. C. 2011f. [WA471468, *Gelocheledon nilotica* (Gmelin, 1789)]. www.wikiaves.com/471468 (accessed on 09 December 2012).
- Lees, A. C. & Moura, N. G. 2011. Photographing Maria-bonita *Taeniopygia andrei*. *Neotropical Birding*, 8: 75-78.
- Lees, A. C. & Peres, C. A. 2006. Rapid avifaunal collapse along the Amazonian deforestation frontier. *Biological Conservation*, 133: 198-211.
- Lees, A. C.; Moura, N. G.; Silva, A. S.; Aleixo, A. L. P.; Barlow, J.; Berenguer, E.; Ferreira, J. & Gardner, T. A. 2012. Paragominas: a quantitative baseline inventory of an Eastern Amazonian avifauna. *Revista Brasileira de Ornithologia*, 20: 93-118.
- Lees, A. C.; Zimmer, K. J.; Marantz, C. M.; Whittaker, A.; Davis, B. J. W., and Whitney, B. M. 2013. Alta Floresta revisited: an updated review of the avifauna of the most intensively surveyed site in south-central Amazonia. *Bulletin of the British Ornithologists Club*. In press.
- Lopes, E. V. 2011a. [WA585974, *Falco femoralis* Temminck, 1822]. www.wikiaves.com/585974 (accessed on 03 July 2012).
- Lopes, E. V. 2011b. [WA481116, *Bubo virginianus* (Gmelin, 1788)]. www.wikiaves.com/481116 (accessed on 03 July 2012).
- Magnusson, W. E.; Araújo, M. C.; Cintra, R.; Lima, A. P.; Martinelli, L. A.; Sanaiotti, T. M.; Vasconcelos, H. L. & Victoria, R. L. 1999. Contributions of C3 and C4 plants to higher trophic levels in an Amazonian savanna. *Oecologia*, 119: 91-96.
- Magnusson, W. E.; Lima, A. P.; Albernaz, A. L. K. M., Sanaiotti, T. M. & Guillaumet, E. J. E. 2008. Composição florística e cobertura vegetal das savanas na região de Alter do Chão, Santarém-PA. *Revista Brasileira de Botânica*, 31: 165-177.
- Mahood, S. P.; Lees, A. C. & Peres, C. A. 2012. Amazonian countryside habitats provide limited avian conservation value. *Biodiversity and Conservation*, 21: 385-405.
- Miranda, I. S. 1993. Estrutura do estrato arbóreo do cerrado amazônico em Alter do Chão, Pará, Brasil. *Revista Brasileira de Botânica*, 16: 143-150.
- Mittermeier, J. C.; Zyskowski, K.; Stowe, E. S. & Lai, J. E. 2010. Avifauna of the Sipaliwini Savanna (Suriname) with insights into

- its biogeography affinities. *Bulletin of the Peabody Museum of Natural History*, 51: 97-122.
- Monk, R. R. & Baker, R. J. 2001.** e-Vouchers and the use of digital imagery in natural history collections. *Museology*, 10: 1-8.
- Moura, N. 2010a.** [XC94679, *Crypturellus obsoletus griseiventris*] <http://www.xeno-canto.org/94679> (accessed on 03 July 2012).
- Moura, N. 2011a.** [WA441603, *Columbina minuta* (Linnaeus, 1766)]. www.wikiaves.com/441603 (accessed on 03 July 2012).
- Moura, N. 2011b.** [XC94621, *Columbina minuta*]. www.xeno-canto.org/94621 (accessed on 03 July 2012).
- Naka, L. N.; Cohn-Haft, M.; Mallet-Rodrigues, F.; Santos, M. P. D. & Torres, M. D. F. 2006.** The avifauna of the Brazilian state of Roraima: bird distribution and biogeography in the Rio Branco basin. *Revista Brasileira de Ornitologia*, 14: 197-238.
- Nepstad, D. C.; Moutinho P.; Dias-Filho, M. B.; Davidson, E.; Cardinot, G.; Markewitz, D.; Figueiredo, R.; Vianna, N.; Chambers, J.; Ray, D.; Guerreiros, J. B.; Lefebvre, P.; Sternberg, L.; Moreira, M.; Barros, L.; Ishida, F. Y.; Tohver, I.; Belk, E.; Kalif, K. & Schwalbe, K. 2002.** The effects of partial throughfall exclusion on canopy processes, aboveground production, and biogeochemistry of an Amazon forest. *Journal of Geophysical Research*, 107: 1-18.
- Novaes, F. C. 1978.** Sobre algumas aves pouco conhecidas da Amazônia Brasileira II. *Boletim do Museu Paraense Emílio Goeldi Série Zoologia*, 90: 1-15.
- Novaes, F. C. & Lima, M. F. C. 1998.** *As aves da grande Belém*. Belém: Secretaria do Meio Ambiente do Estado do Pará.
- Pacheco, J. F. & Olmos, F. 2005.** Birds of a latitudinal transect in the Tapajós-Xingu interfluvium, eastern Brazilian Amazonia. *Aranajuba*, 13: 29-46.
- Parrot, J. A.; Francis, J. K. & de Almeida, R. 1995.** *Trees of the Tapajós - A photographic field guide*. Rio Piedras: General Technical Report, U. S. Department of Agriculture, Forest Service, International Institute of Tropical Forestry.
- Paynter Jr, R. A. & Traylor M. A. Jr. 1991.** *Ornithological gazetteer of Brazil, 2 volumes*. Cambridge: Museum of Comparative Zoology.
- Pelzeln, A. 1871.** Zur Ornithologie Brasiliens: Resultate von Johann Nattersers Reisen in den Jahren 1817 bis 1835. A. Pichler's Witwe und Sohn, Wien.
- Piacentini, V. Q.; Aleixo, A. & Silveira, L. F. 2009.** Hybrid, subspecies or species? The validity and taxonomic status of *Phaethornis longuemareus aethopyga* Zimmer, 1950 (Trochilidae). *Auk*, 126: 604-612.
- Pires, J. M. & Prance, G. T. 1985.** The vegetation types of the Brazilian Amazon, p. 109-145. In: Prance, G. T. & Lovejoy, T. E. (ed.). *Key Environments: Amazonia*. New York: Pergamon.
- Portes, C. E. B.; Carneiro, L. S.; Schunck, F.; Silva, M. S. S.; Zimmer, K. J.; Whittaker, A.; Poletto, F.; Silveira, L. F. & Aleixo, A. 2011.** Annotated checklist of birds recorded between 1998 and 2009 at nine areas in the Belém area of endemism, with notes on some range extensions and the conservation status of endangered species. *Revista Brasileira de Ornitologia*, 19: 167-184.
- Pyle, P. 1997.** *Identification Guide to North American Birds, Part I*. Bolinas: Slate Creek Press.
- Remsen, J. V. Jr. 1994.** Use and misuse of bird lists in community ecology and conservation. *Auk*, 111: 225-227.
- Remsen, J. V., Jr. 2001.** True winter range of the Veery (*Catharus fuscescens*): Lessons for determining winter ranges of species that winter in the tropics. *Auk*, 118: 838-848.
- Remsen, J. V. Jr. 2003.** *Family Furnariidae (Ovenbirds)*, p. 162-357. In: J. Del Hoyo, A. Elliott & D. A. Christie (eds.). *Handbook of the Birds of the World*. Volume 8. Barcelona: Lynx Edicions.
- Riker, C.B. & Chapman, F. M. 1890.** A List of Birds Observed at Santarém, Brazil. *Auk*, 7: 131-137.
- Riker, C. B. 1891.** A List of Birds Observed at Santarém, Brazil. *Auk*, 8: 24-31.
- Riker, C. B. & Chapman, F. M. 1891.** A List of Birds Observed at Santarém, Brazil. *Auk*, 8: 158-164.
- Robbins, M. B.; Braun, M. J. & Finch, D. W. 2004.** Avifauna of the Guyana southern Rupununi, with comparisons to other savannas of northern South America. *Ornitologia Neotropical*, 15: 1-29.
- Sanaiotti, T. M. & Cintra, R. 2001.** Breeding and migrating birds in an Amazonian savanna. *Studies on Neotropical Fauna and Environment*, 36: 23-32.
- Sanaiotti, T. M. & Magnusson, W. E. 1995.** Effects of annual fires on the production of fleshy fruits eaten by birds in a Brazilian Amazonian savanna. *Journal of Tropical Ecology*, 11: 53-65.
- Santos, M. P. D.; Aleixo, A. L. P.; Horta, F. M. & Portes, E. 2011.** Avifauna of the Juruti region, Pará, Brazil. *Revista Brasileira de Ornitologia*, 19: 134-153.
- Santos, M. P. D. & Silva, J. M. C. 2007.** As aves das savanas de Roraima. *Revista Brasileira de Ornitologia*, 15: 189-207.
- Schunck, F.; De Luca, A. C.; Piacentini, V. Q.; Rego, M. A.; Rennó B. & Corrêa, A. H. 2011.** Avifauna of two localities in the south of Amapá, Brazil, with comments on the distribution and taxonomy of some species. *Revista Brasileira de Ornitologia*, 19: 93-107.
- Slater, P.L. & Salvin, O. 1878.** On the collection of birds made by Prof. Steere in South America. *Proceedings of the Zoological Society of London*, 46: 135-142.
- Sick, H. 1985.** *Ornitologia brasileira, uma introdução*. Brasília: Universidade de Brasília.
- Silva, M. C. & Willis, E. O. 1986.** Notas sobre a distribuição de quatro espécies de aves da Amazonia Brasileira. *Boletim do Museu Paraense Emílio Goeldi Série Zoologia*, 2: 151-158.
- Silva, J. M. C. 2011.** Santarém, p. 88-91. 2011. In: Valente, R. M.; da Silva, J. M. C.; Straube, F. C.; Nascimento, J. L. X. (org.). *Conservação de Aves Migratórias Neárticas no Brasil*, v. 1, 1ª ed. Belém: Conservação Internacional.
- Silveira, L. F.; de Lima, F. C. T. & Höfling, E. 2005.** A new species of *Aratinga* parakeet (Psittaciformes: Psittacidae) from Brazil, with taxonomic remarks on the *Aratinga solstitialis* complex. *Auk*, 122: 292-305.
- Somenzari, M., Silveira, L. F., Piacentini, V. Q., Rego, M. A., Schunck, F. & Cavarzere. 2011.** Birds of an Amazonia-Cerrado ecotone in Southern Pará, Brazil, and the efficiency of associating multiple methods in avifaunal inventories. *Revista Brasileira de Ornitologia*, 19: 260-275.
- Stotz, D. F.; Bierregaard Jr, R. O.; Cohn-Haft, M.; Petermann, J. S.; Whittaker, A. & Wilson, S. V. 1992.** The status of North American migrants in central Amazonian Brazil. *Condor*, 94: 608-621.
- Teixeira, D. M.; Oren, D. & Best, R. C. 1986.** Notes on Brazilian Seabirds. 2. *Bulletin of the British Ornithologists Club*, 106: 74-77.
- Tobias, J. A. & Seddon, N. 2007.** Nine bird species new to Bolivia and notes on other significant records. *Bulletin of the British Ornithologists Club*, 127: 49-84.
- Todd, W. E. C. 1926.** Four new birds from Brazil. *Proceedings of the Biological Society of Washington*, 38: 111-114.
- Todd, W. E. C. 1948.** Critical remarks on the oven-birds. *Annals of Carnegie Museum*, 31: 33-43.
- Trinca, C. T.; Ferrari, S. F. & Lees, A. C. 2008.** Curiosity killed the bird: arbitrary hunting of harpy eagles (*Harpia harpyja*) on an agricultural frontier in southern Brazilian Amazonia. *Cotinga*, 30: 12-15.
- Vasconcelos, M. F.; Dantas, S. M. & Silva, J. M. C. 2011.** Avifaunal inventory of the Amazonian savannas and adjacent habitats of the Monte Alegre region (Pará, Brazil), with comments on biogeography and conservation. *Boletim do Museu Paraense Emílio Goeldi Ciências Naturais*, 6: 119-145.
- Vasconcelos, M. F.; Lopes, L. E.; Hoffmann, D.; Silveira, L. F. & Schunck, F. 2008.** Noteworthy records of birds from the Pantanal, Chiquitano dry forest and Cerrado of south-western Brazil. *Bulletin of the British Ornithologists Club*, 128:57-67.

- Whittaker, A.; Zimmer, K. J. & Carlos, B. 2008.** The status of Mississippi Kite *Ictinia mississippiensis* in Brazil, including further documented records for the country. *Cotinga*, 29: 139-143.
- Wunderle, J. M. Jr.; Henriques, L. M. P. & Willig, M. R. 2006.** Short-term responses of birds to forest gaps and closed canopy: an assessment of reduced impact logging in a lowland Amazon forest. *Biotropica*, 38: 235-255.
- Wunderle, J. M. Jr.; Willig, M. R. & Henriques, L. M. P. 2005.** Avian distribution in treefall gaps and understorey of *terra firme* forest in the lowland Amazon. *Ibis*, 147: 109-129.
- Zimmer, J. T. 1934.** Studies of Peruvian birds XIV. Notes on the genera *Dendrocolaptes*, *Hylexetastes*, *Xiphocolaptes*, *Dendroplex*, and *Lepidocolaptes*. *American Museum Novitates*, 753: 19-26.
- Zimmer, K. & Hilty, S. L. 1997.** Avifauna of a locality in the upper Orinoco drainage of Amazonas, Venezuela. *Ornithological Monographs*, 48: 865-885.
- Zimmer, K. J.; Parker, T. A.; Isler, M. L. & Isler, P. R. 1997.** Survey of a southern Amazonian avifauna: the Alta Floresta region, Mato Grosso, Brazil. *Ornithological Monographs*, 48: 887-918.
- Zimmer, K. J. & Whittaker, A. 2004.** Observations on the vocalisations and behaviour of Black-chested Tyrant *Taeniotriccus andrei* from the Serra dos Carajás, Pará, Brazil. *Cotinga* 22: 24-29.

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APPENDIX 1

List of 583 species recorded from the Santarém-Belterra region, south of the Amazon and east of the Tapajós (PA, Brazil). Inventories are as follows: 1 = this study (* denotes if recorded during quantitative fieldwork), 2 = Henriques *et al.* 2003, 3 = Sanaiotti and Cintra (2001). Photo reference and sound reference numbers are searchable in the online databases of www.wikiaves.com.br (WA), www.xeno-canto.org (XC) and the Macaulay Library <http://macaulaylibrary.org/> (ML). Initials given after online voucher numbers are those of non-author contributors, photographers: DO = D. Oliveira, DLF = Diogo Lagroteria Faria, FG = Felipe Gomes, FS = Francisco Sérgio, FP = Frederico Pereira, GL = Gilmar Leal, HGS = Helena G. Salgado, IT = Ian Thompson, IM = Ingrid Macedo, IG = Ivo Ghizoni-Jr, JAA = J. Augusto Alves, KO = Kurazo Okada, LATB = Luiz Álvaro Toledo Barros, RC = Robson Czaban, TD = Tulio Dornas, VH = Valdir Hobus and sound-records: CM = Curtis Marantz, JM = Jeremy Minns, PI = Phyllis Isler, Sidnei Dantas. Accession numbers are presented for species previously collected in the region and housed at the American Museum of Natural History, New York City, USA (AMNH), the Academy of Natural Sciences, Philadelphia, USA (ANSP), the Carnegie Museum of Natural History, Pittsburgh, USA (CM), the Field Museum of Natural History, Chicago, USA (FMNH), the Los Angeles County Museum of Natural History, Los Angeles, USA (LACM), the Louisiana State University Museum of Natural Science, Baton Rouge, USA (LSUMZ), the Museu Paraense Emílio Goeldi, Belém, Brazil (MPEG), the Museu de Zoologia Universidade de São Paulo, São Paulo, Brazil (MZUSP), the University of Michigan Museum of Zoology, Ann Arbor, USA (UMMZ) and the United States National Museum, Washington, USA (USNM). Taxonomy and nomenclature follows CBRO (2011).

Family / species	Inventories	This study			Previous fieldwork					
		XC foreground	XC background	Wikiaves	Specimen	Wikiaves	Photographer	Sound	Recordist	
TINAMIDAE										
<i>Tinamus tao</i>	1*,2	XC91214			MZUSP 10583			ML114917		CM
<i>Tinamus guttatus</i>	1*,2	XC94649			CM 74874			ML115028		CM
<i>Crypturellus cinereus</i>	1*,2	XC90693	XC91205							
<i>Crypturellus soui</i>	1*,2	XC90703	XC90764		CM 72221			ML117119		CM
<i>Crypturellus obsoletus</i>	1	XC94679			CM 74876					
<i>Crypturellus undulatus</i>	1,3		XC94878		CM 78240					
<i>Crypturellus strigulosus</i>	1*,2	XC91207	XC91203		CM 78199					
<i>Crypturellus variegatus</i>	1*,2	XC90705	XC94871		MPEG 56038					
<i>Crypturellus parvirostris</i>	1*,2	XC94650	XC94670		MPEG 47652					
ANHIMIDAE										
<i>Anhima cornuta</i>					CM 73737					
ANANTIDAE										
<i>Sarkidiornis sylvicola</i>					CM 73268					
<i>Cairina moschata</i>	1			WA580720	UMMZ 27966			WA189071	KO	
<i>Amazoneta brasiliensis</i>	1*			WA426586	MZUSP 20920			WA559786	VH	
<i>Dendroceryna autumnalis</i>	1,3			WA429940	CM 73634			WA576641	IT	

Family / species	Inventories	This study	Previous fieldwork
CRACIDAE			
<i>Ortalis motmot</i>	1*,2,3	XC94608	MZUSP 46267
<i>Penelope superciliosus</i>	1*,2,3		CM 75036
<i>Penelope pileata</i>	1*	XC91206	MZUSP 21058
<i>Aburria cijubi</i>	1*,2		MZUSP 20832
<i>Pauxi tuberosum</i>	1*,2	XC91214	MZUSP 20467
ODONTOPHORIDAE			
<i>Odontophorus gujanensis</i>	1*,2	XC94805	MZUSP 10602
PODICIPEDIDAE			
<i>Tachybaptus dominicus</i>	1		MCZ 173025
CICONIIDAE			
<i>Ciconia maguari</i>			MCZ 23047
PHALACROCORACIDAE			
<i>Phalacrocorax brasilianus</i>	1		MZUSP 21925
ANHINGIDAE			
<i>Anhinga anhinga</i>	1		MCZ 173021
ARDEIDAE			
<i>Tigrisoma lineatum</i>	1		CM 72000
<i>Agamia agami</i>			MZUSP 35885
<i>Cochlearius cochlearius</i>	1		MZUSP 35886
<i>Zebrilus undulatus</i>	1		CM 75076
<i>Botaurus pinnatus</i>			MCZ 173069
<i>Ixobrychus exilis</i>			CM 72388
<i>Nycticorax nycticorax</i>			CM 78113
<i>Butorides striata</i>	1,2		MZUSP 61789
<i>Bulbucus ibis</i>	1,3		MPEG 36473
<i>Ardea cocoi</i>	1		MCZ 23190
<i>Ardea alba</i>	1*		LACM 34344
<i>Ptilerodius pileatus</i>	1,2		MZUSP 46199
<i>Egretta thula</i>	1		
<i>Egretta caerulea</i>			WA183310

Family / species	Inventories	This study	Previous fieldwork			
THRESKIORNITHIDAE						
<i>Mesembrinibis cayennensis</i>	1*		WA588367	MCZ 173072		
<i>Theristicus caudatus</i>	1*		WA366370		WA205442	KO
CATHARTIDAE						
<i>Cathartes aura</i>	1*2,3		WA505835	CM 78110	WA242292	IT
<i>Cathartes burrovianus</i>	1*3		WA359441		WA189075	KO
<i>Cathartes melambrotus</i>	1*2,3		WA333384			
<i>Coragyps atratus</i>	1*2,3		WA333385	CM 78109	WA242294	IT
<i>Sarcorhamphus papa</i>	1,2			AMNH 285739		
PANDIONIDAE						
<i>Pandion haliaeetus</i>	1,3		WA357402	MCZ 173117	WA549592	VH
ACCIPITRIDAE						
<i>Leptodon cayanensis</i>	1,2			MCZ 173091	WA918207	RC
<i>Chondrohierax uncinatus</i>	1*2		WA435547	MCZ 173092		
<i>Elanoides forficatus</i>	1*2,3		WA429985	CM 73057		
<i>Gampsonyx swainsonii</i>	1		WA629547	MPEG 34430		
<i>Harpagus bidentatus</i>	1*2			MPEG 15342	WA320216	FG
<i>Harpagus didon</i>				MPEG 35598		
<i>Accipiter superciliosus</i>	1*2		WA361613	CM 72934		
<i>Accipiter striatus</i>	3			CM 72517		
<i>Accipiter bicolor</i>				CM 72339		
<i>Ictinia plumbea</i>	1,2,3		WA936127			
<i>Busarellus nigricollis</i>	1			FMNH 257783	WA185781	KO
<i>Rostrhamus sociabilis</i>			WA435213	FMNH 257787		
<i>Geranoospiza caerulecens</i>	1,2		WA645500	FMNH 257800		
<i>Buteogallus schistaceus</i>				FMNH 101510		
<i>Heterospizias meridionalis</i>	1*3		WA431330		WA180997	KO
<i>Urubitinga urubitinga</i>	1*2,3		WA514779	FMNH 257765		
<i>Rupornis magnirostris</i>	1*2,3	XC94809	WA329171	MZUSP 10134	WA206722	KO
<i>Geranoaetus albicaudatus</i>	1*3		WA443906	MCZ 173102		
<i>Pseudastur albicollis</i>	1*2		WA432803	MPEG 13772		
<i>Leucopternis melanops</i>				MZUSP 46240		

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<i>Leucopternis kuhli</i>	1*,2	XC92080	XC94851	WA514724	FMNH 101120	WA320489	FG	
<i>Buteo nitidus</i>	1*,2,3	XC95086	XC94874	WA491528	MPEG 35598			
<i>Buteo brachyurus</i>	1*,3			WA499991				
<i>Buteo swainsoni</i>					USNM 121073			
<i>Morphnus guianensis</i>	1			WA356485				
<i>Harpia harpyja</i>	1			WA616225	MPEG 1855			
<i>Spizaetus tyrannus</i>	1*,2	XC96328	XC96343	WA329317	FMNH 101130	WA320256	FG	JM
<i>Spizastur melanoleucus</i>	1*,2			WA467097	MCZ 173114			
<i>Spizaetus ornatus</i>	1*,2		XC96376		MCZ 173115			JM
FALCONIDAE								
<i>Daptrius ater</i>	1*,2			WA347314	CM 74791			
<i>Ibeyer americanus</i>	1*,2	XC95591		WA356727	CM 72788			CM
<i>Caracara plancus</i>	1*,2			WA580755	ANSP 76478			
<i>Mitluago chimachima</i>	1*,2,3			WA500112	MZUSP 35888	WA552031	VH	
<i>Herpetotheres cachinnans</i>	1*,2,3			WA516301				
<i>Micrastur ruficollis</i>	1*,2	XC90680	XC90687					
<i>Micrastur mintoni</i>	1*,2	XC95106	XC90680		MZUSP 18030			
<i>Micrastur mirandollei</i>	1*	XC94623			MZUSP 10862			
<i>Micrastur semitorquatus</i>	1*,2			WA346345	CM 74614			CM
<i>Falco ruficularis</i>	1*,2,3			WA447466	CM 75002			
<i>Falco deiroleucus</i>					CM 73801	WA632317	IG	
<i>Falco femoralis</i>	1*,3			WA500144	MCZ173143			
<i>Falco peregrinus</i>						WA325212	FP	
EURYPYRIDAE								
<i>Eurypyga belias</i>				WA517296	CM 72364			
ARAMIDAE								
<i>Aramus guaranauna</i>				WA583437	CM 73676	WA185149	KO	
PSOPHIDAE								
<i>Psophia dextralis</i>		XC96488		WA359490	CM 75034			
RALLIDAE								
<i>Aramides cajaneus</i>	1*,2	XC94871			CM 72145			
<i>Anaerolimnas concolor</i>					CM 71647			

Family / species	Inventories	This study	Previous fieldwork				
<i>Laterallus viridis</i>	1*,2	XC94670	MZUSP 35891			ML117040	CM
<i>Laterallus exilis</i>	1*		MCZ 173214				
<i>Neocrex erythrops</i>	1*	XC91474	MPEG 74208				
<i>Gallinula galeata</i>			MZUSP 22636				
<i>Porphyrio martinica</i>	1*,2		CM 71555	WA500120	WA104023	GL	
<i>Porphyrio flavirostris</i>			CM 71615				
HELIORNITHIDAE							
<i>Heliornis fulica</i>			MZUSP 35892	WA362963			
CHARADRIIDAE							
<i>Vanellus cayanus</i>	1		CM 73189	WA333899	WA99261	JAA	
<i>Vanellus chilensis</i>	1*		CM 73677	WA583439	WA182115	KO	
<i>Pluvialis dominica</i>			LACM 34401		WA757451	HGS	
<i>Charadrius collaris</i>	1		MZUSP 35894	WA467107	WA546923	VH	
RECURVIROSTRIDAE							
<i>Himantopus mexicanus</i>				WA431336	WA183311	KO	
SCOLOPACIDAE							
<i>Gallinago paraguaiiae</i>			MPEG 36472		WA205424	KO	
<i>Bartramia longicauda</i>			MZUSP 35895				
<i>Actitis macularia</i>			CM 74312	WA357318			
<i>Tringa solitaria</i>	1		MZUSP 35896	WA357320	WA242305	IT	
<i>Tringa flavipes</i>			CM 73689	WA508864	WA182114	KO	
<i>Calidris melanotos</i>			MCZ 173293		WA189072	KO	
<i>Calidris minutilla</i>			MCZ 173283				
JACANIDAE							
<i>Jacana jacana</i>			MZUSP 3376	WA511911	WA205425	KO	
STERNIDAE							
<i>Sterna superciliosa</i>			CM 78510	WA435379			
<i>Phaetusa simplex</i>			CM 73739	WA432695	WA549214	VH	PI
<i>Gelochelidon nilotica</i>					WA176659	KO	
RYNCHOPIDAE							
<i>Rynchops niger</i>			MCZ 23042	WA357316	WA559241	VH	

Family / species	Inventories	This study		Previous fieldwork				
COLUMBIDAE								
<i>Columbina passerina</i>	1*,2,3	XC94650	WA500208	MPEG 17611	WA550785	VH		
<i>Columbina minuta</i>	1*	XC94621	WA441603					
<i>Columbina talpacoti</i>	1*,2		WA333907	CM 73312	WA319722	FG		
<i>Claravis pretiosa</i>	3			MPEG 47665			ML117176	CM
<i>Columba livia</i>	1*		WA333902					
<i>Patagioenas speciosa</i>	1*,3			MZUSP 10607				
<i>Patagioenas cayennensis</i>	1*,3		WA372475	MZUSP 35897	WA205427	KO		
<i>Patagioenas plumbea</i>	1*,2	XC94779		AMNH 285541			ML115068	CM
<i>Patagioenas subvinacea</i>	1*,2	XC95107		CM 74472			XC87137	JM
<i>Zenaida auriculata</i>	1*,3		WA359445	MPEG 17612	WA547583	VH		
<i>Leptotila verreauxi</i>	1*,2		WA505858	CM 72540				
<i>Leptotila rufaxilla</i>	1*,2,3	XC95111		CM 73078				
<i>Geotrygon montana</i>	1*,2,3	XC95572		MZUSP 10606	WA320511	FG		
PSITTACIDAE								
<i>Anodorhynchus hyacinthinus</i>	1*	XC91202		MCZ 173413				
<i>Ara ararauna</i>				CM 72105				
<i>Ara macao</i>	1*,2		WA522295				ML115115	CM
<i>Ara chloropterus</i>	1*,2,3	XC95108		MCZ 173415				
<i>Ara severus</i>	1*,2	XC90773	WA444684	MZUSP 11834	WA185148	KO		
<i>Orthopsittaca manilata</i>	1*	XC94856		CM 72174				
<i>Aratinga leucophthalma</i>	1*,2	XC95676	WA426594	CM 74387	WA319711	FG		
<i>Aratinga aurea</i>	1*,3	XC94618	WA357380	MPEG 28147	WA180979	KO	ML117043	CM
<i>Pyrrhura amazonum</i>	1*,2	XC94954	WA356522	MZUSP 3416			XC85381	JM
<i>Forpus passerinus</i>	1*		WA467169	MPEG 2330	WA205438	KO		
<i>Brotogeris versicolurus</i>	1*,3	XC94874	WA351745	MZUSP 3410				
<i>Brotogeris chrysoptera</i>	1*,2	XC94955	WA351744	MPEG 8890				
<i>Brotogeris sanctithomae</i>			WA872402	MZUSP 35909	WA183291	KO	XC84943	JM
<i>Touit buetii</i>	1*						ML115198	CM
<i>Pionites leucogaster</i>	1*,2	XC95118		CM 74836				
<i>Pyrilia vulturina</i>	1*,2	XC95120		MZUSP 10630			ML114929	CM
<i>Graydidascalus brachyurus</i>				CM 72417				

Family / species	Inventories	This study			Previous fieldwork				
<i>Pionus menstruus</i>	1*,2,3	<u>XC95117</u>	XC94832	WA352463	MZUSP 10624				
<i>Pionus fuscus</i>	1*,2	XC95125		WA500133	CM 74545			ML115035	CM
<i>Amazona festiva</i>					CM 72900				
<i>Amazona farinosa</i>	1*,2	XC95112	XC90706	WA356731	CM 74734			ML115064	CM
<i>Amazona amazonica</i>	1*,2	<u>XC95122</u>	XC90773		LACM 34501				
<i>Amazona ochrocephala</i>	1*,2	XC94682			CM 73608				
<i>Deropnyx accipitrinus</i>	1*,2	<u>XC95123</u>		WA500189	MZUSP 10618			ML114902	CM
OPISTHOCOMIDAE									
<i>Opisthocomus hoazin</i>				WA432121	MZUSP 35889	WA183343	KO		
CUCULIDAE									
<i>Coccyzus minuta</i>	1*	XC94622		WA567160	CM 72868				
<i>Piaya cayana</i>	1*,2,3	XC96333		WA500202	MZUSP 61865	WA247315	IT		
<i>Piaya melanogaster</i>	1*,2	XC96382		WA432789	MPEG 56039				
<i>Coccyzus melacoryphus</i>					CM 73549	WA182095	KO		
<i>Coccyzus euleri</i>					CM 72739	WA52668	VH		
<i>Crotophaga major</i>	1*,3			WA337955	MZUSP 35904	WA189087	KO		
<i>Crotophaga ani</i>	1*,2,3	XC94607	XC94648	WA500149	MPEG 17617	WA189086	KO		
<i>Tapera naevia</i>	1,2				MPEG 47671				
<i>Dromococcyx phasianellus</i>	1*	XC87287	<u>XC95171</u>		LACM 34519				
<i>Neomorphus squamiger</i>					CM 74616				
TYTONIDAE									
<i>Tyto alba</i>				WA436255	MCZ 173144				
STRIGIDAE									
<i>Megascops choliba</i>	1*,2,3		XC94800	WA432016	CM 73578				
<i>Megascops usta</i>	1*,2		XC94645		MPEG 53840				
<i>Lophostrix cristata</i>	1*,2				CM 72585			ML114946	CM
<i>Pulsatrix perspicillata</i>	1*,2	XC90764			CM 72854				
<i>Bubo virginianus</i>				WA481116					
<i>Strix virgata</i>	1*	XC94713			MCZ 173158				
<i>Strix hubbula</i>	1*	XC94712							
<i>Glaucidium hardyi</i>	1*,2	XC94683	XC94710					ML114944	CM
<i>Athene cunicularia</i>	1*			WA509541					

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<i>Asio clamator</i>			WA357321	
<i>Asio stygius</i>			WA583443	MCZ 173148
NYCTIBIIDAE				
<i>Nyctibius grandis</i>	1,2,3			MZUSP 35913
<i>Nyctibius aethereus</i>	1*	XC94710		
<i>Nyctibius griseus</i>	1*,2,3		WA567100	CM 72237 WA49272 IM
<i>Nyctibius leucopterus</i>	1*,2	XC94711		ML114943 CM
CAPRIMULGIDAE				
<i>Nyctipbrynus ocellatus</i>	1*,2	XC95113		MPEG 54302 CM
<i>Antrostomus rufus</i>	1*,3			MZUSP 10894 WA631559 IG
<i>Antrostomus sericocaudatus</i>	1*	XC86600		MPEG 56042 CM
<i>Lurocalis semitorquatus</i>	1*,2	XC90702		
<i>Hydropsalis leucopyga</i>				MZUSP 35916 WA756417 HGS
<i>Hydropsalis nigrescens</i>	1*,2		WA576637	CM 71585 ML115079 CM
<i>Hydropsalis albicollis</i>	1*,2	XC94800		CM 73263 ML115038 CM
<i>Hydropsalis parvula</i>				CM 73674 CM
<i>Hydropsalis maculicauda</i>				CM 73816 CM
<i>Hydropsalis climacocerca</i>			WA431349	CM 71658 WA98817 JAA
<i>Hydropsalis torquata</i>				MPEG 27368 WA25992 IM
<i>Chordeiles nacunda</i>				CM 73153 WA178884 KO
<i>Chordeiles rupestris</i>			MCZ 173600	
<i>Chordeiles acutipennis</i>	1,3			MPEG 37761 WA316733 DLF
APODIDAE				
<i>Chaetura spinicauda</i>	1*,2			
<i>Chaetura chapmani</i>	1*		WA360041	
<i>Chaetura brachyura</i>	1*,2		XC94831	WA320213 FG
<i>Tachornis squamata</i>	1*,2			
<i>Panyptila cayennensis</i>	1,2		WA573688	
THROCHILIDAE				
<i>Glaucis birsutus</i>	1*,2,3			
<i>Phaethornis rupurumii</i>	1*	XC84327		MPEG 53832 MPEG 8869
<i>Phaethornis aethopyga</i>	1*,2,3	XC90519	WA358701	CM 74518

Family / species	Inventories	This study		Previous fieldwork				
<i>Phaethornis ruber</i>	1*	XC94882		AMNH 148269	WA206708	KO		
<i>Phaethornis bourcieri</i>	1*,2			MPEG 56041				
<i>Phaethornis superciliosus</i>	1*,2,3	XC91212		CM 74606				
<i>Campylloperus largipennis</i>	1,2						ML114922	CM
<i>Eupetomena macroura</i>				CM 78361	WA634736	IT		
<i>Florisuga mellivora</i>	1*,2			MPEG 53839				
<i>Anthracothorax viridigula</i>				CM 73471				
<i>Anthracothorax nigricollis</i>	1*,2,3			CM 73265				
<i>Avocettula recurvirostris</i>	2			MZUSP 3409			ML115199	CM
<i>Topaza pella</i>	1,2						XC5725	SD
<i>Chlorostilbon notatus</i>	3			MPEG 8881				
<i>Thalurania furcata</i>	1*,2,3		WA567110	MPEG 53837				
<i>Hylorcharis sapphirina</i>	1,2,3		WA645522	CM 72123				
<i>Polytmus theresiae</i>	1,3			MCZ 173823	WA185793	KO		
<i>Amazilia versicolor</i>				MCZ 173755				
<i>Amazilia fimbriata</i>	1*			MPEG 35617	WA185769	KO		
<i>Heliothryx auritus</i>	1*,2			CM 78631				
<i>Heliothryx longirostris</i>	1,2		WA624861	MZUSP 3404	WA319712	FG		
<i>Caliphlox amethystina</i>			WA625025		WA183292	KO		
TROGONIDAE								
<i>Trogon melanurus</i>	1*,2	XC94717	WA583441	CM 72885			ML115062	CM
<i>Trogon viridis</i>	1*,2,3	XC95314	WA500148	MZUSP 35920	WA78768	LATB	ML115159	CM
<i>Trogon ramoniamus</i>	1*,2		WA522329	CM 74432				
<i>Trogon rufus</i>	1*,2	XC95308	WA676347	MPEG 53841			ML114920	CM
<i>Pharomacrus pavoninus</i>				MCZ 173835				
ALCEDINIDAE								
<i>Megascyle torquata</i>	1*,2		WA583444	MPEG 27312	WA325211	FP		
<i>Chloroceryle amazona</i>	1,2,3		WA366364	MZUSP 35922	WA98818	JAA		
<i>Chloroceryle aenea</i>	2,3			MZUSP 15947				
<i>Chloroceryle americana</i>	1*,2,3		WA583449	MZUSP 46551	WA185167	KO		
MOMOTIDAE								
<i>Baryphthengus martii</i>	1*,2	XC90680	WA356477	CM 75042				

Family / species	Inventories	This study		Previous fieldwork				
<i>Momotus momota</i>	1*,2		XC94679	WA442693	CM 74832			
GALBULIDAE								
<i>Galbula cyanicollis</i>	1*,2	<u>XC95109</u>	XC95110		CM 74550		XC4883	SD
<i>Galbula ruficauda</i>				WA936123	CM 71853			
<i>Galbula dea</i>	1*,2			WA573667	CM 75062		ML115189	CM
<i>Jacamerops aureus</i>	1*,2	XC94777	XC87290	WA676330	CM 75073		ML115013	CM
BUCONNIDAE								
<i>Notharchus hyperrhynchus</i>	1*,2		XC91203	WA500142	MZUSP 10683	WA320253	ML117113	CM
<i>Notharus ordii</i>	1*	XC94707						
<i>Notharchus tectus</i>	1*,2,3	XC91203		WA363562	MZUSP 10688	WA101535	ML117107	CM
<i>Bucco tamatia</i>	1*,2			WA544924	CM 71967	WA553066		
<i>Bucco capensis</i>	1*,2	XC94709	XC94871		CM 72995		ML114990	CM
<i>Nystalus maculatus</i>	1*,2,3		XC94618	WA500146	MPEG 17614	WA551718	ML117140	CM
<i>Malacoptila rufa</i>	1*,2		XC90772	WA567157	MPEG 56044			
<i>Monasa nigrifrons</i>	1			WA583455	MZUSP 35926			
<i>Monasa morphoeus</i>	1*,2	XC95269	XC94679	WA500134	MPEG 40577		ML115175	CM
<i>Chelidoptera tenebrosa</i>	1*,2,3			WA428002	MZUSP 35928			
RAMPHASTIDAE								
<i>Ramphastos toco</i>	1,3			WA435202	CM 74281			
<i>Ramphastos tucanus</i>	1*,2		XC90703	WA472581	MZUSP 82495			
<i>Ramphastos vitellinus</i>	1*,2,3		XC90774	WA352476	MPEG 14851		ML114981	CM
<i>Selenidera gouldii</i>	1*,2		XC94803	WA871417	MZUSP 10671			
<i>Pteroglossus inscriptus</i>	1*,2,3			WA352331	MZUSP 3424	WA320254		
<i>Pteroglossus bitorquatus</i>	1*,2	XC95110		WA500203	MZUSP 10659	WA49283	ML117120	CM
<i>Pteroglossus aracari</i>	1*,2,3	XC90777		WA467112	MZUSP 10665	WA319710	ML114949	CM
PICIDAE								
<i>Picumnus aurifrons</i>	1*,2,3		XC90709	WA349052	MPEG 53843			
<i>Picumnus cirratus</i>				WA351754	CM 78190			
<i>Melanerpes candidus</i>					CM 73144		ML47952	PI
<i>Melanerpes cruentatus</i>	1*,2		XC95086	WA573656	CM 73063			
<i>Veniliornis affinis</i>	1*,2	<u>XC95304</u>			MPEG 36697	WA320545	ML114951	CM
<i>Veniliornis passerinus</i>					CM 72952			

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<i>Piculus flavigula</i>	1*,2,3	XC94957	WA675088	CM 75072			ML114956		CM
<i>Piculus chrysochloros</i>	1*		WA356507	CM 72647					
<i>Colaptes punctigula</i>	1,3		WA366369	MZUSP 3420	WAJ183309	KO			
<i>Celeus grammicus</i>	1*,2,3	XC91204	WA674439	MZUSP 3419					
<i>Celeus elegans</i>	1*,2,3		WA356077	MPEG 56045					
<i>Celeus flavescens</i>				CM 73169					
<i>Celeus flavus</i>	1*,2	XC95305	WA359486	MZUSP 10708			ML115217		CM
<i>Celeus torquatus</i>	1*,2	XC96148	XC96151	CM 74743	WA919233	RC	ML114909		CM
<i>Dryocopus lineatus</i>	1*,2,3	XC94959	XC94959	MZUSP 10716			XC87455		JM
<i>Campephilus rubricollis</i>	1*2	XC95102	XC95109	CM 72866	WA319721	FG	ML114957		CM
<i>Campephilus melanoleucus</i>	1*,3	XC95103	WA442184	MZUSP 35932	WA629817	IT			
THAMNOPHILIDAE									
<i>Myrmornis torquata</i>	2			MPEG 53917					
<i>Pygiptila stellaris</i>	1*2	XC95310	XC90772	CM 74493					
<i>Microrhopias quixensis</i>	1*2	XC94851		MPEG 53900			XC88940		JM
<i>Myrmeciza bemimelaena</i>	1*2	XC95315	XC90760	MPEG 56086			ML115203		CM
<i>Epinecrophylia leucophthalma</i>	1*2	XC96451	XC90760	MPEG 56078			ML114994		CM
<i>Epinecrophylia ornata</i>	1*2			MPEG 53893					
<i>Myrmotherula brachyura</i>	1*2	XC94887	XC90774	MPEG 56084					
<i>Myrmotherula sclateri</i>	1*2	XC95307	XC90760	CM 74937			ML114962		CM
<i>Myrmotherula klagesi</i>				CM 78427					
<i>Myrmotherula hauxwelli</i>	1*2	XC90707		MPEG 56072					
<i>Myrmotherula axillaris</i>	1*2	XC95311	XC90704	MPEG 53897	WA320531	FG			
<i>Myrmotherula longipennis</i>	1*2	XC95317	XC96303	MPEG 56071			ML115032		CM
<i>Myrmotherula meneresii</i>	1*2	XC95316	XC96455	MPEG 56074			XC88775		JM
<i>Myrmotherula assimilis</i>				CM 73136			ML47950		PI
<i>Formicivora grisea</i>	1*,3	XC94648	XC94670	MPEG 35616			ML117125		CM
<i>Formicivora rufa</i>	3			MPEG 37766	WA639485	IT			
<i>Thamnomanes caesiis</i>	1*2	XC94719	XC94851	MPEG 56068			ML115122		CM
<i>Dichrozona cincta</i>	2			MPEG 53904			XC88789		JM
<i>Herpilochmus rufimarginatus</i>	1*2	XC95402	XC90760	CM 74645			ML114913		CM
<i>Sakesphorhus luctuosus</i>				CM 72794	WA185174	KO	XC87606		JM

Family / species	Inventories	This study		Previous fieldwork				
<i>Thamnophilus doliatus</i>	1,3				MPEG 26699	WA634314	FS	
<i>Thamnophilus schistaceus</i>	1*2	XC90697	XC87290		MPEG 56062			
<i>Thamnophilus nigrocinereus</i>					CM 72219			
<i>Thamnophilus strictocephalus</i>	1*3	XC94611		WA619262	MPEG 26710		ML117126	CM
<i>Thamnophilus aethiops</i>	1*2	XC95318	XC95466		MPEG 53872			
<i>Thamnophilus amazonicus</i>	1*				CM 74955			
<i>Cymbilaimus lineatus</i>	1*2	XC94888	XC91205	WA356488	MPEG 56060		ML115024	CM
<i>Taraba major</i>	1*2		XC94620		CM 72511			
<i>Scelateria naevia</i>	1*2				CM 74856	WA206694	KO	
<i>Schistocicbla rufifacies</i>	2				CM 72556		ML115023	CM
<i>Hypocnemoides melanopogon</i>	1				CM 72350			
<i>Hylodylax naevius</i>	1*2	XC90776	XC91214		MPEG 56093		ML115186	CM
<i>Hylodylax punctulatus</i>	1*2	XC94780	XC95401		CM 74463			
<i>Pyriglena leuconota</i>	1*2		XC96494		MPEG 40590		ML115047	CM
<i>Myrmoborus lugubris</i>					CM 72226		ML47948	PI
<i>Myrmoborus myotherinus</i>	1*2	XC90747	XC90773	WA675602	MPEG 56244			
<i>Cercomacra cinerascens</i>	1*2	XC91216	XC91204		MPEG 56064	WA185151	KO	
<i>Cercomacra nigrescens</i>	1*2	XC95465		WA447471	CM 74773		ML114996	CM
<i>Hypocnemis striata</i>	1*2	XC96355	XC90709	WA356468	MPEG 56096	WA320252	FG	CM
<i>Hypocnemis hypoxantha</i>	1*2	XC87289	XC94623	WA356117	CM 74732		ML115172	CM
<i>Willisornis poecilinotus</i>	1*2	XC91222			CM 75079			
<i>Phlegopsis nigromaculata</i>	1*2	XC90744	XC91206		MPEG 56104		ML114942	CM
<i>Rhegmatorhina gymnops</i>	1*2	XC96150	XC94872		MPEG 56102		XC90272	JM
CONOPOPHAGIDAE								
<i>Conopophaga aurita</i>	1*2	XC94952		WA357416	MPEG 56105		ML114979	CM
GRALLARIDAE								
<i>Grallaria varia</i>	1*2	XC94645			CM 72858			
<i>Hyllopezus macularius</i>	1*2	XC86599	XC90705	WA357411	MPEG 56099		ML115081	CM
<i>Hyllopezus berlepschi</i>	1*2	XC94723	XC96341		CM 78386		XC6519	SD
<i>Myrmothera campanisona</i>	1*2	XC94889	XC91202		CM 74656		ML114910	CM
FORMICARIIDAE								
<i>Chamaeza nobilis</i>					CM 75049			

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<i>Formicarius colma</i>	1*2	XC95312		MPEG 53920				
<i>Formicarius analis</i>	1*2	XC95313	WA500201	MPEG 53921				
SCLERURIDAE								
<i>Sclerurus mexicanus</i>	1*2	XC96534		MPEG 53866				
<i>Sclerurus rufigularis</i>	1*2	XC96380	XC90707	MPEG 53869				
<i>Sclerurus caudatus</i>	1*2	XC94774		MPEG 36465				
DENDROCOLAPTIDAE								
<i>Dendrocincla fuliginosa</i>	1*,2	XC94830	XC95269	MPEG 56046			ML114930	CM
<i>Dendrocincla merula</i>	1*,2,3	XC94829	XC94831	MPEG 53850			ML115052	CM
<i>Deconychura longicauda</i>	1*,2	XC95571		MPEG 53852			ML115073	CM
<i>Certhiasomus stictolaemus</i>	1*,2			MPEG 53851				
<i>Sittasomus griseicapillus</i>	1*,2	XC96151	WA356030	MPEG 47735				
<i>Glyphorhynchus spirurus</i>	1*,2	XC95678	XC90709	MPEG 56054	WA320215	FG		
<i>Xiphorhynchus spixii</i>	1*,2	XC94876	XC96376	MPEG 56051			ML115123	CM
<i>Xiphorhynchus obsoletus</i>	1			MPEG 55293				
<i>Xiphorhynchus gattatus</i>	1*,2,3	XC95467	XC90740	MPEG 56049			ML114900	CM
<i>Campylorhynchus procurvoides</i>	1*,2	XC90761		MPEG 56093				
<i>Campylorhynchus trochilirostris</i>				CM 71504				
<i>Dendroplex picus</i>	1*,2,3	XC94885	XC90697	MPEG 55291	WA189088	KO		
<i>Dendroplex kienerii</i>				MPEG 55160				
<i>Lepidocolaptes angustirostris</i>	1,3			MPEG 19701	WA550043	VH		
<i>Lepidocolaptes albolineatus</i>	1*,2	XC96153	XC96154	MPEG 56055			ML117115	CM
<i>Nasica longirostris</i>	1			CM 73175				
<i>Dendrexetastes rufigula</i>	1*	XC87286	XC96496					
<i>Dendrocolaptes certhia</i>	1*,2	XC90769	XC94679	MPEG 53855			ML114916	CM
<i>Dendrocolaptes picumnus</i>	1*,2	XC90767	XC90703	MPEG 53859	WA500147		ML115181	CM
<i>Xiphocolaptes promeropirhynchus</i>	1*,2	XC94715	XC95467	MPEG 47698			ML114924	CM
<i>Hylexetastes uniformis</i>	1*,2	XC90740	XC90705	MPEG 53857	WA360070		ML117106	CM
FURNARIIDAE								
<i>Xenops minutus</i>	1*,2		XC96457	MPEG 56057	WA320530	FG	ML115050	CM
<i>Berlepschia rikeri</i>				USNM 109221				
<i>Furnarius figulus</i>	1*			CM 72394	WA359474			

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<i>Furnarius minor</i>			CM 72014	WA180980	KO	
<i>Ancistrops strigilatus</i>	1*	XC95119	CM 74882			
<i>Automolus ochrolaemus</i>	1*,2	XC94886	CM 74600	WA360092		
<i>Automolus paraensis</i>	1*,2	XC95303	MPEG 53864		ML115019	CM
<i>Automolus rufipileatus</i>	1*,2	XC95468	MPEG 53863			
<i>Philydor ruficaudatum</i>	1*,2	XC95121	CM 74983			
<i>Philydor erythrocerum</i>	1*,2	XC96455	MPEG 56056	WA500204		
<i>Philydor pyrhrhodes</i>	1*,2	XC95124	MPEG 47737			
<i>Certhiaxis cinnamomeus</i>			MPEG 36471	WA98816	JAA	
<i>Certhiaxis mustelinus</i>			CM 72392			
<i>Synallaxis albescens</i>	1*	XC87288	CM 72311			
<i>Synallaxis rutilans</i>	1*,2	XC94606	CM 74663		ML114952	CM
<i>Synallaxis gujanensis</i>	1*,2		CM 72131		XC6583	SD
<i>Cranioleuca vulpina</i>			CM 72181		XC91265	JM
<i>Cranioleuca muelleri</i>			CM 71831			
PIPRIDAE						
<i>Neopelma pallescens</i>	1,3		CM 78332	WA432109		ML117165
<i>Tyrannetes stolzmanni</i>	1*,2	XC94831	CM 74778	WA357339		ML115137
<i>Pipra aureola</i>			CM 73444			
<i>Pipra rubrocapilla</i>	1*,2	XC95466	CM 72985	WA360056		
<i>Lepidobrix iris</i>	1*,2	XC95469	CM 74351	WA350948		ML115232
<i>Manacus manacus</i>	1*,2,3	XC95470	CM 71803		VH	ML117132
<i>Heterocercus linteatus</i>	1		CM 74422			
<i>Machaeropterus pyrocephalus</i>	1*	XC91205	MPEG 35610			
<i>Chiroxiphia pareola</i>	1*,2,3	XC90695	MPEG 27125	WA621992		ML117138
TITYRIDAE						
<i>Onychorhynchus coronatus</i>	1*,2	XC94724	MPEG 56122			ML114935
<i>Terenotriccus erythrus</i>	1*,2	XC96314	MPEG 53924	WA320528	FG	
<i>Myiobius barbatus</i>	1*,2		MPEG 53929			
<i>Myiobius atricaudus</i>			MCZ 175749			
<i>Schiffornis major</i>			CM 78261			
<i>Schiffornis turdina</i>	1*,2	XC90687	MPEG 56123			

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<i>Laniocera hypopyrra</i>	1*,2		XC94719	CM 74551			
<i>Iodopleura isabellae</i>	1*,2				WA500136		
<i>Tityra inquisitor</i>	1*,2,3			CM 74683			
<i>Tityra cayana</i>	1*,2			CM 72152			
<i>Tityra semifasciata</i>	1*,2			CM 73293	WA356510		ML115041
<i>Pachyrhamphus rufus</i>	1*,2	XC96341		CM 73309	WA363556	IT	ML115089
<i>Pachyrhamphus castaneus</i>				CM 73462			
<i>Pachyrhamphus polychropterus</i>	1*,3			CM 72347			
<i>Pachyrhamphus marginatus</i>	1*,2		XC90680	CM 74892	WA500164		
<i>Pachyrhamphus minor</i>	1*,2		XC94849	CM 74712	WA674422		ML115056
<i>Pachyrhamphus validus</i>				MPEG 56120			
COTINGIDAE							
<i>Lipaugus vociferans</i>	1*,2	XC95589	XC90679	CM 74728			ML114921
<i>Gymnoderus foetidus</i>	1,3			CM 74417			
<i>Xipholena lamellipennis</i>	1*,2	XC96154		CM 78385	WA467154	FG	
<i>Cotinga cotinga</i>	1*			USNM 120922	WA356517		
<i>Cotinga cayana</i>	1*,2			CM 74452	WA467112	FG	
<i>Querula purpurata</i>	1*,2		XC91212	CM 72789	WA585264	FG	ML115077
<i>Phoenicircus carnifex</i>	1*,2		XC90519	MZUSP 10781	WA358706		ML115046
RHYNCHOCYLIDAE							
<i>Platyrinchus saturatus</i>	1*,2			MPEG 56112			ML114961
<i>Platyrinchus coronatus</i>	2			MPEG 47907			ML114912
<i>Platyrinchus platyrhynchos</i>	1*,2	XC96149		MPEG 56114			ML114975
<i>Piprites chloris</i>	1*,2	XC94949	XC95466	MPEG 53943			
<i>Mionectes oleagineus</i>	1*,2	XC95577		CM 74861			
<i>Mionectes macconnelli</i>	1*,2	XC95582	XC95589	MPEG 56109	WA358691		ML115011
<i>Corybopsis torquata</i>	1*,2	XC94832		CM 74611			
<i>Rhynchocyclus olivaceus</i>	1*,2	XC90704	XC90703	MPEG 56119			
<i>Tolmomyias assimilis</i>	1*,2	XC90760	XC94647	CM 75085	WA573666		ML115022
<i>Tolmomyias poliocephalus</i>	1*,2	XC94953		CM 73047			ML115009
<i>Tolmomyias flaviventris</i>	1*,3	XC94813	XC87286	MPEG 47911	WA584504		
<i>Todirostrum maculatum</i>	1,3			MPEG 15446	WA357387	KO	

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<i>Todirostrum cinereum</i>	1,3		WA363019	CM 78277			
<i>Todirostrum chrysocrotaphum</i>	1*	XC95679	WA359478	CM 73630			
<i>Poeciloriccus latirostris</i>				CM 73669			
<i>Myiornis ecaudatus</i>	1*,2		XC94889	CM 73468		ML115043	CM
<i>Hemitriccus griseipectus</i>				CM 74717			
<i>Hemitriccus striaticollis</i>	1*,2,3	XC94612	WA361101	MPEG 50976		ML115017	CM
<i>Hemitriccus minimus</i>	1*,2	XC86601	WA357409	CM 78150		ML114970	CM
<i>Lophotriccus galeatus</i>	1*,2	XC95590	XC94953	MPEG 56106		ML117099	CM
TYRANNIDAE							
<i>Zimmerius acer</i>	1*,2	<u>XC95352</u>	XC90774	CM 78409		ML114932	CM
<i>Inezia subflava</i>				MCZ 175873			
<i>Ornithion inerne</i>	1*,2	XC95592	WA357363	CM 78584		ML117101	CM
<i>Campostoma obsoletum</i>	1*,2,3		XC94885	MPEG 25716			
<i>Elaenia flavogaster</i>	1*,2,3		XC94776	MPEG 35603		ML117175	CM
<i>Elaenia parvirostris</i>	3			CM 73503			
<i>Elaenia cristata</i>	1*,3		WA357381	MPEG 17659	WA206691		
<i>Elaenia pelzelni</i>				CM 73687			
<i>Elaenia chiriquiensis</i>	1,3		WA361082	MPEG 32449		ML117144	CM
<i>Suiriri suiriri</i>	3			MPEG 26415			
<i>Myiopagis gaimardii</i>	1*,2,3	XC90775	XC90697	CM 74859		ML115069	CM
<i>Myiopagis caniceps</i>	1*	XC104022	WA444713				
<i>Myiopagis flavivertex</i>	1*	XC87285	WA357356				
<i>Myiopagis viridicata</i>	1*			CM 71927			
<i>Tyrannulus elatus</i>	1*,2,3	XC94803	WA363020	CM 74642			
<i>Capsiempis flaveola</i>	1*	XC94620		MPEG 47920			
<i>Phaeomyias murina</i>	1*,3		XC94648	CM 78368			
<i>Serpophaga hypoleuca</i>				MPEG 40568		ML117159	CM
<i>Attila cinnamomeus</i>	1*,2		XC94611	CM 72406			
<i>Attila spadiceus</i>	1*,2		XC90702	MPEG 35605			
<i>Attila bolivianus</i>				MPEG 53931		ML114928	CM
<i>Legatus leucophaius</i>	1*,2,3		XC94953	CM 72909			
<i>Ramphorhynchus ruficauda</i>	1*,2	XC94680	WA515389	CM 73516			
			WA357403	MPEG 8627			

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<i>Myiarchus tuberculifer</i>	1*,2		WA472584	MPEG 40565
<i>Myiarchus swainsonii</i>	3			CM 72386
<i>Myiarchus ferox</i>	1*,2,3	XC94723	WA361742	MPEG 47899
<i>Myiarchus tyrannulus</i>	1*,3		WA357382	MPEG 25539
<i>Rhytipterna simplex</i>	1*,2	XC95590		MPEG 56121
<i>Rhytipterna immunda</i>				CM 78626
<i>Casiornis fuscus</i>				CM 73783
<i>Pitangus sulphuratus</i>	1*,2,3	XC94775	WA363015	CM 72043
<i>Phylodyor lictor</i>	1*,2		WA584507	CM 73735
<i>Myiodinastes maculatus</i>	1*,2,3	XC94723		MPEG 47896
<i>Tyrannopsis sulphurea</i>	1*,3		WA359435	CM 73243
<i>Megarhynchus pitangus</i>	1*,2,3	XC94956	WA361104	CM 73775
<i>Myiozetetes similis</i>	1		WA361748	CM 78404
<i>Myiozetetes cayanensis</i>	1*,2,3	XC94650	WA361745	MPEG 40564
<i>Myiozetetes lateiventris</i>	1*,2	XC96496	WA515439	CM 74488
<i>Tyrannus albigularis</i>	1,3		WA590808	MPEG 26016
<i>Tyrannus melancholicus</i>	1*,2,3	XC94812	WA143667	MPEG 47892
<i>Tyrannus savana</i>	1*,3		WA436252	CM 72317
<i>Griseotyrannus aurantioatrocristatus</i>	1		WA361093	MPEG 26478
<i>Empidonax varius</i>	1*,2,3	XC94874	WA361089	MPEG 47895
<i>Conopias trivirgata</i>	1*,2	XC87290	WA357332	CM 72771
<i>Colonia colonus</i>	1*	XC95681		
<i>Myiophobus fasciatus</i>	1*	XC94776		
<i>Sublegatus obscurior</i>				MPEG 56107
<i>Sublegatus modestus</i>				MCZ 175958
<i>Pyrocephalus rubinus</i>				CM 72875
<i>Fluvicola albiventer</i>	1			CM 71619
<i>Arundinicola leucocephala</i>	1			MPEG 36694
<i>Cnemotriccus fuscatus</i>	1*	XC94878		CM 78450
<i>Lathrotriccus enleri</i>				CM 78471
<i>Empidonax traillii</i>				MPEG 32320
<i>Contopus nigrescens</i>				ML114941

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<i>Knipolegus poecliocercus</i>							
VIREONIDAE							
<i>Cyclarhis gujanensis</i>	1*,2,3		XC94878	WA363554	MPEG 40572		
<i>Vireolanius leucotis</i>	1*,2	XC90679	XC87290	WA357364	CM 74926		ML114963
<i>Vireo olivaceus</i>	1*,2,3	XC90697	XC94648	WA363560	MPEG 54788	WA552752	VH
<i>Vireo altiloquus</i>	1				MCZ 176304		
<i>Hylophilus semicinctus</i>	1*,2	XC92089	XC94620		MCZ 176308		
<i>Hylophilus pectoralis</i>	1*,2,3		XC94620	WA363555	MPEG 47949		ML117123
<i>Hylophilus hypoxanthus</i>	1*,2	XC94847	XC94680	WA360087	MPEG 47950		XC6510
<i>Hylophilus ochraceiceps</i>	1*,2	XC96312			MPEG 36470		ML115235
HIRUNDINIDAE							
<i>Atticora fasciata</i>	1,2			WA584510			
<i>Stelgidopteryx ruficollis</i>	1*,2,3			WA472579	CM 72747	WA100657	JAA
<i>Progne tapera</i>	1,3			WA462582	MPEG 54787		
<i>Progne subis</i>	1			WA573665	LACM 38905		
<i>Progne chalybea</i>	1*,2	XC96378	XC95572	WA348548	CM 74309	WA205428	KO
<i>Tachycineta albiventer</i>	1*,2,3			WA348554	CM 72712	WA206709	KO
<i>Hirundo rustica</i>	1*,3			WA360057	MPEG 47927		
<i>Riparia riparia</i>	1*			WA360063			
TROGLODYTIDAE							
<i>Microcerculus marginatus</i>	1*,2	XC94706			MPEG 56138		XC6568
<i>Odontorhynchus cinereus</i>	1*,2	XC90774	XC94623	WA335247	CM 74980		ML114936
<i>Troglodytes muscivus</i>	1*,2,3	XC94798		WA358650	MPEG 47936		
<i>Campylorhynchus turdinus</i>	1*,2	XC96294			CM 75082		
<i>Pheugopedius coraya</i>	1*,2	XC90737	XC86601	WA360049	MPEG 53947		ML115045
<i>Canthorbichilus leucotis</i>	1*,2,3	XC94806	XC94620	WA142405	MPEG 47935		ML117127
<i>Cyborhinus arada</i>	1*,2		XC96732		MPEG 56136		ML117074
DONACOBIIDAE							
<i>Donacobius atricapilla</i>	1*	XC94812			CM 71507		
POLIOPTILIDAE							
<i>Ramphocaenus melanurus</i>	1*,2		XC94882		CM 74871		ML114958
<i>Polioptila plumbea</i>	1			WA352469	CM 78424		

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<i>Poliptila paraensis</i>	1*,2						
TURDIDAE							
<i>Catharus fuscescens</i>				MPEG 54844			
<i>Catharus mimus</i>				MPEG 47943			
<i>Turdus nudigenis</i>				CM 72988			
<i>Turdus leucomelas</i>	1*,3	XC90695	XC94670	MPEG 35602	WA446714	TD	
<i>Turdus fumigatus</i>	1*			CM 74475			
<i>Turdus albicollis</i>	1*,2	XC96492		MPEG 56139			
MIMIDAE							
<i>Mimus saturninus</i>				MPEG 08546			
MOTACILIDAE							
<i>Anthus lutescens</i>	1*	XC96368		CM 73185			
COEREBOIDAE							
<i>Coereba flaveola</i>	1*,2,3			MPEG 53952			ML115037
THRAUPIDAE							
<i>Saltator grossus</i>	1*,2	XC90772	XC92089	MPEG 56142			ML114919
<i>Saltator maximus</i>	1*,2	XC96344		MPEG 23662			
<i>Saltator coerulescens</i>	1*			CM 72178			
<i>Parkerthraustes humeralis</i>	1*,2	XC104858					
<i>Lamprospiza melanoleuca</i>	1*,2	XC94951	XC94949	CM 74850			
<i>Nemosia pileata</i>	1,3			CM 72632			ML117145
<i>Tachyphonus rufus</i>	1*,2,3	XC96330		FMNH 258333	WA509899	IT	
<i>Ramphocelus carbo</i>	1*,2,3		XC94611	MPEG 22794	WA100650	JAA	ML115208
<i>Ramphocelus nigrogularis</i>				CM 72702			
<i>Lanio luctuosus</i>	1*,2			CM 75084			
<i>Lanio cristatus</i>	1*,2			CM 74707			
<i>Lanio cuculatus</i>	1	XC94890					
<i>Lanio versicolor</i>	1*,2	XC96152		MPEG 53955			XC91264
<i>Lanio surinamus</i>	1*,2			CM 75078			ML115051
<i>Lanio penicillatus</i>				CM 73592			
<i>Tangara mexicana</i>	1*,2,3	XC96313		CM 72207			XC5981
<i>Tangara velia</i>	1*,2				WA357353		

Family / species	Inventories	This study	Previous fieldwork
<i>Tangara varia</i>	1*	XC96295	
<i>Tangara punctata</i>	1*,2		WA467140
<i>Tangara episcopus</i>	1*,2,3	XC94878	WA358065 MPEG 17778 KO
<i>Tangara palmarum</i>	1*,2,3	XC94648	WA500207 CM 72052 KO
<i>Tangara cayana</i>	1,3		WA444716 CM 78198 IT WA51855 MPEG 37767
<i>Schistoclamis melanops</i>			
<i>Paroaria gularis</i>	1,2,3		WA340077 CM 73727 VH
<i>Dacnis lineata</i>	1*,2		WA356513
<i>Dacnis flaviventer</i>			CM 72799
<i>Dacnis cayana</i>	1*,2,3		WA467126 MPEG 23826
<i>Cyanerpes caeruleus</i>	1*,2		WA487618 CM 74612
<i>Cyanerpes cyaneus</i>	1*,2,3		WA356513 CM 72808 ML117142
<i>Chlorophanes spiza</i>	1*		WA443043 MCZ 22928 CM
<i>Hemithaupis guira</i>	1*,2		WA500180 CM 74941 ML115025
<i>Conirostrum bicolor</i>			CM 73679
EMBEREZIDAE			
<i>Annodramus humeralis</i>	1,3		WA544922 MPEG 23449 CM
<i>Annodramus aurifrons</i>	1		WA583468 CM 73732 KO
<i>Sicalis colombiana</i>	1		WA144015 MPEG 36695 TD ML47953
<i>Sicalis luteola</i>			CM 73513
<i>Volatinia jacarina</i>	1*,2,3	XC94618	WA467122 CM 71954 CM
<i>Sporophila schistacea</i>			MPEG 47983
<i>Sporophila americana</i>	1*	XC94776	WA444715 CM 71800
<i>Sporophila lineola</i>	1*		WA500123 CM 72651
<i>Sporophila nigricollis</i>	1*		WA347325 WA576640 IT
<i>Sporophila caeruleus</i>	2		MCZ 176848
<i>Sporophila minuta</i>	1*		WA467116 CM 72072
<i>Sporophila castaneiventris</i>			WA340079 CM 71617
<i>Sporophila angolensis</i>	1*,2,3	XC94874	WA514803 CM 72521
<i>Arremon taciturnus</i>	1*,2		MPEG 53961 ML115061
CARDINALIDAE			
<i>Piranga flava</i>	3		USNM 276980

Family / species	Inventories	This study		Previous fieldwork			
<i>Piranga rubra</i>			WA924652	MZUSP 47382			
<i>Habia rubica</i>	1*,2	XC96312		MPEG 35338		ML88362	CM
<i>Granatellus pelzelni</i>	1*	XC92090		CM 74460			
<i>Periporphyrus erythromelas</i>	1*,2	XC104023					
<i>Cyanoloxia cyanooides</i>	1*,2	XC94734		MPEG 35608		ML115042	CM
PARULIDAE							
<i>Phaeothlypis rivularis</i>				MPEG 53957		ML114985	CM
<i>Dendroica striata</i>	3			MPEG 50977		ML117141	CM
<i>Geothlypis aequinoctialis</i>				CM 78459			
ICTERIDAE							
<i>Psarocolius viridis</i>	1*,2	XC91202		CM 75037		ML115067	CM
<i>Psarocolius decumanus</i>	1*,2,3			CM 71975		ML115059	CM
<i>Psarocolius bifasciatus</i>	1*,2	XC94714		CM 73313			
<i>Prociacicus solitarius</i>				CM 71999			
<i>Cacicus haemorrhous</i>	1*,2			CM 74580			
<i>Cacicus cela</i>	1*,2,3	XC94775	WA441607	MPEG 23351		ML115210	CM
<i>Icterus cayanensis</i>	1,2		WA675100	CM 72081			
<i>Icterus croconotus</i>				CM 72609		XC91267	JM
<i>Gymnomystax mexicanus</i>	1		WA348555	CM 71607	WA550297		VH
<i>Chrysomus icterocephalus</i>				CM 71939			
<i>Molothrus oryzivorus</i>	1*,2,3		WA348559	MPEG 15252	WA240665		IT
<i>Molothrus bonariensis</i>	1*,2		WA348556	MPEG 36693	WA550669		VH
<i>Sturnella militaris</i>	1*,3		WA467176	MPEG 35614			
FRINGILIDAE							
<i>Euphonia chlorotica</i>	1,3		WA357326	CM 72623	WA370312		IT
<i>Euphonia violacea</i>	1*,2		WA584513	CM 72853		ML115106	CM
<i>Euphonia minuta</i>	1*,2			CM 73799			
<i>Euphonia xanthogaster</i>				CM 74535			
<i>Euphonia rufiventris</i>	1*,2	XC94738	WA514793			ML115140	CM
PASSERIDAE							
<i>Passer domesticus</i>	1		WA349047				

APPENDIX 2

List of 26 species reported from the Santarém-Belterra region, south of the Amazon and east of the Tapajós (PA, Brazil) but without any permanent vouchering material.

Species	Details of sighting
<i>Penelope jacquacu</i>	Sight records, C. B. A., A. C. L., B. J. W. D., Catchments: 69, 81, 99, 103, 157, 165, 236, 260, 261, 307, 399
<i>Egretta tricolor</i>	Sight record, A. Whittaker 14/11/1988, Alter do Chão
<i>Ictinia mississippiensis</i>	Sight record, G. M. Kirwan & C. F. Collins, 19 Alter do Chão 4/12/2005, listed in Whittaker <i>et al.</i> (2008)
<i>Helicolestes hamatus</i>	Sight record listed in Henriques <i>et al.</i> (2003)
<i>Buteo albonotatus</i>	Sight record listed in Sanaiotti & Cintra (2001)
<i>Falco columbarius</i>	Sight record, E. L., 30/11/2011, campus of the Universidade Federal do Oeste do Pará
<i>Aratinga maculata</i>	Sight records by E. Willis: Maicá 16/01/1984, Rodagém, 18/10/1984, Urumari, in Feb, 1985, listed in Willis & Silva (1986)
<i>Pyrrhuna lepida</i>	Aural records, E. L., 15/02/2012, Rio Curuauna
<i>Cypseloides</i> sp.	Sight record, A. C. L., 27/01/2011, Catchment 129
<i>Threptes leucurus</i>	Mist net captures listed by Henriques <i>et al.</i> (2003)
<i>Phaethornis hispidus</i>	Sight record, B. J. W. D. 31/01/2011, Catchment 112
<i>Lophornis ornatus</i>	Sight record Henriques <i>et al.</i> (2003)
<i>Chrysolampis mosquitus</i>	Sight record B. Whitney Km 21 on road to Alter do Chão, 19 June and again 7 July 1995)
<i>Trogon curucui</i>	Aural records C. B. A., A. C. L., B. J. W. D., Catchments: 81, 112
<i>Brachygalba lugubris</i>	Sight records in Henriques <i>et al.</i> (2003)
<i>Xenops rutilans</i>	Sight records C. B. A., Catchment: 157
<i>Microxenops milleri</i>	Sight records C. Marantz, 23/8/1999, 18/09/1999, 09/10/1999, Base de Sucupira, FLONA
<i>Dixiphia pipra</i>	Mist-net capture, Henriques <i>et al.</i> (2003)
<i>Tolmomyias sulphureus</i>	Mist-net capture, reported in Henriques <i>et al.</i> (2003)
<i>Sirystes sibilator</i>	Sight record listed in Sanaiotti & Cintra (2001)
<i>Contopus cooperi</i>	Sight record, C. Marantz, 26/09/1999, Base de Sucupira, FLONA
<i>Petrochelidon pyrrhonota</i>	Sight record, A. Whittaker, 14/11/1988, Alter do Chão (in Stotz <i>et al.</i> 1992)
<i>Atticora tibialis</i>	Sight record, C. B. A., 18/11/2010, Catchment 307
<i>Cyanocorax chrysops</i>	Sight record, B. Whitney, 06/07/1995, Maicá
<i>Tersina viridis</i>	Sight record in Sanaiotti & Cintra (2001)
<i>Cissopis levertianus</i>	Sight record, C. B. A. 03/11/2010, Catchment 399