

Twenty years later: an update to the birds of the Biological Dynamics of Forest Fragments Project, Amazonas, Brazil

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ABSTRACT: Although species lists from throughout Amazonia have become available, relatively complete inventories based on long-term work remain rare. Longitudinal comparisons at well-studied sites provide the best opportunities for describing communities and identifying changes in regional avifaunas. Within central Amazonia, no region has received as much consistent ornithological coverage as the *terra firme* forests north of Manaus, Brazil, at the Biological Dynamics of Forest Fragments Project (BDFFP). Here we provide an updated list of the area, including notes on all species added between 1997 and 2017. We recorded 21 species new for the site, most of which (>75%) are birds that prefer *várzea* or second-growth forest. This brings the cumulative BDFFP list up to 409 species, the majority (66%) of which inhabit primary *terra firme* forest. Together, this confirms that the regional *terra firme* community had been well-characterized by the 1990s, and that species additions to the list over the last 20 years are consistent with a changing landscape as urbanization, agriculture, and second-growth spread from Manaus. The final product continues to represent the most complete avian inventory for a single site in all of lowland Amazonia.

KEY-WORDS: Amazon, avifauna, inventory, Neotropics, *terra firme*.

INTRODUCTION

Although published species lists from throughout Amazonia have become increasingly available [for example, see a special issue entitled “Bird surveys in the Amazon” in *Revista Brasileira de Ornitologia* 19(2)], relatively complete, long-term avifaunal inventories – spanning multiple years – are rare. Furthermore, locations that contain updated, longitudinal inventories enabling discussion of changes over time within the avian community or in knowledge are rarer still (*e.g.*, Manu National Park in Peru, and Alta Floresta and the Santarém region in Brazil), and most of these strain the definition of a site, instead covering a broad region or a so-called “sprawling site” (Terborgh *et al.* 1984, Karr *et al.* 1990, Zimmer *et al.* 1997, Lees *et al.* 2013a, b). The extreme paucity of these site-specific avian inventories with longitudinal data, from otherwise remote tracts of rainforest, greatly increases the value of such information.

Within central Amazonia, no region has received more ornithological coverage than the *terra firme* forests north of Manaus and, consequently, the avifauna

here is well-described. The first avifaunal survey of the region was published in 1977 (Willis) and included 289 species of birds that had been recorded in the vicinity of the northwestern corner of Reserva Ducke. This list, however, was considered preliminary as it was compiled from ~15 months between 1972 and 1974 (Willis 1977), and, as has become clear from subsequent fieldwork in the region, it takes considerably longer to describe a complete avifauna in such a species-rich ecosystem, especially in an era with very limited access to regional field guides or bird vocalizations. Stotz & Bierregaard-Jr. (1989) studied a nearby site, the Biological Dynamics of Forest Fragments Project (hereafter BDFFP), connected to Reserva Ducke by about 50 km of seemingly similar and unbroken forest all within the same Guianan area of endemism (Cracraft 1985). They summarized seven years of intensive fieldwork at the BDFFP and documented 352 species of birds. Willis (1977) found 32 species at Reserva Ducke that were not recorded at the BDFFP by 1986, despite substantially more effort at the latter site; this difference was largely due to a suite of open and forest edge species that was then restricted to Reserva

Ducke (Stotz & Bierregaard-Jr. 1989). Eight years of additional fieldwork at the BDFFP further diminished this difference, adding another 49 species to the BDFFP list (Cohn-Haft *et al.* 1997). Taking into account various revisions and removals, Cohn-Haft *et al.* (1997) presented a comprehensive checklist of 394 species for the BDFFP, which included all but 16 species documented from nearby Reserva Ducke.

Twenty years have now passed since the last published update (Cohn-Haft *et al.* 1997). Both the physical and ornithological landscape have changed markedly since then. This further allows us to evaluate how much of the difference between successive inventories is a response to the accretion of records accompanying changes in the physical landscape and the passage of time or are instead a product of advancements in field identification criteria, the availability of reliable field guides for the region, accessible regional audio recordings, and an increased resolution of species' distributions and taxonomic relationships. Here we present an updated and annotated list to the birds of the BDFFP, including all species added between 1997 and 2017. The final product represents the most complete avian inventory for a single site in all of lowland Amazonia. Furthermore, this single, comprehensive list consolidates taxonomic and nomenclatural changes that have accumulated during the past two decades.

METHODS

Study area

The BDFFP (2°20'S; 60°00'W) is located ~80 km north of Manaus, Amazonas, Brazil (Fig. 1). The project was initiated in 1979 to help determine the minimum critical size needed to preserve an intact ecosystem and, today, is the largest and longest-running experiment on forest fragmentation (Bierregaard-Jr. *et al.* 2001, Laurance *et al.* 2018). Prior to the late 1970s, the entire study area and surrounding region consisted of virtually unbroken, primary *terra firme* forest, with forest trees dominated by members of the families Lecythidaceae, Fabaceae, and Sapotaceae (Rankin-de-Mérona 1992). Over a period of about 10 years beginning in 1980, three ~15,000 ha cattle ranches (the *fazendas* Dimona, Porto Alegre, and Esteio) were established and then gradually abandoned or operated at low production levels. Thus, the current landscape is still predominantly primary forest, with a relatively small, but intensely studied, mosaic of open pastures, second growth of various heights and ages (from 3 to >30 years), and experimentally isolated forest fragments (for more detailed information about the primary and secondary forest tree communities, see Rankin-de-Mérona 1992 and Mesquita *et al.* 2001, respectively).

The BDFFP is characterized by nutrient-poor soils, supporting a typical canopy height of 25–30 m, although emergent trees can reach as high as 40 m (C.L.R., unpubl. data). The understory of the forest is relatively open and is characterized by palms. Average annual rainfall in the region is ~2550 mm, as measured at Reserva Ducke over the span of 50 years, with peak rainfall in March and April and the driest months from June through August (L.A. Candido, pers. comm., see also Stouffer *et al.* 2013). The annual cycle here is typically split evenly between a six-month rainy season (December–May) followed by a six-month dry season (June–November).

Sampling

Fieldwork at the BDFFP by ornithologists interested in the comprehensive list has varied in intensity since 1997, with the result that most opportunities for adding new species have been since 2004. Most work from 1997–2004 was in the form of 1–2 months/year, during the dry season, based at ZF-3 KM41 (Fig. 1; Stouffer 2007). This continuous primary forest site offers little habitat variation except for roadsides and two small forest ponds. During the dry seasons of 2000–2002, we also conducted standard-effort mist netting and surveys for particular species of interest in the fragments (Stouffer *et al.* 2009). From 2005 to 2009, year-round, whole-community surveys were conducted at two continuous forest plots (see TEAM [2017] for more information). This work also offered the researchers the opportunity to explore the mosaic of pastures and second-growth of various ages near ZF-3 KM24. From 2007 onward, considerably more research effort was focused on second growth at all three

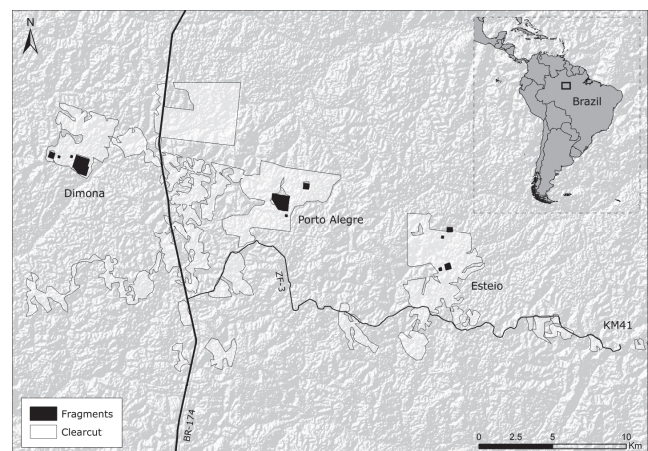


Figure 1. Map of the study area, showing the three main *fazendas* that comprise the Biological Dynamics of Forest Fragments Project, as well as the additional roads and localities mentioned in-text. All 11 forest fragments, ranging in size from 1 to 100 ha, are shown, and the region's digital elevation model is here represented using a hillshade effect. It is important to note that the vast majority of original clearcuts delineated here in this figure have since regenerated.

fazendas, in addition to continuing long-term sampling in fragments and continuous forest, again predominantly during the dry season. Here we report all species added from 1997 to 2017.

Additionally, we update the abundance and habitat codes published in Cohn-Haft *et al.* (1997) to reflect the current status of each species. Although there are now areas of second growth as much as 35 years old, these regenerating forests are converging on a primary forest avifauna (P.C.S., unpubl. data). Thus, to maintain comparability with Cohn-Haft *et al.* (1997), we define secondary forest as relatively early successional forest (*capoeira*), less than 15 years old (the oldest those authors encountered), most of which is currently dominated by *Cecropia* trees. For a few species, the changes in abundance that we present represent genuine changes over time (*e.g.*, declines in some terrestrial insectivores or early successional species), whereas for most it merely represents an increase in the precision of our understanding.

When possible, we documented new records with digital vouchers (or e-vouchers) archived at the Macaulay Library (Lees *et al.* 2014). These are accessible via the Macaulay Library catalog numbers in the text below (*e.g.*, ML51348641); those catalog numbers additionally provide date, location, observer, and a link to a corresponding eBird checklist (*e.g.*, S26343524, which corresponds to <http://ebird.org/ebird/view/checklist/S26343524>). Taxonomy and nomenclature follow the South American Checklist Committee (Remsen-Jr. *et al.* 2017) for simplicity of comparison with earlier lists from which this taxonomy diverges relatively little.

RESULTS

A total of 409 species representing 57 families have now been recorded from the BDFFP, the majority (270 species; 66%) of which we classified as preferring primary *terra firme* forest (Appendix I). We added 21 species to the list that had not been confirmed prior to 1997 and removed two species based upon updated knowledge (see Identification revisions below). Because of more intensive sampling effort in the latter decade, most new records were added after 2006: 1997 ($n = 2$), 2006 ($n = 2$), 2007 ($n = 7$), 2009 ($n = 2$), 2015 ($n = 3$), 2016 ($n = 3$), and 2017 ($n = 1$). However, this resolution means that it is impossible to ascertain when exactly a colonizing species may have first arrived at the BDFFP.

Unlike Cohn-Haft *et al.* (1997), we exclusively defined the study area as the BDFFP proper: the three aforementioned *fazendas* along the ZF-3 road. Cohn-Haft *et al.* (1997) also included four species (*Avocettula recurvirostris*, *Chrysolampis mosquitus*, *Accipiter poliogaster*, *Tachyphonus phoenicius*) that had only been registered from the canopy tower along the ZF-2 road 13 km to

the south of the BDFFP. Of these, only *A. poliogaster* has subsequently been documented from the BDFFP (17 November 2007 in the Dimona 100 ha fragment). Therefore, for consistency, we remove the three remaining species because they have not subsequently been found at the BDFFP proper.

Records of new species since 1997

Cairina moschata (Muscovy Duck): this widespread Neotropical duck has been found on two occasions at the BDFFP. Open water is limited at the BDFFP, restricted to seven ponds primarily embedded within pasture, although two seasonal ponds are found amidst continuous primary forest (Cohn-Haft *et al.* 1997). P.C.S. found an adult female on 02 July 1997 at the seasonal forest pond and a pair was present on 02–13 August 2010 at one of the pasture ponds (P.C.S. and E.I.J.). Although *C. moschata* prefers a variety of forested wetlands (*e.g.*, rivers, lakes, lagoons), they are known to undergo local or seasonal movements, especially during the dry season (Hilty & Brown 1986, Carboneras 1992). Thus, our records at the beginning of the dry season agree with this pattern, although the majority of fieldwork also occurs during that time of year. Undoubtedly, records are primarily limited by a paucity of this species' preferred habitat (ML75923911).

Bartramia longicauda (Upland Sandpiper): this long-distance migrant from North American boreal breeding grounds has been found only once, during southbound migration. A single bird was discovered on 08 October 2007 in the largest complex of remaining pastures at the project (E.I.J.). The timing of this record is consistent with this species' regional migration phenology: mid-October–mid-November (Ilha da Marchantaria, just upriver from Manaus on the Rio Solimões), September–October (Venezuela), early September–late October (Colombia), and late August–October (Suriname; Haverschmidt 1966, Hilty & Brown 1986, Stotz *et al.* 1992, Hilty 2002). Open habitat is limited at the BDFFP, occurring only near roads and pastures actively used by cattle or horses.

Patagioenas speciosa (Scaled Pigeon): P.C.S. discovered an immature in its first preformative molt (F.P.F.; Johnson *et al.* 2011) on 22 June 2007 in second-growth that appears to have been the vanguard for this species' recent colonization. In recent years (2015–2017), small numbers of *P. speciosa* have continued to be found at the Porto Alegre *fazenda*, especially as eastbound commuters over second-growth forest shortly after sunrise. This includes 3–4 confirmed individuals (25 November 2015 and 30 January 2016), but possibly as many as 9 different birds on the former date. This species uses a variety of forested habitats, including forest borders, old second-growth, and gallery forests, but does not usually inhabit interior *terra*

firme forests (Hilty & Brown 1986, Hilty 2002). It occurs regularly only some 40 km farther north near the town of Presidente Figueiredo, where its preferred *campina* (white-sand) vegetation is more abundant (ML53594681 and ML51348641).

Glaucis hirsutus (Rufous-breasted Hermit): C.L.R. captured a female on 10 September 2015 within a 10 ha fragment (~140 m to the nearest border) and aged the bird as an adult (F.A.J.; Johnson *et al.* 2011) based on bill corrugations (Ortiz-Crespo 1972). *Glaucis hirsutus* is an understory hummingbird in a wide variety of wooded habitats outside of primary forest (Schuchmann 1999); locally, this species is found predominantly in *várzea* and also frequents second-growth and edge habitat (ML51349111 and ML51349121).

Touit huetii (Scarlet-shouldered Parrotlet): although never previously noted in the area, we now have at least 21 records (2006–2013, 2017) from every month between April and December at the BDFFP, without any obvious peak in seasonality. These detections are predominantly auditory and come from continuous primary *terra firme* forest, although the species has also been detected from large 100 ha fragments and once over secondary forest. Additionally, a BDFFP study using autonomous sound recorders in both primary and secondary forest (21–32 years old) registered 60 detections between June and August 2011 (Figueira *et al.* 2015). Although in that study *T. huetii* was easier to detect in primary forest than in secondary forest, there was no difference in probability of use between the two habitats (Figueira *et al.* 2015), and it has even been detected once in the city of Manaus (M.C.H.). The published distribution of this poorly known parrotlet is disjunct, leaving out most of central Amazonia, including the vicinity around Manaus (Collar 1997). However, M.C.H. has now encountered the species in scattered localities throughout the Brazilian Amazon, usually in *terra firme* or black-water flooded forest, especially in regions with a considerable presence of *campina* or white sand habitats. We have no evidence of breeding or even local residence and suspect the species engages in as yet undetermined regional movements, perhaps only passing through the study area. It is likely that this low-density and unobtrusive species has simply been overlooked at the BDFFP prior to 1997 and is not a recent arrival. Thus, it is best treated as part of the “core primary *terra firme* avifauna” at our site (*sensu* Cohn-Haft *et al.* 1997), although its status remains unclear.

Megascops choliba (Tropical Screech-Owl): this common and widespread South American screech-owl has been found sporadically (2007, 2010, 2011, 2016, 2017) in second-growth forests that border pastures and field camps, and it is probably now a resident in low numbers. Detections span three distinct locations at the project, but spontaneous calling has only been recorded during June, July, August, and September. Throughout

its range, *M. choliba* is less numerous within interior primary forest, instead preferring more lightly wooded areas such as tall second-growth, borders of *terra firme* and *várzea*, and trees around human settlements (Hilty & Brown 1986, Hilty 2002), but in central Amazonia it appears to be entirely absent from primary *terra firme* (ML59899251).

Hypocnemoides melanopogon (Black-chinned Antbird): although this species was included in the first iteration of the project checklist (Stotz & Bierregaard-Jr. 1989), it was subsequently removed when it became apparent that the single record was outside of the study area (Cohn-Haft *et al.* 1997). However, on 31 December 2016, a female-plumaged bird was heard calling and then seen briefly at dawn before heading in the direction of a forest stream (M.C.H.). This species' occurrence was all the more surprising because it appeared at a remote camp surrounded by extensive *terra firme* forest. *Hypocnemoides melanopogon* chiefly inhabits forests that are tied to stagnant or slow-moving water, predominantly *várzea* or *igapó*, but also gallery forests and *terra firme* where it is not well-drained (Hilty & Brown 1986, Ridgely & Tudor 1994, Hilty 2002, Krabbe & Schulenberg 2003). Thus, this single record appears to refer to a non-territorial, dispersing individual and may represent a rare, long-range dispersal event.

Elaenia flavogaster (Yellow-bellied Elaenia): the most widespread member of its genus, this species has been found at two of the three *fazendas*: on 10 June 2009 in second-growth forest just outside the border of a 100 ha fragment (C.B.A.) and a territorial pair in August–September 2017 at the edge of an active pasture (C.L.R.). Absent from heavily-forested habitats, *E. flavogaster* is found in semi-open areas that include woodland borders, second-growth, scrub, and even parks and gardens (Hilty 2002, Fitzpatrick *et al.* 2004) and appears to be increasing within the city of Manaus, in other nearby settlements, and throughout the central Amazon (Borges *et al.* 2017; ML68467031 and ML68467051).

Sublegatus sp. (Scrub-Flycatcher species): only a single sighting has been registered at the BDFFP on 08 June 2009 (C.B.A.) inside, but near the border of, a 100 ha fragment. It is our opinion that the status and identification of members of this genus within the Amazon are poorly defined. Austral migrant *S. modestus* may appear in the canopy of *terra firme* forest, at least in southern Amazonia, and individuals present (throughout the year?) in *várzea* along the main Amazonian rivers are believed to be *S. obscurior*, and other taxa and vocal types (as yet not clearly distinguished) may be involved. Regional photographs and sound recordings archived in WikiAves (Costa 2008, Padua 2013, Carvalho 2015) provide further support of *S. obscurior*, as this species has been recorded more frequently than *S. modestus* in the region (Manaus and Novo Airão), including from the *terra firme* (Presidente Figueiredo).

Mionectes oleagineus (Ochre-bellied Flycatcher): this subtle flycatcher is strikingly similar to its much more common congener, *M. macconnelli*, and as such, may have been overlooked when Cohn-Haft *et al.* (1997) was published. Potential evidence in support of this is a capture of a putative *M. oleagineus* on 18 December 1991 from a 10 ha fragment; however, as this capture record lacks supplementary details about plumage or soft part coloration used to differentiate it from *M. macconnelli*, we consider this report hypothetical. Subsequently, five individuals have been captured six times, in addition to a single sighting (2007–2009). This species has been exclusively recorded from forest fragments (1 ha, 10 ha, and 100 ha) during July, September, and November. In the vicinity of Reserva Ducke, *M. oleagineus* is confined to second-growth, patchy woodlands, and forest edge, generally avoiding interior *terra firme* forests, which *M. macconnelli* inhabits (Willis *et al.* 1978); this same pattern was also described where the two species are sympatric in Venezuela (Hilty 2002; ML 53618181, ML 53618211, ML 53618221, ML53618291).

Hemitriccus josephinae (Boat-billed Tody-Tyrant): this poorly known endemic resident of the Guianan Shield was first discovered in September 2007, which marked a *c.* 60 km range extension and the southwesternmost outpost for this species' distribution (Cohn-Haft *et al.* 1997, Johnson *et al.* 2010). Intensive fieldwork subsequently resulted in the documentation of at least seven individuals on five territories from 2007–2009, mostly in continuous primary forest ($n = 4$ territories), but also included a single territory from a 10 ha fragment (Johnson *et al.* 2010). Although all sightings stemmed from *terra firme* forest, habitats were characterized by some level of disturbance or localized seasonal flooding (Johnson *et al.* 2010). This matches the general habitat description of disturbed areas in humid forest for *H. josephinae* – typically vine tangles along treefall gaps and forest edges, but also dense vine tangles in seasonally flooded forest (Ridgely & Tudor 1994, Hilty 2002, Fitzpatrick *et al.* 2004, Robbins *et al.* 2007). This species is one of only a few previously known from *c.* 60 km northeast of our sites, at Balbina, and thenceforth across the Guianan area of endemism (Cohn-Haft *et al.* 1997). We have interpreted this as a microhabitat association with forests with higher topographical relief, the presence of rocks, presumed higher rates of treefall, a more broken canopy, and the presence of more and denser vine tangles. Unlike most of the Guianan species that occur in the BDFFP and in Reserva Ducke, these birds appear to reach their southernmost limit away from the Amazon and Negro Rivers. As such, we suspect that the presence of *H. josephinae* at the BDFFP represents an ephemeral population at the limit of the species' distribution.

Myiophobus fasciatus (Bran-colored Flycatcher): this species has only recently been sighted in the central

Amazon (Gomes 2013, 2014, Braga 2014). Thus, it is perhaps unsurprising that C.L.R. found a single individual 05–10 August 2015 along the edge of a small cattle pond in overgrown pasture. *Myiophobus fasciatus* prefers early successional vegetation, such as overgrown pastures, forest borders, shrubby regrowth, hedgerows, and thickets (Hilty 2002). Published distributions show this species to be absent from most of the Amazon Basin, except at the periphery (Ridgely & Tudor 1994, Fitzpatrick *et al.* 2004). With deforestation, the species appears to be colonizing areas within the heart of the Amazon, similar to its expansion into historically forested regions in Colombia (Hilty & Brown 1986; ML51348451 and ML51348461).

Megarynchus pitangua (Boat-billed Flycatcher): although this widespread flycatcher occurs throughout the Neotropics, it has only recently been detected at the BDFFP. The first record occurred on 27 July 2007 (E.I.J. and C.F.V.), but it was found at all three *fazendas* that year, suggesting some indication of establishment prior to discovery. This species has been subsequently found in secondary forest and fragments of all sizes, with sightings ranging from July to October, as recently as 08 September 2017. In general, this species prefers lightly wooded areas, such as forest borders, plantations, and second-growth (Hilty 2002); however, in Amazonia, it is primarily a bird of *várzea* forest canopies, often associated with water (Ridgely & Tudor 1994), or of extensively disturbed areas with scattered tall trees, such as city parks.

Myiarchus tyrannulus (Brown-crested Flycatcher): similar to the aforementioned species, this is another widespread Neotropical flycatcher that was first discovered here in 2007 (E.I.J.). By 2010, it had been found in all three *fazendas*, always in secondary forest, often within close proximity to forest fragments. Its continued presence at specific sites and the most recent sighting (08 September 2017) suggests that individuals were not simply dispersing through the region, but rather had been gradually colonizing. The species is found in a variety of drier open to semi-open habitats, including scrubby disturbed areas, arid scrub, second-growth, gallery forests, and forest borders (Ridgely & Tudor 1994, Hilty 2002, Fitzpatrick *et al.* 2004) and had been noted by us (M.C.H., unpubl. data) at scattered localities in and near Manaus before appearing at the study site (ML59897621, ML59897631, ML59897701, ML59902381, ML59902691, ML59902771).

Attila cinnamomeus (Cinnamon Attila): this local, but occasionally common, flycatcher ranges throughout the Amazon Basin (Hilty 2002). It has been found only once at the BDFFP, heard singing by M.C.H. in a Moriche Palm (*Mauritia flexuosa*) swamp at KM21 of the ZF-3 road. This species is found near water, mostly in seasonally flooded forests (Ridgely & Tudor 1994, Hilty 2002). The closest thing to its preferred habitat within

the study area are scattered palm swamps and narrow forest streams within the *terra firme*, none of which may be extensive enough to support permanent populations.

Tyrannus albogularis (White-throated Kingbird): this austral migrant breeds in most of the eastern Amazon and adjacent Cerrado to the south and east, but may be found throughout the Amazon during austral winter (May–August; Ridgely & Tudor 1994, Fitzpatrick *et al.* 2004). On 24 June 1997, P.C.S. spotted a single individual at the same seasonal forest pond where *C. moschata* was noted (see above). The species is seldom found far from water (*e.g.*, edges of gallery forests, river islands, palm swamps, and shrubby areas), although it occupies a wider variety of semi-open habitats when not breeding, including cities and towns (Hilty & Brown 1986, Ridgely & Tudor 1994, Fitzpatrick *et al.* 2004).

Heterocercus flavivertex (Yellow-crested Manakin): an apparent adult male was captured and banded on 10 September 2016 in secondary forest – the first and only record for the BDFFP (A.D.C., G.J.F., and I.R.C.). This species occurs in so-called white sand forest (*campina/campinarana*; Adeney *et al.* 2016) in upland and seasonally flooded localities (Hilty 2002, Borges 2004). The nearest known locality for the species is the INPA Campina Reserve *c.* 26 km away, separated by continuous *terra firme* forest. This record suggests that the forest mosaic around white sand habitats is at least a partially permeable matrix for the dispersal of habitat specialist species (Capurucho *et al.* 2013, ML52201591).

Pachyramphus polychopterus (White-winged Becard): the most widely distributed of all the *Pachyramphus* becards, this species has only been found once here (30 January 2016; C.L.R.). An immature male was seen along the border where a cleared swath of regrowth abuts older second-growth forest, adjacent to a dry seasonal pond. Because *Pachyramphus* have been shown to exhibit a Complex Alternate Strategy molt, the bird's mix of adult male-like and female-like plumage – with at least four adult male-like rectrices and a single tertial – suggest that the bird was in its first cycle alternate (F.C.A.) plumage (Johnson & Wolfe 2017). The contrast between this male's dark gray underparts and black crown and wings suggests that it was *P. p. tristis*, a taxon that we suspect to be a rare migrant into the Amazon, as opposed to *P. p. nigriiventris*, the mostly black form found resident in Amazonian flooded forests.

Tachyphonus rufus (White-lined Tanager): a male probably of this species was seen in 2016, and a pair was photographed on 08 September 2017, with both records stemming from very young second-growth adjacent to active pastures (C.L.R.). Although *T. rufus* was once described only from the “extreme lower Amazon area” in Amapá and Pará states (Ridgely & Tudor 1989), there are now numerous documented records from western

Pará and eastern Amazonas, including about 40 km due north of the study area in the town of Presidente Figueiredo (*e.g.*, Antunes 2013, Czaban 2015). This non-forest species favors shrubby clearings, cultivated areas, and forest borders (Hilty & Brown 1986, Hilty 2002, ML68469551, and ML68469581).

Geothlypis aequinoctialis (Masked Yellowthroat): C.L.R. found a male and female at the same location on 05 and 10 August 2015, respectively, along the edge of a small cattle pond in an overgrown pasture. These birds could have originated from either of two populations: local residents from nearby *várzea* (*G. a. aequinoctialis*) or austral migrants from southern Brazil and neighboring countries (*G. a. velata*). However, the limited extent of gray in the male's crown, blending to olive in the hindcrown, suggests locally expanding *G. a. aequinoctialis* (Curson 2010). This species typically occupies damp thickets or grasses in pastures, fields, marshes, or along woodland borders (Hilty & Brown 1986, Hilty 2002, ML51348521).

Cacicus cela (Yellow-rumped Cacique): first encountered at the study site about ten years ago, there have been a total of only three records: once at a continuous forest site (26 August 2006) and twice from forest fragments (10 and 100 ha) at widely separated *fazendas*, both in 2007 (P.C.S., E.I.J., and C.F.V.). *Cacicus cela* inhabits *várzea*, gallery forest, forest borders, second-growth, and other settings with scattered trees, including towns and villages (Hilty & Brown 1986, Ridgely & Tudor 1989, Fraga 2011). It is common in the Manaus area in flooded forests and in the city. As this species prefers edge habitats, it has likely benefited from human-created habitats caused by road construction or deforestation (Corwin 2012).

Identification revisions

Penelope jacquacu (Spix's Guan): this widespread species is virtually identical in plumage to the guan of the Guianan Shield, *P. marail*, although the two differ in size. Willis (1977) included only *P. jacquacu* on the list of the birds of Reserva Ducke, but subsequent checklists for the BDFFP contain both species, although each time *P. marail* is listed as more abundant (Stotz & Bierregaard-Jr. 1989, Cohn-Haft *et al.* 1997). This difficult field identification has never been fully resolved, although we should note that early ornithologists at the BDFFP (including, notably, Ted Parker) believed that two species were present. To date, however, we still lack any physical evidence that *P. jacquacu* has been registered at the BDFFP. It may be that confusion between these two species is simply the perpetuation of a misidentification that has never since been corrected, a scenario that is not uncommon elsewhere in the Neotropics (Willis 2003). Further

collecting or a closer look at regional specimens, if they exist, could help to elucidate this situation, because there is apparently no overlap in tarsus length between these two species (*P. marail jacupeba* = 53–60 mm; *P. jacquacu orienticola* = 72–84 mm; Blake 1977). In the absence of evidence to the contrary, we are removing *P. jacquacu* from the BDFFP list.

Celeus grammicus (Scale-breasted Woodpecker): similar to the case of the guans, *C. grammicus* and *undatus* are similar in plumage, but they are not usually sympatric. Although both Stotz & Bierregaard-Jr. (1989) and Cohn-Haft *et al.* (1997) list both species as occurring at the BDFFP, there are no specimens or diagnostic photos to establish this, and vocalizations appear to be identical (Hilty 2002, Benz & Robbins 2011). The two are sister species that show the typical Amazonian pattern of geographic replacement on opposite sides of major rivers (Haffer 1997, Naka *et al.* 2012). Furthermore, they exhibit minimal genetic (0.2–0.3%), morphological, and behavioral differentiation, and indeed may best be treated as a single species (Benz & Robbins 2011). Differences in the presence and extent of barring on the rump, tail, and head are often used to separate them, and observed variability in these traits at the BDFFP led to the inference of co-occurrence. Alternatively, however, this variability may represent a hybrid population or actually be typical of *C. undatus*, the expected species east of the lower Rio Negro and the one whose plumage characteristics have most unequivocally been observed. We now believe that careful documentation of these woodpeckers through collecting should be provided before either co-occurrence or hybridization are inferred. Meanwhile, we are removing *C. grammicus* from the site list.

DISCUSSION

A total of 409 bird species have now been documented at the BDFFP site. This takes into account 21 species added and 6 removed due either to redefinition of the area covered (*Avocettula recurvirostris*, *Chrysolampis mosquitus*, *Tachyphonus phoenicius*), reidentification (*Penelope jacquacu*, *Celeus grammicus*), or taxonomic changes (*Icterus chrysiocephalus* is currently treated as a subspecies of *I. cayanensis*, but both are found at the site; Remsen-Jr. *et al.* 2017). Despite continued and intensive fieldwork over twenty years by numerous skilled field ornithologists (particularly from 2007–2017), representing many thousands of person-hours in the field, the overall change has been an increase of only 4%. This study confirms that the local avifauna at the BDFFP has been historically well characterized (Stotz & Bierregaard-Jr. 1989, Cohn-Haft *et al.* 1997).

Although the BDFFP avifauna does appear to be

well characterized and gradual additions over time of vagrants or very rare species to lists should be expected, additions due to increased knowledge or to changes in the landscape are important to distinguish. These additions may represent processes likely to affect bird populations over the long term. Of the 21 additions, three (*Bartramia longicauda*, *Pachyrhamphus polychopterus*, and *Tyrannus albogularis*) are non-breeding migrants and appear to be vagrants. Similarly, a number of species listed as “casual” by Cohn-Haft *et al.* (1997), have not been detected subsequently (*e.g.*, *Pipile cumanensis*, *Pionites melanocephalus*, *Pharomachrus pavoninus*, *Sclateria naevia*, *Phyllomyias griseiceps*, *Euphonia chlorotica*, *Tersina viridis*, and *Conirostrum speciosum*), reinforcing that status.

Another two species added (*Touit huetii* and *Hemitriccus josephinae*) are typical of primary *terra firme* forest and are considered rare at our site, where they probably have always occurred. Thus, they appear to represent cases of improved knowledge and detection ability. Although their local status is unclear, even if they are treated as integral parts of the site's primary *terra firme* avifauna (previously listed as 264 species), this would represent an increase of 0.8%, consistent with the prediction that the “core avifauna” had already been characterized to >99% precision (Cohn-Haft *et al.* 1997).

The great majority (16 species, 76%) of the species added are birds that prefer *várzea*, second-growth, disturbed, or edge habitats. This suggests that the farm and fragment matrix of the BDFFP continues to accumulate non-primary forest species. A similar pattern has been described from other Amazonian sites (*e.g.*, Borges *et al.* 2017), and many of the recent additions to the Santarém area and Alta Floresta lists were associated with anthropogenic habitat alteration (Lees *et al.* 2013a, b). However, some of these may also be vagrants, expected to appear rarely and at a more or less constant rate as they disperse through or over primary forest. Others may represent permanent additions to the local avifauna. Furthermore, the colonization process by non-primary forest species may be changing over time with changes either at the study site itself or in the surrounding landscape, increasing the likelihood of colonization (via increases in deforestation or dispersal along roads, for example). Distinguishing among these possibilities, however, would require a temporal landscape analysis.

The BDFFP continues to have the most thoroughly documented avifauna in all of central Amazonia. This updated list, replete with extensive, recent fieldwork at the BDFFP, likely reflects local and regional land-use changes that have accumulated during the past two decades and serves as one of the few complete, longitudinal avian inventories available in all of lowland Amazonia. Although other intensive lists have been published at a variety of Amazonian sites (*e.g.*, Terborgh *et al.* 1984,

Karr *et al.* 1990, Parker-III *et al.* 1994), we look forward to updates to those inventories as well as other published lists to become available, which will be even more useful to make comparisons across the biogeographically diverse Amazon.

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APPENDIX I

Bird species recorded at the Biological Dynamics of Forest Fragments Project in the state of Amazonas, Brazil. Taxonomy and order follow the South American Classification Committee (9 March 2017). Abundance codes are: c – common, u – uncommon, r – rare, x – casual; followed by seasonality codes if not year-round resident: a – austral migrant, b – boreal migrant, m – unspecified movements. Habitat codes are: 1 – primary *terra firme* forest, 2 – secondary forest, p – pasture, w – water bodies, c – *campinarana*.

Families and species	English name	Abundance, seasonality	Habitat
TINAMIDAE			
<i>Tinamus major</i>	Great Tinamou	c	1
<i>Crypturellus soui</i>	Little Tinamou	u	2, 1
<i>Crypturellus variegatus</i>	Variegated Tinamou	c	1
<i>Crypturellus brevirostris</i>	Rusty Tinamou	u	1
ANATIDAE			
<i>Cairina moschata</i>	Muscovy Duck	x	w
<i>Nomonyx dominicus</i>	Masked Duck	r	w
CRACIDAE			
<i>Penelope marail</i>	Marail Guan	c	1
<i>Pipile cumanensis</i>	Blue-throated Piping-Guan	x	1
<i>Ortalis motmot</i>	Variable Chachalaca	c	2
<i>Crax alector</i>	Black Curassow	u	1
ODONTOPHORIDAE			
<i>Odontophorus gujanensis</i>	Marbled Wood-Quail	u	1, 2
PODICIPEDIDAE			
<i>Tachybaptus dominicus</i>	Least Grebe	u	w
COLUMBIDAE			
<i>Patagioenas speciosa</i>	Scaled Pigeon	r	2
<i>Patagioenas plumbea</i>	Plumbeous Pigeon	c	1
<i>Patagioenas subvinacea</i>	Ruddy Pigeon	c	1, 2
<i>Geotrygon montana</i>	Ruddy Quail-Dove	cm	1
<i>Leptotila verreauxi</i>	White-tipped Dove	c	2, p
<i>Columbina passerina</i>	Common Ground Dove	r	2, p
<i>Columbina talpacoti</i>	Ruddy Ground Dove	r	2, p
CUCULIDAE			
<i>Crotophaga major</i>	Greater Ani	x	1
<i>Crotophaga ani</i>	Smooth-billed Ani	c	p, 2
<i>Dromococcyx pavoninus</i>	Pavonine Cuckoo	x	1
<i>Piaya cayana</i>	Squirrel Cuckoo	u	2
<i>Piaya melanogaster</i>	Black-bellied Cuckoo	c	1
<i>Coccyzus melacoryphus</i>	Dark-billed Cuckoo	xa	2
<i>Coccyzus euleri</i>	Pearly-breasted Cuckoo	ra	1
NYCTIBIIDAE			
<i>Nyctibius grandis</i>	Great Potoo	r	2, 1
<i>Nyctibius aethereus</i>	Long-tailed Potoo	r	1, 2
<i>Nyctibius griseus</i>	Common Potoo	u	2, 1
<i>Nyctibius leucopterus</i>	White-winged Potoo	u	1
<i>Nyctibius bracteatus</i>	Rufous Potoo	u	1

Families and species	English name	Abundance, seasonality	Habitat
CAPRIMULGIDAE			
<i>Chordeiles acutipennis</i>	Lesser Nighthawk	x	p
<i>Chordeiles minor</i>	Common Nighthawk	rb	1, p
<i>Lurocalis semitorquatus</i>	Short-tailed Nighthawk	u	1
<i>Nyctipolus nigrescens</i>	Blackish Nightjar	u	2, 1
<i>Nyctidromus albicollis</i>	Common Pauraque	c	2, p
APODIDAE			
<i>Streptoprocne zonaris</i>	White-collared Swift	rm	1, 2, p
<i>Chaetura spinicaudus</i>	Band-rumped Swift	c	1, w, p
<i>Chaetura chapmani</i>	Chapman's Swift	u	1, w
<i>Chaetura brachyura</i>	Short-tailed Swift	r	2, w, p
<i>Tachornis squamata</i>	Fork-tailed Palm-Swift	r	p
<i>Panyptila cayennensis</i>	Lesser Swallow-tailed Swift	r	1, 2
TROCHILIDAE			
<i>Topaza pella</i>	Crimson Topaz	r	1, 2
<i>Florisuga mellivora</i>	White-necked Jacobin	u	1, 2
<i>Glaucis hirsutus</i>	Rufous-breasted Hermit	x	2
<i>Phaethornis ruber</i>	Reddish Hermit	r	2
<i>Phaethornis bourcierii</i>	Straight-billed Hermit	c	1, 2
<i>Phaethornis superciliosus</i>	Long-tailed Hermit	c	1, 2
<i>Heliothryx auritus</i>	Black-eared Fairy	c	1, 2
<i>Polytmus theresiae</i>	Green-tailed Goldenthrout	x	p
<i>Anthracothorax nigricollis</i>	Black-throated Mango	r	1
<i>Discosura longicaudus</i>	Racket-tailed Coquette	r	1, 2
<i>Campylopterus largipennis</i>	Gray-breasted Sabrewing	c	1, 2
<i>Thalurania furcata</i>	Fork-tailed Woodnymph	c	1, 2
<i>Amazilia versicolor</i>	Versicolored Emerald	r	2
<i>Amazilia fimbriata</i>	Glittering-throated Emerald	x	1
<i>Hylocharis sapphirina</i>	Rufous-throated Sapphire	u	1, 2
PSOPHIIDAE			
<i>Psophia crepitans</i>	Gray-winged Trumpeter	u	1
RALLIDAE			
<i>Aramides cajaneus</i>	Gray-necked Wood-Rail	r	1, 2
<i>Anurolimnas viridis</i>	Russet-crowned Crake	u	p
<i>Laterallus melanophaius</i>	Rufous-sided Crake	x	w
HELIORNITHIDAE			
<i>Heliornis fulica</i>	Sungrebe	x	w
CHARADRIIDAE			
<i>Pluvialis dominica</i>	American Golden-Plover	rb	w
<i>Charadrius collaris</i>	Collared Plover	x	w, p
SCOLOPACIDAE			
<i>Bartramia longicauda</i>	Upland Sandpiper	xb	p
<i>Calidris himantopus</i>	Stilt Sandpiper	xb	w
<i>Calidris minutilla</i>	Least Sandpiper	xb	w
<i>Calidris fuscicollis</i>	White-rumped Sandpiper	ub	w

Families and species	English name	Abundance, seasonality	Habitat
<i>Calidris melanotos</i>	Pectoral Sandpiper	rb	w
<i>Gallinago paraguaiiae</i>	South American Snipe	x	w
<i>Actitis macularius</i>	Spotted Sandpiper	ub	w
<i>Tringa solitaria</i>	Solitary Sandpiper	ub	w
<i>Tringa melanoleuca</i>	Greater Yellowlegs	ub	w
<i>Tringa flavipes</i>	Lesser Yellowlegs	rb	w
JACANIDAE			
<i>Jacana jacana</i>	Wattled Jacana	c	w
EURYPYGIDAE			
<i>Eurypyga helias</i>	Sunbittern	r	l
CICONIIDAE			
<i>Mycteria americana</i>	Wood Stork	x	p
ANHINGIDAE			
<i>Anhinga anhinga</i>	Anhinga	x	p
ARDEIDAE			
<i>Tigrisoma lineatum</i>	Rufescent Tiger-Heron	r	l, w
<i>Cochlearius cochlearius</i>	Boat-billed Heron	x	l
<i>Nycticorax nycticorax</i>	Black-crowned Night-Heron	x	l
<i>Butorides striata</i>	Striated Heron	x	l
<i>Bubulcus ibis</i>	Cattle Egret	x	p, w, l
<i>Ardea cocoi</i>	Cocoi Heron	r	w
<i>Ardea alba</i>	Great Egret	r	w
<i>Pilherodius pileatus</i>	Capped Heron	x	w
THRESKIORNITHIDAE			
<i>Mesembrinibis cayennensis</i>	Green Ibis	x	l
CATHARTIDAE			
<i>Cathartes aura</i>	Turkey Vulture	u	p, 2
<i>Cathartes melambrotus</i>	Greater Yellow-headed Vulture	c	l, p
<i>Coragyps atratus</i>	Black Vulture	u	p
<i>Sarcoramphus papa</i>	King Vulture	u	l, p
PANDIONIDAE			
<i>Pandion haliaetus</i>	Osprey	xb	w
ACCIPITRIDAE			
<i>Gampsonyx swainsonii</i>	Pearl Kite	r	p
<i>Chondrohierax uncinatus</i>	Hook-billed Kite	x	l
<i>Leptodon cayanensis</i>	Gray-headed Kite	x	l
<i>Elanoides forficatus</i>	Swallow-tailed Kite	um?	l, 2
<i>Morphnus guianensis</i>	Crested Eagle	r	l
<i>Harpia harpyja</i>	Harpy Eagle	r	l
<i>Spizaetus tyrannus</i>	Black Hawk-Eagle	r	l, 2
<i>Spizaetus melanoleucus</i>	Black-and-white Hawk-Eagle	x	l, 2, p
<i>Spizaetus ornatus</i>	Ornate Hawk-Eagle	u	l
<i>Harpagus bidentatus</i>	Double-toothed Kite	u	l
<i>Ictinia plumbea</i>	Plumbeous Kite	um?	l, 2
<i>Accipiter poliogaster</i>	Gray-bellied Hawk	x	l

Families and species	English name	Abundance, seasonality	Habitat
<i>Accipiter superciliosus</i>	Tiny Hawk	r	1
<i>Accipiter bicolor</i>	Bicolored Hawk	r	1
<i>Buteogallus meridionalis</i>	Savanna Hawk	u	p
<i>Buteogallus urubitinga</i>	Great Black Hawk	u	1, 2
<i>Rupornis magnirostris</i>	Roadside Hawk	u	p, 2
<i>Geranoaetus albicaudatus</i>	White-tailed Hawk	r	p
<i>Pseudastur albicollis</i>	White Hawk	c	1, 2
<i>Leucopternis melanops</i>	Black-faced Hawk	r	1
<i>Buteo nitidus</i>	Gray-lined Hawk	c	2, p
<i>Buteo platypterus</i>	Broad-winged Hawk	ub	2, 1
<i>Buteo brachyurus</i>	Short-tailed Hawk	u	2, p
TYTONIDAE			
<i>Tyto alba</i>	Barn Owl	r	2, p
STRIGIDAE			
<i>Megascops choliba</i>	Tropical Screech-Owl	r	2
<i>Megascops watsonii</i>	Tawny-bellied Screech-Owl	c	1, 2
<i>Lophotrix cristata</i>	Crested Owl	c	1
<i>Pulsatrix perspicillata</i>	Spectacled Owl	c	1
<i>Ciccaba virgata</i>	Mottled Owl	r	2, 1
<i>Ciccaba hubula</i>	Black-banded Owl	u	1, 2
<i>Glaucidium hardyi</i>	Amazonian Pygmy-Owl	c	1, 2
<i>Athene cunicularia</i>	Burrowing Owl	x	p
TROGONIDAE			
<i>Pharomachrus pavoninus</i>	Pavonine Quetzal	x	1
<i>Trogon melanurus</i>	Black-tailed Trogon	c	1
<i>Trogon viridis</i>	Green-backed Trogon	c	1, 2
<i>Trogon violaceus</i>	Guianan Trogon	c	1
<i>Trogon rufus</i>	Black-throated Trogon	c	1
ALCEDINIDAE			
<i>Megaceryle torquata</i>	Ringed Kingfisher	r	w
<i>Chloroceryle amazona</i>	Amazon Kingfisher	x	w
<i>Chloroceryle americana</i>	Green Kingfisher	x	1
<i>Chloroceryle inda</i>	Green-and-rufous Kingfisher	r	1
<i>Chloroceryle aenea</i>	American Pygmy Kingfisher	r	1
MOMOTIDAE			
<i>Momotus momota</i>	Amazonian Motmot	c	1
GALBULIDAE			
<i>Galbula albirostris</i>	Yellow-billed Jacamar	c	1, 2
<i>Galbula leucogastra</i>	Bronzy Jacamar	r	c, 1, 2
<i>Galbula dea</i>	Paradise Jacamar	c	1, 2
<i>Jacamerops aureus</i>	Great Jacamar	c	1
BUCCONIDAE			
<i>Notharchus macrorhynchos</i>	Guianan Puffbird	c	1
<i>Notharchus tectus</i>	Pied Puffbird	u	1, 2
<i>Bucco tamatia</i>	Spotted Puffbird	u	1, 2

Families and species	English name	Abundance, seasonality	Habitat
<i>Bucco capensis</i>	Collared Puffbird	u	1
<i>Malacoptila fusca</i>	White-chested Puffbird	u	1
<i>Nonnula rubecula</i>	Rusty-breasted Nunlet	r	1
<i>Monasa atra</i>	Black Nunbird	c	1, 2
<i>Chelidoptera tenebrosa</i>	Swallow-winged Puffbird	r	p, 2
CAPITONIDAE			
<i>Capito niger</i>	Black-spotted Barbet	c	1
RAMPHASTIDAE			
<i>Ramphastos tucanus</i>	White-throated Toucan	c	1
<i>Ramphastos vitellinus</i>	Channel-billed Toucan	c	1
<i>Selenidera piperivora</i>	Guianan Toucanet	u	1
<i>Pteroglossus viridis</i>	Green Aracari	u	1, 2
PICIDAE			
<i>Picumnus exilis</i>	Golden-spangled Piculet	u	1, 2
<i>Melanerpes cruentatus</i>	Yellow-tufted Woodpecker	c	2, 1
<i>Veniliornis cassini</i>	Golden-collared Woodpecker	c	1
<i>Piculus flavigula</i>	Yellow-throated Woodpecker	c	1
<i>Piculus chrysochloros</i>	Golden-green Woodpecker	r	1
<i>Celeus torquatus</i>	Ringed Woodpecker	u	1
<i>Celeus undatus</i>	Waved Woodpecker	c	1
<i>Celeus flavus</i>	Cream-colored Woodpecker	x	1
<i>Celeus elegans</i>	Chestnut Woodpecker	u	1
<i>Dryocopus lineatus</i>	Lineated Woodpecker	c	2, 1, p
<i>Campephilus rubricollis</i>	Red-necked Woodpecker	c	1
FALCONIDAE			
<i>Micrastur ruficollis</i>	Barred Forest-Falcon	c	1, 2
<i>Micrastur gilvicollis</i>	Lined Forest-Falcon	c	1
<i>Micrastur mirandollei</i>	Slaty-backed Forest-Falcon	u	1, 2
<i>Micrastur semitorquatus</i>	Collared Forest-Falcon	u	1, 2
<i>Caracara plancus</i>	Southern Caracara	r	p
<i>Ibycter americanus</i>	Red-throated Caracara	c	1
<i>Daptrius ater</i>	Black Caracara	r	1
<i>Milvago chimachima</i>	Yellow-headed Caracara	u	p
<i>Falco ruficularis</i>	Bat Falcon	c	1, 2, p
PSITTACIDAE			
<i>Touit huetii</i>	Scarlet-shouldered Parrotlet	r	1, 2
<i>Touit purpuratus</i>	Sapphire-rumped Parrotlet	u	1
<i>Brotogeris chrysoptera</i>	Golden-winged Parakeet	c	1
<i>Pyrilia caica</i>	Caica Parrot	u	1
<i>Pionus fuscus</i>	Dusky Parrot	um	1
<i>Pionus menstruus</i>	Blue-headed Parrot	cm	1
<i>Amazona autumnalis</i>	Red-lored Parrot	cm	1
<i>Amazona farinosa</i>	Mealy Parrot	cm	1
<i>Forpus</i> sp.	Parrotlet species	x	1, 2
<i>Pionites melanocephalus</i>	Black-headed Parrot	x	1

Families and species	English name	Abundance, seasonality	Habitat
<i>Derophtus accipitrinus</i>	Red-fan Parrot	c	1
<i>Orthopsittaca manilatus</i>	Red-bellied Macaw	u	p, 1
<i>Ara ararauna</i>	Blue-and-yellow Macaw	c	1
<i>Ara macao</i>	Scarlet Macaw	r	1
<i>Ara chloropterus</i>	Red-and-green Macaw	c	1
<i>Psittacara leucophthalmus</i>	White-eyed Parakeet	r	1, 2, p
THAMNOPHILIDAE			
<i>Euchrepomis spodioptila</i>	Ash-winged Antwren	c	1
<i>Cymbilaimus lineatus</i>	Fasciated Antshrike	c	1, 2
<i>Frederickena viridis</i>	Black-throated Antshrike	r	1, 2
<i>Thamnophilus murinus</i>	Mouse-colored Antshrike	c	1, 2
<i>Thamnophilus punctatus</i>	Northern Slaty-Antshrike	u	2, c
<i>Thamnomanes ardesiacus</i>	Dusky-throated Antshrike	c	1
<i>Thamnomanes caesi</i>	Cinereous Antshrike	c	1
<i>Iseria guttata</i>	Rufous-bellied Antwren	r	1
<i>Epinecrophylla gutturalis</i>	Brown-bellied Antwren	c	1
<i>Myrmotherula brachyura</i>	Pygmy Antwren	c	1, 2
<i>Myrmotherula axillaris</i>	White-flanked Antwren	c	1, 2
<i>Myrmotherula longipennis</i>	Long-winged Antwren	c	1
<i>Myrmotherula menetriesii</i>	Gray Antwren	c	1
<i>Herpsilochmus dorsimaculatus</i>	Spot-backed Antwren	c	1
<i>Hypocnemis cantator</i>	Guianan Warbling-Antbird	c	1, 2
<i>Cercomacroides tyrannina</i>	Dusky Antbird	u	2
<i>Cercomacra cinerascens</i>	Gray Antbird	c	1
<i>Hypocnemoides melanopogon</i>	Black-chinned Antbird	x	1
<i>Sclateria naevia</i>	Silvered Antbird	x	1
<i>Percnostola rufifrons</i>	Black-headed Antbird	c	1, 2
<i>Myrmelastes leucostigma</i>	Spot-winged Antbird	u	1
<i>Myrmoderus ferrugineus</i>	Ferruginous-backed Antbird	c	1
<i>Myrmophylax atrothorax</i>	Black-throated Antbird	r	2, 1
<i>Myrmornis torquata</i>	Wing-banded Antbird	r	1
<i>Pithys albifrons</i>	White-plumed Antbird	c	1
<i>Gymnopithys rufigula</i>	Rufous-throated Antbird	c	1
<i>Hylophylax naevius</i>	Spot-backed Antbird	r	1, 2
<i>Willisornis poecilinotus</i>	Common Scale-backed Antbird	c	1
CONOPOPHAGIDAE			
<i>Conopophaga aurita</i>	Chestnut-belted Gnateater	u	1
GRALLARIIDAE			
<i>Grallaria varia</i>	Variiegated Antpitta	c	1
<i>Hylopezus macularius</i>	Spotted Antpitta	u	1
<i>Myrmothera campanisona</i>	Thrush-like Antpitta	c	1, 2
FORMICARIIDAE			
<i>Formicarius colma</i>	Rufous-capped Antthrush	c	1
<i>Formicarius analis</i>	Black-faced Antthrush	c	1

Families and species	English name	Abundance, seasonality	Habitat
FURNARIIDAE			
<i>Sclerurus mexicanus</i>	Tawny-throated Leaf-tosser	u	1
<i>Sclerurus rufigularis</i>	Short-billed Leaf-tosser	c	1
<i>Sclerurus caudacutus</i>	Black-tailed Leaf-tosser	r	1
<i>Certhiasomus stictolaemus</i>	Spot-throated Woodcreeper	c	1
<i>Sittasomus griseicapillus</i>	Olivaceous Woodcreeper	c	1, 2
<i>Deconychura longicauda</i>	Long-tailed Woodcreeper	c	1
<i>Dendrocincla merula</i>	White-chinned Woodcreeper	c	1
<i>Dendrocincla fuliginosa</i>	Plain-brown Woodcreeper	c	1, 2
<i>Glyphorhynchus spirurus</i>	Wedge-billed Woodcreeper	c	1, 2
<i>Dendrexetastes rufigula</i>	Cinnamon-throated Woodcreeper	u	1
<i>Dendrocolaptes certhia</i>	Amazonian Barred-Woodcreeper	c	1
<i>Dendrocolaptes picumnus</i>	Black-banded Woodcreeper	u	1
<i>Hylexetastes perrotii</i>	Red-billed Woodcreeper	u	1
<i>Xiphorhynchus pardalotus</i>	Chestnut-rumped Woodcreeper	c	1
<i>Campylorhynchus procurvoides</i>	Curve-billed Scythebill	u	1
<i>Lepidocolaptes albolineatus</i>	Guianan Woodcreeper	c	1
<i>Xenops minutus</i>	Plain Xenops	c	1
<i>Microxenops milleri</i>	Rufous-tailed Xenops	c	1
<i>Philydor erythrocerum</i>	Rufous-rumped Foliage-gleaner	c	1
<i>Philydor pyrrhodes</i>	Cinnamon-rumped Foliage-gleaner	u	1
<i>Clibanornis rubiginosus</i>	Ruddy Foliage-gleaner	u	1, 2
<i>Automolus ochrolaemus</i>	Buff-throated Foliage-gleaner	c	2, 1
<i>Automolus infuscatus</i>	Olive-backed Foliage-gleaner	c	1
<i>Synallaxis rutilans</i>	Ruddy Spinetail	r	1
TYRANNIDAE			
<i>Phyllomyias griseiceps</i>	Sooty-headed Tyrannulet	x	2
<i>Tyrannulus elatus</i>	Yellow-crowned Tyrannulet	c	1, 2
<i>Myiopagis gaimardii</i>	Forest Elaenia	c	1
<i>Myiopagis caniceps</i>	Gray Elaenia	c	1
<i>Elaenia flavogaster</i>	Yellow-bellied Elaenia	x	2
<i>Elaenia parvirostris</i>	Small-billed Elaenia	ra	2
<i>Elaenia chiriquensis</i>	Lesser Elaenia	xm	2, p
<i>Ornithion inerme</i>	White-lored Tyrannulet	u	1
<i>Camptostoma obsoletum</i>	Southern Beardless-Tyrannulet	x	2
<i>Phaeomyias murina</i>	Mouse-colored Tyrannulet	r	2
<i>Corythopis torquatus</i>	Ringed Antpipit	u	1
<i>Zimmerius acer</i>	Guianan Tyrannulet	c	1, 2
<i>Phylloscartes virescens</i>	Olive-green Tyrannulet	c	1
<i>Mionectes oleagineus</i>	Ochre-bellied Flycatcher	r	2
<i>Mionectes macconnelli</i>	McConnell's Flycatcher	c	1, 2
<i>Sublegatus</i> sp.	Scrub-Flycatcher species	x	2
<i>Myiornis ecaudatus</i>	Short-tailed Pygmy-Tyrant	u	1, 2
<i>Lophotriccus vitiensis</i>	Double-banded Pygmy-Tyrant	c	1, 2
<i>Lophotriccus galeatus</i>	Helmeted Pygmy-Tyrant	r	2

Families and species	English name	Abundance, seasonality	Habitat
<i>Hemitriccus josephinae</i>	Boat-billed Tody-Tyrant	r	1
<i>Hemitriccus zosterops</i>	White-eyed Tody-Tyrant	c	1, 2
<i>Todirostrum pictum</i>	Painted Tody-Flycatcher	c	1, 2
<i>Rhynchocyclus olivaceus</i>	Olivaceous Flatbill	c	1
<i>Tolmomyias assimilis</i>	Yellow-margined Flycatcher	c	1
<i>Tolmomyias poliocephalus</i>	Gray-crowned Flycatcher	c	1, 2
<i>Neopipo cinnamomea</i>	Cinnamon Manakin-Tyrant	x	1, 2
<i>Platyrinchus saturatus</i>	Cinnamon-crested Spadebill	u	1
<i>Platyrinchus coronatus</i>	Golden-crowned Spadebill	c	1
<i>Platyrinchus platyrhynchos</i>	White-crested Spadebill	u	1
<i>Onychorhynchus coronatus</i>	Royal Flycatcher	u	1
<i>Myiophobus fasciatus</i>	Bran-colored Flycatcher	x	p
<i>Myiobius barbatus</i>	Sulphur-rumped Flycatcher	c	1
<i>Terenotriccus erythrurus</i>	Ruddy-tailed Flycatcher	c	1, 2
<i>Contopus cooperi</i>	Olive-sided Flycatcher	rb	2, 1
<i>Contopus virens</i>	Eastern Wood-Pewee	rb	2, 1
<i>Pyrocephalus rubinus</i>	Vermilion Flycatcher	xa	2
<i>Legatus leucophaeus</i>	Piratic Flycatcher	u	2, 1
<i>Myiozetetes cayanensis</i>	Rusty-margined Flycatcher	c	2, p
<i>Myiozetetes luteiventris</i>	Dusky-chested Flycatcher	x	2
<i>Pitangus sulphuratus</i>	Great Kiskadee	r	2, p
<i>Conopias parvus</i>	Yellow-throated Flycatcher	c	1
<i>Myiodynastes maculatus</i>	Streaked Flycatcher	ra?	2, p
<i>Megarynchus pitangua</i>	Boat-billed Flycatcher	r	2
<i>Tyrannopsis sulphurea</i>	Sulphury Flycatcher	u	1
<i>Empidonomus varius</i>	Variiegated Flycatcher	um?	2
<i>Empidonomus aurantioatrocristatus</i>	Crowned Slaty Flycatcher	ra	1
<i>Tyrannus albogularis</i>	White-throated Kingbird	x	w
<i>Tyrannus melancholicus</i>	Tropical Kingbird	cm	2, p
<i>Tyrannus savana</i>	Fork-tailed Flycatcher	ua?	2, p
<i>Tyrannus tyrannus</i>	Eastern Kingbird	xb	p
<i>Rhytipterna simplex</i>	Grayish Mourner	c	1, 2
<i>Sirystes subcanescens</i>	Todd's Sirystes	c	1
<i>Myiarchus tuberculifer</i>	Dusky-capped Flycatcher	u	2, 1
<i>Myiarchus ferox</i>	Short-crested Flycatcher	u	2
<i>Myiarchus tyrannulus</i>	Brown-crested Flycatcher	r	2
<i>Ramphotrigon ruficauda</i>	Rufous-tailed Flatbill	u	1
<i>Attila cinnamomeus</i>	Cinnamon Attila	x	w
<i>Attila spadiceus</i>	Bright-rumped Attila	c	1
COTINGIDAE			
<i>Phoenicircus carnifex</i>	Guianan Red-Cotinga	u	1
<i>Haematoderus militaris</i>	Crimson Fruitcrow	r	1, 2
<i>Perissocephalus tricolor</i>	Capuchinbird	u	1
<i>Cotinga cotinga</i>	Purple-breasted Cotinga	x	1
<i>Cotinga cayana</i>	Spangled Cotinga	u	1

Families and species	English name	Abundance, seasonality	Habitat
<i>Lipaugus vociferans</i>	Screaming Piha	c	1
<i>Xipholena punicea</i>	Pompadour Cotinga	c	1
PIPRIDAE			
<i>Tyranneutes virescens</i>	Tiny Tyrant-Manakin	c	1
<i>Neopelma chrysocephalum</i>	Saffron-crested Tyrant-Manakin	u	c
<i>Corapipo gutturalis</i>	White-throated Manakin	c	1, 2
<i>Lepidothrix serena</i>	White-fronted Manakin	c	1, 2
<i>Heterocercus flavivertex</i>	Yellow-crowned Manakin	x	2
<i>Manacus manacus</i>	White-bearded Manakin	u	2
<i>Dixiphia pipra</i>	White-crowned Manakin	c	1, 2
<i>Ceratopipra erythrocephala</i>	Golden-headed Manakin	c	1, 2
TITYRIDAE			
<i>Tityra cayana</i>	Black-tailed Tityra	c	1, 2
<i>Schiffornis olivacea</i>	Guianan Schiffornis	c	1, 2
<i>Laniocera hypopyrra</i>	Cinereous Mourner	u	1
<i>Iodopleura fusca</i>	Dusky Purpletuft	xm?	1
<i>Pachyramphus rufus</i>	Cinereous Becard	x	2
<i>Pachyramphus polychopterus</i>	White-winged Becard	x	2
<i>Pachyramphus marginatus</i>	Black-capped Becard	c	1
<i>Pachyramphus surinamus</i>	Glossy-backed Becard	c	1
<i>Pachyramphus minor</i>	Pink-throated Becard	u	1
INCERTAE SEDIS			
<i>Piprites chloris</i>	Wing-barred Piprites	c	1
VIREONIDAE			
<i>Cyclarhis gujanensis</i>	Rufous-browed Peppershrike	c	2, 1
<i>Hylophilus semicinctus</i>	Gray-chested Greenlet	x	2
<i>Hylophilus thoracicus</i>	Lemon-chested Greenlet	r	1
<i>Vireolanius leucotis</i>	Slaty-capped Shrike-Vireo	c	1
<i>Tunchiornis ochraceiceps</i>	Tawny-crowned Greenlet	c	1
<i>Pachysylvia muscicapina</i>	Buff-cheeked Greenlet	c	1
<i>Vireo olivaceus</i>	Red-eyed Vireo	ub	1, 2
<i>Vireo altiloquus</i>	Black-whiskered Vireo	rb	1
HIRUNDINIDAE			
<i>Atticora tibialis</i>	White-thighed Swallow	u	2, 1, w
<i>Stelgidopteryx ruficollis</i>	Southern Rough-winged Swallow	u	2, p
<i>Progne tapera</i>	Brown-chested Martin	xa	p
<i>Progne subis</i>	Purple Martin	rb	1, 2, p
<i>Progne chalybea</i>	Gray-breasted Martin	u	p, 2
<i>Riparia riparia</i>	Bank Swallow	xb	p
<i>Hirundo rustica</i>	Barn Swallow	ub	p
TROGLODYTIDAE			
<i>Microcerculus bambla</i>	Wing-banded Wren	c	1
<i>Troglodytes aedon</i>	House Wren	u	p, 2
<i>Pheugopedius coraya</i>	Coraya Wren	c	2, 1
<i>Cantorchilus leucotis</i>	Buff-breasted Wren	x	2

Families and species	English name	Abundance, seasonality	Habitat
<i>Cyphorhinus arada</i>	Musician Wren	u	1
POLIOPTILIDAE			
<i>Microbates collaris</i>	Collared Gnatwren	c	1
<i>Ramphocaenus melanurus</i>	Long-billed Gnatwren	c	1
<i>Polioptila guianensis</i>	Guianan Gnatcatcher	r	1
TURDIDAE			
<i>Catharus fuscescens</i>	Veery	rb	1, 2
<i>Catharus minimus</i>	Gray-cheeked Thrush	rb	1
<i>Turdus albicollis</i>	White-necked Thrush	c	1
THRAUPIDAE			
<i>Lamprospiza melanoleuca</i>	Red-billed Pied Tanager	c	1
<i>Tachyphonus cristatus</i>	Flame-crested Tanager	c	1
<i>Tachyphonus surinamus</i>	Fulvous-crested Tanager	c	1, 2
<i>Tachyphonus rufus</i>	White-lined Tanager	x	p
<i>Lanio fulvus</i>	Fulvous Shrike-Tanager	u	1
<i>Ramphocelus carbo</i>	Silver-beaked Tanager	c	2, p
<i>Cyanicterus cyanicterus</i>	Blue-backed Tanager	r	1
<i>Thraupis episcopus</i>	Blue-gray Tanager	u	2, p
<i>Thraupis palmarum</i>	Palm Tanager	u	2, p
<i>Tangara varia</i>	Dotted Tanager	r	1
<i>Tangara punctata</i>	Spotted Tanager	c	1, 2
<i>Tangara mexicana</i>	Turquoise Tanager	r	2, 1
<i>Tangara chilensis</i>	Paradise Tanager	c	1
<i>Tangara velia</i>	Opal-rumped Tanager	u	1
<i>Tangara gyrola</i>	Bay-headed Tanager	r	1
<i>Tersina viridis</i>	Swallow Tanager	xm	1
<i>Dacnis lineata</i>	Black-faced Dacnis	c	1
<i>Dacnis cayana</i>	Blue Dacnis	c	1
<i>Cyanerpes nitidus</i>	Short-billed Honeycreeper	u	1
<i>Cyanerpes caeruleus</i>	Purple Honeycreeper	c	1
<i>Cyanerpes cyaneus</i>	Red-legged Honeycreeper	c	1, 2
<i>Chlorophanes spiza</i>	Green Honeycreeper	c	1, 2
<i>Hemithraupis flavicollis</i>	Yellow-backed Tanager	c	1
<i>Conirostrum speciosum</i>	Chestnut-vented Conebill	x	2, 1
<i>Saltator maximus</i>	Buff-throated Saltator	r	2
<i>Saltator grossus</i>	Slate-colored Grosbeak	c	1, 2
<i>Volatinia jacarina</i>	Blue-black Grassquit	u	p, 2
<i>Sporophila bouvronides</i>	Lesson's Seedeater	xm	p
<i>Sporophila lineola</i>	Lined Seedeater	xm	p
<i>Sporophila castaneiventris</i>	Chestnut-bellied Seedeater	u	p
<i>Sporophila angolensis</i>	Chestnut-bellied Seed-Finch	u	2, p
<i>Coereba flaveola</i>	Bananaquit	c	1, 2
EMBERIZIDAE			
<i>Ammodramus aurifrons</i>	Yellow-browed Sparrow	u	p, 2
<i>Arremon taciturnus</i>	Pectoral Sparrow	r	1

Families and species	English name	Abundance, seasonality	Habitat
CARDINALIDAE			
<i>Piranga rubra</i>	Summer Tanager	xb	2
<i>Caryothraustes canadensis</i>	Yellow-green Grosbeak	c	1, 2
<i>Cyanoloxia cyanooides</i>	Blue-black Grosbeak	u	1, 2
PARULIDAE			
<i>Geothlypis aequinoctialis</i>	Masked Yellowthroat	x	p
<i>Setophaga fusca</i>	Blackburnian Warbler	xb	2, 1
<i>Setophaga petechia</i>	Yellow Warbler	xb	1
<i>Setophaga striata</i>	Blackpoll Warbler	rb	2, 1
<i>Myiothlypis rivularis</i>	Riverbank Warbler	u	2, 1
ICTERIDAE			
<i>Psarocolius viridis</i>	Green Oropendola	c	1
<i>Cacicus cela</i>	Yellow-rumped Cacique	x	2, 1
<i>Cacicus haemorrhous</i>	Red-rumped Cacique	c	1, 2
<i>Icterus cayanensis</i>	Epaulet Oriole	r	1, 2
<i>Molothrus oryzivorus</i>	Giant Cowbird	u	p, 2, 1
<i>Molothrus bonariensis</i>	Shiny Cowbird	u	p, 2
<i>Sturnella militaris</i>	Red-breasted Meadowlark	u	p
FRINGILLIDAE			
<i>Euphonia plumbea</i>	Plumbeous Euphonia	x	1, 2
<i>Euphonia chlorotica</i>	Purple-throated Euphonia	x	2
<i>Euphonia chrysopasta</i>	Golden-bellied Euphonia	r	1, 2
<i>Euphonia minuta</i>	White-vented Euphonia	u	1, 2
<i>Euphonia cayennensis</i>	Golden-sided Euphonia	c	1