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# Avifauna of a white-sand vegetation enclave in north-west Rondônia, Brazil: relevant records, body mass and morphometrics

by Edson Guilherme, Edilaine Lemes Marques & Geyse Souza Santos

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**SUMMARY.**—White-sand vegetation (WSV) enclaves occur throughout Amazonia. WSV, known in Brazil as *campina* or *campinarana*, possesses peculiar floral and faunal communities, different from those in adjacent forests but with biogeographic affinities to those in similar ecosystems far distant. Recent ornithological studies of these ‘islands’ have yielded new taxa for science and enabled a better understanding of the zoogeography of many poorly known species in Amazonia. Here we report the results of an ornithological survey of a *campinarana* enclave in north-west Rondônia, southern Amazonian Brazil. The area was inventoried three times in 2010–12, totalling 899 net / hours and 110 hours of observations. A total of 171 bird species was identified, belonging to 44 families. Among them, at least nine species are closely associated with WSV: Green-tailed Goldenthrout *Polytmus theresiae*, White-fringed Antwren *Formicivora grisea*, Natterer’s Slaty Antshrike *Thamnophilus stictocephalus*, Black Manakin *Xenopipo atronitens*, Plain-crested Elaenia *Elaenia cristata*, Pale-bellied Mourner *Rhytipterna immunda*, Campina Flycatcher *Cnemotriccus fuscatus duidae*, Plush-crested Jay *Cyanocorax chrysops diesingii* and Red-shouldered Tanager *Tachyphonus phoenicius*. Approximately 8% of the species recorded are migratory, most of them austral migrants. In addition, body mass and morphometrics of 136 individuals from 55 species are presented. Our results augment ornithological knowledge in Rondônia, aid our understanding of regional zoogeography, and serve as an alert to the need to preserve a region that has suffered severe anthropogenic impacts for >100 years.

Amazonia is the largest and most diverse biome on Earth (Mittermeier *et al.* 2003). It has the largest extent of continuous forest in the world and harbours impressive biodiversity (Kress *et al.* 1998, Mittermeier *et al.* 2003). The biome as a whole is very heterogeneous (Terborgh & Andresen 1998, ter Steege *et al.* 2003). It is a mosaic of different types of ecosystems resulting from variable regional edaphic and climatic conditions (Duivenvoorden *et al.* 2005, Haugaasen & Peres 2006, Fine & Kembel 2011, Fine *et al.* 2012). Among these ecosystems are several forest types, e.g., *terra firme* and *várzea* (Terborgh & Andresen 1998), as well as some non-forest environments, e.g. the enclaves or ‘islands’ of open vegetation within forests (Anderson 1981, Fine *et al.* 2012, Fine & Bruna 2016, Mustin *et al.* 2017, Demarchi *et al.* 2018).

Enclaves of open vegetation are distributed discontinuously throughout Amazonia (Adeney *et al.* 2016). The origin of these enclaves is still being discussed—one hypothesis is a Pleistocene and Holocene provenance, when the climate in Amazonia became drier as a consequence of the last glacial maximum (Pessenda *et al.* 2001, Clark *et al.* 2009). The types of open vegetation in Amazonia are distinguished by their general physiognomy dictated by floristic composition according to the local edaphic, hydrological and climatic conditions (Adeney *et al.* 2016). The two main groups are savanna / *cerrado* (Sanaiotti *et al.* 1997, Silva *et al.*

al. 1997, Sanaïotti & Cintra 2001, Aleixo & Poletto 2007, Aleixo *et al.* 2011, Boss & Silva 2014, Mustin *et al.* 2017) and a special type of vegetation that grows on white-sand soils, known in Brazil as *campina* and *campinarana* (Anderson 1981, Borges 2004, Borges *et al.* 2016a,b, Adeney *et al.* 2016). Recent ornithological studies of these 'islands' of non-forest vegetation have revealed new taxa to science and helped to understand the zoogeography of the many patchily distributed species in Amazonia (Alvarez-Alonso & Whitney 2003, Whitney & Alvarez-Alonso 2005, Poletto & Aleixo 2009, Guilherme & Borges 2011, Alvarez-Alonso *et al.* 2013, Capurucho *et al.* 2013, Cohn-Haft *et al.* 2013, Whitney *et al.* 2013b,d, Borges *et al.* 2016a,b, Matos *et al.* 2016).

Rondônia state, in south-west Amazonian Brazil, lies within an area of endemism of the same name (Silva *et al.* 2005, Fernandes 2013). Although rich in endemic and / or rare species (Fernandes 2013), the state has already lost >30% of its forest cover due to logging and agroforestry (Serrão *et al.* 1996, Piontekowski *et al.* 2014, Fearnside 2017). Ornithological surveys in the state have progressively increased over the last 100 years (e.g. Hellmayr 1910, Stotz *et al.* 1997, Boçon 1999, Kirwan & Shirihai 2007, Olmos *et al.* 2011, Santos *et al.* 2011) and, as further areas are inventoried, several new species of birds have been discovered (Lanyon *et al.* 1990, Whitney *et al.* 2013a,b,c). Despite this, the richness of bird species and their distribution in the state as a whole are poorly known and have not been subject to major review. There are still numerous gaps in our ornithological knowledge of Rondônia because many areas are yet to be surveyed. Here, we present the results of a rapid inventory of an enclave of WSV near the BR-364 and the recently implemented Jirau hydroelectric power plant in north-west Rondônia.

## Methods

**Study area.**—The study was undertaken in an enclave of WSV and its environs called Miratinga, located along a power transmission line west of the BR-364 (between Porto

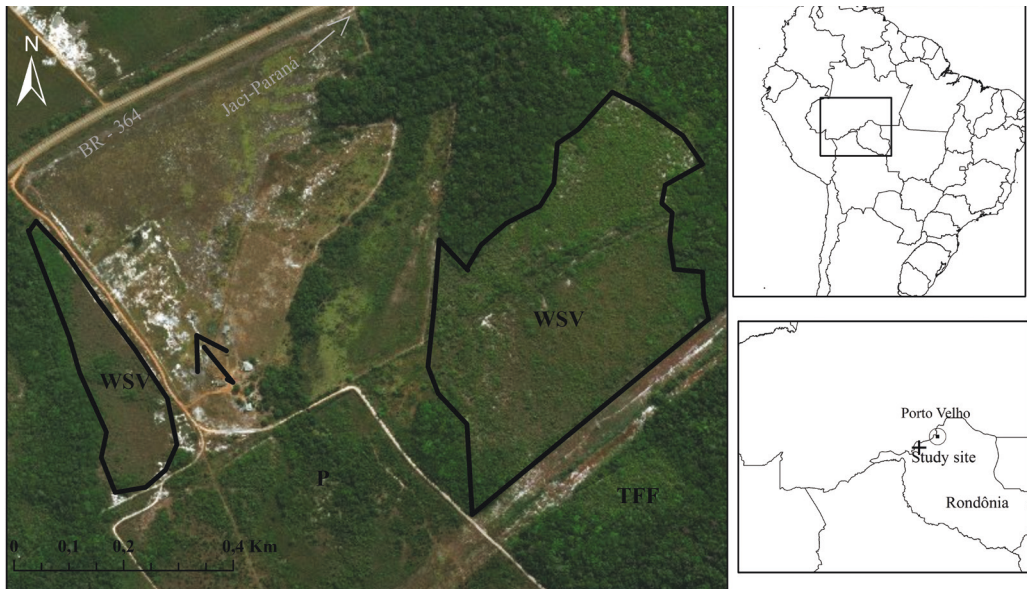


Figure 1. Location of the study area. TFF = terra firme forest, WSV = white-sand vegetation (*campinarana*), P = pasture. The black arrow indicates the commercial sand mining area. (Map adapted from Google Earth; satellite image courtesy of Google Inc. All rights reserved © 2018.)



Figure 2. Overview of the white-sand vegetation (*campinarana*) survey area: (A) access road to *campinarana*, (B) panoramic view of the *campinarana*, (C) structure of the *campinarana* highlighting the presence of *Mauritiella armata* palms, (D) *Pteridium* sp. fern, (E) area where sand is being commercially mined.

Velho and Abunã), c.30 km from Jaci Paraná in the municipality of Porto Velho, Rondônia (09°21'38.3"S, 64°39'29.2"W; Fig. 1).

**Description of the area.**—The *campinarana* enclave is mainly covered by dense shrubs, with sparse, small trees (2–5 m tall) (Fig. 2A–C) and some *Astrocaryum acaule* and *Mauritiella armata* palms (Fig. 2C). The soil is covered by grasses (Fig. 2A–B) and, as in other WSV environments, should be of low fertility and high acidity. At the edges of the patch, in areas of sparse vegetation and where the soil is more humid, an invasive fern *Pteridium* sp. is present (Fig. 2D). Part of the *campinarana* has been deforested and sand is being commercially removed (Fig. 2E). In the vicinity, there are small black-water streams and at least one medium-sized pond. During the wet season, puddles form where vegetation is sparse (Fig. 1) and in the *campinarana*, which is surrounded by fragments of *terra firme* forest severely modified by selective logging, and open pastures (Fig. 1).

**Avifaunal sampling.**—Three visits were made to the area in 2010–12. The avifaunal survey covered both the *campinarana* and surrounding fragments of *terra firme* forest and pastures (Fig. 1). Two approaches were used to inventory the area: (a) quantitative, using mist-nets and (b) qualitative, via field observations using binoculars. The *campinarana* was inventoried on 2 June 2010 (60 net / hours and two hours of observation), 26 February–3 March 2011 (439 net / hours and 54 hours of observation) and 20–24 August 2012 (400 net / hours and 54 hours of observation). Individuals captured with mist-nets were weighed

using a Pesola® scale and their wing, tarsus and total lengths were taken with a millimetre ruler. Wing, tarsus and total lengths were measured in accordance with standard reference works, see Proctor & Lynch (1993: 295–297) and Sick (1997: 91, Fig. G). Ageing and sexing were performed whenever possible. Some specimens were collected as vouchers and were prepared using standard taxidermy techniques. Specimens were collected under ICMBio / SISBIO authorisation no. 23269-1, and deposited either at the Universidade Federal do Acre (UFAC), Rio Branco, or the Museu Paraense Emílio Goeldi (MPEG), Belém. Scientific nomenclature follows that of the Brazilian Committee of Ornithological Records (Piacentini *et al.* 2015).

## Results and Discussion

A total of 171 species from 44 families was recorded in the *campinarana* enclave and its environs (Table 1). Of these, 74 (43.2%) species are non-Passeriformes and 97 (56.7%) Passeriformes. Among the latter, the families Tyrannidae (26), Thraupidae (17) and Thamnophilidae (12) were richest in species (Table 1). At least nine species recorded in the study area are closely associated with *campinarana*: Green-tailed Goldenthrout *Polytmus theresiae*, White-fringed Antwren *Formicivora grisea*, Natterer's Slaty Antshrike *Thamnophilus stictocephalus*, Black Manakin *Xenopipo atronitens*, Plain-crested Elaenia *Elaenia cristata*, Pale-bellied Mourner *Rhytipterna immunda*, Campina Flycatcher *Cnemotriccus fuscatus duidae*, Plush-crested Jay *Cyanocorax chrysops diesingii* and Red-shouldered Tanager *Tachyphonus phoenicius* (Table 1). Two other important records included Rondônia Bushbird *Clytoctantes atrogularis* (Guilherme & Souza 2013) and Buff-cheeked Tody-Flycatcher *Poecilatriccus senex*. Approximately 8% of the species recorded are visitors, mostly austral migrants, e.g. Large Elaenia *Elaenia spectabilis*, Chilean Elaenia *E. chilensis*, Small-billed Elaenia *E. parvirostris*, Fork-tailed Flycatcher *Tyrannus savana*, Crowned Slaty Flycatcher *Griseotyrannus aurantioatrocristatus*, Variegated Flycatcher *Empidonomus varius*, Southern Scrub Flycatcher *Sublegatus modestus*, Vermilion Flycatcher *Pyrocephalus rubinus*, Fuscous Flycatcher *Cnemotriccus fuscatus bimaculatus*, Chivi Vireo *Vireo chivi*, Creamy-bellied Thrush *Turdus amaurochalinus*, Yellow-bellied Seedeater *Sporophila nigricollis* and Double-collared Seedeater *S. caerulescens*, while Solitary Sandpiper *Tringa solitaria* was the only Nearctic migrant (Table 1).

## Species accounts

### GREEN-TAILED GOLDENTHROAT *Polytmus theresiae*

Relatively common but discontinuously distributed in enclaves of open vegetation throughout Amazonia (Schuchmann 1999, Borges *et al.* 2001, Sanaiotti & Cintra 2001, Aleixo & Poletto 2007, Schulenberg *et al.* 2007, Guilherme 2012). Hellmayr (1910) reported two collected by W. Hoffmanns around Rio Preto, in the north-east of the state, and Aleixo & Poletto (2007) the presence at MPEG of one collected by J. Hidasi at Guajará-Mirim, on the border with Bolivia. Additionally, the species was photographed in the municipalities of Cabixi and Vilhena in southern Rondônia (Wikiaves 2018). On 2 June 2010, three were collected (MPEG 70938, 70939, male, 70940) and on 22–23 August 2012 we collected another five (UFAC 507, 508, 511, 522, 523). Available records of *P. theresiae* in Rondônia indicate that the species is locally common, but only in enclaves of *cerrado*, *campina* and *campinarana*.

### NATTERER'S SLATY ANTSHRIKE *Thamnophilus stictocephalus*

Previously treated as a race of a widespread Eastern Slaty Antshrike *T. punctatus* (Isler *et al.* 1997). Distributed patchily in *campina* and *campinarana* east of the Guaporé / Madeira Rivers

TABLE 1

Birds recorded in a *campinarana* (white-sand vegetation) and its environs in north-west Rondônia, Brazil. Habitat: C = *campinarana*; TF = *terra firme* forest; R = reservoirs and lakes; AO = open areas; P = pasture and man-modified areas. Record types: V = vocalisation; O = sight; S = museum specimen. Nomenclature follows Piacentini *et al.* (2015). <sup>1</sup> = follows *Handbook of the birds of the world* (del Hoyo & Collar 2016). \* = white-sand specialists following Stotz *et al.* (1996) and Borges *et al.* (2015). \*\* = migrants <sup>a</sup> = austral; <sup>n</sup> = Nearctic.

Family / Species	English name	Habitat	Record
<b>TINAMIDAE</b>			
<i>Crypturellus cinereus</i>	Cinereous Tinamou	TF	V
<i>Crypturellus strigulosus</i>	Brazilian Tinamou	C	V
<b>ANATIDAE</b>			
<i>Amazonetta brasiliensis</i>	Brazilian Teal	R	O
<b>CRACIDAE</b>			
<i>Penelope jacquacu</i>	Spix's Guan	TF	O
<i>Ortalis guttata</i>	Speckled Chachalaca	TF	O
<b>ARDEIDAE</b>			
<i>Tigrisoma lineatum</i>	Rufescent Tiger Heron	R	O
<i>Bubulcus ibis</i>	Cattle Egret	P	O
<i>Ardea cocoi</i>	Cocoi Heron	R	O
<i>Ardea alba</i>	Great Egret	R	O
<i>Egretta thula</i>	Snowy Egret	R	O
<b>CATHARTIDAE</b>			
<i>Cathartes aura</i>	Turkey Vulture	OA, P	O
<i>Cathartes melambrotus</i>	Greater Yellow-headed Vulture	OA, P	O
<i>Coragyps atratus</i>	Black Vulture	OA, P	O
<b>ACCIPITRIDAE</b>			
<i>Rupornis magnirostris</i>	Roadside Hawk	TF	O
<i>Buteo nitidus</i>	Grey-lined Hawk	TF	O
<b>RALLIDAE</b>			
<i>Laterallus viridis</i>	Russet-crowned Crane	R	V
<i>Laterallus melanophaius</i>	Rufous-sided Crane	R	V, O
<i>Porphyrio martinicus</i>	Purple Gallinule	R	O
<b>CHARADRIIDAE</b>			
<i>Vanellus chilensis</i>	Southern Lapwing	P	O
<b>SCOLOPACIDAE</b>			
<i>Tringa solitaria</i> <sup>tn</sup>	Solitary Sandpiper	R	O
<b>JACANIDAE</b>			
<i>Jacana jacana</i>	Wattled Jacana	R	O
<b>COLUMBIDAE</b>			
<i>Columbina passerina</i>	Common Ground Dove	C, P	S
<i>Columbina talpacoti</i>	Ruddy Ground Dove	C, P	S
<i>Claravis pretiosa</i>	Blue Ground Dove	C	S
<i>Patagioenas speciosa</i>	Scaled Pigeon	C	O
<i>Leptotila verreauxi</i>	White-tipped Dove	C	S
<i>Geotrygon montana</i>	Ruddy Quail-Dove	TF	S

Family / Species	English name	Habitat	Record
<b>CUCULIDAE</b>			
<i>Piaya cayana</i>	Squirrel Cuckoo	TF	O
<i>Crotophaga ani</i>	Smooth-billed Ani	P, C	O
<b>TYTONIDAE</b>			
<i>Tyto furcata</i>	American Barn Owl	TF	V
<b>STRIGIDAE</b>			
<i>Megascops choliba</i>	Tropical Screech Owl	TF	V
<i>Athene cucularia</i>	Burrowing Owl	P	O
<b>CAPRIMULGIDAE</b>			
<i>Nyctidromus nigrescens</i>	Blackish Nightjar	C	S
<i>Nyctidromus albicollis</i>	Common Pauraque	C, P	V, O
<b>APODIDAE</b>			
<i>Chaetura brachyura</i>	Short-tailed Swift	OA	O
<i>Panyptila cayennensis</i>	Lesser Swallow-tailed Swift	OA	O
<b>TROCHILIDAE</b>			
<i>Phaethornis ruber</i>	Reddish Hermit	TF	O
<i>Phaethornis philippii</i>	Needle-billed Hermit	TF	S
<i>Campylopterus largipennis</i>	Grey-breasted Sabrewing	TF	S
<i>Polytmus theresiae</i> *	Green-tailed Goldenthrout	C	S
<b>TROGONIDAE</b>			
<i>Trogon curucui</i>	Blue-crowned Trogon	TF	O
<b>ALCEDINIDAE</b>			
<i>Megaceryle torquata</i>	Ringed Kingfisher	R	O
<i>Chloroceryle amazona</i>	Amazon Kingfisher	R	O
<i>Chloroceryle americana</i>	Green Kingfisher	R	O
<i>Chloroceryle inda</i>	Green-and-rufous Kingfisher	R	O
<b>BUCCONIDAE</b>			
<i>Bucco tamatia</i>	Spotted Puffbird	TF	S
<i>Monasa nigrifrons</i>	Black-fronted Nunbird	TF	O
<i>Chelidoptera tenebrosa</i>	Swallow-winged Puffbird	TF	O
<b>CAPITONIDAE</b>			
<i>Capito dayi</i>	Black-girdled Barbet	TF	O
<b>RAMPHASTIDAE</b>			
<i>Ramphastos tucanus</i>	White-throated Toucan	TF	O, V
<i>Ramphastos vitellinus</i>	Channel-billed Toucan	TF	O, V
<i>Pteroglossus inscriptus</i>	Lettered Aracari	TF	O
<i>Pteroglossus castanotis</i>	Chestnut-eared Aracari	TF	O, V
<b>PICIDAE</b>			
<i>Picumnus aurifrons</i>	Bar-breasted Piculet	TF	S
<i>Melanerpes cruentatus</i>	Yellow-tufted Woodpecker	TF	O, V
<i>Colaptes punctigula</i>	Spot-breasted Woodpecker	TF	O
<i>Dryocopus lineatus</i>	Lineated Woodpecker	TF	O, V
<i>Campephilus melanoleucos</i>	Crimson-crested Woodpecker	TF	O, V
<b>FALCONIDAE</b>			
<i>Daptrius ater</i>	Black Caracara	OA	O, V

Family / Species	English name	Habitat	Record
<i>Ibycter americanus</i>	Red-throated Caracara	TF	O, V
<i>Caracara plancus</i>	Southern Caracara	P	O, V
<i>Mitvago chimachima</i>	Yellow-headed Caracara	P	O, V
<i>Herpetotheres cachinmans</i>	Laughing Falcon	TF	O, V
<i>Falco ruficularis</i>	Bat Falcon	TF	O
<b>PSITTACIDAE</b>			
<i>Ara ararauna</i>	Blue-and-yellow Macaw	TF	O, V
<i>Ara macao</i>	Scarlet Macaw	TF	O, V
<i>Ara chloropterus</i>	Red-and-green Macaw	TF	O, V
<i>Ara severus</i>	Chestnut-fronted Macaw	TF	O, V
<i>Orthopsittaca manilatus</i>	Red-bellied Macaw	TF	O, V
<i>Psittacara leucophthalmus</i>	White-eyed Parakeet	TF	O, V
<i>Aratinga weddellii</i>	Dusky-headed Parakeet	TF	O, V
<i>Pionus menstruus</i>	Blue-headed Parrot	TF	O, V
<i>Amazona farinosa</i>	Mealy Parrot	TF	O, V
<i>Amazona ochrocephala</i>	Yellow-crowned Parrot	TF	O, V
<b>THAMNOPHILIDAE</b>			
<i>Pygiptila stellaris</i>	Spot-winged Antshrike	TF	S
<i>Microrhopias quixensis</i>	Dot-winged Antwren	TF	O
<i>Clytoctantes atrogularis</i>	Rondônia Bushbird	C	S
<i>Myrmophylax atrothorax</i>	Black-throated Antbird	TF	O, V
<i>Formicivora grisea*</i>	White-fringed Antwren	C	S
<i>Thamnomanes saturninus</i>	Saturnine Antshrike	TF	S
<i>Thamnophilus doliatus</i>	Barred Antshrike	TF	O, V
<i>Thamnophilus schistaceus</i>	Plain-winged Antshrike	TF	O, V
<i>Thamnophilus stictocephalus*</i>	Natterer's Slaty Antshrike	C	S
<i>Sciaphylax hemimelaena</i>	Chestnut-tailed Antbird	TF	S, O, V
<i>Hypocnemis ochrogyna</i>	Rondônia Warbling Antbird	TF	S
<i>Willisornis poecilinotus</i>	Common Scale-backed Antbird	TF	O, V
<b>DENDROCOLAPTIDAE</b>			
<i>Glyphorhynchus spirurus</i>	Wedge-billed Woodcreeper	TF	S
<i>Xiphorhynchus elegans</i>	Elegant Woodcreeper	TF	S
<i>Xiphorhynchus guttatoides</i>	Lafresnaye's Woodcreeper	TF	O, V
<i>Dendroplex picus</i>	Straight-billed Woodcreeper	TF	O, V
<b>XENOPIDAE</b>			
<i>Xenops minutus</i>	Plain Xenops	TF	S
<b>FURNARIIDAE</b>			
<i>Berlepschia rikeri</i>	Point-tailed Palmcreeper	TF	O, V
<i>Furnarius leucopus</i>	Pale-legged Hornero	TF	O, V
<i>Anabacerthia ruficaudata</i>	Rufous-tailed Foliage-gleaner	TF	O
<i>Philydor erythrocerum</i>	Rufous-rumped Foliage-gleaner	TF	S
<i>Synallaxis rutilans</i>	Ruddy Spinetail	C	S
<b>PIPRIDAE</b>			
<i>Ceratopipra rubrocapilla</i>	Red-headed Manakin	C, TF	S
<i>Manacus manacus</i>	White-bearded Manakin	C	S



Family / Species	English name	Habitat	Record
<i>Machaeropterus pyrocephalus</i>	Fiery-capped Manakin	TF, C	S
<i>Xenopipo atronitens</i> *	Black Manakin	C	S
<b>ONYCHORHYNCHIDAE</b>			
<i>Terenotriccus erythrurus</i>	Ruddy-tailed Flycatcher	TF	S
<b>TITYRIDAE</b>			
<i>Iodopleura isabellae</i>	White-browed Purpletuft	TF	O
<i>Tityra semifasciata</i>	Masked Tityra	TF	O
<b>COTINGIDAE</b>			
<i>Querula purpurata</i>	Purple-throated Fruitcrow	TF	O
<i>Lipaugus vociferans</i>	Screaming Piha	TF	V, O
<b>RHYNCHOCYCLIDAE</b>			
<i>Mionectes oleagineus</i>	Ochre-bellied Flycatcher	TF	S
<i>Tolmomyias flaviventris</i>	Yellow-breasted Flycatcher	C	S
<i>Todirostrum maculatum</i>	Spotted Tody-Flycatcher	TF, C	O, V
<i>Poecilatriccus senex</i>	Buff-cheeked Tody-Flycatcher	C	S
<i>Poecilatriccus latirostris</i>	Rusty-fronted Tody-Flycatcher	TF	O, V, S
<b>TYRANNIDAE</b>			
<i>Camptostoma obsoletum</i>	Southern Beardless Tyrannulet	C, TF	O, V
<i>Elaenia spectabilis</i> **a	Large Elaenia	C	S
<i>Elaenia chilensis</i> **a	Chilean Elaenia	C	S
<i>Elaenia parvirostris</i> **a	Small-billed Elaenia	C	S
<i>Elaenia cristata</i> *	Plain-crested Elaenia	C	S
<i>Myiopagis viridicata</i>	Greenish Elaenia	C	O, V
<i>Tyrannulus elatus</i>	Yellow-crowned Tyrannulet	C, TF	S
<i>Phaeomyias murina</i>	Mouse-coloured Tyrannulet	C	S, V
<i>Legatus leucophaeus</i>	Piratic Flycatcher	TF	O, V
<i>Myiarchus ferox</i>	Short-crested Flycatcher	C, TF	S, V, O
<i>Rhytipterna immunda</i> *	Pale-bellied Mourner	C	S, O
<i>Pitangus sulphuratus</i>	Great Kiskadee	C, TF	O, V
<i>Myiodynastes maculatus</i>	Streaked Flycatcher	C, TF	O, V
<i>Tyrannopsis sulphurea</i>	Sulphury Flycatcher	C, TF	O, V
<i>Megarynchus pitangua</i>	Boat-billed Flycatcher	C, TF	O, V
<i>Myiozetetes cayanensis</i>	Rusty-margined Flycatcher	C, TF	O, V
<i>Myiozetetes similis</i>	Social Flycatcher	C, TF	O, V
<i>Tyrannus melancholicus</i>	Tropical Kingbird	C, TF	O, V
<i>Tyrannus savana</i> **a	Fork-tailed Flycatcher	C, P, TF	O
<i>Griseotyrannus aurantioatrocristatus</i> **a	Crowned Slaty Flycatcher	C	O
<i>Empidonomus varius</i> **a	Variegated Flycatcher	C	O
<i>Sublegatus modestus</i> **a	Southern Scrub Flycatcher	C	S
<i>Pyrocephalus rubinus</i> **a	Vermilion Flycatcher	C, P	O
<i>Cnemotriccus fuscatus duidae</i> *	Campina Flycatcher <sup>1</sup>	C	S
<i>Cnemotriccus fuscatus beniensis</i>	Fuscous Flycatcher	TF	S
<i>Cnemotriccus fuscatus bimaculatus</i> **a	Fuscous Flycatcher	C	S
<b>VIREONIDAE</b>			
<i>Cyclarhis gujanensis</i>	Rufous-browed Peppershrike	C, TF	O, V

Family / Species	English name	Habitat	Record
<i>Vireo chivi</i> **a	Chivi Vireo	C	S
<b>CORVIDAE</b>			
<i>Cyanocorax chrysops diesingii</i> *	Plush-crested Jay	C	O, V
<b>HIRUNDINIDAE</b>			
<i>Stelgidopteryx ruficollis</i>	Southern Rough-winged Swallow	OA	O
<i>Progne tapera</i>	Brown-chested Martin	OA	O
<i>Progne chalybea</i>	Grey-breasted Martin	OA	O
<i>Tachycineta albiventer</i>	White-winged Swallow	R	O
<b>TROGLODYTIDAE</b>			
<i>Troglodytes musculus</i>	Southern House Wren	C, P	O, V
<i>Campylorhynchus turdinus</i>	Thrush-like Wren	TF	O, V
<i>Pheugopedius genibarbis</i>	Moustached Wren	TF	S
<b>TURDIDAE</b>			
<i>Turdus amaurochalinus</i> **a	Creamy-bellied Thrush	TF	S
<i>Turdus ignobilis</i>	Black-billed Thrush	C, TF	S
<b>PASSERELLIDAE</b>			
<i>Ammodramus aurifrons</i>	Yellow-browed Sparrow	C, P	O, V
<b>ICTERIDAE</b>			
<i>Psarocolius bifasciatus</i>	Olive Oropendola	TF	O
<i>Cacicus cela</i>	Yellow-rumped Caciue	TF	O, V
<i>Icterus cayanensis</i>	Epaulet Oriole	TF	O
<i>Sturnella militaris</i>	Red-breasted Meadowlark	P	O
<b>THRAUPIDAE</b>			
<i>Schistochlamys melanopis</i>	Black-faced Tanager	C	O
<i>Paroaria gularis</i>	Red-capped Cardinal	R	O
<i>Tangara episcopus</i>	Blue-grey Tanager	C, P, TF	S, O, V
<i>Tangara palmarum</i>	Palm Tanager	TF	O, V
<i>Hemithraupis flavicollis</i>	Yellow-backed Tanager	TF	O
<i>Volatinia jacarina</i>	Blue-black Grassquit	C, P	S
<i>Tachyphonus phoenicius</i> *	Red-shouldered Tanager	C	S
<i>Ramphocelus carbo</i>	Silver-beaked Tanager	C, P, TF	S, O, V
<i>Tersina viridis</i>	Swallow Tanager	TF	S
<i>Cyanerpes cyaneus</i>	Red-legged Honeycreeper	TF	O
<i>Dacnis cayana</i>	Blue Dacnis	TF	O
<i>Dacnis lineata</i>	Black-faced Dacnis	TF	O
<i>Sporophila nigricollis</i> **a	Yellow-bellied Seedeater	TF, P	S, O
<i>Sporophila caerulescens</i> **a	Double-collared Seedeater	C, P	S
<i>Sporophila angolensis</i>	Chestnut-bellied Seed Finch	C	O
<i>Saltator maximus</i>	Buff-throated Saltator	TF	O
<i>Saltator coerulescens</i>	Greyish Saltator	TF	O
<b>FRINGILLIDAE</b>			
<i>Euphonia chrysopasta</i>	Golden-bellied Euphonia	TF	O

to the island of Marajó in Pará (Isler *et al.* 1997, Zimmer & Isler 2003). Olmos *et al.* (2011) reported *T. stictocephalus* in savannas at Serra da Cutia National Park, in the south-west of the state, and at Campos do Urupa within the Uru-Eu-Wau-Wau Indigenous Territory, in central Rondônia. Natterer's Slaty-Antshrike has been found in several municipalities along the BR-364, between Vilhena and Porto Velho (Wikiaves 2018). Very common in the study area, being seen and caught in mist-nets daily (Fig. 3A). Five specimens were collected, a female on 2 June 2010 (MPEG 70950) and two pairs, on 27 February 2011 (UFAC 284, 286) and 1 March 2011 (UFAC 310, 309). Our records of *T. stictocephalus* extend the species' range to extreme north-west Rondônia.

#### **RONDÔNIA BUSHBIRD** *Clytoctantes atrogularis*

A globally threatened species (BirdLife International 2017) whose unusual record in the study area was discussed by Guilherme & Santos (2013). The female collected (UFAC 473) represents the westernmost available record (Costa *et al.* 2017).

#### **WHITE-FRINGED ANTWREN** *Formicivora grisea*

Occurs from the right bank of the Madeira River east to the Atlantic coast, including all of north-east Brazil, as well as in northern South America including the Guianas, Venezuela and Colombia (Zimmer & Isler 2003). Recently found in *campinarana* in extreme south-west Amazonas (Guajará) and westernmost Acre (Cruzeiro do Sul and Mâncio Lima) (Poletto & Aleixo 2005, Guilherme 2012). In Rondônia, it was known from around Rio Preto in the north-east (Hellmayr 1910) and in savanna at Traçadal Biological Reserve and Serra da Cutia National Park (Olmos *et al.* 2011) in the centre-west. Abundant in *campinarana* at Miratinga. On 2 June 2010, three were collected (MPEG 70951, male, 70952, female, 70953, male). On 27–28 February 2011, four were trapped of which three were collected (UFAC 283, male, 288, female, 304, female) and on 20–23 August 2012 seven were trapped of which four were prepared as specimens (UFAC 476, juvenile male, 480, male, 510, female, 525, male). Records of *F. grisea* at Miratinga extend the species' range in Rondônia 232 km to the north-west and 227 km north, from Rio Preto and Traçadal Biological Reserve, respectively.

#### **BLACK MANAKIN** *Xenopipo atronitens*

Considered an indicator species of *campinarana* (Borges *et al.* 2016a). Although abundant in habitat, it is patchily distributed (Aleixo & Poletto 2007, Poletto & Aleixo 2005, Guilherme & Borges 2011, Borges *et al.* 2014, 2016b). Previous records in Rondônia were by Whittaker (2004) at Taquaras (BR-425) and by Olmos *et al.* (2011) in savanna at Traçadal Biological Reserve and Serra da Cutia National Park. Since 2010, it has been photographed in several municipalities in eastern Rondônia, e.g. Machadinho d'Oeste, Parecis and Chupinguaia (Wikiaves 2018). At Miratinga, Black Manakin was seen and trapped daily. A male was collected on 6 February 2010 (MPEG 70977), while another four were collected subsequently, three in 2011 on 26 February (UFAC 276, female, 282, male) and 1 March (AC 312, female), and one on 22 August 2012 (UFAC 512, male). Records of *X. atronitens* at Miratinga extend its range to far north-west Rondônia.

#### **BUFF-CHEEKED TODY-FLYCATCHER** *Poecilatriccus senex*

Until very recently, known only from the type locality at Borba, Amazonas state, on the right bank of the lower Madeira River (Hellmayr 1910, Hoyo *et al.* 2004). In recent years, recorded at localities on the right bank of the middle (Cohn-Haft *et al.* 2007, Whittaker 2009) and upper Madeira (Whittaker 2004, Wikiaves 2018). In Rondônia, reported initially in 2002, at a *campina* at Taquaras (BR-425), in the north-west of the state (Whittaker



Figure 3. Bird specialists of white-sand vegetation in Amazonia: (A) male Natterer's Slaty-Antshrike *Thamnophilus stictocephalus*, 27 February 2011, (B) Pale-bellied Mourner *Rhytipterna immunda*, 28 February 2011, (C) Buff-cheeked Tody-Flycatcher *Poecilatriccus senex*, 27 February 2011, (D) Plush-crested Jay *Cyanocorax chrysops diesingii*, 1 March 2011 (Edson Guilherme)

2004). On 27 February 2011, we collected one at the edge of *campinarana* (MPEG 74005). Unfortunately, during its preparation, mass was not taken and neither was it possible to sex the bird (Fig. 3B; Table 2). Recent records indicate that the species inhabits patches of open vegetation in a swath from northern Rondônia and extreme south-east Amazonas (e.g. Humaitá National Forest) from the right bank of the Madeira east to the Madeira / Tapajós interfluvium (Whittaker 2004, 2009, Cohn-Haft *et al.* 2007, Wikiaves 2018).

#### PALE-BELLIED MOURNER *Rhytipterna immunda* (Figure 3C)

An uncommon species readily confused with a *Myiarchus* (Lanyon 1973). *R. immunda* is unique to savanna environments in Amazonia, from easternmost Colombia to the Guianas, and in Brazil it occurs patchily in WSV through the Negro drainage east to Pará, Amapá and Tocantins, and in southern Rondônia and Mato Grosso (Lanyon 1973, Scholes 2004, Whittaker 2004, Dornas *et al.* 2012). It has also been recorded in north-east Bolivia (Scholes 2004, Tobias & Seddon 2007). The first record in Rondônia was documented by Whittaker (2004) in the north-west of the state, in a *campina* at Taquaras, Porto Velho municipality. Subsequently, it was recorded in savanna at Serra da Cutia National Park, south-west Rondônia, and in Uru-Eu-Wau-Wau Indigenous Territory, in central Rondônia (Olmos *et al.* 2011). Also documented in the municipalities of Guajará-Mirim and Machadinho d'Oeste (Wikiaves 2018). Among species associated with *campinarana*, this was one of the most

abundant in mist-nets. Ten were trapped, of which five were collected: three on 26 and 28 February 2011 (UFAC 278, 295, 296) and two on 22 August 2012 (MPEG 82235–36). Records of *R. immunda* in north-west Rondônia (e.g. Miratinga) are the south-westernmost in Brazil.

#### CAMPINA FLYCATCHER *Cnemotriccus fuscatus duidae*

Strongly associated with *campina* / *campinarana* (Borges *et al.* 2016a). Differs from other races of *C. fuscatus* by its much more yellowish underparts (Zimmer 1938; Fig. 4A). It occurs patchily across almost all of Amazonia (Tobias & Seddon 2007, Guilherme & Borges 2011, Borges *et al.* 2016a). One was collected on 22 February 2011 in *campinarana* (UFAC 294; Fig. 4A–B), the first record of this taxon in Rondônia. The closest previous record of *C. f. duidae* was on the Bolivia / Brazil border at Piedritas, on the left bank of the Madeira River, c.100 km south-west of our study area (Tobias & Seddon 2007). *C. f. duidae*, unlike its congeners (see below), appears to be resident in *campina* / *campinarana* in the region.

#### FUSCOUS FLYCATCHER *Cnemotriccus fuscatus*

In addition to the specimen attributed to *C. f. duidae* (above), three other specimens of *C. fuscatus* were collected. Two (MPEG 70971 and UFAC 509) match *C. f. beniensis* and a third (UFAC 477) more closely resembles *C. f. bimaculatus* (Fig. 4A–C). Although Tobias & Seddon (2007) argued that *C. f. beniensis* could be synonymous with *C. f. fuscator*, a series collected in Acre (Guilherme 2009, 2012, 2016) plus the two from Rondônia agree with the description presented by Gyldenstolpe (1945) to differentiate it from *C. f. bimaculatus*. Some of the differences noted by Gyldenstolpe (1945) and observed in UFAC 509 are: ‘...chin and throat grayish-white, usually without any yellowish tinge; breast greyish brown without olivaceous suffusion; bill larger and stronger...’ (Fig. 4A–C). Although bill length is almost identical among specimens UFAC 509 (*beniensis*) and 477 (*bimaculatus*) (14.1 vs. 14.04 mm respectively), in UFAC 509 it is broader (5.0 vs. 3.92 mm) and flatter than in UFAC 477 (Fig. 4C). The morphological similarities, as a whole, between UFAC 509 from Rondônia (Fig. 4A–C) and the holotype of *C. f. beniensis*, from Bolivia, were proven by comparing it with the photograph of the type specimen (NRM 569425) online (<http://www.nrm.se>). UFAC 509 also shows clear differences from the holotype of *C. f. fuscator* (Fig. 4D). The latter, AMNH 211013 from Ecuador, as described by Chapman (1926) has ‘...Upperparts much darker and wing-bars narrower than in any other described race of the species... the breast grayish olive, the belly pale sulphur-yellow...’ (Fig. 4D). In UFAC 509, the wingbars are broad as in UFAC 477 (*bimaculatus*) (Fig. 4B) and the back and chest are brown (Fig. 4A–B), not grey as in *C. f. fuscator* (Fig. 4D). Additionally, *C. f. fuscator* is associated with *várzea* and river islands (Tobias & Seddon 2007), while UFAC 509 (Fig. 4A–C) and MPEG 70971 are from a *campinarana* enclave in *terra firme*, which reinforces our conviction that the two latter specimens represent *beniensis*. Taxonomy of the group is confused (Chapman 1926, Zimmer 1938, Gyldenstolpe 1945, Tobias & Seddon 2007) and genetic and vocal analyses should seek to clarify how many species-level taxa are involved. The certainty is that at least three taxa of the *C. fuscatus* complex occur at Miratinga. This is the first record of *beniensis* in Rondônia (where its status is uncertain), while *bimaculatus* is an austral migrant (Hellmayr 1910, Stotz *et al.* 1997, Whittaker 2004, Santos *et al.* 2011).

#### PLUSH-CRESTED JAY *Cyanocorax chrysops diesingii*

This subspecies is the Amazonian substitute of *C. c. chrysops*, which is common in south-east Brazil, northern Argentina, Uruguay, Paraguay and Bolivia (Ridgely & Tudor 1994). *C. c. diesingii* is a specialist of *campina* / *campinarana* (Aleixo & Poletto 2007, Whittaker 2009, Borges *et al.* 2016a). On 1 March 2011 a pair was observed vocalising and later one was



Figure 4. Three specimens of the Fuscous Flycatcher *Cnemotriccus fuscatus* complex collected in *campinarana* and deposited at the Universidade Federal do Acre, Rio Branco (UFAC) compared to the holotype of *C. f. fuscator* in the American Museum of Natural History, New York (AMNH 211013): (A–B) ventral and lateral views of UFAC 509, 477 and 294; (C) front view showing difference between bills of UFAC 477 and UFAC 509 (Edson Guilherme); (D) ventral and lateral views of AMNH 211013 (Paul Sweet). UFAC 294 = *C. f. duidae*; UFAC 477 = *C. f. bimaculatus*, UFAC 509 = *C. f. beniensis* and AMNH 211013 = *C. f. fuscator* holotype.

photographed at the edge of *campinarana* at Miratinga (Fig. 3D). In 2012, the species was seen daily in the same place. This taxon appears to be common in enclaves of *campinarana* along the BR-364 between Porto Velho and Abunã, in the north-west of the state. It is possible that *C. c. diesingii* occurs sympatrically with the recently discovered Campina Jay *C. hafferi* (Cohn-Haft *et al.* 2013) in *campina* / *campinarana* further north, in Amazonas, e.g. in WSV enclaves around Borba (Hellmayr 1910, Wikiaves 2018).

#### RED-SHOULDERED TANAGER *Tachyphonus phoenicius*

Typical of open vegetation in Amazonia (e.g. *cerrado*, *campina* and *campinarana*) and present in three different biogeographic regions. North of the Solimões / Amazon River in the states of Roraima, Pará and Amapá, as well as in eastern Colombia, southern Venezuela and the Guianas; in the south, from the Madeira basin in the region of Guayaramerin

in Bolivia (Tobias & Seddon 2007) to the east; and in the extreme south-west, in north-east Peru (Loreto), western Acre (Mâncio Lima and Cruzeiro do Sul) and south-western Amazonas (municipality of Guajará) (Hilty 2011, Guilherme 2012, 2016; E. Guilherme & A. Aleixo unpubl.). In Rondônia, *T. phoenicius* was recorded by Olmos *et al.* (2011) at Traçadal Biological Reserve and Serra da Cutia National Park, in the south-west of the state, with other documented records from the municipalities of Parecis and Vilhena (Naumburg 1930, Wikiaves 2018). A female was collected in *campinarana* at our study site on 20 August 2012 (UFAC 475), extending the species' range in Rondônia to the north, c.230 km from Traçadal Biological Reserve.

## Discussion

Although our visits to the study site were short, totalling just nine days, a significant number of species was recorded. The avifauna found exclusively in *campinarana* represented 17.7% of all species recorded and consists of birds that colonise forest edge, open country or habitat specialists (*sensu* Stotz *et al.* 1996, Borges 2004, Borges *et al.* 2016a). Of the 35 taxa considered by Borges *et al.* (2016a) to be WSV specialists throughout Amazonia, 17.1% were recorded in this small *campinarana*. However, if we consider only the 11 WSV specialists from the southern Solimões / Amazon basin (*sensu* Stotz *et al.* 1996), representativeness increases to 54.5%. Some species (e.g. *Xenopipo atronitens*) have specialised to such an extent that they occur only in enclaves of open vegetation across Amazonia (Capurucho *et al.* 2013, Borges *et al.* 2016a). This implies that vegetation growing on white sand functions as 'islands' or mini-refugia (*sensu* Isler *et al.* 1997) within the surrounding forest. These 'islands' also offer a range of food resources capable of attracting seasonal migrants from other open biomes (e.g., Cerrado, Chaco, *campos sulinos*), which explains the comparatively large number of austral migrant species in this small patch of WSV. The result is a unique community of birds different from that in surrounding forest (Borges 2004). Therefore, the presence of an enclave of *campinarana* contributes significantly to regional diversity in Amazonia (Borges *et al.* 2016a).

**Body mass and morphometrics.**—These data, taken from 136 individuals of 55 different species (Table 2), are presented separately by age and gender (Table 2). Because many species in the study area are uncommon and patchily distributed, we consider it important to publish these mass and morphometric data. Such information forms the basis of comparative studies in various aspects of animal biology, including community structure and theoretical modelling (Hudson *et al.* 2013, Frasier 2016). Dunning (2008) compiled body mass data for 8,700 species worldwide, but for some the number of individuals sampled was very small and from a single locality, e.g. *Thamnophilus stictocephalus*, for which just one male from Bolivia was available to Dunning (2008). In this study, we not only increased the number of *T. stictocephalus* so measured, but we also collected mass and morphometrics for many other species from Brazil that were poorly sampled or unrepresented in Dunning's work, e.g. Rondônia Warbling Antbird *Hypocnemis ochrogyna*, which was recently split from *H. cantator* (Isler *et al.* 2007; Table 2).

**Conservation.**—The small enclave of WSV at Miratinga lies within a region that is highly threatened (Vale *et al.* 2008, Fernandes *et al.* 2010). It is directly impacted by the BR-364 and, according to the Socioecological and Economic Zoning of Rondônia, forms part of 1.2 Sub-zone, which is subject to accelerated occupation and uncontrolled deforestation. Furthermore, the area is likely to witness increasing agricultural and other anthropogenic disturbance in the future (Fernandes *et al.* 2010). A concrete example of this is the recently implanted Jirau Hydroelectric Plant, 9.5 km from the study site. Allied to this, an energy transmission line, linking the states of Rondônia and Acre, transects the *campinarana* (see

TABLE 2

Body mass and morphometrics of 55 different species captured in a *campinarana* and its environs in north-west Rondônia, Brazil. Age: A= adult; Y = young. Sex: F = female; M = male, U = undetermined. Nomenclature follows Piacentini *et al.* (2015). Wing, tarsus and total length in mm; body mass in g. \* No mass data from South America in Dunning (2008). \*\* No mass data from Brazil in Dunning (2008).<sup>1</sup> Sample of fewer than ten individuals in Dunning (2008).<sup>2</sup> No mass data in Dunning (2008).

Species name	Age	Sex	Body mass	Wing	Tarsus	Total length
			Mean $\pm$ SD (n) max.–min.	Mean $\pm$ SD (n) max.–min.	Mean $\pm$ SD (n) max.–min.	Mean $\pm$ SD (n) max.–min.
<i>Columbina passerina</i> *	A	F	34	80	12	160
<i>Columbina talpacoti</i> **	A	F	42	86	13	175
<i>Leptotila verreauxi</i> *	A	M	130	129	35	270
<i>Geotrygon montana</i> **	A	F	100	125	32	230
<i>Nyctidromus nigrescens</i> **	A	F	45	138	13	215
<i>Phaethornis philippii</i> **	A	U	(2) 4	(2) 55–70	(2) 4–3	(2) 124–154
<i>Campylopterus largipennis</i>	A	U	7	74	3.1	135
<i>Polytmus theresiae</i> **	A	F	3	56	3	101
	A	M	3	60	3	102
	J	U	4	55	3	96
	A	U	(2) 3	(2) 56	(2) 4	(2) 100–101
<i>Bucco tamatia</i> **	A	U	35	79	16	185
	A	F	33	75	19	181
<i>Picumnus aurifrons</i> <sup>1</sup>	A	M	8	48	15	82
<i>Pygiptila stellaris</i> **	A	M	23	81	16	148
<i>Clytoctantes atrogularis</i> <sup>1</sup>	A	F	33	85	27	197
<i>Formicivora grisea</i> **	A	M	10.6 $\pm$ 0.8 (5) 10–12	54.6 $\pm$ 2.0 (5) 52–57	20 $\pm$ 2.5 (5) 18–24	134 $\pm$ 3.7 (5) 130–139
	A	F	10.6 $\pm$ 0.8 (6) 1 0–12	51.3 $\pm$ 2.5 (6) 48–55	21.6 $\pm$ 5.1 (6) 17–29	129.5 $\pm$ 6.4 (6) 122–139
<i>Thamnomanes saturninus</i>	A	F	19	72	18	155
	A	U	21	80	16	156
<i>Thamnophilus stictocephalus</i> <sup>1</sup> **	A	M	(2) 17–19	(2) 65–66	(2) 25–27	(2) 148–158
	A	F	(2) 12–16	(2) 65–66	(2) 24–27	(2) 135–160
<i>Sciaphylax hemimelaena</i> **	A	F	13	54	22	115
<i>Hypocnemis ochrogyna</i> <sup>2</sup>	A	U	11	55	18	124
<i>Glyphorhynchus spirurus</i>	A	U	13 $\pm$ 0 (3)	73.3 $\pm$ (3) 71–76	15 $\pm$ 1.7 (3) 13–16	154 $\pm$ 2 (3) 152–156
	<i>Xiphorhynchus elegans</i>	A	U	39	105	20
<i>Xenops minutus</i>	A	U	14	65	15	123
<i>Philydor erythrocerum</i> **	A	U	27	95	20	176
<i>Synallaxis rutilans</i> **	A	U	13	61	15	155
<i>Ceratopipra rubrocapilla</i>	A	M	12	59	17	106
	A	F	(2) 14	(2) 62–63	(2) 12	(2) 112
<i>Manacus manacus</i>	A	M	13.6 $\pm$ 1.1 (3) 13–15	51.3 $\pm$ 2 (3) 105–106	21.6 $\pm$ 5.5 (3) 16–27	105.3 $\pm$ 0.5 (3) 105–106
	A	F	13	47	21	110
<i>Machaeropterus pyrocephalus</i> **	A	M	9	48	18	86



Species name	Age	Sex	Body mass	Wing	Tarsus	Total length
			Mean $\pm$ SD ( <i>n</i> ) max.–min.	Mean $\pm$ SD ( <i>n</i> ) max.–min.	Mean $\pm$ SD ( <i>n</i> ) max.–min.	Mean $\pm$ SD ( <i>n</i> ) max.–min.
<i>Xenopipo atronitens</i> **	A	F	8.3 $\pm$ 0.5 (3) 8–9	49.6 $\pm$ 1.5 (3) 48–51	15.6 $\pm$ 2 (3) 14–18	85.6 $\pm$ 5.5 (3) 80–91
	A	M	(2) 13	(2) 72–74	(2) 15	(2) 123–130
<i>Terenotriccus erythrurus</i> **	A	F	13.8 $\pm$ 1.4 (5) 12–16	66.6 $\pm$ 2.4 (5) 64–70	16.4 $\pm$ 2.4 (5) 14–19	127.4 $\pm$ 4.6 (5) 120–131
	A	U	7	48	13	102
<i>Mionectes oleagineus</i> **	A	M	10	56	19	105
	A	U	11 $\pm$ 1 (3) 10–12	56.6 $\pm$ 1.1 (3) 56–58	14.6 $\pm$ 4.6 (3) 12–20	122 $\pm$ 6 (3) 115–126
<i>Tolmomyias flaviventris</i> **	A	M	11	58	21	125
	A	F	(2) 13–11	(2) 54	(2) 19–21	(2) 126–130
	A	U	(2) 10–12	(2) 60–61	(2) 16	(2) 120–127
<i>Poecilotriccus senex</i>	A	U	----	44	16	101
<i>Poecilotriccus latirostris</i> **	A	U	6	43	17	101
<i>Elaenia spectabilis</i> <sup>1</sup>	A	U	22	92		165
<i>Elaenia chilensis</i> **	J	U	14	68	16	113
<i>Elaenia parvirostris</i> **	A	U	12 $\pm$ 2.4 (6) 8–14	71 $\pm$ 2.5 (6) 66–73	15.8 $\pm$ 2.5 (6) 12–20	147 $\pm$ 8.3 (6) 133–158
	A	U	(2) 13–17	(2) 67–69	(2) 14.4–15	(2) 160
<i>Tyrannulus elatus</i> **	A	U	9	60	13	112
<i>Phaemyias murina</i> **	A	U	7.75 $\pm$ 0.5 (4) 7–8	56.5 $\pm$ 1.2 (4) 55–58	16 $\pm$ 0.8 (4) 15–17	122 $\pm$ 1.4 (4) 120–123
	J	U	8	56	15	114
<i>Myiarchus ferox</i>	A	U	27 $\pm$ 1.7 (3) 25–28	86 $\pm$ 3.4 (3) 82–88	19.3 $\pm$ 0.5 (3) 19–20	198.3 $\pm$ 5.7 (3) 195–205
	A	M	23	85	23	179
<i>Rhytipterna immunda</i> **	A	F	(2) 26	(2) 84–92	(2) 26–29	(2) 180–187
	A	U	24.8 $\pm$ 2.6 (6) 20–27	89 $\pm$ 4.6 (6) 85–96	19.8 $\pm$ 0.9 (6) 18–21	196 $\pm$ 7.1 (6) 188–206
	A	U	31	95	15	199
<i>Sublegatus modestus</i> <sup>1</sup>	A	U	(2) 13–14	(2) 66	(2) 13–15	(2) 138–142
<i>Cnemotriccus fuscatus duidae</i> <sup>2</sup>	A	U	11	66	21	145
<i>Cnemotriccus fuscatus beniensis</i> <sup>2</sup>	A	U	11	65	22	150
<i>Cnemotriccus fuscatus bimaculatus</i> <sup>2</sup>	A	U	12	69	23	156
<i>Turdus ignobilis</i> **	A	M	55	108	31	220
	J	F	59	109	34	206
<i>Turdus amaurochalinus</i>	A	U	60	122	30	225
<i>Pheugopedius genibarbis</i>	A	F	18	59	25	---
<i>Tangara episcopus</i>	A	U	21	88	17	170
<i>Volatinia jacarina</i> **	J	M	(2) 7–10	(2) 53–55	(2) 12–15	(2) 114–116
	A	M	(2) 09–11	(2) 51–52	(2) 13–19	(2) 108–117
	A	F	8	47	14	106
<i>Tachyphonus phoenicius</i>	A	F	24	71	18	168
<i>Ramphocelus carbo</i>	A	F	26	76	18	180

Species name	Age	Sex	Body mass	Wing	Tarsus	Total length
			Mean $\pm$ SD (n) max.–min.	Mean $\pm$ SD (n) max.–min.	Mean $\pm$ SD (n) max.–min.	Mean $\pm$ SD (n) max.–min.
	A	M	23.3 $\pm$ 0.5 (3) 23–24	78.3 $\pm$ 3.2 (3) 76–82	18 $\pm$ 1.7 (3) 17–20	171.3 $\pm$ 12 (3) 159–183
<i>Tersina viridis</i>	J	M	25	82	15	161
<i>Sporophila caeruleascens</i> **	J	U	10	58	13	121
	J	M	9	56	12	118
<i>Sporophila nigricollis</i> **	A	F	8	52	14	101
<i>Sporophila angolensis</i>	A	F	11.8 $\pm$ 0.4 (5) 11–12	55.6 $\pm$ 1.5 (5) 54–58	13.6 $\pm$ 1.3 (5) 12–15	134.8 $\pm$ 17.5 (5) 125–166

Fig. 4 in Guilherme & Santos 2013) affecting also adjacent *terra firme* forests. Furthermore, commercial sand mining has directly impacted this small 'island' of WSV in north-west Rondônia. This process completely destroys the vegetation, thereby exposing the soil (Ferreira *et al.* 2013, Adeney *et al.* 2016). Post-exploration, the mined areas are usually abandoned without any type of environmental recovery (Ferreira *et al.* 2013; Fig. 2E). Finally, human impacts on this area date back many decades. One evidence of this is the Madeira / Mamoré railway, whose scar, 52 years after its decommissioning, is still visible in the centre of the study site (Fig. 1).

Although small and degraded, the patch of *campinarana* we surveyed still harbours many species of conservation concern (Table 1, Guilherme & Santos 2013). In general, patches of WSV in Amazonia are fragile and sensitive to anthropogenic activities, being both threatened and poorly represented within the protected area system (Adeney *et al.* 2016, Fine & Bruna 2016). Despite an increase in studies of these ecosystems in recent years, many remain largely unknown scientifically (Adeney *et al.* 2016, Fine & Bruna 2016). We recommend that the environmental authorities in Brazil aim to restore the environmental integrity of the site, and consider the possibility of incorporating our study area into a conservation unit.

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