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The Avifauna of the Matura Environmentally Sensitive Area, Trinidad and Tobago

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ABSTRACT

A baseline survey of the avifauna of the Matura Environmentally Sensitive Area (MESA) in Trinidad was conducted to characterise the avifauna of the site and establish the presence of species of particular conservation interest. Surveys were conducted over 22 days on nine site visits between 2008 and 2010 from 152 sector (transect) surveys, supplemented by general observation. Overall, 95 species and 1067 individuals were detected, including 89 year-round residents, three non-breeding migrants, and three species which breed locally but disperse post breeding to the mainland. This represents 59% of the species expected in the MESA. The rate of species accumulation suggests that further sampling will yield one additional species per ten sectors. The assemblages observed reflect Trinidad's proximity to South America. Both of Trinidad's endemic birds, the Trinidad Motmot, *Momotus bahamensis*, Trinidad Piping-Guan, *Pipile pipile*, and the rare Scaled Antpitta, *Grallaria guatimalensis*, were detected within the study area. High-altitude specialists observed include the Brown Violetear, *Colibri delphinae*, Speckled Tanager, *Tangara guttata*, Hepatic Tanager, *Piranga flava* and Yellow-legged Thrush, *Turdus flavipes*. The vegetation and altitude along the trail across the MESA on which the survey was conducted is described in sections. The degree of difficulty and potential camping locations of each section are also described to facilitate subsequent surveys.

Key words: Matura, ESA, avifauna, endemic, Trinidad, Trinidad Piping-Guan.

INTRODUCTION

The Matura Environmentally Sensitive Area (MESA) was created in 2004 for the protection of the area's flora and fauna (Environmental Management Authority 2004). The area is an amalgamation of three adjoining parcels, initially declared as Reserves in 1922, 1958 and 1959.

Previous ecological work in the area focussed on flora (Van den Eynden 2006), avifauna (Hayes *et al.* 1998), and use of forest resources (Van den Eynden 2006; Trewenack 2010). Van den Eynden (2006) reported that recreation, agriculture, timber extraction (in the early 1990s; now rare) and hunting (up to about 500 local hunters) were the major forest uses. In a study of forest management in northeast Trinidad, Trewenack (2010) conducted interviews with the residents and obtained similar results for resource use.

Hayes *et al.* (1998) accumulated an *ad hoc* species list of 145 birds in the northeast of Trinidad from Madamas River to Matura Bay. His fieldwork was done before the area was designated an environmentally sensitive area, and includes observations well beyond the current MESA and from habitats not represented therein. Nelson *et al.* (2007) recorded a list of birds in his study of the adjacent Madamas Watershed using fixed-radius point counts, mist netting and call playback. Sixty-one species were observed during point counts and two additional species from mist netting and general observation.

The status, distribution and abundance of the avifauna in Trinidad are well known with a long history of ornithological work (ffrench 1998), good field guides (Kenefick *et al.* 2011; ffrench 2012) and an active Bird Status and Distribution Committee (Kenefick 2014). Thus, despite the paucity of studies or observations within the MESA's boundary, a list of expected species can be prepared with some confidence. However, management of the MESA should be supported as much as is practical by actual observations within the MESA.

The primary objective of this study was to characterise the avifauna in the MESA. Specifically, the species present were documented, the characteristics of bird community structure such as species diversity were recorded, and any species which can serve as a focus for conservation efforts was identified. These should help guide the MESA's management team. A second objective was to provide training to four members of the local community to be able in the future to continue conducting such surveys or serve as guides. This activity is not reported here.

For each trip, the survey team comprised one experienced birder, two tour guides (from local community non-governmental organisations), an occasional Forestry officer, and the University of the West Indies' Project Coordinator. Field trips from the north of the MESA were led by two guides from the Grande Riviere Tour Guide Association, and trips from the south were led by two or

three guides from Nature Seekers, Matura.

STUDY AREA

The MESA is located at the northeastern tip of Trinidad (Fig. 1). It encompasses approximately 9000 ha of largely undisturbed forest in the Northern Range (CFCA 1998). Rural communities are situated on the outskirts of the perimeter. Rainfall patterns indicate that the highest annual precipitation levels in the country (3,048mm) are in the Matura/Grande Riviere area in the northeast of the range (Berridge 1981). Rainfall varies between the wet (July-December) and dry (January-June) seasons and the pattern reflects the typical moist tropical forest environment. The average annual temperature is 24°C (Kricher 1997).

At the boundaries, the landscape features slopes that reach down into the rural villages. The entire site is mountainous; ranges are a continuation of the coastal cordillera of Venezuela oriented in an east-west direction, with steep slopes which reach up to nearly 600m. Streams on the northern slopes flow into the Grande Riviere and Shark Rivers. To the south, the tributaries flow into the Salybia and Matura Rivers. Vegetation ranges from herbaceous layers up to 1 m, to large canopy species reaching 40m in height. The forest types are as described by Beard (1944), as they are in very good condition having escaped conversion to cocoa plantation due to ruggedness and isolation. The vegetation associations are Evergreen Seasonal Forest, Lower Montane and Montane Rain Forest (Beard 1944). Much of the lower southern slopes of the park are comprised of Mora forest, *Mora exselsa*, Evergreen Seasonal Forest species and some secondary forest. The dominant higher altitude species are of the Myrtaceae and Podocarpaceae families, and include the eastern-most extension of several high altitude species such as the endemics *Clusia aripoensis, C. tocuchensis*, *Macrolobium trinitense*, *Podocarpus trinitensis*, *Eugenia cruegeri* and *Ocotea trinidadensis* (Van den Eynden 2006). Much secondary growth exists at lower elevations on the northern side of the park where low lying areas were cleared for cocoa cultivation. The forest on the northern slopes is structurally different from the southern slopes (probably from periodic disturbance of hurricanes on the northern slopes), with significantly larger and fewer tree stems on the southern slopes. Canopy cover in the park is usually >80% and one or two sub-canopy strata are common. Gaps and clearings are few, except at ridge tops. Stream bank habitats are narrow, as the streams lie between slopes that rise quickly with steep gradients.

About 10% of the area is inhabited or farmed. Game and hunting trails can be found off the main access and survey trails, as well as scattered hunters' scaffoldings. There is evidence of old logging at the lower altitudes on both the Salybia and Grande Riviere sides of the ESA. There were no obvious signs of intensive logging, however Van den Eynden (2006) estimated that about 300 ha were disturbed at the southern (Salybia) end.

METHODS

Nine trips were made to the study site between September 2008 and August 2010. Access to the site was via Grey Trace in Salybia or Sangre Grande Trace in Grande Riviere, and each trip attempted to reach the highest point along the trail, known locally as "Mars," at an altitude of 580m. The trips were planned in pairs with one from the north and south alternating between two experienced observers and scheduled throughout the year. Some trips were postponed or shortened due to heavy rain.

Surveys using fixed-width transect sampling (Bibby *et al.* 2000) were used to record the presence and numbers of species detected visually and aurally along paths or rivers in the study area. At the beginning of a sector, we recorded data on habitat structure, visibility and dominant tree species, which could be noted while standing still. This period allowed the birds some time to adjust after initial disturbance. A Garmin 60SCx GPS unit was used to record location in UTM coordinates (Naparima BWI datum). Birds detected within 25m perpendicular to the trail were counted, whilst species detected beyond 25m were recorded as present. The GPS unit was used to adjust walking speed such that each survey unit was sampled in 15 minutes. Survey units were each a 200m long sector of the trail, and were established 200m apart to minimise the probability of counting a particular individual more than once. One hundred and fifty-two sectors were sampled in this way (Fig. 1). Any leks (closely clustered mating territories defended by male birds) observed along the trail were recorded either within the sector or with a separate GPS reading.

Sampling was conducted according to Table 1, and generally during the morning from 0600 h to 0930 h and the afternoon from 1600 h to 1730 h when the birds were most active. On overcast days this period was extended. Each survey was conducted by two persons including one experienced observer and one person taking notes.

During non-sampling periods any additional species observed, including nocturnal species heard, were recorded. On ten occasions in the late afternoon a recording alternating between the calls of the Trinidad Piping-Guan, *Pipile pipile*, and the Scaled Antpitta, *Grallaria guatimalensis*, was played for 5 minutes, followed by a listening period of three minutes.

Training was generally accomplished between sample periods and by having the trainee serve as the scribe. The training included explaining the survey methods, partici-

Table 1. Sampling logistics: Dates marked with an asteryx indicate trips where sampling was compromised because of heavy rain.

Field Trip Date	Access Point	Sectors Sampled
*22 August, 2008	Salybia	0
*17-18 September, 2008	Salybia	13
*2-4 October, 2008	Grande Riviere	12
10-13 December, 2008	Salybia	21
20-23 January, 2009	Grande Riviere	23
24-27 March, 2009	Grande Riviere	31
19-22 May, 2009	Salybia	29
*4-7 August, 2009	Grande Riviere	7
13-16 January, 2010	Grande Riviere	16

pating in the survey and learning to identify the birds either visually or by their vocalisation.

Presentation of results

Species are presented in the taxonomic order following the South American Classification Committee's (SACC) list (Remsen *et al*. 2015). For each species, the total number observed within 25m is presented as a measure of relative abundance. For species not detected within 25 m, the proportion of sectors in which it was detected is presented in brackets. For convenience, the table of relative abundance includes the status and abundance of each species in Trinidad following White *et al.* (2007).

A species-accumulation curve, alongside a plot of Simpson's (Inverse) Diversity Index (Simpson 1949), illustrate the rate of species sampling and species diversity, respectively, and serve as a baseline for subsequent investigations or comparative studies. A Cole Rarefaction curve provides a randomised recreation of the species accumulation. The determinate axis selected is the number of individuals detected. This provides a more intuitive comparison between habitats with differing visibility and may be useful in comparative studies.

The bird species assemblage is characterised by status and habitat use. The species observed during the study are compared to a hypothetical list of species which the authors expect to be present at the site. This list excludes species which, although common and widespread in Trinidad, are not generally associated with a forested habitat. It also excludes rare species unless previously recorded within the park boundary.

RESULTS AND DISCUSSION

Description of avifauna

Overall, 95 species representing 36 families were observed during this survey from 152 dedicated sector samples and incidental observations (Table 1). This list comprises 73 species detected within 25m of the sectors, an additional six species detected during sectors but beyond 25m, and an additional 16 species detected between sectors, including birds heard during the night. The species observed represent 59% of the species expected to be found in the MESA.

The abundance of each bird species detected during the survey is presented in Table 2. This reflects to some extent the relative abundance of species. However, the detectability of each species varies. Thus, very quiet and camouflaged species are under-detected, and bright noisy species are over-represented. Shy, vocal species are often detected beyond the 25m limit. The extent to which detectability varies is demonstrated by the number in brackets, which gives the number of sectors in which the species was recorded. So whilst only five Bearded Bellbirds, *Procnias averano* were detected within 25m, they were heard from 50 sectors. Four Trinidad Piping-Guans, *Pipile pipile* were detected but they were almost certainly three individuals, with one bird detected twice.

Of the 95 species observed, 89 are resident breeding species, three are non-breeding migrants and three are species which breed in Trinidad and disperse to the mainland during non-breeding periods. The 'hypothetical' list of 161observed and expected species includes 138 residents,

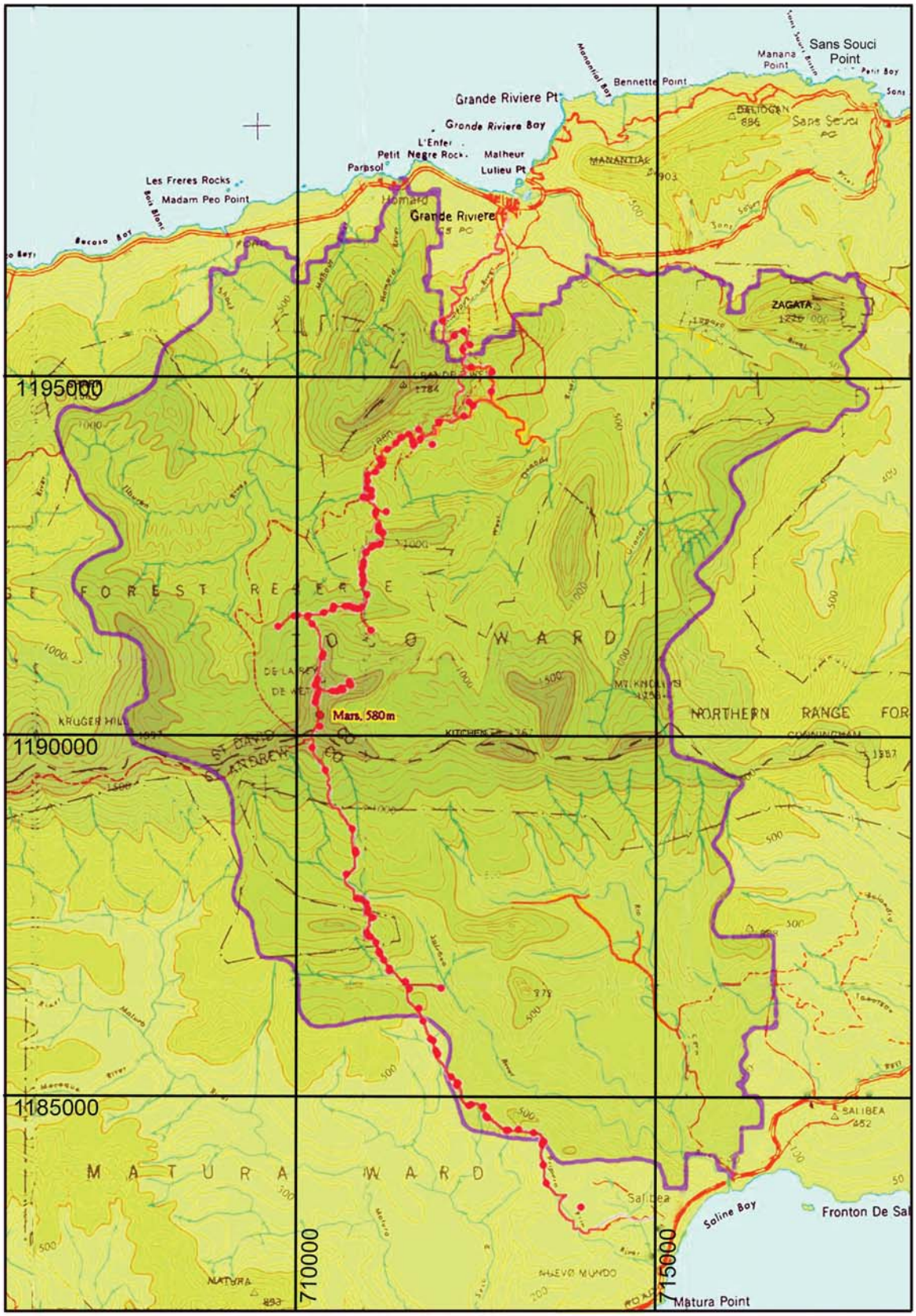

Fig. 1. Boundaries of the Matura Environmentally Sensitive Area (purple line) and the distribution of sample sectors (red dots) across the trail. (Prepared by Edward Rooks).

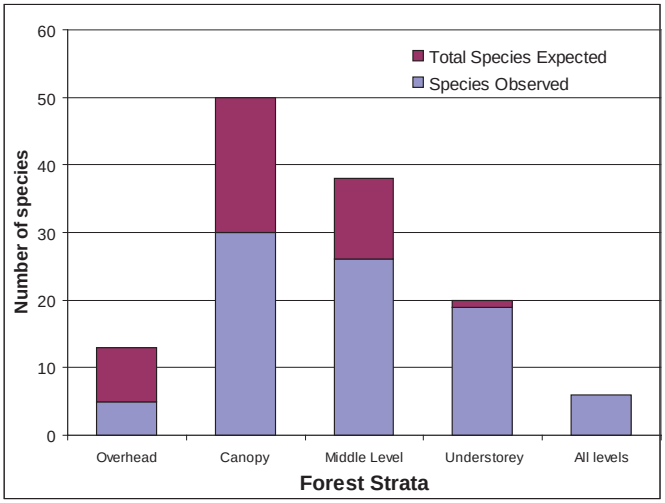

Fig. 2. Species richness observed of species favouring different forest strata, compared with a hypothetical list of species expected at the site.

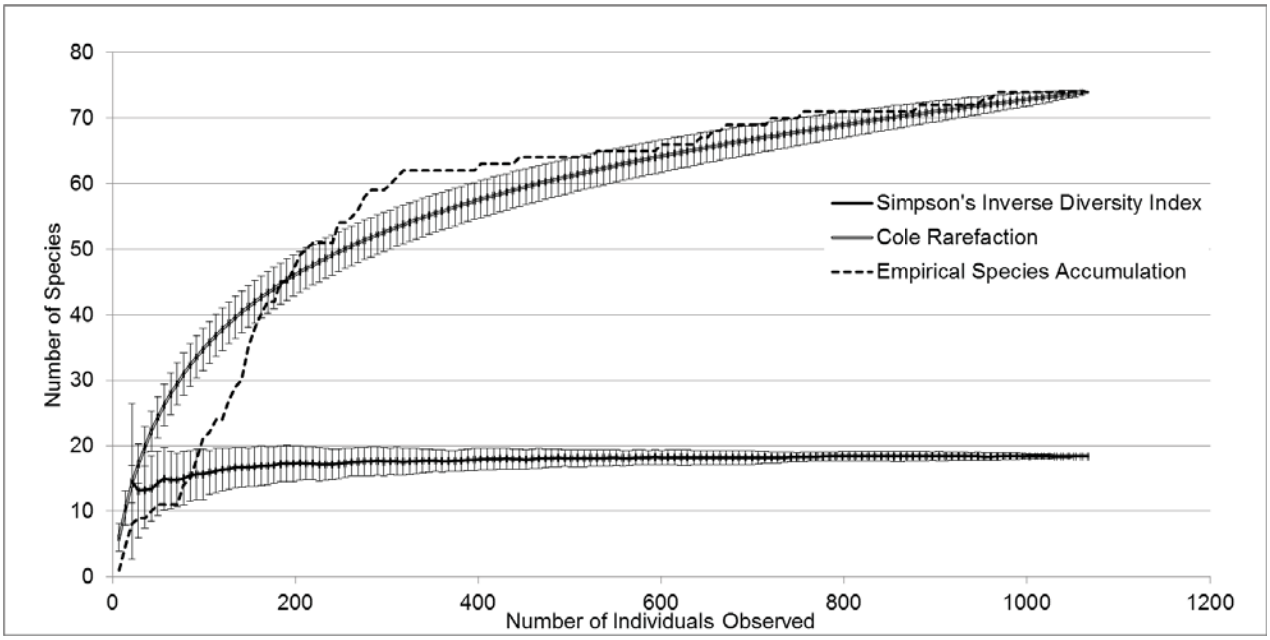

Fig. 3. Species accumulation, Cole Rarefaction curve and Simpson's (Inverse) Diversity Index for all species detected within 25m of all sectors at the Matura ESA, September 2008 -August 2010.

15 migrants (generally non-breeding) and eight species which breed locally and disperse.

With respect to habitat use, most (70) of the species observed were typical of a forest habitat. Sixteen species are found in both forest and scrub, three species are usually associated with scrub, five are aerial foragers and one can be found along rivers. Of the species usually found in forested habitats, 30 were usually associated with the canopy, 26 with the middle levels of the forest, 20 with the understorey, five above the canopy and six at all forest levels. If this distribution is compared with equivalent figures from the 'hypothetical list', it is apparent that whilst the middle and lower levels are well represented in the samples, the canopy dwelling species are under-represented (Fig. 2).

The rate of accumulation of species within 25m of the sector is illustrated by a species-accumulation curve and a supplementary plot of the species diversity (Fig. 3). This rate of species accumulation suggests that further sampling will yield one additional species per ten sectors. The cumulative plot of the Simpson's (Inverse) Diversity Index is very stable and is unlikely to change from the final value of 18.36.

Species of special interest

The assemblage reflects the avian communities of northern South America, with the tanagers (Thraupidae),

Table 2. Relative abundance (RA) of birds detected in the Matura ESA (September 2008-August 2010) and their status and abundance within Trinidad (from White *et al.* 2007).

Species	RA[a]	Status[b]	Abundance[c]
Tinamidae			
Little Tinamou, *Crypturellus soui*	1 (8)	BR	C
Cracidae			
Trinidad Piping-Guan, *Pipile pipile*	4 (2)	BR	R
Cathartidae			
Turkey Vulture, *Cathartes aura*	1 (2)	BR	A
Black Vulture, *Coragyps atratus*	2 (8)	BR	A
Accipitridae			
Swallow-tailed Kite, *Elanoides forficatus*	1 (1)	BD	U
Ornate Hawk-eagle, *Spizaetus ornatus*	(1)	BR	Sc
Plumbeous Kite, *Ictinia plumbea*	2 (3)	BD	C
Common Black-hawk, *Buteogallus anthracinus*	(2)	BR	C
Zone-tailed Hawk, *Buteo albonotatus*	(1)	BR	C
Columbidae			
Scaled Pigeon, *Patagioenas speciosa*	4 (18)	BR	C
Gray-fronted Dove, *Leptotila rufaxilla*	(3)	BR	U
Cuculidae			
Squirrel Cuckoo, *Piaya cayana*	1 (1)	BR	C
Strigidae			
Mottled Owl, *Ciccaba virgata*	N.O.	BR	R
Nyctibiidae			
Common Potoo, *Nyctibius griseus*	N.O.	BR	U
Caprimulgidae			
Short-tailed Nighthawk, *Lurocalis semitorquatus*	N.O.	BR	U
Common Pauraque, *Nyctidromus albicollis*	N.O.	BR	C
Apodidae			
White-collared Swift, *Streptoprocne zonaris*	3 (4)	MS	U
Band-rumped Swift, *Chaetura spinicaudus*	9 (2)	BR	C
Gray-rumped Swift, *Chaetura cinereiventris*	23 (5)	BR	C
Short-tailed Swift, *Chaetura brachyura*	1 (1)	BR	A
Trochilidae			
Rufous-breasted Hermit, *Glaucis hirsutus*	17 (10)	BR	C
Little Hermit, *Phaethornis longuemareus*	66 (27)	BR	C
Green Hermit, *Phaethornis guy*	65 (32)	BR	C
Brown Violetear, *Colibri delphinae*	B.S.	BR	Sc
Blue-chinned Sapphire, *Chlorestes notata*	9 (10)	BR	C
White-chested Emerald, *Amazilia brevirostris*	11 (11)	BR	C
Trogonidae			
Green-backed Trogon, *Trogon viridis*	15 (16)	BR	C
Guianan Trogon, *Trogon violaceous*	9 (20)	BR	C
Collared Trogon, *Trogon collaris*	21 (34)	BR	C

Species	RA[a]	Status[b]	Abundance[c]
Alcedinidae			
Green Kingfisher, *Chloroceryle americana*	1 (2)	BR	C
Momotidae			
Trinidad Motmot, *Momotus bahamensis*	B.S.	BR	U
Galbulidae			
Rufous-tailed Jacamar, *Galbula ruficauda*	B.S.	BR	C
Ramphastidae			
Channel-billed Toucan, *Ramphastos vitellinus*	6 (36)	BR	C
Picidae			
Golden-olive Woodpecker, *Colaptes rubiginosus*	5 (14)	BR	C
Chestnut Woodpecker, *Celeus elegans*	7 (3)	BR	U
Lineated Woodpecker, *Dryocopus lineatus*	(4)	BR	C
Psittacidae			
Lilac-tailed Parrotlet, *Touit batavicus*	2 (3)	BR	U
Blue-headed Parrot, *Pionus menstruus*	1 (5)	BR	U
Orange-winged Parrot, *Amazona amazonica*	21 (53)	BR	A
Thamnophilidae			
Great Antshrike, *Taraba major*	2 (5)	BR	C
Plain Antvireo, *Dysithamnus mentalis*	10 (19)	BR	U
White-flanked Antwren, *Myrmotherula axillaris*	21 (13)	BR	C
Silvered Antbird, *Sclateria naevia*	3 (3)	BR	U
White-bellied Antbird, *Myrmeciza longipes*	17 (52)	BR	C
Grallariidae			
Scaled Antpitta, *Grallaria guatimalensis*	B.S.	BR	R
Formicariidae			
Black-faced Antthrush, *Formicarius analis*	3 (14)	BR	U
Furnariidae			
Gray-throated Leaftosser, *Sclerurus albigularis*	5 (4)	BR	U
Plain-brown Woodcreeper, *Dendrocincla fuliginosa*	7 (5)	BR	C
Cocoa Woodcreeper, *Xiphorhynchus susurrans*	13 (49)	BR	C
Streaked Xenops, *Xenops rutilans*	1 (1)	BR	U
Stripe-breasted Spinetail, *Synallaxis cinnamomea*	3 (4)	BR	C
Tyrannidae			
Forest Elaenia, *Myiopagis gaimardii*	1 (1)	BR	C
Southern Beardless Tyrannulet, *Camptostoma obsoletum*	1 (1)	BR	C
Ochre-bellied Flycatcher, *Mionectes oleagineus*	B.S.	BR	C
Slaty-capped Flycatcher, *Leptopogon superciliaris*	2 (4)	BR	U
Yellow-breasted Flycatcher, *Tolmomyias flaviventris*	19 (26)	BR	C
White-throated Spadebill, *Platyrinchus mystaceus*	1 (1)	BR	U
Euler's Flycatcher, *Lathrotriccus euleri*	3 (7)	BR	C
Boat-billed Flycatcher, *Megarynchus pitangua*	B.S.	BR	C
Bright-rumped Attila, *Attila spadiceus*	(6)	BR	U
Cotingidae			
Bearded Bellbird, *Procnias averano*	5 (50)	BR	U

Species	RA[a]	Status[b]	Abundance[c]
Pipridae			
Golden-headed Manakin, *Pipra erythrocephala*	93 (74)	BR	C
White-bearded Manakin, *Manacus manacus*	48 (33)	BR	C
Vireonidae			
Rufous-browed Peppershrike, *Cyclarhis gujanensis*	5 (10)	BR	C
Golden-fronted Greenlet, *Hylophilus aurantiifrons*	47 (36)	BR	C
Hirundinidae			
Southern Rough-winged Swallow, *Stelgidopteryx ruficollis*	B.S.	BR	C
Troglodytidae			
House Wren, *Troglodytes aedon*	1 (1)	BR	C
Rufous-breasted Wren, *Pheugopedius rutilus*	21 (45)	BR	C
Polioptilidae			
Long-billed Gnatwren, *Ramphocaenus melanurus*	12 (17)	BR	C
Turdidae			
Yellow-legged Thrush, *Turdus flavipes*	B.S.	BR	U
Cocoa Thrush, *Turdus fumigatus*	2 (6)	BR	C
Spectacled Thrush, *Turdus nudigenis*	5 (5)	BR	C
White-necked Thrush, *Turdus albicollis*	28 (66)	BR	C
Thraupidae			
White-lined Tanager, *Tachyphonus rufus*	8 (9)	BR	C
Silver-beaked Tanager, *Ramphocelus carbo*	3 (3)	BR	C
Palm Tanager, *Thraupis palmarum*	1 (1)	BR	A
Speckled Tanager, *Tangara guttata*	B.S.	BR	L
Turquoise Tanager, *Tangara mexicana*	1 (1)	BR	C
Bay-headed Tanager, *Tangara gyrola*	15 (7)	BR	C
Blue Dacnis, *Dacnis cayana*	1 (1)	BR	C
Purple Honeycreeper, *Cyanerpes caeruleus*	38 (25)	BR	C
Red-legged Honeycreeper, *Cyanerpes cyaneus*	7 (5)	BD	C
Green Honeycreeper, *Chlorophanes spiza*	13 (13)	BR	C
Bananaquit, *Coereba flaveola*	174 (93)	BR	A
Sooty Grassquit, *Tiaris fuliginosus*	B.S.	BR	U
Cardinalidae			
Hepatic Tanager, *Piranga flava*	B.S.	BR	L
Red-crowned Ant-tanager, *Habia rubica*	25 (23)	BR	U
Parulidae			
Northern Waterthrush, *Parkesia noveboracensis*	3 (3)	MN	C
American Redstart, *Setophaga ruticilla*	1 (1)	MN	C
Tropical Parula, *Parula pitiayumi*	1 (1)	BR	C
Golden-crowned Warbler, *Basileuterus culicivorus*	5 (6)	BR	C
Icteridae			
Crested Oropendola, *Psarocolius decumanus*	1 (2)	BR	A
Yellow-rumped Cacique, *Cacicus cela*	7 (8)	BR	C
Fringillidae			
Trinidad Euphonia, *Euphonia trinitatis*	B.S.	BR	U
Violaceous Euphonia, *Euphonia violacea*	33 (29)	BR	C

Table 2 Key

[a] **Relative abundance**	Number of individuals detected within 25m (Number of sectors in which species was detected).
B.S.	Observed between sectors.
N.O.	Calls heard at night.
[b] **Status**	
BR	Resident species without significant movement out of Trinidad and Tobago. Breeding is assumed even if no nest has been documented.
BD	Species that breed locally and migrate or disperse to the mainland (sometimes only partially) during the non-breeding period.
MS	Migrants from South America. May breed occasionally.
MN	Non-breeding migrants from North America.
[c] **Abundance**	
A	Abundant; widespread.
C	Common; usually found in suitable habitat.
U	Uncommon; occasionally seen in suitable habitat.
Sc	Scarce; less than five records per year.
R	Rare; not recorded annually.
L	Locally distributed in restricted habitat.

flycatchers (Tyrannidae) and hummingbirds (Trochilidae) relatively well represented in the data. By far, the most abundant species detected was the Bananaquit, *Coereba flaveola*, followed by the Golden-headed Manakin, *Pipra erythrocephala*.

Trinidad's endemic birds, the Trinidad Motmot, *Momotus bahamensis* and the Trinidad Piping-Guan, *Pipile pipile* were detected within the study area. The former has recently been identified as a full species by the SACC following Stiles (2009). It is generally shy in Trinidad and though widespread in forested areas, it is seldom seen.

The Piping-Guan is regularly seen at the northern edge of the park where it receives some level of protection. Nesting attempts have also been observed. In this survey, three Piping-Guans were seen on the southern slopes of the study site at Grid Reference 0711215 E, 1186833 N. The species has not been observed this far south in recent years but given the appropriateness of the habitat, the bird is probably widespread in the park. The current population estimates are 70-200 individuals (Hayes *et al.* 2009a) and the species has been designated as an Environmentally Sensitive Species (Environmental Management Authority 2004). In terms of conservation, this is the most significant bird species within the MESA.

One individual of the Scaled Antpitta, *Grallaria guatimalensis*, arguably Trinidad's rarest resident, was heard in the valley below the highest ridges of the study site. This is the most eastern record of this species in Trinidad with all other records in the past 50 years from the Lopinot, Arima and Marianne drainages. The observations of the Trinidad Piping-Guan (unpubl. Trinidad and Tobago Rare Birds Committee records) and the Scaled Antpitta (Kenefick 2010) have been submitted and ratified by the Trinidad and Tobago Bird Status and Distribution Committee.

Several of the species whose distribution within Trinidad is limited to comparatively high altitudes were detected. These species are mainly of Andean distribution (Snow 1985) and include the Brown Violetear, *Colibri delphinae*, Scaled Antpitta, *Grallaria guatimalensis*, Yellow-legged Thrush, *Platycichla flavipes*, Speckled Tanager, *Tangara guttata* and Hepatic Tanager, *Piranga flava.* The MESA probably represents the eastern-most edge of the range of each of these species.

Along the ridge three small clearings were observed (Fig. 4). These were described by locals as 'bird clearings'. Their suggestion was that the clearings were created and grasses and sedges (*Scleria latifolia; Bequerelia cymosa* [Van den Eynden 2006]) planted to attract the Chestnut-bellied Seed-Finch, *Oryzoborus angolensis*, which can then be trapped. The Chestnut-bellied Seed-Finch

is a popular cage-bird and locally caught individuals are much sought by cage-bird fanciers. Van den Eynden (2006) produced a map of natural resource used in and around the MESA and plotted the locations of 22 such areas, with 12 of them concentrated on the highest altitudes of the main ridge in the site. From interviews she recorded that the Chestnut-bellied Seed-Finch, *Oryzoborus angolensis*, the Lesson's Seedeater, *Sporophila bouvronides*, the Gray Seedeater, *Sporophila intermedia* and the Violaceous Euphonia, *Euphonia violacea* are popular birds to trap. No seed-finches or seedeaters were observed during the survey. However, the habitat is appropriate for the Chestnut-bellied Seed-Finch. One local resident assured us that he traps one or two individuals per year. Another local resident was seen returning to Grey Trace carrying a trap cage with a Chestnut-bellied Seed-Finch. Van den Eynden (2006) reported that, on average, 19 seed-finches are trapped per year. This species is greatly threatened in Trinidad due to bird trapping, and unless the resident population is augmented by birds immigrating from Venezuela, it is unlikely to survive in Trinidad.

Fig. 4. Small clearings across the ridgetop around a campsite at Mars. These clearings are purported to attract seedeaters.

Manakins, bellbirds and a few hummingbird species exhibit lekking behaviour. These are species in which the males are polygynous and compete with each other in closely clustered territories for the opportunity to mate with females. The females take full responsibility for nest construction and rearing of the brood. The males congregate at regular locations where they vie for the attention of females by ritualised dances and calls. The leks can last decades (Berres 2002) and, coupled with the often strikingly coloured dancing males, provide a reliable attraction to visitors along the trails. They are also attractive to students of animal behaviour, as much of the seminal work on lekking birds was done in Trinidad (see Olson and McDowell 1983; Snow and Snow 1973; Snow, B.K. 1970; Snow, D.W. 1962a, 1962b, 1968).

The distribution and abundance of leks along the main trail is illustrated in Figure 5. Leks of some species, especially Golden-headed Manakins, *Pipra erythrocephala* and Bearded Bellbirds, *Procnias averano*, may extend over an area in excess of 200m in diameter. Thus leks of the same species within 200m of each other, but recorded on different trips, may be a duplication of the same lek.

The most abundant leks were the Golden-headed Manakin, *Pipra erythrocephala* and the White-bearded Manakin, *Manacus manacus*. This is expected given the abundance of each species. The Golden-headed Manakin tends to predominate in well-forested areas. Only one Bearded Bellbird calling site was detected. According to Snow (1970), the bird selects fruits of the Lauraceae and Burseraceae families for specific nutritional value. Perhaps a scarcity of these resources contributed to a low detection of calling sites.

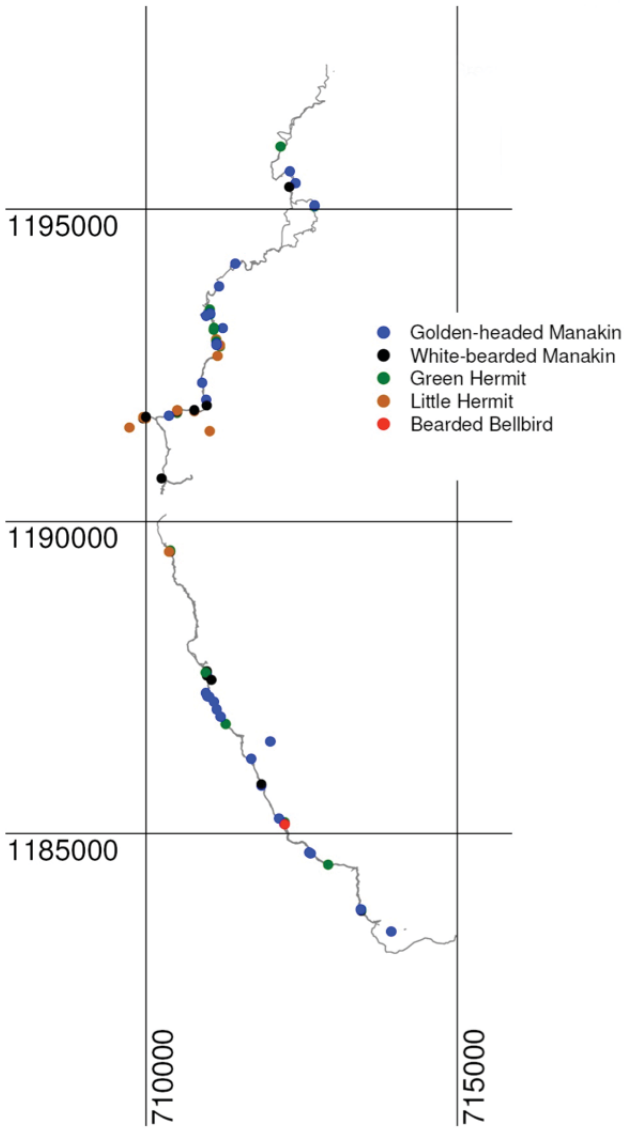

Fig. 5. Distribution of leks along the Grey Trace to Grande Riviere trail.

Of the hummingbirds, the Green Hermit, *Glaucis hirsuta* and Little Hermit, *Phaethornis longuemareus* are lekking species. Green Hermit leks tend to be quite large and noticeable. The Little Hermit is quite difficult to see when calling at leks and some effort is required. Most of the Little Hermit leks along the trail were north of the main ridge. As more trails in the park are described and mapped, more leks will be discovered. Some of these will almost certainly be closer to the access points.

Bird species richness and observation rate across the MESA

For a comparison of abundance or species richness across the MESA, the route followed was separated into the six sections based on habitat type and altitude. The topographic character of the sections is illustrated in Figure 6. Apart from the topography, sections differ in vegetation, ease of movement and survey effort. Comparisons are therefore exploratory (Table 3). The most striking observation is the lower number of species observed within the two sections above 350m altitude. This tendency was observed while conducting the surveys and may have been due to the conditions at the higher altitudes. Here the canopy was lower, visibility often poor, movement difficult and strong winds often made observation difficult. The canopy and ground vegetation along the higher ridges are illustrated in Figures 7, 8 and 9.

Section 3 comprised the Fig Walk River (Fig. 10). Here the noise of the river made detection of bird calls difficult and only the louder spected were heard.

CONCLUSIONS AND RECOMMENDATIONS

The diverse bird community of the MESA makes for a good birdwatching destination, lending to good ecotourism opportunities for the local community and its NGOs. Charismatic species observed include the Trinidad Motmot and lekking species such as the bellbird, manakins and hermits. The persistence of these leks will contribute to the attractiveness of the ESA to visitors, due to the unique lekking calls and behaviour of these species.

The most important component of the avifauna of the MESA is the population of Trinidad Piping-Guans. This species should be adopted as a flagship species for the management of the area and studies to better understand the habitat requirements of the species should be conducted or facilitated, adding to the previous studies of Alexander (2002) and Hayes *et al.* (2009b). In addition, there is no other location which supports comparable populations of the Trinidad Piping-Guan, and which have the legislative framework in place to provide for such protection. Management of the MESA for the benefit of the Trinidad Piping-Guan will benefit the entire avifaunal community, including the Scaled Antpitta.

There are no other bird species of comparative importance in the MESA. The small population of Chestnut-bellied Seed-Finches is important nationally but not from a regional perspective. The seedeaters in Trinidad are threatened by the cage-bird trade rather than habitat destruction. The Trinidad Motmot, though endemic and thus of restricted range, is still widespread in many forested parts of the country. Its endemism, however, can be highlighted to market the ecotourism potential of the MESA.

The species list recorded represents 59% of the species, exclusive of rare species, which the authors expect to observe in the MESA. Further studies will increase the species count, especially if the studies cover a wider area and target canopy species. The authors recommend that further studies specifically target the distribution and food plants of the Trinidad Piping-Guan. During such surveys, additional bird species should be recorded.

There are several species common in forested areas that were not detected in this survey. Such species will be recorded with further surveys and their absence from the current survey is probably due to chance. An exam-

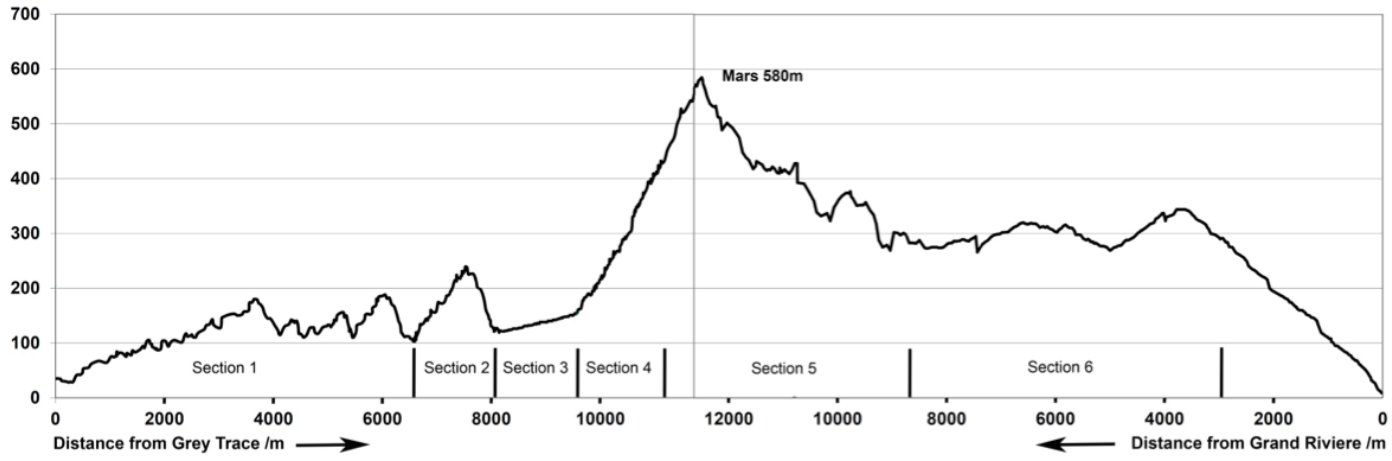

Fig. 6. Transect across ridge from Grey Trace to Grand Riviere showing sections of differing altitude.

Table 3. Summary of sample size, species richness, species diversity and observation rate per section.

Section of trail	1	2	3	4	5	4 and 5	6	ALL*
Length of section/km	6.5	1.5	1.5	2.0	4.75	6.75	5.75	22.0
Number of sectors	30	13	8	16	51	67	31	152
Number of species overall (and within sectors)	45 (39)	38 (32)	28 (19)	36 (24)	50 (41)	54 (47)	55 (46)	95 (73)
Simpson's Inverse Diversity Index	24	27	19	17	20	20	20	23
Mean number of species per sector (SE)	5.30 (0.67)	4.92 (0.96)	5.00 (0.81)	3.88 (0.41)	3.78 (0.28)	3.81 (0.23)	5.8 (0.40)	4.68 (0.21)
Mean number of individuals per sector (SE)	6.97 (0.93)	6.31 (0.79)	8.25 (1.42)	7.63 (1.30)	6.67 (0.54)	6.9 (0.51)	8.00 (0.51)	7.16 (0.32)
* Three sectors were just beyond section 6								

Fig. 7. Canopy of ridgetops.

ple of such a species is the Blue-gray Tanager, *Thraupis episcopus*. Other species, common and widespread in secondary growth in Trinidad, were not encountered or were encountered in low numbers. Their absence may be interpreted as an indicator of the quality of the habitat. Examples include the Great Kiskadee, *Pitangus sulphuratus* and Grayish Saltator, *Saltator coerulescens*.

Consequently, the species assemblage observed from these samples represented primarily an understorey community of birds of moderate to high detectability. Future surveys in the MESA, whilst targeting primarily the Trinidad Piping-Guan, should aim for better coverage by deploying additional canopy observations. Call playback at point count stations should also be used to capture the presence of focal species such as the Trinidad Piping-Guan and Scaled Antpitta. Since training assistants was a deliverable of the overall study, the "transect-walk" method was deemed appropriate for interactive survey sessions. This constrained the opportunities for survey sites and comparison with other studies. Fixed-radius point counts would provide a greater flexibility for the surveys and, as it is a more widely used method, give more opportunities to compare the data with other sites.

Fig. 8. Understorey vegetation along ridges.

Fig. 9. Bromeliads common on the ground at higher elevations.

Fig. 10. Fig Walk River.

For the current study much physical effort was needed to access sites and navigate the terrain. This resulted in a level of noise and movement which may have scared off wary species and detracted from the survey effort. Subsequent studies should budget for the use of porters to bring in equipment and supplies, thus freeing the collecting of data.

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