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LIVING WORLD

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Field Naturalists' Club

1999-2000

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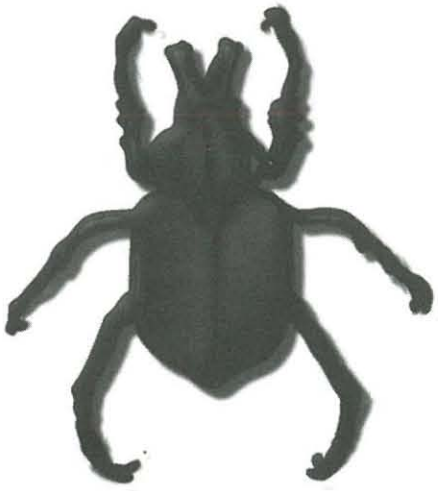

Natura Maxime Miranda in Minimis

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Layout and cover art by Michael Tikasingh

EDITORIAL

The lead article on this issue by Paul Comeau describes the disruptive effects of quarrying in ecosystems and makes recommendations for the rehabilitation of quarry sites. His article is followed by a series on ornithology, the first of which by Graham White describes abundance and seasonal migration of birds at the Port of Spain sewage ponds. Then there are two articles by our regular and most prolific contributor to the Journal, Richard ffrench. In the first he discusses non-breeding bird visitors from South America to Trinidad, and Trinidad and Tobago residents that may migrate to South America. His second article is to give some ideas on the abundance of birds in some locations. Information on abundance of birds is not easy to come by in most countries so any data accumulated along these lines may be useful.

Data on the Annual Christmas Bird Counts are presented for the years 1981 to 1990 and we hope to bring this information up to date by the next issue.

We welcome to our pages the first report of the Rare Bird Committee and we hope this will become a regular feature in future issues of the Journal.

Sharsha Lall and Floyd Hayes have recorded five species of reptiles and mammals new to the fauna of Chacachacare in the continuing studies on the fauna of the Bocas islands.

Matthew Cock completes his series of articles on the skipper butterflies of Trinidad.

It was with sadness we learnt in 1998 of the death in New York of Arthur Greenhall. He and his wife were honorary members of the Club. He was a close friend to many members including the Editor. Geoffrey Gomes and Victor Quesnel pay tribute to Arthur Greenhall on our pages.

Readers will note that in recent issues of the Journal there have been a preponderance of articles on ornithology. This is not a reflection of a bias on the part of the Editorial Committee, but a situation where we do, in fact receive more articles on ornithology for review. We are aware that there are other groups in the Club as well as other workers in the country studying various aspects of our flora and fauna and we would like to encourage them to record their observations in the Journal.

In our next issue we plan that our lead article will be a lengthy review paper on some aspect of our flora/fauna/environment and that each subsequent issue of the Journal will carry such a feature.

E.S.T.

THE TRINIDAD AND TOBAGO FIELD NATURALISTS' CLUB

The Trinidad and Tobago Field Naturalists' Club was founded on 10th July 1891. Its name was incorporated by an Act of Parliament (Act No.17 of 1991). The objects of the Club are to bring together persons interested in the study of natural history, the diffusion of knowledge thereof and the conservation of nature.

Monthly lecture meetings are held at St. Mary's College, on the second Thursday of every month, while field excursions are held on the last Sunday of every month except December.

Membership is open to all persons of at least fifteen years of age, who subscribe to the objects of the Club.

All enquiries concerning the Club or its Journal should be addressed to the Honorary Secretary, P.O. Box 642, Port of Spain, Republic of Trinidad and Tobago

email: *ttfnc@wow.net*

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Front Cover:
Arthur M. Greenhall, 1911-1998 and Funnel-eared bats *Natalus tumidirostris haymani,* at Chaguaramas, 1993. (Photo Geoffrey Gomes)

ACKNOWLEDGEMENTS

Appreciation is extended to the Trinidad Publishing Co. Ltd. for their assistance in the production of the negatives used in this issue of the Journal.

Rehabilitation of Abandoned Quarry Sites in Trinidad, W.I.

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ABSTRACT

Two sand and gravel quarry sites, one a surface and the other a deep excavation, and a hillside limestone quarry were studied in northern Trinidad with the purpose of recommending rehabilitation measures using native plant species. In addition, two control sites were examined, a rehabilitated hillside quarry, and an abandoned site where natural regeneration of plants has taken place. Based on the existing abiotic and biotic conditions at the three study sites the following rehabilitation options are considered: regeneration of natural forest cover, agroforestry, recreational or commercial development, and landfill. The environmental impact of these rehabilitation options is examined.

INTRODUCTION

A great deal has been written about the revegetation of quarried landscapes outside the tropics where extensive work has been done in Europe, in particular the U.K. (Humphries 1976, Johnson and Bradshaw 1979, Coppin and Bradshaw 1982) and Germany (Knabe 1964, Petsch 1975), in North America, especially the U.S. (Hodder 1973, Marx 1975) and in Australia (Tacey 1979). In Trinidad, where a considerable number of reports have been written about the quarry industry (Salisbury 1992), very little has been published about the rehabilitation of quarried land (Heesterman 1982, Greenwood 1983, Ramdial 1983, Huber and Kisto 1986). A recent study commissioned by the Government of Trinidad and Tobago (Jackson 1993) and the efforts of the Field Naturalists' Club's Botany Group (Quesnel *et al.* 1996) have helped to rectify this shortcoming. At The University of the West Indies, St. Augustine, hardly any research has been directed towards rehabilitation. What has been done seems to be confined to the Engineering Faculty, especially the Department of Land Surveying (Ramroop 1987, Scott 1987)

The following study is an attempt to evaluate the current state of abandoned quarry sites in Trinidad with respect to their ecology and vegetation and to make recommendations for their rehabilitation. Three specific categories are considered, a complex sand and gravel quarry where mainly surface mining has taken place, a deep sand and gravel site where water-filled depressions now occur and a hillside limestone quarry. These typify approximately 75 quarries presently found in Trinidad, 35 of which are closed or abandoned. It is hoped that this study will add to the needed body of knowledge, especially in the tropical environment, that will be required on a wider scale to deal with this aspect of landscape deterioration. Trinidad is a country that prides itself on being self-sufficient in aggregate production and an exporter of aggregate material to other countries in the Caribbean region. There is no shortage of knowledge about

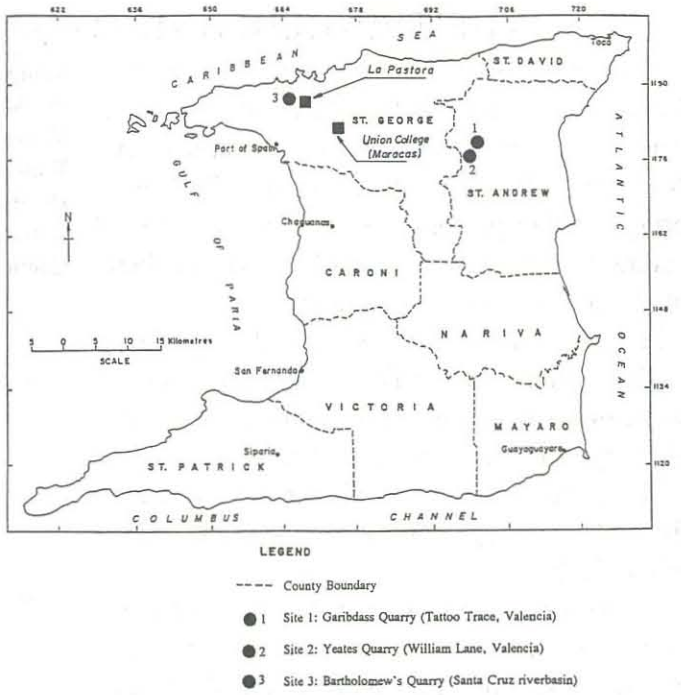

Figure 1. Location of test quarry sites, Trinidad, W.I. (Adapted from Jackson 1993).

excavation techniques but information is lacking with respect to rehabilitation. The goal of this study is to correct the inbalance to some extent.

BACKGROUND

Sites and Location

The three test sites chosen for detailed study are located in north Trinidad (Fig. 1). Two of these, Garibdass quarry complex and Yeates deep quarry, both sand and gravel, are situated inside the Valencia Wildlife Sanctuary and former Forest Reserve. The Sanctuary has an area of 2,736 ha. and is under public ownership (IUCN 1982). The other site, Bartholomew's hillside limestone quarry, is located near the upper end of the Santa Cruz Valley at the base of one of the flanks of the Northern Range. It too is on state land that has had a varied history of environmental disturbance. In addition, two control sites also were examined, the Union College quarry in the Maracas Valley where some rehabilitation work has been undertaken and La Pastora quarry in the Santa Cruz Valley where natural regeneration has occurred since the site was abandoned (Fig. 1).

Topography

The topography at the Valencia Wildlife Sanctuary is flat to gently undulating with elevations ranging from 7.5 to 15 m above sea-level. Drainage is eastward towards the Atlantic Ocean with Garibdass quarry situated between the Turure and La Seiva Rivers while Yeates quarry is located near the Quare River which flows out of Hollis Reservoir. Within the quarry sites a variety of topographic features are found which include ridges (dry areas - high), gravel heaps, flats (dry areas - low) and depressions (wet areas). Some of the depressions at Yeates are water-filled to a depth of 5 m (Jackson 1993). At the base of Bartholomew's hillside quarry elevation is approximately 105 m above sea-level and drainage is southward via the Santa Cruz River. The general topography of this area is mountainous while at the quarry site topographic features include vertical rock faces, terraces, slopes and sediment outflow at the base.

Soils

Alluvial deposits of sand and gravel over clay predominate at the Valencia Wildlife Reserve. Soil pH is generally acidic with low nutrient status (Doubleday and Jones 1977) and little or no organic matter. Internal drainage is free where sands and gravels form thick surface deposits without cementation but impeded drainage prevails where silty clays are found in the profile. The presence of limestone at Bartholomew's hillside quarry contributes to nutrient enrichment at the site and less acid conditions. Above the limestone quarry, under forest cover, a thin loamy soil with free drainage has developed over bedrock.

Climate

The climate in Trinidad is tropical, i.e., warm and wet, with distinct seasons based on the amount of rainfall. Normally, the wet season occurs from June to December with the wettest months being June, July, August and November. There is a mini dry spell in September/October known as the Petit Careme. The dry season usually lasts from January to May with the driest month being March (Marshall 1934). The amount of rainfall within the Valencia Wildlife Sanctuary ranges between 250 and 300 cm per annum while in the upper region of the Santa Cruz Valley annual rainfall is 175 cm or less. Temperatures also fluctuate according to season with the hottest month being September and the coolest month, February. Daily temperatures at low elevation non-coastal areas generally reach a high of 32° Celsius and drop by about five degrees at night. In the mountains temperatures can be about 10 degrees cooler.

Original Vegetation

When the Valencia Wildlife Sanctuary also functioned as a forest reserve, the natural vegetation was classified as Evergreen Seasonal belonging to the association *Carapa-Eschweilera* (Crappo-Gautecare) with a strong *Mora* component (Marshall 1934, Beard 1946). The presence of *Attalea maripa* (Cocorite Palm) and the absence of *Sabal mauritiiformis*(Carat Palm) in parts of this association was indicative of poor soil conditions (Marshall 1934). Other characteristic trees included *Aniba panurensis* (Laurier Canelle), *Sterculia caribaea* (Mahoe), *Pachira insignis* (Wild Chataigne), *Pentaclethra macroloba* (Bois Mulatre), *Diospyros irensis* (Bois Charbon) and *Licania biglandulosa* (Wild Debasse), the last occur-

ing in the understory (Beard 1946).

The natural forest cover in the upper regions of the Santa Cruz Valley was classified as Semi-deciduous, Foot-hills Type by Marshall (1934) with typical trees being *Cordia alliodora* (Cypre), *Tabebuia serratifolia* (Yellow Poui), *Sideroxylon quadriloculare* (Acoma), *Protium guianense* (Incense), *Astronium obliquum* (Yoke), *Terminalia obovata* (White Olivier), *Guazuma ulmifolia* (Bois d'Orme) and *Machaerium robinifolium* (Saltfish Wood). It is more difficult to fit this area into Beard's (1946) classification, the closest approximation being his Semi-evergreen Seasonal *Ficus* (Figuier) Faciation belonging to the *Trichilia-Brosimum* (Acurel-Moussara) Association which he describes as being found in mountainous limestone areas with very steep slopes.

Surrounding (current) Vegetation

Some of the relic trees from the original forest that are still growing around the Garibdass quarry complex include *Tabebuia stenocalyx* (Wild Calabash), *Terminalia amazonia* (White Olivier), *Mora excelsa* (Mora), *Pentaclethra macroloba* (Bois Mulatre), *Carapa guianensis* (Crappo), *Virola surinamensis* (Cajuca), *Byrsonima coriaceae* (Serrette), *Parinari campestris* (Bois Bande) and the palms *Euterpe precatoria* (Manac), *Oenocarpus bataua* (Palma Real) and *Manicaria saccifera* (Timite). No evidence of fire was observed in the survey area.

Fire, however, has badly damaged the forest on the west side of the study area at Yeates. This devastation probably took place during the prolonged dry season of 1987. Post-fire species observed along the forest margin include:

Cordia curassavica (Black Sage)
Clibadium surinamense (Composite)
Scleria secans (Razor Grass)
Vismia guianensis (Kiskidee)
Vismia laxiflora (Kiskidee)
Miconia myriantha (Melastome)
Cecropia peltata (Bois Canon)
Ficus amazonia
Ficus broadwayi (Beefwood)
Ficus maxima
Ficus nymphaeifolia
Blechnum serrulatum (Fern)
Nephrolepis rivularis (Fern)
Renealmia alpina

Despite the fire, a number of species that were characteristic of the original forest still remain. Those observed along the margin are:

Didymopanax morototoni (Jereton)
Tabebuia stenocalyx (Wild Calabash)
Protium guianense (Incense)
Terminalia amazonia (White Olivier)
Maprounea guianensis (Petite Feuille)
Calophyllum lucidum (Galba)
Symphonia globulifera (Yellow Mangue)
Eschweilera subglandulosa (Guatecare)
Calliandra guildingii (Niaure)
Pithecellobium jupunba (Puni)
Carapa guianensis (Crappo)
Virola surinamensis (Cajuca)
Euterpe precatoria (Manac Palm)
Manicaria saccifera (Timite)
Attalea maripa (Cocorite)
Coccoloba latifolia (Cuchape)
Parinari campestris (Bois Bande)

The forest above Bartholomew's quarry also had evidence of fire. Deciduous trees that reflect the Semi-evergreen aspect of this plant community include *Spondias mombin* (Hog Plum), *Tabebuia rufescens* (Black Poui), *Ceiba pentandra* (Silk Cotton), *Bursera simoruba* (Naked Indian), *Machaerium robinifolium* (Saltfish Wood) and *Guazuma ulmifolia* (Bois d'Orme).

Observed native trees at Bartholomew's that were a component of the original forest include:

Spondias mombin (Hog Plum)
Ceiba pentandra (Silk Cotton)
Protium insigne (Gommier)
**Croton gossypiifolius* (Bois Sang)
* *Brownea latifolia* (Cooperhoop)
* *Machaerium robinifolium* (Saltfish Wood)
Lonchocarpus punctatus (Savonette)
Andira inermis (Angelin)
Swartzia pinnata (Bois Pois)
Guarea glabra (Carimbo)
**Brosimum alicastrum* (Moussara)
**Cecropia peltata* (Bois Canon)

Attalea maripa (Cocorite)
Guazuma ulmifolia (Bois d'Orme)

* denotes common occurrence

Trees that are remnants of the former plantation or estate at the hillside site include *Carica papaya* (Pawpaw), *Dipteryx odorata* (Tonka Bean), *Artocarpus altilis* (Breadfruit), *Myristica fragrans* (Nutmeg) and *Theobroma cacao* (Cocoa).

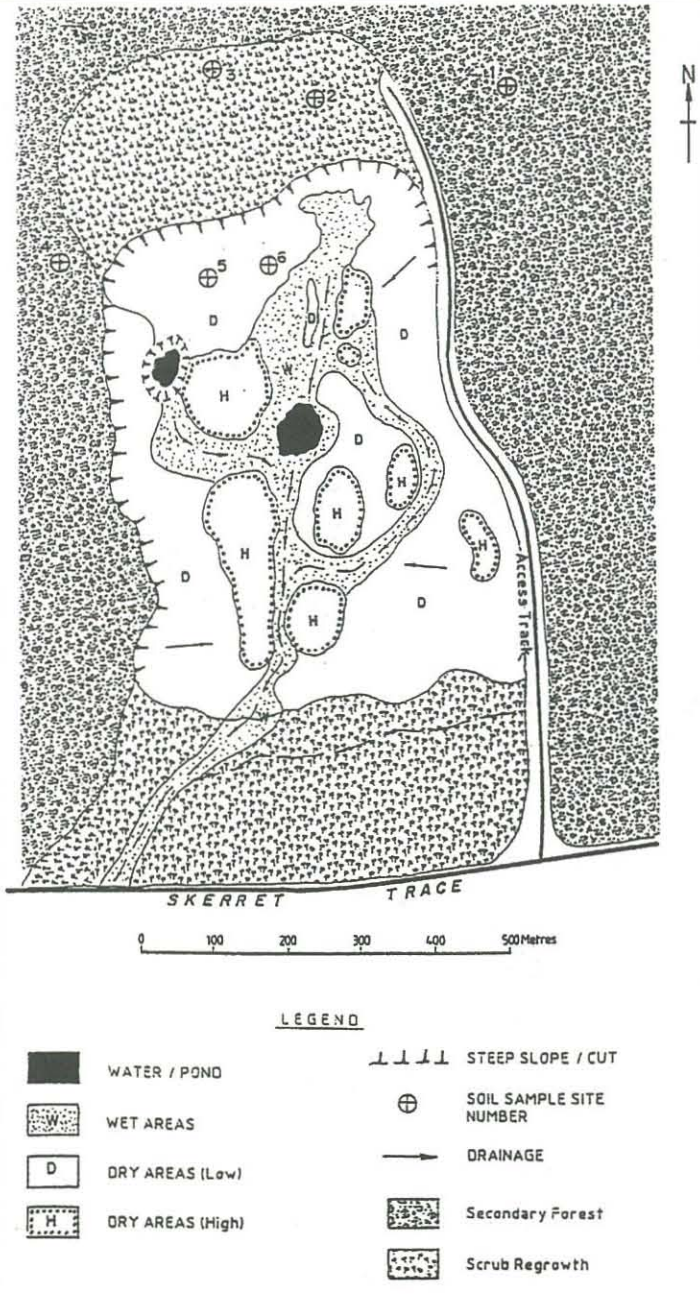

Figure 2. Surface features at Garibdass quarry, Trinidad, W.I. (Adapted from Jackson 1993).

METHODS

The vegetational survey was conducted in November 1992. At all sites, both test and control, the vegetation was classified into categories according to habit (growth form). The following categories were used: shrub or tree (ST), vine or epiphyte (VE) and herbaceous (H). The reference used for the correct spelling of botanical names is the checklist (unpublished) for the Flora of Trinidad and Tobago available at the National Herbarium. The citation for the botanical names used in this paper can be found in the published Flora of Trinidad and Tobago (Williams, R.O. *et al.* 1928-).

At each study site six soil samples, to a depth of 20cm, were taken that reflect the various topographical features. One of the six samples at each site came from under forest cover. The analysis of the samples was carried out at the U.W.I., Soil Science Department, St. Augustine.

OBSERVATIONS

A. VEGETATION

Garibdass and Yeates

As the topographic features at Garibdass quarry complex (Fig. 2) and Yeates deep quarry (Fig. 3) are very similar and with the two sites in close proximity and within the same vegetation type, i.e., Crappo-Guatecare Association, direct comparisons can be made. If we relate the habit types at these two sites to topographic features the patterns shown in Table 1 emerge.

Table 1. Habit types versus topographic features at Garibdass and Yates quarries, Trinidad, W.I.

		Habit* (No. of species)		
Area	**Topography**	**ST**	**VE**	**H**
Garibdass	ridges	**38**	12	21
Yeates	ridges	**30**	13	24
Garibdass	dry ground	9	5	**18**
Yeates	dry ground	21	6	**30**
Garibdass	depressions	4	2	**20**
Yeates	depressions	6	1	**25**

* ST = shrub or tree; VE = vine or epiphyte; H = herbaceous

Table 2. Families and species versus topographic features at Garibdass and Yates quarries, Trinidad, W.I.

Area	Topography	Families	Species
Garibdass	ridges	40	71
Yeates	ridges	33	67
Garibdass	dry ground	23	32
Yeates	dry ground	24	57
Garibdass	depressions	16	26
Yeates	depressions	16	32

It can be seen from the table that shrubs and trees (ST) are the predominant feature on ridges at the two quarry sites while herbaceous vegetation (H) is the dominant growth form on dry ground and in depressions. If we look at family and species numbers at the two sites, it is evident that ridges are species-rich and dry ground and depressions are species-poor as shown in Table 2.

At the two sites, ridges are topographic features of least disturbance in the quarried area and represent land where sand and gravel deposits were thin over clay. Therefore, they were ignored by the quarry operators. The most important families here are the Compositae (Composites), Gramineae (Grasses), Guttiferae, especially *Vismia* (Kiskidee), Melastomataceae (Melastomes) and Rubiaceae, especially *Isertia* (Wild Ixora). Although the Cyperaceae

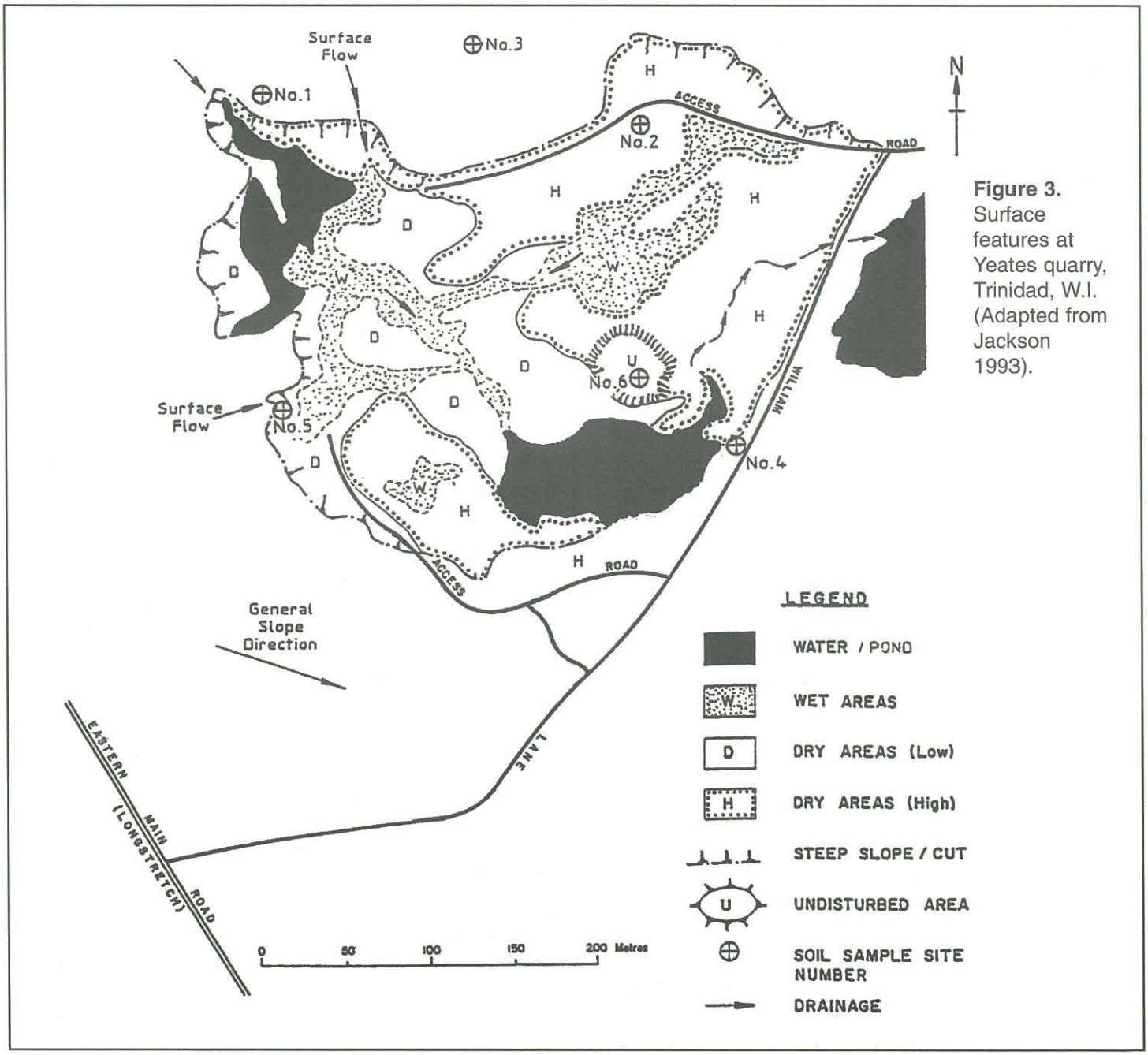

Figure 3. Surface features at Yeates quarry, Trinidad, W.I. (Adapted from Jackson 1993).

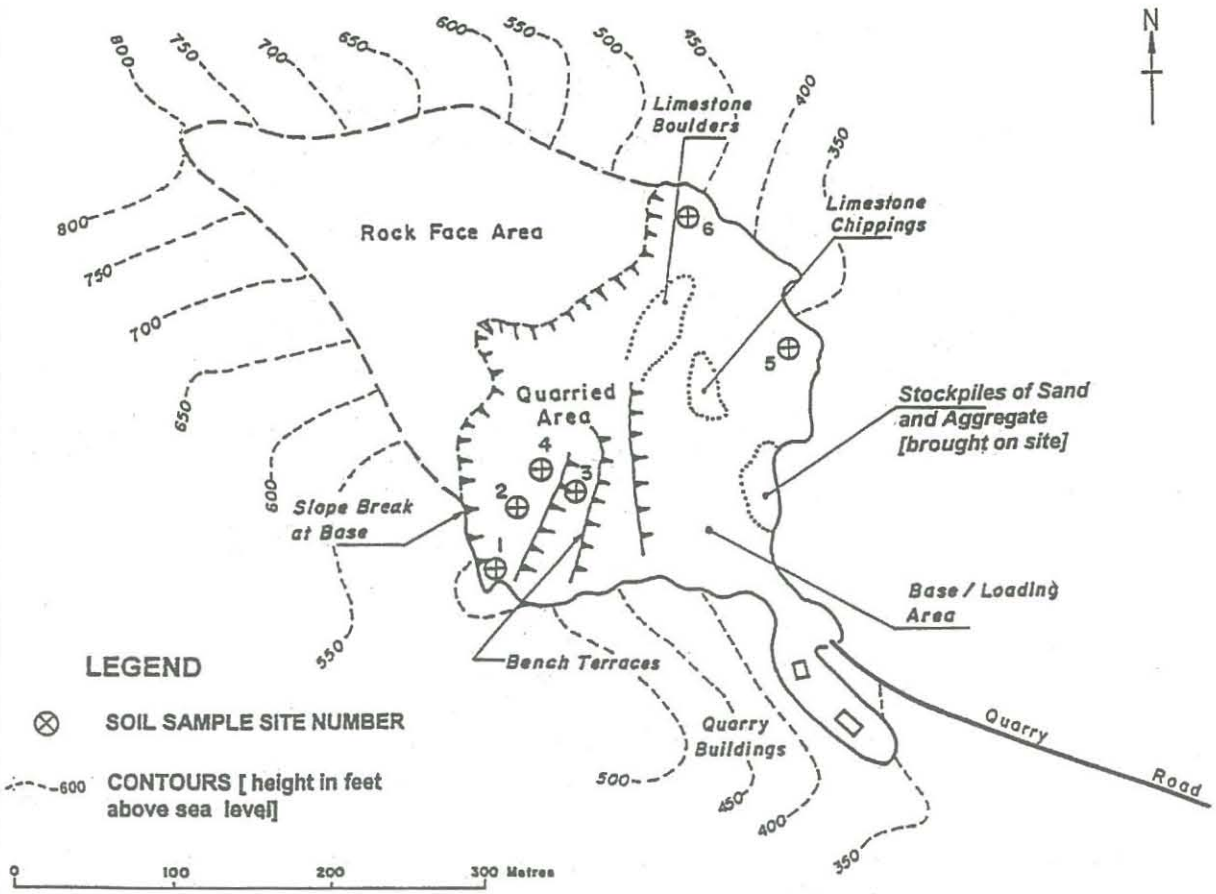

Figure 4. Surface features at Bartholomew's quarry, Trinidad, W.I. (Adapted from Jackson 1993).

Table 3. Soil analysis of samples collected from Garibdass, Yeates and Bartholomew's quarries, Trinidad, W.I.

Sample Location	Sample Lab Number	pH Units 1:2.5 Soil Water Soil Rx.	Cation Exchange Capacity cmol/kg	Exchangeable Cations				Extractable			Available P (Trong)	Organic Carbon	Total Organic Matter	Total Nitrogen
				Ca	Mg	K	Na	Al	Fe	Na				
				cmol/kg				mg/kg			mg/kg	%	%	%
GARIBDASS														
Secondary forest	1	4.8	2.83	0.03	0.04	0.03	0.03	0.00	0.10	0.00	14	0.66	1.13	0.003
Depression	2	4.5	4.54	0.02	0.14	0.05	0.03	0.00	0.00	0.00	14	0.58	1.00	0.002
Ridge	3	4.5	3.69	0.05	0.08	0.03	0.07	0.00	0.00	0.00	19	1.06	1.82	0.005
Ridge	4	5.1	1.70	0.05	0.07	0.04	0.05	1.90	0.60	0.02	19	1.34	2.30	0.005
Ridge	5	4.9	3.40	0.02	0.03	0.03	0.10	0.00	0.00	0.00	16	0.61	1.05	0.003
Depression	6	5.1	2.83	0.03	0.04	0.05	0.07	0.40	0.30	0.30	24	0.13	0.23	0.002
YEATES														
Ridge (high ground)	1	4.5	3.40	0.01	0.05	0.04	0.06	0.00	0.00	0.00	16	0.48	0.83	0.002
Ridge (high ground)	2	4.5	4.54	0.01	0.04	0.04	0.05	0.00	0.30	0.00	19	1.06	1.82	0.003
Forest (western margin)	3	4.5	1.97	0.16	0.06	0.04	0.26	0.00	0.00	0.10	10	0.41	0.71	0.002
Depression	4	5.4	1.97	0.03	0.03	0.03	0.03	0.00	0.00	0.20	10	0.13	0.23	0.000
Dry ground (gravel heap)	5	5.0	4.26	0.02	0.05	0.04	0.05	0.00	0.00	0.10	10	0.66	1.14	0.000
Ridge (isolated)	6	4.6	3.40	0.01	0.03	0.04	0.04	0.00	0.00	0.00	19	0.23	0.39	0.000
BARTHOLOMEW'S														
Forest (old bench trail)	1	4.5	3.12	2.10	0.13	0.03	0.10	0.00	0.00	0.00	trace	0.53	0.91	0.025
Quarry terrace	2	6.9	1.11	2.20	0.09	0.03	0.33	0.00	0.00	0.60	4	0.21	0.36	0.004
Quarry slope	3	8.0	0.54	2.36	0.08	0.03	0.14	0.00	0.00	0.00	14	0.58	1.00	0.004
Quarry terrace	4	8.2	2.54	1.00	0.09	0.03	0.13	0.00	0.00	0.00	7	0.58	1.00	0.010
Sediment outflow	5	8.2	0.54	2.00	0.09	0.03	0.09	0.00	0.00	0.40	4	0.53	0.91	0.002
Rubble slope	6	5.4	2.26	0.11	0.06	0.04	0.03	0.00	0.00	0.10	14	0.96	1.67	0.004

(Sedge) family has a large number of species on ridges they are all rare. When the vegetation on ridges at the two sites is compared, we find that 55% of the species from this topographic feature at Garibdass also are found on the ridges at Yeates while 58% of the species on ridges at Yeates also occur on ridges at Garibdass. Similarity values of greater than 50% are considered to be high.

Dry ground, i.e., gravel heaps and flats, at the two Valencia sites, as compared to ridges and depressions, is intermediate in terms of elevation and numbers of families and species. On dry ground the most important families are the Gramineae, especially *Andropogon*, and the Melastomataceae. Comparing the vegetation on dry ground from the two study sites, 63% of the species at Garibdass also are found at Yeates whereas only 35% of the plants at Yeates occur at Garibdass. This greater species diversity on dry ground at Yeates may reflect better environmental conditions with respect to soil moisture and seed source, or a lack of uniformity in the sampling.

When considering depressions at the two quarry sites, wet conditions prevail with periodic flooding and, in the case of Yeates, permanent surface water. The depressions are dominated by herbaceous vegetation, in dense mats at Yeates, but are species-poor when compared with the other topographic types. The most important family is the Cyperaceae (Sedges) with *Cyperus haspan*, *Eleocharis* and *Rhynchospora* being prominent species and genera. Where flowing water occurs, *Tonina fluviatilis* (Eriocaulaceae) grows vigorously and seems to be a good indicator of unpolluted water. Around one of the large ponds at Yeates, *Leersia hexandra* (Cascadoux Grass) forms dense swards at the water's edge. Other wet indicator species at the two sites include *Utricularia juncea* (Bladderwort) and *Xyris caroliniana* (Xyridaceae). Fifty percent of the species found in depressions at Garibdass also occur at Yeates while only 41% of the depression plants at Yeates are growing at Garibdass. This difference is attributable to the wetter conditions at the deep quarry site.

Bartholomew's and the Control Sites

With a different location, topography and parent material, Bartholomew's hillside quarry (Fig. 4) becomes more difficult to compare with the sites at Valencia. For this reason two additional hillside quarries were chosen as controls so more meaningful comparisons could be made. One of the control sites is located on the west side of Maracas Valley behind the Caribbean Union College and is identified in this study as the Union College quarry. The elevation at the base of this quarry is 90m above sea-level. It has been abandoned for some time and rehabilitation work by the Forestry Division began there in 1986. The other control site is situated in the same area of Santa Cruz Valley as Bartholomew's quarry and has a similar elevation, approximately 105m. This quarry has been identified as La Pastora and appears to have been abandoned since 1987. At the time of the study, portions of Bartholomew's quarry had been abandoned for 12 years.

Most of the plant species growing on vertical rock faces at Bartholomew's hillside quarry are few in number. Only the following are common: *Ochroma pyramidale* (Bois Flot), *Cordia curassavica* (Black Sage), *Pluchea carolinensis* (Geritout) and *Pteris vittata* (Fern). All of the plants here are true pioneer species aiding in the breakdown of the bedrock through the action of their roots which penetrate the cracks and crevices trying to find anchorage. Only a single vine was observed, *Jacquemontia pentantha* (Convolvulaceae). The best represented families are the Compositae (Composites), Gramineae (Grasses), Leguminosae (Legumes) and Polypodiaceae (Ferns). At the Union College control site vines were more prominent on the rock face especially those belonging to the family Leguminosae while at La Pastora the grass *Eragrostis ciliaris* and the fern *Nephrolepis multiflora* were common on the vertical rock surface.

The terraces at Bartholomew's quarry were created in order to stabilize the vertical slope. They contain a relatively large number of herbaceous plants compared to the other growth forms with the Euphorbiaceae (Euphorbs) and Gramineae (Grass) families being prominent in this regard. Two other important families here are the Composites and the Legumes. The presence of *Muntingia calabura* (Elaeocarpaceae) reflects the higher levels of calcium and more neutral pH at the site (see Table 3). At La Pastora control quarry the Legumes *Aeschynomene sensitiva* and *Alysicarpus vaginalis* are common on the dry terraces. No prominent terraces are present at

the Union College quarry.

The rubble slopes in the abandoned portions of Bartholomew's hillside site have very unstable surfaces some of which are well vegetated, others only sparsely so. The loose rubble is easily dislodged making the vegetation cover rather vunerable and subject to burial by minor landslides. The Compositae and Leguminosae Families are the best represented. *Pueraria phaseoloides* (Kudzu), belonging to the latter family, is a common vine together with *Ipomoea nil* (Convolvulaceae). Shrubs and herbaceous plants, however, make up the major portion of the vegetation cover on these slopes. The slopes at the Union College quarry are stabilized by rehabilitation efforts, e.g. *Bambusa vulgaris* (Bamboo), *Gliricidia sepium*, with the Composites and Legumes also being important families here, as well as the Melastomataceae. *Muntingia calabura*, however, is absent from the Union College site.

In the sediment outflow area at Bartholomew's, as was the case on the terraces, herbaceous plants are the predominant growth form. Here, however, the Cyperaceae (Sedge) family is the most prominent, reflecting the wetter conditions, followed by the Gramineae, Leguminosae and Compositae. Vines like *Ipomoea nil* and *Pueraria phaseoloides* (Kudzu) are also common. Frequent deposits of sediment prevent stabilization in this area. No equivalent areas were examined at the control sites.

B. FAUNAL ACTIVITY

Habitats

All three study sites have provided, and are still providing, an environment that sustains wildlife, i.e., plants and animals. Although the natural conditions have been drastically altered by the quarry operations, natural communities still exist in these areas.

Both the Garibdass quarry complex and Yeates deep quarry have small streams flowing through the study area. This aquatic habitat attracts a variety of animals that require wetter conditions in order to survive, for example the tortoises. Yeates also has a number of ponds that were created by the quarry excavations and are now in various stages of stabilization. These provide a habitat for small fish and the plankton upon which they feed (Jackson 1993).

The three quarries also have forest communities in various stages of degradation that are situated within the study area and surround parts of the site. These too serve as habitats for plants and animals including the birds, bats and epiphytes that frequent the tree canopy and the insects and micro-organisms that act as decomposers. Here, there are communities within communities occupying habitats within habitats. At Garibdass quarry, the forest community is severely degraded and broken up into isolated patches. Very few mature forest trees remain at this quarry complex. Most of the trees present are small secondary growth species that have managed to survive where quarry operations were minimal, usually on ground with thin sand and gravel deposits that were not in large enough quantities to warrant excavation. At Yeates, the marginal forest on the north and west boundaries of the study area is all that remains. This forest was badly damaged by fire in recent times and is currently regenerating with second growth species in the understory. Many trees that formed the upper canopy were killed by the fire but are still standing within the forest. The best forest is found at Bartholomew's on the mountain ridge above the excavation site. This forest is mature secondary growth that once was part of a large estate. The forest has been occasionally affected by fire but still has large thriving trees present.

The poorest habitats at the Valencia sites are the gravel heaps and flat dry ground that have little vegetation cover, no trees or shrubs beyond the seedling or sapling stage, no soil or organic matter, and maximum exposure to sun, wind and rain. Even these severely degraded sites support some animal life, for example lizards and insects. At Bartholomew's and the control sites, the poorest habitats are the exposed bedrock surfaces where little chemical or physical weathering has taken place. The simplest forms of life here are the lichens that are attached to the rock surface and the mosses that start to accumulate soil.

Observations of Animal Life

The Valencia Wildlife Sanctuary is the habitat for a number of lowland forest birds as well as mammals and reptiles. Some of the mammals reported for the area include *Mazama americana* (Red Brocket Deer), *Tayassu tajacu* (Quenk or Wild Hog), *Dasyprocta*

agouti (Agouti) and *Dasypus novemcinctus* (Tattoo or Armadillo) while some of the reptiles are *Tupinambis negropunctatus* (Matte), *Iguana iguana* (Iguana), *Geochelone denticulata* (Morocoy or Tortoise) and various species of snake (IUCN 1982). At the upper end of the Santa Cruz Valley the same variety of animal life can be found except that the birds are more likely to be highland forest dwellers. One addition to the mammals would be *Agouti paca* (Lappe) while the Brocket Deer may be absent (IUCN 1982).

During the course of the field work a number of observations were made concerning animal activity. Either direct sightings took place or indirect evidence was encountered. Although mammals are usually difficult to see, evidence of their presence is not, as they leave tell-tale signs in their droppings, footprints and browsing, e.g. nibbled fruits and seeds.

At Garibdass quarry complex, mammal observations included the Tayra or Highwoods Dog (*Eira barbara*) near the stream flowing from the study area as well as some Brocket Deer tracks adjacent to the two-acre detailed sampling site. Bird sightings included a pair of White Hawks (*Leucopternis albicollis)* near the two-acre block and an immature hawk in the vicinity of Tattoo Trace. Evidence of amphibian activity was a batch of frog eggs in one of the intermittent pockets of water inside the two-acre block. At Yeates deep quarry, birds seen were a Great Blue Heron (*Ardea herodias*) and some Tyrant Flycatchers while reptiles included the Caiman (*Caiman crocodilus*). All these sightings were in the pond areas. On some of the higher ground, i.e. ridges and flats, several bird nests were observed in the small trees and taller shrubs as well as the nests of insects, e.g., ants, wasps and termites. At Bartholomew's hillside quarry, large termite nests were seen inside the forest above the excavated site.

DEVELOPMENT OPTIONS: CONSERVATION OF EXISTING FEATURES

Wherever environmental rehabilitation work is undertaken it is important not to remove or destroy features of the landscape that can be beneficial to the rehabilitation process and which might be incorporated into the development proposals for the site. This would apply to both physical and biological aspects of the area such as bodies of water, rocky escarpments and outcrops, and patches of vegetation that may not have been too severely damaged during the period when the site was being exploited for whatever purpose. The relic vegetation may contain plant species of the original natural community and hence will be a valuable seed source for recolonizing other areas of the site. These patches of vegetation may also harbor animals that can assist in seed dispersal as well as micro-organisms that can improve soil conditions.

Garibdass

All the ridges at this abandoned quarry site which are well elevated and covered in dense vegetation containing trees and shrubs should be left undisturbed in the rehabilitation process. This also applies to portions of the stream edge that are well vegetated. At the time of the study, the Garibdass quarry had been abandoned for approximately ten years and nature had made little progress in revegetating the most disturbed parts. Those areas, therefore, that have dense well-established vegetation should not be tampered with in the light of the slow recovery rates. The relic trees in the area also should be left standing for the positive role they play in maintaining environmental quality.

Yeates

At Yeates deep quarry, the ponds that now have dense fringes of vegetation around their borders and beyond should be left alone. One of these ponds had good water quality with a thriving population of small fish (Jackson 1993). The fire-damaged forest that partially surrounds the quarry should be allowed to regenerate naturally. Even the tall dead trees in this community should be left standing so that the organic matter they contain will be recycled within the stand.

Bartholomew's

The limestone quarry has an excellent second growth forest stand covering the ridge above the excavation area. This forest should be kept intact for proper watershed management. Parts of the forest are already threatened by shifting cultivators.

REVEGETATION UTILIZING NATIVE SPECIES

If the three abandoned quarries were left to their

own devices, soil would develop over a period of time and plant communities would undergo succession to reach a state of dynamic equilibrium with their environment. The severity of the disturbance will determine the rate at which recovery takes place. The Valencia sites, especially Garibdass, are very retarded in their natural development whereas Bartholomew's shows signs of a faster recovery owing to the more favorable environmental conditions that exist there. In order to speed up rehabilitation at these sites and increase their potential for resource management, the following development options are recommended.

Garibdass can be developed for agroforestry or a mixed forest stand. In order to determine which is the better choice, experimental plots should be set up to test each option and a control site set aside to monitor progress in the test plots. Initially, a ground cover of herbaceous species would be planted in the experimental plots to be followed later by shrubs and trees. A time frame of ten years is proposed for this development.

Two options are suggested for Yeates abandoned quarry. The first proposal is to develop the site for recreational or commercial ventures and the second is to initially use the area as a landfill site then later develop it for agroforestry or mixed forest. With the risk of toxic contaminants in a landfill, perhaps the former would be the preferred choice.

The best option for Bartholomew's limestone quarry is to leave it alone and let it recover naturally to a wooded hillside. If development is to be considered, then the area has some potential for residential or commercial buildings.

In the light of these options, revegetation of the sites using native plants is now considered bearing in mind that some introduced exotic species could be part of the rehabilitation plan. These non-native species, however, are beyond the scope of this study.

Garibdass

All the areas at the Garibdass quarry complex that have sparce vegetation cover should be re-contoured in order to facilitate the setting up of experimental plots where agroforestry and mixed forest stands can be established. These areas would include the gravel heaps and flats that constitute dry ground at the site. In addition, those sparsely vegetated depressions that are periodically flooded should be converted to permanent ponds with inflow and outflow channels. Areas where dense vegetation now occurs on ridges or borders streams should be left alone. In altering the terrain for the experimental plots, the gravel heaps could be levelled and dry hollows filled in to create a gently undulating land surface with appropriate drainage channels. Tailings (pitrun) from the hillside limestone quarries could be utilized by mixing this material with the sand and gravel spoils at Garibdass. Once these engineering works are completed, the revegetation of the site can commence. Initially only an herbaceous ground cover is needed in order to stabilize the surface and prevent erosion. Vines and grasses together with some legumes are suitable as early colonizers. All of these plants occur naturally at the site and could be utilized in the early stages of rehabilitation. These include:

Mandevilla hirsuta (vine)
Mikania micrantha (vine)
Mikania scabra (vine)
Davilla aspera (vine)
Andropogon bicornis (grass)
Andropogon selloanus (grass)
Homolepis aturensis (grass)
Paspalum virgatum (grass)
Desmodium adscendens (legume)
Mimosa pudica (legume)
Banisteriopsis leptocarpa (vine)
Nepsera aquatica (herb)
Pterolepis glomerata (herb)
Sauvagesia erecta (herb)
Passiflora laurifolia (vine)
Coccocypselum guianense (herb)
Achetaria guianensis (herb)
Cissus erosa (vine)

One plant to be avoided in this early stage because it tends to form dense cover and is difficult to eradicate, is the fern *Dicranopteris pectinata.* It is important to utilize a mixture of plants and not create pure stands of one species. The greater the diversity, the healthier the stand which in turn speeds up recovery. There will also be a tendency for other species, even shrubs and trees, to colonize the plots. This should not be discouraged as it will enhance the diversity of the

site.

Once a good herbaceous cover is in place soil conditions will start to improve and native woody plants can be introduced into the section designated for mixed forest while agroforestry species can be established in the section set aside for that purpose. Early successional native trees and shrubs that are already found at the abandoned quarry site include:

Ochroma pyramidale (Bois Flot)
Cordia curassavica (Black Sage)
Terminalia amazonia (White Olivier)
Alchornea triplinervia (Honeywood)
Maprounea guianensis (Petite Feuille)
Vismia cayennensis (Black Kiskidee)
Vismia guianensis (Kiskidee)
Vismia laxiflora (Kiskidee)
Lacistema aggregatum
Byrsonima coriacea (Serrette)
Cecropia peltata (Bois Canon)
Pisonia eggersiana (Jiggerwood)
Isertia parviflora (Wild Ixora)
Trema micranthum

These species will want to be encouraged in the mixed forest plot but kept in check in the agroforestry section. *Trema micranthum* is a multi-purpose species that in addition to reafforestation can be used for shade, wood, pulp and fodder. It is particularly useful as a pioneer species on poor soils in barren areas (BOSTID 1980).

As time progresses, later successional native trees will become established in the mixed forest experimental area either on their own or through artifical regeneration. These species too are already growing at the abandoned quarry:

Didymopanax morototoni (Jereton)
Tabebuia stenocalyx (Wild Calabash)
Protium guianensis (Incense)
Diospyros irensis (Bois Charbon)
Erythroxylum carthagense
Clusia palmicida (Matapal)
Ormosia monosperma (Jumbie Bead)
Henriettea multiflora (Sardine)
Virola surinamensis (Cajuca)
Euterpe precatoria (Manac Palm)
Parinari campestris (Bois Bande)
Amaioua corymbosa (Camayung)
Laetia procera (Bois Toucan)
Simarouba amara (Marouba)

In addition to those listed above, some of the original forest trees still found in this area could be planted at the site in the later successional stages. These include *Mora excelsa* (Mora), *Pentaclethra macroloba* (Bois Mulatre), *Carapa guianensis* (Crappo), *Oenocarpus bataua* (Palma Real) and *Manicaria saccifera* (Timite) all of which are important socio-economic species.

Yeates

In considering the first option for this site where it would be developed as a recreational or commercial venture, it would be necessary to enhance the areas around the existing ponds. If the ponds are to be used for fishing, then fast growing shade trees, e.g., *Samanea saman* (Saman), should be planted and boardwalks constructed to minimize damage in the wetter sections of the site. Dense vegetation already exists around some of the ponds and should be left undisturbed as this forms an effective buffer zone and protects the quality of water in the pond . Where sparsely vegetated gravel heaps and flats occur some landscaping will be required and should follow the same format as already proposed for the Garibdass quarry. Once these areas have been graded, then a revegetation plan can be put into effect. Here the object is to create an environment that is conducive to recreational pursuits. Therefore, unpleasant vegetation, species that are thorny, urticating or poisonous must be kept out. As an additional bonus, that would enhance the recreational value of the area, the forest on the north and west sides of the site should be protected and made accessible with nature trails.

Conversely, if the site is to be developed as a commercial venture to raise tropical fish or caiman (BOSTID 1983a) in the ponds or for using the water in the ponds for horticulture in order to grow orchids or cut flowers, e.g., Anthuriums and Ginger Lilies, then controlled access to the ponds must be maintained to protect the quality of the water. In the case of horticulture where a lot of infrastructure, i.e., covered garden beds or greenhouses, would be required,

then the sparsely vegetated dry ground at the site could be levelled to accommodate these facilities.

Pursuing the option of initially utilizing the area for a landfill site would preclude eventually using the site for recreational development. Instead, the land could later be developed as an agroforestry or mixed forest stand. The landfill option is attractive because of the shortage of space for refuse dumps in Trinidad. Also the ponds at the site contain only surface water and are not connected to any aquifers (Jackson 1993) thus making them suitable for landfill. The overpopulated east-west corridor needs additional landfill sites, especially at its eastern end to accommodate the expanding communities of Arima and Sangre Grande. Site preparation to convert the area for landfill would require utilizing the gravel heaps already present as overburden to bury the rubbish. In addition, a buffer zone of vegetation, fast growing trees and shrubs, would be needed to segregate the area from the public and control access to the site.

Once the area's capacity for landfill has been exhausted, then the terrain must be prepared for conversion to agroforestry or mixed forest. To begin with, most of the land will already be level following the landfill phase so little landscaping will be needed. Revegetating the area would follow the same procedure as described for Garibdass quarry and require an initial cover of herbaceous plants before the site is ready for agroforestry or mixed forest. Nearly all the native species that were listed as ground cover plants for revegetation at Garibdass are also presently growing at Yeates, the only exception being *Davilla aspera,* a vine which was not picked up in the survey at the latter site. Two additional candidates found at Yeates , can be placed on the list of herbaceous plants, namely *Odontadenia nitida,* a vine, and *Hyptis atrorubens,* an herb.

Following the initial revegetation phase, either agroforestry species can be introduced or natural succession to a mixed forest can be encouraged. If the latter option is followed, then early successional native trees and shrubs will become established either naturally or through artifical regeneration. Again, many of the species already listed for Garibdass are also growing at Yeates. In addition to these, the following early successional native trees and shrubs found at Yeates can be included in the list: *Eupatorium odoratum* (Christmas Bush), *Pisonia salicifolia* (Jiggerwood), *Flemingia strobilifera* (Wild Hops) and *Pithecellobium jupunba* (Puni). The latter two are legumes.

As the mixed forest community becomes more stable, late successional species will become the dominant plants. About half of the late successional native trees recorded at Yeates also were found at Garibdass. In addition, the following species occurring at Yeates can be placed on the list: *Chrysobalanus icaco* (Fat Pork), *Clusia nemorosa* (Matapal), *Pisonia cuspidata* (Jiggerwood), *Hirtella paniculata*, a small tree belonging to the Rosaceae family, and *Calliandra guildingii* (Niaure). Other *Calliandra* species in the tropics have been recommended for soil improvement and reafforestation projects as they can grow well on marginal soil and tolerate extended dry spells. They also compete successfully with course grasses when the latter dominate the vegetation cover (BOSTID 1983b).

Bartholomew's

This hillside quarry presents the fewest problems in terms of rehabilitation. With environmental conditions here being more favorable, a faster natural recovery takes place. Aside from stabilizing the rock face to ensure that no rock falls occur, the area at the base of the quarry, which includes spoil heaps and sediment outflow, could be restored to some extent. After levelling the basal area, herbaceous cover will quickly stabilize the spoil material which should contain enough calcium (see Table 3) to prevent acidic conditions. Grasses will be one of the early invasive species along with Composites, Euphorbs and Legumes. As a result, no ecological rehabilitation effort is needed at this initial stage of plant succession.

Once the herbaceous cover is well established at the base of the quarry, it may be desirous to speed up recovery in this area. Some of the early sucession native shrubs and trees, already present at the site, could be planted here. These include:

Ochroma pyramidale (Bois Flot)
Cordia curassavica (Black Sage)
Eupatorium odoratum (Christmas Bush)
Pluchea carolinensis (Geritout)

Muntingia calabura
Hura crepitans (Sandbox)
Cassia fruticosa (legume)
Coursetia arborea (legume)
Flemingia strobilifera (legume)
Cecropia peltata (Bois Canon)
Ficus yoponensis (Figuier)
**Psidium guajava* (Guava)
Lantana camara (Kayakeet)
* non-native but naturalized

Muntingia calabura grows well where limestone deposits occur (BOSTID 1980). It is abundant at the limestone quarries in the Arima Valley, and occurs at La Pastora and Bartholomew's quarry in the Santa Cruz Valley. It was absent, however, at the Union College quarry which may indicate that limestone is no longer present at this site or that chance dispersal has favored other species.

Additional early succession shrubs and trees found at La Pastora control site that could be included in the above list are *Croton gossypiifolius* (Bois Sang), *Citharexylum fruticosum* (White Fiddlewood), and the legumes *Aeschynomene sensitiva* and *Crotalaria retusa* .

With an abundant seed source from the nearby forest, late succession native trees would be able to establish at the base of the quarry. Species for consideration here that were not found in the forest above the quarry but were recorded for the control sites include *Erythrina pallida* (Wild Immortelle), *Platymiscium trinitatis* (Roble), *Carapa guianensis* (Crappo) and *Genipa americana* (Juniper). The former two are legumes and were found at La Pastora while the latter two were recorded for the Union College quarry.

In their study of the Lady Young Quarry (McClean Monument), the Trinidad and Tobago Field Naturalists' Club's Botany Group (Quesnel *et al.* 1996) found the legumes *Lonchocarpus punctatus* and *Coursetia arborea* (see list above) growing well at the site.

ENVIRONMENTAL IMPACT OF REHIBILITATION

Engineering Works and Landscaping

During the early phases of rehabilitation when the terrain at the abandoned quarry site has to be physically altered in order to improve the area for revegetation, some of the problems normally generated during quarry operations will be repeated, e.g. noise, dust, contamination of ground and surface water, obstruction of surface drainage. Steps, therefore, need to be taken to minimize the harmful effects generated by this activity.

Noise levels are the most difficult to control as heavy machinery, bulldozers and graders, will be needed to move and recontour suface material. In the test sites covered by this study, the Valencia quarries are remote from large population centers and residential areas. Some housing does occur in the vicinity of Bartholomew's hillside quarry but this is the area requiring the least amount of rehabilitation work.
Dust is a problem in the dry season which is a more favorable time for rehabilitation work as it minimizes erosion of surface material by heavy rainfall. Dust levels can be controlled to some extent by periodically spraying the rehabilitation area with water.
Contamination of ground and surface water can be avoided if drainage is channelled into temporary sediment ponds during the physical rehabilitation. As both the Valencia sites have streams flowing through them and Yeates has several ponds, these will have to be protected from harmful sediments by constructing temporary barriers along their borders to prevent an influx of contaminated water. If the establishment of ponds in the sparsely vegetated depressions at Garibdass is to be one of the rehabilitation options, these could initially serve as sediment collecting areas.

In recontouring the land, proper drainage will be an essential part of the landscape design. Unnecessary flooding of well-vegetated lowland should be avoided by constructing an effective drainage system that can handle varying amounts of rainfall. Inadequate drainage will have harmful effects on the plants, especially trees that cannot tolerate prolonged inundation.

Revegetation

When considering this aspect of rehabilitation work, in terms of environmental impact, care must be taken to ensure that the species introduced are compatible with their new environment. For example,

some hillside trees, like *Cordia alliodora* (Cypre), do not grow well in lowland regions while other species, such as *Machaerium robinifolium* (Saltfish Wood), do well in drier habitats and avoid wetter areas (Quesnel *et al.* 1996).

Special caution and attention should be given to exotic or non-native plants. When these are removed from their original habitat where they have existed in harmony with their environment as either neutral or benificial species and placed in a new setting where natural controls are no longer in place, they may become detrimental, usually as invasive species growing out of control or escaping into other parts of the region where they can pose a threat to agriculture. This problem is more likely to occur when native species are ignored in the rehabilitation process as has happened in the Forestry sector. When rehabilitation to a mixed forest is being considered as an option, there are lots of good native species to choose from as indicated in this study. In terms of agroforestry, the indigenous choices are more limited as most of the food crops, orchard and plantation species grown in Trinidad have been introduced from other parts of the world.

In assessing the environmental impact of revegetation at the three study sites attention should be given to public access to the area, to visual impact and to pollution control. Access to the site will be determined by what type of development option is chosen. At Garibdass, public access should be restricted if mixed forestry or agroforestry are being considered. Fire, predial larceny, squatting and uncontrolled cutting, e.g., slash and burn, have been and will continue to be serious environmental threats in Trinidad. If any reafforestation program is to succeed then these detrimental practices have to be curtailed. Squatters have already moved onto land adjacent to the study sites at Garibdass and Yeates.

Access to Yeates will need to be restricted only if the landfill option followed by agro- or mixed forestry is chosen. The recreational or commercial options will require that public access be controlled to minimize excessive visitor impact on the environment around the ponds and adjacent forest. In the wetter areas this can be done by the use of well-maintained boardwalks while in the forest clearly marked nature trails can reduce visitor impact.

Visual impact at the study sites can immediately be enhanced by removing all the derelict machinery, abandoned vehicles and rubbish that has accumulated in the areas. The visual impact with respect to revegetation will be aesthetically pleasing to a greater or lesser extent depending on the option, greater in the case of recreational fishing and nature trails, less so with respect to horticultural development. Visual impact will be a problem only in the case of the landfill option. Here remedial measures can be taken by fencing the area with fast growing ornamental shrubs or small trees.

Pollution control measures need to be taken to assure the quality of water in the streams at the two Valencia sites and in particular in the ponds at Yeates. The success of the recreational or commercial ventures at this latter site will depend on a good supply of fresh water. The ponds should be continually tested and monitored in order to maintain high standards of water quality. With respect to the landfill option, strict pollution control measures will be required to prevent contamination of nearby rivers e.g., the Quare. The types of waste material dumped at the site will have to be carefully controlled. Toxic chemicals, radioactive material, heavy metals, e.g., lead from batteries, and other known harmful waste products should not be dumped at the site as these may later cause serious contamination problems.

ADDITIONAL REHABILITATION MEASURES

Research

More research work is needed on rehabilitation of quarried land in the tropics. The local campus of The University of the West Indies could be the venue for this work in Trinidad. One student research project at St. Augustine has identified five tree species as good initiators of succession at abandoned quarry sites. These are *Acacia mangium, Leucaena leucocephala, Citharexylum fruticosum* (White Fiddlewood), *Muntingia calabura* and *Coursetia arborea.* These species are fast growing deep- rooted evergreens with a high leaf fall and produce abundant seed. They can colonize the poorest land surfaces, even bedrock. These trees are able to set in motion a self-sustaining nutrient cycle which in turn can benefit other plants that are in close proximity. The object is to circumvent

the costly process of reintroducing topsoil to a degraded site. Other species that can short circuit the slow process of succession need to be identified.

Drainage

Revegetation should never be initiated until proper drainage has been established at a site. This ensures that no erosion or flooding will damage the vegetation cover. The problems encountered at the Arena sand pit in this regard and the high financial cost incurred (Ramdial 1983) should serve as an effective warning to those involved in quarry rehabilitation.

Existing Vegetation

Do not tamper with existing well-vegetated areas at the rehabilitation site. These serve as useful seed sources and habitats for a variety of wildlife from birds to micro-organisms. The temptation may be to start from scratch with the rehabilitation work and bulldoze all existing features. This attitude should be avoided. Make use of what is available and incorporate these features into the rehabilitation plan.

Inter-agency/Ministry Co-operation

There needs to be more co-operation between government ministries and agencies that deal with quarry rehabilitation. The Ministry of Energy as the principal advisory agency to quarry operators needs to work more closely with the Forestry Division, the principal agency responsible for rehabilitation work. For example, the Ministry of Energy has received little or no directive from Forestry as to back filling operations at the quarry sites. The Ministry of Energy, therefore, has not given firm directives to the quarry operators on this matter.

Native Species

Nature does not produce useless species. Too often the attitude has been that unless a tree has timber value, then it must be treated as "bush" or a weed and chopped down. Many of these 'useless species' have unknown attributes that contribute to the maintenance of dynamic plant communities (Comeau 1991). In plant succession, as a component of rehabilitation work, all species have importance whether as soil builders, e.g., mosses, or habitat engineers, e.g., climax species. The sooner it is understood the important roles they play the faster the possibility of solving the problems associated with the rehabilitation of derelict land.

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Abundance and Seasonal Migration of Birds at the Port of Spain Sewage Ponds

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ABSTRACT

The Port of Spain sewage ponds offer an opportunity to study wetland birds in a relatively constant habitat. Twenty-five visits were made between 1985 and 1986, and all species or seen or heard along a standard route were recorded. Of 107 species recorded, 55 were associated with the sewage facility and 34 with the surrounding mangrove. The remaining species utilized both habitats. The species list included 58 residents, 40 non-residents and nine species with both migrant and resident populations. The presence of Black-necked Stilts throughout the year with nesting in June and July was confirmed. Late or early dates are recorded for Least Sandpiper, Spotted Sandpiper, Red Knot, White-rumped Sandpiper, Black Tern, Prothonotary Warbler, American Redstart and Barn Swallow. Local movement is suspected for the Yellow-breasted Crake.

INTRODUCTION

Wastewater treatment ponds are often areas with rich avian diversity as they provide a man-made wetland with a continuous supply of nutrients. As wastewater is generated in areas of high population density, treatment facilities may serve as small sanctuaries with abundant food and no hunting. In Trinidad and Tobago there are three sewage treatment facilities which support high populations of wetland birds: Port of Spain and Trincity sewage ponds in Trinidad and the Bon Accord sewage facility in Tobago.

The composition of the bird communities in Trinidad's wetlands is well documented. Checklists have been published for Caroni swamp (Bacon 1970, ffrench 1977) and Nariva swamp (Worth 1973) and species from all major wetlands considered by Ramcharan and ffrench (1988). A small wetland at Galeota Point was described by (Morgan 1984). There is, however, a lack of baseline data on the abundance of species other than a subjective assessment given by ffrench (1980,1991). An objective assessment was attempted by Ramcharan and ffrench (1988) but the methods and criteria used offer little improvement over ffrench (1980,1991) and they omitted a large number of species which would usually be associated with wetlands. James *et al.* (1984) describe all the wetlands areas of Trinidad but their treatment of the status and distribution of the birds is based on few observations and for many species is contrary to ffrench (1980,1991). No studies have focused on the seasonal composition of wetland birds. However, ffrench (1980, 1991) compiles sightings from a great range of sources, including his own, to present the seasonality of each species.

This study was conducted to document the abundance and seasonality of birds at the Port of Spain sewage ponds and to compare the observed seasonality of migrant species to that described by ffrench (1980, 1991). The Port of Spain sewage ponds pro-

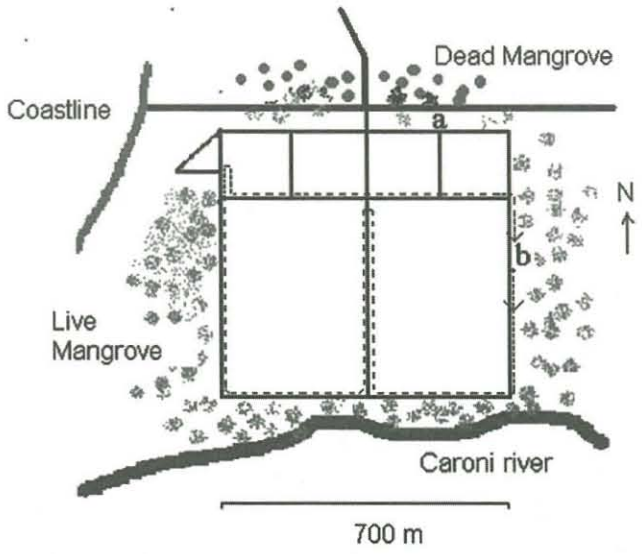


Figure 1. Diagrammatic representation of the Port of Spain Sewage ponds.

vide an excellent site for monitoring migrant waders, being more stable and predictable than the natural habitats that it approximates. There are no tidal effects and seasonal differences are minimal. Visibility and accessibility are relatively constant.

Description of study site

The Port of Spain sewage processing facility comprises 50 ha, divided into four small and two large ponds, (Figure 1). It was constructed in 1962-1963 and is located just north of the Caroni River mouth and south of Port of Spain (Gerald 1985). The site is surrounded by live mangroves on three sides with dead mangroves to the north. The sea is visible from the northwestern corner. Sewage enters the system into small anaerobic ponds at the north and works its way by gravity to the larger facultative ponds, from which it enters the mangroves and the Caroni River.

Table 1. Resident birds of Trinidad recorded at the Port of Spain Sewage Ponds, October 1985 - October 1986

Species		Frequency of occurrence	Greatest Number	Predominant Habitat
Tachybaptus dominicus	Least Grebe	0.32	8	Pond open water
Bubulcus ibis	Cattle Egret	1.00	>200	Pond and roadside vegetation, pond mudbanks
Nycticorax nycticorax	Black-crowned Night-heron	0.04	2	Mangrove edges
Nyctanassa violacea	Yellow-crowned Night-heron	0.08	4	Mangrove edges
Ixobrychus exilis	Least Bittern	0.04	1	Pond vegetation
Coragyps atratus	Black Vulture	0.88	>30	Dead mangrove
Cathartes aura	Turkey Vulture	0.04	1	Airspace
Buteogallus anthracinus	Common black Hawk	0.32	2	Dead Mangrove
Milvago chimachima	Yellow-headed Caracara	0.24	3	Dead mangrove
Rallus longirostris	Clapper Rail	0.52	7	Mangrove roots
Aramides sp.	Wood-Rail	0.04	1	Mangrove roots
Porzana flaviventer	Yellow-breasted Crake	0.36	10	Pond vegetation
Porphyrula martinica	Purple Gallinule	0.76	18	Pond vegetation and open water
Jacana jacana	Wattled Jacana	0.96	>200	Pond vegetation
Zenaida auriculata	Eared Dove	0.08	>200	All vegetation
Columbina talpacoti	Ruddy Ground-dove	0.96	>20	Roadside vegetation
Leptotila verreauxi	White-tipped Dove	0.64	2	Roadside vegetation
Forpus passerinus	Green-rumped Parrotlet	0.76	10	Mangrove branches
Amazona amazonica	Orange-winged Parrot	0.04	2	Mangrove branches
Coccyzus minor	Mangrove Cuckoo	0.08	1	Mangrove branches
Piaya minuta	Little Cuckoo	0.16	1	Mangrove branches
Crotophaga major	Greater Ani	0.68	5	Mangrove branches
Crotophaga ani	Smooth-billed Ani	0.80		Mangrove, roadside and pond vegetation
Tapera naevia	Striped Cuckoo	0.44	1	Mangrove, roadside and pond vegetation
Chaetura brachyura	Short-tailed Swift	0.08		Pond airspace
Reinarda squamata	Fork-tailed Palm-Swift	0.16		Pond airspace
Anthracothorax viridigula	Green-throated Mango	0.16	1	Mangrove branches
Amazilia tobaci	Copper-rumped Hummingbird	0.44	2	Mangrove, roadside and pond vegetation
Chloroceryle aenea	Pygmy Kingfisher	0.04	1	Mangrove edges
Xiphorhynchus picus	Straight-billed Woodcreeper	0.08	1	Mangrove branches
Synallaxis cinnamomea	Stripe-breasted Spinetail	0.04	1	Pond and roadside vegetation
Certhiaxis cinnamomea	Yellow-throated Spinetail	0.92	6	Pond and roadside vegetation
Sakesphorus canadensis	Black-crested Antshrike	0.36	2	Mangrove branches
Fluvicola pica	Pied Water-tyrant	1.00	5	All vegetation
Arundinicola leucocephala	White-headed Marsh-tyrant	0.88	6	All vegetation
Tyrannus melancholicus	Tropical Kingbird	0.88		Pond and roadside vegetation
Pitangus sulphuratus	Great Kiskadee	0.16		All vegetation
Tolmomyias flaviventris	Yellow-breasted Flycatcher	0.32	1	Mangrove branches
Elaenia flavogaster	Yellow-bellied Elaenia	0.28	2	Mangrove branches
Sublegatus modestus	Scrub Flycatcher	0.20	1	Pond and roadside vegetation
Tachycineta albiventer	White-winged Swallow	0.48	10	Mangrove branches
Progne chalybea	Grey-breasted Martin	0.36		Pond vegetation and airspace
Stelgidopteryx ruficollis	Southern rough-winged Swallow	0.04		Pond airspace
Mimus gilvus	Tropical Mockingbird	0.76		All vegetation
Cyclarhis gujanensis	Rufous-browed Peppershrike	0.52		All vegetation
Molothrus bonariensis	Shiny Cowbird	0.76		Mangrove branches
Quiscalus lugubris	Carib Grackle	0.96	>50	All vegetation and roads
Agelaius icterocephalus	Yellow-hooded Blackbird	0.88	>50	All vegetation and roads
Icterus nigrogularis	Yellow Oriole	0.76	2	Pond and roadside vegetation
Sturnella militaris	Red-breasted Blackbird	0.04	2	Mangrove branches
Geothlypis aequinoctialis	Masked Yellowthroat	0.04	1	Pond and roadside vegetation
Coereba flaveola	Bananaquit	0.12		Mangrove branches
Conirostrum bicolor	Bicoloured Conebill	0.60	6	Mangrove branches
Thraupis episcopus	Blue-grey Tanager	0.48		Mangrove branches
Thraupis palmarum	Palm Tanager	0.08		Mangrove branches
Saltator coerulescens	Greyish Saltator	0.04		Mangrove branches
Paroaria gularis	Red-capped Cardinal	0.04	1	Mangrove branches
Volatinia jacarina	Blue-black Grassquit	0.72	8	Roadside vegetation

Table 2. Resident birds with migrant populations recorded at the Port of Spain Sewage Ponds October 1985 - October 1986

Species		Frequency of occurrence	Greatest number	Predominant habitat
Casmerodius albus	Great Egret	0.60	35	Pond vegetation
Egretta thula	Snowy Egret	0.96	50	Pond mudbanks
Egretta caerulea	Little blue Heron	0.72	15	Pond vegetation and mudbanks
Egretta tricolor	Tricoloured Heron	0.92	14	Pond vegetation and mudbanks
Butorides striatus	Striated Heron	0.96	12	Pond vegetation and mangrove roots
Dendrocygna autumnalis	Black-bellied Whistling-duck	0.60	24	Pond vegetation
Charadrius collaris	Collared Plover	0.20	17	Pond mudbanks, roadways
Himanotopus mexicanus	Black-necked Stilt	0.88	>100	Pond vegetation and mudbanks, roadways
Tyrannus dominicensis	Grey Kingbird	0.04	1	All vegetation

At the time of the study the infrastructure was grossly neglected. This was to the benefit of the bird life. The anaerobic ponds had high levels of sediment, to the extent that an island developed around the inflow pipe that supported wading birds, herons and gulls. Other areas of these anaerobic ponds were covered with a surface crust that supported small sandpipers and plovers. In the large ponds there was no surface scum and in some areas the water looked no different from natural ponds. A wide fringe of vegetation extended into all ponds, including large floating mats of *Paspalum serpentinum*, and *Eichhornia* sp., clumps of the ferns *Acrostichum* sp., *Blechnum* sp. and *Ceratopteris* sp. and an exotic *Typha* sp. This was particularly so in the southwest pond where a considerable area was covered with a thick stand of the *Acrostichum* sp. Other vegetation of the ponds and along roadways included sedges, grasses and herbaceous weed species typical of the area.

METHODS

The Port of Spain sewage ponds were visited on 25 occasions between October 1985 and October 1986. The time of each visit was approximately 6:30 am to 9:00 am. The routine on most visits started with an examination of birds at the sewage inlet at point **a,** following this observers traced the path **b – b** described by the dotted line in Figure 1. The observing party ranged from one to six persons; most visits involved two persons. All species seen or heard from the ponds or surrounding mangrove were recorded. During the latter part of the study, an attempt was made to count or estimate the numbers of each species.

For each species, the frequency of occurrence (the number of visits for which it was recorded divided by 25) and the greatest number recorded on any single visit, were used to indicate their abundance. Habitat designation was based on accumulated experience with each species, and aimed to separate the marsh species from those typical of mangrove forest. Habitat categories included: pond airspace, open water, pond vegetation, pond mud-banks, canal edges, roadways, roadside vegetation, mangrove roots, mangrove branches and mangrove edges.

The birds were categorized into resident species (those which breed in Trinidad , but may be absent for part of the year), non-resident species (those which do not breed in Trinidad even if they visit for several months) and species with both resident and migrant populations. Categories were based on ffrench (1991) with minor modification. At the time of the study, the Scarlet Ibis was not known to be breeding in Trinidad and was therefore included with the non-residents. Most of the non-resident species are northern visitors, which represent wintering birds. Some non-breeding

Table 3. Seasonal occurance of resident birds with migrant populations at the Port of Spain Sewage Ponds, October 1985 - October 1986

Species	Date of visit	85.10.06	85.10.13	85.11.03	85.11.12	85.11.17	85.12.06	86.01.19	86.02.02	86.02.16	86.03.15	86.03.29	86.04.06	86.04.27	86.05.04	86.05.18	86.06.01	86.06.07	86.06.22	86.07.13	86.07.24	86.08.09	86.08.30	86.09.14	86.09.21	86.10.05
Casmerodius albus	Great Egret		x		x	x					x			x					x				x			
Egretta thula	Snowy Egret	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Egretta caerulea	Little blue Heron	x	x		x	x	x	x	x	x		x	x			x	x		x	x	x	x	x		x	x
Egretta tricolor	Tricoloured Heron	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x			x	x	x	x	x
Butorides striatus	Striated Heron	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x
Dendrocygna autumnalis	Black-bellied Whistling-duck	x	x	x	x	x			x						x					x	x	x	x	x	x	x	x
Charadrius collaris	Collared Plover																		x	x	x	x		x			
Himanotopus mexicanus	Black-necked Stilt	x	x	x	x	x	x	x	x	x	x			x	x	x	x	x	x	x		x	x	x	x	x	x
Tyrannus dominicensis	Grey Kingbird																										x

Table 4. Non-resident birds of Trinidad recorded at the Port of Spain Sewage Ponds, October 1985 - October 1986

Species		Frequency of occurrence	Greatest number	Predominant habitat
Ardea herodias	Great blue Heron	0.04	1	Mangrove edges
Eudocimus ruber	Scarlet Ibis	0.68	>100	Mangrove roots
Dendrocygna bicolor	Fulvous Whistling-duck	0.52	37	Pond vegetation
Anas discors	Blue-winged Teal	0.16	6	Mangrove edges
Pandion haliaetus	Osprey	0.96	6	Dead Mangrove, Pond airspace
Falco peregrinus	Peregrine Falcon	0.16	1	Dead mangrove, pond airspace
Falco columbarius	Merlin	0.20	1	Dead mangrove, Pond airspace
Porzana carolina	Sora	0.28	2	Pond vegetation
Pluvialis squatarola	Black-bellied Plover	0.16	2	Pond mudbanks
Charadrius semipalmatus	Semipalmated Plover	0.40	10	Pond mudbanks
Arenaria interpres	Ruddy Turnstone	0.16	4	Pond mudbanks and roadways
Tringa solitaria	Solitary Sandpiper	0.40	12	Pond vegetation
Tringa flavipes	Lesser Yellowlegs	0.92	>50	Pond mudbanks
Tringa melanoleuca	Greater Yellowlegs	0.80	4	Pond mudbanks
Actitis macularia	Spotted Sandpiper	0.92	12	Pond mudbanks, Mangrove roots
Catoptrophorus semipalmatus	Willet	0.76	26	Canal edges
Calidris canutus	Red Knot	0.48	70	Pond mudbanks
Calidris minutilla	Least Sandpiper	0.56	>20	Pond mudbanks
Calidris fuscicollis	White-rumped Sandpiper	0.32	5	Pond mudbanks
Calidris melanotos	Pectoral Sandpiper	0.32	15	Pond mudbanks
Calidris pusilla	Semipalmated Sandpiper	0.72	>20	Pond mudbanks
Calidris mauri	Western Sandpiper	0.84	>60	Pond mudbanks
Numenius phaeopus	Whimbrel	0.84	20	Canal edges
Limosa fedoa	Marbled Gotwit	0.04	1	Pond mudbanks
Limnodromus griseus	Short-billed Dowitcher	0.44	100	Pond mudbanks
Gallinago gallinago	Common Snipe	0.12	1	Roadways
Larus fuscus	Lesser black-backed Gull	0.04	1	Pond mudbanks
Larus atricilla	Laughing Gull	0.80	>30	Pond mudbanks
Chlidonias niger	Black Tern	0.60	5	Pond airspace
Phaetusa simplex	Large-billed Tern	0.28	3	Pond airspace
Sterna nilotica	Gull-billed Tern	0.12	2	Pond airspace
Sterna superciliaris	Yellow-billed Tern	0.12	8	Pond airspace
Rynchops niger	Black Skimmer	0.52	3	Pond surface,
Tyrannus savana	Fork-tailed Flycatcher	0.44	10	Pond and roadside vegetation
Riparia riparia	Bank Swallow	0.12	4	Pond airspace
Hirundo rustica	Barn Swallow	0.72	20	Pond airspace and vegetation
Protonotaria citrea	Prothonatory Warbler	0.12	1	Mangrove trees
Dendroica petechia	Yellow Warbler	0.44	6	Mangrove trees
Seiurus noveboracensis	Northern Waterthrush	0.64		Mangrove roots
Setophaga ruticilla	American Redstart	0.28		Mangrove trees

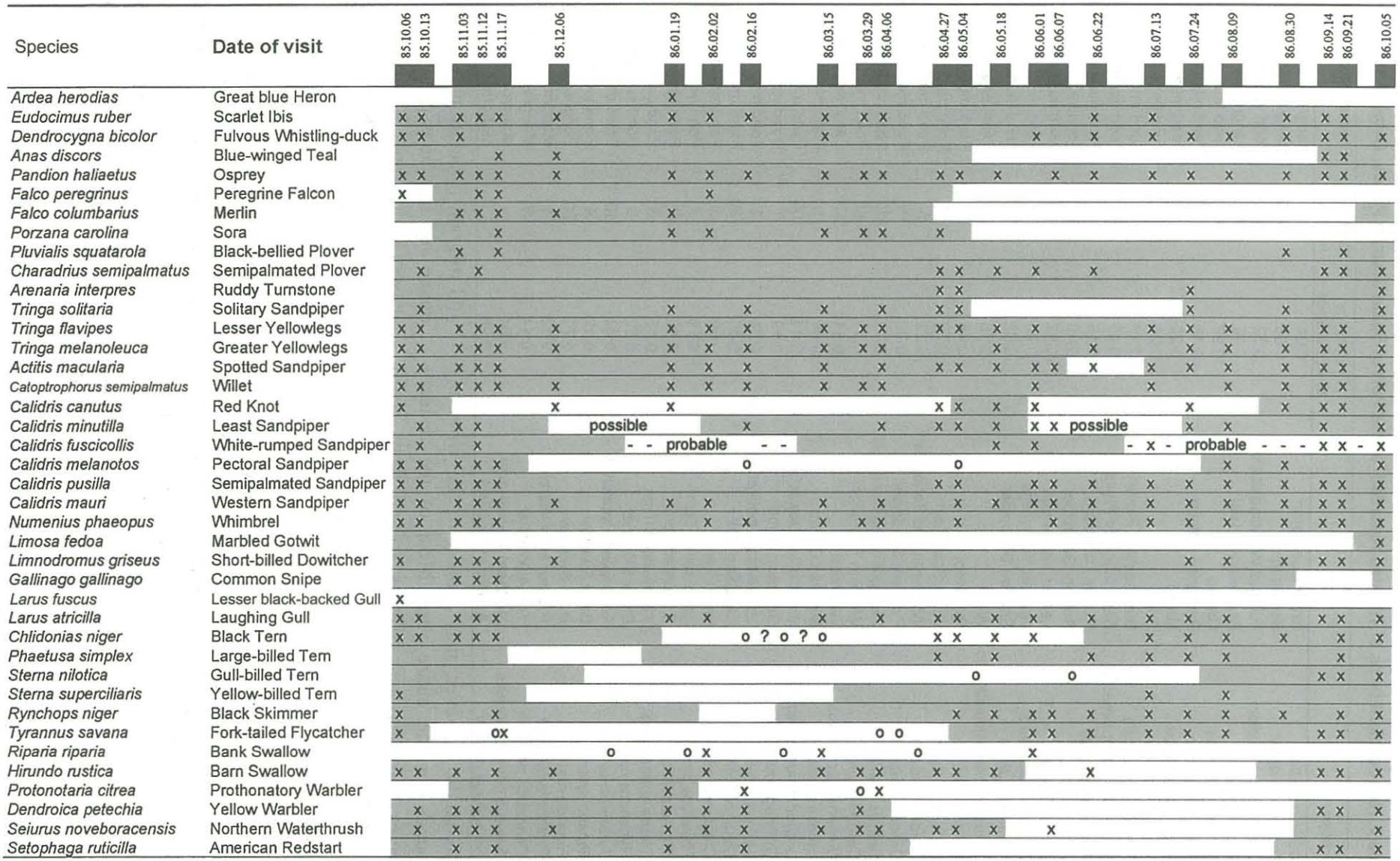
individuals, however, may remain in the wintering grounds for the entire year. Most of the resident species with seasonal influxes arrived from South America.

RESULTS

During the one-year period, 107 species were recorded, seventy-one of which were noted on five or more occasions. Of the 107 species, 55 were associated with the sewage ponds and 34 were characteristic of mangrove forest. The remaining species utilized both habitats. There were 58 resident species recorded at the sewage facility. Their abundance and habitat use is presented in Table 1. Nine species with resident and migrant populations were recorded. Their abundance and habitat is presented in Table 2, and their seasonal occurrence is shown in Table 3. There were 40 non-resident species recorded at the sewage ponds. Their abundance and habitat is presented in Table 4 and their seasonal occurrence, compared with that presented by ffrench (1991), is shown in Table 5. The expected period of occurrence, extracted from ffrench (1991), spans the earliest and latest recorded dates, with individual records in between indicated by an "o".

Three species of interest stand out; the Black-necked Stilt, the Black-bellied Whistling-duck and the Yellow-breasted Crake. Black-necked Stilts were

Table 4. Seasonal occurence of non-resident birds at the Port of Spain Sewage Ponds, October 1985 - October 1986.
Light Shading denotes expected period of occurrence, "o" denotes individual site records.



recorded all months of the year. High numbers (>50) were observed in the months September to December, with numbers gradually diminishing until March 29 and April 6 when no Stilts were seen. In May, there appeared to be an influx of migrants when a flock of 20 apparently exhausted birds (which seemed reluctant to fly off when approached) was recorded, with numbers increasing thereafter. Nesting was observed during June and July. Black-bellied Whistling-ducks were observed on 15 occasions, with twelve records from July to November and three records between December and June. The Yellow-breasted Crake was recorded on nine occasions. Six records were of single birds but between May 18 and June 22, ten, seven and five individuals were recorded.

DISCUSSION

The presence of non-resident migrants closely reflects the previously observed status (ffrench 1991) although this study was for just one year at one location. This demonstrates the value of the sewage ponds as a location for monitoring such species.

The data on the Black-necked Stilt shows the species to be present throughout the year but with highest numbers between May to December. This supports the suggestion in ffrench (1991) that the Stilts "probably migrate to the continent outside of the breeding season." Prior to the development of the Caroni Rice Project, the Port of Spain sewage ponds probably represented a major breeding site for the Black-necked Stilt in Trinidad.

Some local movement is suspected for the Yellow-breasted Crake. All records were of birds seen and there was no apparent change in the vegetation, which could make the birds more visible. It is possible that by the end of the dry season, Crakes were attracted to the ponds as alternative habitat dried out. Crakes are generally difficult to observe and the sewage ponds present an opportunity for more work.

The Black-bellied Whistling duck is described by ffrench (1991) as "resident with some local migration evident, commonest during the wet season". This is confirmed with twelve records from July to November and only three from December to June. However, records of the Black-bellied Whistling-duck are similar to those for the Fulvous Whistling duck. Since they often associate it is possible that they may migrate together. The Fulvous Whistling-duck is described by ffrench (1991) as an occasional visitor. Data from this study suggest that visits of the latter may be increasing in frequency.

Most of the Sandpipers recorded at the sewage ponds regularly overwinter in Trinidad, and it is not surprising that a few non-breeding birds remain throughout the year. Records of the Least Sandpiper extend into June; while this was deemed "possible" (ffrench 1991) there were no previous records for this month. The record of a Spotted Sandpiper on June 22 falls in between the previous extreme dates.

Passage migrants like the Red Knot, White-rumped Sandpiper and Pectoral Sandpiper, are less likely to be recorded throughout the year. The records of each of these migrants reflects their status as passage migrants but with early and late dates for the Red Knot and early dates for the White-rumped Sandpiper. The records of the White-rumped Sandpiper in July, September and October are the first for these months. The White-rumped Sandpipers southward passage through the USA spans July to early December with return passage from April to mid June (Hayman *et. al.* 1986). The records of Red Knots in December and January may represent over-wintering birds. While the Red Knot is considered to be a passage migrant there are populations which over-winter in the southern USA (Hayman et. al. 1986).

Four records of Black Terns from April 27 to June 1 are all earlier than previously recorded, although a "few spring records" have been made (ffrench 1991).

Sightings of the Prothonotary Warbler and American Redstart are later than previously recorded. The Barn Swallow on June 22 is the latest.

Future studies at the Port of Spain sewage ponds should include census counts on migrant birds, and birds of uncertain status. The few individuals recorded during summer months are not as important ecologically as the major influxes each winter. It would be useful to establish the nesting periods of common residents, but the nature of the habitat makes investigation of nests difficult.

As further studies become available it would be interesting to compare the wader community at the sewage ponds with that from freshwater (e.g. Caroni rice project) and estuarine mudflats (e.g. Brickfield).

Future studies would benefit from concentrating on fewer species and the inclusion of census counts, as it is the overall seasonal pattern that should be high-

lighted rather than individual out-of-season sightings. A description of the seasonal changes in the environment will also assist in determining whether a species's absence is due to a lack of appropriate environment rather than a migration pattern.

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Possible Intra-Regional Bird Migration in Trinidad and Tobago

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INTRODUCTION

The position of Trinidad and Tobago at the southern end of the West Indies island chain, linking them to the South American continent, raises some interesting problems relating to bird migration. The best known routes involve species that breed in North America or West Indies and migrate south to or through Trinidad and Tobago during the boreal winter. Because most of these populations have been studied for many years, and also because banding studies, primarily originating in North America, have provided valuable information on the movements of individuals, we are able to form a fairly accurate picture of where these species are at any time of year, and why they move from place to place.

To a much lesser extent we also know something about the regular annual movements of a few species that breed in southern South America and move northward during the austral winter, some of these spending the months from May to September on our islands (Table 1). In this paper I will deal partly with this second group, but also with a third group that comprises birds that breed locally but appear to be absent regularly from our islands for a period each year (Table 2). The main problem with this group is that of course one cannot be sure if the absence of some regularly seen individuals means that they have left the islands for the continent, or have merely moved to another part of the country. It is possible that during the moult (or for some other unknown reason) these birds become more difficult to find. We really know little about exactly what wild birds do during their annual moult. Maybe they just become more reclusive than at other times, giving the impression that they are indeed absent.

Only by making a systematic study of these species, and especially trying to find out where they go during the critical months of apparent absence, can we hope to come to adequate conclusions. Even after 40 years' experience I feel I have hardly been able to do more than make qualified guesses, and it is my hope that this paper, which deals only with land-based species, may stimulate others to focus on this issue. The data here come from my own observations and published records, and in addition I have drawn on information supplied by regularly visiting tour-groups of birdwatchers.

Table 1. Non-breeding visitors from South America to Trinidad and Tobago.

Species	Usually present	
Lesser Nighthawk*	August	- October
Nacunda Nighthawk*	June	- October
White-collared Swift	July	- October
Ringed Kingfisher*	March	- June
Variegated Flycatcher	July	- September
Fork-tailed Flycatcher#	June	- September,
	also November	- February
Swainson's Flycatcher	July	- September
Crested Doradito*	June	- September
Small-billed Elaenia	May	- August
Lesser Elaenia*	May	- August
Blue-and-white Swallow*	June	- September

*There are a few isolated breeding records on Trinidad for these species, some of them possibly suspect (ffrench 1997).
#There are two separate races involved.

NON-BREEDING VISITORS FROM SOUTH AMERICA

The eleven species in Table 1 are mostly uncommon or rare species from the continent that are present during the austral winter months. Occasionally one may breed, but I believe these are unusual occurrences.

The two nighthawks are not particularly rare on Trinidad, and their presumed breeding records in my opinion require further confirmation (ffrench 1997). There is little doubt that the Ringed Kingfisher *Ceryle torquata* breeds regularly on the mainland, probably along its great river-courses. But the five less common

Table 2 Trinidad & Tobago residents that may regularly visit South America

Species	Breeding period			Usually absent		
Swallow-tailed Kite	March	-	August	September	-	February
Plumbeous Kite	March	-	August	October	-	January
Eared Dove	March	-	September	November	-	February (Trinidad)
White-necked Jacobin	January	-	February	? October	-	December
Brown Violetear	February			September	-	November
Black-throated Mango	January	-	July	September	-	November
Ruby-topaz Hummingbird	December	-	June	September	-	November
White-tailed Goldenthroat	June	-	August	September	-	November (?+)
Long-billed Starthroat	March	-	April	September	-	November
Piratic Flycatcher	February	-	August	October	-	January
Caribbean Martin	April	-	July	October	-	December
Red-eyed (Chivi) Vireo	April	-	June	October	-	February (Trinidad)
Swallow-Tanager	April	-	June	October	-	February
Red-legged Honeycreeper	March	-	July	October	-	December

species of flycatchers and the Blue-and-white Swallow *Notiochelidon cyanoleuca* are much more likely to be true southern migrants, moving north to escape the southern winter. In the case of the swallow collected specimens have been only of the southern race *patagonica*, and I strongly doubt the validity of Smooker's 1922 breeding record (1937) at Diego Martin of the nominate *cyanoleuca*, a highland race and unlikely to be breeding near sea-level.

The Fork-tailed Flycatcher *Tyrannus savana* provides an interesting situation, for this species has two separate, identifiable populations that visit Trinidad. The great majority belong to the nominate race, which breeds in southern S. America, migrating to the north of the continent during the austral winter and reaching Trinidad, Tobago and even occasionally Grenada and Barbados. A separate, paler race *monachus* breeds in Venezuela and countries north to Mexico; a few of these turn up on Trinidad between November and February, and may stay on, possibly escaping notice among the far greater number of southern migrants. Some *monachus* birds might even breed on Trinidad, but no records have yet confirmed such speculation.

The large White-collared Swift *Streptoprocne zonaris* is well-known on Trinidad during July to October, when large bands roam the mountains. Its great power of flight enables this species to cover great distances in the course of one day, yet we have little idea where this population breeds. Vagrants occur on both Tobago and Grenada, but the only West Indian breeders are in the Greater Antilles. It seems more likely that those visiting Trinidad come from colonies in the mountains of northern S. America, where it is known to nest behind waterfalls. Of course they may not return from Trinidad to their nests every night; there is speculation that this species could well spend the night soaring high above ground, possibly even sleeping on the wing (Lack 1973).

TRINIDAD AND TOBAGO RESIDENTS

The fourteen species in Table 2 are all known to breed regularly on Trinidad and/or Tobago, but in some cases breeding records are few. Habitats and ecological situations are variable, ranging from hill forest to lowland scrub/savannah and even sea-coast. Some individual analysis is necessary here.

Swallow-tailed Kite *Elanoides forficatus.* Records of its occurrence between September and February are

only occasional. From March to August birds are seen usually in small (or sometimes quite large) groups, and several nests have been found over the last 35 years, usually in forested areas. Isolated records from Tobago show that this species wanders widely. There is evidence of a regular passage through Panama (Ridgely 1976), with occasional vagrants occurring in the northern West Indies (Raffaele *et al* 1998).

Plumbeous Kite *Ictinia plumbea.* A regular breeding visitor, especially common in the south of Trinidad, but also seen over northern forests. It seems to flock mostly on migration, especially in August. Recorded nests have all been in southern forests. It is unclear where this population goes between September and February. As with the previous species, migrating flocks move through Panama in February and again in August. Could "our" birds be involved in those movements? One way to find out might be to band our young birds in the nests.

Eared Dove *Zenaida auriculata.* Unlike the others in this group, this is probably a fairly recent arrival from the continent, since the species was not mentioned by collectors of the 19th century such as Leotaud and Kirk. It has recently colonised some Lesser Antillean islands such as St Vincent and St Lucia (Raffaele *et al* 1998), so is probably expanding its range northwards. Breeding occurs from March to September (and occasionally in other months), and migratory or dispersing movements have been seen on Tobago, at Toco and Soldado Rock mostly in August. On Trinidad the species particularly favours mangroves and adjoining savannahs, but seems to be scarcer from November to February, whilst on Tobago it is widespread in the scrublands of the southwest.

White-necked Jacobin *Florisuga mellivora.* Hummingbirds are particularly difficult birds to monitor, and the provision by people of artificial feeders may well affect their movements or status. This species seems to be resident on both islands, for a few nests have been recorded in January and February; but it is unclear whether they remain in the area during the last three months of the year. A dead bird was found in early November at Pointe-a-Pierre, nowhere near its normal habitat, which implies local movement, if not indeed migration to the continent. (Note. There is also some evidence that a similar forest-dwelling hummingbird on Tobago, the White-tailed Sabrewing *Campylopterus ensipennis* is largely absent during September - December from its breeding-grounds on the Main Ridge. It has been suggested that it moves to lower altitudes on Tobago at that time, but I am not certain whether this has been confirmed. But if it is not on Tobago, where does it go?)

Brown Violetear *Colibri delphinae.* Another high-forest species on Trinidad, conspicuous during its breeding period in the dry season because of its prominent song. Nesting has only been recorded in February. Very hard to find during the later wet season from August to November, when not singing. Does it leave the island?

Black-throated Mango *Anthracothorax nigricollis.* A conspicuous and common species during January to August, when most breeding records occur, but much less common from September to November, although occasional individuals have been seen then (ffrench & ffrench 1977, Feinsinger *et al* 1985). Although the species does breed in higher parts of the Northern Range, it is also common at sea-level, so its scarcity in later months does not seem to involve altitudinal migration. The reason for the departure of this species and others from the islands was thought by Feinsinger and his team to be a food shortage involving nectar-producing flowers during a three-month period from September to November. Presumably such a shortage might vary somewhat annually, which would account for the occasional records of these species during those three months.

Ruby-topaz Hummingbird *Chrysolampis mosquitus.* The situation for this species seems to mirror that for the last, even though on Trinidad its habitat is more limited to lower altitudes than on Tobago. Records are scarce between September and November, whereas it is quite common during its breeding season, especially on Tobago.

White-tailed Goldenthroat *Polytmus guianumbi.* This uncommon species frequents savannahs and scrub, but also appears in suburban gardens, feeding on the

flowers of plants such as *Russellia* sp. and *Lagerstroemia* sp. Its nesting period is clearly later than those of most other local hummingbirds; most nests have been found during the early rainy season on waterlogged savannahs. It is usually scarce from September to March, even though there are a few records between December and March.

Long-billed Starthroat *Heliomaster longirostris.* Although Victor Quesnel (1977) has challenged my previous assertion that this species is uncommon and a probable seasonal migrant, I certainly do not agree with him that it may be "the second most abundant hummingbird on Trinidad"! I do accept that during September to November individual birds may sometimes be found feeding at flowering plants in gardens (but never in significant numbers, compared with, say, Copper-rumped or White-chested Emeralds *Amazilia* spp.). Feinsinger's studies found the species remarkably consistent in its choice of food-source, principally *Erythrina* sp. and *Mandevilla hirsuta*, while Quesnel found a bird or birds in his garden feeding mainly on Ixora. Breeding records in March and April indicate their main period of abundance; I am still not convinced that most birds of this species remain on Trinidad from September through November.

Piratic Flycatcher *Legatus leucophaius.* This common species is well-known from its parasitic dependence on various icterids and other flycatchers, whose nests it appropriates. Its insistent calls, delivered usually from a tree-top, draw the attention especially during February to August; but it may be mainly absent on the continent from October to January, when its call is rarely heard. On the other hand, it is hardly a conspicuous bird when it is not calling. Is it possible that it does not leave, but merely escapes notice by remaining silent?

Caribbean Martin *Progne dominicensis.* Resident in many Caribbean islands from the Greater Antilles south to Tobago (Raffaele *et al* 1998) during January to September, breeding between April and July, this species becomes scarce or absent from Tobago during October to December. It has never been reliably recorded on Trinidad, but most observers believe it to spend the non-breeding season in South America. This assumption, however, needs some positive evidence.

Red-eyed or **Chivi Vireo** *Vireo chivi.* (*olivaceus*) Here there is a particularly puzzling situation, possibly involving up to four different populations, or even different species (ffrench 1991); of these the northern breeders (*olivaceus*) are known to migrate south during the fall through the West Indies, with some birds reaching northern S. America and presumably Trinidad. A closely related population seems to be resident on Tobago (Dinsmore 1972, ffrench & ffrench 1977). Yet another group breeds on Trinidad from April to June, when it is highly vocal, but appears to be absent from October to February, when its song is never heard. It might be helpful to carry out extensive trapping on the Bocas islands, a favourite habitat of the species, during the period October to February, which should confirm its presence or not.

Swallow-Tanager *Tersina viridis.* A regular and conspicuous species in northern Trinidad, breeding from April to June, but records are very spotty during the non-breeding period. Known on the continent to flock when not breeding, so is unlikely to escape notice on Trinidad if present at that time. Its erratic nature is well-known in South America (Ridgely & Tudor 1989); I believe it must leave Trinidad in the off-season.

Red-legged Honeycreeper *Cyanerpes cyaneus.* An attractive and conspicuous resident of both islands, frequenting mainly the high forests, and breeding from March to July (though few nests have been found). Its appearance does seem erratic, by comparison with its congener the Purple Honeycreeper *C. caeruleus*, which can be found in large numbers at the Asa Wright Nature Centre feeders at most times of the year. The Red-legged seems to be absent particularly from October to December, and may indeed leave the islands altogether.

DISCUSSION

Although it is not absolutely certain that the species mentioned above do in fact leave the islands for the continent, it seems at least likely that some of them do. In an equable climate it does not seem reasonable to suppose that adverse weather conditions force them to

depart. The reasons are likely to be based either on food-supply or population pressure. Where in-depth studies have been carried out (e.g. Feinsinger *et al* 1985), the shortage of nectar in certain areas is likely to be the over-riding cause of migration. It is much more difficult to show this in the case of species that live on insects or larger prey.

Population pressure may force species to migrate into Trinidad and Tobago in order to find breeding space, as in the cases of Piratic Flycatcher, Caribbean Martin and Swallow-Tanager. It may also cause emigration because of over-population (e.g. Eared Dove). We find cases of this kind of dispersal coming into Trinidad from the continent (e.g. recent records of continental immigrants into Trinidad like Pied Lapwing, Double-striped Thick-knee and Burrowing Owl). It may well happen the other way too. We know of isolated instances of movements between the islands and Venezuela. On Soldado Rock I found individual birds, such as Ruddy Quail-Dove, Pied Water-Tyrant, *Elaenia* sp. and a hummingbird, that were clearly moving one way or the other (ffrench 1989). I also watched a flock of Lilac-tailed Parrotlets coming over the sea towards Chacachacare from the Venezuelan Paria peninsula. These movements may well be much more common than we think. The circumstances that cause movements may in some cases be temporary, so that "new" species turn up, only to disappear again. There was a recent arrival of the Red-breasted Blackbird on Tobago, but after a few years it seems to have gone, perhaps because of a shortage of genetic variation. Did this also happen in the case of the Oilbirds on Tobago (ffrench 1993), or was that merely a food-foraging influx? In some cases movements may result from ancestral habits formed centuries ago when ecological conditions were different from today. Before we can hazard too many guesses, we need to establish the facts more firmly than I have been able to do.

If the birds are not in fact absent, they may be more difficult to find because they are in moult, a time when it is always more difficult to study birds, because they become more reclusive. Not surprisingly, most ornithologists tend to study species during the breeding season, when they are more active (and therefore more "interesting"). Here again there is much scope for future study. I hope somebody will take up the challenge.

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Comparative Abundance of Birds in Trinidad's Northern Range

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INTRODUCTION

During the years 1961 through 1983 we carried out fieldwork at various locations in Trinidad's Northern Range, trapping birds with mist-nets as part of a study of populations, and in order to obtain information on size, plumage and moult. The following statistics are presented in order to give some idea of comparative species abundance in the area, since little work has been done involving trapped birds in that field since the monumental study by Snow & Snow (1963), which, however, dealt mainly with measurements and was not restricted to any single habitat or district of Trinidad.

The trapping sites were at five forested locations all within 4 miles (6.5 km) of Las Lapas Trail at the watershed of the Range above Lopinot valley, mostly at an altitude of about 2000 feet (660m). Trapping was carried out on 97 days, spread unevenly between 29 January 1961 and 26 December 1983; most of the work was at Las Lapas Trail (58 days), followed by Andrews Trace (22 days), El Tucuche (9 days), St. Pats Estate (6 days) and Asa Wright Nature Centre (2 days). The main work at Las Lapas, over the dates 6 June 1964 to 23 May 1976, had to be halted when a man illegally built a house exactly on the netting site (which was a very narrow corridor at a col). A total of 2080 birds were trapped, involving 94 species.

Because the fieldwork was carried out at somewhat haphazard intervals, fitted into the schedule of a busy life 50 miles away, we have to be careful about reading too much into the statistics. In addition, some species are easier to trap than others, and the proximity of particular feeding areas or display grounds may well have influenced the results to favour certain species. Nevertheless, some useful information can be seen relating to comparative abundance of species, and the times of year when species were trapped is in some cases significant, showing periods when they were present or absent.

To give an idea of when trapping took place, figures are given showing the number of occasions each year:-

1961 4	1968 4	1975 5
1962 10	1969 1	1976 3
1963 4	1970 2	1978 1
1964 5	1971 6	1979 1
1965 6	1972 12	1982 2
1966 15	1973 7	1983 1
1967 2	1974 5	

Trapping took place are mostly in the dry season, since heavy rain makes the operation of nets difficult or even impossible. However, some trapping was carried out in every month of the year, as follows:-

January 7,	July 5,
February 20,	August 1,
March 5,	September 6,
April 20,	October 3,
May 13,	November 4,
June 7,	December 6.

In the table we have omitted scientific names in order to save space. Nomenclature follows ffrench (1991). For each species we show the number of individuals trapped, the months when they were trapped, and the years when they were trapped. Although many species are represented only by single figure totals, for a few there are many more, indicating particular abundance, e.g.

Gray-rumped Swift	110	Ochre-bellied Flycatcher	97
Band-rumped Swift	56	White-necked Thrush	87
Rufous-breasted Hermit	160	Bananaquit	170
Copper-rumped Hum.	52	Green Honeycreeper	60
Plain-brown Woodcreeper	60	Violaceous Euphonia	124
Golden-headed Manakin	139	Bay-headed Tanager	196
White-bearded Manakin	64		

Table of trapped birds

Species	Number trapped	Months when trapped	Years when trapped
Scaled Pigeon	4	Jan - March	70 - 71
Gray-fronted Dove	3	Apr - May	63, 71 - 72
Ruddy Quail-Dove	1	May	64
Lined Quail-Dove	1	Apr	64
Lilac-tailed Parrotlet	2	May, Dec	65
Ferruginous Pygmy-Owl	2	May	61, 73
Short-tailed Nighthawk	1	Nov	67
Gray-rumped Swift	110	Jan - Jul, Oct - Nov	61 - 62, 64 - 66, 69 - 76, 79
Band-rumped Swift	56	Jan - Jun, Oct - Nov	61, 66, 69 - 75
Short-tailed Swift	1	Sep	62
Chapman's Swift	9	Jan, Mar - Apr, Oct	65 - 66, 70 - 71, 74 - 75
Rufous-breasted Hermit	160	Jan - Dec	61 - 62, 64 - 76, 82 - 83
Green Hermit	34	Jan - May, Jul, Nov - Dec	62, 64, 66 - 67, 69-76, 78, 83
Little Hermit	17	Feb, Apr - Jul, Sep-Oct, Dec	62, 64, 66, 71-74, 79, 83
White-necked Jacobin	7	Jan - Mar, May	62, 65, 69, 71, 75 - 76
Blue-chinned Sapphire	32	Jan - Aug, Oct - Dec	62 - 67, 71 - 76, 82 - 83
Ruby-topaz Hummingbird	1	Feb	66
Copper-rumped Hum.	52	Jan - Dec	61-66, 68-69, 71-75, 79, 82-83
White-chested Emerald	40	Jan - Dec	61 - 66, 68, 70 - 74, 79, 82
Black-throated Mango	35	Jan - Jul, Nov - Dec	61-64, 66, 68-69, 71-73, 82-83
Tufted Coquette	3	Apr, Nov - Dec	66, 71, 83
Long-billed Starthroat	2	Feb, May	73, 79
Collared Trogon	1	Mar	65
White-tailed Trogon	1	Mar	62
Blue-crowned Motmot	2	Apr	62
Pygmy Kingfisher	1	Feb	66
Golden-olive Woodpecker	17	Jan - Jun, Sep, Nov	61 - 66, 70 - 72, 76, 82
Chestnut Woodpecker	2	Feb, Apr	61, 64
Red-rumped Woodpecker	4	Apr - Jun, Sep	62, 72 - 73
Cocoa Woodcreeper	7	Mar - Jun	62, 64, 66, 68, 71 - 72
Plain-brown Woodcreeper	60	Jan - Jul, Sep - Dec	62 - 69, 71 - 73, 75, 79
Pale-breasted Spinetail	2	Jan - Feb	68, 73
Stripe-breasted Spinetail	4	Jan, Feb, May, Dec	71 - 72
Streaked Xenops	3	Feb, May	69, 72
Gray-thr. Leaftosser	2	Feb, Apr	62, 64
Great Antshrike	2	May, Dec	71, 74
Barred Antshrike	7	Jan, Apr - May, Nov	63, 66, 73 - 74
White-bellied Antbird	4	Jan - Mar, Dec	70 - 71, 74 - 75
Black-faced Ant-thrush	2	Jul, Nov	67, 72
Bearded Bellbird	13	Feb - Mar, May - Jul, Dec	65, 72 - 76
Golden-headed Manakin	139	Jan - Dec	61 - 72, 75-76, 78-79, 82 - 83
White-bearded Manakin	64	Jan - Jul, Sep, Dec	62 - 72, 75 - 76
Streaked Flycatcher	3	Jan, Apr	61 66
Boat-billed Flycatcher	1	Feb	66
Great Kiskadee	7	Feb - Jun	65 - 66, 68, 72, 82
Dusky-capped Flycatcher	1	May	79
Tropical Pewee	3	Jan, Apr, Dec	66, 71, 82

Species	Number trapped	Months when trapped	Years when trapped
Euler's Flycatcher	4	Feb - Apr, Dec	64 - 66, 73
Yellow-bellied Elaenia	5	Feb, Apr - Jun	66, 68, 72
Yellow-breast Flycatcher	3	Feb, May	69, 73 - 74
White-thr. Spadebill	4	Feb - May	62, 64, 72, 74
Ochre-bellied Flycatcher	97	Jan - Aug, Oct - Dec	62, 64 - 76, 82 - 83
Olive-striped Flycatcher	2	Feb	68, 73
Slaty-capped Flycatcher	5	Feb - Apr, Sep - Oct	62, 64, 66, 72
White-winged Becard	1	Jun	71
Black-tailed Tityra	1	May	66
Gray-breasted Martin	7	Jan, Mar, Jun, Oct	64, 66, 71, 75
S. Rough-winged Swallow	1	Feb	61
Rufous-breasted Wren	11	Feb, Apr - Jun, Nov	66, 70, 72 - 74, 76, 79
House Wren	1	Mar	70
Yellow-legged Thrush	19	Feb, Apr-May, Jul-Aug, Oct-Dec	64 - 66, 71-72, 75
Cocoa Thrush	47	Jan - Sep, Nov - Dec	61-62, 64-66, 70-72, 74-75
Bare-eyed Thrush	12	Mar - Apr, Jul	62, 66 - 68, 70
White-necked Thrush	87	Jan - Jul, Sep - Dec	61 - 67, 69, 71 - 75, 78
Long-billed Gnatwren	5	Feb - May, Dec	62, 68, 70 - 71, 74
Rufous-br. Peppershrike	9	Feb - May, Dec	62, 65 - 66, 71, 73 - 74
Yellow-throated Vireo	1	Apr	71
Golden-fronted Greenlet	8	Apr - May, Jul, Nov	63, 66- 67, 73
Giant Cowbird	1	Jan	71
Crested Oropendola	1	Mar	66
Tropical Parula	1	Apr	82
Northern Waterthrush	6	Feb - Apr, Dec	64, 66, 71 - 72, 75
American Redstart	3	Feb - Mar	66, 75 - 76
Golden-cr. Warbler	23	Jan - May, Jul, Sep, Nov - Dec	62,64-66,69,71-73,75-76,78-79
Bananaquit	170	Jan - Dec	62 - 69, 71 - 75, 79, 82 - 83
PurpleHoneycreeper	45	Jan - Jun, Aug - Dec	62 - 66, 68, 71 - 76, 78 - 79
Red-legged Honeycreeper	8	Mar - May, Sep	61 - 62, 64 - 66, 70, 82
Green Honeycreeper	60	Jan - May, Jul - Aug, Oct - Dec	61 - 76, 79, 82 - 83
Blue Dacnis	12	Feb, Apr, Sep - Oct	61 - 62, 66, 82
Swallow-Tanager	4	May	63, 71
Violaceous Euphonia	124	Jan - Dec	61 - 75, 79, 82 - 83
Speckled Tanager	25	Jan - May, Sep, Nov - Dec	61-63,65-67,69-71,73-74,76,82
Turquoise Tanager	11	Feb, Apr, Sep, Dec	62 - 63, 66, 73, 82
Bay-headed Tanager	196	Jan - Dec	61 - 76, 79, 82 - 83
Blue-gray Tanager	21	Feb - Jun, Sep - Dec	62 - 67, 69, 71 - 73, 79
Palm Tanager	28	Feb - Jul, Oct, Dec	64, 66 - 72, 75, 82 - 83
Silver-beaked Tanager	28	Feb - Jul, Sep, Nov	61 - 62, 65 - 66, 68, 71 - 73
Hepatic Tanager	6	Feb, Sep, Nov - Dec	62 - 63, 67, 72, 75
Red-cr. Ant-Tanager	2	Apr	64, 66
White-shouldered Tanager	1	Apr	82
White-lined Tanager	38	Jan -Feb, Apr - Aug, Oct - Dec	61 - 62, 64 - 66, 68-75, 82- 83
Blue-black Grassquit	3	Jan, May, Nov	72 - 73
Sooty Grassquit	2	Jun - Jul	64, 75
Yellow-bellied Seedeater	4	May, Jul	65 - 66

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Species and Individuals Recorded on Christmas Bird Counts, 1981 - 1990

Ian Lambie and Vishnu Debie
Asa Wright - Nature Centre
Arima Valley
Trinidad and Tobago

The Annual Christmas Bird Counts have been published for the years 1969-1975 and 1981-1983 (ffrench, 1986) and for the years 1976 - 1980 by Lambie and Debie (1998). In continuation of this series of records we present the data obtained for the years 1981 -1990. Methods used for these counts have been given by ffrench (1986).

	SPECIES / YEAR	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1	Little Tinamou	4	2	5	7	7	4	4	6	5	13
2	Least Grebe								4		32
3	Pied-Billed Grebe	12	10	6	1	0					3
4	Olivaceous Cormorant										
5	Anhinga	1	2	2			2				4
6	Magnificent Frigatebird	10	1		6	4	6	6	4		1
7	Stripe-Backed Bittern										1
8	White-Necked Heron										
9	Great Egret	13	8	13	5	18	3	3	2		4
10	Snowy Egret	4	3	1	1	35	10	10			7
11	Green-Backed Heron					6	6	6	6		3
12	Great Blue Heron								1		
13	Little Blue Heron	23	86	22	19	15	13	13	24	20	39
14	Tricoloured Heron	32	38	7	26	12	6	6	40	15	47
15	Striated Heron	4	1	2	12						
16	Cattle Egret	714	795	280	398	200	10	100	388	300	186
17	Black-Crowned Night-Heron										
18	Yellow-Crowned Night-Heron	3				4	27	2	2	3	2
19	Boat-Billed Heron			1	1	3				10	3
20	Least bittern								1		
21	Pinnated Bittern										
22	Scarlet Ibis	5000	3500	3500	2366	7000	3000	3000	2295	2500	4500
23	Fulvous Whistling-Duck	2			6	2	2	2			81
24	Snow Goose				4						
25	American Wigeon		2								
26	Blue-Winged Teal	20	1		6	13	14	14	5	2	3
27	King Vulture										
28	Black Vulture	1133	181	701	644	600	71	71	340	551	742
29	Turkey Vulture	7	7	19	25	35	5	5	19	22	38
30	Gray-Headed Kite	1				1			1	1	1
31	Hook-Billed Kite										
32	Pearl Kite										1
33	White-Tailed Kite					2					
34	Double-Toothed Kite								2	3	2
35	Short-Tailed Hawk				1	4	2	2	2	2	4
36	Zone-Tailed hawk					1	1	1			1
37	Gray Hawk		1	1	3				1		
38	White Hawk	2			2	3	2	2	2	4	5
39	Savanna Hawk	5	6	4	5	5	10	10	6	3	5
40	Broad -Winged Hawk								CW	1	4
41	Common Black Hawk	4	2	4	8	9	3	3	12	8	21
42	Great Black Hawk										
43	Ornate Hawk-Eagle	1	4						1	2	4
44	Long-Winged Harrier					1					
45	Osprey	2	6	8	1	7	2	2	4	8	6
46	Crested Caracara										
47	Yellow-Headed Caracara				1	1			4		1
48	Peregrine Falcon				2	1					5
49	Bat Falcon		1	3	1	1			2	2	2
50	Merlin		1	2	1	1			CW	1	3
51	Gray-Breasted Crake			1	1						
52	Clapper Rail	2	2	2	6		2	2	5	3	
53	Gray-Necked Rail										
54	Sora										
55	Common Moorhen	49	55	38	7	2			1		4
56	Purple Gallinule			4	2	2	23		3		
57	Azure Gallinule								1		
58	Limpkin										
59	Wattled Jacana	38	59	49	32	100	51	51	55	43	39
60	Southern Lapwing	24	15	19	7	57	50	50	49	4	15
61	Semipalmated Plover						3	3			
62	Black-Bellied Plover			22	96		4	4		7	
63	Collared Plover										
64	Solitary Sandpiper	3	3	5	6	5	1	1	3		4
65	Lesser Yellowlegs	8	1	9		6	6	6	4	74	
66	Greater Yellowlegs		7	3	13	4	7	7		10	2
67	Spotted Sandpiper	30	20	41	12	20	4	4	19		10
68	Willet			6	12		27	27		8	33
69	Black-Necked Stilt										
70	Wimbrel				1					3	4
71	Sanderling										
72	Western sandpiper										
73	Least Sandpiper	4		17					5		3
74	Pectoral Sandpiper		5	6							
75	Ruddy Turnstone						1	1			4
76	Semipalmated Sandpiper	40	1	2	3		5	5	CW		
77	Common Snipe	1	1			1					1
78	Short-Billed Dowitcher			1							
79	Yellow-billed tern										
80	Rock Dove										129
81	Scaled Pigeon	5	12	22	12	8	8	8	6	13	12
82	Pale-Vented Pigeon										
83	Eared Dove	8	4	2		9	3	3			2
84	Common Ground-Dove	7	4	4	3	7	6	6	7	20	2
85	Plain Breasted Ground Dove								1		
86	Ruddy Ground-dove	56	58	36	49	200	22	22	152	10	63
87	White-Tipped Dove	1	2	2	2	4	1	1	6	3	1
88	Gray-Fronted Dove	7	1	1	3		3	3	5	2	3
89	Red-Bellied Macaw										
90	Brown-Throated Parakeet										
91	Green-Rumped Parrotlet	33	2	30	11	12	14	14	12	12	15
92	Lilac-Tailed Parrotlet	12	4		7	18	2	2	22	18	67
93	Blue-Headed Parrot	10	6	10	2	4	19	19	6	6	27
94	Yellow-Crowned Parrot										
95	Orange-Winged Parrot	21	75	29	66	61	42	42	47	52	39
96	Mangrove Cuckoo		1	1		1					
97	Squirrel Cuckoo	1		2	3	2			3	5	3

	SPECIES / YEAR	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
98	Little Cuckoo					1					
99	Greater Ani						2	2	1		3
100	Smooth-Billed Ani	35	35	18	34	162	10	10	32	43	52
101	Striped Cuckoo	6			1	2			2		2
102	Barn Owl			1	1	1					2
103	Tropical Screech owl					1			1		2
104	Spectacled Owl					3	1	1	2	4	1
105	Ferruginous Pygmy-Owl	8	4	5	4	7	7	7	6	8	2
106	Mottled Owl								1		1
107	Oilbirds	123	105	50	1	48	59	59	98	102	138
108	Common Potoo				3	15			10	3	4
109	Semicollared Nighthawk		1								
110	Pauraque			1							4
111	White-Tailed Nightjar										10
112	White-Collared Swift										
113	Chestnut-Collared Swift					3					
114	Gray-Rumped Swift		30	12	46	55	31	31	9	51	32
115	Band-Rumped Swift			10	10	20	21	21	1	85	7
116	*Chaetura spp.*										
117	Short-Tailed Swift	3	6	21	37						5
118	Lesser Swallow-Tailed Swift			1	1	2					
119	Forked-Tailed Palm Swift					19					5
120	Rufous-Breasted Hermit	3	4	9	1	3	3	3	3	4	11
121	Green Hermit	4	4	3	4	2	2	2	8	2	3
122	Little Hermit	5	4	5	4	6	1	1	6	5	7
123	White-Necked Jacobin			1	2		2	2	3	1	14
124	Brown Violetear								CW		
125	Green-Throated Mango										
126	Black-Throated Mango	4	2	2	5		3	3	4	3	15
127	Ruby Topaz	1		1		1	1	1			
128	Tufted Coquette	1	1	1	6	5	4	4	1	1	9
129	Blue-Chinned Sapphire	3		4	10	12	6	6	2	3	7
130	White-Tailed Goldernthroat										
131	White-Chested Emerald	12	1	5	8	10	10	10	6	16	15
132	Copper Rumped Hummingbird	9	4	9	23	21	8	8	11	19	16
133	Long-Billed Starthroat	1		1			1	1	2	1	1
134	White-Tailed Trogon	1	1	2	5	4	1	1	3	3	5
135	Collared Trogon	5		1		5			2		5
136	Violaceous Trogon	3		3	4	8	5	5	3	5	8
137	Ringed Kingfisher										
138	Green Kingfisher					1			1		1
139	Belted Kingfisher										
140	Pygmy Kingfisher		1								
141	Blue-Crowned Motmot	2	1	2	2	1	6	6	6	14	8
142	Rufous-Tailed Jacamar					1	36	2	1		2
143	Channel-Billed Toucan	9	17	12	13	13	14	14	7	10	23
144	Goldern-Olive Woodpecker	6	4	3	9	23	1	4	10	7	15
145	Red-Rumped Woodpecker			1					1	6	3
146	Chestnut Woodpecker	2		2	4	1	4	4	3	5	4
147	Lineated Woodpecker	3		2	7	5	4	4	4	9	4
148	Crimpson-Crested Woodpecker										
149	Plain-Brown Woodcreeper	1	2	1	1	5	3			5	1

	SPECIES / YEAR	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
150	Straight-Billed Woodcreeper					2			2		
151	Buff-Throated Woodcreeper	1	2	2	3	6	2	2	3	3	6
152	Streak Headed Woodcreeper					1					
153	Pale-Breasted Spinetail	6	4	1	2	8			2	1	2
154	Stripe-Breasted Spinetail	1			1		1	1		2	7
155	Yellow-Chinned Spinetail	6	2	8	1	6			9	4	3
156	Gray-Throated Leaftosser			2							3
157	Streaked Xenops				1	3			1		2
158	Great Antshrike	2	3	3	7	4	3	3	4	1	5
159	Black-Crested Antshrike	2	3	2		3				1	3
160	Barred Antshrike	12	4	4	5	5	5	5	5	7	14
161	Plain Antvireo	1					4	4	1		2
162	White-Flanked Antwren			3	1	1	3	3	5	2	7
163	White-Bellied Antbird		2	6	3	1			1		1
164	Black-Faced Antthrush	3	4	4	4	9	5	5	5	8	12
165	Bright-Rumped Attila	2	2	1					1		1
166	Black-Tailed Tityra	3		1	4	5	2	2	1	1	12
167	Bearded Bellbird	8	5	6	9	10	6	6	5	8	11
168	Goldern-Headed Manakin	8	5	19	23	34	22	22	25	11	36
169	White-Bearded Manakin	10	5	20	13	23	10	10	40	22	14
170	Fork-Tailed Flycatcher			18							
171	Pied-Water Tyrant	8	12	8	4	6	2	2	4	5	5
172	White-Headed Marsh-Tyrant	19	16	12	5	27	11	11	6	7	11
173	Tropical Kingbird	22	16	19	28	200	14	14	30	44	20
174	Gray Kingbird										
175	White-Winged Becard								1		1
176	Sulphury flycatcher										1
177	Piratic Flycatcher					1					1
178	Boat-Billed Flycatcher	8	3	6	6	10	6	6	2	7	5
179	Streaked Flycatcher	2	1	1	4	2	1	1	1	1	1
180	Varigated Flycatcher										
181	Great Kiskadee	21	17	16	15	13	7	7	24	24	11
182	Dusky-Capped Flycatcher						2	2	2		1
183	Olive-Sided Flycatcher			1	2	2	1	1			1
184	Tropical Pewee	1		3	5	2	1	1	3	1	4
185	Euler's Flycatcher			1	3	3			1	1	3
186	Fuscous Flycatcher										1
187	Bran-Colored Flycatcher								1		
188	Yellow-Olive Flycatcher			1	1				2		3
189	White-Throated Spadebill										1
190	Yellow-Breasted Flycatcher	3	6	2	4	4	2	2	7	4	7
191	Yellow-Bellied Elaenia	6	4	5	1	6	1	1	9	11	9
192	Small-Billed Elaenia					2					
193	Forest Elaenia	2			1	1			1	1	5
194	Short-Tailed Pygmy Tyrant										
195	Scrub Flycatcher								1		
196	Southern Beardless Tyrannulet	1		8		2	1	1	5	3	3
197	Slaty-Capped Flycatcher	2				4	4	4	1	1	3
198	Ochre-Bellied Flycatcher			2	3	8	2	2	2	2	8
199	White-Winged Swallow		1			10	8	8	2	3	6
200	White Wagtail								CW		

	SPECIES / YEAR	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
201	Gray-Breasted Martin	4	54	5	2	13	4	4	3		4
202	S.Rough-Winged Swallow	2	1		8	11	3	3	2	20	2
203	Barn Swallow	73	115	7	4	20	14	14	126	22	1
204	Rufous-breasted Wren	8	8	7	9	11	5	5	13	6	22
205	House Wren	26	5	7	15	9	11	11	18	4	9
206	Long-Billed Gnatwren	8	2	5	1	6		5	3	3	22
207	Tropical Mockingbird	26	10	12	20	16	16	12	46	23	16
208	Yellow-Legged Thrush		1			14					
209	Cocoa Thrush	27	11	8	11	18	2	8	32	40	20
210	Bare-Eyed Thrush	6	2	2	2	8	5	5	5	12	3
211	White-Necked Thrush	2	2	7	3	6	3	3	3	7	6
212	Rufous-Browed Peppershrike	11	7	7	10	7	12	12	26	11	13
213	Red-Eyed Vireo			1					1		
214	Goldern-Fronted Greenlet	2	2	12	17	5	6	6	3	18	27
215	Black-And-White Warbler					1	1	1			2
216	Prothonotory Warbler								1		
217	Tropical Parula	1			6	6	5	5	1	3	8
218	Yellow Warbler	15	2	5	7	5	3	3	11	4	3
219	Blackpoll Warbler										
220	Canada Warbler										
221	Northern Waterthrush	6	2	8	13	2	2	2	9	11	7
222	Masked Yellowthroat								1		
223	American Redstart	5	2	2	4	5	6	6	2	5	5
224	Bay-Breasted Warbler										1
225	Goldern-Crowned Warbler	1	1	5	1	4	4	4	CW	5	15
226	Blackburnian Warbler										
227	Bicolored Conebill	3	9	3	3	14	5	5	13	7	10
228	Bananaquit	41	26	33	75	122	32	32	63	39	44
229	Purple Honeycreeper	16	4	5	41	11	18	18	15	4	27
230	Red-Legged Honeycreeper						1	1		2	
231	Green Honeycreeper	4	2	12	15	12	13	13	19	19	22
232	Blue Dacnis	6		7	9	14	5	5	2	10	10
233	Trinidad Euphonia				1	3	1	1	1	9	5
234	Violaceous Euphonia	12	6	12	21	59	15	15	44	27	27
235	Speckled Tanager	2	4	5	4	1	14	14		4	23
236	Turquoise Tanager	15	14	16	32	48	9	9	22	31	30
237	Bay-Headed Tanager	26	10	26	48	91	50	50	38	31	46
238	Blue-Gray Tanager	12	22	14	31	44	11	11	31	49	30
239	Blue-Capped Tanager						1	1			
240	Palm Tanager	23	17	24	47	51	32	32	19	71	49
241	Silver-Beaked Tanager	11	20	12	24	26	11	11	11	23	14
242	Hepatic Tanager		5	1	4	3	5	6			2
243	Summer Tanager			1		1			1		
244	Red-Crowned Ant-Tanager		4	2	1		1	1	2	3	2
245	White-Lined Tanager	13	10	8	25	34	20	20	21	17	26
246	Swallow Tanager										
247	White-Shouldered Tanager	2	1		6	8	4	4	3		1
248	Grayish Saltator	8			3	6	3	3	6	5	5
249	Streaked saltator										
250	Red-Capped Cardinal										
251	Dickcissel										

	SPECIES / YEAR	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
252	Blue-Black Grassquit	33	6	6	41	60	13	13	33	29	14
253	Sooty Grassquit										1
254	Yellow-Bellied Seedeater										
255	Ruddy-Breasted Seedeater	4		2	1	1			1		
256	Grey Seedeater										
257	Shiny Cowbird	20	52	15	5	11	7		8	10	2
258	Giant Cowbird	15	3	3	9	10	9	7	17	4	3
259	Crested Oropendola	61	59	18	191	127	67	67	72	55	108
260	Yellow-Rumped Cacique	17	16	21	23	10	17	9	4	6	17
261	Carib Grackle	44	640	134	71	200	15	15	96	40	48
262	Yellow-Hooded Blackbird	6	4	7	12	2	4	4	52	2	22
263	Moriche Oriole										2
264	Yellow Oriole	9	4	3	9	14	3	3	13	7	3
265	Red-Breasted Blackbird	7	4	5	7	10	17	10	5	4	3

Year	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Total Number	8400	6509	5814	5205	5175	4380	4370	4969	5059	7737
Total Species	135	125	148	149	162	142	140	161	135	184

Number of different species for years 1969 to 1996 = 265

CW = Count Week

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First Report of The Trinidad and Tobago Rare Bird Committee

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For nearly four decades, reports of rare bird records for Trinidad and Tobago were compiled and evaluated single-handedly by Richard ffrench, who periodically published summaries of such records and incorporated those records into two editions of his comprehensive field guide to the country's birds (see ffrench 1973, 1991, and references therein). During this period many regional committees were established in the more developed countries to evaluate and compile records of rare birds within their jurisdiction. Consistent with this trend, ffrench's efforts to objectively compile and evaluate rare bird records culminated in the establishment of the Trinidad and Tobago Rare Bird Committee (TTRBC) in September 1995.

The TTRBC, which currently comprises seven volunteer members, is an independent organisation governed by a set of bye-laws. In addition to the authors, the initial TTRBC members included Richard ffrench, Davis Finch, Ian Lambie, William Murphy and Victor Quesnel. The primary functions of the TTRBC are to ascertain which records of rare birds in Trinidad and Tobago are acceptable beyond reasonable doubt, to publish periodic reports of TTRBC decisions, and to maintain an official list of birds for Trinidad and Tobago.

METHODOLOGY

The TTRBC solicits details for all reports of species on its review list. Observers are encouraged to submit written reports (accompanied by documentation, if possible, such as photographs, videotapes, tape recordings, etc.) to the TTRBC's secretary, who is responsible for assigning a number to and cataloging each report received, circulating the reports among TTRBC members, and compiling the decisions. Each TTRBC member evaluates whether the information provided in each report is sufficient to support the identification. A record is accepted when a minimum of six members vote for it. For species whose origin is questionable (e.g., escaped cagebird), each member judges whether the bird more likely arrived under its own power or with the aid of humans; a minimum of six votes is required to accept the record as a natural occurrence.

Because the majority of records rejected by the TTRBC lacked sufficient details to support the identification, it is imperative that observers report as much information as possible regarding the record. Nevertheless, we encourage birders to submit records regardless of the amount of information available because rejected records provide information for possible occurrence. We encourage birders to always carry with them a small, hardbound field notebook in which details of unusual bird sightings may be written (Dittmann and Lasley 1992, available from us upon request) and subsequently prepared for submission to the TTRBC. A TTRBC Rare Bird Report Form may be used as a guide for submitting reports, but is not mandatory. Copies of the TTRBC Bye-Laws, Review List and Rare Bird Report Form are available upon request from G. White, the TTRBC Secretary, at the above address.

All records previously accepted by ffrench (1991) are accepted by the TTRBC. Nevertheless, all records remain subject to reconsideration. All records reviewed by the TTRBC are deposited in a permanent archive at the Department of Life Sciences, University of the West Indies, St. Augustine, Trinidad, where they remain accessible to researchers seeking information beyond what is published in periodic TTRBC reports.

In addition to providing a concise overview of the TTRBC's history, objectives and methodology, this inaugural report is intended to provide the results for

the records circulated by the TTRBC during the period of 1996-1998. The highlights of accepted records have been briefly published elsewhere (ffrench and Hayes 1998, ffrench and White submitted).

RESULTS

This report includes 96 records extending from October 1981 to February 1998, based on reports submitted by 27 observers. Of these, 76 (79.2%) were accepted, 18 (18.8%) rejected, and two (2.1%) placed in a supplemental list of species whose identification was accepted but natural occurrence was rejected. The records included 52 (54.2%) from Trinidad, 38 (39.6%) from Tobago, two (2.1%) from the Bocas Islands, and four (4.2%) from St. Giles and Little Tobago.

The following species accounts are arranged in the taxonomic sequence of the American Ornithologists' Union (1998). Each record includes the locality, date(s), observer(s) who submitted a report (except for rejected records), and the TTRBC record number. Details for records published elsewhere are cited. Island abbreviations include: CHA=Chacachacare; LTO=Little Tobago; MON=Monos; STG=St. Giles Islands; TOB=Tobago; TRI=Trinidad; T&T=Trinidad and Tobago. For accepted and supplemental records, the initials of those who found and/or identified the bird and submitted a report are listed first, followed by a semicolon; the initials of others who submitted reports are listed alphabetically by surname (see Acknowledgements). For rejected records, the reason for the verdict is presented.

RECORDS ACCEPTED

Greater Shearwater *Puffinus gravis*. Single birds were seen: 1 km south of Carenage, TRI, 3 Jul 1994 (FH; 1996-2), representing the 1st for the Gulf of Paria (Hayes 1996); several km south of Crown Point, TOB, 3 Jul 1994 (FH; 1996-4), representing the 1st for TOB (Hayes 1996); and several km S of Crown Point, TOB, 29 Jun 1997 (FH; 1998-27), providing the 2nd for TOB.

Manx Shearwater *Puffinus puffinus*. One was seen 19 km N of Grande Riviere, TRI, and 30 km WSW of Crown Point, TOB (11% 01'N, 61% 03'W), 23 Feb 1997 (FH; 1998-21), representing the 4th for TRI (nearest island).

Red-Billed Tropicbird *Phaethon aethereus*. One was seen 8 km N of Las Cuevas, TRI (10% 52'N, 61% 24'W), 3 Jul 1994 (FH; 1996-3), representing the 4th for TRI (see Hayes [1996], who overlooked the record by Morgan [1983]).

Masked Booby *Sula dactylatra*. At least one individual, possibly three adults, were seen at STG, 29 Sep 1995 (Rff; 1996-11). Four adults were seen about 1.5 km N of STG, 20 Feb 1996 (AC; 1996-12). These records constitute the 2nd and 3rd for T&T; the only previous record was from TRI (ffrench 1991).

Red-Footed Booby *Sula sula*. A light-phased adult was seen 17.5 km N of Matelot, TRI, and 35 km WSW of Crown Point, TOB (10% 59'N, 61% 07'W), 17 Mar 1996 (FH; 1998-14), representing the 1st for TRI (nearest island; Hayes 1998).

Cocoi Heron *Ardea cocoi*. Records for TOB include single birds at: Buccoo, 24 Mar 1996 (FH; 1998-16), and Turtle Beach, 12 Jan 1997 (FH; 1998-20), representing the 2nd (Hayes 1998) and 3rd for TOB.

Little Egret *Egretta garzetta*. Records include: one at Buccoo, TOB, 14 Aug 1990 (GW; 1996-34); one at Bon Accord (not Buccoo), TOB, 23 Dec 1993 (FH; 1996-1); one at Speyside, TOB, 7 Nov 1994 (FH; 1996-8); two at Buccoo, TOB, 20 Jan to 26 Mar 1995 (DF; FH; 1996-25, 1998-12); one at Nariva, TRI, 13 Jan 1997 (DF; 1998-1); one at Trincity, TRI, 14 Jan 1997 (DF; 1998-2); one at Buccoo, TOB, 18 Jan to 20 Mar 1997 (DF; FH; 1998-3); two at Trincity, TRI, 16-17 Jun 1997 (FH; 1998-24); one at Nariva, TRI, 31 Aug 1997 (PW; 1998-36); and one at Trincity, TRI, 4 Sep 1997 (PW; 1998-37). All records were of light-phased birds. Several TOB records were reported by Hayes (1996, 1998). This Old World species appears to be increasing in T&T, and may even be nesting. A breeding colony of up to 20 pairs was recently established on Barbados (Raffaele *et al.* 1998).

Eurasian Spoonbill *Platalea leucorodia*. An immature was photographed at Buccoo, TOB, 3 Nov 1986

(WS; 1996-19), representing the 1st for the New World. It was considered a natural vagrant rather than an escaped bird because: (1) it was a young bird unlikely to have spent any time in captivity; (2) the legs were unbanded; (3) no nearby zoos have kept the species; and (4) TOB is an unlikely destination for an escaped bird, but a likely landfall for a trans-Atlantic vagrant. A. James (pers. comm. to WS) stated that two birds had been present.

Black Vulture *Coragyps atratus*. An adult was seen at LTO, 17 Jan 1997 (DF; 1998-5), providing the 1st record of natural occurrence for LTO. Previous LTO records up until 1972 were thought to represent birds released at TOB in 1959 (ffrench 1991).

King Vulture *Sarcoramphus papa*. Single adults were seen soaring above Trinity Hills, TRI, 20 Feb 1994 (GW; 1996-43), and Aripo Savannas, TRI, 14 Jan 1996 (PT; 1996-52). This species appears to be a sporadic vagrant to TRI.

Greater Flamingo *Phoenicopterus ruber*. An immature was seen at Waterloo, TRI, 7-21 Dec 1996 (Rff; GW; 1997-1). Up to four immatures were seen at Waterloo, TRI, 22 Jul 1997 to 26 Jan 1998 (GW; FH, IS, PW; 1998-28). These records represent the 3rd and 4th for TRI.

Black-Bellied Whistling-Duck *Dendrocygna autumnalis*. A flock of over 50 birds, including a group of five chicks, was seen at Buccoo, TOB, 31 Dec 1985 (GW; 1996-41), representing the 1st confirmed record and 1st breeding record for TOB.

Ring-Necked Duck *Aythya collaris*. An immature male and two females were seen at Buccoo Swamp and Lowlands, TOB, 18 Jan 1997, with a female lingering as late as 20 Mar 1997 (DF; FH; 1998-6), representing the 2nd for TOB (the 1st is pending).

Lesser Scaup *Aythya affinis*. A male was seen at Arena Reservoir, TRI, 14 Jan 1995 (DF; 1996-26). Another male was seen at Lowlands, TOB, 20 Dec 1995, representing the 2nd for TOB and 1st since the 19th century (Hayes 1998).

Masked Duck *Oxyura dominica*. Two adult males were seen at Pitch Lake, TRI, 30 Jan 1993 (GW; 1996-40). Two males and a female were seen at Buccoo, TOB, 15 Jan to 22 Feb 1993 (DF; GW; 1996-28), and a female at the same locality on 21 Jan 1995 (DF; 1996-27). These are the 1st records for TOB since the 19th century.

Yellow-Headed Caracara *Milvago chimachima*. An adult was seen at Bon Accord, TOB, 18 Jan 1997 to 11 May 1998 (DF; FH; 1998-10). In both 1997 and 1998 it was observed carrying nesting material, but a potential mate and the nest eluded detection; this is the 1st nesting attempt for TOB since it first appeared in 1987 (ffrench 1991).

Trinidad Piping-Guan *Pipile pipile*. Several birds were seen at Grande Riviere, TRI, 30 May 1997 to present (FH; 1998-23), where they have been seen regularly since 1985 (James and Hislop 1997).

Caribbean Coot *Fulica caribaea*. An adult was seen at Pointe-a-Pierre, TRI, 6 Mar 1994 (FH; 1998-29), which was present for some time before and after (M. Gaskin and K. Sheppard, pers. comm.). A pair was seen at Buccoo, TOB, 30 May to 21 Aug 1997 (BG; FH; 1998-30).

Double-Striped Thick-Knee *Burhinus bistriatus*. One was seen at Orange Grove, TRI, 14 Aug 1991 (GW; 1996-36), representing the 2nd for TRI (ffrench 1993); one was photographed at Petite Trou, TOB, 16 Aug 1995 (ER; 1996-14), representing the 1st for TOB; and one was seen and heard at Wallerfield, TRI, 8 Dec 1996 (Rff; 1997-2), representing the 3rd for TRI.

Wilson's Plover *Charadrius wilsonia*. An alternate plumaged adult was seen at Buccoo, TOB, 27 Apr 1996 (FH; 1998-17), representing the 1st for TOB (Hayes 1998).

American Oystercatcher *Haematopus palliatus*. At Waterloo, TRI, records include two adults, 7 Oct 1995 to 11 Jan 1996 (GW; BO; 1996-48), and five adults, 9 Dec 1996 (Rff; 1997-3), representing the 3rd and 4th records for TRI.

Black-Necked Stilt *Himantopus mexicanus*. Two were seen along the beach at Buccoo, TOB, 19 Aug 1997 (FH; 1998-31), representing the 2nd record for TOB.

Spotted redshank *Tringa erythropus*. A basic plumaged bird was seen at Bon Accord Lagoon, TOB, 13 Feb 1983 (DFi; 1996-15), representing the 1st record of this Palearctic vagrant for T&T (Fisher 1998).

Wood Sandpiper *Tringa glareola*. One was seen at Buccoo, TOB, 18 Jan to 27 Feb 1997 (DF; FH; 1998-7), representing the 1st record of this Palearctic vagrant for T&T. The bird was found earlier in Jan 1997 and photographed (W. Petersen and D. McRae, pers. comm.), but details have not yet been submitted.

Hudsonian Godwit *Limosa haemastica.* Individuals were seen at Caltoo Trace, Nariva, TRI, 15 Sep 1991 (GW; 1996-37) and at Caroni Rice Project, TRI, 27 Sep 1992 (GW; 1996-39). This species has since been removed from the Review List.

Marbled Godwit *Limosa fedoa*. Single birds were seen at Waterloo, TRI, 7-19 Oct 1995 and 10 Mar 1996 (GW; FH; 1996-47), and on 19 Oct 1996 (FH; 1998-19), with the 10 Mar date constituting the only spring occurrence for T&T (Hayes 1998).

Ruff *Philomachus pugnax*. Two immatures were photographed at Buccoo, TOB, 11-14 Aug 1990 (GW; 1996-33), representing the 6th for TOB.

Pomarine Jaeger *Stercorarius pomarinus*. At least two dark, probably immature birds were seen at Crown Point, TOB, 15-16 Jan 1996 (BO; 1996-50), providing the 2nd record for TOB.

Parasitic Jaeger *Stercorarius parasiticus*. A pale, probably immature bird was seen at Crown Point, TOB, 16 Jan 1996 (BO; 1996-51), representing the 2nd for TOB.

Common Black-Headed Gull *Larus ridibundus*. A worn, alternate plumaged adult was photographed between Store Bay and Pigeon Point, TOB, 4-14 Jul 1994 (FH; 1996-5). Details were published by Hayes (1996).

Lesser Black-Backed Gull *Larus fuscus*. A subadult was photographed at the Port of Spain Sewage Ponds, TRI, 6 Oct 1985 (GW; 1996-31), an adult and an immature were seen at Waterloo, TRI, 26 Dec 1993 (GW; 1996-42), and a subadult was seen at Waterloo, TRI, 11 Jan 1996 (BO; 1996-49). These records provid the 5th, 6th and 7th records for TRI. A 1st-winter immature was seen at Buccoo Reef and Turtle Beach, TOB, 15 Jan to 20 Mar 1997 (DF; FH; 1998-4), and an adult was seen at Pigeon Point, TOB, 20 Mar 1997 (FH; 1998-22), representing the 3rd and 4th for TOB.

Black-Legged Kittiwake *Rissa tridactyla*. An immature was seen by many observers at Blanchisseuse, TRI, 17 Feb 1998 (FG; 1998-38), providing the 1st record for T&T and the southernmost for the western Atlantic (Raffaele *et al.* 1998).

Scaled Dove *Columbina squammata*. One was seen and videotaped at Nariva Swamp, TRI, 7 Dec 1996 (RMcN; 1997-4). The only previous record for T&T was from Toco, TRI, in 1929 (ffrench 1991).

Mangrove Cuckoo *Coccyzus minor*. Records for TOB include: one at Buccoo, TOB, 18-19 Jan 1992 (DF; 1998-9); one photographed at Buccoo, TOB, 9-10 Jul 1994 (FH; 1996-6), providing the 1st documented record for TOB (Hayes 1996); and up to three at Buccoo, TOB, 18 Jan to 3 Jul 1997 (DF; FH; 1998-8). The spate of recent records suggests a resident population on TOB, but breeding has yet to be confirmed.

Rufous-Shafted Woodstar *Chaetocercus jourdanii*. An immature female was seen along the Blanchisseuse Rd. (c. 10.25 mile post), TRI, 3 Aug 1995 (Rff; 1996-10). Previous records of this species were mostly immatures or females in the Northern Range (ffrench 1991).

Gray-Throated Leaftosser *Sclerurus albigularis*. Records for TOB include: a nesting female captured and photographed 2.1 km SSE of Castara, 21-22 Mar

1996 (FH; TG, WH; 1998-15); a heard bird 2.1 km SSE of Castara; an observed bird 2.0 km S of Englishman's Bay; and a heard bird 1.0 km SSE of Parrot Hall, all on 20 Aug 1997 (FH; 1998-32). These records provided the 1st for TOB since 1903 (Hayes *et al.* 1998).

Bank Swallow *Riparia riparia*. One was seen at Trincity, TRI, 1 Oct 1994 (FH; 1996-7), providing the earliest date for T&T (Hayes 1996).

Cliff Swallow *Petrochelidon pyrrhonota*. One (not three, as in ffrench and Hayes [1998]) was seen at Trincity, TRI, and two at the Port of Spain Sewage Ponds, TRI, 17 Jan 1995 (DF; 1996-30), representing the 4th and 5th records for TRI.

Chestnut-Sided Warbler *Dendroica pensylvanica*. An immature was seen at Simla, TRI, 13 Jan 1995 (DF; 1996-29), representing the 6th for TRI.

Summer Tanager *Piranga rubra*. An adult male was seen and heard at Waterloo, TRI, 11 May 1994 (GW; 1996-44), providing the latest date for TRI (ffrench 1991).

Scarlet Tanager *Piranga olivacea*. An adult male was seen at Edward Trace near Lagon Bouffe, TRI, 28 Apr 1983 (VQ; 1996-53), representing the 2nd for TRI (ffrench 1991). Another adult male was photographed at MON, unknown date in Apr 1995 (unknown observer, photo given to GG; 1996-13), representing the 1st for the Bocas Islands.

Rose-Breasted Grosbeak *Pheucticus ludovicianus*. A female was seen at CHA, 22 Apr 1995 (GS; 1996-16), providing the 1st record for the Bocas Islands. A male was seen at the Asa Wright Nature Centre, TRI, on 17 Jun 1997 (NN; 1998-11), representing the 3rd for TRI and latest date.

RECORDS REJECTED

Greater Shearwater *Puffinus gravis*. Five shearwaters were seen several km S of Crown Point, TOB, 23 Jun 1996 (1998-18), but the identification was rejected due to poor viewing conditions (see Hayes 1988).

Sooty Shearwater *Puffinus griseus*. An all-dark shearwater was seen sitting on the water 1 km W of Port of Spain, TRI, 29 Jun 1997 (1998-26), but other dark *Pterodroma* sp. or a dark-phased Manx Shearwater *P. puffinus* were not eliminated. There is only one previous record of Sooty Shearwater for TRI (ffrench 1993).

Agami Heron *Agamia agami*. One was identified at Nariva Swamp, TRI, 14 Feb 1998 (1998-39), but the observers were not confident of its identification.

Green Ibis *Mesembrinibis cayennensis*. An ibis identified as this species was flushed from El Soccorro Marsh, TRI, 9 Jun 1988 (1996-23), which would be the 1st for T&T. However, the brevity of observation precludes acceptance.

Blue-Winged Teal *Anas discors*. A female or immature teal was flushed from a puddle on LTO, 7 Nov 1994 (1996-9), which would have provided the 1st record for LTO (see Hayes 1996).

Hook-Billed Kite *Chondrohierax uncinatus*. A light-phased bird was reported from Las Lapas Trace, TRI, 12 Jan 1989 (1996-21), but may have been a misidentified immature Gray-headed Kite *Leptodon cayanensis*.

Rufous Crab-Hawk *Buteogallus aequinoctialis*. A subadult was photographed at Nariva Swamp, TRI, 10 Feb 1996 (1996-17). Two TTRBC members felt that other *Buteogallus* spp. could not be eliminated. However, the record is currently being reconsidered.

Crested Caracara *Caracara plancus*. An adult was seen at the Aripo Livestock Farm, TRI, 26 Apr 1992 (1996-38), but no description was provided.

Rufous-Necked Wood-Rail *Aramides axillaris*. One was reported from the Port of Spain Sewage Ponds, TRI, 29 Mar 1986 (1996-32), but was rejected due to inadequate description. One was briefly seen flying across the road at Pointe Gourde, TRI, 20 Jun 1997 (1998-25), but was rejected due to brevity of observation.

Dunlin *Calidris alpina.* A basic plumaged bird was seen at the Port of Spain Sewage Ponds, TRI, 5 Oct 1992 (1996-24). Although the bird was well described and initially accepted, the circumstances regarding the observation were questioned, resulting in rejection during a 2nd round.

Yellow-Billed Tern *Sterna superciliaris.* A basic plumaged adult was seen at Buccoo, TOB, 23 Aug 1997 (1998-33), which would have represented the 1st for TOB. It was rejected due to possible confusion with Least Tern *S. albifrons* on the basis of its bill colouration.

Red-Shouldered Macaw *Ara nobilis.* An individual was reported from Waterloo, TRI, 20 Oct 1994 (1996-46), but the description did not eliminate the White-eyed Parakeet *Aratinga leucophthalmus.*

Blue-Tailed Emerald *Chlorostilbon mellisugus.* A female was reported from Tunapuna, TRI, 16-17 Sep 1994 (1996-45), but no description was provided.

Rufous-Shafted Woodstar *Chaetocercus jourdanii.* A male was seen at Arena Forest, TRI, 11 Jan 1989 (1996-22), but the circumstances regarding the observation were questioned.

Long-Billed Gnatwren *Ramphocaenus melanurus.* A pair was reported from Englishman's Bay, TOB, 31 Dec 1996 to 6 Jan 1997 (1997-5), which would have been the 1st for TOB. However, the calls were not described, suggesting possible confusion with House Wren *Troglodytes aeodon.*

Prairie Warbler *Dendroica discolor.* An adult male was glimpsed from a boat as it flew past Buccoo Reef, TOB, 4 Oct 1981 (1996-20), which would have represented the 1st for TOB. However, the brevity of observation precludes acceptance.

Sooty Grassquit *Tiaris fuliginosa.* An adult male was seen at Speyside, TOB, 15 Feb 1996 (1996-18), which would have represented the 1st for TOB. However, the underwing linings and calls were not described, suggesting possible confusion with Blue-black Grassquit *Volatinia jacarina.*

SUPPLEMENTARY LIST

Common Waxbill *Estrilda astrild.* Four were seen at Orange Grove, TRI, 18-30 Sep 1990 (GW; 1996-35), providing the 1st record for TRI. A feral population of at least 40 appears to be growing (ffrench 1998).

House Sparrow *Passer domesticus.* A pair was photographed at Caroni, TRI, 28 May 1997 (BG; 1998-35), providing the 1st record for TRI. The origin of the birds is unknown, but it is rapidly colonising South America, with the nearest known locality at La Guaira, near Caracas (Sharpe *et al.* 1997).

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Observations on the Reptiles and Mammals of Chacachacare, Bocas Islands, Notes on Five Species New to the Island

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INTRODUCTION

Chacachacare is the westernmost of the three major Bocas Islands between the Paria Peninsula of Venezuela and the Chaguaramas Peninsula of Trinidad. Despite many visits by zoologists to Chacachacare, much remains to be learned regarding the island's vertebrate fauna. Thus far no amphibians have been recorded from Chacachacare; however, 15 species of reptiles have been reliably reported (Bacon 1973, Boos 1983, Murphy 1997). Only two species of mammals have been reported (ffrench 1967b, Boos and Quesnel 1993). Although the relative abundance of each species of bird was provided by ffrench (1967a, 1967b, 1969), a paucity of information exists on the relative abundance of various reptile and mammal species.

In this note we report our observations on the reptiles and mammals of Chacachacare, including five species new to the island, based on several recent trips to the island. Data on the population ecology of birds on Chacachacare and the other Bocas Islands will be published separately (Hayes *et al.* in prep.).

METHODS

We surveyed lizards at Chacachacare during 2-4 and 9-11 August 1998. All lizards observed were counted during morning hikes starting from the Nun's Quarters along the Salt Pond and Lighthouse trails. These trails are described by Comeau *et al.* (1992). Mammals and reptiles were noted during bird studies on Chacachacare between January 1997 and November 1998. Amphibians and reptiles were identified by consulting Murphy (1997), while mammals were identified by consulting Eisenberg (1989).

RESULTS AND DISCUSSION

In the species accounts below, we include all species recorded thus far from Chacachacare, including those which we have not observed. Census data on lizards are provided in Table 1. Relatively few lizards were seen on 3 October 1998 owing to intermittent rainfall.

Table 1. Abundance of lizards along trails of Chacachcare Island, October 1998.

	Lighthouse Trail		Salt Pond Trail	
Species	**03 Oct**	**10 Oct**	**04 Oct**	**11 Oct**
Gonatodes v. vittatus	12	20	14	5
Hemidactylus sp.	0	1	0	0
Gymnophthalmus speciosus	0	1	0	0
Iguana iguana	*1	0	1	**0
Polychrus marmoratus	0	1	0	0
Mabuya bistriata	0	0	1	0
Ameiva ameiva	0	25	13	12
Cnemidophorus lemniscatus	3	29	25	30

*dead
**egg shells found

Turtles

Eretmochelys i. imbricata. Previously reported (Bacon 1973). We observed turtle tracks, presumably of this species, on a small beach south of La Tinta Bay on 3 October 1998. This indicates that nesting still occurs despite environmental degradation in the Gulf of Paria.

Crocodilians

Crocodylus sp. Not observed; only one previous record (Boos 1983).

Lizards

Gonatodes v. vittatus. Frequently observed during both trips along the Salt Pond and Lighthouse Trails.

Both sexes were sighted.

Gymnophthalmus speciosus. One observed at La Tinta Bay on 10 October 1998.

Iguana iguana. On 4 October 1998, we captured a 1.2 m individual in a hole along the Salt Pond Trail. It was most likely a female since there were no large spines on its back and cracked egg shells were found nearby. A dead individual was found at Stanislas Bay on 3 October 1998.

Polychrus marmoratus. A male was captured along the coast of Stanislas Bay on 10 October 1998.

Mabuya bistriata. Previously unrecorded. On 4 October 1998, we captured an individual of this species resting at the top of a small tree along the Salt Pond Trail. It was about 8 cm SVL, its skin was smooth and the body was flattened dorsally where it was glossy chocolate-brown, with a distinct black stripe running laterally along the body from snout to tail. There was no white border above the stripe as seen in the *Gymnophthalmus specious*. The underside was distinctly white and the legs were short.

Ameiva ameiva. Frequently observed along both trails.

Cnemidophorus lemniscatus. This species was the most frequently observed lizard on the island, all sightings being female. However, we examined a live male specimen captured by Rajendra Mahabir at the lighthouse on 10 October 1998. Our data indicate that the *Cnemidophorus lemniscatus* population is bisexual, with a strong female-skewed sex ratio. Whether females reproduce parthenogenetically, as some unisexual populations apparently do in South America (Murphy 1997), remains to be determined.

The following six lizards were not observed during this study, but have been reported previously on the island:*Gonatodes ceciliae*. *Hemidactylus mabouia*, *Hemidactylus palaichthus*, *Thecadactylus rapicauda*, *Bachia heteropa trinitatis*, and *Anolis chrysolepis planiceps*.

Lizards were considerably more abundant than turtles, snakes or mammals, and would be an ideal group for further studies of their population ecology.

Snakes

Mastigodryas b. boddaerti. Five individual observed during our trips.

Oxybelis aeneus. Previously unrecorded. On 11 October 1998, an individual of this distinctive species was observed in bushes beside the Nuns' Quarters, and the following description was made: long, thin body; large, pointed head; brown above, hint of slight darker blotches; sharply defined creamy underparts; faint blacker line through eye, separating browner head from paler underparts.

Pseudoboa neuwiedii. Previously unrecorded. On 5 November, we captured and photographed a ±0.8 m long snake on a dirt path at La Tinta. It was light brown above and creamy white below, with a distinctly pointed, slightly upturned snout resembling Murphy's (1997) description of a "unique spade-shaped rostral scale". The photograph clearly shows that the dorsal portion of the head lacked the darker brown-black colouration typical of adults from Trinidad (Murphy 1997). The snake did not attempt to bite. This species has been previously reported from Gaspar Grande (Boos 1983), thus its occurrence on Chacachacare is not unexpected.

Mammals

Glossophaga longirostris. Previously recorded by ffrench (1967b). No small, terrestrial species of bats were observed.

Noctilio leporinus. Previously unrecorded. P. Bacon, one of us (Hayes) and students from the University of the West Indies observed a few individuals of this distinctive species fishing at night in Chacachacare Bay in November 1997, 2-4 and October 1998.

Sciurus granatensis. This species was previously reported from the old leprosarium hospital by Ishmael Samad (Boos and Quesnel 1993). On 20 October 1996, one of us (Hayes) observed a single squirrel in the same area. However, none were observed elsewhere on the island. Boos and Quesnel (1993) suggested that these squirrels may be the descendants of escaped pets. Our observations indicate that at least one individual still survived.

Rattus rattus. Previously unrecorded. On 9 October 1998, an unidentified rat was briefly seen at night at the Nuns' Quarters. During the morning of 11 October 1998, approximately 250 m from the Nuns' Quarters in the forest, we observed a brown-coloured rat as it climbed down a tree and ate a seed less than 1m from where we were standing It scurried away as

we attempted to capture it. It was distinguished from *R. norvegicus* by its relatively longer tail and arboreal behaviour (Eisenberg 1989). The occurrence of this introduced species is not surprising given the long history of human habitation.

CONCLUSIONS

Further data on the biodiversity of Chacachacare and other Bocas Islands are needed to better understand the historical and ecological biogeography of the islands. Thus far the only serious attempt at biogeographical analysis was conducted for the tiny Five Islands Archipelago (Temple 1986). Topics which should be addressed include: the routes and timing of colonizations; the effects of island size, topography and degree of isolation on species richness; changes in the composition of the biota (turnover rates); and rates of extinction for various taxonomic groups. Data on density and biomass are needed to better understand the reasons why smaller islands often have higher densities of organisms (density compensation), with reduced competition and predation. From a conservation perspective, population data may enable us to better protect threatened or endangered species.

The impact of humans on the biota of Chacachacare is poorly understood. Islands are highly susceptible to invasion by introduced species (Brown and Gibson 1983). *Sciurus granatensis* and *Rattus rattus*, both of which were probably introduced by humans, apparently occur in low densities and may be confined to formerly inhabited areas; their impact on the native flora and fauna appears to be minimal.

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The Skipper Butterflies (Hesperiidae) of Trinidad Part 10, Pyrginae Completed, Genera Groups F and G

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INTRODUCTION

Two Genera Groups, F and G, are treated in this paper. This completes my treatment of the Trinidad Pyrginae, the second of the three subfamilies of Trinidad Hesperiidae.

All plates of adults include a scale bar of 10 mm, and are collected by, and in the collection of, the author unless otherwise stated.

This series of articles now covers 150 species of Trinidad & Tobago Pyrrhopyginae and Pyrginae, i.e. about half the total number of Hesperiidae. Since I started this series of papers in 1981 much new information has come to light, including species new to science, new island records, new distribution records and new information on food plants and biology. For example, when I listed the Trinidad & Tobago Hesperiidae in 1982, I recognised 272 species of Hesperiidae (Cock 1982c); today I know of 305 species - an increase of 33 (net of one species removed from the list). Of these new island records, 18 have been featured in this series of articles published in *Living World* and 16 (including 5 further Pyrginae) are unpublished.

I reiterate my thanks to Dr C Dennis Adams, Mrs Yasmin Comeau, Bhorai Kalloo and Winston Johnson of the National Herbarium who identified the plants from which I reared Hesperiidae in Trinidad. The following have very kindly assisted in providing access to the collections in their care: Dr George McGavin of the Hope Entomological Collections, Oxford University Museum (HEC), Dr Phillip Ackery of the Natural History Museum (NHM) (formerly British Museum (Natural History)), Dr Mark Shaw of the Royal Scottish Museum (RSM), Mr Scott Alston-Smith to his private collection (SAS), Professor Julian Kenny and Dr Gene Pollard of the University of the West Indies, St. Augustine (UWI).

Once again, I especially thank Scott Alston-Smith who has read and commented on this paper, and provided additional records from his collecting, and observations and food plant records which have not previously been published (indicated as SAS in text).

GENERA GROUP F

Genera Groups F and G are included in Section 2 of the Pyrginae (Evans 1953), as described in Cock (1991). In Section 2 the palpi may be entirely forward pointing (porrect), and the third segment always protrudes in front of the second (Figures 2-3 in Cock 1991), and the forewing cell is generally short, less than two-thirds of the length of the costa and shorter than the dorsum (Figure 1 in Cock 1991).

Evans (1953) characterised Group F as follows. Abdomen shorter than the dorsum of the hind-wing. Antennal club bent before its middle. Under surface of the anterior portion of the forewing more concave than usual, giving rise to the name "batwing" (see plates of adults at rest). Evans (1953) did not know their resting position (wings open or closed), but all the species I have observed in the field rest with their wings held open.

Evans (1953) arranges the 74 American species of group F in 16 genera. The Trinidad fauna includes 16 species in 11 genera, although one of these needs confirmation. Just three species of Group F are found in Tobago. One species treated here, *Anastrus obscurus neaeris* Möschler, is a new record for Trinidad discovered by Scott Alston-Smith.

There is information available regarding the life history or food plants of 11 Trinidad species. All recorded food plants are dicotyledons, and in Trinidad include Annonaceae (*Cycloglapha*), Leguminosae

(*Gesta*), Malpighiaceae (*Chiomara, Ebrietis, Timochares*), Myrtaceae (*Anastrus*), Polygonaceae (*Anastrus*), Rutaceae (*Achlyodes, Helias*), and Verbenaceae (*Chiomara*).

118. F2/1 *Achlyodes busirus negro* Kaye 1921

This species is found from Mexico to Bolivia and Argentina in four subspecies (Evans 1953). *A. busirus negro* is an endemic subspecies in Trinidad. It is characterised by the entirely black male, and the very limited yellow markings UNH in the female. All the mainland subspecies have more extensive yellow or brown markings and are slightly larger.

Kaye (1914, addenda) records a K St A Rogers specimen from Siparia (13.i.1913) as "*Eantis busiris*" (a mis-spelling). Subsequently, Kaye (1921) introduced the name *negro* as a subspecies of *A. busirus* Stoll 1782 when he also records a Sir N Lamont capture from Morne Diable (31.vii.1917). He pointed out the difference in colouring from the mainland subspecies, but neglected to mention that he was naming a new subspecies!

Plate 1. *Achlyodes busirus negro* ♂ on flowers of *Austroeupatorium inulaefolium*, Rio Claro - Guayaguayare Road, 11.x.1993

The male (Plate 1) is completely black above and below, with very indistinct dark brown bands; the black colouring, together with its large size and the shape of the wings (F falcate, bulging outwards in spaces 2-3, H bulging outwards in spaces 2-3), make it unmistakable in the Trinidad fauna. The female is brown above, with dark brown discal and marginal bands (Plate 2); below it is lighter brown with variable yellow markings (Plate 3). I have one female with no yellow markings on the UNS at all (Plate 4). Normally there is diffuse yellow shading on the costa just short of the apex UNF, and on the margin, just above the tornus UNF, and a conspicuous yellow margin in spaces 1C-3 UNH, sometimes with a matching submarginal band linked to the marginal band along veins 2 and 3. The cilia are brown apart from a paler patch UNF margin just below apex. The female is readily recognised by its large size, wing shape, and when present the UNS yellow markings. Illustrations in Barcant (1970, Fig. 4, No. 10, ♂) and Lewis (1973, Plate 80, No. 4, ♀). No costal fold; F ♂ 27 mm, ♀ 29 mm.

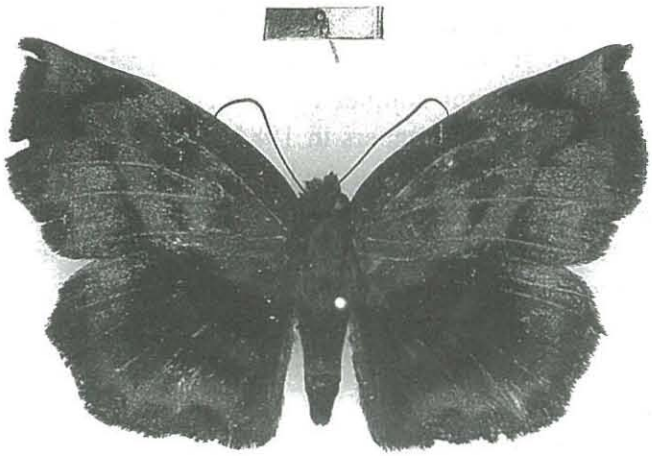

Plate 2. *Achlyodes busirus negro* ♀, Morne Catherine, 28.I.1980.

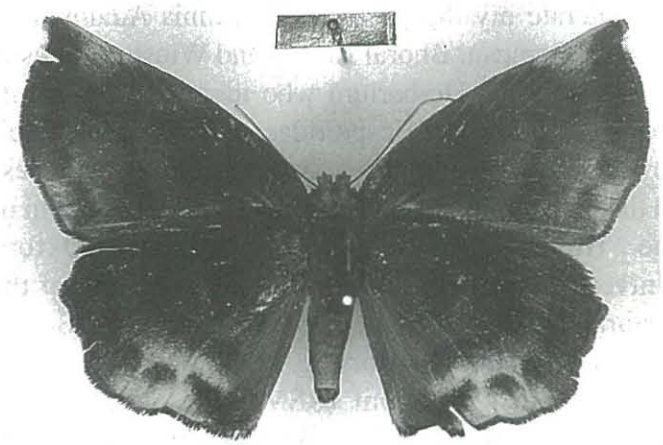

Plate 3. *Achlyodes busirus negro* ♀ UNS, Parrylands, 2.ii.1980

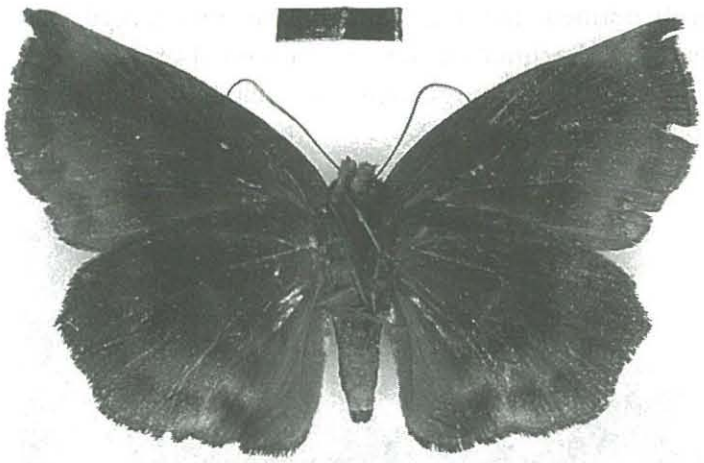

Plate 4. As plate 2, UNS.

This large and distinct species is not particularly rare in forested parts of Trinidad, and can be quite common at times in the South. I have records of more than 16 specimens from the South, one from Central and nine from the North (three from Morne Catharine). It comes readily to flowers, especially *Austroeupatorium* and *Chromolaena* in the South (Plate 1). Although more common in lowland areas, its range does extend to the ridge-tops of the Northern Range.

Moss (1949) reared what Evans (1953) treats as the nominate subspecies on a species of *Zanthoxylum* (Rutaceae) different to that used by *A. thraso* Hübner at Belem. Differences between his description and mine for subspecies *negro* are discussed below. Hayward (1941) lists *Citrus* sp. (Rutaceae) as the food plant, based on earlier publications from Brazil, while Biezanko (1963) and Biezanko & Mielke (1973) are more specific, listing *Citrus aurantium* L., *C. medica limetta* Risso and *C. sinensis* Osbeck, as food plants in Rio Grande do Sul, Brazil.

I have reared this species in Trinidad from a larva found on a sapling of *Zanthoxylum martinicense* (Lam.) DC. in Parrylands Oil-field (23.xii.1981). The early shelters are made with a triangular flap from the edge of a leaf, but the larger larvae hide between two leaves, one on top of the other. The small larvae do not perforate the leaves, but leave windows with the dorsal leaf cuticle intact.

The mature larva measures about 35 mm and is attractively marked with white and yellow stripes on a mauve background. Head chordate, glabrous, shiny, strongly rugose; brown merging with darker area on clypeus and ventrally. T1 anterior half brown, posterior half concolorous with body. Body glabrous; ground colour translucent brown-mauve-grey; 2 mm below spiracles a strong white lateral line, shaded yellow in middle of each segment; T3-A7 with a narrow white band on posterior margin, reaching lateral stripe; T2 with similar line that stops well short of lateral line; T2-A1, A9 with yellow transverse band dorsally at the middle of each segment, meeting lateral line at anterior margin of segment; A2-8 with similar yellow band dorsally nearer the posterior margin (at about 2/3 width of segment) passing just anterior to spiracles, but not quite reaching the lateral line. Spiracles brown, inconspicuous. Legs brown; prolegs concolorous with body. Medium sized larvae (15 mm) are similar, but the markings are less distinct, and small larvae (5 mm) are plain green with a brown chordate head.

The pupa is formed in the last larval shelter which is densely lined with silk. It lasts about 12 days for the male. It is rounded and heavily covered with a white waxy bloom; spiracles dark; frontally, five dark spots are arranged in a pentagon, the two dorsal spots linked by a short line to the T1 spiracles; two dark spots anterior to cremaster on dorsal side, linked to cremaster by two narrow dark lines, initially curved but parallel on the cremaster; the appendages are delineated with narrow dark lines.

In his description of the larva of subspecies *busirus*, Moss (1949) refers to a yellow stripe on each of its ten segments (i.e. T1-A7), whereas I observed them on T2 to A9; he states that these lines meet the lateral stripe, but I note that those of A2-A8 stop short; he refers to the segment interstices as very light blue, which I considered white. He does not mention any markings on the pupa. Since I only reared and described one larva, it is difficult to suggest that these differences might be consistent without examining further material.

119. F2/2 *Achlyodes thraso* Hübner 1807

The taxonomy of this species is somewhat obscure. There is a group of between three and five species or subspecies involved. Evans (1953) recognised five subspecies which he attributed to the species *A. thraso*. However, this is not the senior name in the group:

thraso was described by Hübner in 1807 (given as Jung 1792 in Evans 1953, but corrected in Evans 1955) while *mithridates* was described by Fabricius in 1793. The five subspecies recognised by Evans (1953) are: *thraso* found from Texas to Argentina, *mithridates* restricted to Jamaica, *papinianus* Poey 1832 restricted to Cuba, *minor* Comstock 1944 restricted to Dominica, and *sagra* Evans 1953 from Haiti (TL), Puerto Rico and St Thomas. Most subsequent authors have followed this treatment, except for recognising *mithridates* as the senior name (e.g. Scott 1986, Bridges 1988).

However, the account given in Brown & Heineman (1972) is the only recent critical consideration of the taxonomy of this complex. They concluded that *A. mithridates* is sufficiently different from *A. thraso* in details of the male genitalia and secondary sexual characters (*A. thraso* has a hair tuft on each hind tibia which fits into a thoracic pouch; both are lacking in *A. mithridates*) as indicated by E.L. Bell (quoted in Brown & Heineman 1972, p. 375) that they should be treated as separate species. They further consider that the other three taxa represent a single clinal species, *A. papinianus*, where the *papinianus* form represents one extreme, *minor* represents the other, and *sagra* is intermediate. These conclusions seem to have been overlooked by subsequent authors. In light of the differences in the descriptions of the larvae of *A. mithridates* (Brown & Heineman 1972) and *A. thraso* (below), I am following the conclusion of Brown & Heineman and treating *A. thraso* as a separate, distinct species, with no subspecies. The Texas population of *A. thraso* has been referred to subspecies *tamenund* Edwards 1870, although Evans (1953) and recent treatments (e.g. Bridges 1988) treat this name as a synonym of *A. thraso*.

Kaye (1914) recorded this species from Trinidad as "*Eantis thraso*", citing a capture by H. Caracciolo in 1906; subsequently (Kaye 1921) he added records from St Joseph (iii.1914, F.W. Jackson) and the South (Sir N Lamont). Kaye (1921) also records *A. papinianus* from Trinidad from a St Ann's specimen (no further data given). *A. papinianus* as indicated above is restricted to either Cuba, or to Cuba, Haiti and Dominica depending upon one's interpretation of the taxon. Kaye (1921) states that "it can be recognised by the mottled hind wing, in which it chiefly differs from [*Achlyodes*] *thraso*". *A. papinianus* does have well defined markings, and I think this record was based upon either an extreme individual of *A. thraso*, or the previously unrecognised female, or an error of identification.

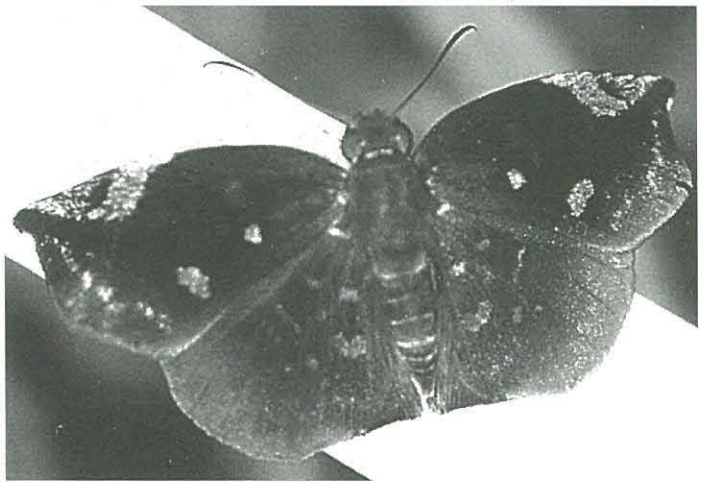

Plate 5. *Achlyodes thraso* ♂, Inniss Field, 2.x.1994

Male almost black above; dark purple scales faintly delineate submarginal bands on both wings; UPH two discal bands of dark mauve-brown spots; a bar of same colour across costa to end cell, extending in a narrow line to costa just short of apex (Plate 5). UNS uniform dark black-brown; a light brown patch on costa just before apex; UNH paler towards dorsum. Cilia brown except for pale patch on UNF margin just below apex. Female similar to male, but ground colour brown, and markings much more distinct (Plate 6); UNS with light brown discal bands only hinted at in male. The wing shape (falcate F), and markings, especially the pale patch on costa UPF near apex will enable this species to be recognised. Illustrations in Barcant (1970, Fig. 4, No. 8, ♀) and Lewis (1973, Plate 80, No. 6, ♂). No costal fold; F ♂ 20-21 mm, ♀ 22-23 mm.

This species is quite common and widespread in lowland areas of all Trinidad, particularly in forested areas and around old neglected citrus estates. I have only once found it at any altitude, at 1500 ft on Morne Catharine. I would expect it to be found around neglected citrus plantings in the Northern Range, but have not noted this. It feeds readily at flowers, including *Bidens pilosa*, *Austroeupatorium* and *Chromolaena*.

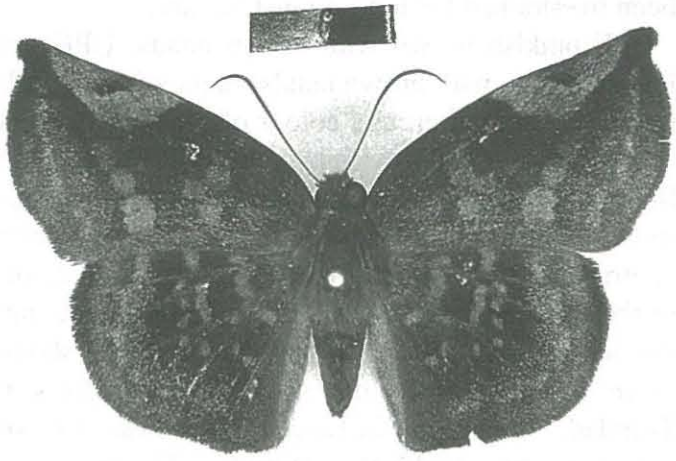

Plate 6. *Achlyodes thraso* ♀, Las Lomas, Spanish Farm, 7.iii.1980

In his list of food plants of Argentine Hesperiidae, Hayward (1941) gives *Zanthoxylum hiemalis* (St. Hil.) Engl. and *Z. naranjillo* (Grisel) Engl. (Rutaceae), while for Rio Grande do Sul, Biezanko (1963) and Biezanko & Mielke (1973) report *Z. hiemalis* and *Z. rhoifolia* as food plants. Moss (1949) records the food plants in Belem as various species of *Citrus* (Rutaceae), and in the forest on *Z. rhoifolia* Engl. He notes "the larva is plain green with a rotund brown head. The larval shelters consist of leaves pulled together and are easy to detect. The pupa is short and robust and smooth and is covered with a white bloom". In Texas, *A. thraso* has been recorded to feed on *Z. fagara* (L.) Sarg. (Kendall 1965).

In the collection of IIBC at Curepe there are two females reared from citrus at Curepe by RE Cruttwell (now MacFadyen). I have reared this species in Trinidad from a larva found on a sapling of *Z. martinicense* in Parrylands Oil-field (23.xii.1981), while SAS has found it on the same food plant in Inniss Field. *Z. martinicense* is known locally as "l'epinet" and is also noteworthy as the food plant of the lycrophon swallowtail, *Papilio lycrophon* Hübner (S Alston-Smith pers. comm.). SAS has also reared *A. thraso* from *Z. microcarpa* at Point Gourde (xi.1993). My larva was collected on the same plant and on the same day as I found larvae of *A. busirus negro* (above). The shelters are similar to those of *A. busirus negro*.

The mature larva measures about 28 mm. Head chordate; pale brown; dark with reddish tint ventrally and laterally; small white spot laterally. Body translucent whitish green; T3-A7 with dorso-lateral row of yellow spots (T3 very small in middle of segment; A1-3, A5 larger, mid segment; A4, A6-7 elongate); dorsal line clearer and darker; lateral to the dorso-lateral spots the body is speckled with yellow to give yellow-green effect. Legs concolorous. Panton (1897, quoted in Brown & Heineman 1972 and summarised in Smith *et al.* 1994 and various publications on the North American fauna) gives a detailed description of the larva of *A. mithridates*, which differs in aspects of the head, and body colouring, especially the arrangement of the dorso-lateral spots.

The translucent pupa is pale green, covered with a heavy layer of white waxy powder; appendages delineated with narrow dark lines; short blunt frontal spike with dark tip; pair of small dark spots below frontal spike; spiracles brown, inconspicuous except those of T1 which are dark; dark spot above eye; four small black spots arranged in a square anterior to the cremaster on both the ventral and dorsal surface. Pupation lasted 11 days.

120. F3 *Grais stigmaticus stigmaticus* Mabille 1883

This species is the only one recognised from the genus. It occurs from Mexico to Argentina (TL Brazil) in the nominate subspecies, and additional subspecies are described from Mexico (Paso de San Juan) and Jamaica.

Specimens collected by Sir N Lamont at Palmiste (24.x.1915; now in RSM) and Rock Penal Road (14.i.1921) were the basis for Kaye's (1921) inclusion of this species in the addenda of his catalogue.

UPS light brown, with macular brown marginal and discal bands (Plate 7); UNS yellow-brown with light brown macular marginal and discal bands UNH space 1A and 1B paler, but margin black. Female UNS is darker than that of the male, and the female has three small white hyaline apical spots absent in the male. The large size and rather featureless brown wings distinguish this from other skippers. Illustrations in Brown & Heineman (1972, Plate X, No. 1, ♀), Lewis (1973, Plate 83, No. 7), Riley (1975, Plate 22, No. 12, ♂) and Smith *et al.* (1994, Plate 29, No. 7, ♀ from Trinidad). No costal fold; F ♂ 25 mm, ♀ 27 mm.

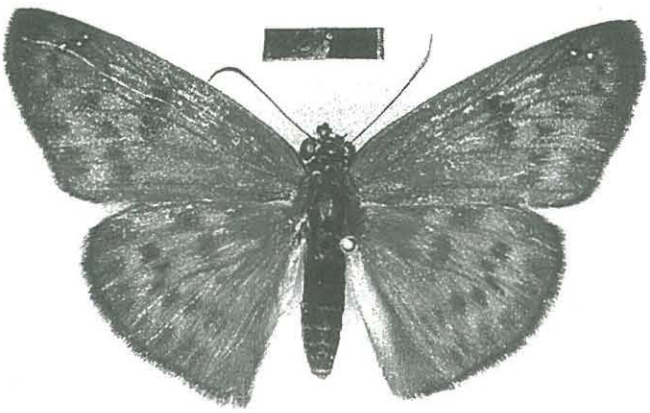

Plate 7. *Grais stigmaticus stigmaticus* ♀, Rock Penal Road, milestone 8.75, at flowers, 31.xii.1979

Kaye (1921) notes that this species appears to be confined to the South. It is certainly much commoner in forested areas of the South (I have records of 9 specimens), but J & F Preston also caught a male on the Lower Morne Catherine Road (27.ii.1982) and the specimen illustrated by Smith *et al.* (1994) is from "W. central Trinidad" (probably Caparo). When feeding on flowers with its wings held flat, this is a conspicuous and easily recognised species. Although I have made several captures at flowers of *Chromolaena odorata* (♂,♀, Rock-Penal Road, 31.xii.1979; ♀, Parrylands, 18.i.1988), I have also caught it in forest shade (♂,♀, East Moruga oil-field, 24.ii.1980) and sunbathing in a forest clearing (♂, West Moreau oil-field, 31.xii.1979).

Nascimento & Hay (1993) record the food plant to be *Metrodorea pubescens* St. Hil. & Tull (Rutaceae) in Central Brazil.

121. F5/1 *Timochares trifasciata trifasciata* Hewitson 1868

This species is widespread as the nominate subspecies from Mexico to Paraguay (TL Bolivia), and as subspecies *sanda* Evans 1953 from Argentina. There is only one other species in the genus, *T. ruptifascia* Plötz 1884, from Mexico and Jamaica.

Kaye (1940) first recorded this species from Trinidad on the basis of specimens from St Joseph (xii.1922, F.W. Jackson) and Port of Spain (10.vii.1927, Forbes), commenting that since it had been overlooked for long it must be rare.

UPF pinkish brown with brown bands; UPH yellowish brown with brown bands - a pleasing but subtle contrast in the ground colour of the fore and hind wings (Plate 8). UNS light yellowish brown, with light brown bands. The female is slightly larger, has more rounded wings, and the UPF markings are more contrasting. The contrast between the ground colour of the fore and hind wings UPS is characteristic, and the sharply contrasting discal bands UPH should serve to distinguish this species from others in Trinidad. Illustration in Lewis (1973, Plate 87, No. 40). Long costal fold; F ♂ 21 mm, ♀ 22 mm.

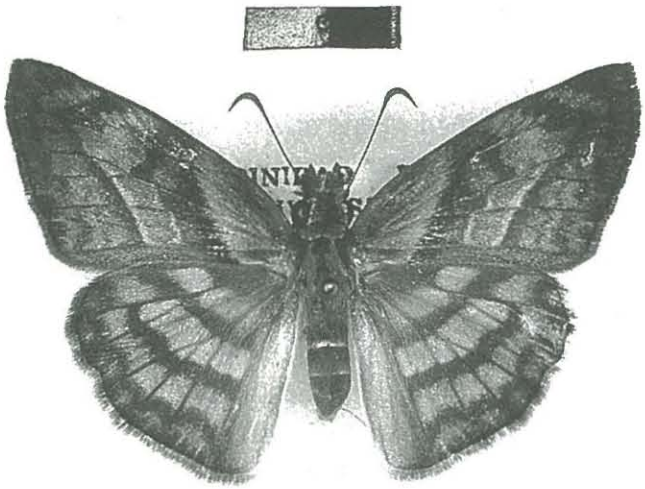

Plate 8. *Timochares trifasciata trifasciata* ♀, Nariva Swamp, Manzanilla - Mayaro Road, milestone 46 track, 23.v.1979

In addition to the records given by Kaye from St Joseph and Port of Spain, I have two females from Nariva Swamp (23.v.1979, 25.xi.1980) (Cock 1982a) and a male from Bush Bush (7.v.1995; others seen). I have seen three more females from Grande Ravine (8.x.1977, SAS) and Parrylands (13.iii.1982, 27.iii.1982, J & F Preston), and a male from Manzanilla (10.i.1923, F.W. Jackson in NHM). Evidently a widespread but uncommon species. At Bush Bush (v.1995) it was feeding at flowers of *Cordia curassavica*.

SAS has discovered that the food plant of *T. trifasciata* in Trinidad is *Stigmaphyllon adenodon* (Malpighiaceae); having observed a female ovipositing, he successfully reared out larvae from Cruse

Field in 1991. The congeneric *T. ruptifasciata ruptifasciata* Plötz is recorded to feed on *Malpighia glabra* (Malpighiaceae) (Scott 1986). I have seen hesperiid shelters on *Malpighia glabra* (West Indian Cherry or Barbados Cherry) in Tunapuna, which may have been this or another Group F species.

Anastrus Hübner 1824

Three species of this genus are found in Trinidad although one, *Anastrus obscurus neaeris*, is here recorded from the island for the first time. They are united by the distinctive wing shape, with the F more pointed than usual for Pyrginae.

122. F6/1 *Anastrus sempiternus simplicior* Möschler 1876

The subspecies *simplicior* Möschler 1876 is restricted to South America, being found from Venezuela to Bolivia (TL Surinam). The nominate subspecies is found from Mexico to Venezuela and Ecuador (TL Costa Rica), and has the UNH dorsal third bluish white, whereas in *simplicior* the UNH is uniform ochreous brown (Evans 1953). A third subspecies, *dilloni* Bell & Comstock 1948 is restricted to Haiti (TL) and Jamaica.

A single specimen collected vi.1898 by W.J. Kaye was the basis for his inclusion of this species in the Trinidad list (Kaye 1904).

UPS ground colour brown with a coppery tint; dark brown submarginal and discal bands on the UPS Plate 9). UNS pale coppery brown with lighter marginal and discal bands. The female is larger, UPS lighter, UNS with markings considerably more contrasting. The wing shape will distinguish this from other genera of Group F, while the UPS and UNS banding will distinguish it from the other two *Anastrus* spp. Illustrations in Brown & Heineman 1972, Plate IX, No. 14), Lewis (1973, Plate 80, No. 22), Riley (1975, Plate 22, No. 13, ♂) and Smith *et al.* (1994, Plate 29, No. 8, ♀ subsp. *dilloni*). Short, very narrow costal fold; F ♂ 19 mm, ♂ 21 mm.

This is not a very common species, although perhaps it is overlooked since its food plant, guava, is common enough. I have specimens from Parrylands (♂, at flowers of *Chromolaena odorata*, 2.ii.1980), Wallerfield (22.x.1980), Brechin Castle (♀, larva on guava, adult 26.xi.1981), and Bush Bush (♀ 7.v.1995). I have also seen specimens from Grande Ravine (♂, 13.x.1977, SAS), Fondes Amandes (♂, 5.i.1977, SAS) and Maraval (vii.1891 in NHM). It would appear to be widespread in disturbed mostly lowland areas (although SAS has found a pupa at the summit of El Tucuche), but not very common.

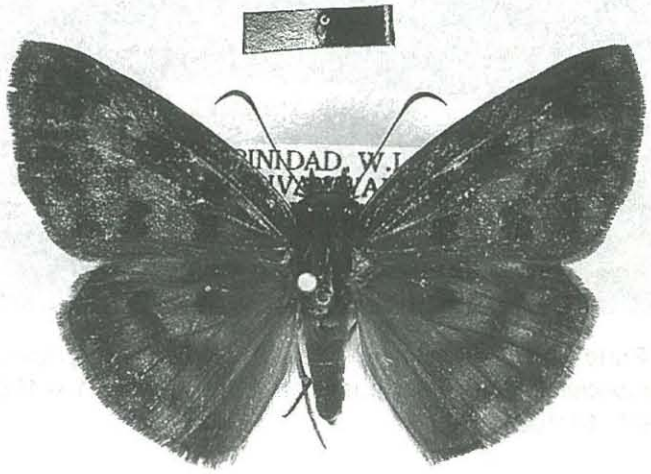

Plate 9. *Anastrus sempiternus simplicior* ♀, Nariva Swamp, Bush Bush Island, at Cordia flowers, 7.v.1995

Moss (1949) reared this subspecies in Belem, and notes that the plain green larvae feed on guava (*Psidium* sp.), *Eugenia* spp., *Tapirira* spp. and other Myrtaceae. Kendall (1976) has reared *Anastrus sempiternus sempiternus* Butler & Druce 1872 from larvae collected on *Terminalia catappa* L. (Combretaceae) in Mexico. Apart from a pupation period of 9-12 days no details of the biology are given. Steinhauser (1975) lists the same food plant in his list of Hesperiidae of El Salvador. Brown & Heineman (1972) give Turner's unpublished details of the life history of *A. s. dilloni* which also feeds on guava.

I reared this species from a larva collected on guava, *Psidium guajava* L. (Myrtaceae) which I collected at Brechin Castle, 1.xi.1981. SAS has collected a pupa also from guava, on the summit of El Tucuche. The fourth instar larval shelter was a triangular flap cut from the edge of the leaf lamina. The larva measured 12 mm when collected; head chordate, dark reddish brown with an indistinct black marking antero-laterally; body green, tinged with yellow anteriorly and posteriorly, with pale speckles and a pair of small black dots dorsally on T3-A2 (Plate 10).

The fifth instar larva 30 mm; large head, strongly chordate, rugose, dark brown posteriorly, light brown anteriorly, with a dark broad arc across the face, convex side dorsally; body yellow green with a pair of small dorsal black spots on A1-3. When mature, the larva turns milky white and the dorsal spots fade out.

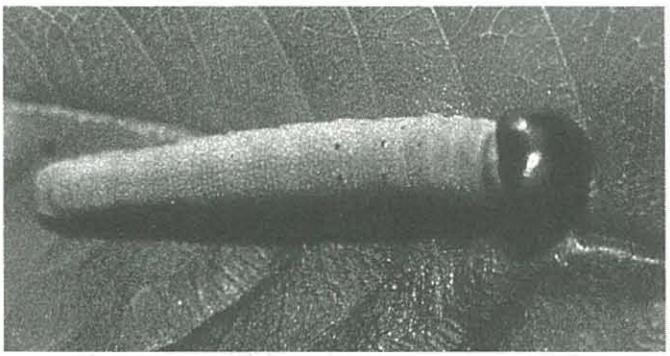

Plate 10. Fourth instar larva of *Anastrus sempiternus simplicior* collected on guava, Brechin Castle, 1.xi.1981 (Ref.: 81/10B).

The translucent pupa is pale shining green; spiracle T1 with brown edge. There is no production of wax at pupation in this species or other members of the genus. Pupation took eight days.

123. F6/3 *Anastrus petius petius* Möschler 1876

The nominate subspecies is restricted to South America, being found from Colombia through the Amazons to South Brazil (TL Surinam); a second subspecies, *obliqua* Plötz 1884 is only recorded from Guatemala and Honduras (Evans 1953).

Kaye (1940) first recorded this species from a specimen collected at Fort George by F.W. Jackson (i.1922). He mis-spelt the specific name as *retius*, although in his text for this species *petius* is spelt correctly; Barcant (1970) perpetuates this error. This species was recorded from Tobago for the first time by Cock (1982c), on the basis of a male which I took on the Main Ridge (18.v.1981).

UPS dark brown with two very faintly discernible blue bands UPH (Plate 11.). UNS uniformly light coppery brown, tinged with grey on dorsum of both wings. The wing shape, almost uniform UPS and UNS, and faint blue bands UPH all serve to characterise this species. Costal fold to middle of costa, narrow, white internally; F ♂ 21-22 mm.

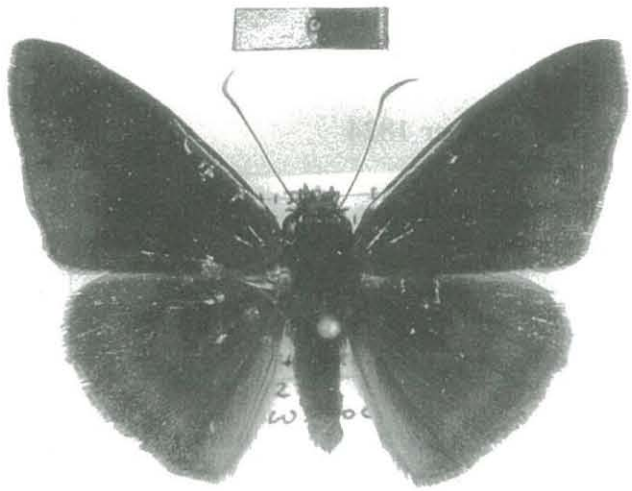

Plate 11. *Anastrus petius petius* ♂, Waller Field, ex pupa coll. on *Coccoloba venosa*, 24.xi.1981

This is a species which seems to be more frequent in the North, particularly on the higher parts of the Northern Range. I have specimens from El Tucuche (♂, 2700 ft, 27.iii.1979), Andrew's Trace (♀, 2000 ft, 20.ix.1978), Morne Bleu Textel Road (♂, 7.x.1979; others seen), Lalaja Ridge (♂, 20.iii.1979, 14.ix.1979), and have also seen a female from Grande Ravine (ix.1978, SAS) and a pair from Port of Spain (i.1897, Dr Rendall in NHM). I have also reared a male from Waller Field (adult 4.xii.1981). The localities and food plants suggest that it is more closely related to forest situations than the last.

Although he was unable to identify the food plant of this species, Moss (1949) records some details of the larva and its biology. "The larvae are light bluish green, the head bifurcated and black-edged on the frons, in colour red-brown, this deepening towards the mouth and bearing a pair of ochreous eye-spots situated near each other in the upper portion. ... The larval shelters consist of large triangular pieces of leaf, flimsily spun down at the tips and gnawed irregularly on the edge but without the ventilation holes." In his material in the NHM there is a leaf shelter attributed to this species which contain cocoons of a parasitic *Apanteles* sp.

In shady secondary forest at Waller Field (24.xi.1981), I found a pupa of this species on a plant

of *Coccoloba venosa* L. (Polygonaceae) of less than 1m. Extensive feeding on two of the large leaves had left little more than the mid-ribs and main veins, and in a 30 mm shelter at the tip of one of these, the pupa was formed. It was similar to that of *A. sempiternus*, pale shining green, with the cremaster tip and the edge of the T1 spiracle dark. SAS has collected and reared early stages of this species from *C. marginata* from Valencia and Andrew's Trace.

123a. F6/6 *Anastrus obscurus neaeris* Möschler 1878

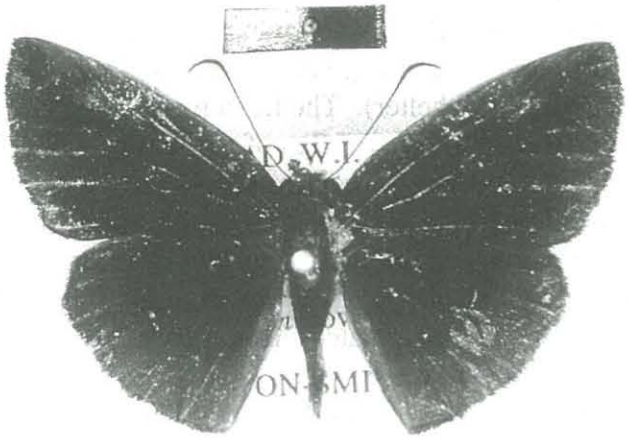

Plate 12. *Anastrus obscurus naearis* ♂, Rio Claro - Guayaguayare Road, *Eupatorium* flowers, ix.1993, S. Alston-Smith

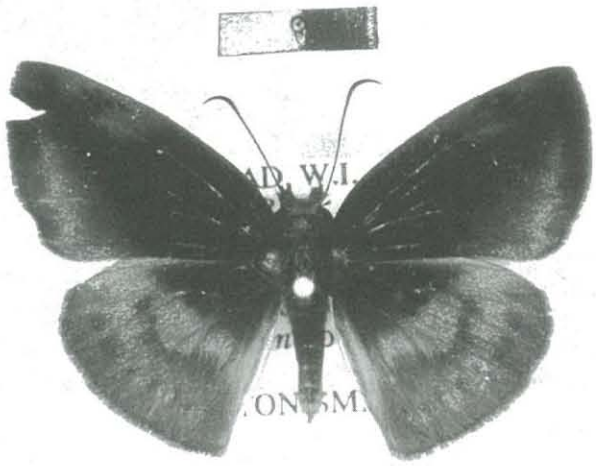

Plate 13. *Anastrus obscurus naearis* ♀, Rio Claro - Guayaguayare Road, *Eupatorium* flowers, ix.1993, S. Alston-Smith

Evans (1953) recognises four subspecies of *A. obscurus* Hübner 1824, although the differences in the genitalia suggest that some or all of these merit species rank. Subspecies *neaeris* is found in Central America, Colombia (TL) and Venezuela. Subspecies *narva* Evans 1953 is similar but has the UNH uniform brown, and is found from the Guianas through the Amazon basin to Bolivia (TL Upper Putumayo). The other subspecies extend the range to South Brazil and Bolivia.

Sexually dimorphic. Male UPS black, distal half UPH with a dark blue suffusion (Plate 12). UNS dark brown with copper tint; UNH dorsal half of wing shaded to light grey. Female dark brown above; UPH distal two-thirds occupied by two discal bands of lilac which fuse at costa and continue as a narrowing submarginal band UPF to costa (Plate 13). UNS as male. The UPS colouring cannot be confused with any other Trinidad species. Illustration in Lewis (1973, Plate 80, No. 21, ♂). No costal fold; F ♂ 19 mm, ♀ 19 mm.

This species is here recorded from Trinidad for the first time. It was discovered by SAS along the Rio Claro - Guayaguayare Road in 1993. On this occasion, it was not rare and SAS collected a series of five males and five females. It is remarkable that such a distinctive species should have avoided detection for so long. It appears to occur in very localised and temporary broods. An alternative explanation would be that it is a recent coloniser in Trinidad; time will tell if it spreads and becomes more common.

Moss (1949) does not mention rearing this species, but there is a final instar cast larval skin under this name in his material in the NHM. It has a plain brown head capsule.

124. F8/4 *Ebrietis anacreon anacreon* Staudinger 1876

The nominate subspecies is widespread, from Mexico to Argentina (TL Brazil). Two populations in Ecuador and Colombia to Venezuela have the tornal area UNH more or less white and are considered separate subspecies by Evans (1953). Curiously, Kaye (1921, 1940) did not record this species from Trinidad, and the listing by Evans (1953) seems to be the first record from the island.

Sexual dimorphism slight; males have more pointed F and reduced pale markings (Plates 14, 15). UPS dark brown with light brown marking with a blue tint. UNS brown with indistinct pale brown bands; dorsum UNF and UNH paler with copper tint. This and the next species with their blue-mauve tinted markings on a dark background are reminiscent of *Gorgythion* spp., but can be immediately recognised as they are considerably larger. These two species are superficially similar, but the wing shapes are different, and while the UPS markings of *E. anacreon* are solid, those of the discal and basal areas for *C. thrasybulus* mostly have a dark brown centre. Costal fold; F ♂ 17-19 mm, ♀ 18 mm.

Plate 14. *Ebrietis anacreon anacreon* ♂, Rio Claro - Guayaguayare Road, 11.x.1993

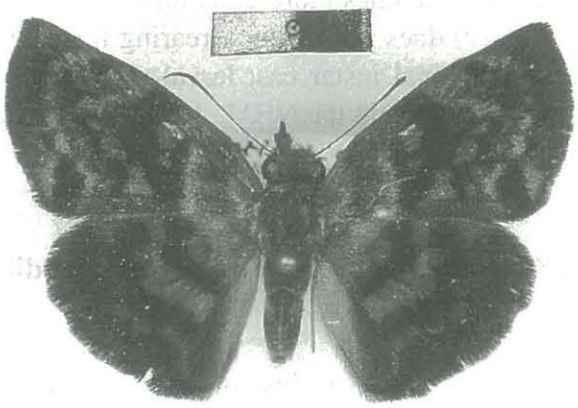

Plate 15. *Ebrietis anacreon anacreon* ♀, Parrylands Oilfield, 23.xii.1981

This is a widespread, although not especially common species in forested parts of Trinidad. I have records from the heights of the Northern Range (♀, Andrew's Trace, 2200 ft, 6.xii.1978; ♀, Arima-Blanchisseuse Road, milestone 10, 11.ix.1979), Waller Field (♂, 5.x.1981, J & F Preston), and the South (Rio Claro-Guayaguayare Road, Cats Hill, Parrylands). Males come occasionally to flowers (Cats Hill, *Austroeupatorium* flowers, 19.ix.1982), but I have found the females more commonly, resting on leaves.

I am not aware of any published observations on the life history. In Trinidad I have twice found larvae on a vine, *Stigmaphyllon findlayanum* (Malpighiaceae) at Point Gourde (x.1995 and vii.1996). The stage III larval shelter used by the L4 and L5 is a long petiolate flap, hinged at one end along a major vein; and held above the leaf surface with strands of silk (in Africa larvae of the Pyrginae genus *Eagris* make a rather similar stage III shelter). The larva rests on the under surface of the turned over flap of the shelter.

L4 20 mm. Head chordate, only slightly indent at epicranial notch; rugose; matt; dark except for light brown marking across face, split by heavy dark line from near epicranial notch to mouth parts. T1 with narrow, dark dorsal plate. Body blue-green with evenly distributed dense yellow dots; indistinct, clear dorsal line; narrow, pale dorso-lateral line; ventro-lateral flap pronounced. Legs concolorous; spiracles pale and inconspicuous.

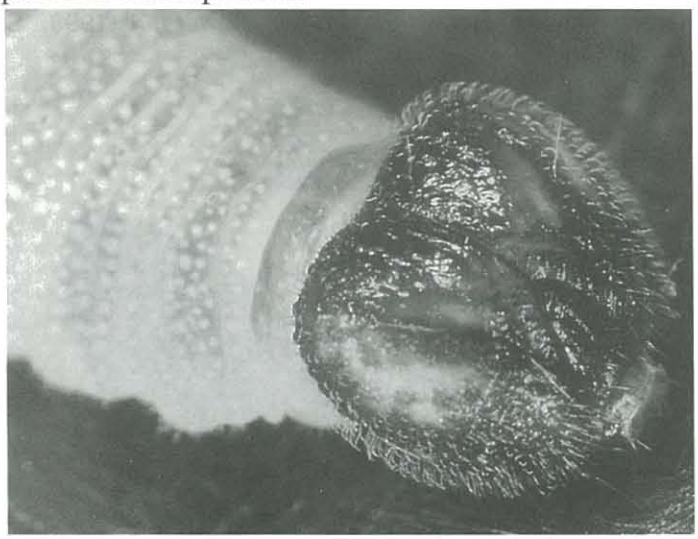

Plate 16. Fifth instar larva of *Ebrietis anacreon anacreon*, collected on *Stigmaphyllon findlayanum*, Point Gourde, 14.vii.1996 (Ref. 96/9).

L5 27 mm. Head chordate, broadly and shallowly indent at epicranial notch; covered with short, pale,

erect setae; dark brown or brown with a broad, light brown band across face, much wider laterally, and interrupted by a heavy, dark brown stripe from epicranial notch to mouth parts; a parallel, pale brown streak below the light brown band, above the stemmata. T1 concolorous with body. Body matt pale green, covered with yellow dots; dorsal line slightly darker; narrow, yellow dorso-lateral line. Legs concolorous, spiracles yellow, inconspicuous; anal plate truncate posteriorly.

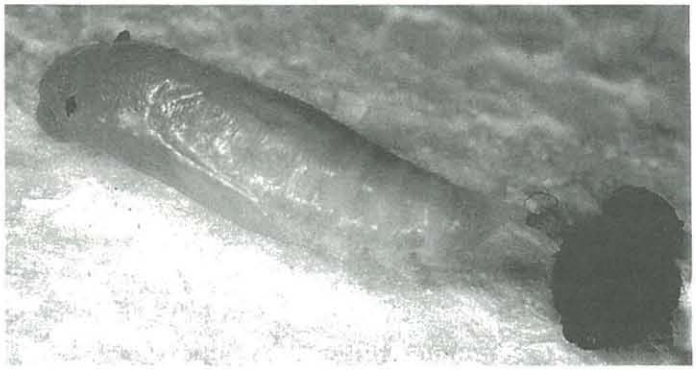

Plate 17. Pupa of *Ebrietis anacreon anacreon*, collected as larva on *Stigmaphyllon findlayanum*, Point Gourde, 14.vii.1996 (Ref. 96/9).

Pupa 17 mm; rounded outline, with pointed cremaster; light green except tip of cremaster dark and T1 spiracles which are light brown and protuberant.

125. F9/1 *Cycloglapha thrasibulus thrasibulus* Fabricius 1793

This is another widespread species, being found from Mexico to Paraguay (TL "Indiis") in the nominate subspecies, while a population from Ecuador and North Peru with the tornal area UNH white is treated as a separate subspecies, *flinta* Evans 1953.

This species was originally recorded from Trinidad by Kaye (1904, 1921) as *Camptopleura thrasibulus*, without giving any details of captures.

Sexual dimorphism quite marked, the male much darker due to reduced markings above (Plate 18, 19). UPS dark brown with blue-purple tinted brown markings, several with dark brown centres - which should serve to distinguish this species from the last. UNS dark brown with indistinct coppery brown markings in male and pale coppery brown markings in female. Illustration in Lewis (1973, Plate 82, No. 5). Costal fold; F ♂ 17 mm, ♀ 18 mm.

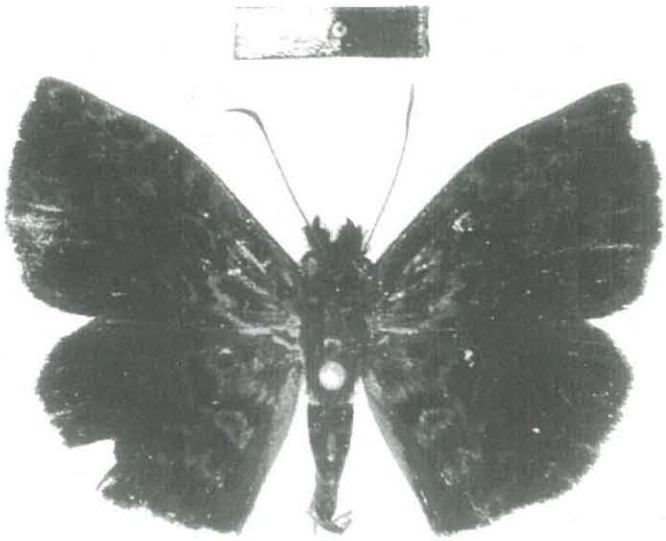

Plate 18. *Cycloglapha thrasibulus thrasibulus* ♂, Palo-Seco Oilfield, 7.x.1995

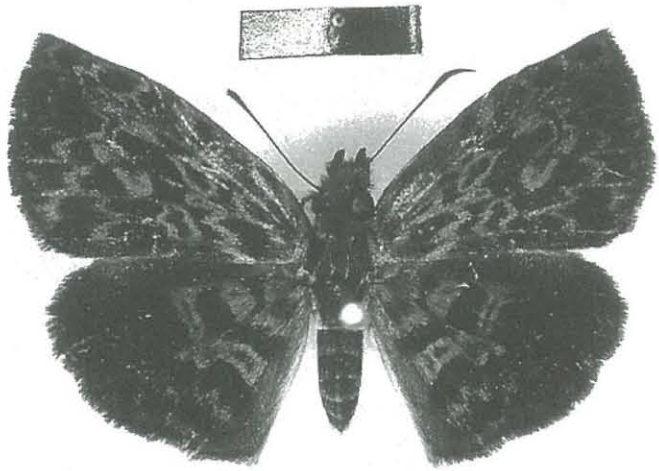

Plate 19. *Cycloglapha thrasibulus thrasibulus* ♀, Parrylands, 2.ix.1980

This is not a common species in Trinidad in my experience. I have just three records of adults: a male from the Palo Seco Oilfield (7.x.1995), a female at flowers of *Cordia curassavica* (Parrylands, 2.ix.1980) and another from the summit of Cumberland Hill (8.viii.1981). There is a male from St Anns in the NHM.

The larval food plants of this subspecies have been recorded as *Styrax* ferrugineus Nees & Mart. (Stryracaceae) near Brasilia (Diniz & Morais 1995),

Annona and *Guatteria* (Annonaceae) in Belem (Moss 1949), and *Platanus mexicana* Moric (Platanaceae) in Mexico (Kendall & McGuire 1975).

SAS has found the food plant of this species in Trinidad to be *Rollinia multiflora* (Annonaceae), and reared it out from Grande Ravine in x.1992. Since then I have also reared this species from the same food plant, collected from the border between the pine plantation and the old cacao estate behind St Benedict's (ix.1994). I have also found empty shelters on the Arima-Blanchisseuse Road, milestone 9.25 (x.1994).

The stage I shelter is a triangular flap cut from the edge of the leaf lamina, using a major vein as a hinge on the short side of triangular flap; of the two distal sides of the shelter, one is usually significantly longer than the other. The stage II shelter is similar, but larger. The stage III shelter is also similar in concept, but larger, with irregular notches cut from the longest side of the triangle, and with the aid of strands of silk from the margin of the shelter, it is held well off the surface of the leaf, similarly to that of the last species.

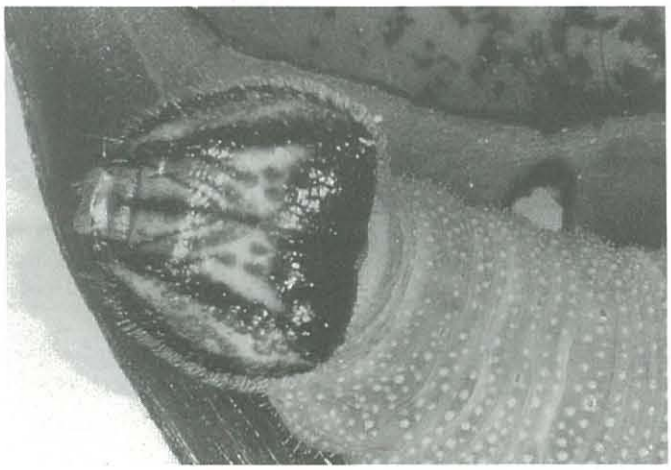

Plate 20. Fifth instar larva *Cycloglapha thrasibulus thrasibulus* collected on *Rollinia multiflora*, behind St. Benedict's, 30.ix.1994 (Ref. 94/40).

L5 30 mm. Head chordate; rugose; short pale setae; dark brown with light brown vertical streaks anteriorly and laterally. T1 concolorous with body. Body uniform yellow-green with yellow speckles (absent ventrally). Legs and prolegs concolorous. Pupa 16 mm. Smoothly contoured, eyes a bit protuberant; green; spiracle T1 protuberant, black; no white waxy powder. Pupation took eight days.

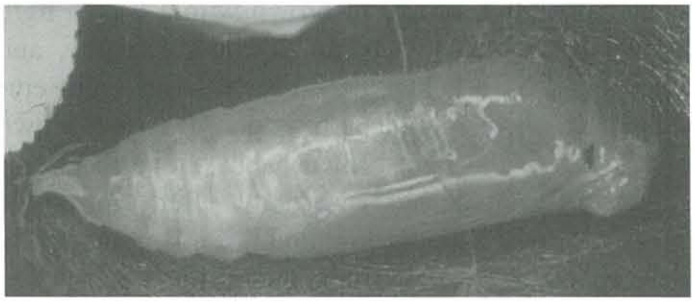

Plate 21. Pupa *Cycloglapha thrasibulus thrasibulus* collected as larva on *Rollinia multiflora*, behind St. Benedict's, 30.ix.1994 (Ref. 94/40).

126. F10 *Helias phalaenoides phalaenoides* Fabricius 1807

This is the only species recognised from the genus *Helias* by Evans (1953). It occurs in four subspecies, of which the nominate is the most widespread, being recorded from Panama to Bolivia (TL not given, but probably Surinam). Other subspecies extend this range to Mexico in the North and Argentina in the South.

Kaye (1904) first recorded this species from Trinidad as *Diphoridas phalaenoides*, commenting that it was "not rare in the Botanical Gardens". Evans (1953) lists two males from Tobago, and this is the first record from that island, although since they were collected by F.W. Jackson in 1914, it is strange that Sheldon (1936, 1938) was not aware of them.

Sexual dimorphism slight, the male is darker than the female (Plate 22) and the pale markings have a blue tint. UPS dark brown with extensive brown markings. UNS brown, with pale tornal area and discal bands UNH. This species is quite distinctive in the Trinidad fauna; the size, wing shape, and a dark brown stripe across the disc UPF which runs into a similar broad band UPH which narrows at the dorsum should distinguish it from other species. Illustration in Lewis (1973, Plate 83, No. 10). No costal fold; F ♂ 14 mm, ♀ 14 mm.

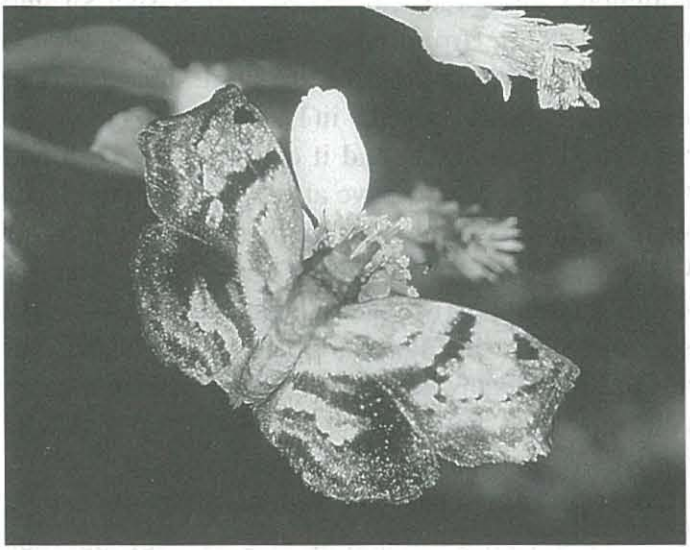

Plate 22. *Helias phalaenoides phalaenoides* ♀, Brasso, 11.x.1993

This is a common species along roadsides and in open disturbed situations throughout lowland Trinidad. I have records from the North Coast, valleys and disturbed lower slopes of the Northern Range, Waller Field, Brasso and various localities in the South. It is particularly fond of flowers of *Bidens pilosa*, on which it feeds with open wings, the forewing tips bent downwards (Plate 22) - a typical and pronounced "batwing".

Moss (1949) has reared the plain green larva of this species from *Citrus*. The translucent pupa is light brown when emerged, with a protuberant brown spiracle on T1 and no frontal spike or wax (Moss's material in NHM). SAS has noted the same food plant in Trinidad.

126a. F11/2 *Camptopleura auxo* Möschler 1878

Although this species is widespread from Guatemala to Paraguay (TL Colombia), it is not particularly common, and was only recently recorded from Trinidad for the first time by J & F Preston (Cock 1984a).

I have not seen the male. Female UPS dark brown with indistinct brown markings (Plate 23). UNS brown with paler brown markings, most extensive at tornus UNH. The size, wing shape, and very obscurely marked dark UPS should distinguish this species. F ♀ 16 mm. The illustration of *Camptopleura theramenes* Mabille in Lewis (1973, Plate 81, No. 24) is similar to *C. auxo*.

Plate 23. *Camptopleura auxo* ♀, Brasso, 11.x.1993

The original record of this species was from milestone 10.5 on the Arima-Blanchisseuse Road (4.x.1981, J & F Preston). Since then SAS has caught a full series (5 males, 5 females) and I have photographed and caught a female at Brasso. This seems to be a localised rather than a rare species, and it is surprising that it wasn't picked up before, although perhaps it was overlooked for the more common dark species of this group.

Life history and food plants apparently unknown.

127. F13/1 *Chiomara asychis simon* Evans 1953

This is a very widespread species, being found from Mexico to Argentina and some of the Lesser Antilles. The differences in the genitalia suggest that more than one species may prove to be involved. Subspecies *simon* Evans is restricted to Panama, Colombia (TL), Venezuela and Trinidad, and is similar to the nominate subspecies, *asychis* Stoll 1780, which is from the Guianas (TL Surinam) and North-east Brazil. *C. a. asychis* is larger and darker; UPF the markings are narrower and more sharply defined; UPH the spots in space 7 are smaller and the outer spot is less marked.

This species was first recorded from Trinidad by Kaye (1940), based on records from Manzanilla in 1915 and iii.1922 by F.W. Jackson.

Sexual dimorphism is quite pronounced, the male being significantly more extensively white on both the

UPS and UNS (Plate 24, 25). This brown and white species is distinctively marked and unlikely to be confused with any other Trinidad species. Illustrations in Lewis (1973, Plate 81, No. 37), Riley (1975, Plate 22, Fig. 16, ♂) and Smith *et al.* (1994, Plate 29, No. 10, ♂ ssp. *vincenta*, and No. 11, ♂ ssp. *grenada*). No costal fold; F ♂ 17-19 mm, ♀ 18-19 mm.

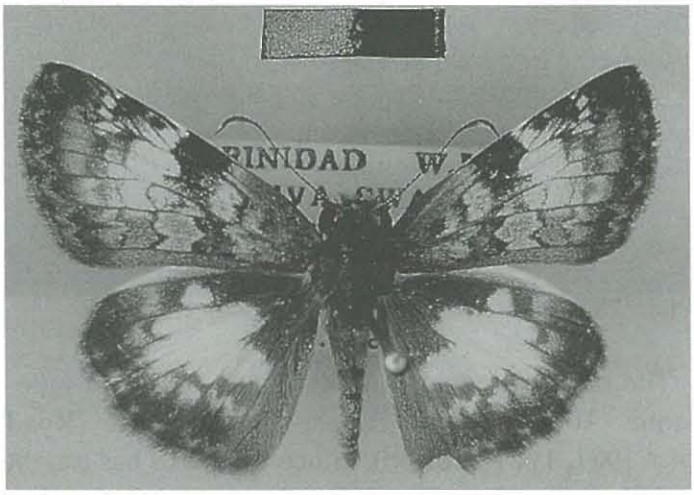

Plate 24. *Chiomara asychis simon* ♂, Nariva Swamp, 21.ix.1979

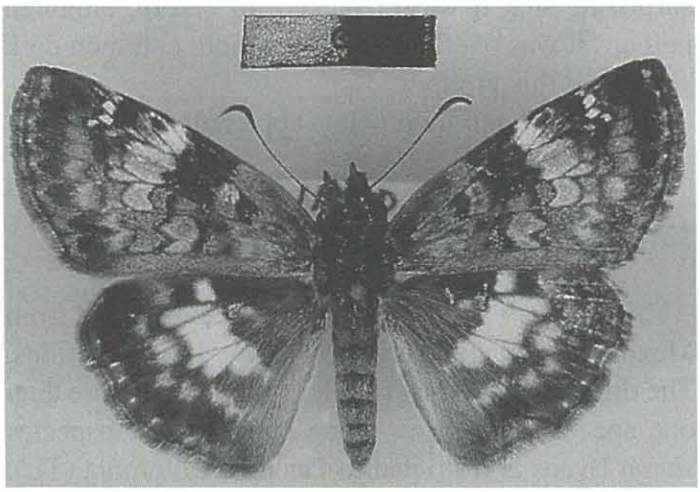

Plate 25. *Chiomara asychis simon* ♀, Nr. Mayaro, 29.viii.1982

Although Kaye (1940) suggests that this species is "certainly rare" in Trinidad, it would be more correct to say that it is localised to a specific habitat, where it is quite common. The clue is in the locality recorded by Kaye (Manzanilla). I have already discussed the suite of swamp butterflies recorded by F.W. Jackson from "Manzanilla" (Cock 1984b); *C. asychis simon* is one of these. In fact this skipper can be found quite commonly along the seaward edge of Nariva Swamp (Cock 1982a), from milestone 39 to 49 of the Manzanilla-Mayaro Road. Capture months (and numbers caught) include ii(1), iii(3), iv(1), vii(3), viii(2), ix(4), and x(1) and it can probably be found throughout the year. I have also found it on the landward side of Caroni Swamp in the vicinity of Cacandee Sluice (ffrench and Bacon 1982), where it is quite common (i-ii.1982). There are three early specimens labelled Port of Spain in the NHM, but these are probably from one of the nearby swamp patches which have now been destroyed. Adults come to flowers such as *Cordia curassavica*.

The nominate subspecies was reared at Belem by Moss (1949) on a "straggling creeper with glaucous leaves and 5-petalled yellow flowers belonging to the Malpighiaceae". The Central American subspecies, *C. asychis georgina* Reakirt 1868, has been recorded to feed on *Malpighia glabra* L. in Texas (Kendall & Rickard 1976) and *Gaudichaudia pentandra* Juss. in Mexico (Kendall 1976) (both Malpighiaceae), while in Rio Grande do Sul, Brazil, the food of subspecies *autander* Mabille 1891 is given as *Vitex montevidensis* Cham. (Verbenaceae) by Biezanko (1963) and Biezanko & Mielke (1973).

In Trinidad, the food plant of subspecies *simon* is *Brachypterys ovata* (Cav.) Small (Malpighiaceae), a sprawling bush with yellow flowers which grows in swampy areas (possibly the same food plant found by Moss for subspecies *asychis*). I have reared it from this species from Caroni Swamp, while SAS has reared it from Nariva Swamp. The early larvae use triangular leaf flaps cut from the lamina edge, and the large larvae shelter between two leaves, where pupation takes place. The mature larva has a shield-shaped head, slightly indented at the epicranial notch; it is grey anteriorly (on the face) and dark posteriorly; the dark area extends laterally along the latero-ventral edge, and in a diagonal stripe towards the mouth parts, and dorsally in a broad stripe which extends onto the dorsal part of the face; white markings are present as a stripe lateral to the broad dark dorsal stripe, and a spot placed antero-laterally above the lateral diagonal dark stripe; body whitish blue green. I made no notes regarding the pupa, but Moss (1949) states that it is greenish, and his emerged pupal skin in the NHM has the spiracle of T1 whitish with a brown margin, and

no frontal spike or wax. At least one pupa that Moss collected was parasitised by a yellow and black solitary chalcidoid pupal parasitoid (?*Spilochalcis* sp.).

128. F13/3 *Chiomara mithrax* Möschler 1878

No subspecies are recognised of this widespread species which is found from Mexico to Argentina (TL Colombia). It was first recorded from Trinidad in the addenda to Kaye (1914), on the basis of a specimen taken in Emperor Valley by K St A Rogers in i.1913.

The sexes are similar. UPF almost black; basal band dark brown with lighter coppery margins; discal bands brown with coppery margins; termen coppery brown; some scattered light brown scales on disc (Plate 26). UPH dark brown with light brown diffuse bands. UNF brown; pale in space 1A and sub-apical patch on costa. UNH brown with diffuse pale brown bands to match UPH. Illustrations in Lewis (1973, Plate 81, No. 40), Riley (1975, Plate 22, No. 17, ♂) and Smith *et al.* (1994, Plate 29, No. 12, ♂). No costal fold, F ♂ 17 mm, ♀ 19 mm.

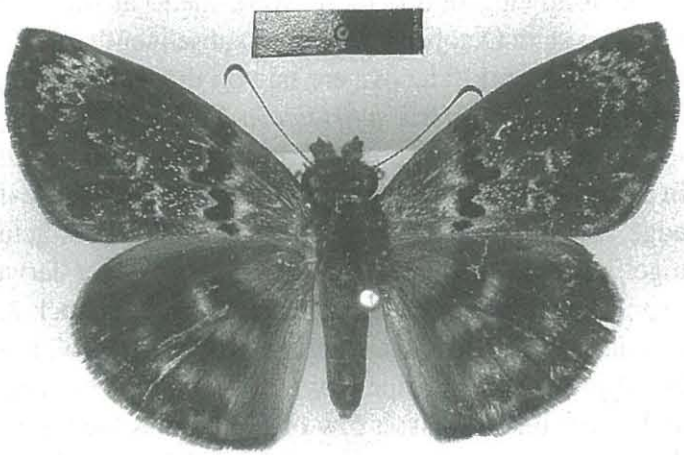

Plate 26. *Chiomara mithrax* ♀, Brigand Hill, 25.xi.1980

This is a widespread and occasional species in open and disturbed areas of Trinidad. Most of my records are from fairly low areas (St Anns, Blanchisseuse-Paria Bay Track, Arima, San Rafael, Cats Hill, Rock-Penal Road, Morne Diable), but I do have specimens from about 1150 ft on Mt. Tabor (♀, 5.viii.1979) and from the summit of Brigand Hill (25.xi.1980). It comes readily to flowers of *Bidens pilosa* and *Eupatorium*, and usually flies close to the ground.

Moss (1949) found shelters of this species quite common on *Vitex triflora* L. (Verbenaceae). Similarly, Biezanko (1963) and Biezanko & Mielke (1973) report the food plant as *V. montevidensis* Cham. in Rio Grande do Sul, Brazil. Moss (1949) writes that "the larva is dull green with a brown head and lives at first under a more or less flat triangular roof, the final larval shelter being of a type peculiar to this species. Having bored three big holes and eaten away portions between the side ribs of the leaf, the larva retires to its prepared shelter, the elevated oval on an adjacent stiff and dark green leaf, then attaching this to the bared ribs, it fastens the two leaves together. This eventually forms the pupal resting place". Moss's plate of the larva shows the brown head to have three rows of pale spots: a dorsal one of two spots, and two slightly curved lines of four and three spots respectively below this. The emerged pupal skin (in NHM) is similar to that of *C. asychis*.

SAS reared this species from larvae collected on *Vitex capitata* at Arena Forest (i.1992). He notes that the head of the mature larva has two rows of dark spots: an upper row of four spots and a lower row of three spots; the body is green with a thin yellow lateral stripe, and the pupa is light green.

129. F14/4 *Gesta gesta gesta* Herrich-Schäffer 1863

Subspecies *gesta* is widespread from Panama to Argentina, and the Greater Antilles (Cuba [TL], Haiti, Jamaica). A second subspecies, *invisus* Butler & Druce is restricted to Central America, from Mexico to Costa Rica (TL).

This species was included in the first list of Trinidad butterflies by Crowfoot (1893), and confirmed by Kaye (1921) with a capture from Fondes Amandes. It was recorded from Tobago by Sheldon (1936) who found it not uncommon at Speyside, and there is a male and a female in the NHM (Evans 1953).

UPS ♂ dark brown with indistinct brown bands; translucent apical spot (Plate 27); UNS brown largely undifferentiated. The ♀ is paler than the ♂, with markings better differentiated UPS (Plate 28) and UNS. Illustrations in Brown & Heineman (1972, Plate IX, No. 15), Lewis (1973, Plate 82, No. 54, as *Erynnis gesta*), Riley (1975, Plate 22, No. 14, ♂) and Smith *et al.* (1994, Plate 29, No. 9, ♀). No costal fold, F ♂,♀ 15

mm.

Plate 27. *Gesta gesta gesta* ♂, Fort George, 16.x.1993

Plate 28. *Gesta gesta gesta* ♀, Fort George, 16.x.1993

Apart from Kaye's record from Fondes Amandes, there are specimens from Gasparee (♂, 11.iii.1928, Sir N Lamont in RSM), Port of Spain (♂, i.1897, Dr Rendall), St Anns (♂, i-iii.1932, A Hall), Maraval (♂, vii.1891; ♀, viii.1891), St Augustine (♂, 12.ii.1924, CL Withycombe), Siparia (♂, 8.xii.1915, Sir N Lamont in RSM) and Palo Seco (♂, 8.i.1921, Sir N Lamont in RSM). The only recent locality I know is Fort George, where SAS discovered a localised colony just above the Fort where the food plant, wild indigo (*Indigofera suffruticosa* Mill., Leguminosae), also occurred. I would expect it to turn up in similar disturbed, open situations where its food plant can be found.

The food plant is reported to be *Cassia occidentalis* L. (Leguminosae) (Hayward 1941, 1947 based on Brazilian publications). Similarly, in Rio Grande do Sul, Brazil, Biezanko (1963) and Biezanko & Mielke (1973) list the food plants as *C. corymbosa* Lam. and *C. ferruginea* Schrad. In contrast, Moss (1949) observed a female laying eggs on *Indigofera anil* L., but did not rear this species. In Texas, subspecies *invisus* is recorded by Kendall (1965) to feed on *I. suffruticosa* and *I. lindheimeriana* Schelle, while in Mexico Comstock & Garcia (1961) found the food plant to be *Cassia* sp. In contrast to these records from Leguminosae, Diniz & Morais (1995) report the food plant of "*Gesta (?) gesta*" to be *Anacardium humile* St. Hil. (Anacardiaceae) near Brasilia.

There is a specimen of *G. gesta* in the collection of the International Institute of Biological Control, Curepe, "collected as larva on *Lantana camara*". This is certainly not a normal food plant, since the fauna of *L. camara* is well known and does not include this species; most likely this represents a larva that strayed onto *L. camara* and then used the leaves to prepare a pupation chamber.

The following observations were made at the Fort George site in October 1993. SAS subsequently reared out this material. The ova are laid on the leaves of the food plant, *Indigofera suffruticosa* Mill., on both the leaf under surface and upper surface. Young larvae rest in a shelter made with a triangular flap cut from the leaf edge, while larger larvae rest between two leaves held together, one on top of the other. The larger larva matches that described and illustrated by Comstock & Garcia (1961). It has an orange-brown head, with a broad green-brown stripe down the centre of the face, and heavy black spots: a row of four across the top of the head, on the posterior margin; a widely spaced row of three smaller spots below this; another row of three spots below this, almost fused to form a bar apart from the ground colour at the sutures with the clypeus; below this a narrow black bar across the mouth parts. T1 concolorous. Body dull green, with a dense speckling of white dots; a yellow dorso-lateral line from T3 to A9 is strongly marked on the anterior margin of each segment, but diffuse in the posterior part (Plate 29).

Plate 29. Fifth instar larva of *Gesta gesta gesta* on *Indigofera suffruticosa,* Fort George, 16.x.1993

The pupa described and illustrated by Comstock & Garcia (1961) is 12 mm long, uniform green except for black T1 spiracles, and a group of eight coffee-coloured spots at the tip of the cremaster.

130. F15/2 *Ephyriades zephodes* Hübner 1825

Three of the four species of this genus are associated with the Caribbean Islands. E. zephodes seems to be common on Haiti and Cuba, but also recorded from Puerto Rico, Jamaica, St Thomas and St Bartholomew. In addition, Evans (1953) records specimens from Mexico (1♂), Brazil (1♂, 1♀) and Trinidad (1♀); all these mainland records would benefit from confirmation. The Trinidad specimen has labels "coll. Kaden" and "Trinidad / Druce Coll." which do not match any of the other Trinidad labels normally encountered in the NHM. The specimen might have been from Trinidad in Cuba, but it doesn't match the series from Cuba which are smaller and darker. It most closely resembles the specimen labelled Brazil, which suggests that it could be a mainland race.

In size and shape the female resembles *Grais stigmaticus*. It is light mauve brown, with UPF two brown diffuse discal bands and a submarginal one; UPH with similar wider bands. White hyaline spots in spaces 2-9, 2 in cell (in line with spot in space 2) and 12. The male is uniformly black above, with a long costal fold. Illustrations in Lewis (1973, Plate 82, No. 50, ♂) and Riley (1975, p. 174, Fig. 21, ♀).

There is a single female of this species labelled Trinidad in the NHM. Evans (1953) lists this as *E. zephodes*, although Kaye (1940) records it as *E. otreus* Stoll 1780 (TL Surinam?), a synonym of the closely related *E. arcas* Drury 1773. This remains the only known record from Trinidad, and I consider it of doubtful validity as a Trinidad species.

The life history and food plants of *E. zephodes* have not been recorded. In Puerto Rico, *E. arcas* is recorded to feed on *Echites* sp. (Bates 1935), *Stigmatophyllum lingulatum*, *Malpighia fulcata* and *Ceiba pentandra* (Wolcott 1951) and the life history is described by Wolcott (1923). *E. brunnea jamaicensis* Möschler 1878 feeds on *M. punicifolia* (corrected from *Prunus* sp.) in Jamaica and the life history is described in Brown & Heineman (1972). Tamburo & Butcher (1955) describe the life history and illustrate the larva for the Florida subspecies, *E. brunnea floridensis* Bell & Comstock , and published food plants for this subspecies include the Malpighiaceae Barbados cherry, *Malpighia glabra* (Tamburo & Butcher 1955), *Byrsonima* (Baranowski in Kimball 1965) and *Byrsonima lucida* (Lenczewski 1980, quoted by Smith *et al.* 1994). Scott (1986) describes the larva but it is not clear what his source was (it does not seem to be Tamburo & Butcher 1955).

Genera Group G

In Group G, the abdomen is as long as the dorsum of the hind-wing, the antennal club is blunt and generally bent at its commencement. The wings may be erect, half open or flat in repose. All species can be easily recognised and identified from the plates.

Evans lists just 29 species of this group for the Americas. Four of these are recorded from Trinidad, although two of them are only known from Chacachacare Island. One of these, *Heliopetes laviana leca* Butler, is a new country record collected by Scott Alston-Smith. Of this group, only *Pyrgus orcus* is found in Tobago.

The group is better represented in Africa and Asia, and together they form a compact group. In his analysis of the African species, Evans has suggested that the group should be raised to subfamily status, a view with which I sympathise. All larvae familiar to me

(including those of *Spialia* spp. in Africa) have a round head, and the head and body hairy. All Trinidad species are likely to feed on Malvaceae, although African representatives commonly feed on related families including Tiliaceae and Sterculiaceae, and there are records from Convolvulaceae, Rosaceae etc.

131. G1/11 *Pyrgus orcus* Stoll 1780

Pyrgus orcus is found from Costa Rica to Argentina (TL Surinam), and up the Lesser Antilles as far North as Dominica. Evans (1953) treated *P. orcus* as a subspecies of *P. oileus* Linnaeus 1767 which occurs in Central America and the Caribbean through the Greater Antilles and down the Lesser Antilles as far South as Grenada, thus overlapping with *P. orcus* through much of the Lesser Antilles. Although de Jong (1983) is not convinced, I follow Brown & Heineman (1972) in treating *P. orcus* and *P. oileus* as distinct species. The two species can be distinguished by the presence in *P. orcus* of a brown spot mid costa in space 8 of the UNH which is absent in *P. oileus*.

Crowfoot (1893) records *Hesperia ruralis* Boisduval 1852 from Trinidad, but not *P. orcus*; since *Pyrgus ruralis* is a North American species, I am convinced this was an error for *P. orcus*. Kaye (1904) records this "commonest skipper" from Trinidad as *Hesperia syrichtus* Fabricius 1775, which is a synonym of *P. oileus*. Sheldon (1936) also recorded this species as *Hesperia syrichtus* in his list of Tobago butterflies, and it is a common species there. It is also found on Gasparee (2♂, 11.iii.1928, Sir N Lamont in UWI & RSM) and Chacachacare Island (♀, Rusts Bay, 15.i.1980, MJWC & JO Boos) (Cock 1982b).

Male UPS brown with strong clear white spotting, wing bases and dorsum of both wings overlaid with grey setae (Plate 30, 31). Female similar colouring, but white spotting much reduced, giving a very different impression (Plate 31). Both are distinctive in the Trinidad fauna. *P. orcus* is not frequently illustrated, but *P. oileus* is sufficiently similar that illustration of that species can be used to identify *P. orcus* in Trinidad. Illustrations of *P. oileus* can be found in Brown & Heineman (1972, Plate IX, No. 18), Riley (1975, Plate 23, No. 5, ♂), Smart (1976, p. 113, No. 47, ♂) and Smith *et al.* (1994, Plate 29, No. 22, ♂). Costal fold, F ♂, ♀ 14 mm.

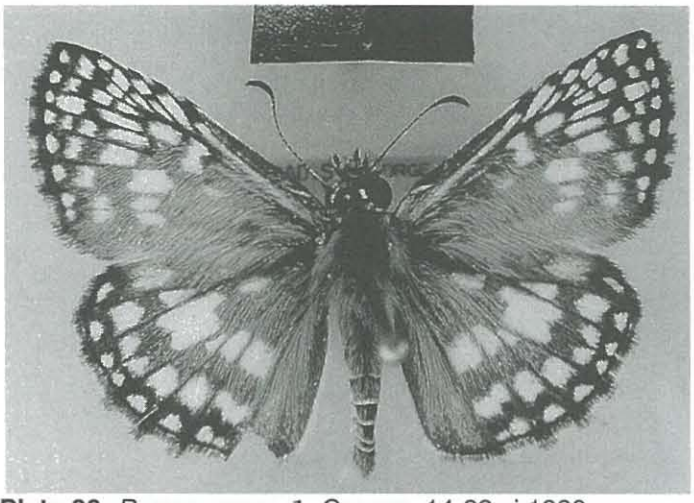

Plate 30. *Pyrgus orcus* ♂, Curepe. 14-22.xi.1980

I am inclined to agree with Kaye, who considered this the commonest skipper. This is a common and widespread species in open, disturbed situations throughout both Trinidad and Tobago. I have found it at up to 2300 ft in the Northern Range (Morne Bleu Textel), and it would probably extend higher were suitable habitat available.

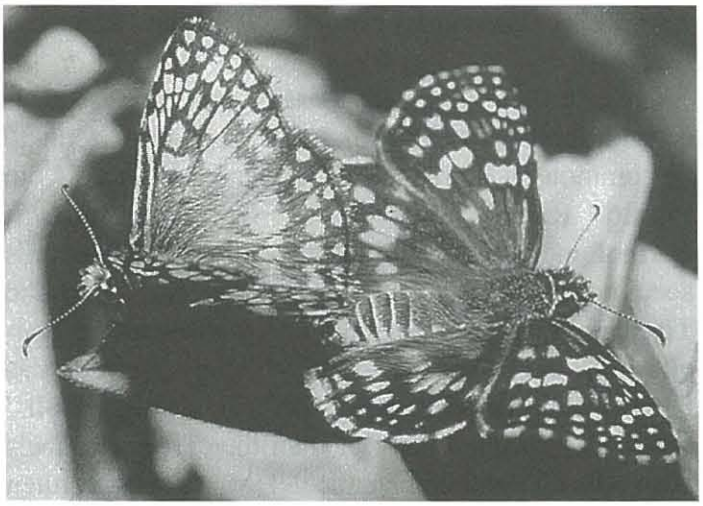

Plate 31. *Pyrgus orcus* in copula, ♂ on the left, Parrylands, 18.i.1988

According to W. Buthn (in Kaye 1921) "the larva feeds on a yellow flowered species of *Sida*. Pupa in a frail cocoon". Moss (1949) reared this species, but did not include any details in the text of his account; the plate of the larva is, in my copy, too indistinct to reveal any detail. In Rio Grande do Sul, recorded food plants include *S. rhombifolia*, *Malva parviflora* L., *Althaea rosea* Cav and *Hibiscus esculentus* L. (all Malvaceae) (Biezanko 1963; Biezanko & Mielke

1973).

Pyrgus oileus also feeds on *Sida* spp., and has been recorded from *Sida rhombifolia* (Bottimer 1926, Brown & Heineman 1972, own unpublished observations), *Sida carpinifolia*, *S. antillensis*, *S. rhombifolia*, and *S. salvaefolia* as well as species of *Abutilon*, *Althaea, Hibiscus*, *Malva, Malvastrum,* and *Sidalcea* (all Malvaceae) (Scott 1986, Smith et al. 1994 and other summaries).

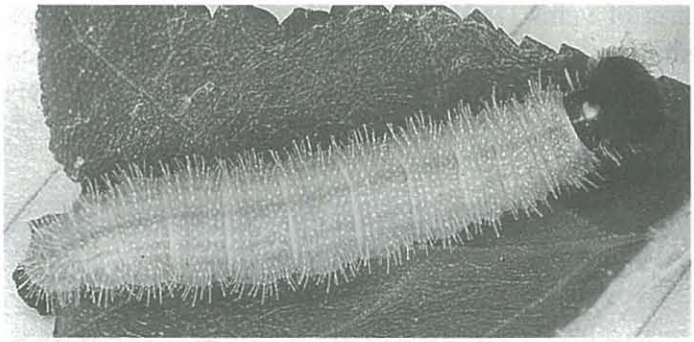

Plate 32. Fifth instar larva *Pyrgus orcus*, on *Sida rhombifolia*, Morne Bleu Textel, 16.i.1988 (Ref. 88/1).

I have reared this species from larvae collected on *Sida rhombifolia* at Aranguez Gardens, Morne Bleu Textel and the Rio Claro-Guayaguayare Road - a range of localities indicative of the range of this species in Trinidad. The mature larvae shelter between several terminal leaves of a shoot held together with silk, and pupation occurs in the same shelter. The mature larva measures about 15 mm. Head chordate, dull black, rugose, with short erect black setae. T1 dull black-brown, with pale dorsal and dorso-lateral longitudinal stripes. Body yellow-green dorsally with scattered yellow dots; green dorsal line and dorso-lateral line; laterally body green with scattered yellow dots; body covered with erect yellow-white setae. T1-2 legs black; T3 legs, prolegs concolorous with body. The pupa is 14 mm long; thorax green; abdomen yellow-green; spiracles black; black spots on abdomen at tornus FW; thorax and abdomen covered with white setae of about 1.5 mm, erect on thorax and semi-recumbent on abdomen. Pupation lasted only eight days.

132. G2/1 *Heliopetes domicella domicella* Erichson 1848

The nominate subspecies is found from USA (Texas) to Colombia and Venezuela and Guyana (TL). A second subspecies, *willi* Plötz 1884, occurs further South, from the Amazon to Argentina, and a third, *margarita* Bell 1937, is restricted to Margarita Island.

UPS brown with white markings; the strong, clear white discal band is distinctive (Plate 33). Sexes similar. Illustration in Lewis (1973, Plate 83, No. 12). Short, weak costal fold; F 13 mm.

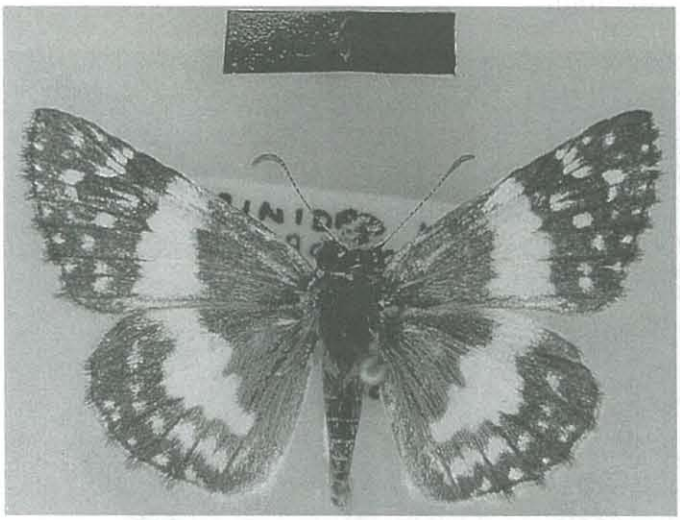

Plate 33. *Heliopetes domicella domicella* ♂, Chacachacare Island, track to lighthouse, 15.i.1980

This species is restricted to Chacachacare Island, where I caught a male and female on a collecting trip in January 1980 with Julius Boos (Cock 1982b). SAS has since caught five males and five females on Chacachacare Island. The habitat was open disturbed situations along the tracks on the island. Scott (1986) note that adults feed at mud and flowers.

Life history and food plants unknown, but likely to feed on Malvaceae. SAS has observed oviposition in Venezuela (Punta de Mata, Monagas), but has not identified the food plant.

132a. G2/5 *Heliopetes laviana leca* Butler 1870

Heliopetes laviana Hewitson 1868 occurs in three subspecies: the nominate form from southern USA to Colombia and parts of Venezuela (TL Nicaragua), subspecies *leca* from Venezuela (TL), Ecuador and Peru (here recorded from Trinidad for the first time), and subspecies *libra* Evans 1944 from Peru and Brazil (TL) to Argentina. A single male of this species, found by SAS on Chacachacare Island in 1992, is the

only record from the country.

UPS white, with margin and apical area of F marked with dark brown (Plate 34); UNF white with apical markings; UNH olive-brown with diffuse white markings. the dark UNH combined with predominantly white markings on the UPS make this species distinctive. Illustration in Lewis (1973, Plate 83, No. 13). Costal fold.

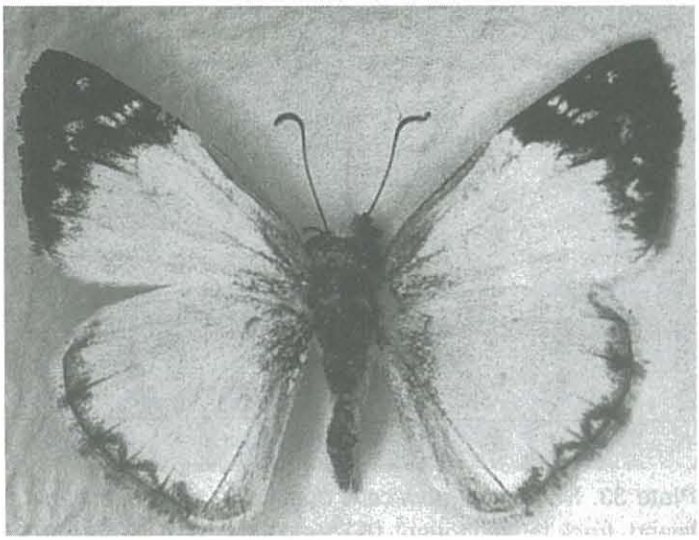

Plate 34. *Heliopetes laviana leca* ♂, Chacachacare Island, 1992, S. Alston-Smith (in collection SAS).

Although Hayward (1941) lists Convolvulaceae as the food plants, based on a Brazilian publication, other authors reports various Malvaceae as the food plants. Thus, the food plants recorded in Rio Grande do Sul, Brazil, by Biezanko (1963) and Biezanko & Mielke (1973) include *Pavonia spinifex* Willd., *Hibiscus esculentus*, *Abutilon pauciflorum* St. Hil. and *A. molle* (Ort.) Sweet. which are all Malvaceae. Scott (1986) lists *Sida filipes*, *Malvastrum americanum*, *Abutilon lignosum*, *A. hypoleucum* and *Pseudabutilon lozani*, presumably based upon observations in the southern USA. Any shrubby Malvaceae on Chacachacare Island would be worth checking for larvae of *H. laviana* and *H. domicella*.

133. G2/7 *Heliopetes arsalte arsalte* Linnaeus 1758

Through most of the wide range of this species, the nominate form is found, but a second subspecies, *marginata* Hayward is restricted to the Pacific margin of Ecuador and Peru. The nominate subspecies is recorded from Mexico to Argentina (TL "Indiis"), and two records from the Greater Antilles are considered to be either vagrants or in error (Riley 1975). This is the only member of the genus recorded from the island of Trinidad itself.

UPS white, with brown markings at margin and F apex (Plate 35); UNS white with termen, distal portion of veins UNF and all veins UNH brown. Sexes similar. A distinctive species unlikely to be confused with any other in Trinidad. Illustrations in Lewis (1973, Plate 83, No. 11) and Riley (1975, Plate 23, No. 4, ♂). Costal fold, F ♂ 16 mm.

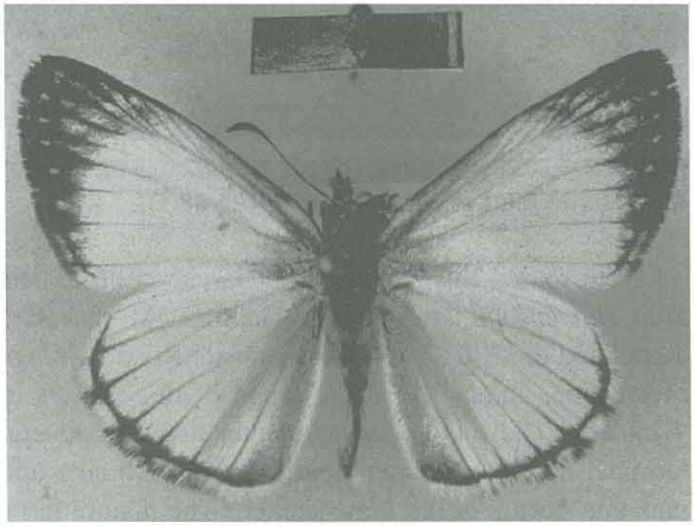

Plate 35. *Heliopetes arsalte arsalte* ♂, Grande Ravine Reserve, 21.vi.1979

This species was first recorded from Trinidad as "frequent, but not abundant" by Kaye (1904). I would regard it as occasional rather than frequent. It is widespread in lowland Trinidad, and because of its conspicuous colour and markings is not easy to overlook. It does not seem to extend to any great altitude in the Northern Range. The habitat, like that of other members of the genus, is open disturbed situations, such as roadsides.

The biology and food plant do not seem to have been recorded before. I found a larva on *Wissadula contracta* (Malvaceae), on the track above St Benedict's, below the fire tower (x.1994) an area where I have not seen adults. The larval shelter is unusual: the terminal leaves were spun together with one or more dead leaves, and the larva actually rested within a dead crumpled leaf.

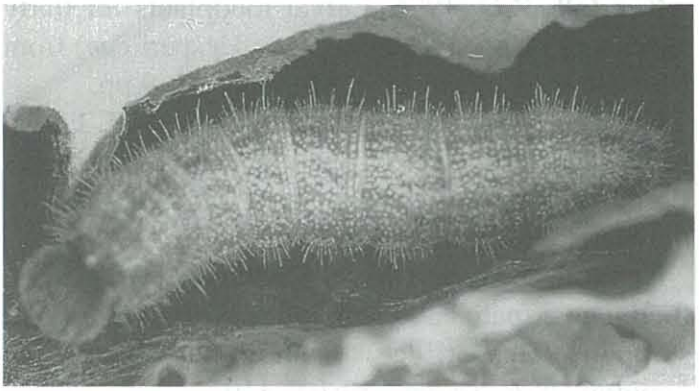

Plate 36. Fifth instar larva of *Heliopetes arsalte* on *Wissadula contracta*, above St. Benedict's, 6.x.1994 (Ref. 94/60).

L5 19 mm (Plate 36). Head rounded, indented at epicranial notch; brown; covered with short, light brown setae. T1 light brown, with narrow, pale, dorsal line and lateral line. Body dull, sullied green, with irregular sullied yellow lateral streaking merging into each other; dorsal line darker, but only clear on anterior margin of each segment; body covered with long, pale setae. Spiracles pale, inconspicuous. Legs brown; prolegs concolorous.

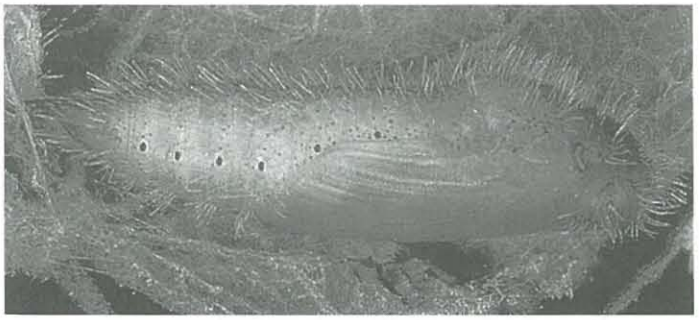

Plate 37. Pupa of *Heliopetes arsalte* collected as larva on *Wissadula contracta*, above St. Benedict's, 6.x.1994 (Ref. 94/60).

Pupa 15 mm (Plate 37). Smoothly contoured; slightly elongate; no projections. Head, thorax and appendages green, wing cases light green distally; abdomen light green; a broad, diffusely defined brown dorsal stripe on abdomen; small, irregular, black, dorsal mark on anterior margin of T1; apart from appendages, pupa covered with long, pale, erect setae. T1 spiracle light brown; abdominal spiracles black. Pupation lasted 10 days.

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Book Review:

Amphibians and Reptiles of Trinidad and Tobago

John C. Murphy. 1997.
Malabar, Florida: Krieger. 245 pp. hb US$ 72.50.
ISBN 0-89464-971-X.

This user-friendly book addresses the need for a single comprehensive guide to the herpetofauna of Trinidad & Tobago. Aside from uncertain records and sea turtles, the author records 32 species of amphibians (all frogs) and 67 species of reptiles from Trinidad, and 14 amphibians and 37 reptiles from Tobago.

Amphibians and Reptiles of Trinidad and Tobago is a physically attractive volume with large-format pages. Given its size, it is clearly not designed for field use. One copy that we have used is showing decided wear in the spine, suggesting that the binding may not sustain the expected heavy use. The presentation is clear and engaging, allowing the author's enthusiasm for the subject to show while maintaining a high scientific level throughout. In this respect, it is an exemplary treatment.

The book comprises three main parts. The opening chapters are a concise introduction to the islands (geology, geography, climate, vegetation) and the background to herpetology. In a readable, no-nonsense way, they set the scene for the substance of the book. Many local naturalists whose main interests are not in land vertebrates will also find this introductory part instructive. The review of vegetation relies heavily on Beard's classic — and now very much out-dated — studies of 1944 and 1946. To note this is not to criticize the author, but to add our voices to those calling for a new, fundamental survey of vegetation patterns.

There follows a 17-page section of keys to species, which will be welcomed by those interested in identifying specimens. These assume a certain degree of familiarity with standard terms and characters, so that beginners will have some difficulty in using them.

The keys are well written, with ample, high-quality drawings to illustrate particular features. It is unfortunate that the drawings are not captioned, which would have added very little effort and would certainly be a big help. As it is, any naturalist owning the book will want to write captions in her/his own copy. Professionals will also note that authors are not included in species names in the keys, so that these must be looked up elsewhere in the book, a minor annoyance. Another complaint about the keys concerns species whose presence here is highly suspect; it is a good idea to include these species, but they should be tagged **in the key itself** as dubious.

The bulk of the book is a straight-forward, comprehensive set of species accounts. It is mainly these that will set the book's value as a reference work. The author (describer) of the species is usually included in the species name at the head of each account, but not always. This irregularity should have been caught in proof-reading.

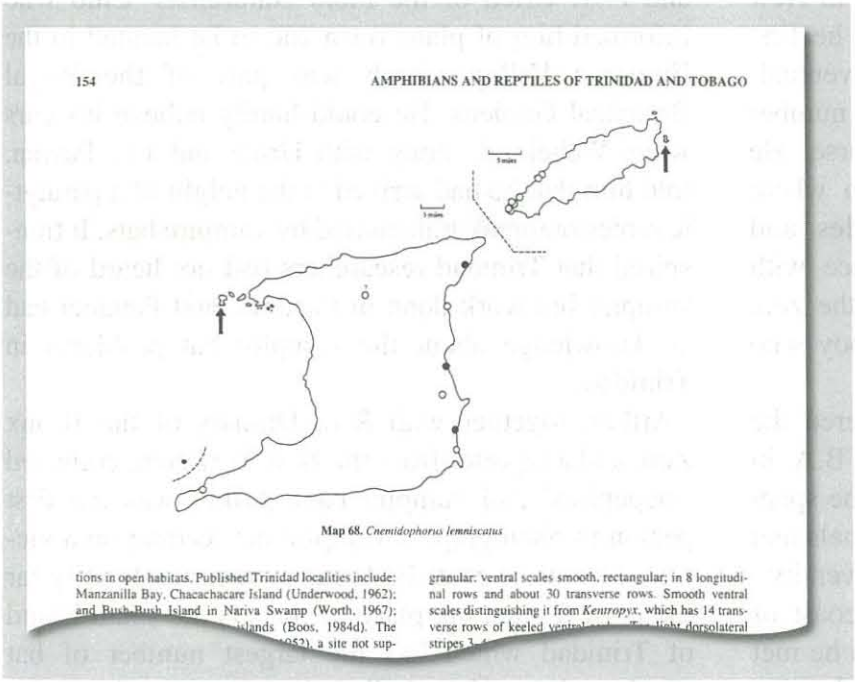
In a standard format, each species account gives common names, the species's total range and where it is found in Trinidad & Tobago (with map), a detailed physical description, natural-history notes, and a list of specimens examined by the author. The descriptions of some lizards and snakes are supplemented with high-quality drawings to show the scale patterns on the head, a valuable feature.

Some species accounts also include comments on nomenclature, especially where more than one scientific name is available. Not all of Murphy's choices among available names will be accepted by everyone, but none is capricious, absurd or outdated. In some respects, he follows a conservative nomenclatural policy. This is seen, for example, in treating under two different names the Trinidad and Tobago populations of our single dendrobatid frog genus. Murphy argues against Hardy's view that these are two different species, but admits that it is not definitely proven that they are one, and so provisionally retains the separation "in order to avoid prematurely resynonymizing" the two populations. This shows good sense.

The formal recognition of subspecies is increasingly unfashionable in zoology, and for good reason. Murphy takes a middle course between adopting a subspecies name wherever one is available for the local form and disregarding subspecies altogether. This critical attitude

is exemplified in a curt agreement with an earlier author that "The subspecies of *Ameiva ameiva* make no sense." Where he does recognize subspecies, he gives both its range and that of the species as a whole, a sound policy.

The 111 range maps are clear and informative, but also very wasteful of space. Each occupies about 45% of a page and, as seen in the example here, comprises an outline of both Trinidad and Tobago.


154 AMPHIBIANS AND REPTILES OF TRINIDAD AND TOBAGO

Map 68. *Cnemidophorus lemniscatus*

tions in open habitats. Published Trinidad localities include: Manzanilla Bay, Chacachacare Island (Underwood, 1962); and Bush Bush Island in Nariva Swamp (Worth, 1967); islands (Boos, 1984d). The 952), a site not sup-

granular; ventral scales smooth, rectangular; in 8 longitudinal rows and about 30 transverse rows. Smooth ventral scales distinguishing it from *Kentropyx*, which has 14 transverse rows of keeled ventral light dorsolateral stripes 3-

By simply moving Tobago further west and cropping the margins, the author could have saved half of this space, even without eliminating any part of either island. As it is, the dead space around the maps amounts in sum to a little over 25 pages, or just about 10% of the book. Unless it is proposed that readers should use this space to write notes into personal copies, such profligacy is little short of shocking.

Further economy could be realized in some cases by putting more than one species on a map. As an example, an entire map of both islands is devoted to the single dot (Charlotteville) for *Atractus univittatus*. The very next species, *Chironius carinatus*, is not known from Tobago, yet it too gets a full map of both islands. This sort of thing is almost comically wasteful, although readers with an eye to the book's price are unlikely to be amused.

On the other hand, in a few cases two species share a map in just the suggested way. And wherever the known range includes one or more of the smaller islands, the author has done well to indicate this clearly with arrows.

In our view, Murphy has been too cautious with respect to species ranges within Trinidad & Tobago. For most it would have been useful and legitimate to indicate the inferred range on the map (e.g. as a dashed line) on the basis of topography, vegetation and presently known records.

An especially attractive feature is the 48-page section of colour photographs. The 172 photos are mostly portraits of living animals, with a few dead specimens, juveniles and habitat shots included. The bulk of them are by the author, and most are excellent. Aside from their utility in illustrating particular features and aiding in identification of specimens, it is a great pleasure to simply look at these pictures.

The photos have informative captions, some of which could be much improved by adding details. As an example, Fig. 127 shows a Suriname specimen of *Erythrolamprus aesculapii*, captioned as such. We understand that it is far better to show a live specimen from elsewhere than the one known dead specimen of this snake from Trinidad, but what is not said is that the colour patterns are quite different, so that for identification purposes the figure is misleading. In this and other cases, the desired additional information is found in the species accounts, but the reader cannot be expected to consult these along with each figure. This is one situation in which some redundancy would have been valuable.

Murphy's review of the literature is thorough, as seen in the mass of citations throughout the text and a list of about 670 references at the end.

The price of the book will unavoidably limit its distribution, especially in the tropics. We are aware of only eight legitimate copies in Trinidad & Tobago, a number that is unlikely to increase significantly. This is a very serious shortcoming. It continues the long-standing problem of the general unavailability to serious amateur naturalists of major works on our herpetofauna. Earlier key treatments have tended to be published in professional journals or in short press runs, and now an otherwise very useful book is priced beyond the reach of most.

In summary, then, *Amphibians and Reptiles of Trinidad and Tobago* is a very good book that will be used and treasured by those naturalists who can afford it.

Christopher K. Starr and Hans E.A. Boos

Tribute
Arthur Mervin Greenhall (1911-1998)

Arthur Greenhall was born on 6 August 1911 in New York City. From an early age he was attracted to animals and kept many of them as pets, especially snakes. At George Washington High School in New York there was no course in zoology when he first arrived there, so he campaigned for one and eventually enlisted 24 other students, the minimum number required for the school to provide the course. He became a regular visitor to the Bronx Zoo where Raymond Ditmars was Curator of Reptiles and Mammals. Having been granted an audience with Ditmars he began doing volunteer work at the zoo, and Ditmars became a foster father to the boy who had lost his parents at the age of three.

After leaving high school in 1930 he entered the University of Michigan and graduated with a B.A. in 1934 and an M.S. in 1935. During this time he spent his summers in the Caribbean collecting animals and doing studies relevant to his course at the university.

In 1932 while on board a vessel off the coast of Cuba, Arthur first heard about Trinidad when he met a gentleman by the name of Sullivan Dillon who was from Tobago. Sullivan's lively enthusiasm about Trinidad, its varied wildlife habitats, and profusion of flora and fauna, impressed Arthur. Hence the seeds were planted in Arthur's mind for Trinidad being a possible site for future collections and study. Arthur was in Cuba collecting reptiles for the Bronx Zoo and the American Museum of Natural History when political and civil events there forced him to leave for Costa Rica and Panama.

In 1933, while on a return visit to Panama, he became interested in vampire bats and returned to the Bronx Zoo with a pregnant vampire, the first ever to be exhibited alive. The vampire and her new born baby caught the attention of many professionals and amateurs alike. It is doubtful that Arthur realized how deeply this successful birth would, in turn, generate a new focus and direction in his own life.

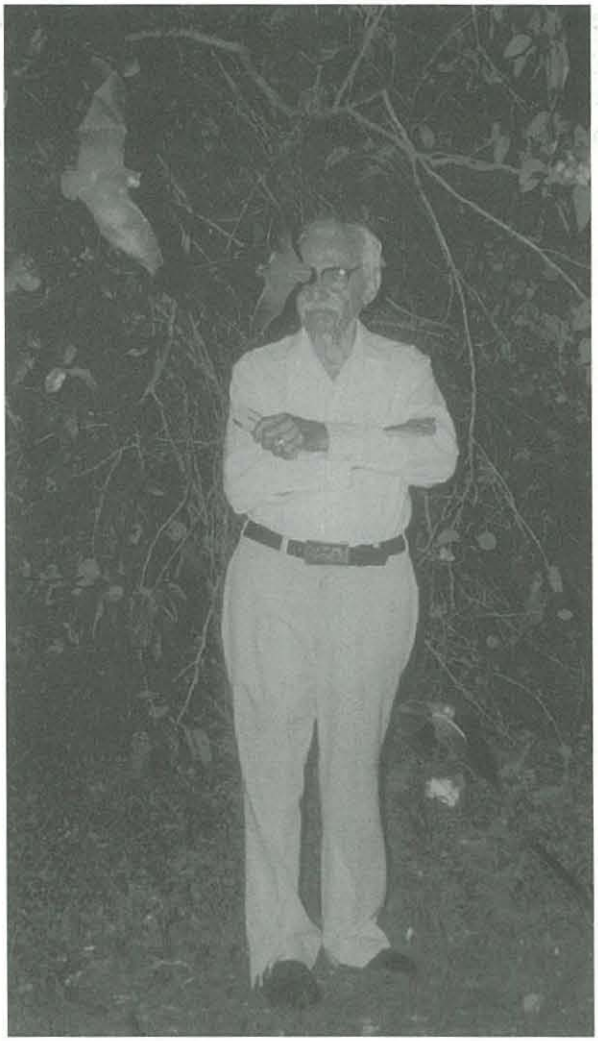
In 1934, he finally arrived in Trinidad to collect fer-de-lance and bushmaster snakes, known locally as 'mapepires', and, if possible, to further study vampire bats. Arthur described Trinidad at that time as "a sleepy British colony where white linen suits and pith helmets were in fashion." He met Ludolf Wehekind and F.W. Urich of the Field Naturalists' Club who informed him of plans for a zoo to be located in the Emperor Valley which was part of the Royal Botanical Gardens. He could hardly believe his ears when Wehekind, along with Urich and J.L. Pawan, told him that he had arrived at the height of a paralytic rabies outbreak transmitted by vampire bats. It transpired that Trinidad researchers had not heard of the vampire bat work done in Panama, and Panama had no knowledge about the vampire bat problems in Trinidad.

Arthur, together with R.L. Ditmars of the Bronx Zoo, and a reporter from the New York Sun, collected 'mapepires' and vampire bats. Arthur was the first person to photograph a vampire bat feeding on a victim, a farmer's goat. In Arthur's own words: "By far the most fascinating place for bats is the small island of Trinidad which has the largest number of bat species, about 65 including the vampires *Desmodus* sp. and *Diaemus* sp. Trinidad is famous for its vampire bat rabies outbreak from 1925 to 1939. Despite the loss of thousands of cattle and 89 human deaths, people considered themselves among the elite if they were bitten by a vampire bat while spending the weekend 'down the islands' on the resorts of Gasparee and Monos." With reference to Carnival and the awareness of Trinidadian masqueraders to their famous bat population, Arthur had this to say: "In the early 1920's bat bands became prominent. There were bats of many colours with wings that flapped. Authentic bats (costumes) often showed sufficient detail to be identifiable as to species. If the bat rolled on skates it was called a fancy bat!"

From 1942 to 1947 when he was Director of the Portland Zoo in Oregon, he assisted Wehekind and the Zoological Society of Trinidad and Tobago in drafting plans for the Emperor Valley Zoo. This consultation continued from 1947 to 1953 when he was the General Curator of the Detroit Zoo and Belle Isle

Aquarium. Wehekind, then president of the Trinidad Field Naturalists' Club, arranged that Arthur become curator of the Royal Victoria Institute Museum. He arrived to take up this post in September 1953.

In 1954 Arthur was appointed first director of the newly formed Emperor Valley Zoo, became Government Zoologist in charge of the bat rabies programme (a second outbreak flared in 1954), and was appointed consultant mammologist at the Trinidad Regional Virus Laboratory of the Rockefeller Foundation. He held these positions until 1963. During this period Arthur directed bat crews who collected these flying mammals from every corner of the island. One new species discovered by him, the Trinidadian Dog-faced bat (*Molossops greenhalli*) was named after Arthur, ensuring an everlasting link between the name Greenhall and Trinidad's natural environment.



The museum and the zoo matured through these years, the latter eventually requiring a full-time director. Arthur's work on bats in general was comprehensive, and he published his findings, thus increasing the known bat fauna in Trinidad and Tobago from 35 to 65 species. These comprise mainly insectivore and fruit-eating bats. He also observed a few species that included nectar in their diet, hovering at flowers like nocturnal hummingbirds. There are omnivores (*Phyllostomus* sp.), mixing small mammals and birds with their fruit diet, and there are carnivores, one species (*Vampyrum* sp.) feeding on birds and smaller mammals including other bats, while another (*Trachops* sp.) dines on lizards and frogs. There is even a species (*Noctilio* sp.) with a diet that is exclusively fish.

With Trinidad and Tobago's independence in 1962, Arthur thought that it would be better for him to leave these shores so that the posts he held might be taken up by local people. After departing from Trinidad he went to the National Museum of Natural History in Washington, D.C. as Chief of the Bird and Mammal Laboratories, U.S. Fish and Wildlife Service, where he continued his studies on bats. After four years as bat zoologist to FAO from 1968 to 1972 he returned to the Fish and Wildlife Service and stayed there until his retirement in 1988. It seems that he had intended to return to Trinidad after retirement but this did not happen for reasons we do not know.

During all this time Arthur published many papers, large and small. For us here in Trinidad and Tobago, the most important is his treatise with George Goodwin entitled "A Review of the Bats of Trinidad and Tobago: Descriptions, Rabies Infection and Ecology." For nearly forty years this has been the definitive work on the bats of our country, and there is no successor in sight. Arthur, however, did not neglect much homelier topics. Thus, he described in a short paper entitled 'A Bamboo Mongoose Trap', the trap used by our crab hunters, adapted as one for trapping mongooses, and he wrote several others on the control of house bats, and bats in agriculture. Throughout his life he seems to have been fascinated by vampire bats and the culmination of this interest came in 1988 with the publication of 'Natural History of Vampire Bats' which he edited with Uwe Schmidt and to which he contributed a paper on feeding behaviour.

Arthur loved Trinidad; of this there can be no doubt. He loved our forests, our hills, our beaches, our bat caves, our people, our culture, carnival and calypsoes. He delighted in the imagination with which bats were portrayed in carnival bands. In everything he was gentle and gentlemanly. He never quarrelled; he spoke softly; he approached every situation calmly and logically. For all that, he knew how to manoeuvre himself through the intricacies of government departments,

both here and in the United States, and in the end he usually got what he could so clearly see was right.

In 1942 he married Elizabeth Rusk Jones and she bore him two children, Alice and Paul. The family arrived in Trinidad in September 1953 to a very different country from the one Arthur encountered in 1934. The country was no longer sleepy; it was restless; a world war had intervened. Political changes were coming; a West Indian Federation was contemplated and later abandoned. Without ever intruding into our political affairs both Arthur and Elizabeth were caught up in the excitement and drama of the emergence of a new nation. They led a full life in our society. When the Trinidad Field Naturalists' Club was revived in 1954 they both joined, and in the same year they were both made honorary life members.

When Arthur left Trinidad in 1963 he took with him very fond memories of the country's forests and wildlife, its people and culture. He described his experiences here as some of the most influential and emotionally rewarding of his life.

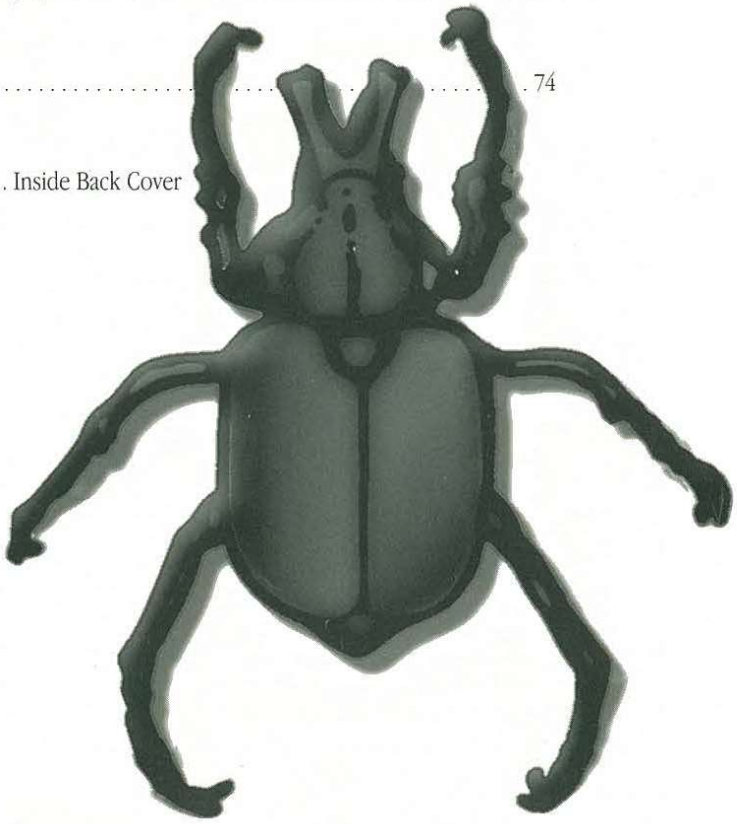
Arthur and Elizabeth were the perfect couple. They not only loved one another but helped each other in everything. Elizabeth read in draft all of Arthur's publications and contributed to their final form. He in turn took an interest in her occupations and helped her achieve her goals. Such love is rare indeed. It was an inspiration to all of us who knew them.

Geoffrey Gomes and Victor C. Quesnel

Contents

Mission Statement

To foster education and knowledge on natural history and to encourage and promote activites that would lead to an appreciation, preservation and conservation of our natural heritage.



Natura Maxime Miranda in Minimis