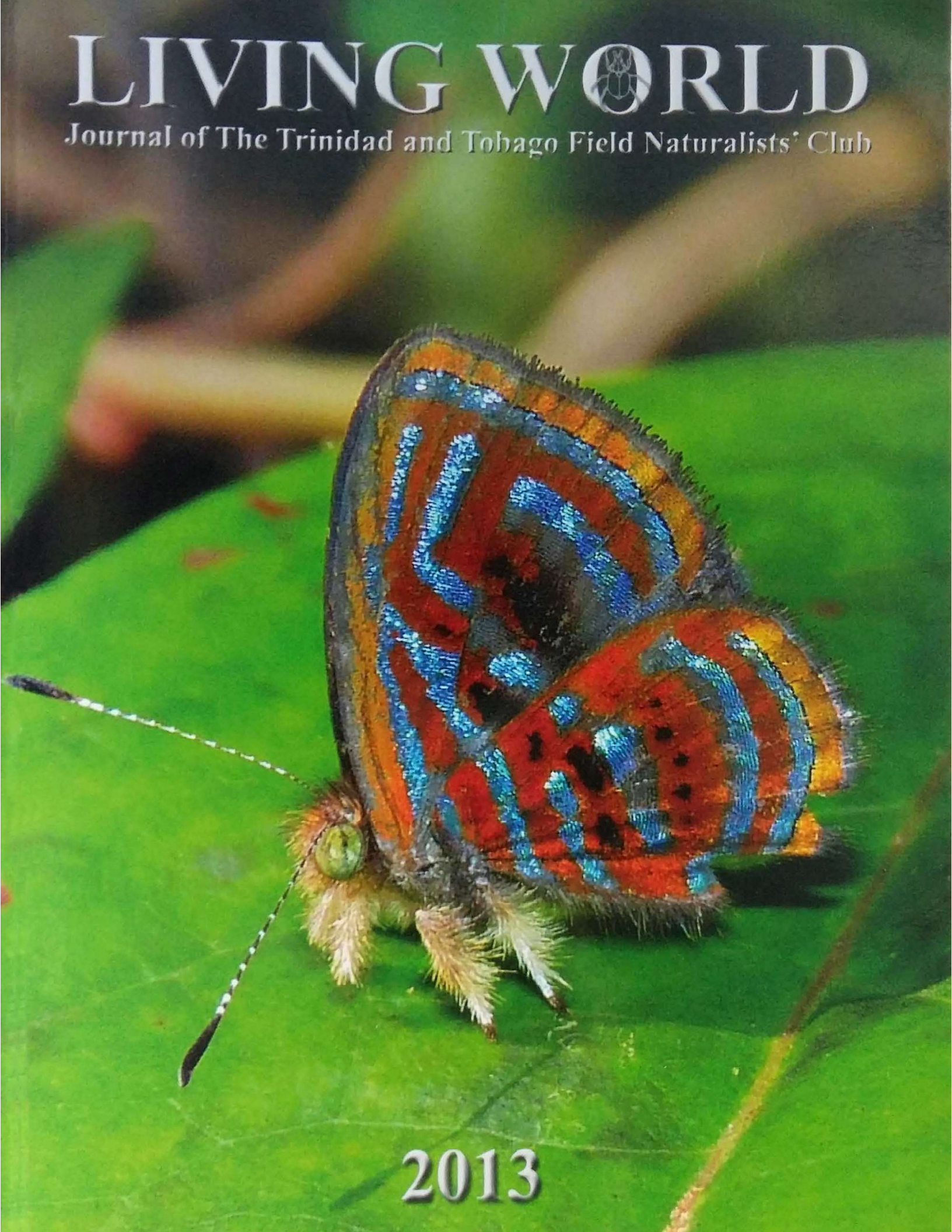
# LIVING WORLD

Journal of The Trinidad and Tobago Field Naturalists' Club



2013

# THE TRINIDAD AND TOBAGO FIELD NATURALISTS' CLUB

The Trinidad and Tobago Field Naturalists' Club was founded on 10 July, 1891. Its name was incorporated by an Act of Parliament (Act 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 meetings are held at St. Mary's College on the second Thursday 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.

**Mission Statement**
To foster education and knowledge of natural history and to encourage and promote activities that lead to the appreciation, preservation and conservation of our natural heritage.



## Enquiries


All enquiries concerning the Club should be addressed to:
The Honorary Secretary
P.O. Box 642, Port of Spain
Republic of Trinidad and Tobago
**E-mail:** *admin@ttfnc.org*
**Website:** *www.ttfnc.org*

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Field Naturalists' Club
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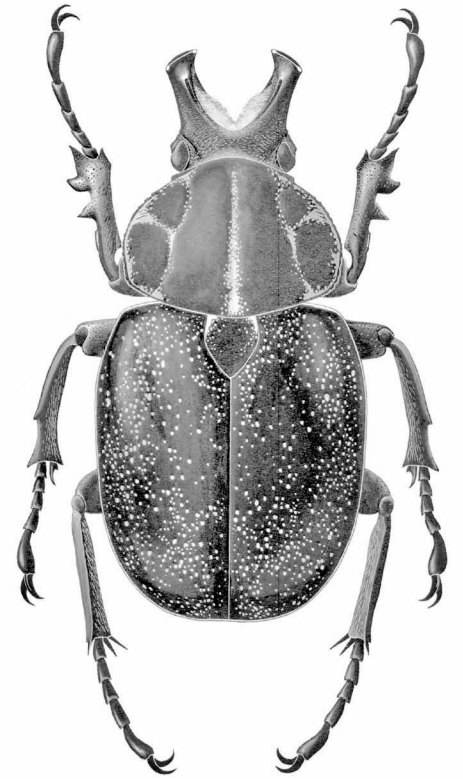
***The 2013 issue of Living World is dedicated to the memory of Dr. Paul Linus Comeau***



*Inca clathrata quesneli* Boos and Ratcliffe

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# DEDICATION

## Paul Linus Comeau
## 1942 - 2012

Paul was a Life Member of the Trinidad and Tobago Field Naturalists' Club (TTFNC) and worked tirelessly on all aspects of the Club's mission.

He was an enthusiastic hiker, often leading the pack and outpacing many of the younger members despite a seemingly frail appearance. It was through this hiking and his knowledge of the forest that he was the lead author of *The Trinidad and Tobago Field Naturalists' Club Trail Guide*. He was also lead editor of the second edition.

For 14 years he served as a member of the Editorial Committee of our Living World Journal and made some valuable suggestions for its improvement. He was a regular contributor to the Journal and authored with his wife Yasmin and Winston Johnson *The Palm Book of Trinidad and Tobago* published by the International Palm Society.

Junior writers could have called on Paul at almost any time for assistance with descriptions of plants. At no time did one feel that the request was a burden to Paul or that one was being intrusive on Paul's time. Paul assisted gladly and in a timely manner. He would also point you towards other relevant literature to facilitate your development.

Paul was always genuine and humble and an avid teacher, happy to share his knowledge with Club members at lectures and on field trips, and was well qualified to do so.

His initial training was in Nova Scotia at Arcadia University after which he did a PhD in Plant Ecology at Durham in the UK. He taught Plant Ecology at the UWI and became intimately acquainted with our plant communities especially the savannahs and the vegetation associated with mud volcanoes. Much of this experience led to his authorship with Julian Kenny and Leslie-Anne Katwaru of *A Survey of the Biological Diversity of Trinidad and Tobago*.

Paul was a dedicated family man, musician and a member of the Lady Fatima R.C. Church in Curepe where he worshipped regularly.

The Editorial team wish to express our condolences to his wife Yasmin and his two sons Andre and Camille.

**Graham White**
**John Lum Young**

# Editorial: 15 Years as Editor of Living World

This is my last issue of Living World as its Editor. I have been Editor for the last 15 years and during this time I have been privileged to work with an editorial team which was dedicated and determined to produce a journal which could be accepted in scientific circles. In the process, we have made many changes to previous issues starting with the issue of 1997-1998.

One of the first things we did was to standardize the references. Previously, authors differed in the way the references were presented. Even in the same article some authors varied in the way they presented their references! We also standardized the font size of the text to 11 pts New Times Roman as well as column width. Later, we introduced abstracts and a list of key words. We also introduced a section for "Short scientific communications" which we later changed to "Nature Notes".

In 2005, we introduced Guest Editorials from outstanding members of the local community versed in our biota to reflect on the burning issues on our environment, the first of which was written by the late Julian Kenny. The Journal has now settled down to a format which includes studies or observations on natural history of Trinidad and Tobago and the wider Caribbean, matters of conservation or taxonomic interest and recognition of individuals who have made outstanding contributions to the Club. We have also widened access to the Journal for authors who are not members of the Club.

One of the more significant things we did was the use of referees which raised the quality of papers published and here I pause to thank the Reviewers most heartily for taking the time off from their busy schedule to review papers for us. They have indeed helped to raise the standard of the Journal.

There were also physical changes, the major one being the use of Matt paper instead of the Bond paper we had been using for printing. The Bond paper was not adequate for reproducing line drawings and photographs with sharp figures. Apart from the cover, colour was first used in 1997-1998, but because of cost the number of pages with colour was kept to a bare minimum. Since then our printer has made changes to their plant which eliminated the need to make colour separations so that printing with colour became cheaper. This change allowed us to move to a full colour format starting with the 2010 issue. Laminating of the cover started in 2003 which made for a sturdier and more lasting cover.

In 2004, we partnered with the Life Sciences Department of The University of the West Indies (St. Augustine) to produce a Supplement to Living World. The Supplement consisted of the "Proceedings of the Nature of the Islands" (a conference on Caribbean island natural history, in memory of Peter R. Bacon). Subsequently, two Supplements were produced in 2011 and one in 2012, again jointly with the Life Sciences Department, U.W.I.

As the Journal began to improve, so did the number of researchers wanting to place their articles in Living World. This demand led to increased sizes of the Journal. This increase in size incurred increased costs and concern from the Management Committee. The Editorial Committee took a closer look at its management of the pages and apart from the streamlining of articles, also reduced font sizes of references and abstracts. The other change involved the placement of short Nature Notes wherever they could fit at the end of research articles. Another change to help defray the cost of production of the Journal was the acceptance of advertisements and outright donations which fell in three categories named after Hummingbirds: Ruby Topaz (contributions of $5000.00 and above), White-Chested Emerald (contributions of $2000.00 to $4999.00) and Blue-Chinned Sapphire (contributions up to $1999.00). The extra income from advertisements and donations plus partial contributions from Club members' fees helped, but were still not meeting the full cost of production. Management must find innovative ways to generate income for production of the Journal.

I must thank the Management Committee of The Trinidad and Tobago Field Naturalists' Club for their confidence in appointing me as Editor of the Journal and their support over the years. Thanks are due for the support of the other members of the Editorial Committee and for their helpful and practical suggestions. These members include: Graham White, the late Paul Comeau, the late Nigel Gains, Victor Quesnel, Shane Ballah and Palaash Narace. There were others outside of the Editorial Committee who made many useful suggestions for the improvement of the Journal. Among these were: Dr. Christopher Starr, Dr. Matthew Cock and Richard ffrench.

My thanks are also due to authors for their co-operation and understanding when they had to do additional work on papers as suggested by the Reviewers. Few disagreed with the Reviewers. Indeed, some authors wrote to me asking me to thank the Reviewers for the work they had done on their papers.

I also want to thank the staff of RPL (1991) Ltd., our printer, who were always helpful and co-operative. They understood that we were trying to produce a scientific journal and were very patient with us. Special mention is made of Jaime Mungal of the Pre-Press section, Stanley Herbert, Production Manager and their staff, the Misses Salima Ramkhalawan, Melissa Bachoo and Rosalyn Panchoo. Both Salima and Melissa's formatting skills and Rosalyn's proof-reading and attention to detail were outstanding.

**The 2013 Issue**

In July 2012, there was bulldozing of a turtle-nesting beach at Grande Rivière on the north coast of Trinidad where eggs and hatchling turtles were destroyed. There were numerous protests and commentaries on the event in the local press. The event also made international news. Professor Paul Shaw of the Geography Department, University of the West Indies gives us a balanced view of the event as our Guest Editorialist for 2013.

In the 2013 issue of Living World there are six research articles. Matthew Cock contributes his final paper on the Hesperiidae (Part 20) giving details on the taxonomy, identification and biology of various species, and he also writes on two *Udranomia* species recorded for Trinidad. The Blue-and-Yellow Macaw was extirpated from the Nariva Swamp, Trinidad in the early 1960s. However, between 1999 and 2004, 31 macaws were brought from Guyana and released in the Nariva Swamp. It was noted in 2012 that the birds were breeding and at last count there were 86 birds in the swamp. Bernadette Plair gives an account of this success. *Philornis downsi* was first described by Dodge and Aitken from Trinidad. This fly has now been found in the Galapagos Islands parasitizing the finches of the islands. Stefanie White, Raymond Martinez and Dave Chadee give their experience in collecting and trying to develop a laboratory colony of *Philornis* sp. The final research article by Roger Downie recommends common names for Trinidad and Tobago species of frogs.

In this issue there are 14 Nature Notes, one more than in 2012.

Martyn Kenefick again reports on rare birds seen in Trinidad and Tobago in 2012.

In the 2001 issue of Living World a tribute was paid to Dr. John Stanley Beard who had done fundamental researches on our forests in the 1940s. In the same vein Dr. C. Starr and Ms. Jo-Anne Sewlal recognise Mr. Hans Boos, a long-standing member of our Club who is an authority on Trinidadian snakes as well as other aspects of Trinidad and Tobago's natural history.

In 2012, a member of the Editorial Committee and a Life Member of the Club, Dr. Paul Comeau, passed away. A tribute is given to him on page iii. A friend of the Club and one who worked on ants in Trinidad while at the University of the West Indies, Dr. David J. Stradling, also passed away in 2012 in England. A short tribute is paid to him in this issue.

While I had inputs in the 2013 issue, most of the editorial work was done by the Assistant Editor, Mr. Graham White, who will be the new Editor in 2014. I welcome him as the new Editor.

**Elisha S. Tikasingh**
*elisha.tikasingh@gmail.com*

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**Cover Photograph**

Resembling a miniature carnival masquerader, the elegant *Sarota gyas* (Cramer) is a widely distributed butterfly of the Riodinidae family. This individual was photographed along the Inniss Field Road in south Trinidad by Kris Sookdeo.

# Guest Editorial: Rivers, Beaches and Leatherback Turtles: the Case of Grande Rivière

Grande Rivière Bay, in north-east Trinidad (Fig. 1), is one of the world's most important sites for the conservation of the Leatherback Turtle (*Dermochelys coriacea*), a species declared critically endangered by the International Union for the Conservation of Nature (IUCN 2012) in 2000. Grand Rivière Beach supports the highest nesting density in the world (Wider Caribbean Sea Turtle Conservation Network 2008) and at the height of the nesting season hundreds (with estimates of up to 300-500) of female turtles climb onto the beach in the hours of darkness, lay their eggs and return to the sea. As global nesting populations may have fallen as low as 26,000 to 43,000 females (US Fish and Wildlife Service 2007), it is a key nesting site, and the nesting event is the focus of a thriving eco-tourist industry, bringing much needed economic benefit to this remote community.

In July 2012 Grande Rivière hit the world's news headlines (BBC 2012a). A flood in the Grande Rivière River, unable to reach the sea directly through the beach, diverted westwards into the 200 metre stretch which is the focus of tourist activity, cutting a channel through the back beach (Fig. 2) and destroying hotel infrastructure (Fig. 3). The Ferdinand River, 200 metres to the west, followed a similar pattern. In response, the Ministry of Works sent in a heavy excavator to create a sand berm and cut off the new channel. In doing so they excavated and crushed some 20,000 turtle eggs and hatchlings, estimated at 10% of the total annual lay (BBC 2012b). This figure was disputed by the Environmental Management Authority (Boodram 2012), amidst claims that 'over a million turtles had been saved by the intervention' (vtbirch101 2012). As images of dead hatchlings circulated the globe, and the procedure was condemned by the Minister of Planning and Sustainable Development (La Vende 2012), local and global conservation communities responded with consternation. Six months later, with no firm data available on egg and hatchling loss, the local community and the Trinidad and Tobago Government are debating not only the circumstances of the event, but the long-term issues of how to prevent its recurrence, and indeed, the complex issues surrounding the management of such small, but vital, part of the natural estate. As independent scientists involved in the monitoring of the beach and its turtle community, we would like to offer comment on some of the issues at stake.

First, consider the beach itself. Beaches are highly dynamic landforms responding constantly to energy flux. Few of Trinidad's beaches are of any great age, because they are ultimately controlled by the altitudinal relationship between land and sea. Maracas Beach, for example, has been dated to around 3,000 years old (Ramcharran 2004). They are subject to wave regimes and currents, which are distributed up and down the beach by the tidal cycle, operating on daily, lunar and annual time scales. Erosion and removal of beach sand tends to take place during short-term (hours/days) high energy events, whilst accretion is favoured by a longer (weeks/months) low energy regime. Although the beach can be eroded at any time, most erosion takes place during the northern winter (October to March), when Atlantic storms set up destructive swells, characterized by large breakers.

Rivers bring water and sediment from the Northern Range to the beach. There may be a gap in the beach through which the river can flow on a day-to-day basis, but in the case of most high energy flow events, the river ponds behind the beach, spreading onto the surrounding flood plain, and then spreading laterally to find the line of least resistance to the sea. Most floods occur during the wet season (June to December), with flow diminishing to almost zero during the dry months.

If we ask what the optimum conditions for turtle nesting are, two factors are obvious. First, during the nesting season (February to August) the leatherback requires a broad beach, stable in terms of both morphology and sand volume. The average depth at which the turtle lays eggs is around 70 cm, therefore removal of a metre depth of beach sand will also terminate the nests within it. Conversely, if a metre of sand is added, it will disadvantage hatchlings, which will have further to climb through the sand. In terms of erosion across the beach profile, the loss of a few metres on the seaward face is far less important than the back beach, where most turtles nest.

Second, outside of the nesting season (September to January) the interests of the turtle are best served by the removal of the beach and its replacement with fresh sand. An accumulation of 'stale' sand and old nesting debris leads to an increase in potentially harmful parasites and pathogens (Conrad *et al.* 2011) which jeopardize nesting success.

In these terms it would appear that the leatherback has adjusted well to beach dynamics. Beach replenishment takes place outside of the nesting season, whilst the maximum nesting activity takes place between April and June, when the chances of beach stability are greatest. However, high seas, combined with spring tides, can occur at any time of the year. The beachfront hotels lost business in April 2009 due to inundation by unusually large waves and the Grande Rivière River is known to have flowed westwards in earlier years, notably 2003. Many local

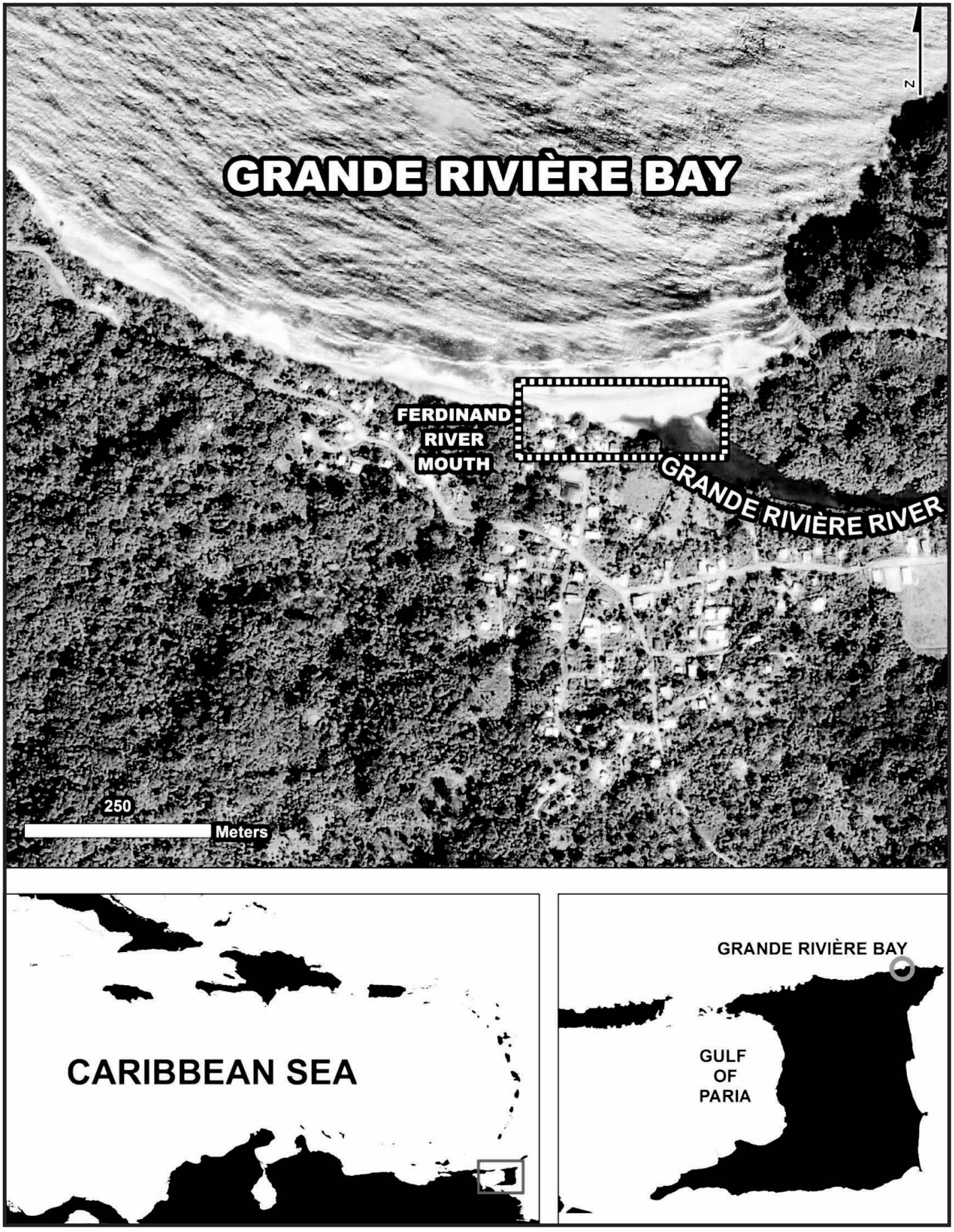


**Fig. 1.** Grande Rivière Bay, location and Google Earth image.

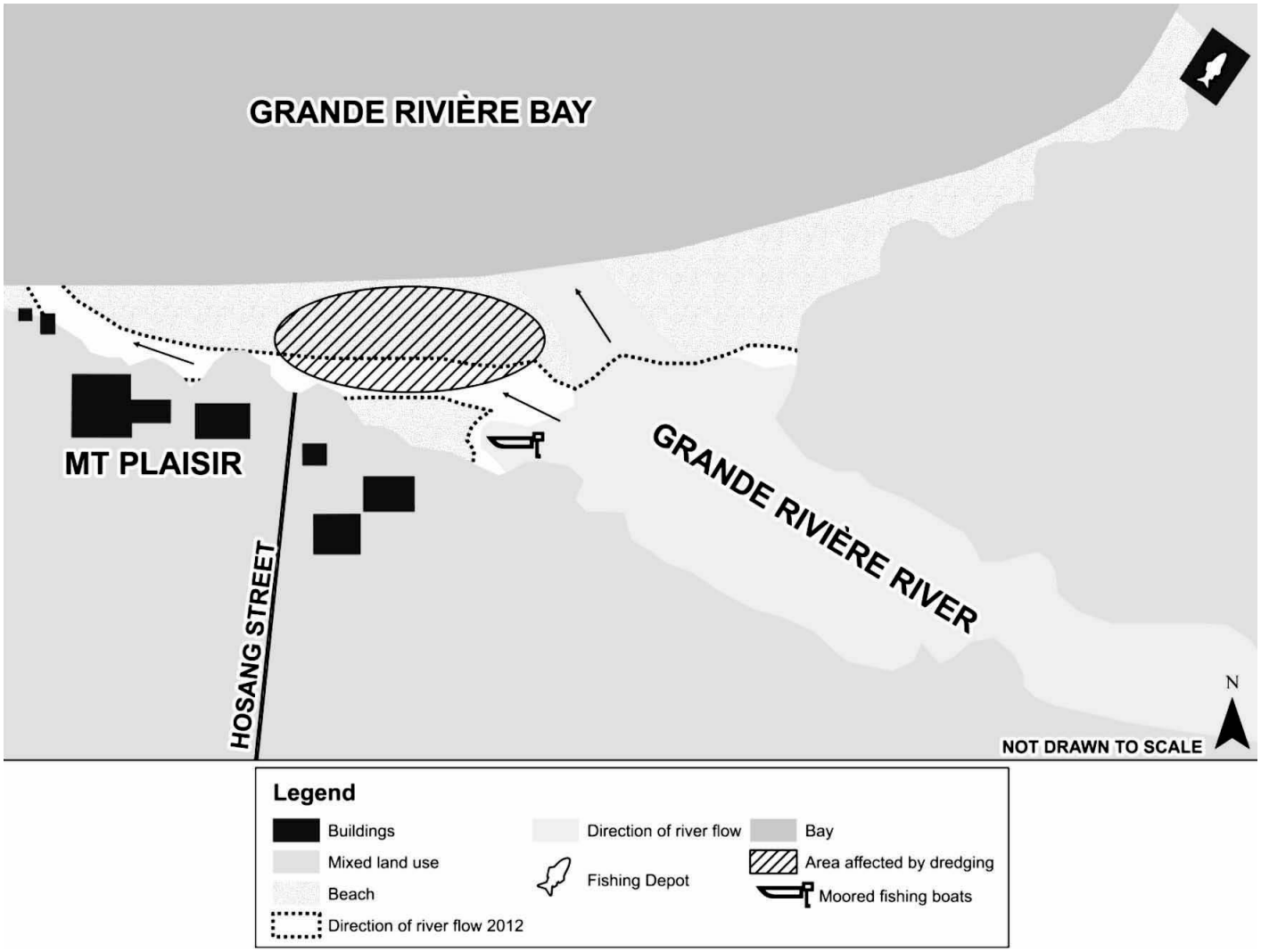


**Fig. 2.** Sketch map showing location of features mentioned in the text.

residents are of the opinion that the switch in river flow is part of a cycle that occurs every 10 to 20 years.

Was there any culpability of the local community in the July 2012 event? Natural hazard modelling posits the existence of unseen but potentially important factors in all disaster events. In this case it was not the tardiness of the Ministry of Works in responding to protests by local hoteliers when the rain began (Moe 2012), but less obvious issues. The July flood was essentially the first of the wet season – meanwhile the mouth of the Grande Rivière River had been allowed to close up, as fishing boats had not used it for access for some weeks. This, in turn, built up water behind the beach. In such circumstances the river normally flows eastwards, either by channelling through the back beach, or flowing across the natural flood plain. This area is undeveloped and forms a natural sacrifice zone. Indeed this has long been recognized by the community and a sluice gate had been constructed at the Fisheries Depot at the eastern end of the beach to release flood water. In this case the system was in a poor state of repair, and the gate is rumoured to have remained closed in July. (At the time of writing – January 2013 –remedial works on the sluice are taking place). Further, a flood defence embankment of unknown legality has been constructed along the eastern river frontage, which can only exacerbate the problem. Clearly there are issues of preparedness which the local community needs to discuss.

Long-term plans for rehabilitation also need to be reviewed critically. Artificial replenishment of the beach has been mooted; bringing in truck loads of sand from adjacent coastal areas. This is a waste of time and money. The Grand Rivière Bay is a closed sediment cell in which loss of sediment takes place to the offshore zone during high energy events, with return during calmer conditions. The database of beach profiles collected by the Institute of Marine Affairs and Department of Geography, UWI, over the past decade confirms this. Likewise a permanently engineered river mouth, as proposed by the former Minister of Works in December 2011 (vtbirch101 2012) is undesirable; at the very least it would disrupt longshore

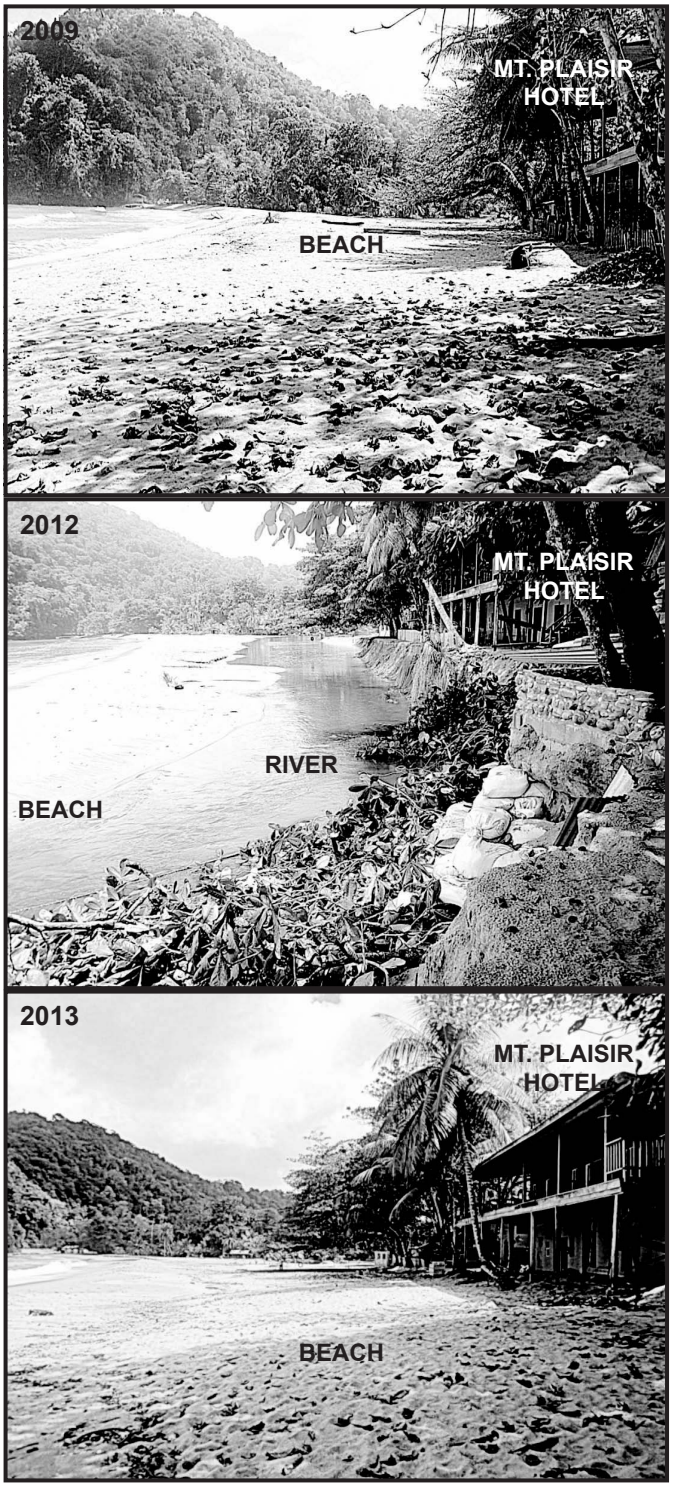


**Fig. 3.** Photos of the beach looking east at the Mon Plaisir Hotel in 2009, July 2012 and January 2013 (see text for details).

sediment transport and create pockets of unrecycled sand. Probably it would be impossible to maintain.

What is apparent is that constant change is part of the system dynamics. Leatherback turtles have negotiated shifting beaches and river mouths for over 100 million years, on coastlines long disappeared on continents that have shifted way beyond recognition. Events such as July 2012 are merely minor positives and negatives on the long-term balance sheet, and bulldozing the beach was ultimately not about saving turtles, but about saving private property. It would be more useful, if we are focusing on contributing to the increasingly unlikely survival of the species, to consider the factors that have led to its dramatic 80% population crash in the Pacific within a generation (Spotila *et al*. 2000), including excessive coastal development, light pollution (the unscreened street lights on the Matelot Road come to mind), illegal fishing practices and the mass dumping of plastic waste into the hydrological and oceanic systems (Crowder 2000).

It may be that the Grande Rivière community, who are just as aware of cyclical beach changes as the most dedicated scientist, regard the preservation of the small 'golden triangle' of sand between the Grande Rivière River and adjacent Ferdinand River as an essential part of the eco-tourist effort. Certainly it is part of an iconic Trinidadian landscape, familiar to us all. The Mon Plaisir Hotel, originally a plantation house, would merit conservation status in most countries. In this case the procedures are clear – mechanical intervention may become necessary as a last resort, but it should be timely and minimal. It should also be based on monitoring (our records of beach morphology and turtle nesting sites are much improved in the last decade, but the river still remains ungauged), modeling and planning at both government and local community level. Only then do we have a clear conscience to enjoy the turtles while they last.

**Postscript:** In January 2013 (Fig. 3), high seas pushed the front beach landwards, thus restoring the shoreline to its 'normal' condition. Optimum conditions for the 2013 nesting season have been restored.

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**Paul Shaw**[1] and **Alana Joseph**[2]
Department of Geography,
UWI, St. Augustine, Trinidad and Tobago.
1. *paul.shaw@sta.uwi.edu*
2. *alana_kezia_joseph@hotmail.com*

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# IN MEMORIAM

## Dr. David John Stradling

1939 - 2012

Dr. David John Stradling, who died in August in the UK after a long illness, was an entomologist and ant expert who loved the wildlife of Trinidad. Born in 1939, he went to school in Bristol, did a BSc and PhD at the University of Bangor, North Wales, and assisted with research on ants in Britain, before working on the biological control of pests in Switzerland and Bariloche, Argentina. In the seventies, he was a Zoology lecturer at The University of the West Indies, St. Augustine in Trinidad, and married Helen, a local headmistress. They returned to the UK where he was appointed lecturer at the University of Exeter, and in his spare time rose to become chairman of the Whitley Wildlife Conservation Trust, which runs Paignton and Newquay Zoos. He will be missed and remembered with affection by his many students and friends for his unfailing loyalty, enthusiasm and optimism, and for his work on ants especially bachacs, Lepidoptera and *Avicularia* spiders. Active to the end, his last paper with Victor Quesnel on the significance of eye-spots in two butterfly genera was published in the *Living World 2012* issue. He is survived by Helen, a son Michael and a daughter Claire.

**Malcolm Cherrett**

# The Skipper Butterflies (Hesperiidae) of Trinidad. Part 20. Hesperiinae, Moncini: the Remaining Genera of Mostly Unmarked Brown Species: *Eutocus, Eprius, Mnasicles, Methionopsis, Sodalia, Thargella, Nastra, Mnasilus, Mnasitheus* and *Papias*

**Matthew J.W. Cock**
c/o CABI, Bakeham Lane, Egham, Surrey TW20 9TY, UK.
*m.cock@cabi.org / mjwcock@btinternet.com*

**ABSTRACT**
Trinidad and Tobago skipper butterflies (Hesperiidae) of the tribe Moncini (genera *Eutocus*, *Eprius, Mnasicles*, *Methionopsis*, *Sodalia*, *Thargella*, *Nastra*, *Mnasilus*, *Mnasitheus* and *Papias*) are treated and the adults illustrated. Details are given of the taxonomy, history, identification and biology of the 10-11 Trinidad species in these genera. *Thargella caura caura* (Plötz) is recorded from Tobago for the first time, while *Eprius veleda veleda* (Godman) is shown to have been misidentified from Tobago. The caterpillar of *Methionopsis ina* (Plötz) and life history of *Papias phaeomelas* (Hübner) are described and illustrated.

**Key words** (not in title): Trinidad and Tobago, Tobago, life history, food plant, parasitism.

## INTRODUCTION

This is the last descriptive part in my series on the skipper butterflies of Trinidad (Cock 2012 and earlier papers) and covers the 'little brown jobs', i.e. those with no spotting or reduced opaque spotting, but normally without hyaline spots. There is a final part planned which will comprise a revised checklist and details of new species recorded from the island since the earlier parts which would have dealt with them were published.

Most of the genera dealt with in this paper were described by F. DuC. Godman in the volume of *Biologia Centrali-Americana* dealing with Hesperiidae (Godman 1899-1901). There is a good reason for this: the pioneering work of Godman on the genitalia of Central American species was seminal in revealing both the diversity of plain brown species, but also the relative ease with which they could be identified from the male genitalia.

This section of Moncini is still a work in progress for Trinidad, inasmuch as there may well be additional plain brown species present. All those attempting to identify Trinidad species of this general appearance need to be aware of the possibility that there are more species than are treated here and so proceed with caution. Some of the more useful characters which differentiate the species treated here are summarised in Table 1 overleaf. Males have secondary sexual characters which aid identification and they can be identified by dissection of the genitalia if necessary. In the future, it should be possible to identify females by examination of the genitalia, but these have not been documented for many of the relevant species as yet, so for now, they are best identified by careful comparison with reliably identified males. Brushing the scales from the ventral end of the female abdomen may reveal characters that can be seen under a dissecting microscope and used to distinguish females, e.g. as shown for *Corticea corticea* (Plötz) in Cock (2010). Pairs taken *in copulo* should be preserved and labelled as such since they provide reliably associated sexes of the same species.

### *Eutocus* Godman 1901

This is a genus of seven species (Evans 1955; Mielke 2004), of which two occur in Trinidad. *Eutocus vetulus vetulus* (Mabille), with pale yellow veins UNS and light blue spots UNH was treated in Cock (2011), whereas treatment of the second species, *E. facilis* (Plötz), was delayed until now, so that the plain brown species may be treated together.

Evans (1955) characterises the genus as similar to *Callimormus* (treated in Cock 2011) with an angled brand over the origin of vein 2, but no brand below that vein; mid tibiae smooth; nudum of 10 segments entirely on the apiculus; palpi segment 3 elongate, erect and pointed; mostly small species, male F 10-12 mm; inconspicuous or no markings UPF. The male genitalia are not of the *Callimormus* type and vary a good deal with the species, so probably more than one genus is involved. Godman (1901) designated the type species as *E. phthia* Godman, which is a synonym of *E. facilis*.

### J3/1 *Eutocus facilis* (Plötz 1884)

Fig. 2.

Plötz (1884) originally described this species from Suriname. Unaware of the Plötz species, Godman (1901) re-described it as *E. phthia* based on a long series from Central America to Guyana, although the material illus-

Table. Summary of the main distinguishing features of the unmarked brown Moncini treated in this paper (mostly after Evans (1955)).

| Species | ♂ F brand | Mid tibiae | Antenna: Costa[1] | Club | Nudum | Palpi 3 | ♂ F length (mm) | ♂ hair tuft | Markings (UPS plain brown except as indicated) | Other features |
|---|---|---|---|---|---|---|---|---|---|---|
| *Eutocus facilis* | Angled brand over origin vein 2, no brand below vein 2 | Smooth | (0.6) | Slender, obtuse at thickest point to long apiculus | 0/10 | Elongate, erect and pointed | 10-12 | None | UNH discal spots, if present, yellowish; UPF may have spots of a few yellow scales in spaces 2, 3, 6 and 7; UNF sparse dark ochreous scaling, dorsum broadly paler; UNH with dark ochreous scaling, usually discal spots of a few yellow scales in spaces 2-6 | |
| *Eprius velada* | Long brand against cell at base of space 2; long brand centred under origin of vein 2, extending inwards nearly to base of cell | Smooth | (0.5) | Yellow at base of club, below | 0/10 | Long, thin | 12 | UPH erect hairs along vein IA | UNF uniform; apex UNF and all UNH sparsely strewn with inconspicuous ochreous scales | Legs yellowish; palpi below, yellow and black |
| *Mnasicles hicetaon* | Narrow broken grey stigma from base vein 3 to vein 1 | A few spines | 0.6 | Yellow at base of club, below | | Long, thin | 13 | UPH with erect hairs along vein IA | UNS pale brown with inconspicuous grey scaling; UNF darker below cell | Cilia grey |
| *Methionopsis ina* | Long brand above vein 2 | Smooth | 0.65 (>0.5) | Yellow under club | 0/10 | Long, thin | Variable, 10-15 | None | UNF dorsum broadly pale; UNH with more or less of a purple gloss and dark ochreous scaling | F vein 5 straight, not decurved |
| *Sodalia sodalis* | A widening brand against cell between veins 3 and 2; short bar under vein 2 | A few spines | 0.6 (0.5) | Yellow under base of club; club slender = ¼ shaft; apiculus obtuse | 2/10 | Cylindrical, slender, protruding | 14 | None | UNH with small faint whitish spots at end cell and on disc from space 2 to space 6 | |
| *Thargella caura* | None | Smooth | 0.7 (0.6) | Yellowish under club; club ¼ shaft, slender; apiculus obtuse | 2/10 | Short, conical | 14 | UPH fringe along vein 1B | UNF chocolate, conspicuously paler along dorsum, below vein 2; UNH chocolate, abdominal fold brown | Strongly arched F costa |
| *Nastra guianae* | None | A few spines | 0.5 (>0.5) | 1/3 shaft | | Short, conical, protruding | 13 | None | UPF discal spots faint or absent; UNH with at least traces of white scaled discal spots in spaces 2-6 | Cheeks against first segment of palpi white |

[1] Author's measurement; Evans (1955) ratio in brackets (converted to decimal number)

Table continued. Summary of the main distinguishing features of the unmarked brown Moncini treated in this paper (mostly after Evans (1955)).

| Species | ♂ F brand | Mid tibiae | Antenna: Costa | Club | Nudum | Palpi 3 | ♂ F length (mm) | ♂ hair tuft | Markings (UPS plain brown except as indicated) | Other features |
|---|---|---|---|---|---|---|---|---|---|---|
| *Mnasilus allubita* | None | A few spines | 0.6 (>0.5) | 1/4 shaft | 3/8 | Short | 11-14 | A recumbent hair tuft along the middle third of space IA UPF | UPS dark brown, with dull greenish-ochreous scaling on costa F and basal 2/3 UPH; UPF with spots of ochreous scales in spaces 1B, 2, 3, 4, 5 and 6-8, some or all of which may be missing; UPH may have faint traces of discal spots; UNF black; apex, costa dull greenish ochreous, no spot in space 1B; other spots as UPF but some or all may be absent; UNH greenish-ochreous; veins more or less paler, may be faint traces of discal spots | F vein 2 mid vein 3 and base |
| *Mnasitheus chrysophrys* | Brands situated beyond the origin of vein 2, centred under origin vein 3: a very short brand over vein 2, a longer one under vein 2 and a still longer one over vein 1 | A few spines | 0.6 (just >0.5) | 1/4 shaft | 3/8 or 2/9 | Short, conical | 11 | None | UPF with inconspicuous yellow scaling forming obscure discal and apical spots; UNF costa and apex and all UNH purple with a few yellow scales | Legs yellow. Palpi yellow and brown. Cilia more or less pale yellow |
| *Papias phainis* | None | Spined | (>0.5) | | 2/9 – 4/9 | Short, stout, conical | 14 | None | UNH and apex UNF chocolate. UNF no traces of discal spots, dorsum to vein 2 paler; UNH small discal spots of yellow scales more or less developed in spaces 2-6 | Cheeks and outer edge of palpi generally orange to yellow |
| *Papias phaeomelas* | None | Spined | 0.6 (>0.5) | | 2/9 – 4/9 | Short, stout, conical | 14 | None | UNH and apex UNF chocolate; UNF with faint yellow discal spots in spaces 2 and 3; UNH may have faint traces of discal spots | Cheeks and outer edge of palpi generally orange to yellow |
| *Anthoptus epictetus* ♀ | - | Smooth | 0.5 (0.6) | Yellow under club; 1/3 shaft | 3/8 | Short, protruding | 13 | None | Entirely brown | Palpi yellow |
| *Anthoptus insignis* | None | Smooth | 0.6 (0.3) | Extensively pale ventrally; apiculus dark brown | 3/8 | Short, protruding | 12 | None | UNH dark ferruginous, also apex and costa UNF | Cheeks dark brown |
| *Anthoptus maracanae* ♀ | - | Smooth | 0.5 (0.6) | Yellow under base club; 1/3 shaft | 3/8 | Short, protruding | 15 | None | Uniform dark brown, above and below | Palpi yellow and brown |

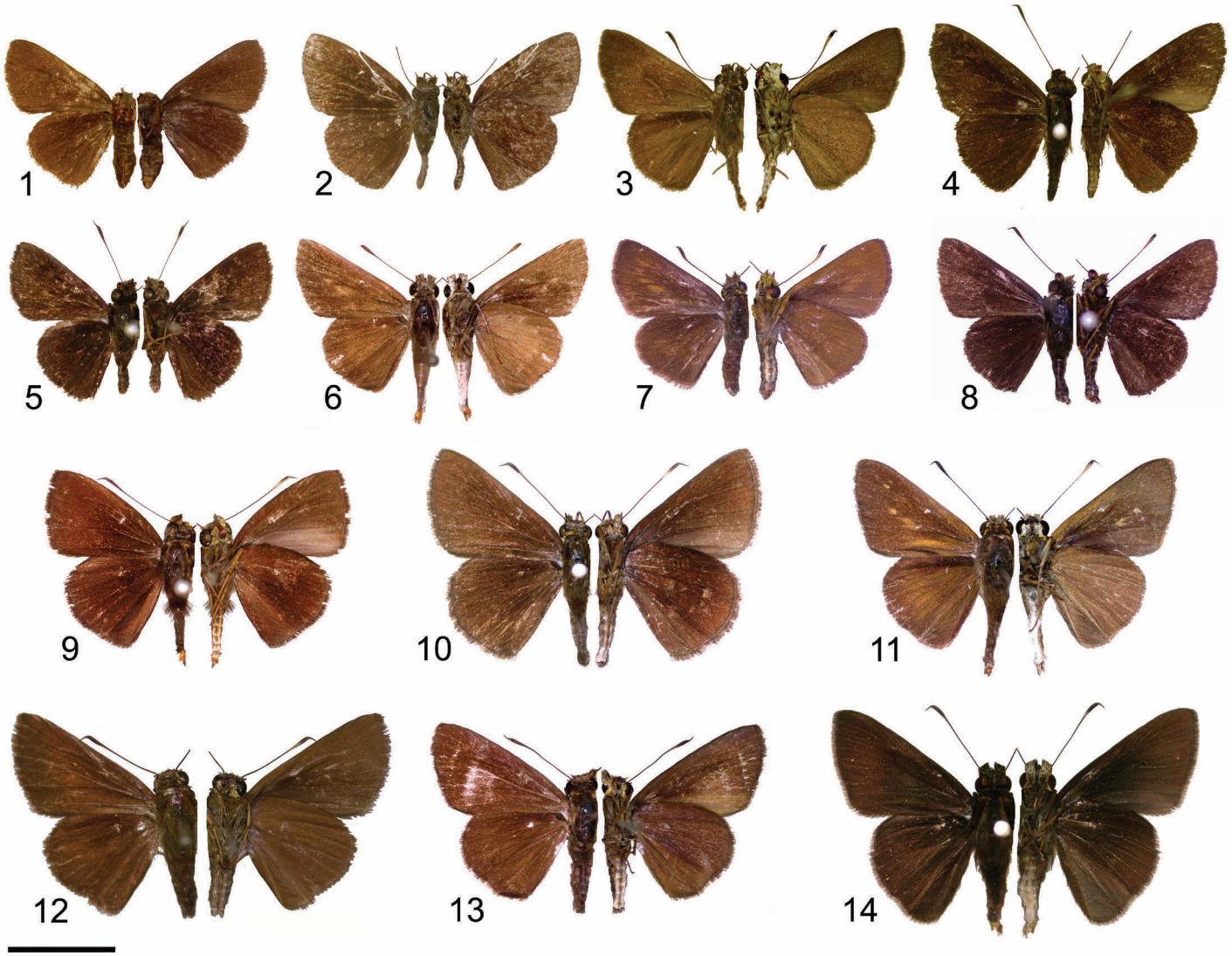


**Fig. 1.** Selected adult Moncini and Anthoptini with markings absent or reduced to opaque spots. 1, *Eutocus facilis* (Plötz) ♀ (Fig. 2) (specimen in NHM); 2, *Eprius veleda veleda* (Godman) ♂ (Fig. 3); 3, *Mnasicles hicetaon* Godman ♂ (Fig. 4); 4, *Methionopsis ina* (Plötz) ♂ (Fig. 6); 5, *Mnasitheus chrysophrys* (Mabille) ♂ (Fig. 17); 6, *Nastra guianae* Lindsey ♂ (Fig. 12); 7, *Anthoptus epictetus* (Fabricius) ♀ (Fig. 28); 8, *Anthoptus insignis* (Plötz) ♂ (Fig. 29); 9, *Thargella caura caura* (Plötz) ♂ (Fig. 10); 10, *Sodalia sodalis* (Butler) ♀ (Fig. 9); 11, *Mnasilus allubita* (Butler) ♂ (Fig. 14); 12, *Anthoptus maracanae* (Bell) ♀ (Fig. 31); 13, *Papias* sp. ?*phainis* ♀ (Fig. 19); 14, *Papias phaeomelas* (Hübner) ♂ (Fig. 20). Scale bar = 1 cm, 1.6 x life size.

trated is from Teapa, Mexico. Evans (1955) lists many specimens from Mexico, and smaller numbers south to Ecuador, the Guianas and a single female from Trinidad. This last was collected by Dr. F.W. Jackson, but lacks a specific locality or date, although it was acquired by the NHM in 1915. Evans' listing is the first published record of this species from Trinidad.

Godman (1901, plate 103.18-20) illustrates the UNS, venation and genitalia (as *E. phthia*); Hayward (1942) illustrates the male genitalia, pointing out that they differ slightly from those illustrated by Godman; Evans (1955) also illustrates the male genitalia, showing a valve very similar to that of Godman.

The female in the NHM collected by Dr. F.W. Jackson and listed by Evans (1955) remains the only known specimen from Trinidad (Fig. 2). Since I normally examine all plain brown skippers that I encounter, this suggests that either it is restricted to areas where I have not collected, or it is rare, or both.

Janzen and Hallwachs (2012) indicate they may have two similar species under this name from Costa Rica. Both feed on grasses, particularly *Lithachne pauciflora*. They show caterpillars with a pale brown head, brown sutures and lateral line to stemmata; green body with broad pale subdorsal stripes. The pupa is off-white, with a very short, blunt frontal projection.

**Fig. 2.** Female *Eutocus facilis*, Trinidad, F.W. Jackson (specimen in NHM; head missing).

**Fig. 3.** Male *Eprius veleda veleda*, Inniss Field, xi.2006, S. Alston-Smith.

***Eprius* Godman 1901**

Godman established this genus for his new species, *E. veleda* Godman, which occurs in Trinidad (below). He originally named the genus *Epeus*, but realising that this name was preoccupied, renamed it *Eprius* in the Addenda to that volume of *Biologia Centrali-Americana*. However, early last century, subsequent workers on the Trinidad fauna overlooked this and have used the original name *Epeus* (e.g. Longstaff 1908; Kaye 1914, 1921; Sheldon 1936). There is still only the one species in the genus (Evans 1955; Mielke 2004).

Evans (1955) characterised the genus as follows. Antennae half costa, shaft chequered yellow and black, yellow at base of club, below; nudum 10 segments all on the apiculus. Palpi slender, third segment long, thin. Mid tibiae smooth: legs yellowish. ♂ UPF with a long brand against cell at base of space 2, and a long brand centred under origin of vein 2, extending inwards nearly to base of cell: UPH erect hairs along vein lA.

**J5 *Eprius veleda veleda* (Godman 1901)**

Fig. 3.

Godman (1901) described this species from Mexico, Guatemala, Honduras and Panama, but illustrated it with specimens from Teapa, Mexico. The nominate subspecies is found from Mexico south to Ecuador and east to Trinidad (Evans 1955; Mielke 1992). A second subspecies, *E. veleda obrepta* (Kivirikko), occurs from the mouth of the Amazon to Argentina (Mielke 1992). Godman (1901) illustrates the UNS, venation and male genitalia, and Evans (1955) illustrates the male genitalia; the evenly rounded clasper is similar in both.

Kaye (1914, Addenda) listed this species from Trinidad based on a specimen captured by K. St. A. Rogers at Emperor Valley, Port of Spain, January 1913. In his 1921 catalogue, Kaye (1921, no. 438) adds no further information, but does include Tobago in the range of this species. Longstaff (1908, 1912) records a specimen from Cocoa Wattie, Tobago, and this record is repeated in Sheldon (1936). I have recently examined Rogers' Trinidad specimen and Longstaff's Tobago specimen in HEC, and they are both males of *Anthoptus insignis* (Plötz) (Cock 2010, and below). Thus, *E. veleda* was incorrectly recorded by Kaye (1914, 1921), Longstaff (1908) and Sheldon (1936). There are no records of this species from Tobago, so it should be removed from the Tobago list.

Evans (1955) lists a male and three females in the NHM, but I found two males and three females from Trinidad curated as *E. veleda*. The two males were collected by A. Hall from the 'Northern Mountains', one in i.1936 and the other xii.1938-i.1939. In my opinion, the three females are a mixed series, and only one (labelled only 'Trinidad') is a good match to the two males. In preparing this paper, I found that I had misidentified this species in my collection, so my previous use of this name, e.g. in Lamont's collection in UWI (Cock 1982 mis-spelt *velada*) is almost certainly incorrect. S. Alston-Smith has collected this species from Inniss Field (v.2003, xi.2006, i.2007) and Bush Bush (iii.2003); all specimens were captured at roadsides in the early morning (0630-0830 h). The food plants and early stages do not seem to be known (Mielke 2005; Beccaloni *et al*. 2008; Janzen and Hallwachs 2012).

***Mnasicles* Godman 1901**

This genus was based on two Central American species (Godman 1901): the type species *M. geta* Godman and the less common, but more widespread *M. hicetaon* Godman. Godman (1901) illustrates the male UNS, venation and genitalia of *M. getus*. One more species was subsequently described from Ecuador, and just three species are known for this genus (Evans 1955; Mielke 2004).

The genus is characterised as generally like *Eprius*; unmarked above; mid tibiae with a few spines; ♂ UPF with a narrow broken stigma from base vein 3 to vein 1; UPH with erect hairs along vein lA; aedeagus and saccus very long (Evans 1955). The form of the brand will separate this genus from *Eprius* and *Methionopsis* (Godman 1901), but as discussed under *M. hicetaon* below, it places it close to *Remella* Hemming 1939. The only known food plants are grasses (below).

**J6/2 *Mnasicles hicetaon* Godman 1901**

Figs. 4-5.

This species was described from three males from Mexico (Godman 1901). Evans (1955) lists a further three males from Trinidad and two from Paraguay, and gives *koehleri* Hayward, described from Corrientes, Argentina, as a synonym. Bell (1932) described *Perimeles stollmeyeri* from Trinidad (Botanic Gardens, Port of Spain). Mielke and Casagrande (2002) examined the type of *stollmeyeri*, and established that it is a synonym of *Mnasicles hicetaon*. Cock (1981, 1982) mis-spelt this species as *hicetaeon*.

**Fig. 4.** Male *Mnasicles hicetaon*, Palo Seco Oilfield, 7 October, 1995.

**Fig. 5.** Female *Mnasicles hicetaon*, Bush Bush Island, 28 March, 2003 (palpi missing).

Although he would have seen specimens – there is a male from Trinidad in the NHM collected July 1891 – Kaye (1921, 1940) did not recognise this species. Furthermore, Kaye (1940) overlooked Bell's description of *stollmeyeri* from Trinidad, although he did include *Arotis kayei* (Bell) described from Trinidad in the same paper (Bell 1932). Kaye and other Trinidad collectors doubtless misidentified *M. hicetaon* for another plain brown species; thus, Lamont's collection in UWI includes specimens of *M. hicetaon* in a mixed series of *Methionopsis ina* (Plötz) (as its synonym *M. modestus* Godman (Cock 1982)). In Cock (1982), I speculated that Kaye's (1921, no. 418) inclusion of *Mnasitheus uniformis* (Butler and Druce) without comment was based on a misidentification of *M. hicetaon*.

The status of the genera *Mnasicles* and *Remella* Hemming need critical re-examination. *Remella* was a replacement name for *Perimeles* Godman 1901, an unavailable homonym (Hemming 1939). The type species of *Remella* and *Perimeles* is *remus* Fabricius (treated in Cock 2011). Bell (1932) placed his new species *stollmeyeri* in *Perimeles* because although the colouring is very different, the male brand and genitalia are very similar. By the same argument, *Mnasicles* may well be synonymous with *Remella* (=*Perimeles*), in which case *Mnasicles* would be the senior name.

The male genitalia are illustrated by Godman (1901, plate 103.27), Bell (1932, Fig. 3), Evans (1955), Hayward (1950, plate 13.5) and Burns (1990 – a reproduction of Godman's figure) and the adult by Hayward (1950, plate 24.20).

This is an occasional species in Trinidad, for which I have 31 records. Sometimes it is locally common – I caught 11 males and four females (half my total records), on one occasion in the Palo Seco Oilfield, 7 October, 1995, feeding on *Bidens pilosa* flowers in an open area. It is widespread in the lowlands of Trinidad, mainly from forested areas, with records including Point Gourde in the north-west, several from around Port of Spain, Nariva Swamp (Cock 1981), and Morne Diablo and Palo Seco in the south. A pair taken in Nariva Swamp (Manzanilla-Mayaro Road, milestone 46 ¼ track) were flying at dusk. The months of capture are spread through the year.

This species has been reared primarily from *Oryza latifolia* in Costa Rica (Janzen and Hallwachs 2012), but also occasionally from several other grasses. The caterpillars they illustrate have the head dark, a pale spot in front of the stemmata, and a broad, diffuse, pale line from adjacent to the vertex around the face towards the pale spot; T1 with a narrow black dorsal plate; body green,

speckled with white; clear dorsal line; diffuse pale dorsolateral line.

### *Methionopsis* Godman 1901

This is a genus of plain brown Moncini, established for two species, with *M. modestus* Godman as the type species (Godman 1901). *Methionopsis modestus* is considered a junior synonym of *M. ina*, and occurs in Trinidad (Evans 1955). There are now four species recognised in the genus (Evans 1955; Mielke 2004). Evans (1955) characterises the genus: antennae longer than half costa: shaft slightly chequered and yellow under club, which is 1/5 shaft; nudum 0/10; palpi slender, third segment long, thin; mid tibiae smooth; F vein 5 straight, not decurved as usual; ♂ UPF typically with inconspicuous narrow brands, against cell between origins veins 3 and 2, over and under vein 2; dark brown, without markings. The only reported food plants are Commelinaceae (see below).

### J8/1 *Methionopsis ina* (Plötz 1882)

Figs. 6-8.

The type locality of *M. ina* is Chiriqui, Panama (Plötz 1882); Godman (1901) described the synonym *M. modestus* from Mexico, Guatemala and Panama, and subsequently synonymised it under *M. ina* (Godman 1907). Evans' (1955) listing of the material in the NHM shows it to be a common species, widespread from Mexico to Paraguay.

Evans (1955) notes the male has a long brand present above vein 2 (not found in other members of the genus); UNF dorsum broadly pale; UNH with more or less of a purple gloss and dark ochreous scaling; very variable in size, ♂ F 10-15 mm. Godman (1901, plate 103.14-16) illustrates the male UNS, venation and genitalia of a specimen from Mexico (as *M. modestus*), and Evans (1955) illustrates the male genitalia.

Kaye (1904) first listed this species from Trinidad as *M. modestus*, commenting, "A common species on the mainland, and probably so in Trinidad." He merely repeats this information in his 1921 catalogue (Kaye 1921, no. 437).

This is a common species in Trinidad, although males seem to be four times as common as females among the 50 records I have compiled from collections. It is widespread in forested areas throughout the island to at least 2300 feet (700 m, Morne Bleu Textel, ♂ 27 November, 1980, ♀ 9 August, 1981, ♀ 16 January, 1988). One male was captured in my light trap (Curepe, 15 January, 1980), and one at dusk at Spanish Farm, Las Lomas (23 March, 1980). Although captures are spread through the year apart from April-May, 60% were from December to March suggesting this species is most active in the dry season.

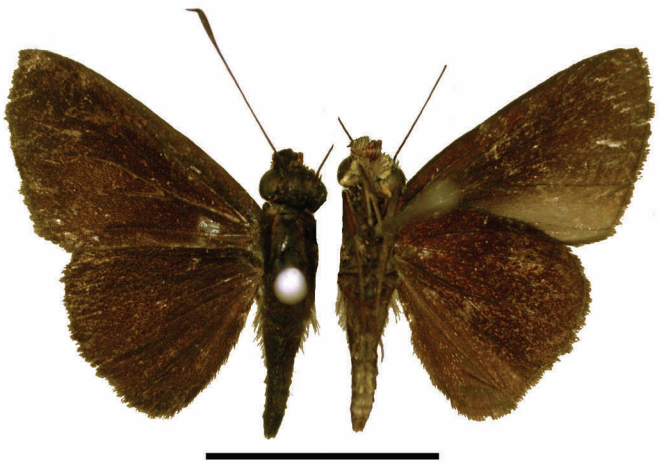

**Fig. 6.** Male *Methionopsis ina*, Mt. Tabor, 13 January, 2004.

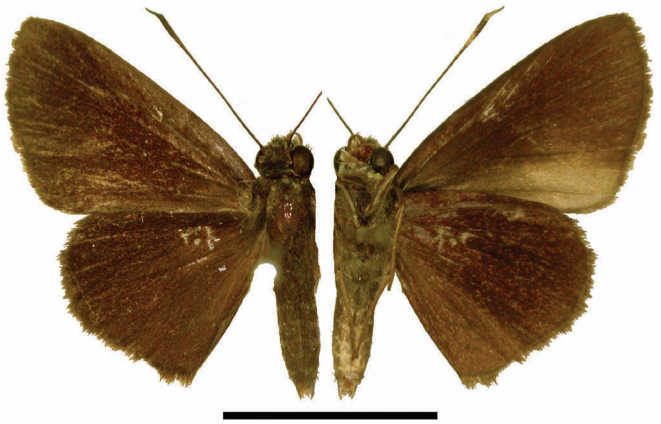

**Fig. 7.** Female *Methionopsis ina*, Las Lomas, Spanish Farm, 17 December, 1980 (palpi missing).

Unusually for this tribe, most of the reported food plants are in the family Commelinaceae. Janzen and Hallwachs (2012) reared it from four genera of Commelinaceae, but predominantly from *Commelina erecta* and *Dichorisandra amabilis,* and occasionally from the grass *Ichnanthus pallens*. I find that their pictures of the caterpillars, especially 04-SRNP-23525, match very closely two parasitized final instar caterpillars which I found on a plant of *D. hexandra*, 14 October, 1995, in forest on the track from St. Benedicts to Mt. Tabor (95/51, 95/52).

Caterpillar 95/51 was in a shelter made by folding a leaf upwards along the midrib, while caterpillar 95/52 was in a tightly rolled pendulous leaf remnant. After two days, caterpillar 95/51 prepared a pupal chamber by trimming the two leaf halves to leave a shallow arc of leaf tissue along the midrib, making a pocket. Within the pupal chamber, caterpillar 95/51 was killed by ten braconid larvae which spun separate white cocoons in the

shelter, but only one adult emerged. Similarly, caterpillar 95/52 made a pupal chamber three days after collection and produced about 13 braconid cocoons which emerged after nine days.

The caterpillars (Fig. 8) measured 22-23 mm when collected. Head oval, widest near base and indent at vertex; ground colour light brown with variable green tint; posterior margin dark; dark stripe from vertex laterally to mouthparts; sutures dark; pale, slightly yellow spots at apex before lateral stripe and before stemmata. T1 with a narrow, black transverse plate. Body translucent pale matt green; dorsal line greener; faint pale subdorsal and dorsolateral lines apparent on caterpillar which took an extra day before preparing pupal chamber; faint lateral line where trachea visible through cuticle; anal plate with a dark arc at posterior margin; spiracles pale inconspicuous; all legs concolorous; gonads not visible through cuticle.

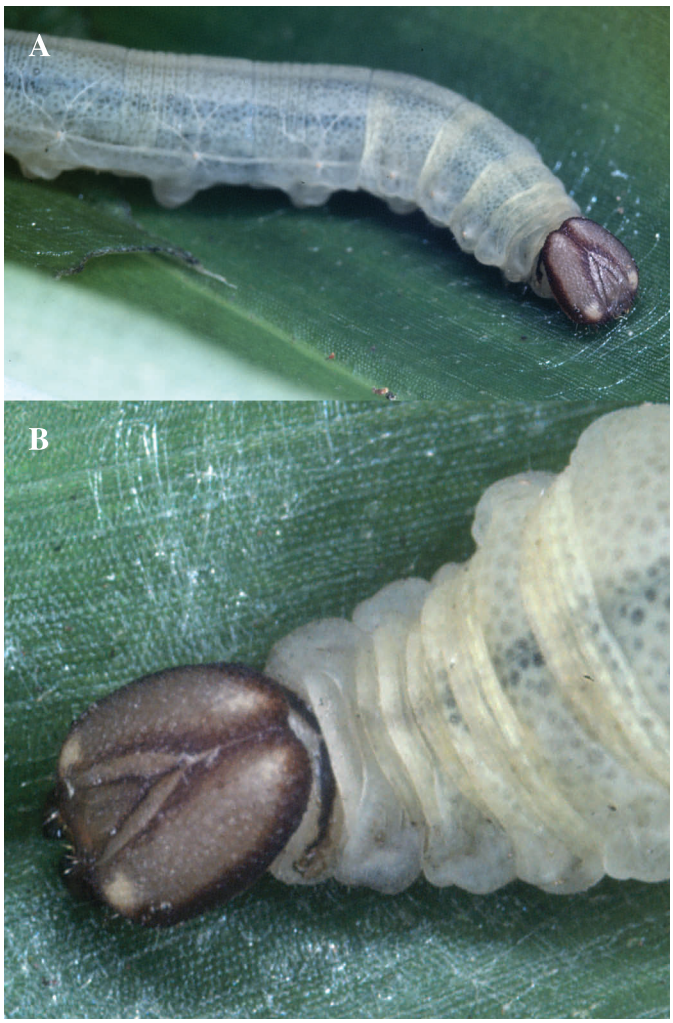


**Fig. 8.** Caterpillars of *Methionopsis ina*, collected on *Dichorisandra hexandra*, lower Mt. Tabor, 14 October, 1995. **A**, anterodorsolateral view, 24 mm, ref. 95/52; **B**, dorsal view, 23 mm, ref. 95/51.

***Sodalia* Evans 1955**

Evans (1955) established this genus for three brown species, with variable markings UNH. He characterised it: antennae = ½ costa; shaft chequered and yellow under base of club: club slender = ¼ shaft; apiculus obtuse, nudum 2/10; palpi slender, hairy: third segment cylindrical, slender, protruding; mid tibiae with a few spines; ♂ UPF with a widening brand against the cell between veins 3 and 2 and a short bar under vein 2; genitalia unlike any other in respect of the uncus and gnathos viewed ventrally – both are divided into two widely separated branches, forming the sides of a square. The type species is *S. sodalis*, which occurs in Trinidad.

**J10/2 *Sodalia sodalis* (Butler 1877)**

Fig. 9.

Butler (1877) described this species from Obydos on the Lower Amazon. Evans (1955) gives two subsequent synonyms: *huaynai* (Lindsey 1925) described from Peru, and *saramacca* (Williams and Bell 1931) from Suriname. The type of *sodalis* is in the NHM along with specimens from Nicaragua south to Ecuador and the Amazon (Evans 1955).

The male genitalia are illustrated by Lindsey (1925, plate 28.10 as *Metiscus*? *huaynai*), Williams and Bell (1931, as *Euroto saramacca*) and Evans (1955); Williams and Bell (1931, plate 1.8) also illustrate the adult male in black and white. It is not obvious that the clasp shown by Lindsey is conspecific with the other two species, although it could be broken and part missing; this synonymy may be worth checking.

The first record of this species from Trinidad was when Evans (1955) listed two males from Trinidad in the NHM. These specimens were from the collection of A. Hall, taken in the "Northern Mountains" between

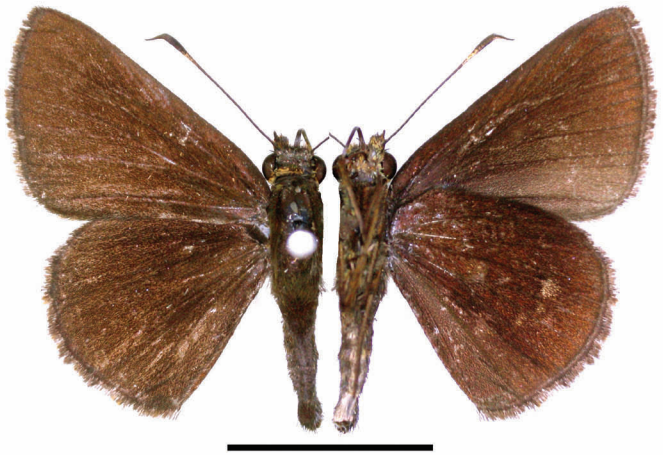

**Fig. 9.** Female *Sodalia sodalis*, swamp behind Las Cuevas Bay, 17 January, 2004.

December 1938 and January 1939; W.J. Kaye would not have seen this material, although there is a male from Irois, 13 March, 1932 in Sir N. Lamont's collection in NMS that Kaye could have seen. Cock (1982) inadvertently overlooked Evans' record in his list of Trinidad Hesperiidae.

This is not a common species in Trinidad – in addition to the three historical specimens mentioned above I have collected three specimens myself from lowland areas: Curepe (♀ 10 January, 1980, ♀ 18 December, 1981), and Las Cuevas Bay, swamp behind beach (♀ 17 January, 2004). S. Alston-Smith has five males and five females in his collection from southern oilfield roads. The months of capture (December to March) suggest this species may fly primarily in the dry season. The food plants and early stages have not been reported (Mielke 2005; Beccaloni *et al*. 2008; Janzen and Hallwachs 2012).

### *Thargella* Godman 1900

The strongly arched F costa of the type species caused Godman (1901) to establish *Thargella* as a new genus, for his new species *T. fuliginosa* Godman, a synonym of *T. caura* (Plötz). A second species has since been described from southern Brazil (Mielke 2004).

Evans (1955) characterised the genus: antennae 9/15 costa; shaft plain, yellowish under club; club ¼ shaft, slender; apiculus obtuse, nudum 2/10; palpi slender, hairy, third segment short, conical; mid tibiae smooth; wings square, costa F highly arched and costa hardly longer than dorsum; no secondary sexual characters, other than a fringe UPH along vein 1B.

### J17 *Thargella caura caura* (Plötz 1882)

Figs. 10-11.

This species was described from Suriname (Plötz 1882) and is found from southern Mexico (Freeman 1976) to Bolivia (Evans 1955). *Thargella fuliginosa* (Godman 1901) is a synonym described from Nicaragua, Colombia, Guyana and the Amazon (Godman 1907). There is a second subspecies, *occulta* (Schaus 1902), found in the vicinity of Rio de Janeiro, southern Brazil (Evans 1955). *Cymaenes sipariana* Kaye (1925) was described from Trinidad, and placed as a synonym of *T. caura* by Evans (1955). However, Mielke and Casagrande (2002) examined the female holotype and established that it is a valid species in the genus *Propapias* as it was treated in Cock (2010).

Godman (1900, plate 100.24-25) illustrates the venation and male genitalia from Nicaragua, and Hayward (1950, plate 20.2) and Evans (1955) illustrate the male genitalia.

This species was first recorded from Trinidad by

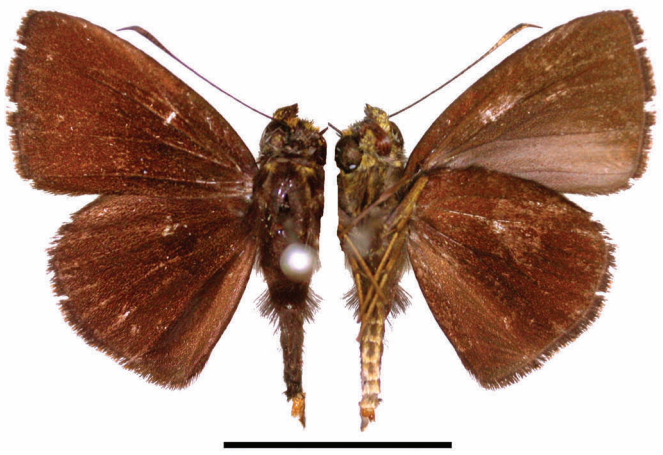

**Fig. 10.** Male *Thargella caura*, San Miguel Valley, 17 October, 1979.

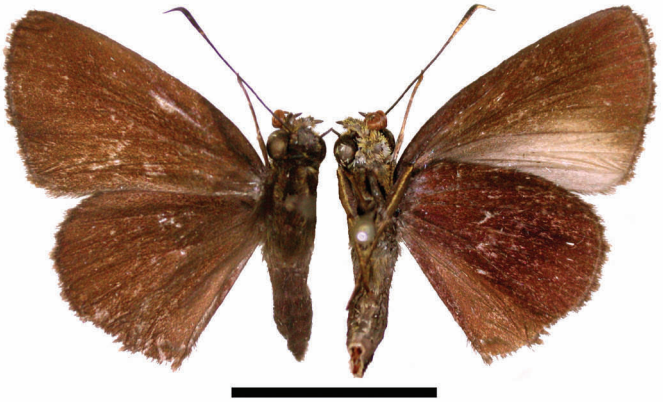

**Fig. 11.** Female *Thargella caura*, Mt. Tamana, 12 November, 1995.

Kaye (1904 as *T. fuliginosa*) from two specimens he captured in June 1898. Later (Kaye 1921, no. 416) he adds that it is not rare. Although *T. caura* has not been recorded from Tobago (Sheldon 1936, 1938; Cock 1982), there is a male in the NHM from the W.G. Sheldon collection which W.H. Evans dissected and drew, but missed in his list of the NHM collections (Evans 1955).

This is a fairly common species in Trinidad (24 records), found in forested areas in lowlands throughout the island, and extending up to 1100 feet (335 m) in the Northern Range (Mt. Tabor, 12 November, 1978). More than 80% of captures have been from October to February. It does not seem to visit flowers.

Moss (1949) reared this species from 'carapicho grass' but gives no description or illustration of the early stages. Carapicho may be a reference to *Cenchrus echniatus* (Poaceae), known as capim-carrapicho in Brazil (Cardenas and Coulson 1967). There are four emerged pupae associated with this name in the NHM dry stages collections from Moss' collection. Moss identified the material as '*Eutychide achelous'*, so the identification as

*T. caura* is due to W.H. Evans. The pupae are pale brown, rather translucent, fragile and have collapsed; they measure 16-19 mm; a short, narrow, blunt, brown frontal projection; proboscis sheath extends to end of cremaster; two shelters are lined with white waxy powder, but two are not. The single, partially visible final instar caterpillar head capsule is dark brown, and particularly the ventral portion is covered with white waxy powder.

### *Nastra* Evans 1955

Evans (1955) compared his new genus, *Nastra*, with *Cymaenes* (see Cock 2011). Hence it can be characterised as follows: antennae rather > ½ costa; club 1/3 shaft; nudum 3/8; palpi slender: third segment short, conical, protruding; mid tibiae with a few spines; no secondary sexual characters. The type species is the North American *Nastra lherminieri* (Latreille).

### J26/5 *Nastra guianae* Lindsey 1925

Fig. 12.

Lindsey (1925) described this species from a single male from Guyana and illustrated the adult and genitalia. Evans (1955) lists specimens from Colombia, Guyana and the Amazon, and illustrates the clasper of the male genitalia.

De Jong (1983) comments on the similarity of *N. guianae* and *Mnasilus allubita* (Butler), which appear externally identical apart from the colour of the palpi and the presence of an inconspicuous recumbent hair tuft F UPS in male *M. allubita*. Note that Lindsey (1925) described *guianae* as a species of *Mnasilus*. The claspers are similar and both have an unusually long aedeagus. They are likely to be congeneric.

I added this species to the Trinidad list (Cock 1982) based on a male from Wallerfield, 17 February, 1982 (Fig. 12). Since then, S. Alston-Smith has collected three males (Inniss Field, November 2006; Rio Claro-Guayaguayare Road, April 2006; North Post, November 1999) and two females (Moruga East Field, November 2006; Rock River Road, February 2007).

There is no information available on the food plants and life history (Mielke 2005; Beccaloni *et al*. 2008).

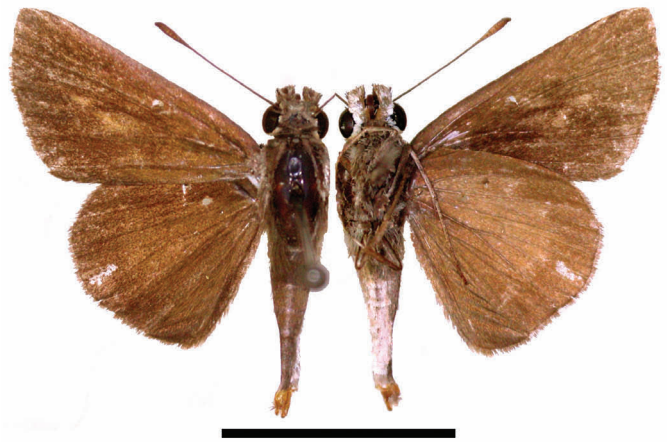

**Fig. 12.** Male *Nastra guianae*, Wallerfield, 17 February, 1982.

### *Mnasilus* Godman 1900

Godman (1900) established this monotypic genus for his new species *M. penicillatus* Godman, now known to be a synonym of *M. allubita* (Butler). Although Godman (1900) compared *Mnasilus* with *Cymaenes* (=*Megistias*), Evans (1955) compared it with *Parphorus* (treated in Cock 2011): antennae rather longer than half costa; club ¼ shaft; nudum 3/8; palpi second segment quadrate, hairy, third short; mid tibiae with a few spines, which may be short or long or obsolete; F vein 2 mid vein 3 and base. Unlike *Parphorus*, there is no brand or stigma, but there is a recumbent hair tuft along the middle third of space lA UPF.

### J29 *Mnasilus allubita* Butler 1877

Figs. 13-16.

Butler (1877) described this species from specimens collected at Obydos (Lower Amazon) and Rio Sapó (Amazonas, Brazil); Mielke and Casagrande (2002) designated the specimen from Obydos as lectotype. *Mnasilus penicillatus* Godman (1900) is a synonym described from Mexico and Panama, while *Vehilius norma* Dyar is another described from Guyana. Evans (1955) lists specimens in the NHM from Mexico to Paraguay, and it was recently recorded from Texas for the first time (Reid and Warren 2009).

Godman (1900) illustrates the UPS, UNS venation and male genitalia; Hayward (1938) illustrates the male

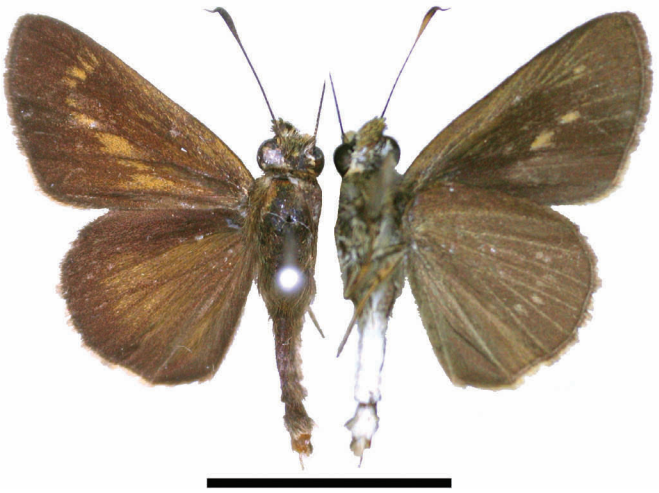

**Fig. 13.** Male *Mnasilus allubita*, Bush Bush Island, 7 May, 1995.

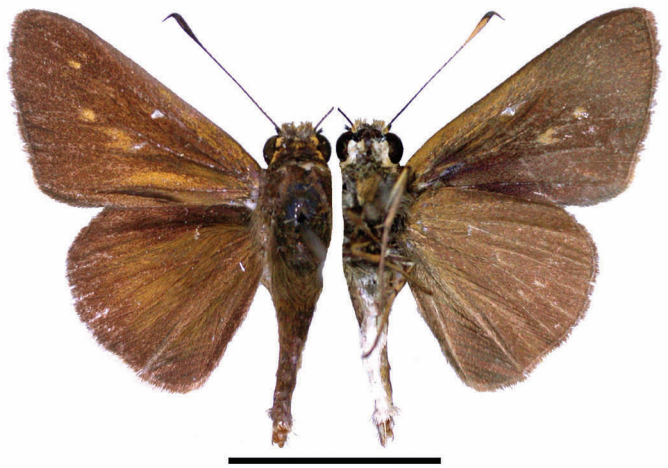

**Fig. 14.** Male *Mnasilus allubita*, Las Lomas, Spanish Farm, 17 December, 1980.

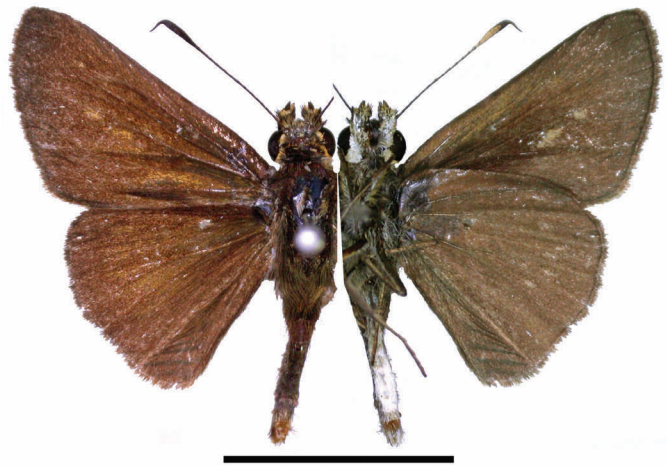

**Fig. 15.** Male *Mnasilus allubita*, Bush Bush Island, 28 March, 2003.

genitalia of specimens from Argentina and Guyana, the latter having a sharp ventral spike to the valve (as do Trinidad specimens), whereas in the former this is blunt (thereby resembling those of *Nastra guianae*, and perhaps not correctly treated as *M. allubita*); Hayward (1950) illustrates the male adult and genitalia (with a pointed ventral spike); Evans (1955) illustrates the male genitalia. The sharp ventral spike of the male claspers can be revealed by brushing away the ventral scales of the genitalia, and this provides a useful supplementary diagnostic feature amongst Trinidad species.

Strangely, Kaye (1921, 1940) did not record this species from Trinidad; there are no specimens from his collection in MGCL (A.D. Warren, pers. comm. 2012), and there are none at all in the NHM (Evans 1955), and yet it is a common species in Trinidad, which led me to suggest that *M. allubita* could be a recent coloniser of Trinidad (Cock 1982). The only early specimen that I have seen is from 1926 (♂, Irois, 10 February, 1926, N. Lamont's

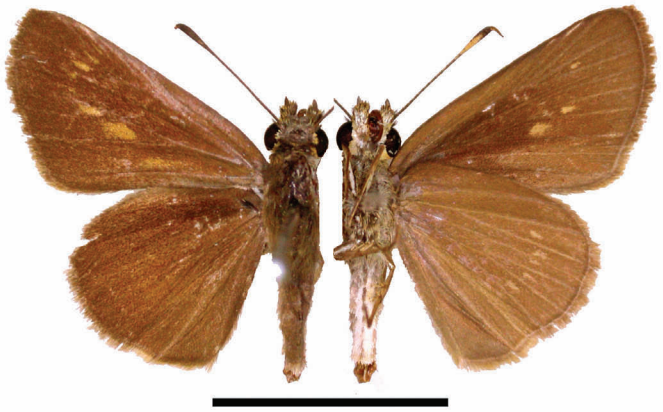

**Fig. 16.** Female *Mnasilus allubita*, Nariva Swamp, Manzanilla-Mayaro Road, milestone 46 track, 5 February, 1980.

collection in UWI, misidentified as *Euroto cocoa* Kaye, a synonym of *Penicula bryanti* (Weeks) as listed in Cock (1982)), but after that I have seen none until my own records from 1979 onwards. The fact that *M. allubita* was recently recorded from Texas for the first time (Reid and Warren 2009) suggests a degree of vagility in this species, supporting the suggestion that it may have recently colonised Trinidad.

This common species can be found in lowland disturbed forest areas throughout the island (66 records). It can be locally very common (Manzanilla Windbelt Reserve 8♂, 5♀ 22 January, 1988; Bush Bush Island 11♂, 3♀ 28 March, 2003). Several localities are swampy areas (Bush Bush Island; Caroni Swamp, ¼ mile E of Cacandee Sluice; Manzanilla Windbelt Reserve; Nariva Swamp, Manzanilla-Mayaro Road, milestone 46 track; Nariva Swamp, Sand Hill) suggesting an affinity with this habitat. Two specimens were caught in a light trap at Curepe (♀ 23 January-10 February, 1982, ♂ 6-11 December, 1981, both F.D. Bennett) and one male was captured at dusk at Las Lomas, Spanish Farm (23 March, 1980). Males perch at a height of about 1m in sunlit forest patches and defend territories. Months of capture are more or less throughout the year.

Dyar (1917) described a synonym, *norma*, from material reared by H.W.B. Moore from 'a water grass' *Paspalum repens* (=*P. gracile*) at Georgetown, Guyana. Moss (1949) reared this species from 'grasses', but gives no description or illustration, and there are no preserved early stages in the NHM. Janzen and Hallwachs (2012) have reared this species occasionally from three species of grass: most frequently from an unidentified species, but also from *Leersia hexandra* and *Oryza latifolia*. Their photographs of caterpillars show a pale brown head with diffuse dark black bands down face and laterally, a yellow spot in front of the stemmata, and a smaller whitish one behind; T1 concolorous; body pale green with

darker speckles.

***Mnasitheus* Godman 1900**

Godman (1900) established this species with *M. cephis* Godman as the type; *M. cephis* is a synonym of *M. chrysophrys* (Mabille). Evans (1955) characterised the genus: small plain dark species with brands or a stigma UPF; antennae just longer than half costa: club ¼ shaft: nudum 3/8 or 2/9; palpi slender, hairy; third segment short, conical; mid tibiae with a few long spines, which may be absent. There are 11 species in the genus, but only *M. chrysophrys* is found in Trinidad.

Janzen and Hallwachs (2012) have reared an unidentified species of *Mnasitheus* from a grass in Costa Rica. The pupa is pale yellow-brown; no frontal spike; conspicuous erect setae on eyes and thorax; spiracle T1 prominent, orange-brown.

**J32/1 *Mnasitheus chrysophrys* (Mabille 1891)**

Figs. 17-18.

This species was described from Colombia (Mabille 1891) and is recorded from Mexico to Paraguay (Evans 1955).

In addition to the generic characters, Evans (1955) notes: UPF with inconspicuous yellow scaling forming obscure discal and apical spots; UNF costa and apex and all UNH purple with a few yellow scales; legs yellow; palpi yellow and brown; cilia more or less pale yellow, often conspicuously so; ♂ UPF brands parallel to veins 1 and 2, situated well beyond the origin of vein 2, centred under origin vein 3: a very short brand over vein 2, a rather longer one under vein 2 and a still longer one over vein 1.

Godman (1900, plate 100. 26-27) illustrates the male venation and genitalia of a specimen from Central America (as *M. cephis*) and Evans (1955) illustrates the male genitalia.

Kaye (1921, 1940) did not record this species from Trinidad, so when Evans (1955) listed eight males from Trinidad in the NHM, this was the first published record from Trinidad. These specimens in the NHM include specimens that Kaye is likely to have seen, and his own collection included two unrecognised specimens, one of which he misidentified as *Mnasitheus simplicissima* (Herrich-Schäffer), (A.D. Warren, pers. comm. 2012). I have previously treated Kaye's report of *M. simplicissima* from Trinidad as a misidentification for *Anthoptus insignis* (Cock 1982, 2010, and this paper below). It is clear from Kaye's and Lamont's collections that there was significant confusion over the application of names to the small brown Hesperiinae from Trinidad, none of which were dissected.

This species is widespread and fairly common (21 records) in lowland forest areas and extends up to the ridges of the Northern Range (around Arima Valley, Morne Catherine). The main months of capture have been January-March, i.e. the dry season.

Although there are no food plant records for this species (Mielke 2005; Beccaloni *et al*. 2008), the record of a *Mnasitheus* sp. from a grass in Janzen and Hallwachs (2012) suggests *M. chrysophrys* is likely to be a grass feeder.

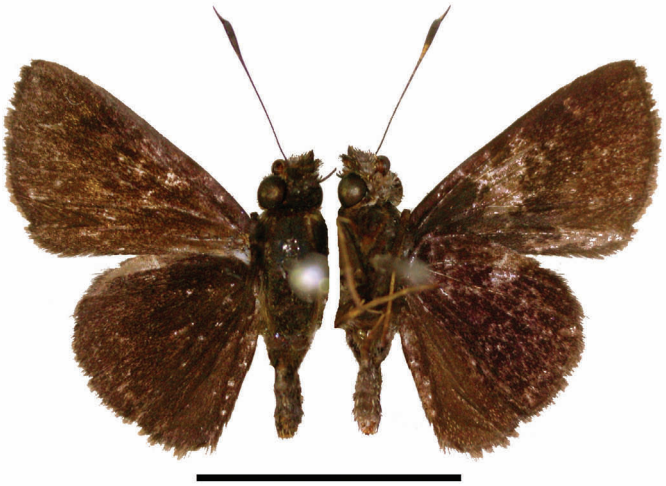

**Fig. 17.** Male *Mnasitheus chrysophrys*, Arima-Blanchisseuse Road, milestone 8, 8 September, 1979.

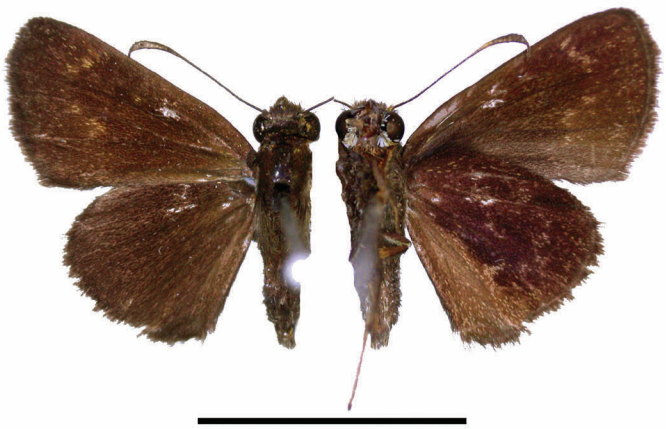

**Fig. 18.** Female *Mnasitheus chrysophrys*, Morne Catherine, 12 February, 1980 (palpi missing).

***Papias* Godman 1900**

This genus was established for four brown skippers which resemble *Lerema* with regard to male genitalia (Godman 1900). The type was fixed as *infuscata* Plötz (Godman 1900), which is a synonym of *subcostulata* Herrich-Schäffer (Evans 1955; Mielke 2004). Subsequently, Godman (1907) considered that he had misidentified *infuscata*, and substituted *integra* Mabille; however, this too is now considered a synonym of *subcostulata*

(Mielke 2004), so the type species for the genus remains *subcostulata*. The genus is now considered to contain ten species (Mielke 2004), and most can only reliably be identified by examination of the male genitalia. Evans (1955) characterised the genus: antennae rather > ½ costa: nudum 2/9 - 4/9; palpi slender, third segment typically short, conical; mid tibiae spined; no secondary sexual characters; UPS unmarked; UNS may be spotted and have pale veins. Cheeks and outer edge of palpi generally orange to yellow.

Kaye (1940) recorded *P. infuscata* from Trinidad based on a specimen that he collected at Maracas, 24 November, 1920. I have not located this specimen, and A.D. Warren (pers. comm. 2012) advises me that there are no *Papias* spp. from Kaye's collection in MGCL. Until Kaye's specimen is located, or new material of *P. subcostulata* (=*infuscata*) is collected from Trinidad, this record should be discounted.

Janzen and Hallwachs (2012) have reared one or more *Papias* spp. probably including *P. subcostulata* on grasses, predominantly *Setaria paniculifera*. The caterpillars have a plain dark brown or black head and an unmarked translucent green body, and the pupa is pale brown, rounded, with no frontal spike.

### J36/4 *Papias phainis* Godman 1900

Fig. 19.

This species was described from Mexico, Guatemala and Costa Rica (Godman 1900), and is known from Mexico south to Bolivia and southern Brazil, including Guyana (Evans 1955). *Papias monus* Bell (1942) described from Guyana, is considered to be a synonym (Evans 1955; Mielke 2004), but the much shorter saccus and aedeagus of *monus* (Bell 1942, Fig. 10) compared to *phainis* (Godman 1900, plate 100.16) suggests this is incorrect. Evans (1955) illustrates the male genitalia and characterised the adult: UNF no traces of discal spots, dorsum to vein 2 paler; UNH small discal spots of yellow scales more or less developed in spaces 2-6.

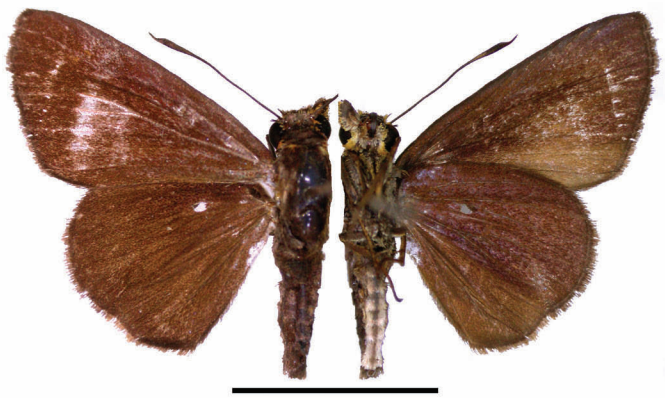

**Fig. 19.** Female *Papias phainis* (provisional identification), Rio Claro-Guayaguayare Rd., N. of junction with Saunder's Trace: ♀ ovipositing 93/12, 11 October, 1993 (M.J.W. Cock).

Schaus (1902) described *Papias ctyanus* from Trinidad, and Kaye (1940, no. 414B) repeated this. Evans (1955) treated *P. ctyanus* as a synonym of *P. phainis*, and it was on this basis that Cock (1982) included *P. phainis* as a Trinidad species. However, Mielke (2004) considers that *P. ctyanus* is a synonym of *Corticea noctis* (Plötz) from southern Brazil, and that the Trinidad locality label of the type is an error (see also *Psoralis chittara* (Schaus) below).

A female that I identified as *P. phainis* was observed ovipositing on grass (pers. comm. in Beccaloni *et al*. 2008) and is shown as Fig. 19. This appears to be *P. phainis*, but as it is female, I have not been able to confirm this identification. Hence, at this time there are no confirmed specimens of *P. phainis* known from Trinidad.

### J36/5 *Papias phaeomelas* (Hübner 1831 in Hübner 1818-1831)

Figs. 20-27.

The type locality of this species is Brazil (Hübner 1818-1831), and it is recorded from Mexico to Guyana to the mouth of the Amazon (Evans 1955). It was described again as *P. microsema* (Godman 1900 in Godman and Salvin 1879-1901) from Mexico, Costa Rica, Panama and Brazil, which Lindsey (1925) noted is a synonym of *P. phaeomelas*. There is a syntype of *phaeomelas* in the Berlin Museum (O.H.H. Mielke, pers. comm. 2012), but it is in poor condition and missing its abdomen, so there seems little scope for a definitive confirmation that it is correctly treated as a senior synonym of *P. microsema*. With this proviso, I continue current usage.

Hübner (1818-1831, Figs. 581-582) illustrates the adult; Godman and Salvin (1879-1901, plate 100.14-15) illustrate the male underside and genitalia; Evans (1955) illustrates the male genitalia. In addition to the distinctive male genitalia, Evans (1955) notes that the UNF has faint yellow discal spots in spaces 2 and 3, and UNH may have faint traces of discal spots.

Kaye (1914, 1921, no. 414) lists *P. phaeomelas* (as *P. microsema*) from Trinidad based on one or more specimens collected in St. Ann's Valley by G.E. Tryhane; I have not located this material. Evans (1955) lists one male from Trinidad in the NHM. I have examined this specimen; it is a male collected at Fort George in September 1891. The abdomen has been glued onto the body, and Evans dissected it and sketched the genitalia. S. Alston-Smith has five males and five females in his collection from southern oilfield roads.

In a small open patch in secondary forest at Inniss Field in south Trinidad, I recently found *P. phaeomelas*

caterpillars (11/15), and observed oviposition (11/21) on *Paspalum fasciculatum*, which I have previously recorded as the food plant of *Perichares philetes philetes* Gmelin (Cock 2005). The ovipositing female was observed at about 1630 h under quite heavily overcast conditions. She was captured and confined in a plastic pot with a leaf of *Paspalum fasciculatum*, and later that evening had laid seven eggs on the leaf (Fig. 24). The following account is based on these two collections.

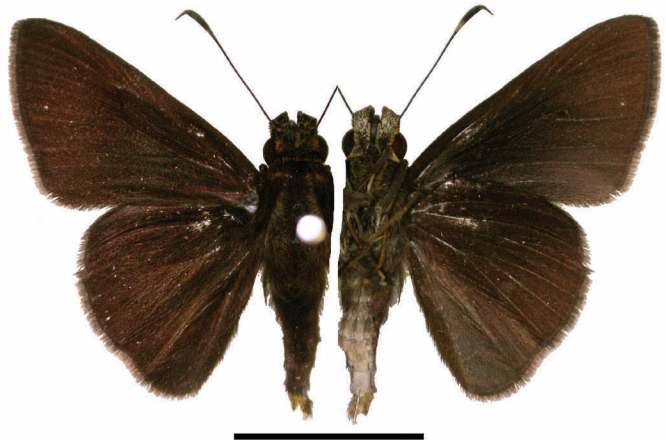

**Fig. 20.** Male *Papias phaeomelas*, Inniss Field, collected as caterpillar on *Paspalum fasciculatum* 9 October, 2011, adult 27 November, 2011, ref. 11/15F.

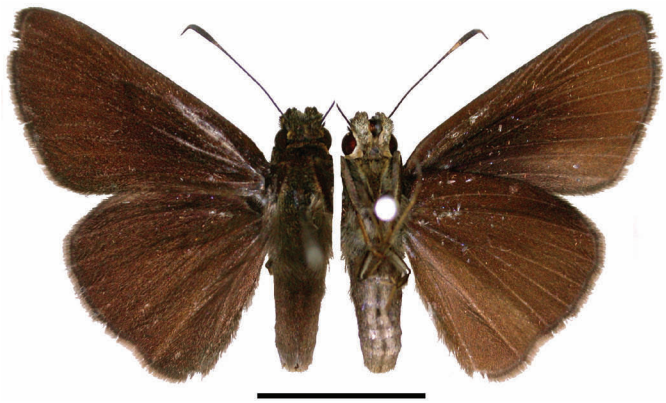

**Fig. 21.** Female *Papias phaeomelas*, reared from ovum laid by female collected at Inniss Field, 9 October, 2011, adult 17 December, 2011, ref. 11/21E.

**Fig. 22.** Adult female *Papias phaeomelas*, collected as caterpillar on *Paspalum fasciculatum* 9 October, 2011, Inniss Field, adult 15 November, 2011, ref. 11/15A.

One third instar caterpillar of 5 mm had constructed its shelter by making two cuts from the edge of the leaf lamina, 15 mm apart, with the resultant flap folded under the leaf. A 6 mm third instar caterpillar had constructed its shelter from the apical 27 mm of the leaf, with one basal cut to the midrib, and the shelter rolled.

A 17 mm fourth instar caterpillar had made a larger shelter using the apical 130 mm of leaf, with basal cuts from each side to the midrib, with some feeding immediately distal to these, so that the shelter hung downwards on the midrib (Fig. 23). One half of the distal part of the

**Fig. 23.** Leaf shelters of fourth instar *Papias phaeomelas in situ* on *Paspalum fasciculatum*, Inniss Field, 9 October, 2011, ref. MJWC 11/15.

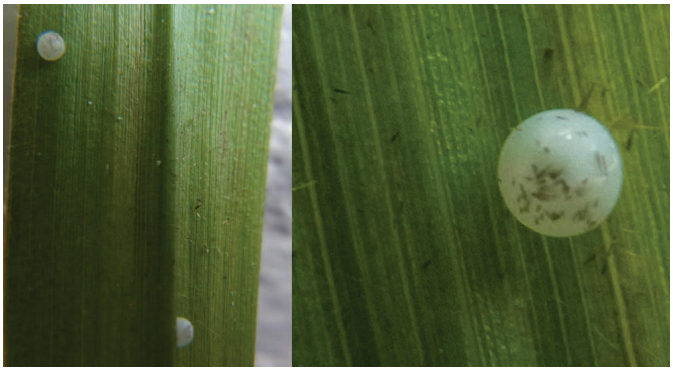

**Fig. 24.** Ova of *Papias phaeomelas* laid in captivity on *Paspalum fasciculatum*; female captured Inniss Field, 9 October, 2011, ref. MJWC 11/21.

leaf was folded over upwards onto the other half to make the shelter. The basal end of the shelter was closed with a small flap of the shelter lid, and the distal end was left open. The caterpillar rested head downwards towards the open distal end of the shelter. Another fourth instar caterpillar had made a similar shelter, but using only the distal 50 mm of the leaf, and the feeding at the basal cuts left the midrib bare for 20 mm.

Ova were laid individually on *Paspalum fasciculatum*, and hatched after 6 days. They were dome-shaped, pale, with very finely reticulated microsculpture; the base measured 1.09 mm (Fig. 24).

There are normally five instars, although one individual (11/21B) had six instars. The head capsules measured 0.43 x 0.71 mm, 0.90 x 1.00 mm, 1.30 x 1.47 mm, 1.95 x 2.32 mm and 2.61 x 3.31 mm respectively in the five instars. The first two instars were similar, having a black shiny head with scattered pale, erect setae, and finely reticulate in the second instar; narrow black transverse plate on T1; translucent shiny green body (as do most Moncini). In the 6-7 mm second instar, pale subdorsal and dorsolateral lines became visible (Fig. 25A). In the 7-8 mm third instar (Fig. 25B), the head was similar, but the body was now translucent matt green, and the subdorsal and dorsolateral lines were white and relatively conspicuous. The fourth instar, which grew to 17 mm, also had a black head, but the body was now dark translucent matt green, with conspicuous white subdorsal and dorso-

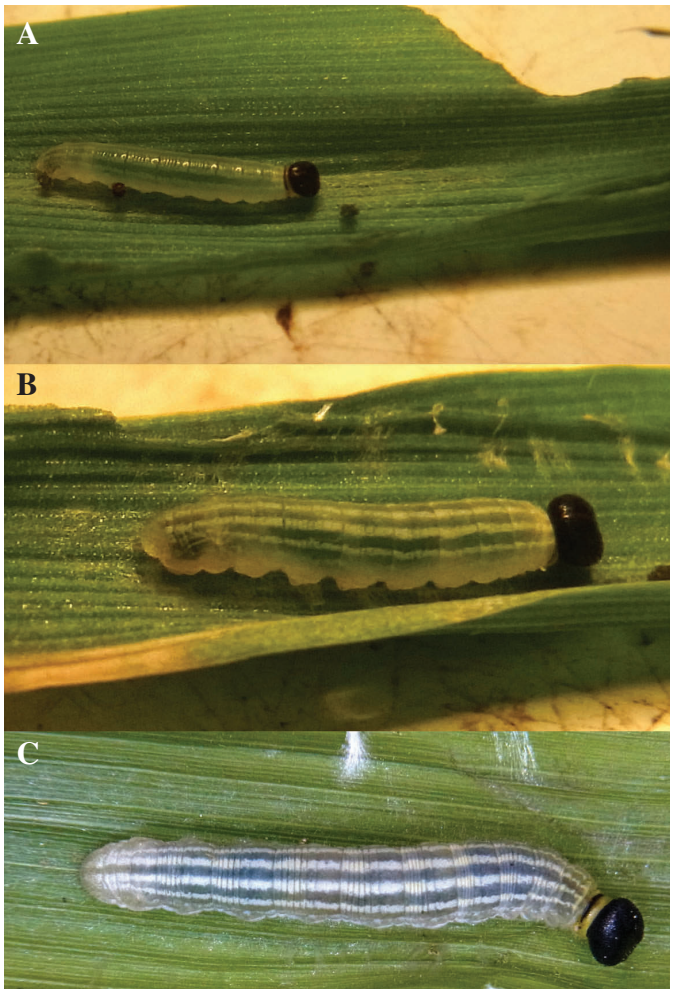


**Fig. 25.** Early instar caterpillars of *Papias phaeomelas*, collected as caterpillar or reared from ovum, Inniss Field. **A**, second instar, 7 mm; moulted to second instar 25 October, 2011; photographed 2 November; moulted to third instar 5 November; ref. 11/21F. **B**, third instar, 8 mm; moulted to third instar 30 October, 2011; photographed 2 November; moulted to fourth instar 7 November; ref. 11/21C. **C**, fourth instar, 17 mm; collected and photographed 9 October, 2011; moulted to fifth instar 14 November; ref. 11/15A.

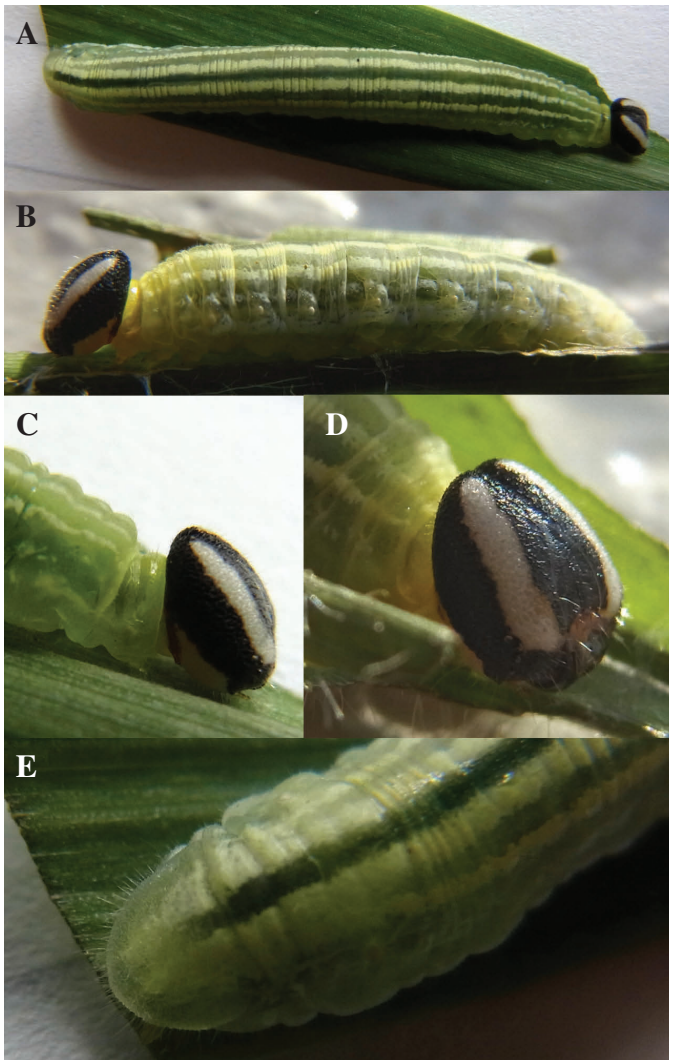


**Fig. 26.** Final instar caterpillar of *Papias phaeomelas*, collected as caterpillar, Inniss Field. **A**, dorsal view, mature larva, 34 mm; moulted to final instar 14 October, 2011; photographed 24 October; pupated 28 October; ref. 11/15A. **B**, lateral view, newly moulted larva; as A, photographed 15 October. **C**, head, lateral view; as A. **D**, head, anterolateral view; as B. **E**, posterior region, dorsal view; as A.

lateral lines and a weak lateral white line (Fig. 25C).

The final, fifth instar (Fig. 26) measured 20 mm when newly moulted and grew up to 34 mm long when mature. Head rounded, widest at base, indented at vertex; black apart from a bold, sharply defined white stripe from apex to stemmata, and area posteroventrally, narrowing to about half height of head. T1 concolorous; dorsal plate inconspicuous. Body dull green; strong white subdorsal and dorsolateral lines; weak white lateral line; pale ventrolateral flange; pale green ventrally; all legs concolorous; spiracles pale, inconspicuous; anal plate semicircular with erect pale setae (Fig. 26E); anal comb with unusually short teeth. The wax glands develop ventrolaterally from the posterior margin of A6 to the middle of A8. At the prepupal stage, white waxy powder is present laterally on the head, around legs T1-T3 and prolegs A6, ventrally on A7-A8 and claspers.

Larval development from egg to pupa took 56 days (n=4, range 48-73 days); instar 1, 4-8 days; instar 2, 9-10 days; instar 3, 7-8 days; instar 4, 7-11 days; instar 5, 12-14 days.

In captivity, pupation was in a slightly folded leaf held with a strand or two of silk. The pupa is attached at the cremaster and by a simple silk girdle. There was no white waxy powder on the pupa or shelter. A pupa (11/15A) measured 27 mm (Fig. 27), including a 3 mm straight frontal spike; elongate; green, with yellow subdorsal and dorsolateral lines on thorax and abdomen. Pupation in captivity (at 18-20°C) took 15.4 days (n=5, range = 13-18 days).

**Fig. 27.** Dorsal view, pupa of *Papias phaeomelas*, collected as caterpillar, Inniss Field; 27 mm; pupated 1 November, 2011; photographed 2 November; emerged 17 November; ref. 11/15E.

The early stages of *P. phaeomelas* reported here, the caterpillar with a distinctively marked head and striped body and the pupa elongate, green, striped with a frontal spike, are very different from those of *P. subcostulata* or near (Janzen and Hallwachs 2012) described in the introduction to *Papias* above. Based on the early stages, it seems unlikely that they are congeneric.

Of the seven caterpillars collected 9 October, 2011 at Inniss Field, three were killed by parasitic mermithid nematodes.

**I6/1 *Anthoptus epictetus* (Fabricius 1793)**

Fig. 28.

Although I have already treated this species in Part 17 (Cock 2010), it is necessary to treat the female here for completeness, as it is another small, almost unmarked, brown species.

**Fig. 28.** Adult female *Anthoptus epictetus*, Blanchisseuse-Paria Bay track, 22 January, 1980.

**J26/9 *Anthoptus insignis* (Plötz 1882)**

Figs. 29-30.

This species was also treated in Part 17 (Cock 2010), but both sexes are more or less unmarked. For many years this species has been known as *Nastra insignis*, following Evans (1955), but Steinhauser (1991) transferred it from *Nastra* Evans to *Anthoptus* Bell, commenting that the male and female genitalia of *insignis* are very similar to those of *A. epictetus*. Godman and Salvin (1879-1901) illustrate the adult genitalia of this species misidentified as *Mnasitheus simplicissima* (Herrich-Schäffer), (Evans 1955). It is found in both Trinidad and Tobago.

**I6/2 *Anthoptus maracanae* (Bell 1934)**

Fig. 31.

This is the third species of *Anthoptus* known from Trinidad. It too was treated in Part 17, but identification is covered here again for the female, which is unmarked brown.

Female (Fig. 31). UPS plain brown; UNS brown but of a paler shade; UNH margin of space 1B UNH and distal portion of vein 2 paler. UNS of head pale; UNS thorax brown; UNS abdomen brown, subventrally a pale patch on posterior margin each segment. F female 15 mm.

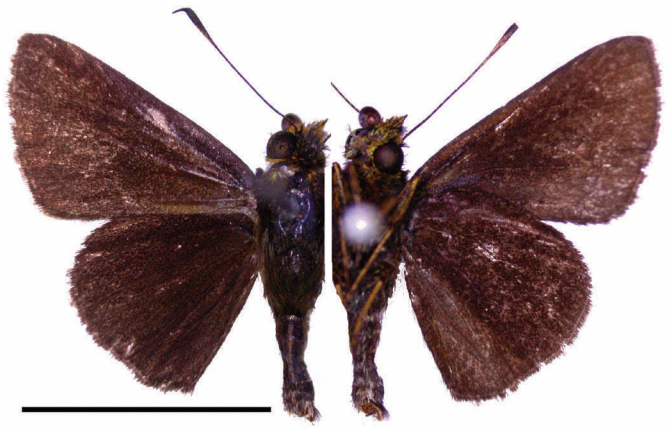

**Fig. 29.** Adult male *Anthoptus insignis*, Arima-Blanchisseuse Road, milestone 9 ¼, 8 October, 1994.

**Fig. 30.** Adult female *Anthoptus insignis*, Mt. Tabor, 1,000 ft., 1 January, 1982.

**Fig. 31.** Adult female *Anthoptus maracanae*, Curepe, MV light trap, 7 August, 1982 (palpi missing).

### *Psoralis chittara* (Schaus 1902)

Schaus (1902) described this species from Trinidad, and so Kaye (1940, no. 414A) added it to the Trinidad list. Mielke (2004) finds that it is a Brazilian species, and that the type must have been mislabelled 'Trinidad'. I have examined the type in the USNM, and it is not a species that I know from Trinidad, so I agree that it should be removed from the Trinidad list.


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The specimen of *Eutocus facilis* shown in Figs. 1 and 2 is in the NHM. I thank Andy Warren who checked the MGCL for historical specimens, and Scott Alston-Smith for adding information based on his observations.


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# Status of Blue-and-yellow Macaws *Ara ararauna* Reintroduced to the Nariva Swamp, Trinidad and Tobago

**Bernadette L. Plair[1], Motilal Lal[2], Audho Ramadhar[3]** and **Sham Ramsubage[4]**

1. 9690 Shawnee Trail, Centerville, Ohio 45458, USA.

2. 8 Sooknanan Street, Biche, Trinidad and Tobago, W.I.

3. 2 Kernahan Trace, Mayaro, Trinidad and Tobago, W.I.

4. Picton Road, Sangre Grande, Trinidad and Tobago, W.I.

Corresponding author: *bplaircrestt@gmail.com*

**ABSTRACT**

The Blue-and-yellow Macaw, once native to the island of Trinidad, was extirpated in the early 1960s primarily due to nest poaching of chicks for the pet trade. Between 1999 and 2004, the Cincinnati Zoo and Botanical Garden, Trinidad and Tobago's Ministry of Environment and the Centre for the Rescue of Endangered Species of Trinidad and Tobago (CRESTT) reintroduced wild-caught birds from Guyana to the Nariva Swamp in Trinidad. After quarantines, testing and physical examinations, the birds were acclimated in a pre-release flight cage and the flight readiness of the first 14 birds was monitored as the main criterion for release. Nine of the 14 birds released (64%) survived and produced 12 chicks in three nesting seasons. Three years later 20 additional wild-caught birds were imported from Guyana and the criterion for their release was expanded to include social behaviors such as pair bonding and compatible groups. There was 100% survival of the 17 flight-ready birds released from the second flock. Bonded pairs and compatible groups that were released stayed together and exhibited behaviors indicating healthy social structure. Fourteen additional chicks were produced in three more nesting seasons. Twenty-six of the 31 birds released (84%) survived. Nesting success continued with the surviving population now estimated at 86 birds. This represents a 230% increase over 12 nesting seasons. Several factors have contributed to the survival and reproductive success of the reintroduced birds. This status report identifies some of these factors and suggests that Blue-and-yellow Macaws can be successfully reintroduced to a habitat from which they were extirpated when conditions are favorable.

**Key words:** acclimation, behavioral monitoring, bonded pairs, social groups, nesting success, post-release monitoring, pioneer group, community involvement.

## INTRODUCTION

As the percentage of threatened and endangered species worldwide keep increasing, the development of conservation strategies for their management is becoming more important (Olney *et al*. 1994; Serena 1994). The family Psittacidae comprises nearly 350 species worldwide and of these, approximately 28% are considered threatened (IUCN 2010). There is high demand for psittacines in the pet trade and aviculture because these birds make sociable companions and have colorful plumage (Collar and Juniper 1992; Wright *et al.* 2001; Carrete and Tella 2008). These demands in addition to widespread habitat loss are the main threats to these birds worldwide (Snyder *et al*. 2000; Wright *et al*. 2001; Wiley *et al*. 2004). As a result, reintroductions and supplementations have been used as a conservation strategy to restore or establish new populations of psittacines, or to bolster existing populations (e.g. Clubb and Clubb 1992; Snyder *et al*. 1994; Sanz and Grajal 1998; Oehler *et al*. 2001; Collazo *et al*. 2003; Ziembicki *et al.* 2003; Brightsmith *et al.* 2005; Collar 2006; Adams and Cash 2010).

The Blue-and-yellow Macaw is found in eastern Panama, Guyana, east and south Venezuela, western Colombia, western Ecuador and most of the Amazon Basin (Juniper and Parr 1998; Restall *et al.* 2006). This species was also found in Trinidad until the 1960s, when the island population was extirpated due to over-collecting for the pet trade and habitat alteration (Brown 2000). Collar (1997) lists the species as apparently extinct in Trinidad and extinct in many areas in Ecuador, Colombia and Brazil. Between 1999 and 2004, the Cincinnati Zoo and Botanical Garden, Trinidad and Tobago's Ministry of the Environment and the Centre for the Rescue of Endangered Species of Trinidad and Tobago (CRESTT) reintroduced a small population of Blue-and-yellow Macaws to the Nariva Swamp in Trinidad (Oehler *et al*. 2001; Plair *et al*. 2008).

The Blue-and-yellow Macaw and the Nariva Swamp offer a unique opportunity to provide much needed research on the reintroduction of a threatened avian species to its historic range. The 6,234 hectare Nariva Swamp

($10^0$ 23' N, $61^0$ 04' W), is a permanent brackish lagoon on the East Coast of Trinidad with an extensive complex of freshwater swamp forests, permanent herbaceous swamp and mangrove forest, separated from the Atlantic Ocean by two parallel sandbars and a large area of seasonally flooded marshes (elevation 0-10 m above sea level). The swamp became a protected wetland under the Ramsar Convention in 1993 and the 1,544 hectare Bush Bush Wildlife Sanctuary, established in 1968 (Bacon and ffrench 1972), remains a prohibited area under the Forest Act of Trinidad and Tobago requiring government permits for visitor entry, fishing and hunting.

The palm swamp forest has an open canopy with *Roystonea oleracea* palms (Royal palms) up to 26 m tall and a density of 380 trees with diameter at breast height (dbh) above 10 cm per hectare. *R. oleracea* comprised 56% of individuals with peak ripe fruit availability from August to November correlating with rainfall (Bonadie 1998). *Mauritia sertigera* palms (Moriche palms) up to 22 m tall and a density of 344 trees ≥10 cm dbh per hectare contributed 43% of individuals with peak ripe fruit availability from September to May. Both palms are a very important source of food and nesting sites for parrots and macaws in the Nariva Swamp (Bonadie and Bacon 1999). Three psittacine species still occupy the Nariva Swamp: Red-bellied Macaws, *Ara manilata*; Orange-winged Parrots, *Amazona amazonica* and Green-rumped Parrotlets, *Forpus passerinus* (Bonadie and Bacon 2000). More recently, there have been regular sightings of Yellow-crowned Parrots, *Amazona ochrocephala* and occasional sightings of Blue-headed Parrots, *Pionus menstruus* and Lilac-tailed Parrotlets, *Touit batavicus* (Kenefick, personal communication).

Wild populations of parrots and macaws frequently suffer from a lack of nest sites (Abramson *et al*. 1995; Nycander *et al*. 1995). Blue-and-yellow Macaws normally nest at heights of about 15 meters in hollow palm trees. Their nests are usually formed when palms die. The leafed crowns dry out and fall and the soft palm heart from the trunk's interior desiccates and recedes, leaving a hollow vertical tube with hard walls. Because of the scarcity of natural nesting sites in South America, only 10 to 20% of adult macaws attempt to breed in any given year (Munn *et al.* 1991). Thus the productivity of a population of wild macaws is naturally very low.

The Nariva Swamp lends itself to a productive study of the nesting success of the Blue-and-yellow Macaws. The limited range of the flock on the island allows for a much better chance to study the birds during their nesting season between January and June. Trained villagers in communities that border the swamp, Kernahan to the south-east, Plum Mitan to the north-west, Biche to the west and Manzanilla/Cocal to the east, already play a leading role in protecting the habitat against forest fires and poaching. Select teams from these areas were specially trained to monitor and collect data on the reintroduced Blue-and-yellow Macaws.

The data collected on the released birds has been totally dependent on these nearby communities with supervision from project personnel. Although poaching has not been eliminated, its frequency has been minimized by the involvement of the villagers in monitoring and protecting the birds and their habitat. In addition, integrating conservation education into the curriculum of schools bordering the swamp and raising national and international awareness of conservation efforts has increased national pride and garnered interest and support worldwide (Butler 1992). This report is an update on two groups of wild-caught Blue-and-yellow Macaws reintroduced to the Nariva Swamp and suggests factors that may play a role in their survival, adaptation and reproductive success in the wild.

## METHODS

Aerial and ground surveys conducted in the Nariva Swamp by the government's Forestry Division, Wildlife Section, and the first author in 1999 and 2003 determined that there were suitable food sources and potential nesting sites to support a population of Blue-and-yellow Macaws. In October 1999, 18 wild-caught Blue-and-yellow Macaws were imported from Guyana to Trinidad following the protocols described in IUCN/SSC Guidelines for Reintroduction, prepared by the SCC Reintroduction Specialist Group and approved by the 41st Meeting of the IUCN Council, Gland Switzerland, May 1995. The birds were trapped by licensed dealers in Guyana in August 1999. Laparoscopic sexing was used to identify nine males and nine females between one and four years old for reintroduction to Trinidad. Transponder chips inserted into the chest muscles of each bird provided a method of permanent identification while a small band around the right or left leg identified males from females.

Following guidelines established by the Trinidad and Tobago Government, the birds were quarantined in Guyana for a period of at least 28 days, under veterinary supervision. They were certified free of endoparasites and ectoparasites prior to importation into Trinidad and tested negative for Psittacosis/Ornithosis, Avian Influenza, and Newcastle's disease. To reduce the stress of relocation, the birds were fed a high carbohydrate diet, supplemented with sunflower seeds and vitamins. Upon entry into Trinidad, the birds were further quarantined at the government's Wildlife Section for 21 days.

The macaws to be released were acclimated for four weeks from November to December 1999 in a 5.5 m x 7.3 m x 6.4 m pre-release flight cage in the protected Bush

Bush Wildlife Sanctuary where they were to be released. During this period their diet consisted of commercial dog chow supplemented with natural fruits and seeds found in the Nariva Swamp e.g. *M. sertigera*, *R. oleracea*, *Hura crepitans* (Euphorbiaceae), *Sterculia caribaea* (Sterculiaceae), *Spondias mombin* (Anacardiaceae), *Rollinia exsucca* (Annonaceae), *Maximiliana elegans* (Palmae) and *Manilkara bidentata* (Sapotacea). Trained villagers from a nearby community fed and observed the birds for flight capability during the pre-release phase. Government veterinarians performed health assessments on the macaws for overall fitness, and birds were selected for release based on the re-growth of their primary feathers and their flight capability. No behavioral monitoring was done on this group of birds.

Four male macaws were released in December 1999, three males and five females in January 2000, and one male and one female in March 2000. One of five males selected for release in December 1999 did not leave the release site and was returned to the flight cage on the same day. This bird was later released in March 2000. Four of the 18 birds did not re-grow their primary feathers and were never released. Supplemental food was made available to the released birds for one week following their release. Trained villagers monitored the survival, flight patterns, feeding and range of the released birds three to four days per week during the dry season from January to June each year. Between April and May of 2001, reports from villagers in a fishing camp suggested nesting activity among three pairs of Blue-and-yellow Macaws in an area of the swamp where there was a thick stand of *Mauritia* palms.

In order to collect data on the availability and use of macaw nesting sites in the Nariva Swamp, a nesting site study was implemented from March 2002 to June 2003. Select teams of villagers from communities bordering the swamp were trained to use variations of standard rock climbing techniques, to collect data on trees with natural nest cavities that were explored or used by four established pairs of Blue-and-yellow Macaws. The monitors recorded the tree species noting location, proximity to other trees and surrounding vegetation. They noted whether trees were alive or dead, had lost their crowns or had holes in their trunk. Measurements were taken of tree height, diameter of the trunk at breast height (dbh), and the orientation and diameter of the holes on the trunk. A qualitative assessment of the degree of decomposition of the hollow trunk and measurement of the depth of the nest cavity was also part of the data collection.

In September 2003, a second group of 20 wild-caught macaws (12 females and 8 males), sexed via laparoscopy, was imported from Guyana. This was critical for establishing a wider genetic base that could evolve into a self-sustaining wild population. The group consisted of four mature females (>3 years old), four adolescent females (2 years old), four immature females (1 year old), two mature males, one adolescent male and five immature males. Following the same guidelines established by the Trinidad and Tobago Government in 1999, the birds were quarantined and tested prior to their importation to Trinidad.

Upon entry into Trinidad in September 2003, the birds were transferred directly to the release site in Bush Bush Wildlife Sanctuary and acclimated for three months in a large 18.3 m x 8.5 m x 6.1 m pre-release flight cage. Cage dimensions were increased from the original flight cage to provide the birds more space to strengthen their flight muscles and to develop social interactions. The birds were fed diets of natural fruits and seeds from the surrounding area, as well as sunflower seeds and seasonal local beans and fruit. A protein enriched plumage enhancer, Nekton Bio (Nekton Products, Germany), was added to their diet to facilitate re-growth of the cut primary feathers.

Prior to the release of this second group, social behaviors of the birds were documented in contrast to the first group of birds released in 1999-2000. The birds were observed for one hour each morning and afternoon, weather permitting. Specific social behaviors such as pair bonding and compatible or aggressive interactions with one another were recorded based on instantaneous scans of the whole group of birds every five minutes during each 1-h observation period (Plair *et al.* 2008).

In December 2003, three bonded pairs and a group of three birds including two females and a male were selected for release. In addition, three individual females that showed no particular affinity to each other but integrated well with the group were chosen for release. All showed strong flight capability and had re-grown their primary feathers. Of the remaining eight birds, three had re-grown their primary feathers but these birds displayed aggressive tendencies towards some of the birds chosen for release and they were not released with the group of twelve. Supplemental food was provided for three days following the release. The birds were released in December when both *Roystonea* and *Mauritia* palm fruit were available. Since the birds foraged in flocks, integration of the newly released birds with the existing wild population seemed feasible.

Following the December 2003 release, data on the eight birds remaining in captivity were not collected daily. The birds were observed weekly for additional pair bonding, socialization and flight readiness. In June 2004, two male and three female macaws were released. There was no pair bonding or serious aggression among these five birds. Of the three birds not released, one male died

due to an infected wing follicle and the remaining pair of birds had poor re-growth of their primary feathers.

Following the final release in 2004, trained villagers continued to monitor the survival, flight patterns, feeding and range of the birds during the dry season from January to June each year until 2006. They did not collect specific data on the nesting sites as was done during the nesting site study in 2002 to 2003. Instead, they recorded sightings of bonded pairs, single or social groups of adult birds and any young birds that were seen in flight, perching or feeding with adult birds following each nesting season. In 2007, the responsibility for funding and data collection on the reintroduction project was transferred from the Cincinnati Zoo and Botanical Garden to the Trinidad and Tobago Government. The author still maintains personal contact with the macaw monitors and villagers in the communities, and receives updates on the status of the birds through telephone communications and annual visits to the reintroduction area.

**RESULTS**

There was 50% survival of the four male macaws released in December 1999. The four males were observed at the flight cage eating the supplemental food for two days after the release. Vocalizations of the released birds were heard in the area of the flight cage up to one week later, but they did not return to the cage or the supplemental food. Five days later two males were observed actively foraging in an area 13 to 14 km from the release site. Two males were spotted in the south-west region of the swamp about 9 km from the release site less than three weeks later. The other two males were neither seen nor heard.

There was 100% survival of the eight birds released in January 2000 for at least four weeks post-release. Among them were two bonded pairs, one female that was bonded to a non-flighted male and three unpaired birds. Following the release, two pairs of macaws were observed above the forest canopy, flying distances of approximately 10 km within 24 hours of the release. For four days following the release a female and male macaw returned to the enclosure for supplemental feeding and to perch in close proximity to individual birds remaining in the flight cage. Two weeks after the release, one female macaw found perched outside a private aviary on the south-east corner of the island, some 26 km away, was captured, kept isolated and released on the day after her return. For one month after the release, sightings of pairs of macaws were reported as far as 27 km north and 24 km north-west of the release site. Frequently, two unpaired macaws were observed feeding on *Mauritia* palm fruit in an area approximately 16 km north of the release site.

In February 2000, villagers in the areas bordering the swamp were still seeing 10 of the 12 released birds. The deteriorated body of a male macaw identified by its leg band to be one that was released in December 1999 was found on 2 May, 2000 by a farmer in a village 14 km from the release site. Nine out of 14 birds (64%) released between December 1999 and March 2000 continued to be sighted between May 2000 and December 2003. Four birds remained of unknown status.

In Trinidad the Blue-and-yellow Macaws nest during April and May (Forshaw 1989). No nesting was observed following the releases between December 1999 and March 2000. During the 2001 nesting season three pairs of macaws produced five chicks. Nest sites were not located and monitored but in September 2001, six adults and five young were observed feeding together on fruiting *Cordia alliodora*. Based on this success, a nesting site assessment was implemented in March 2002 to June 2003. During this time, four pairs of Blue-and-yellow Macaws successfully used seven of 22 explored nest sites and produced seven chicks (Plair, unpublished). This brought the number of surviving chicks to12 after three nesting seasons.

Four of the nest sites located in dead *Roystonea* palms each fledged one chick, one live *Roystonea* palm yielded one chick, a dead *Mauritia* palm fledged two chicks and a dead *Spondias mombia* tree fledged one chick. Three eggs were laid in the nest of a dead *Roystonea* palm but this tree was deliberately felled by a poacher looking for young nestlings. The felled *Roystonea* palm tree provided the only accessible data on the depth of the nest and the degree of decomposition inside the nest cavity. The nest hole was 107 cm deep, and the cavity of the hollow trunk consisted of fine wood chips from the inner bark as well as refined wood dust.

There was 100% survival of the eight female and four male macaws released in December 2003. There were approximately 26 birds in the wild prior to the December 2003 release. With the survival of all 12 birds released in December 2003, the total population increased to 38 birds. The five macaws released in June 2004 also had 100% survival. The three female and two male macaws, did not return to the empty pre-release cage on the days following their release. Those birds integrated with the macaws already established in the area. The population in the wild increased to 43 birds.

Nesting success continued with five more chicks in 2004 and three chicks in 2005. Two eggs were lost presumably to nest predation in 2005 when shells were found at the base of a nest site tree. Eight pairs fledged six chicks in 2006 bringing the total population to 52 birds consisting of 26 adults and 26 chicks. Between 2007 and 2010, 22 surviving chicks were added to the population. Nine pairs of birds fledged 12 additional chicks between 2011 and

2012. Nest poaching has not been eliminated. Occasionally two to three young chicks appear for sale in pet shops or open markets. Overall, there has been a 230% increase in the original surviving population of 26 birds. With a total of 60 chicks surviving over 12 nesting seasons, there is an estimated population of 86 birds in the wild (Table1).

During the first year after the 1999 to 2000 releases, the nine surviving birds explored areas well beyond the boundaries of the swamp. Three pairs established a range that encompassed the swamp and areas 27 km north, 24 km north-west and 20 km west of Nariva. Three macaws flew south near a private aviary and established a range between the south-east and south-central coast of the island between 26 and 40 km from the release area. From January to June of 2001, the three pairs of macaws were routinely seen in a flight pattern that terminated in an area dominated by thick *Mauritia* palms 4 km to 5 km from the release site. In February 2002, the three macaws that occupied the south-east and south-central range in 2000 and 2001 integrated with the three pairs of macaws within the swamp and a fourth pair was formed. These birds remained within the boundaries of the swamp and, with successful nesting, began to establish a pioneer flock.

None of the birds from the groups released in December 2003 and June 2004 explored beyond the boundaries of the swamp as did the original flocks. For two to three days after the release, all 12 birds returned in pairs or groups to the flight cage. Several perched on top of the cage, eating supplemental food and interacting with the eight remaining birds in the flight cage. When supplemental feeding was ceased after three days they dispersed, flying distances up to15 km, but returning in pairs or groups to areas around the pre-release cage.

Macaw monitors from communities around the swamp noticed an increase of two or more birds normally observed in their particular range following the December 2003 release. This suggests that the newly released birds were integrating with the established flock. Birds from the first translocation returned with the newly released birds to the release site. A banded female with a juvenile bird (identified by its short tail and no band) was observed perched on a tree close to the pre-release cage about three weeks after the December 2003 release. This bird appeared to be the offspring of parents from the first reintroduction. Between January and June 2004, some of the released birds continued to visit and perch on trees above and around the pre-release cage which still housed the eight remaining birds.

In 2006, monitors within the swamp recorded the flight patterns of eight pairs of macaws in areas between 8 km and 15 km from the release site. Two pairs were frequently seen within 4 km of the release site. Between 2007 and

**Table 1.** Survival and reproduction of wild-caught Blue-and-yellow Macaws reintroduced to the Nariva Swamp, Trinidad.

| Year | # Birds Released | % Surviving | # Surviving Male/Female | # Pairs Established | # Young Produced | # Eggs/ Chicks Lost | Total Population |
|---|---|---|---|---|---|---|---|
| 1999 | 4 | 50 | 2/0 | 0 | 0 | | 2 |
| 2000 | 10 | 80 | 5/4 | 2 | 0 | | 9 |
| 2001 | 0 | | 5/4 | 3 | 5 | | 14 |
| 2002 | 0 | | 5/4 | 4 | 3 | 3 | 17 |
| 2003 | 12 | 100 | 9/12 | 4 | 4 | | 33 |
| 2004 | 5 | 100 | 11/15 | 7 | 5 | | 43 |
| 2005 | 0 | | | 7 | 3 | 2 | 46 |
| 2006 | 0 | | | 7 | 6 | | 52 |
| 2007 | 0 | | | 8 | 7 | 2 | 59 |
| 2008 | 0 | | | 8 | 3 | | 62 |
| 2009 | 0 | | | 8 | 6 | | 68 |
| 2010 | 0 | | | 8 | 6 | 3 | 74 |
| 2011 | 0 | | | 9 | 5 | | 79 |
| 2012 | 0 | | | 9 | 7 | 2 | 86 |
| **Total** | **31** | **84** | **11/15** | **9** | **60** | **12** | **86** |

2012, the birds began to expand their range to areas bordering the swamp. Forest fires resulting in smoke within the swamp appear to be one of the factors that influence the dispersal of the birds to areas beyond the swamp. Access to food on nearby cultivated lands bordering the swamp seems to be another factor. Following fires in an open area of the swamp during the dry season, a flock of nine birds was frequently observed feeding on *Roystonea* palm fruit and *Hura crepitans* seeds in a populated area about 6 km south of the swamp. Another flock of 11 birds frequented an area to the south-west, about 8 km outside the borders of the swamp. Six to eight birds were reported about 26 km to the south-east and three birds were observed in the south-central area as far as 40 km from the swamp. These areas all supported stands of *Roystonea* palm. Small flocks of five to seven birds were observed feeding on non-palm fruit such as *Syzygium malaccense*, *Mangifera indica* and *Spondias dulcis* in cultivated areas 6 km north and 9 km north-east of the swamp. Flocks of Blue-and-yellow Macaws ranging in size from 15 to 18 birds continue to be seen within the swamp when food is abundant and the area is smoke free (Fig. 1).

## DISCUSSION

This study suggests that Blue-and-yellow Macaws can be successfully reintroduced to their historic range when conditions are favorable (White *et al*. 2012). Factors that may have contributed to this success include the use of wild-caught birds for translocation (Snyder *et al.* 2000; Wiley *et al*. 1992); releasing birds within their historical range (Sanz and Grajal 1998); the availability of suitable habitat (IUCN 1995); low competition for food and nesting sites (Griffith *et al*. 1989); and reduced threat of predation (Butler 1992).

A key factor in gaining high survival of birds reintroduced to the wild is the establishment of a pioneer group. When the first group of reintroduced Blue-and-yellow Macaws was released within the Nariva Swamp, the birds explored up to 40 km beyond their historic range during the first year. The survival rate of this first group was 64%. Birds released from a second translocation two years later, did not explore beyond the boundaries established by the pioneer group but instead integrated with the wild group for up to three years after release. There was 100% survival of the birds released from the second translocation. Between 2007 and 2012, small flocks of birds began to expand their range to areas from 6 km to 40 km beyond the swamp when fires occurred within its boundaries.

Macaws face many threats including clearing for agriculture, logging and the pet trade. Logging often targets

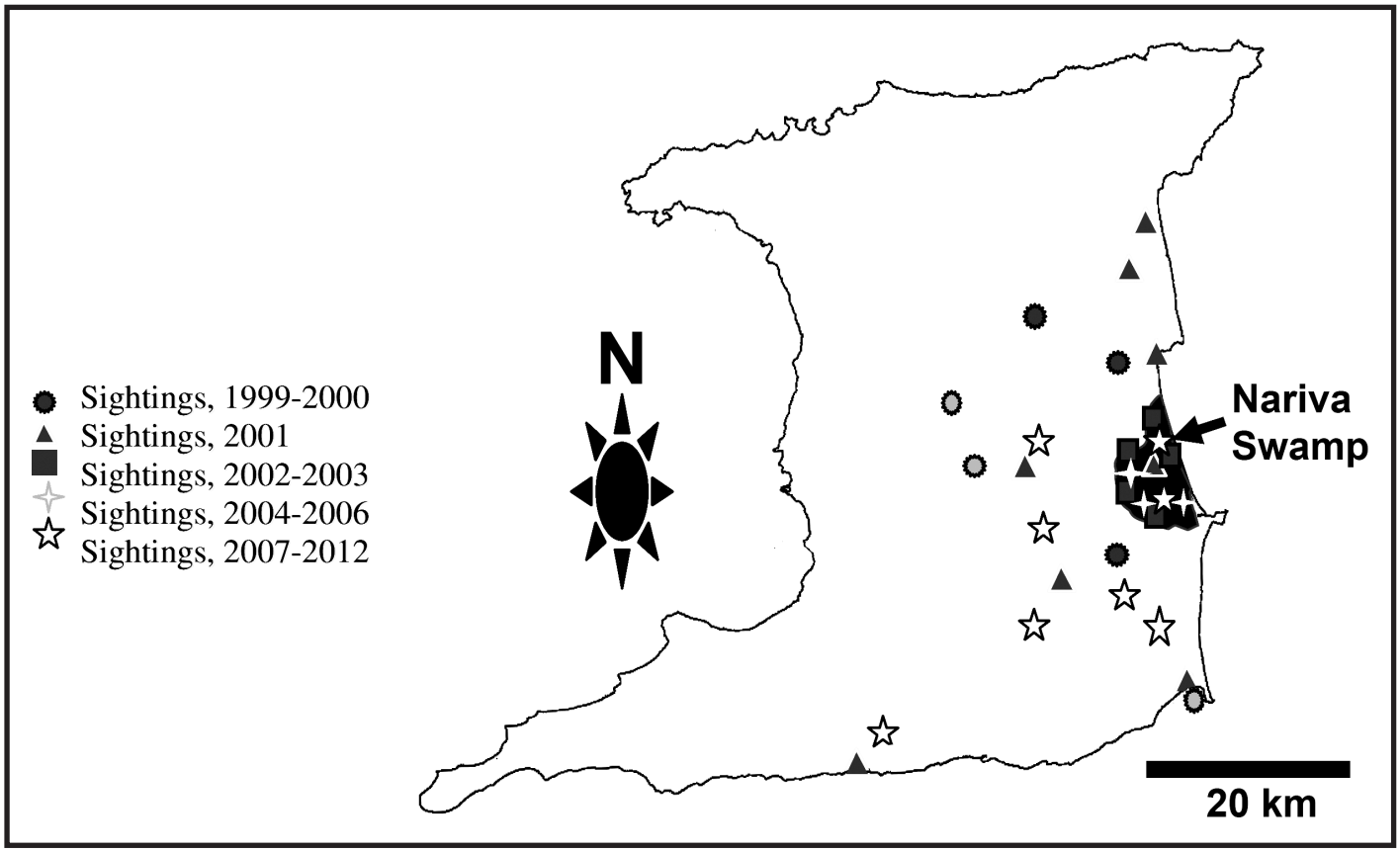


**Fig. 1.** Dispersal of Blue-and-yellow Macaws released in the Nariva Swamp, their historic range in Trinidad.

the biggest trees, with large cavities that macaws need to nest. In addition, many collectors cut down nest trees to get to the young. As a result, the number of available nest sites for macaws has been greatly reduced in recent years. This is compounded by the fact that suitable natural cavities are often very rare even in pristine old growth forests that have not suffered any real impacts from logging (Munn *et al*. 1991). Researchers at Tambopata Research Center in south-eastern Peru have been studying the availability and use of natural as well as artificial nest sites in that area for the past fifteen years (Nycander *et al*. 1995; Brightsmith and Bravo 2006). Their findings suggest that macaws prefer to nest in the hollow cavities of dead palms and that Blue-and-yellow Macaws are very selective about the depth and degree of decomposition of the nest cavities that they choose.

Blue-and-yellow Macaws have reproduced at a high rate in the Nariva Swamp. The birds nested in hollow *Roystonea* and *Mauritia* palms as well as in hard wood trees. There was little or no competition for nest sites with the Red-bellied Macaws that also occupy the swamp. Red-bellied Macaws nest in hollow palms with holes on the sides of the trunk. These nest sites are commonly found in the swamp. The Blue-and-yellow Macaws showed preference for tall topless palms with wide openings at the top and deep well-rotted cavities. In Peru, Blue-and-yellow Macaws nested predominantly in *Mauritia* palm trees (Brightsmith and Bravo 2006*)* whereas in Trinidad five of seven successful nests were in *Roystonea* palms and one in a *Mauritia* palm. One of the seven nest sites used in Trinidad was in a live *Roystonea* palm trunk.

Dead tree trunks used were hollow and a long nail could easily be pushed into the trunk by hand. With the exception of one nest in a felled *Roystonea* tree, heavy rainfall during the study period prevented the collection of data on the depth of nest cavities and the degree of decomposition of the hollow trunks. Examination of the nest cavity in the felled tree supported the findings in Peru that nest cavities chosen by Blue-and-yellow Macaws are deep and well decomposed on the inside (Nycander *et al.* 1995). Three eggs found in this nest cavity confirmed that it was a preferred nesting site for the macaws. In the nest site study conducted from March 2002 to April 2003, four adult pairs of Blue-and-yellow Macaws had seven surviving chicks over the two nesting seasons. They used seven of 22 explored nest sites. None of the nest sites explored or used in 2002 were revisited or used in 2003. Overall, the success of natural nests was higher in Trinidad with 1.2 chicks/nest compared to natural nests in Peru 0.71 chicks/nest (Nycander *et al*. 1995). In contrast, reproductive success has been minimal for captive raised Scarlet Macaws released in Costa Rica but at Tambopata, Peru, hand-raised macaws bred successfully with wild mates (Brightsmith *et al*. 2005). The use of wild-caught birds and lack of competition for nest sites, in addition to behavioral monitoring of social interactions during pre-release acclimation facilitating the release of bonded pairs and compatible groups of birds, may have aided in the high reproductive rate achieved in Trinidad (Plair *et al*. 2008).

Raptor predation has plagued reintroductions of smaller psittacines like Puerto Rican and Thick-billed Parrots (Snyder *et al*. 1994; USFWS 2002; White *et al*. 2005). Large macaws may avoid high rates of raptor predation due to the fact that there are relatively few avian predators large enough to capture adult macaws and these occur at naturally low densities (Willis and Eisenmann 1979; Terborg *et al*. 1996; Thiolly 1994). In Trinidad there are no serious threats from raptor predation, and loss of eggs and chicks is mainly due to poaching by humans (Wright *et al*. 2001). Using trained villagers from communities bordering the swamp to monitor and protect the birds, promoting increased public awareness through conservation education and encouraging national pride in the restoration of an extirpated species aid in mitigating the effect of nest site poaching of macaws (Butler 1992).

In 2004, the Cincinnati Zoo and Botanical Garden partnered with the Miami University of Ohio to launch a global field program called Earth Expeditions to work with scientists in different countries and raise global awareness of ongoing conservation projects. The first 10-day field expedition of this program was conducted in Trinidad in June 2004, where the participants witnessed the release of the last five Blue-and-yellow Macaws translocated from Guyana to the Nariva Swamp. To date, there have been nine field expeditions to Trinidad led by the author. One hundred and ninety-eight Earth Expedition participants have visited the macaw reintroduction site and the communities bordering the swamp. Macaw monitors serve as field guides during these 10-day field expeditions and the communities and local schools play a significant role in the in-country experience and cultural immersion of the Earth Expedition participants (Janzen *et al.* 1993). After more than twelve years of spearheading this conservation effort, funding and management of data collection for the Blue-and-yellow Macaw reintroduction program was handed over from the Cincinnati Zoo and Botanical Garden to the Trinidad and Tobago Government in 2007. Since then, official reports on data collection are no longer submitted to the Cincinnati Zoo. However, the author still maintains close contact with the macaw teams and community people through the Earth Expeditions program and CRESTT, and continues to monitor the survival and nesting success of the birds through telephone communication with the team leaders and annual in-country visits.

It should also be noted that in addition to the release of wild-caught birds from Guyana between 1999 and 2004 as noted in this report, there have been releases of captive-bred Blue-and-yellow Macaws in the Nariva Swamp. The author first learned through media reports that the Emperor Valley Zoo released six to eight captive-bred birds in July 2009. The details of this release and the status of the birds have not been shared with the author. Similarly, in April 2011 the Pointe-à-Pierre Wild Fowl Trust (PWFT) released ten captive-bred birds into the swamp. I first learned of this release through reports in the local media and later found information about it on the PWFT website.

Despite the seeming success of the Blue-and-yellow Macaw reintroduction program in Trinidad, considerable improvement needs to be made in order to make this a sustainable conservation effort. A consistent and co-operative level of systematic and detailed documentation of all methods used in the reintroduction process must be implemented. A practical and effective plan for post-release monitoring should be established in order to provide the information necessary to accurately assess both short and long-term results of all releases (White *et al*. 2012). In addition, better communication and collaboration between organizations involved in the reintroduction and supplementation of Blue-and-yellow Macaws in Trinidad is of paramount importance to the successful development and implementation of a long-term management plan for this species on the island. Further releases need to be carefully considered based on the "carrying capacity" of the habitat. Releases should follow established IUCN protocols and must be thoroughly documented. It is disastrous to release birds without ensuring that they are disease-free. Post-release monitoring should also be implemented and documented.

Finally, there needs to be an assessment of the Nariva Swamp in its current state to determine if it can support the new population of Blue-and-yellow Macaws or whether some mitigation is needed to ensure the continued survival of the species in Trinidad.

## ACKNOWLEDGEMENTS

I am grateful to the Trinidad and Tobago Field Naturalists' Club for requesting this report on the status of the Blue-and-yellow Macaws reintroduced to the Nariva Swamp, Trinidad. This work would not have been possible without the financial support of the Cincinnati Zoo and Botanical Garden, Talisman Petroleum Ltd., BHP Billiton, British Gas of Trinidad and Tobago, the Cleveland Zoological Society, the Miami University of Ohio and many private donors in the USA and Trinidad. Thanks to the Forestry Division, Ministry of Public Utilities and the Environment, Trinidad and Tobago, the Centre for the Rescue of Endangered Species of Trinidad and Tobago and Veterinarians in the USA, Trinidad and Guyana for their assistance with this project. Thanks also to the Emperor Valley Zoo, the Manatee Conservation Trust and BPTT for their support during the 1999-2000 reintroductions. Most importantly, we thank the monitoring teams and villagers in the communities and schools bordering the swamp for their invaluable commitment and contribution to this reintroduction program.

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# Dr. Allan W. Hook (1953-2013)

The Trinidad and Tobago Field Naturalists' Club (TTFNC) lost another of its stalwarts with the recent passing of Allan Hook just short of his 60th birthday. I first met Al in 1976 when we were graduate students together at the University of Georgia. He specialized in the nesting biology of solitary wasps, while I did social wasps, so that our interests complemented each other nicely. Al went on to do his PhD at Colorado State University, a stint that included a period in Australia. Soon after graduation, he joined the faculty of St. Edward's University in Texas, where he remained for the rest of his life.

In the early 1990s Al told me that he had a sabbatical coming up and asked whether Trinidad would be a good place to work on solitary wasps. I responded right off that it would be a very good choice, seeing as the local solitary wasps were quite juicy and had hardly been studied since E. McC. Callan was here almost half a century earlier. Thus began Al's happy, fruitful association with Trinidad, which included a later sabbatical year and at least a few weeks during most other years.

Not one to just do his tropical field work and then go home, Al developed a large and enthusiastic circle of friends both in academia and among the country people. And as an ardent lifelong naturalist he quickly discovered and joined the TTFNC, to which he contributed both financially and through his participation.

Despite being a sociable guy, Al remained a bachelor into middle age. He was by no means averse to female company -- ahead of his first sabbatical, I went so far as to organize a Trinidadian girlfriend for him, so he could hit the ground running -- and we just figured he was destined for lifelong bachelorhood. Not so. When he was already past 50 he and Rosemary Guzman discovered each other, and they remained devotedly wedded to the end of his days.

Among Al's most treasured duties at St. Edward's was as academic director of the nearby Wild Basin Wilderness Preserve, a 92-hectare forest that serves as a recreational, conservation and research site. It is very fitting, then, that the Hooks have established an endowment in his memory to support research by students from around the world at Wild Basin. For instructions on how to contribute to this worthy endeavour, see http://bit.ly/drahook.

**Christopher K. Starr.**
The University of the West Indies

# *Udranomia* spp. (Lepidoptera: Hesperiidae: Eudaminae) in Trinidad, West Indies

**Matthew J.W. Cock**
*m.cock@cabi.org / mjwcock@btinternet.com*

**Scott Alston-Smith**
13 Hopeton Crown Trace, Black Rock, Tobago.

**ABSTRACT**
*Udranomia orcinus* (C. Felder and R. Felder) is confirmed as a Trinidad species, and the early stages are described and illustrated from Nariva Swamp. The food plant is *Ouratea purdieana* (Ochnaceae), an uncommon endemic species in Trinidad. A second species *Udranomia eurus* (Mabille and Boullet) is recorded from Trinidad for the first time, based on specimens from the summit ridge of El Tucuche.

**Key words** (not in title): *Udranomia orcinus*, *Udranomia eurus*, *Ouratea purdieana*, Ochnaceae, Nariva Swamp, El Tucuche.

## INTRODUCTION

*Udranomia* is a Neotropical genus of just four species of small skipper butterflies. Previously it was placed in the subfamily Pyrginae (Evans 1952; Cock 1984), but in the new classification of the Hesperiidae, it joins many other Neotropical species in the new subfamily Eudaminae (Warren *et al*. 2009).

Until now, there has been just one doubtful record of an *Udranomia* species from Trinidad. *Udranomia orcinus* (C. Felder and R. Felder) was known only from a single record from the island. Kaye (1940) records this capture, '♂ Manzanilla, 22.iii.1922 (Dr. F.W. Jackson)'. The whereabouts of this specimen – if it still exists – is unknown. When MJWC treated this species in his series on the Hesperiidae of Trinidad (Cock 1984), he concluded that as Jackson had recorded several unusual butterflies associated with swamps in Trinidad with the same data, then 'somewhere in the swamps of east Trinidad this species probably awaits rediscovery'. Here we report this rediscovery, together with a new record of a congeneric species, *U. eurus* (Mabille and Boullet).

### *Udranomia orcinus* (C. Felder and R. Felder)

Figs. 1-4.

Cock (1984) presents basic information on this species in Trinidad. Moss (1949) records the food plant of *U. orcinus* as *Ouratea subscandens* (=*Gomphia subscandens*) (Ochnaceae) at Belém (=Pará), Brazil. In Costa Rica, Janzen and Hallwachs (2012) have reared this species repeatedly from *Cespedesia spathulata* (Ochnaceae) and several times from *O. lucens* and three species of *Quiina* (Quiinaceae). Ochnaceae is represented by two species of *Ouratea* and two of *Sauvagesia* in Trinidad (Williams 1929b), while Quiinaceae is represented by two species of *Quiina* (Williams 1929a).

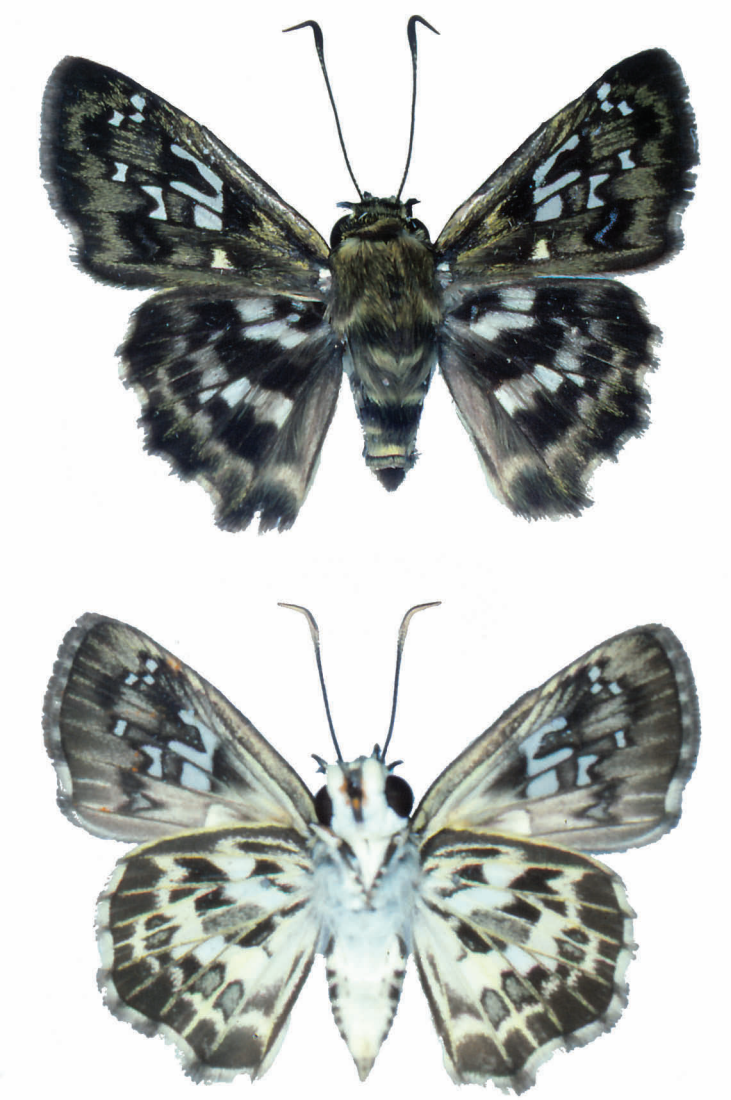

**Fig. 1.** *Udranomia orcinus* pinned adults. **Above**, UPS male, Bush Bush Island, August 1993; **Below**, UNS female, Parrylands, April 1993 (S. Alston-Smith).

In 1993 SAS discovered the early stages of *U. orcinus* at Bush Bush Island and Parrylands and reared out adults (Fig. 1). In May 1995, we visited Bush Bush Island together. As soon as we reached the edge of the forest from Kernahan, we found an adult of *U. orcinus* feeding at flowers of black sage, *Cordia currassavica*. Inside the forest, we collected the early stages which are documented here (MJWC ref. 95/33).

A sample of the food plant was pressed (MJWC 195) and identified by the National Herbarium as *Ouratea purdieana* (Ochnaceae), an uncommon endemic species in Trinidad, with records from the Northern Range (Williams 1929b). In Bush Bush Island, it is found beside shady paths and the serrated leaf edges, and common hesperiid damage on flush growth due to *U. orcinus,* made it quite obvious.

The eggs are small, laid mostly on the leaf under surface (12 examples) but also on the upper surface (2 examples). The stage 1 leaf shelter is a small irregular two-cut triangle from the leaf edge, folded over upwards or downwards. The stage 2 shelter is also an irregular triangle, about 20 x 10 mm, and folded over upwards or downwards; the shelter edges may be irregular due to caterpillar feeding from the edge. The stage 3 shelter is a large two-cut flap from the edge of the leaf, hinged adjacent to the midrib; one example measured 70 x 30 mm, with the bridge (hinge) 16 mm wide. To complete the shelter about eight deep notches are cut from the edge of the flap and from the edge of the leaf on which the flap rests.

The final instar caterpillar (Fig. 2) measured 18 mm, six days after moulting and about 14 days before it pupated; six days before pupation it had grown to 25 mm. Head wide, almost as wide as high, 1.41 x 1.44 mm wide x high, broadly indent at vertex; the stemmata placed around a slight bulge; light shiny brown, the epicranial suture slightly darker; smooth, but slightly rugose in two bands, the upper from apex towards adfrontals, and the lower parallel to and slightly below this. T1 concolorous. Body dull yellowish translucent green, becoming pink-brown just before pupation; spiracles light yellow-brown; all legs concolorous. The caterpillars documented by Janzen and Hallwachs (2012) are similar, but the head is red-chestnut in colour, and the posterior margin of the anal plate has a brown line. In Trinidad, the previous two instars are similar to the final instar, but the head is smooth: the head of the penultimate instar measures 2.29 x 2.39 mm wide x high, while the previous instar measures 1.41 x 1.44 mm.

The pupa (Fig. 3) is relatively broad for its length, the anterior part of the abdomen appears swollen, the eyes are bulbous, and the frons protuberant; proboscis does not project beyond wing cases; ground colour light brown with a very light powdering of white waxy powder; abdomen and dorsal part of thorax with faint rows

**Fig. 3.** Pupa of *Udranomia orcinus*, collected as penultimate instar caterpillar on *Ouratea purdieana*, Bush Bush Island, 2 May, 1995; pupated c. 31 May; photographed 16 June; adult 21 June; ref. 95/33C.

**Fig. 2.** Final instar caterpillar of *Udranomia orcinus*, collected as penultimate instar caterpillar, 2 May, 1995 on *Ouratea purdieana*, Bush Bush Island; moulted to final instar 11 May; photographed 17 May; pupated c. 31 May; ref. 95/33C.

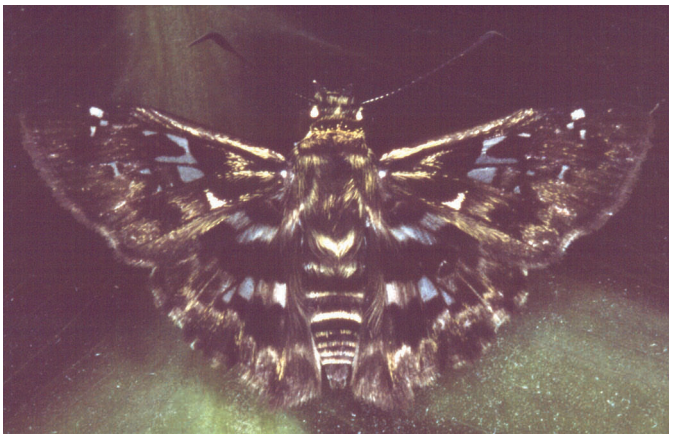

**Fig. 4.** Newly emerged adult male *Udranomia orcinus*, collected as penultimate instar caterpillar, 2 May, 1995 on *Ouratea purdieana*, Bush Bush Island; adult emerged and photographed 21 June; ref. 95/33C.

of dark spots, giving a smudged appearance; wing cases yellow-brown; T1 spiracle a black arc, convex side to posterior; the dorsal suture between the two T1 spiracles narrowly dark; the remaining spiracles small and dark, those of A1-A2 surrounded by a small area clear of dark spots.

Since then, SAS has found widely scattered plants of *O. purdieana* around Trinidad, usually with the distinctive shelters of *U. orcinus.* Revisiting Bush Bush Island in October 2011, MJWC readily spotted the familiar food plant, this time with empty shelters. We conclude that this is a widespread but easily overlooked species, always closely associated with its uncommon food plant.

***Udranomia eurus* (Mabille and Boullet)**

Fig. 5.

This rare species was described from Venezuela and has also been recorded from Amazonas, Brazil (Evans 1952), Colombia (Warren *et al*. 2012) and Costa Rica (Janzen and Hallwachs 2012). It has not previously been recorded from Trinidad, so we place on record the only captures we are aware of, three males taken by SAS on the summit ridge of El Tucuche, March 1983 and March 1989 (2) (Fig. 5).

Janzen and Hallwachs (2012) include just one rearing of this species from Costa Rica in their database: from *Cespedesia spathulata* (Ochnaceae). The caterpillar is quite similar to that of *U. orcinus* shown here, but the head is bright red-chestnut, and the body is green with yellow speckles. The food plant in Trinidad is likely to also be an Ochnaceae, perhaps, *O. purdieana*, which is known from El Tucuche (Williams 1929b).

**Fig. 5.** Pinned adult male *Udranomia eurus*, collected on summit ridge of El Tucuche, March 1989, SAS. **Above,** upperside; **Below,** underside.

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# What Common Names Should We Use for Trinidad and Tobago's Frogs?

**J.R. Downie**
School of Life Sciences, Graham Kerr Building,
The University of Glasgow, Glasgow G12 8QQ, UK.
*roger.downie@glasgow.ac.uk*

**ABSTRACT**
Many of Trinidad and Tobago's frogs lack appropriate common names. Common names are easier for the general public to use than scientific names and can help species to become better known. Existing common names for the species found in Trinidad are listed and suggestions made for new common names. A plea is made to Trinidad and Tobago's natural historians to discuss and agree on common names where there are none so far.

**Key words:** Trinidad, Tobago, frogs, common names.

## INTRODUCTION

Common names for animals and plants may be very ancient. They were coined long before natural historians got down to the business of classifying and providing scientific names for the world's species, using the binomial Latin system devised by Linnaeus. It has often been found that indigenous peoples have devised names for species which map closely to the species boundaries scientists have later determined (Bailenson *et al.* 2002). However, this tends to apply mainly to those species with which people closely interact such as birds, mammals and flowering plants. In some groups of organisms, common names may refer to a set of species that share some characteristics, rather than to individual species.

Common names can be quite local and language specific so that species which have wide ranges crossing national boundaries may acquire common names that differ from place to place. On the other hand, species which have only recently been noticed by people may lack common names altogether.

Do common names have any value? It can be argued that too many common names vary from place to place and have so little in the way of descriptive content for them to have any use. However, Latin scientific names are frequently cumbersome and difficult for most people to pronounce and write. If conservation biologists are to succeed in the task of persuading the general public to support species conservation, they need communication tools – names for species – that are easy to grasp and understand. An additional problem with scientific names is that they are not necessarily stable: phylogenetic species revisions frequently lead to scientific name changes which need not affect established common names (see Table 1 and Murphy and Downie 2012). Common names can therefore have communication and stability values.

## TRINIDAD AND TOBAGO: FROG COMMON NAMES – CURRENT AND PROPOSED

In Trinidad and Tobago, my experience is that very few frog species have established common names, in the sense of being widely used and understood by local people. Murphy (1997) reported common names for only eight of the 36 species he listed. This no doubt relates to the country's complex colonial history, at least in part. If the indigenous Amerindians had common names for any of the frogs, they have not survived in Trinidad and Tobago.

The nearest I have found is from a list of Arawak plant and animal names compiled from Guyana (Forte 1996). Table 1 shows the nine Arawak frog names listed, most of them clearly based on calls. Only one, the shibero, is identified to its scientific name (*Hyla maxima*, now *Hypsiboas boans);* the adaba may be *Trachycephalus typhonius (= venulosus*) and the arabaio sounds like *Pipa pipa.* All three of these species occur in the Guianas as well as Trinidad (Frost 2013). Would these names be appropriate for use in Trinidad and Tobago? According to Besson and Brereton (1992), the Amerindians inhabiting Trinidad when Columbus arrived comprised several different groups; speaking versions of two language families, Arawak and Cariban, but we have no way of knowing if they used names for the local frogs equivalent to those used in Guyana.

From the period of French occupation, the word 'crapaud' (for the large toads, *Rhinella marina*) is in common usage. People also use 'flying frog' (for any of the large tree frogs they come across). The lack of widely used common names for frogs may also relate to a general indifference, even distaste, for these animals in Trinidad and Tobago.

The lack of widely used common names does not mean that no such names exist. Frank and Ramus (1985) published a world species list for amphibians and reptiles which included a list of common names, some of which

**Table 1.** Arawak frog names and their English equivalents, as listed by Forte (1996).

| **Arawak** | **English and Scientific** |
|---|---|
| adaba | tree frog with loud, grunting voice |
| akhorá | forest ground frog |
| arabaio | flat back aquatic frog |
| katakata | small grey aquatic frog |
| kórekóre | kind of frog |
| shibero | bullfrog = *Hyla maxima* |
| sorakara | frog |
| tontonle | small ground frog |
| wareke | frog |

they devised. However, many amphibian and reptile species have been described since that time (Köhler *et al*. 2005) so their list is incomplete. In addition, the common names Frank and Ramus devised have been criticised. Caramaschi *et al.* (2005) characterised Frank and Ramus's common names for leptodactylid frogs as mostly "inappropriate, inane, or both", mainly because the descriptions included in the names are inaccurate or misleading. For example, Frank and Ramus call *Leptodactylus* the 'white-lipped frogs', but most species do not have white lips.

Of the two major world amphibian species on-line databases, AmphibiaWeb (2013) does not include common names, but Amphibian Species of the World (Frost 2013) does. Many of these are drawn from Frank and Ramus, but Frost also lists additional published common names, including some he designates as no longer recognised. Frost lists common names under the heading 'English names'.

Table 2 shows the current list of Trinidad and Tobago's frogs, with the scientific and recognised English names provided by Frost (2013) along with a list of common names suggested in this paper mainly on the basis of appearance or habitat. Two conventions are in use concerning the typing of common names: capitals for all initial letters, or lower case throughout (except where a proper name is included as part of the common name). I prefer the latter style and use it for the suggested list. There follow comments on the 'recognised' and 'suggested' names.

The name 'poison frog' for any member of the genus *Mannophryne* is inappropriate. Even when these frogs were considered dendrobatids, it was known that they are non-toxic. Murphy (1997) listed *M. trinitatis* by the name 'yellow-throated frog' (from a 19th century paper by Mole and Urich). However, only the females have a yellow throat. In recent publications, we have called this species the 'Trinidad stream frog', which is appropriate for its habitat (Downie *et al.* 2001). 'Tobago stream frog' might therefore suit *M. olmonae*.

Of the bufonids, there is no dispute over the identity of *Rhinella marina*, previously called *Bufo marinus*. I am sure that the local name of 'crapaud', listed by Murphy (1997), will continue to be used, but this is a general French word for toad so it would be sensible to use a more specific common name. Both cane toad and marine toad are appropriate, as associating the species with habitats it utilises (the seashore and rivers entering the sea, not the sea itself) on both islands. There is, however, a dispute over the other bufonid long listed as *Bufo*, now *Rhinella beebei*. A recent taxonomic revision has concluded that *R. beebei* is the same species as the Colombian *R. humboldti* (Narvaes and Rodriguez 2009). Even if this is correct, it is unclear that the specific *humboldti* should have precedence over *beebei*; and Murphy *et al.* (in preparation) provide evidence that the Trinidad species is not *humboldti*. Because of William Beebe's long association with Trinidad, it would make sense to name the species locally as 'Beebe's toad'.

'Glass frog' is a recognised common name for the centrolenids and well reflects their transparent appearance. Of the two islands, *Hyalinobatrachium orientale* only occurs on Tobago. As a local name, 'Tobago glass frog' would be suitable.

The families Craugastoridae and Eleutherodactylidae belong to the vast assemblage of Neotropical species known as the terrarananas (Hedges *et al*. 2008): these share the characteristics of terrestrial oviposition and direct development to froglets, with no tadpole stage. Common names are a problem for these species, partly because identification of new species continues apace, and interspecific differences tend to be subtle. Trinidad and Tobago have three craugastorids, only one with a listed common name and two restricted to Tobago. Frank and Ramus (1995) gave the name 'robber frogs' to the group, for no obvious reason. They are mostly found in forest leaf litter, so 'litter frog' might be a suitable general name with specifics related to locality or discoverer. *Pristimantis charlottevillensis* would become the 'Charlotteville litter frog'; *P. turpinorum,* 'Turpin's litter frog'; *P. urichi,* 'Urich's litter frog'. The other terraranan is *Eleutherodactylus johnstonei*, an invasive alien now well established in Trinidad and recently reported from Tobago (Graham White, personal communication), it would be 'Johnstone's litter frog'.

The hylids are characterised (mostly) by their adhesive digital pads and generally live in trees or bushes. 'Tree frog' is the general common name for the family. 'Flying frog' can also be used generally, but is often restricted to larger species found high in trees and therefore seen 'flying' from branch to branch. Trinidad and Tobago have

**Table 2.** The names of Trinidad and Tobago's frogs.

| **Family and Species** | **Location**<br>**To = Tobago only**<br>**Tr = Trinidad only**<br>**TT = Trinidad and Tobago** | **'Recognised' Common Names and Sources[1]** | **Suggested Names for Trinidad and Tobago** |
|---|---|---|---|
| **Aromobatidae** | | | |
| *Mannophryne olmonae* | To | Bloody Bay Poison Frog (FR) | Tobago stream frog |
| *M. trinitatis* | Tr | Trinidad Poison Frog (FR) | Trinidad stream frog |
| **Bufonidae** | | | |
| *Rhinella humboldti (= beebei)* | Tr | Rivero's Toad (FR) | Beebe's toad |
| *R. marina* | TT | Giant Toad (FR); Marine Toad, Shoulder-knot Frog, Aqua Toad, Cane Toad (others) | crapaud, cane toad, marine toad |
| **Centrolenidae** | | | |
| *Hyalinobatrachium orientale* | To | Eastern Glass Frog (FR) | Tobago glass frog |
| **Craugastoridae** | | | |
| *Pristimantis charlottevillensis* | To | None | Charlotteville litter frog |
| *P. turpinorum* | To | None | Turpin's litter frog |
| *P. urichi* | TT | Lesser Antilles Robber Frog (FR) | Urich's litter frog |
| **Eleutherodactylidae** | | | |
| *Eleutherodactylus johnstonei* | Tr | Johnstone's Robber Frog (FR) | Johnstone's litter frog |
| **Hylidae** | | | |
| *Dendropsophus microcephalus* | Tr | Yellow Treefrog (FR); Small-headed Treefrog, Yellow Cricket Treefrog (others) | small-headed tree frog |
| *D. minusculus* | Tr | Rivero's Tiny Treefrog (FR) | minuscule tree frog |
| *D. minutus* | TT | Lesser Treefrog (FR) | minute tree frog |
| *Hypsiboas boans* | Tr | Rusty Treefrog (FR); Giant Gladiator Treefrog (others) | giant tree frog |
| *H. crepitans* | TT | Emerald-eyed Treefrog (FR); Rattle-voiced Treefrog (others) | rattle-voiced tree frog |
| *H. geographicus* | Tr | Map Treefrog (FR) | map tree frog |
| *H. punctatus* | Tr | Polka-dot Treefrog (FR) | lesser green tree frog |
| *Pseudis paradoxa* | Tr | Swimming Frog (FR); Paradoxical Frog, Jacky, Jackie, Proteus Frog, Paradox Frog (others) | paradox frog |
| *Phytotriades auratus* | Tr | Trinidad Heart-tongued Frog (FR); El Tucuche Golden Frog (others) | Trinidad golden tree frog |
| *Phyllomedusa trinitatis* | Tr | Trinidad Leaf Frog (FR) | Trinidad leaf frog |
| *Scinax ruber* | TT | Red Snouted Treefrog (FR) | lesser brown tree frog |

| Family and Species | Location<br>To = Tobago only<br>Tr = Trinidad only<br>TT = Trinidad and Tobago | 'Recognised' Common Names and Sources[1] | Suggested Names for Trinidad and Tobago |
|---|---|---|---|
| *Scarthyla vigilans* | Tr | Maracaibo Basin Treefrog | pale grey-green tree frog |
| *Sphaenorhynchus lacteus* | Tr | Orinoco Lime Treefrog (FR); Orange Frog (others) | lime tree frog |
| *Trachycephalus typhonius (=venulosus)* | TT | Warty Treefrog, Marbled Treefrog, Veined Treefrog (FR), Veined Frog, Milky Treefrog, Vein-eyed Glue Frog, Amazon Milk Frog | milky tree frog, warty tree frog |
| **Hemiphractidae** | | | |
| *Flectonotus fitzgeraldi* | TT | Mount Tucutche (error for Tucuche?) Treefrog (FR) | Trinidad and Tobago marsupial tree frog |
| **Leptodactylidae[2]** | | | |
| *Adenomera hylaedactyla* | Tr | Napo Tropical Bullfrog (FR) | lesser dark-spotted thin-toed frog |
| *Engystomops pustulosus* | TT | Tungara Frog (FR) | tungara frog |
| *Leptodactylus fuscus* | TT | Rufous Frog (FR); Fuscous Foam Frog (others) | whistling frog |
| *L. insularum (= bolivianus)* | Tr | San Miguel Island Frog (FR) | Barbour's thin-toed frog |
| *L. macrosternum* | Tr | Miranda's White-lipped Frog (FR) | greater dark-spotted thin-toed frog |
| *L. nesiotus* | Tr | None | Trinidad thin-toed frog |
| *L. validus* | TT | None | Garman's thin-toed frog |
| **Microhylidae** | | | |
| *Elachistocleis ovalis* | Tr | Common Oval Frog (FR); Oval Frog, Slate Burrowing Frog (others) | common narrow-mouthed or siren frog |
| *E. surinamensis* | Tr | Suriname Oval Frog (FR) | Suriname narrow-mouthed or siren frog |
| **Pipidae** | | | |
| *Pipa pipa* | Tr | Suriname Toad (FR); Suriname Water-toad, Pipa (others) | pipa toad |
| **Ranidae** | | | |
| *Lithobates palmipes* | Tr | Amazon River Frog (FR); Spring Chicken (others) | great olive-green ground frog |

1. All 'recognised' common names as listed in Frost (2013); we show names devised or listed by Frank and Ramus (1995) as FR, and the remainder listed by Frost as by 'others'.
2. The 2013 version of Frost's Amphibian Species of the World returns *Engystomops* to the family Leptodactylidae and prefers *Adenomera hylaedactyla* to listing this species under the genus *Leptodactylus.*

13 species of hylid, including the somewhat anomalous *Pseudis paradoxa*. This species is fully aquatic, lacks digital pads and is best known for its giant tadpoles. Despite many efforts, molecular phylogenetic methods have not succeeded in separating the genus *Pseudis* from the hylids, despite its unusual characteristics (Garda and Cannatella 2007). 'Paradox frog', derived from its unusual life history, with tadpoles at full size much larger than adults, continues to be an appropriate name.

For the more characteristic hylids, 'map tree frog' suits *Hypsiboas geographicus* because of its adult dorsal map-like patterning; 'Trinidad leaf frog' fits well for *Phyllomedusa trinitatis*; for *Phytotriades (= Phyllodytes) auratus,* I suggest 'Trinidad golden tree frog' is better than 'El Tucuche golden frog' since the species is found on El Cerro del Aripo as well as El Tucuche, and is a tree frog; 'lime tree frog' might suit *Sphaenorhynchus lacteus*, with its overall colour. The other hylids are more of a problem: the three smallest, *Dendropsophus microcephalus, D. minusculus,* and *D. minutus* are not well distinguished in Trinidad and Tobago by the 'recognised' names in Table 2. *Scinax ruber* in Trinidad and Tobago is not red-snouted. *Hypsiboas punctatus* turns red at night and is green with small pale spots by day: it is not obvious that 'polka-dot' fits this description. Two of the larger tree frogs, *Hypsiboas boans* and *H. crepitans,* might suit names in Table 2: 'giant tree frog' for the former and 'rattle-voiced tree frog' for the latter. *Scarthyla vigilans* seems to have arrived relatively recently in Trinidad (Smith *et al*. 2011): the Table 2 'recognised' name does not fit its new locality. *Trachycephalus typhonius* (= *venulosus)* has several 'recognised' common names reflecting its wide distribution and conspicuousness: when large choruses of these frogs are calling, they are hard to miss. I suggest two names from Trinidad, one describing their warty appearance the other reflecting the milky secretion they release when disturbed.

Trinidad's marsupial frog (eggs incubated in a pouch on the female's back) has recently been reclassified into the family Hemiphractidae. The recognised name in Table 2 is inappropriate since this species is widely distributed in both islands. I suggest 'Trinidad and Tobago marsupial tree frog' as a suitable name.

Caramaschi *et al.* (2005) proposed that the general common name for members of the genus *Leptodactylus* should be 'thin-toed frogs', a name based on the Latin name originated by Fitzinger and descriptive of all members of the genus. Caramaschi *et al.* set up a website as a forum for discussion of *Leptodactylus* names (www.http://learning.richmond.edu/Leptodactylus/CommonNames.cfm). For *L. fuscus* they suggest 'whistling frog' which fits well with the easily recognisable call. For *L. insularum*, they suggest 'Barbour's thin-toed frog' (from the original describer). They currently (January 2013) have no suggestion for *L. macrosternum,* 'Garman's thin-toed frog' for *L. validus*, and 'Trinidad thin-toed frog' for *L. nesiotus,* since it is an endemic known only from the Cedros-Icacos area.

For the non-*Leptodactylus* leptodactylids, Murphy (1997) noted 'coong-la', 'canal frog' and 'pung-la-la' as local names for *Engystomops pustulosus*. This species is internationally known as the 'tungara frog' from the extensive work of Ryan (1985) and it may be sensible to stick with this as the common name, unless further analysis sub-divides this extensively distributed species. No local name for *Adenomera hylaedactyla* is known, but 'bullfrog', as given by Frank and Ramus (1995), is not appropriate, as discussed by Caramaschi *et al.* (2005).

'Microhylid' means narrow-mouthed and that is the general common name used by Murphy (1997). Both the Trinidad species are quite fat little frogs, so 'oval frog' is not entirely inappropriate. Their calls resemble high-pitched sirens, so 'siren frog' could be a good name.

For *Pipa pipa*, since pipa is an easy name to say and remember, 'pipa frog' or 'pipa toad' (they are very warty-skinned, so toad is more descriptive in that sense) is a good name to use.

Trinidad's only ranid, *Lithobates palmipes,* has no currently used common name: 'river frog' (Frank and Ramus 1995) is not appropriate, at least in Trinidad.

## CONCLUSION

Amphibians are, of course, not the only group where common names may be lacking. However, a survey of the other vertebrate groups in Trinidad and Tobago suggests that the lack is greatest in the frogs: Phillip and Ramnarine (2001) give common names for 32 out of the 38 freshwater fishes in their main list; Murphy (1997) gives common names for most of the reptiles, though many of them are not locally used; and effectively all the birds have common names (Kenefick *et al*. 2007).

In my view, it would be very valuable in terms of public education and conservation to establish common names for Trinidad and Tobago's frogs. The best way for this to be achieved is by public discussion amongst those who have interests in the flora and fauna of the islands. My aim in writing this discussion paper, therefore, is to set up a forum among natural historians familiar with and/or based in Trinidad and Tobago where suggestions for common names can be put forward and tested. Please send comments on the suggested list in Table 1 and ideas for better names to roger.downie@glasgow.ac.uk.

**ACKNOWLEDGEMENTS**

Thanks to John Murphy for comments and support. Since this paper was accepted, Mike Rutherford's Trinidad and Tobago Wildlife Guide (2013) has become available. This lists 17 of the amphibian species including common names, some of them the same as in Table 2, others different: a usueful contribution to the discussion.

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# Investigations on *Philornis downsi* Dodge and Aitken (Diptera: Muscidae) in Trinidad: a Parasite of the Darwin Finches

**Stefanie White[1], Raymond Martinez[1], Andrew G. Parker[2], John Agard[1]** and **Dave D. Chadee[1]**

1. Department of Life Sciences, University of the West Indies, St. Augustine, Trinidad, West Indies.

2. Entomology Unit, FAO/IAEA Agriculture and Biotechnology Laboratories, Agency's Laboratories, Seibersdorf, IAEA, A-1400 Vienna, Austria.

**ABSTRACT**

The larvae of *Philornis downsi* (Diptera: Muscidae) are external haematophagous parasites of nestling birds. It is an invasive fly to the Galapagos Islands that poses a threat to several endemic bird species. Preliminary investigations were conducted in Trinidad on suitable hosts from which to source *Philornis* for laboratory rearing and with which to conduct field studies on *P. downsi* within its natural range. Bird nests were collected from 13 locations around Trinidad and all examined for parasitism by *Philornis* species. The most abundant *Philornis* species by far was *P. trinitensis*. Several common birds from residential and agricultural areas were found to be hosts of *P. downsi* including the Carib Grackle, Greater Kiskadee, Tropical Mockingbird, House Wren and Palm Tanager. Of these the House Wren, *Troglodytes aedon* and Carib Grackle, *Quiscalus lugubris* appear to be most suited for field studies and collection.

**Key words** (not in title): laboratory rearing, host range, parasitoids, House Wren, Carib Grackle.

## INTRODUCTION

*Philornis* Meinert is a genus of fly which in its larval stages parasitizes nestling birds, particularly in the Neotropics (Dudaniec and Kleindorfer 2006). Ten species of the genus were recorded in Trinidad by Wilbur Downs and Thomas Aitken in the 1950s during the course of taking blood samples from nestling birds for the study of arboviruses. Eight of the *Philornis* species were new to science (Dodge and Aitken 1968). One of these, *Philornis downsi* Dodge and Aitken, has become of particular interest as it is an invasive species in the Galapagos Islands and it threatens populations of the islands' endemic bird species. The 17 bird species threatened by *P. downsi* include the Darwin Finches, the very rare Mangrove Finches, the Floreana Mockingbird and the Medium Tree Finch (Weiden *et al.* 2007). Field observations in the Galapagos Islands indicated that first and early second instar *Philornis downsi* larvae infested finch nostrils and other tissues while older second and third instars were haematophagous, feeding externally and dwelling in the nest material. The infestations resulted in high nestling mortalities, (76%) and in deformed beaks, anaemia and poor fitness potential in surviving nestlings (Fessl *et al.* 2006).

Control of *P. downsi* might be possible using sterile insect release techniques. However, management of the *Philornis* threat is likely to ultimately rely on their natural enemies, either native to the Galapagos Islands or introduced from other parts of their geographic range. Either approach requires a thorough understanding of the life cycle of *P. downsi* and a reliable means of rearing the species under laboratory conditions.

The current work in Trinidad, in conjunction with The Charles Darwin Foundation, is part of an international initiative to conserve the Galapagos finches. It aims to establish the conditions for laboratory rearing of *P. downsi.* This will facilitate field studies on *P. downsi* and their natural enemies within its natural range, and potentially, the rearing and quarantining of candidate parasitoids for introduction elsewhere. There have been previous records of parasitoids of *Philornis* in Trinidad (Couri *et al*. 2006).

This paper describes the first phase of these investigations; to find a reliable supply of wild-caught *Philornis downsi* to support laboratory studies and initiate cultures and find suitable hosts for life history studies. As *Philornis downsi* is comparatively rare, for these initial studies all species of *Philornis* were considered.

The host range of *Philornis* from Trinidad identified by Dodge and Aitken (1968) included 29 species but there was no indication of relative infestation levels. These comprise a wide taxonomic range of forest birds including several common garden birds. If suitable hosts with comparatively high infection levels are available within a residential or disturbed area, this would be preferred.

There is no suggestion from previous observations that *P. downsi* is limited in distribution within Trinidad. However to increase coverage, collections included the north, south and west Trinidad. The approach adopted involved collecting and examining easily accessible bird nests. The search was centered on (but not limited to) residential, agricultural and other easily accessed areas where the vegetation was such that it permitted the detection and collection of nests.

## METHODOLOGY

Collections were made between February 2012 and March 2013 from thirteen locations around Trinidad (Figure). Vegetation was searched for nests at each location. Any nests found were examined for evidence of *Philornis* parasitism, including intact pupae, larvae and old pupal cases. Active nests and nestlings were carefully examined on site for larvae. Vacant nests were collected and placed in plastic bags. Any adult flies observed resting around nests were also collected with a small net, placed in vials and transported to the laboratory. In the laboratory, nests were meticulously deconstructed and any *Philornis* puparia seen were collected and placed in screened vials to await emergence of the adult. Field collected adult flies, as well as those reared from puparia, were kept in netted cages (30 x 30 x 30 cm) in the laboratory and initially fed on a mixture of milk, egg powder and papaya. Various foods were offered and watermelon, banana, raisins and papaya appeared to be the preferred diet of the flies. The oviposition of the flies was recorded and attempts made to hatch the eggs by incubating them at various temperatures (24°C, 26°C, 28°C and 30°C) at relative humidity 80%.

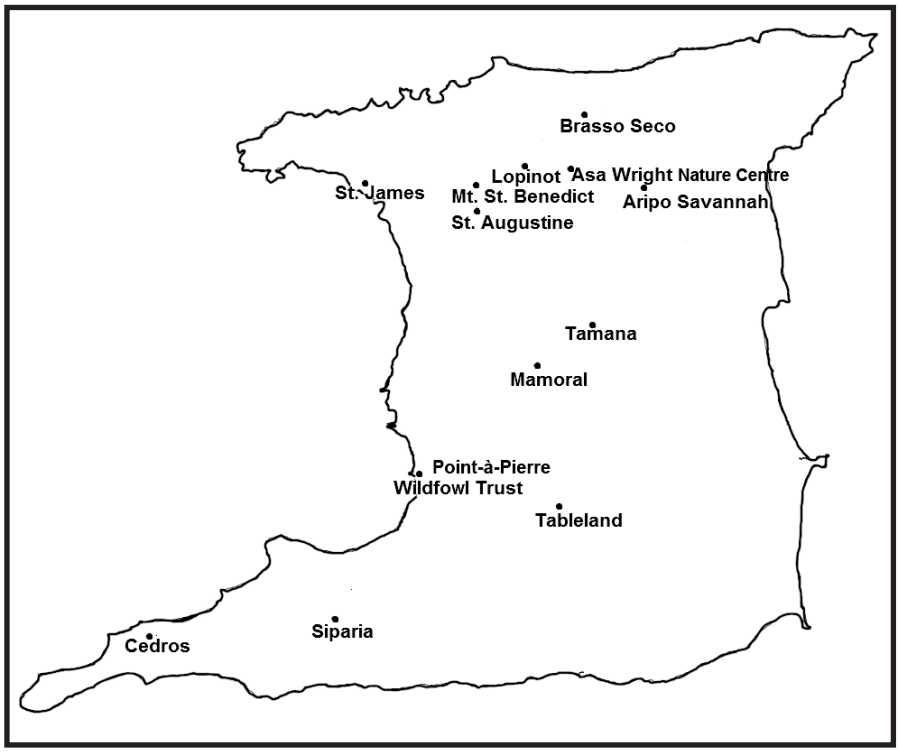


**Fig.** *Philornis* study sites in Trinidad (February 2012 - March 2013).

Twenty-five yellow McPhail traps were also set up at study sites in an attempt to capture adult flies. These are plastic containers containing an attractant and are used to trap a variety of muscids. They have a transparent lid and coloured bottom and are designed to be hung in trees (Steyskal 1977). A combination of attractants was used including papaya, guava and mango mixed with sugar, egg powder and milk.

A papaya and sugar mixture had been previously demonstrated to be the most successful attractant used to trap *P. downsi* (Lincango and Causton 2008). Traps were hung on branches of trees within easy reach for examination (approximately 1.5 m high) in areas where there would be minimal disturbance from people.

## RESULTS

Parasitism by *Philornis* was fairly common as indicated by the prevalence of empty pupal cases found in the nests examined. Overall, 223 nests were examined from 19 host species (see Table). Many of the nests containing *Philornis* that were collected were found in highly altered human environments such as in the eaves of buildings and shrubs near to houses. The presence of *Philornis* in nests was detected in both north and south Trinidad.

All the birds found to host *Philornis* in this study were included in the initial list of species parasitized in Trinidad as determined by Dodge and Aitken in 1968 except for the Carib Grackle.

The most productive sources of *Philornis* were House Wren, Great Kiskadee and Tropical Mockingbird. The House Wren and Great Kiskadee were productive due to high infestation levels. The Tropical Mockingbird showed lower infestation levels but more nests were found resulting in a relatively large total number of puparia. The nests of Bananaquits and Ruddy Ground Doves yielded fewer pupae per nest. Bananaquits are unusual as they build nests for sleeping in and it is likely that many of the nests examined were of this kind and therefore not attractive to *Philornis*. Ruddy Ground Dove nests are composed partly of faecal matter and are compact. This might make the lower layers of the nest impenetrable to *Philornis* larvae and pupae and less attractive as a host.

Overall, 999 *Philornis* puparia were collected, of which 931 (93%) were empty. However, from the 68 viable puparia collected, 44 eclosed. Twelve puparia failed to eclose and were considered dead.

Puparia were identified following taxonomic keys by Couri (1999), Dodge and Aitken (1968) and Skidmore (1985). Puparia which keyed out as *P. downsi* were found in the nests of: Great Kiskadee, Tropical Mockingbird, Yel-

**Table.** *Philornis* collected from nests by bird species (February 2012 - March 2013).

| Bird Species | Common Name | Number of Nests Examined | Total Puparia (Number Intact) | Eclosed |
|---|---|---|---|---|
| *Coragyps atratus* | Black Vulture | 1 | 0 | 0 |
| *Columbina talpacoti* | Ruddy Ground Dove | 22 | 3 | 0 |
| *Amazilia tobaci* | Copper-rumped Hummingbird | 3 | 0 | 0 |
| *Myrmotherula axillaris* | White-flanked Antwren | 1 | 0 | 0 |
| *Pitangus sulphuratus* | Great Kiskadee | 16 | 426 | 0 |
| *Tyrannus melancholicus* | Tropical Kingbird | 4 | 0 | 0 |
| *Troglodytes aedon* | House Wren | 7 | 289 (12) | 0 |
| *Mimus gilvus* | Tropical Mockingbird | 35 | 103 (16) | 10 |
| *Turdus nudigenis* | Spectacled Thrush | 2 | 0 | 0 |
| *Turdus fumigatus* | Cocoa Thrush | 1 | 0 | 0 |
| *Ramphocelus carbo* | Silver-beaked Tanager | 3 | 0 | 0 |
| *Thraupis palmarum* | Palm Tanager | 35 | 37 (36) | 30 |
| *Coereba flaveola* | Bananaquit | 50 | 22 (4) | 4 |
| *Psarocolius decumanus* | Crested Oropendola | 7 | 0 | 0 |
| *Cacicus cela* | Yellow-rumped Cacique | 3 | 0 | 0 |
| *Icterus nigrogularis* | Yellow Oriole | 17 | 99 | 0 |
| *Molothrus bonariensis* | Shiny Cowbird | 1 | 0 | 0 |
| *Quiscalus lugubris* | Carib Grackle | 14 | 20 | 0 |
| *Euphonia violacea* | Violaceous Euphonia | 1 | 0 | 0 |
| **Total** | | **223** | **999 (68)** | **44** |

low Oriole, House Wren, Palm Tanager and Carib Grackle.

Three of the House Wren nests were recovered from nest boxes, all of which contained numerous *Philornis* pupal cases. While five were identified as *P. downsi*, the majority of these were found to be *P. trinitensis*. Fewer puparia were found in Carib Grackle nests; however the majority of these were found to be *P. downsi*.

The collection of living specimens was limited as few nests were found with intact pupae. Several species of *Philornis* were identified from material collected in the field and reared in the laboratory. Two of these species, recovered from a Bananaquit nest, were tentatively identified as *P.*sp.nr. *blanchardi* and *P.*sp.nr. *pici*, which have not been previously recorded from Trinidad. Taxonomic work on these as well as the other adult flies is ongoing.

There was evidence of the emergence of parasitoids from many of the pupae. One puparium of *P. trinitensis* yielded 17 parasitoids. The species is yet to be identified. Two specimens of *Philornis downsi* puparia were observed with dead wasps inside from a Yellow Oriole nest in Tableland, Trinidad, September 2012.

No adult *Philornis* were captured in the McPhail traps although a variety of other muscids were collected. Two adult *Philornis trinitensis* were captured on an overcast day resting near to regularly used Palm Tanager nests. The nests were situated under the eaves of a house and were found to contain *P. downsi* puparia.

Adult flies were successfully kept alive for several weeks and laid eggs in the cages provided. However these eggs failed to hatch. Longevity of the four *P. downsi* females ranged from 19 to 28 weeks while the two males survived for 6 and 12 weeks respectively. The twelve *P. trinitensis* females survived between 8 and 25 weeks and the 8 males; between 6 and 14 weeks.

The *P. downsi* females laid an average of 18.5 eggs each and the *P. trinitensis*, an average of 32.3 eggs each over time.

## DISCUSSION

*Philornis* species, and more specifically *P. downsi*, and parasitoids can be collected and studied within residential, agricultural and other disturbed habitats. Common bird species including Palm Tanager, Great Kiskadee, Tropical Mockingbird, Carib Grackle and House Wren serve as suitable hosts for further study.

The present study was suitable for selecting host species for collection but was too all-encompassing for quantitative assessment of seasonality or life history parameters for *P. downsi*. In addition, as nests were examined well after fledging, the periods of occupation and those of *Philornis* infestation were not known.

House Wrens would appear to be a particularly suitable host for further study. House Wrens are common in residential areas. They can be facilitated by the installation of nest boxes which can be constructed and positioned for efficient observation and access. Amongst the candidate species, House Wrens are best habituated to human presence and will better tolerate nest inspections. House Wrens also regularly reuse nesting sites so a series of nests can be observed in a single nest box. It is further possible that the high numbers collected were due to the nest box providing a suitable microhabitat for *Philornis* to pupate. In light of this, the construction and use of bird nest boxes for the further study of *Philornis* is suggested.

Carib Grackles might also be suitable hosts for study. Carib Grackles nest collectively at persistent sites making observations efficient. They are comparatively tolerant of human presence and indeed often 'buzz' persons nearing their nest sites.

For efficiency, collection of *Philornis* for laboratory rearing should be done together with field studies on *P. downsi* as the nest monitoring inherent in field studies can potentially yield more *Philornis* adults than collection of old nests. Focused field studies can also be supplemented by opportunistic examinations of other host species.

The microhabitat created for reproduction and rearing may need to be modelled on the conditions the *Philornis* may experience in the field. For example, these may include conditions met in the nest such as $CO_2$ levels or requisites of diet of the adult flies. This can be further investigated as a more reliable supply of field-collected flies is available.

## ACKNOWLEDGEMENTS

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# Diversity and Species Composition of the Spider Fauna of the Aripo Savannas, Trinidad, W.I.

**Jo-Anne Nina Sewlal**
Dep't. of Life Sciences, University of the West Indies, St. Augustine, Trinidad, West Indies.
*joannesewlal@gmail.com*

**ABSTRACT**
Little attention has been placed on the biodiversity of natural savannas, which are declining worldwide. On the island of Trinidad, West Indies, many studies have been conducted on the flora in the Aripo Savannas Scientific Reserve, but none on the arachnid fauna it contains. This study aims to document and compare the biodiversity of the spiders found in the three main habitat types in the reserve: savanna, palm marsh and marsh forest. Three localities of each habitat were sampled for 15 hours each, utilising sweep-netting and visual search methods to collect spiders from a wide spectrum of microhabitats. The spider fauna was separated into three functional groups: plant wanderers, ground wanderers and web-builders. A total of 585 individuals belonging to 69 species distributed among 21 families were found on the reserve. Data were analysed using Analysis of Variance (ANOVA), species abundance models and multi-dimensional scaling plots. Habitat type was found to have no significant influence on species richness, diversity, evenness or dominance. All habitat types were dominated by web-builders; a smaller proportion of plant and ground wanderers were found as could be expected since most species in these groups are cryptic. However, the savanna possessed the most distinct spider species assemblage.

**Key words:** Araneae, marsh forest, palm marsh, savanna, biodiversity, species composition.

## INTRODUCTION

Many studies state that tropical habitats possess high species richness and abundance, for example Robinson *et al.* (1974) and Wilson (1998) emphasize that rainforests have greater richness and abundance than other tropical habitats such as grasslands or savannas. Grassland habitats are not considered high in biodiversity and have largely been lost in parts of the world such as North America where approximately only 4% of this habitat remains (Richardson and Hanks 2009). The amount of natural savanna in Trinidad has decreased over the decades with the Piarco and O'Meara Savannas converted into an international airport and industrial estate respectively (Richardson 1963). The remaining savannas include the Aripo Savannas Scientific Reserve which experiences numerous threats from human activities including mining, logging, squatting (Lum Young 2006) and fires (Comeau 1990).

There is a consensus that information is lacking on the biodiversity of arthropods globally (Floren and Deeleman-Reinhold 2005). The Aripo Savannas are the best documented of all the savannas in Trinidad in terms of vegetation (Beard 1946; Richardson 1963), with many endemic species (Richardson 1963). However, very little has been focused on the fauna found in these savannas. Natural reserves provide the opportunity to study the biodiversity of habitats in their primary state. Knowledge of species distribution is also vital if they are to be conserved (Cardoso 2009). Since invertebrates are a major component of terrestrial ecosystems, they should be an important concern in terms of continued conservation efforts (Haddad *et al.* 2009).

This study focuses on spiders, which make excellent subjects for studying biodiversity since they are abundant, diverse, easily collected and functionally significant in ecosystems as prey while acting as predators themselves (Cardoso *et al.* 2008; Oxborough *et al.* 2005; Sharma *et al.* 2010; Stratton *et al.* 1979; Wise 1993). Their interaction with the biotic and abiotic components of their environment reflects changes in the ecology of the habitat they occupy (Haddad *et al.* 2009; Uetz 1991; Hsieh *et al.* 2003; Hsieh and Linsenmair 2011). Spiders also depend on vegetation structure for protection from predators and the elements, maintenance of the microclimate and as structures for web attachment (Wise 1993).

This study aims to fill an important information gap by documenting the biodiversity and community structure of spiders in one of the most unique protected areas in this country and by examining species diversity and composition of the spider fauna of the major habitats found in the Aripo Savannas.

## METHODOLOGY

### Study site

The Aripo Savannas Scientific Reserve is located within the Long Stretch Forest Reserve in the east-central section of the Northern Plain (Richardson 1963) (10°35'30" N, 61°12'0" W) and is comprised of approximately 1800 hectares. The area experiences an average maximum monthly temperature of 32°C in May and an average minimum of around 20°C in May, with the diurnal variation

in temperature around 10ºC and an annual rainfall of 250-280 cm (Richardson 1963). In this study I sampled three habitat types found in the Aripo Savannas (according to Beard 1946): savanna, palm marsh and marsh forest (Fig. 1). Sampling was carried out in Cumuto, Wallerfield and Valencia. Sites of savanna, marsh forest and palm marsh acting as representatives of these habitat types were sampled in each of these localities and selected based on accessibility and safety issues.

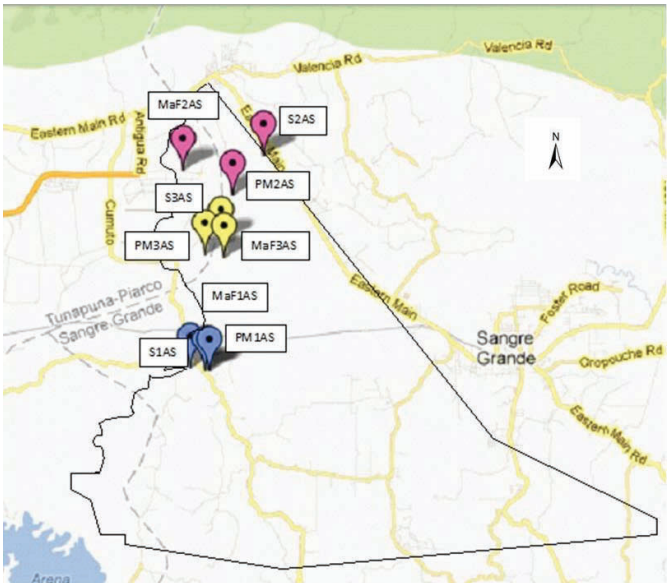


**Fig. 1.** Map showing sites sampled in the Aripo Savannas for the period March 2006 to May 2009. Site abbreviations as in Table 2.

## Field collection and lab analysis

Each habitat was sampled at three localities (Table 1) and sampling effort was standardised across all sites (Sewlal 2013). Data were collected using two methods; sweep-netting and visual search, which ensured thorough and rapid collection of a majority of species. Sweep-netting involved the use of a canvas insect net to sweep the understorey vegetation. After approximately 15 to 20 sweeps, the contents of the net were checked and large pieces of vegetation like leaves and twigs were shaken before removal to dislodge any spiders. Specimens were transferred to a vial of 70% alcohol within the net. Visual search involved the collector walking around and collecting the spiders seen by hand. This method included specimens found on the surface of stems, logs, plants and leaf litter, but excluded under stones and logs as it was primarily designed to look at orb-weavers (Sewlal 2013). Five sampling sessions at each locality, each consisting of a 2 h visual search and 1h of sweep-netting, were undertaken, as preliminary surveys indicated that this was sufficient in order to collect a majority of the species at each site (Sewlal 2013). A stopwatch was used to time each sampling session and it was paused during data recording. Sampling at each site was completed within a period of two weeks to reduce the possibility of species richness inflation due to transient species. Preliminary sampling carried out during both wet and dry seasons did not yield differences in species biodiversity (Sewlal 2013), therefore data from different seasons were combined. Night-time sampling was not carried out due to safety concerns. This was addressed by using sweep-netting which will dislodge nocturnal species resting in the vegetation.

**Table 1.** GPS co-ordinates of the sites of marsh forest, palm marsh and savanna habitats sampled in the Aripo Savannas Scientific Reserve for the period March 2006 to May 2009.

| Habitat Type | Site 1 | Site 2 | Site 3 |
|---|---|---|---|
| Marsh Forest | 10.583608, -61.203461 | 10.630241, -61.209812 | 10.609931, -61.200006 |
| Palm Marsh | 10.584262, -61.207967 | 10.624589, -61.197925 | 10.610627, -61.204362 |
| Savanna | 10.583587, -61.203418 | 10.633615, -61.190758 | 10.613791, -61.2008 |

## Data analysis

### Biodiversity

The completeness of sampling at each site was determined through the use of species accumulation curves of the observed species richness *(S)* (Fig. 2). The Shannon (*H'*), Simpson *(D)* and Berger-Parker (*d*) indices which determine species diversity, species evenness and dominance respectively, were also calculated. It should be noted that based on the recommendation of Downie *et al.* (1995) and Magurran (2004) in this study the Simpson index was calculated using $D = 1/y$, where $y = \Sigma(n_i (n_i -1) / N(N-1))$ in its reciprocal form, in order to produce a measure directly related to diversity. All the data were first checked for normality using the Anderson Darling Normality Test in Minitab 14 and transformed if not normally distributed, after which a series of one-factor ANOVA tests were carried out for S, *H'*, *D* and *d* to determine if these biodiversity parameters were significantly different among the habitats sampled.

### Species composition

Rank abundance curves were plotted to better illustrate the relationship between species richness and evenness (Magurran 2004). Each graph was fitted to four well-known species abundance models: log series, truncated log normal, geometric series and broken stick using calculations given in Magurran (1988, 2004) to determine the

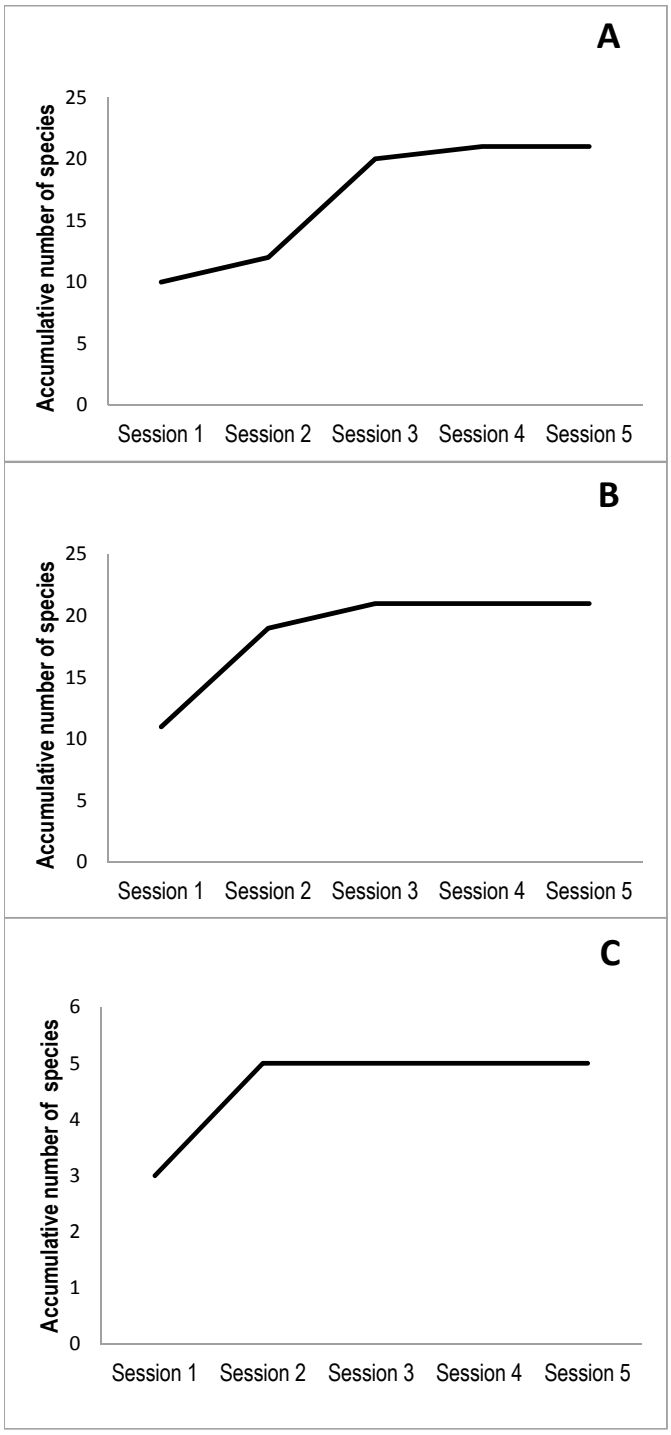


**Fig. 2.** Representative species accumulation curves for **(A)** marsh forest (site MaF1), **(B)** palm marsh (site PM2) and **(C)** savanna (site S3).

ecological conditions of the spider community found in these habitats. The curve was determined to fit the model if the test statistic was lower than the critical value. The test statistic and critical value for the log series, geometric series and truncated log normal curves were denoted by D and $D_{0.05}$ respectively, while for the broken stick model it was denoted by $\chi^2$ and $\chi^2_{0.05}$. Community structure was determined by conducting cluster analysis (Barlow *et al.* 2007; Gardner *et al.* 2007) using Primer 5 software (Clarke and Warwick 2001). The data were first transformed using presence/absence and Bray-Curtis similarity to produce a similarity matrix which was then used to generate a cluster dendrogram. The default options were selected for this calculation including the group average linkage cluster mode.

**Functional groups**

According to Whitmore *et al.* (2002), functional groups contain species that "potentially compete for jointly limited resources". Separating spiders into functional groups provides valuable insight into their composition as each group has its own microhabitat, vegetation preferences and responds differently to changes in habitat (Haddad *et al.* 2009; Hsieh *et al.* 2003). In this study the spider families were arranged into three functional groups: ground wanderers, plant wanderers and web-builders, based on their predatory methods and habitat preferences (Whitmore *et al.* 2002).

**RESULTS**

Sampling yielded a total of 585 individuals belonging to 69 species and 21 families (Table 2) which were divided among savanna (254 individuals; 22 species), marsh forest (204 individuals; 43 species) and palm marsh (127 individuals; 37 species) (Table 3). However, there was no significant difference between the abundance of individuals found in each habitat type according to a one-way ANOVA ($F_{2,215} = 0.35$; $P = 0.704$). One-way ANOVA tests also showed that habitat did not influence species richness ($F_{2,8}=1.16$; $P=0.38$), species diversity ($F_{2,8}=3.08$; $P=0.12$), species evenness ($F_{2,8}=3.11$; $P=0.12$) or dominance ($F_{2,8}=4.1$; $P=0.076$).

The rank abundance curves (Fig. 3) for the savanna ($D=0.087$; $D_{0.05}=14.067$) and palm marsh ($D=0.047$; $D_{0.05}=14.067$) habitats were found to fit the log series model indicating that species arrived at the habitat in random intervals (Magurran 2004). However, marsh forest ($\chi^2_4=5.96$; $\chi^2_{0.05}=14.067$) fitted the broken stick model as they generated a test statistic lower than the critical value. The latter model indicates that the species are uniformly distributed among the habitat, most likely due to a relatively even sharing of an important ecological factor between species (Murphy 2004), or that the species present possess equal competitive ability for niche space (Magurran 2004).

**Species composition**

Some families dominated specific habitat types, for instance, Miturgidae, Deinopidae, Theridiosomatidae and Prodomidae were only found in marsh forest, Sparassidae only in palm marsh and Anapidae, Nephilidae and Gna-

phosidae were only found in savanna (Fig. 4). Overall, a limited number of families were found in the savanna habitat.

A cluster dendrogram (Fig. 5) of the data shows that the marsh forest and palm marsh habitats at each site were most similar to each other, with the savanna habitat forming a distinct group. It must be noted that the borders of these habitats were not sampled, thus eliminating the influence of edge effects on the results.

**Functional groups**

Web-builders dominated all habitat types in terms of abundance and species richness (Fig. 6a and b). In terms of species richness, the number of web-builders and ground wanderers increases slightly from savanna to palm marsh and then to marsh forest, while the number of plant wanderers decreases. In terms of abundance, palm marsh contained the most plant wanderers followed by marsh forest then savanna. ANOVA tests showed that species richness and abundance were not significantly different among the different habitats for each functional group: web-builders (S: $F_{2,8}$=1.76; P=0.25), (N: $F_{2,8}$=0.73; P=0.52); ground wanderers (S: $F_{2,8}$=0.78; P=0.501), (N: $F_{2,8}$=0.73; P=0.52); or plant wanderers (S: $F_{2,8}$=0.19; P=0.84), (N: $F_{2,8}$=0.08; P=0.92).

**DISCUSSION**

This study shows that the Aripo Savannas contain substantial biodiversity in terms of spiders, containing 21 families out of the 52 (40%) confirmed to be present in Trinidad and Tobago (Sewlal 2012). However, one-way ANOVA tests confirm that there was no significant difference in the biodiversity components among the different habitat types. This lack of difference could be due to the relatively close proximity of these habitats to each other (Fig. 1) thus facilitating easy movement of species between them, especially with respect to the marsh forest and palm marsh habitats. Sensitivity to sample size was disadvantageous to the Shannon index (Magurran 2004) because it works on the assumption that all species are represented in the sample because individuals are randomly sampled from an infinitely large community. Therefore its sensitivity to relative species abundance and richness makes the interpretation of the results tricky when it comes to comparing sites (Magurran 2004).

The savanna habitat was shown to possess a unique species assemblage (Fig. 5). This study also showed that some families were found only in one habitat type (Fig. 4) however, further sampling of different habitats not included in this study may show them to be present in multiple habitats.

There were also no significant differences in species richness and abundance among the habitats even when the data were organized into functional groups. Web-builders were found to dominate all habitat types in terms of species richness and abundance (Fig. 6a and b). The lack of ground wanderers could be due to the sampling methods used which did not include pitfall trapping which specifically targets members of this group. However, the placement of pitfall traps was not feasible in the sites of palm marsh sampled as the ground was very marshy and waterlogged and flooded in some instances which would cause the traps to fill with water rendering them useless. However, the low abundance and species richness of plant wanderers (Fig. 6a and b) could not be attributed to the collecting methods used, since sweep-netting would have collected members of this guild by dislodging them from the vegetation. Web-builder dominance of savanna habitat has also been observed in tropical savannas in other parts of the world like the Nylsvley Nature Reserve in South Africa (Dippenaar-Schoeman *et al.* 1989).

All functional groups in the Aripo Savannas follow the trend of an increase in species richness along with an increase in structural complexity (Fig. 6b). Many studies state habitat complexity as a major influencing factor of spider abundance and species richness (Hatley and MacMahon 1980; Halaj *et al.* 1998; Stratton *et al.* 1979), exhibiting a greater influence than prey abundance (Wise 1993). It is expected to be a major factor for web site selection for web-building spiders as habitat complexity provides more sites for web attachment (Riechert and Gillespie 1986; Uetz 1991). Habitat complexity also provides the spider with protection from strong winds or flying debris that could potentially damage the web (Enders 1974, 1976, 1977; Hodge 1988) and from thermal extremes allowing it to stay on its web for extended periods of time (Riechert and Gillespie 1986). Increased vegetation complexity means an increase in microhabitats (Greenstone 1984; Robinson 1981; Uetz 1991). Cardoso *et al.* (2007) showed that greater canopy cover resulted in a relatively constant microclimate as it acts as a buffer for the organisms in the understorey from rain, light intensity, wind and temperatures (Geiger *et al.* 2009), (Perfecto and Vandermeer 1996; Perfecto *et al.* 1996). This is supported by the community structure of marsh forest, the most structurally complex habitat, which was shown to contain species that evenly share an ecological factor or are equally capable of competing for niche space (Magurran 2004) (Fig. 3). Savanna and palm marsh had less structural diversity so that species were not evenly distributed but rather populated the area in random intervals. This absence of microhabitats and lack of protection from the elements and predators could also explain the greatly reduced presence of ground wanderers in the savanna habitat compared to the two other habitats.

**Table 2.** The spider fauna recorded from sites in savanna, palm marsh and marsh forest habitats in the Aripo Savannas Scientific Reserve sampled for the period March 2006 to May 2009.

| Species | S1 | S2 | S3 | PM1 | PM2 | PM3 | MaF1 | MaF2 | MaF3 |
|---|---|---|---|---|---|---|---|---|---|
| **Anapidae** Sp. A | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Araneidae** *Acacesia hamata* | 5 | 21 | 7 | 19 | 0 | 0 | 0 | 0 | 0 |
| *Alpaida trispinosa* | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Argiope argentata* | 3 | 1 | 6 | 3 | 0 | 3 | 0 | 0 | 3 |
| *Cyclosa caroli* | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 |
| *Cyclosa filililineata* | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| *Eriophora atrax* | 0 | 0 | 0 | 2 | 1 | 1 | 1 | 1 | 1 |
| *Eustala anastera* | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 0 | 0 |
| *Eustala* sp. A | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Gea heptagon* | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Hypognatha scutata* | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Kaira cobimcha* | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Larinia* cf. *directa* | 21 | 73 | 36 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Mangora melanocephala* | 0 | 0 | 0 | 3 | 4 | 0 | 20 | 2 | 0 |
| *Metazygia laticeps* | 0 | 0 | 0 | 3 | 0 | 0 | 4 | 3 | 0 |
| *Micrathena acuta* | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 |
| *Micrathena evansi* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 |
| *Micrathena schrebersi* | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| *Micrathena triangularis* | 0 | 0 | 0 | 1 | 0 | 0 | 12 | 0 | 2 |
| *Micrathena triangularispinosa* | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 |
| *Neoscona arenata* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Ocrepeira maraca* | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| *Verrucosa* sp. A | 0 | 0 | 0 | 1 | 0 | 0 | 5 | 0 | 0 |
| *Verrucosa* sp. B | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| *Wagneriana jelskii* | 0 | 0 | 0 | 0 | 2 | 0 | 5 | 0 | 1 |
| **Corinnidae** Sp. A | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 3 | 0 |
| **Deinopidae** Sp. A | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 |
| **Gnaphosidae** Sp. A | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Linyphiidae** Sp. A | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 0 |
| **Lycosidae** Sp. A | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 0 |

| Species | S1 | S2 | S3 | PM1 | PM2 | PM3 | MaF1 | MaF2 | MaF3 |
|---|---|---|---|---|---|---|---|---|---|
| **Mimetidae** Sp. A | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sp. B | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 |
| *Ero* sp. | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| **Miturgidae** Sp. A | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| **Nephilidae** *Nephila clavipes* | 2 | 0 | 0 | 4 | 2 | 4 | 6 | 4 | 3 |
| **Nesticidae** Sp. A | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Oxyopidae** *Oxyopes salticus* | 2 | 0 | 0 | 15 | 0 | 0 | 0 | 19 | 0 |
| Sp. A | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 2 | 0 |
| **Pisauridae** Sp. A | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 4 | 0 |
| **Prodomidae** Sp. A | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| **Salticidae** Sp. A | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sp. B | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| Sp. C | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sp. D | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Maota* sp. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| *Freya* sp. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| *Scopocira* sp. | 0 | 0 | 1 | 1 | 0 | 0 | 2 | 0 | 0 |
| *Synesmosyna* sp. | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Hypaeus* cf. *flavipes* | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Freya* cf. *decorate* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 |
| *Chinoscopus maculipes* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Euophryinae* | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| **Sparassidae** Sp. A | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| **Theridiidae** Sp. A | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 |
| Sp. B | 0 | 0 | 0 | 1 | 0 | 0 | 5 | 0 | 0 |
| Sp. C | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| Sp. D | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sp. E | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 3 | 0 |
| **Theridiosomatidae** Sp. A | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 |

| Species | S1 | S2 | S3 | PM1 | PM2 | PM3 | MaF1 | MaF2 | MaF3 |
|---|---|---|---|---|---|---|---|---|---|
| Sp. B | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| **Tetragnathidae** *Azilia vachoni* | 0 | 0 | 0 | 4 | 0 | 0 | 4 | 1 | 0 |
| *Leucauge argyra* | 7 | 0 | 0 | 5 | 6 | 2 | 0 | 9 | 1 |
| *Leucauge regnyi* | 0 | 12 | 0 | 0 | 0 | 0 | 12 | 0 | 0 |
| *Tetragnatha nitens* | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| *Tetragnatha pallenscens* | 17 | 6 | 1 | 3 | 0 | 0 | 6 | 1 | 3 |
| *Tetragnatha* (unidentified sp. A) | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| **Thomisidae** Sp. A | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Sp. B | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Stephanopis* sp. | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| **Uloboridae** Sp. A | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 1 | 0 |
| Sp. B | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 |
| **TOTAL** | **88** | **115** | **51** | **75** | **38** | **14** | **107** | **76** | **21** |

| **Key to site abbreviations** | | | | | |
|---|---|---|---|---|---|
| S1 | Savanna site 1 | PM1 | Palm Marsh site 1 | MaF1 | Marsh Forest site 1 |
| S2 | Savanna site 2 | PM2 | Palm Marsh site 2 | MaF2 | Marsh Forest site 2 |
| S3 | Savanna site 3 | PM3 | Palm Marsh site 3 | MaF3 | Marsh Forest site 3 |

**Table 3.** Total abundance *(N)*, observed species richness *(S)*, Shannon index *(H')* (species diversity), Simpson index *(D)* (species evenness), Berger-Parker index *(d)* (dominance) across the samples for each site sampled for the period March 2006 to May 2009. Site abbreviations as in Table 2.

| Site | *N* | *S* | *H'* | *1/D* | *d* |
|---|---|---|---|---|---|
| S1AS | 88 | 18 | 2.39 | 8.43 | 0.24 |
| S2AS | 115 | 7 | 1.11 | 2.24 | 0.64 |
| S3AS | 51 | 5 | 0.92 | 1.91 | 0.71 |
| PM1AS | 75 | 21 | 2.52 | 8.83 | 0.25 |
| PM2AS | 38 | 21 | 2.84 | 21.3 | 0.16 |
| PM3AS | 14 | 7 | 1.8 | 8.27 | 0.29 |
| MaFAS | 107 | 21 | 2.7 | 12.88 | 0.19 |
| MaFAS | 76 | 25 | 2.76 | 11.35 | 0.25 |
| MaFAS | 21 | 11 | 2.24 | 13.12 | 0.19 |

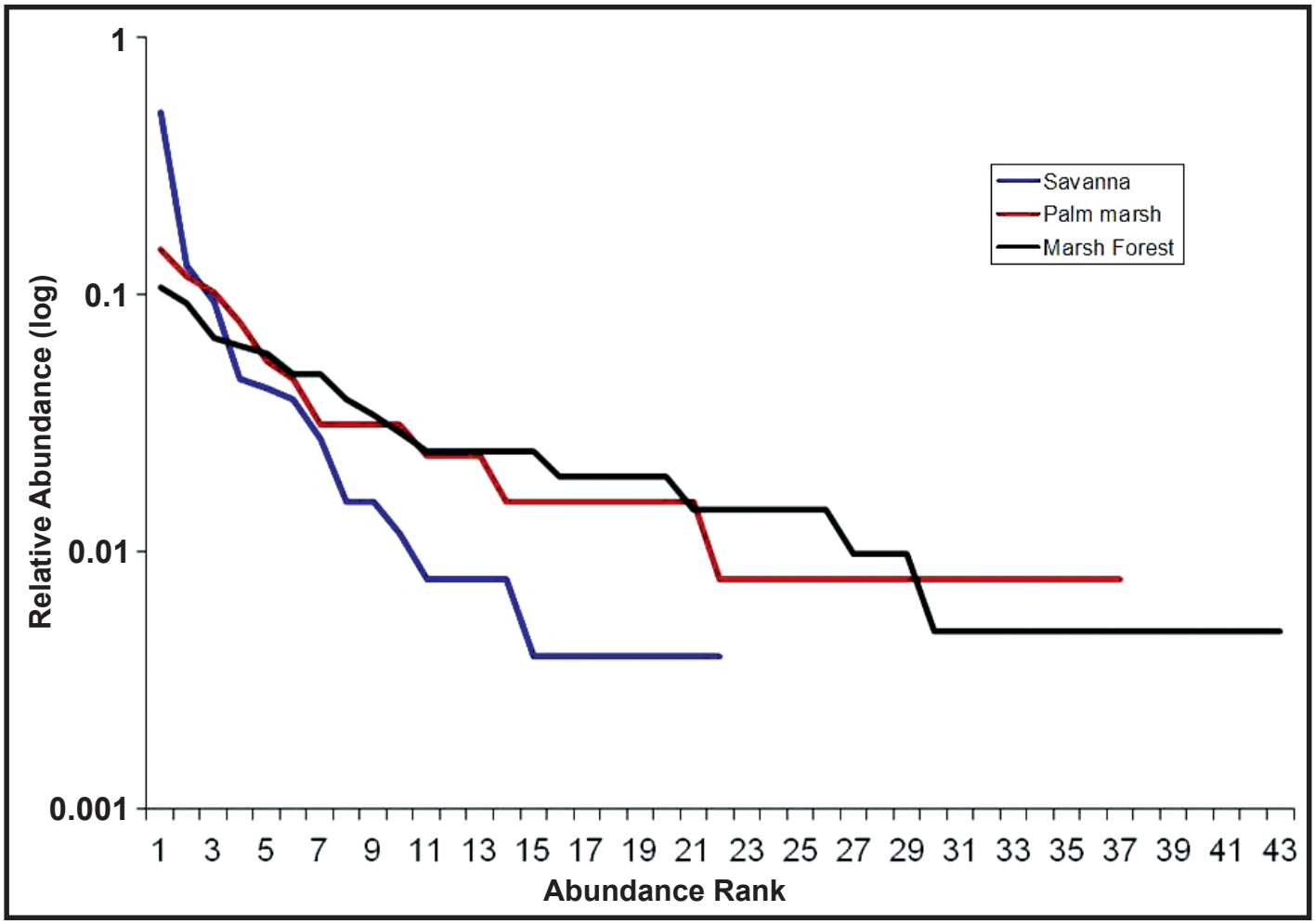


**Fig. 3.** Rank abundance curves of the spider families in savanna, marsh forest and palm marsh habitats sampled in the Aripo Savannas for the period March 2006 to May 2009.

Future studies in this area could include sub-dividing the largest functional group of web-builders into different types to see the effects of vegetation and habitat type.

The habitats found in the reserve display a range of structural complexity and in turn possess a range of microhabitats. Unfortunately these habitats face numerous threats due to human activities, in most instances illegal in nature, and is cause for better enforcement of laws that are in place to protect biodiversity and the maintenance of conservation efforts which will not only protect spiders, but the other species in the food webs in these habitats.

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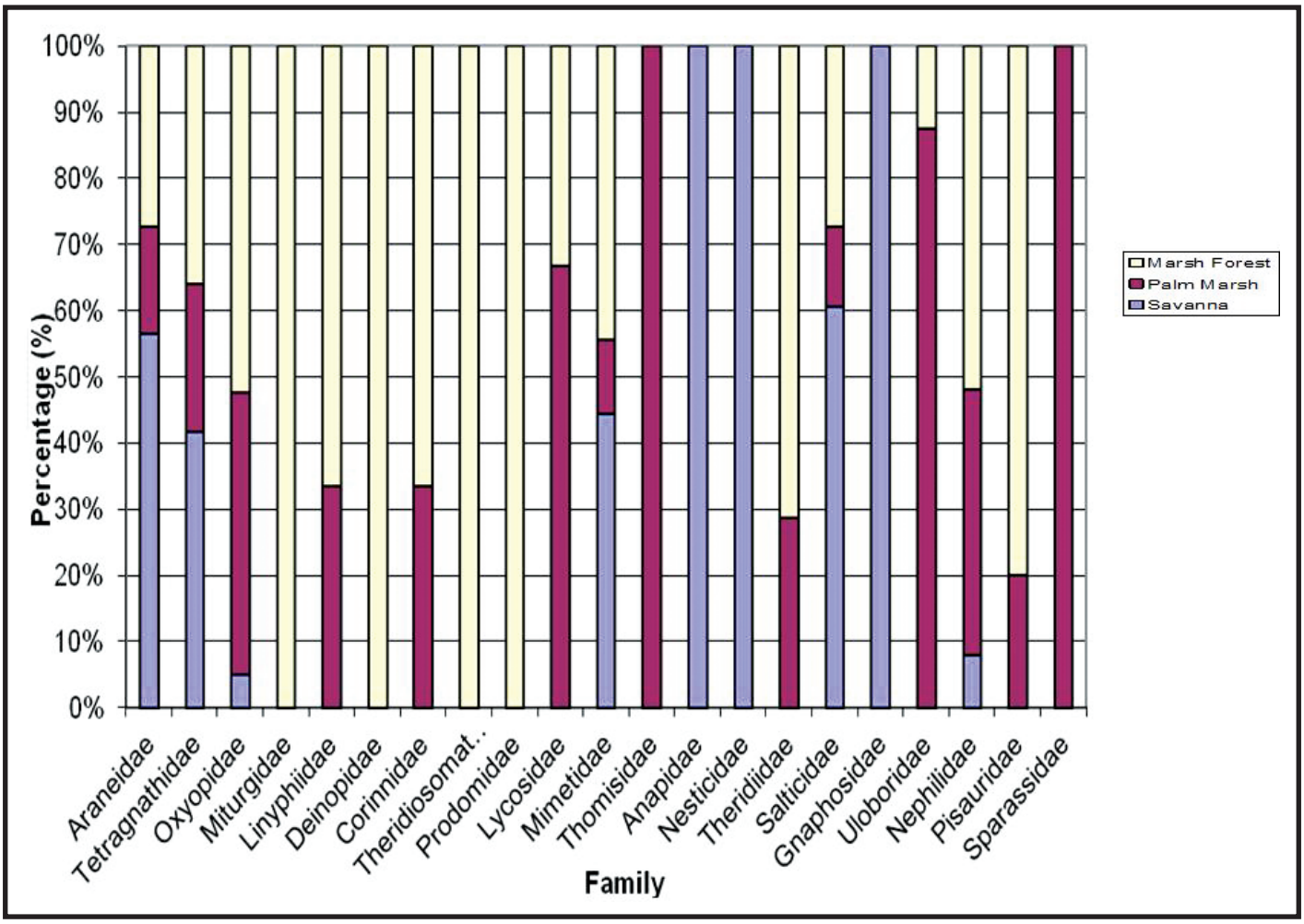


**Fig. 4.** 100% stacked column chart comparing the family composition in each habitat type, savanna, marsh forest and palm marsh habitats, sampled according to site for the period March 2006 to May 2009.

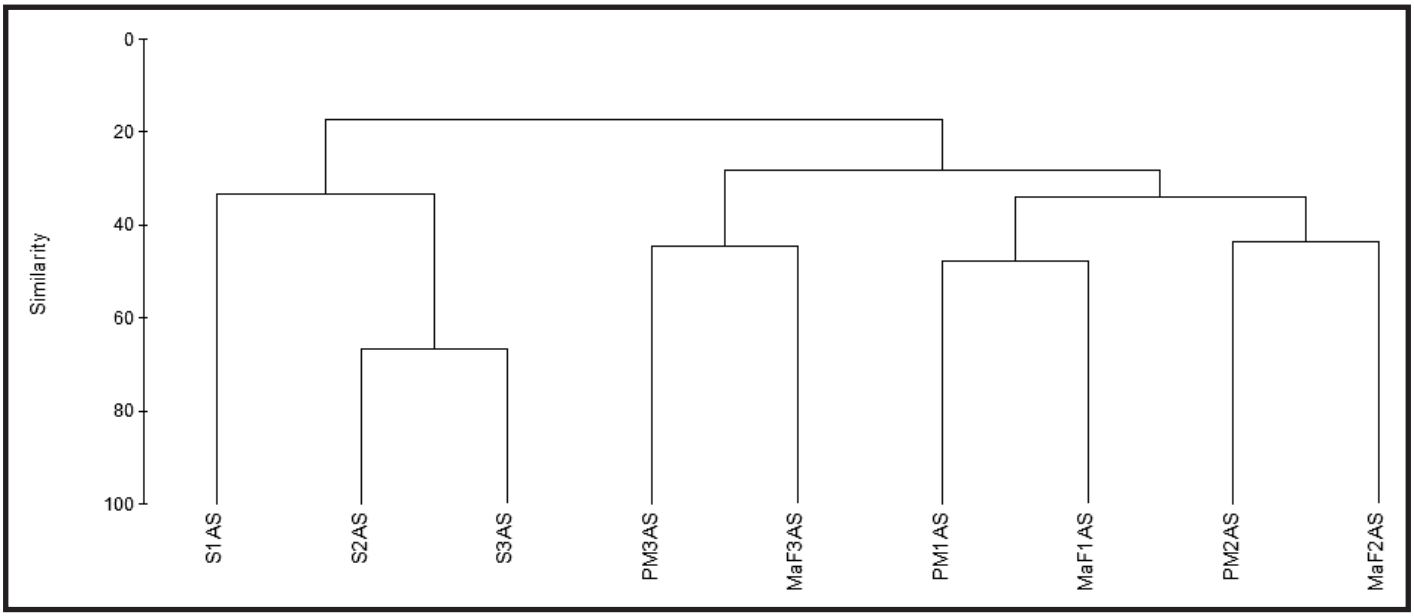


**Fig. 5.** Dendrogram of cluster analysis done on the savanna, marsh forest and palm marsh habitats sampled according to site for the period March 2006 to May 2009.

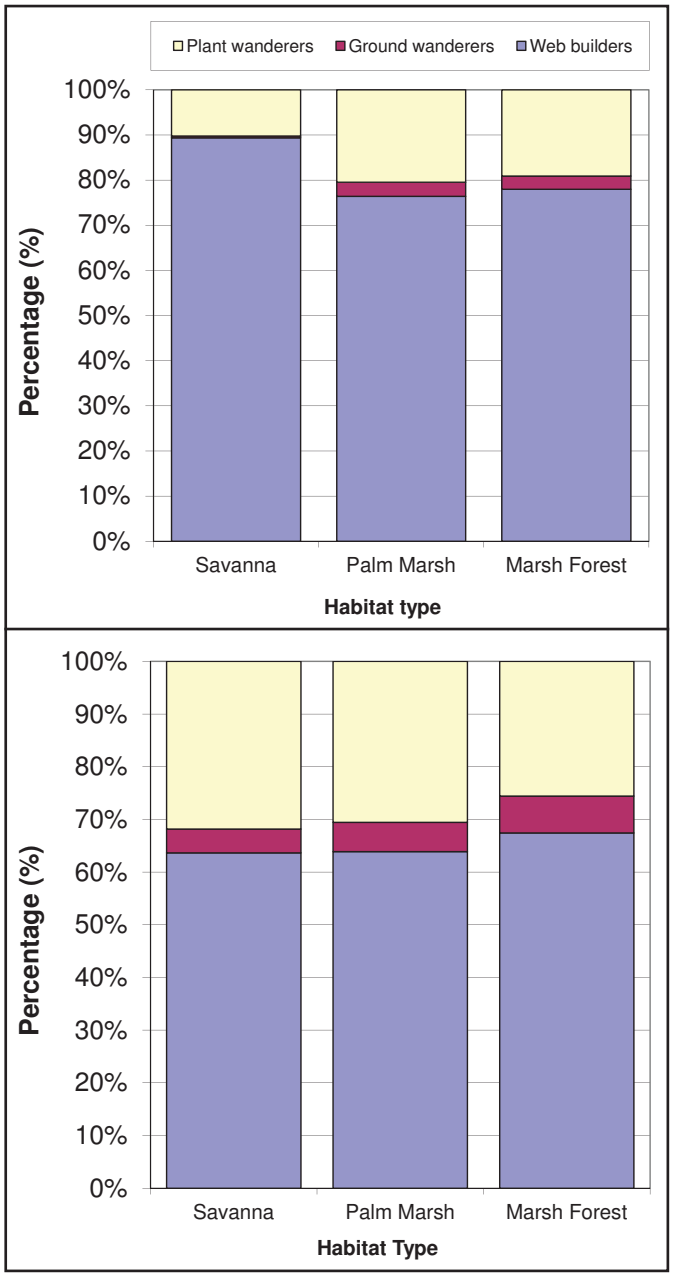


**Fig. 6.** 100% stacked column chart comparing the abundance (a) and species richness (b) of the functional groups in each habitat type, savanna, marsh forest and palm marsh habitats, sampled according to site for the period March 2006 to May 2009.

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# NATURE NOTES

## Small Mammals from Chaguaramas, Trinidad and Tobago

The Trinidad Regional Virus Laboratory (TRVL) established in 1952 had as its main objective the study of arboviruses (viruses transmitted by insects, ticks and mites) from various parts of Trinidad. The Chaguaramas area however, at that time was a United States Naval Station and not available for studies. Eventually, the Trinidad and Tobago Government gained control of that area and placed it under the jurisdiction of the Chaguaramas Development Authority. Since the area was earmarked for development and with possible increases of human activity, it was thought necessary to monitor that area for arbovirus activity. Initially, work was started in December 1969, but because of the military uprising in April 1970, studies came to an abrupt end.

Activities were restarted in June 1974 which consisted of trapping small mammals, capturing of birds, and the trapping of blood-sucking arthropods. Arboviruses have mammals and birds as hosts and are transmitted by blood-sucking arthropods. The data obtained from the studies at Chaguaramas were never published and there has been no other mammal study since the TRVL work. I therefore thought it useful to place the mammal data on record as baseline information for other workers who might want to work in the area.

Two areas were selected for study: Tucker Valley (TV), representing a lowland agricultural area at the edge of a grapefruit grove, while the second area was a hilly, forested area adjacent and west of Tucker Valley and known as Cano Venturo Rd. (CVR). The CVR area rises from sea level to 539 m in about 3.62 km. The collecting station was approximately 1.5 km along the CVR.

Seven small and medium sized Hav-a-hart traps baited with peanut butter and oats were used in each area. Trapping was done for four nights of the week alternately at TV and CVR from June to December, 1974.

A total of 80 small mammals representing 11 species (Table) was captured in 1584 trap nights. No virus was isolated from the Chaguaramas mammals. Overall, five mammals were caught per 100 trap/nights. However, at CVR 3.7 mammals were caught per 100 trap/night when compared to 6.9 per 100 trap/night at TV. The Spiny Pocket Mouse, *Heteromys anomalus* was the most commonly caught species. *Mus musculus* was captured at TV, but not at CVR, while the reverse was true for the opossum *Didelphis marsupialis.*

Most small mammal studies in Trinidad have been based on single night captures or at most over a few nights.

**Table.** Small mammals captured at Chaguaramas, Trinidad, June-December, 1974.

| **Species *** | **CVR** | **TV** | **Totals** |
|---|---|---|---|
| *Caluromys philander,* Bare-tailed Woolly Opossum | 1 | 2 | 3 |
| *Didelphis marsupialis,* Common Opossum | 2 | 0 | 2 |
| *Heteromys anomalus,* Spiny Pocket Mouse | 7 | 10 | 17 |
| *Hylaeamys megacephalus,* Rice Rat | 4 | 5 | 9 |
| *Marmosops fuscatus,* Gray-bellied Slender Opossum | 4 | 6 | 10 |
| *Marmosa robinsoni,* Robinson's Mouse Opossum | 1 | 7 | 8 |
| *Mus musculus,* House Mouse | 0 | 3 | 3 |
| *Necromys urichi,* Grass Mouse | 1 | 1 | 2 |
| *Nectomys palmipes,* Water Rat | 1 | 10 | 11 |
| *Proechimys trinitatus,* Spiny Rat | 12 | 1 | 13 |
| *Rattus rattus,* Black/Roof Rat | 1 | 1 | 2 |
| **Totals** | **34** | **46** | **80** |
| Trap nights | 920 | 664 | 1584 |
| Animals captured/100 trap nights | 3.7 | 6.9 | 5.0 |
| * Common names follow Emmons and Feer (1997). | | | |

The TRVL however, had conducted studies over several months and in many cases over several years in different locations in Trinidad. For example, Worth *et al.* (1968) working in Bush Bush Forest during the period 1960-1963 captured 11 species of small mammals. In the first year (1960), 6.5, mammals per 100 trap/nights were captured, but over the next three years the numbers collected were reduced each year to a low of 1.1 mammal per 100 trap/nights in 1963. The continual removal of these animals from the Bush Bush Forest environment might have led to a population crash in 1963.

Mammal species captured at Bush Bush Forest and Chaguaramas were similar except that the Grass Mouse, *Necromys urichi* and the Bare-tailed Woolly Opossum, *Caluromys philander* were not found at Bush Bush Forest while a species of Rice Rat *Oecomys trinitatus* (formerly *Oryzomys concolor*) was found in the Bush Bush Forest, but not at Chaguaramas.

Trapping of small mammals at Chaguaramas and Bush Bush Forest however, differed significantly from the results of Nelson and Nelson (2008) using Sherman traps at Spring Hill Estate, Arima Valley where the authors were only able to collect two species of rodents and one species of marsupial in 1848.5 trap nights. The difference in paucity of species at Spring Hill Estate might have been due to the type of traps used. I have used various types of mammal traps including Sherman traps over several years in various parts of Trinidad and found the Hav-a-hart trap the most successful.

Further trapping at Chaguaramas using different types of traps as well as the use of different types of bait at Chaguaramas might show the presence of other species.

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**Elisha S. Tikasingh**
*elisha.tikasingh@gmail.com*

# How Long do Trinidad's Frogs Take to Reach Metamorphosis?

A key parameter in the life history of any amphibian is the time taken from spawning to metamorphosis. This is the phase when most species (terrestrial direct developers and some others are exceptions) require an aquatic habitat where they are faced by a range of potential predators. Many amphibians spawn in temporary water bodies where they are unlikely to suffer predation by fish, but such pools are inhabited by many invertebrate predators, notably odonate and coleopteran larvae. Temporary pools hold water for varying times, relating to speed of drainage and evaporation, depth profile and pattern of rainfall. Since few tadpole species can survive their pool drying up, we might expect species that breed in temporary pools to minimise the duration of the larval period, to improve their chances of metamorphosing before the pool disappears.

How long do Trinidad's amphibian species take to reach metamorphosis? It is not easy to answer this question since it requires knowing when a particular batch of eggs was laid, then following the larvae through to metamorphosis. In temperate regions where all spawning occurs over a short period in the spring, this task is straightforward; but in Trinidad, individual frogs may spawn whenever it rains and they are gravid, so new larvae can be entering the population throughout the wet season. Without marking individuals (generally not feasible for amphibian larvae), it is difficult to follow a particular batch to completion. Here I present observations of four species where the spawning and metamorphic times were known. Developmental staging is according to Gosner (1960).

In July 1982, I noted that a small isolated temporary pool on the University of the West Indies, St. Augustine campus contained a large number of hatchling *Rhinella beebei*, implying spawning within the previous 36 h. Twelve days later, with little intervening rain, the pool was almost dry. I captured a sample for staging (they were stage 36-37) and kept them in a small aquarium in the laboratory. Two days later, the pool dried up and all the tadpoles died. In the laboratory, two had completed metamorphosis after a further two days, so the time from spawning to initiation of metamorphosis was 17 days in a small pool with a large number of tadpoles, where intraspecific competition would have been intense.

In June 2012, I was able to obtain data for three further species. The spawning site was the foundation of an abandoned building site at Sunset Drive on the Lopinot Road, northern Trinidad. An extensive deep hole (dimen-

sions: 21 x 13.7 m, depth below surrounding field 2.7 m) had an uneven concrete bottom with the result that the site holds water for some time following heavy rain. Small trees and bushes have grown up around the periphery of the site, providing some shade. The field around the pond site drains poorly and depressions there also hold water. Over the years that we have visited the site, it has been colonised by at least 10 frog species (*Trachycephalus typhonius, Hypsiboas crepitans, Scinax ruber, Phyllomedusa trinitatis, Dendropsophus microcephalus, Rhinella marina, Rhinella beebei, Elachistocleis ovalis, Engystomops pustulosus* and *Leptodactylus fuscus*: names as in Frost 2013, except that I prefer *R. beebei* to *R. humboldti* as the name for the smaller of Trinidad's toads).

In 2012, I first visited the site on 8 June. Despite a little rain on the previous day and local reports that the dry season had been quite showery, the site was completely dry, with no sign of any amphibian larvae. On 10 June, heavy rains fell on north Trinidad from early to mid-morning. That night, I visited the site: it contained water over the main area to a depth of about 15 cm. A substantial chorus of *T. typhonius* was calling; also many *E. pustulosus, L. fuscus* and smaller numbers of *S. ruber, D. microcephalus, H. crepitans* and *E. ovalis.* I anticipated extensive spawning by some or all of these species. On 12 June, there had been more rain overnight; I checked the site in the morning and found plentiful well developed *T. typhonius* spawn which must have been deposited on the night of 10 June. More rain fell on 13 and 15 June and the water level became a little deeper but there followed a series of hot, dry days. I first sampled for tadpoles, using a hand net, on 19 June and found two species that were already well developed, *T. typhonius* and *E. ovalis*. These were found in deeper, cooler water towards the centre of the site. Netting also revealed an abundance of predatory insect larvae, mainly odonates and coleopterans. I returned a sample of both tadpole species to the laboratory for staging and measuring, using callipers. Further samples were taken on 21, 24 and 26 June (including on 26 June a third species, *S. ruber*). Since the furthest developed tadpoles were approaching metamorphosis on 26 June, I returned a sample of live tadpoles to the laboratory and maintained them in aquaria at ambient temperature to assess the earliest date for metamorphosis (See Table).

There was very little rain between 26 June and 2 July. On 2 July the water level was low, around 5 cm in most parts, and there was no sign of well developed *T. typhonius, E. ovalis* or *S. ruber.* Netting captured large numbers of odonate and coleopteran larvae. Presumably, the amphibian larvae resulting from the spawnings on 10 June had now metamorphosed or been predated. It is also possible that some larvae died from overheating. Following a sequence of dry days, we found early afternoon temperatures in the shallow water were above 40°C and some tadpoles appeared stressed and unhealthy.

From these observations, the minimum time to metamorphosis in field conditions, with abundant predator presence, is 19-20 days for *T. typhonius* and *S. ruber* and probably a little longer for *E. ovalis*, though for this species, the small initial numbers and high predation levels prevented us seeing completion.

Experimental rearings in Trinidad of *L. fuscus* and *E. pustulosus* tadpoles, both outdoors and in laboratory conditions (Downie *et al*. 2008; Hailey *et al.* 2006), have suggested that previous estimates (Kenny 1969) of larval period duration were too high, but it remained possible that these results were an artefact of field conditions. Here I show that this is not the case, at least for the fastest developing members of spawnings of four species, *R. beebei, T. typhonius*, *E. ovalis* and *S. ruber*. All reached metamorphosis in 20 days or less, whereas Kenny (1969) gave larval periods for these species as 28, 42, 56 and 42 days respectively.

All the species reported here primarily inhabit temporary water bodies as larvae and metamorphose at a relatively small size. In addition to re-investigating other

**Table.** The most advanced stages of development (Gosner 1960) and sizes (total lengths) reached in the field by three species of Trinidad tadpole following spawning on the night of 10 June, 2012. Column a = Gosner stage; column b = total length (mm). NS = not sampled; - = not found.

| Species | Days after spawning | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 8.5 | | 10.5 | | 13.5 | | 15.5 | | 19.5 |
| | a | b | a | b | a | b | a | b | a |
| *T. typhonius* | 31 | 30.9 | 32 | 29.7 | 36 | 36.7 | 37 | 42.6 | 42 |
| *E. ovalis* | 28 | 14.4 | 31 | 19.4 | - | | - | | - |
| *S. ruber* | NS | | NS | | NS | | 38 | 30.0 | 42 |

small temporary pond species, there is a need to assess larval periods in species inhabiting more permanent water bodies, such as streams, rivers and swamps, such as *Mannophryne trinitatis, Hypsiboas boans* and *Hypsiboas geographicus,* and those growing to large sizes at metamorphosis. Nutrition is another factor that needs investigation. The oligotrophic Northern Range rivers utilised by *H. boans* and *H. geographicus* may be very different in nutrient availability to temporary pools. Competition may also modulate tadpole growth. Under experimental conditions, we have demonstrated an inhibitory effect of one tadpole species, *L. fuscus,* on another, *E. pustulosus,* (Downie *et al*. 2008). Unravelling the complexity of such interactions where up to ten tadpole species may share the same pond with an abundance of invertebrates is a considerable challenge.

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**J.R. Downie**
School of Life Sciences,
Graham Kerr Building,
The University of Glasgow,
Glasgow G12 8QQ, UK.
*roger.downie@glasgow.ac.uk*

# The Greater Windward Skink, *Copeoglossum aurae* (Reptilia: Squamata: Mabuyidae), a Semi-Arboreal Lizard of the Eastern Caribbean

Two mabuyid skinks are present in Trinidad and Tobago, the Greater Windward Skink, *Copeoglossum aurae* Hedges and Conn and the Lesser Windward Skink, *Marisora aurulae* Hedges and Conn. Both lizards have a similar distribution in the southern Windward Islands, including St. Vincent and the Grenadines, Grenada, Trinidad and Tobago, as well as the Peninsula de Paria of Venezuela, with a great deal of sympatry throughout the range.

Distinguishing between the two species of Trinidad and Tobago skinks is difficult. The Greater Windward Skink usually has the parietal scales separated, a heavily spotted dorsum, and a dorsolateral stripe that extends to the hind legs and onto the tail. The Lesser Windward Skink has the parietal scales in contact, few spots on the dorsum, and a dorsolateral stripe that fades on the posterior body (Hedges and Conn 2012).

Since 2010 we have been conducting field surveys of amphibians and reptiles in Trinidad and Tobago and have noted *Copeoglossum aurae* is frequently off the ground, in trees, bushes, or on anthropogenic structures, suggesting that it is arboreal. In 2011 we observed one specimen suspected to be this species that was about three meters above the ground on a tree stump in central Tobago. In 2012 we found a specimen about 1.5 m above the ground in a small tree in the Arima Valley; on Tobago a specimen was found on a concrete wall about 0.75 meters above the ground; and another specimen was found near Corvo Point, Tobago under loose tree bark about one meter above the ground. One individual assumed to be this species was observed 10 m above ground in a tree in the Lopinot Valley.

Additional evidence of the arboreal nature of this lizard is provided by a photograph showing a specimen being eaten by the Vine Snake, *Oxybelis aeneus*, on the trail to the top of Mt. St. Benedict in Trinidad (Fig. 1). The skink and its predator were about 0.6 m above the ground. And, a second photograph (Fig. 2) shows a pair of the lizards in copula about 1.6 to 2 m above the ground. There seems little doubt that the Greater Windward Skink is spending much of its time in the trees. Two of us have observed this skink on the ground in the leaf litter, under rocks and logs in open forested habitats; suggesting it is not completely arboreal.

Skinks likely evolved arboreal habits multiple times. The large Solomon Islands skink (*Corucia zebrata*) is an arboreal species (McCoy 2006), as are at least some of the South East Asian skinks, including the genera *Vietnascincus, Lamprolepis,* and *Dasia* (Greer 1970; Das 2004; Darevsky and Orlov 2011) and some of the North Ameri-

**Fig. 1.** The Vine Snake, *Oxybelis aeneus*, feeding on *Copeoglossum aurae,* Mt. St. Benedict. BR.

**Fig. 2.** A pair of *Copeoglossum aurae* in copula on a tree trunk in the Lopinot Valley.

can skinks in the genus *Plestiodon* (Cooper and Vitt 1994). Given the difficulty of surveying arboreal microhabitats, this skink may be more common than previously thought.

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**John C. Murphy[1], Stevland Charles, Mike Rutherford, Tom Anton, Gabriel Hast, Bryan Reynolds, Joshua Traub** and **Graham White**

1. Science and Education,
Field Museum of Natural History,
Chicago, IL 60605 USA.
*fordonia1@comcast.net*

# Comings and Goings of *Agelaia multipicta* (Hymenoptera: Polistinae) in Trinidad, West Indies

*Agelaia multipicta* (Haliday) is a widespread swarm-founding social wasp found throughout most of Central America and tropical South America (Richards 1978) and one of 20 species of swarm-founding wasps found in Trinidad, West Indies (Starr and Hook 2003). As far as is known, its nests of several parallel combs are always built in cavities and without envelopes (Richards 1978). Vertebrate carrion is among *A. multipicta*'s main food sources (O'Donnell 1995; Moretti *et al.* 2011). Despite the extreme patchiness of this resource and its large colony sizes, there appears to be no food source communication among nest mates (Jeanne *et al.* 1995).

In November 2012 a colony of *A. multipicta* was found occupying a bird box in a garden in the Lopinot Valley of Trinidad, West Indies (10°40'N, 61°20'W). The nest box had an internal volume of 3.36 liters and three apertures that could serve as entrances and/or exits. Two of these were circular holes in the front board of the nest box with diameters 13 mm (A) and 32 mm (B). At the back was a low, rectangular aperture 10 x 100 mm (C), where the back panel did not reach the base. There was no evident attempt to narrow or occlude any of the openings with nest carton.

This presented an opportunity to study the movement of wasps in and out of the nest in order to determine whether one hole was preferred as an entrance and another an exit. Studies of one colony of the swarm-founding wasp *Synoeca septentrionalis* (Starr 1989) and three of the stingless bee *Hypotrigona gribodoi* (P.E. Asante and C.K. Starr, unpublished) with doubled entrance tubes showed a clear directional bias between tubes in each case. In these species, a doubled passageway is a building anomaly, while in *A. multipicta* it was a pre-existing feature of the nest cavity.

During the course of one day, the numbers of wasps entering and leaving the nest through each of the holes were recorded for six ten-minute periods at two-hour intervals from 0800 h to 1815 h. One observer recorded traffic through each hole at the front of the box, while a second observer did the same for the single hole at the back. Observations were made from a distance of about two metres, with observers alternated front and back for successive counts. The wasps had been habituated to human presence for at least one year and showed no signs of disturbance at this distance. On the day of recording the weather was bright and fair.

A total of 2427 wasps entered or exited during the observation period, with most of the traffic through opening B (Table). The most striking result is that opening C at the back of the nest box served almost exclusively as an exit. Combining openings A and B, we find that the wasps preferentially utilized the front as an entrance and the back as an exit ($\chi^2$>100, p< 0.001). The result is the same if we disregard opening A.

**Table.** Movement of *Agelaia multipicta* individuals in and out of three nest openings during one day.

| **Opening** | **A** | **B** | **C** | **Total** |
|---|---|---|---|---|
| Perimeter of opening (mm) | 41 | 100 | 220 | |
| Wasps entering | 8 | 1402 | 4 | 1414 |
| Wasps exiting | 4 | 860 | 149 | 1013 |
| **Total traffic** | **12** | **2262** | **153** | **2427** |

We hypothesize that the differentiation into entrance and exit in this nest arose over time through a process of consensus building. This is open to test and description if a way can be found to induce swarms to adopt artificial nest boxes.

The pattern of overall traffic during the day showed a peak during mid-morning, followed by a lull at midday and a higher peak in the late afternoon. A more rigorous study over several days would be required to confirm this trend.

At the same time, we took the opportunity to study the nest and colony composition. At the time of observation, the colony had been in place for at least a year (personal observation). Few nests of *A. multipicta* have been described, probably because of the difficulty of collecting them from their cavities. Jeanne (1991) does not include any colony sizes for this species.

We collected the colony at night with the aid of Abraham Hefetz. It is standard practice to collect colonies at night, when few or no wasps are away from the nest. In addition, in the case of a potentially dangerous species such as *A. multipicta*, night collecting affords the option of turning out the lights if things go wrong. About 50 additional wasps were found at the nest site the following day, apparently having overnighted away. We killed and preserved the entire colony by freezing it.

The nest consisted of nine approximately vertical combs, with neighbouring combs connected by multiple petioles. The overall surface area of the combs was estimated at 1103 $cm^2$ by means of a 1cm x 1cm transparent grid laid over each comb. The total number of cells was estimated at 10,892 by counting the cells in 10 grids of 4 $cm^2$ laid haphazardly on combs. Nests with horizontal

combs are also known from this species (Giannotti 1998).

The number of adult wasps was estimated volumetrically. The collected wasps occupied 20 vials of 30 $cm^3$ of which we counted the wasps in eight vials chosen haphazardly. This yielded an estimate of 3957 wasps. Together with the wasps that returned the following morning, the entire adult population of the colony was about 4000.

The colony composition, based on a haphazard sample of 200 adult wasps, is estimated at 1380 callow (recently emerged) females, 2580 fully mature females and 40 fully mature males. Fully mature individuals are readily distinguished from callows by eye colour; immediately after emergence, the compound eyes of both females and males are black, changing to grey or greenish grey as the cuticle hardens. Dissection of a sample of 100 fully mature females showed only one with developed ovaries, indicating that the colony had very few queens. This one queen stood out for having a somewhat swollen abdomen and a very mature overall appearance. The presence of males shows that the colony had reached reproductive maturity. Richards (1978: 254) mentioned a colony of *A. multipicta* with more than 5000 adults, and data from four other *Agelaia* species (Jeanne 1991: Table 6.5) suggests that mature colony sizes from several hundred to several thousand are normal for the genus.

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**Figure. A,** rear opening and **B,** front opening of bird box inhabited by a colony of *Agelaia multipicta*.

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**Stefanie White**[1] and **Christopher K. Starr**[2]

1. *einafets.depp@hotmail.com*
2. *ckstarr@gmail.com*

# Albino Slug-eating Snake, *Sibon nebulata nebulata* from Couva, Trinidad, West Indies

On 6 October, 2012 an albino *Sibon nebulata nebulata* (Linnaeus 1758) was discovered in the backyard of a house in Basta Hall, Couva, Trinidad by the occupant, Jason Ramdial. The yard backed onto secondary forest. The snake was captured alive but died within a few days and was then passed to the University of the West Indies Zoology Museum where it was accessioned under the number UWIZM.2012.35.

The specimen has a snout-vent length (SVL) of 421 mm and a total length of 556 mm. During preservation it was noted that there were two almost fully developed eggs inside the snake, thus confirming that it was a mature female. The snake was a true albino, with the body all white with only a hint of a pattern and pinky-red eyes before preservation; after preservation the pattern and red eyes disappeared. As far as we are aware there are no reports of albino *S. nebulata nebulata*.

Dead snake before preservation. Photo: John C. Murphy.

This species is widespread in Trinidad and is generally only active at night; during the day it hides in leaf litter and decaying vegetation and is thought to feed exclusively on slugs and snails (Murphy 1997).

There are many records of albinism in reptiles; Boos (2001) mentions one albino *Erythrolamprus cobella* and one partial albino *Oxyrophus petolarius* both from Trinidad, Dyrkacz (1981) lists 16 species in North America and Sazima and Di-Bernardo (1991) list 18 species of Neotropical snakes with examples of albinism.

It is interesting to note that this albino *S. nebulata nebulata* could survive to adulthood and also mate despite lacking the camouflage colouring of its conspecifics. Being a nocturnal species may have contributed to its survival as there was less chance of being spotted by a predator. The majority of the species with examples of albinism tend to be nocturnally active snakes or at least live in cryptic habitats (Sazima and Di-Bernardo 1991).

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**Mike G. Rutherford**[1] and **John C. Murphy**[2]

1. University of the West Indies Zoology Museum,
   Department of Life Sciences,
   The University of the West Indies,
   St. Augustine, Trinidad and Tobago.
   *mike.rutherford@sta.uwi.edu*
2. *fordonia1@comcast.net*

# Predation of a Frog by Introduced Tufted Capuchins, *Cebus apella,* in Chaguaramas, Trinidad and Tobago

During an intensive study of the introduced tufted capuchin (*Cebus apella*) in the Chaguaramas peninsula during March-November, 2010 (Narang *et al.* 2010), we observed the behaviour by which a capuchin monkey systematically ate a frog. We describe below, the observations of that predation event.

The Tufted Capuchin Monkey, *Cebus apella,* occurs throughout Amazonia and is consistently classified as an omnivore. Thus, while it is largely frugivorous and insectivorous, it is also known to eat buds, new shoots, pith, stems, seeds, flowers, nectar, arthropods, lizards, frogs, bird's eggs and snakes (Rylands 1987). They are very resourceful in their foraging methods and catching arboreal frogs from hollow bamboo internodes has been well documented (Izawa 1978).

While conducting the surveys on the *C. apella* population in the Chaguaramas peninsula (Narang *et al.* 2010), we observed a tufted capuchin juvenile carrying a dead frog of an unknown species. We initially observed the capuchin at a distance of around 10 m and slowly moved to about 5 m during the predation event. It appeared that the monkey had just taken the frog from the forest floor and was moving up into the bamboo, *Bambusa vulgaris* understorey. This monkey remained in the bamboo at a height of approximately 3 m from the ground. The frog was not seen prior to the capture, so we are uncertain if it was killed by the capuchin or if it was already dead. The species of the frog was undetermined at the time of these observations and no sample of the frog was obtained as it was mostly consumed.

Upon finding a suitable bamboo limb for use as a surface, the capuchin was seen intensely examining the belly of the frog. After removing the skin of the frog's abdomen, the capuchin collected nearby wet bamboo leaves and used these to wipe the interior visceral cavity of the frog. We observed the capuchin spending approximately 8-10 minutes in the consumption of the internal organs and viscera of the frog.

During the consumption of the frog, a second capuchin monkey of similar size approached the first monkey from behind. Although no begging behaviour was observed, this second monkey was clearly aware of the presence of the frog in the first monkey's possession. The proximity of the second monkey apparently caused the first monkey with the frog to make swift movements with the frog in its hands or mouth, and avoid the second monkey.

After consumption of the viscera and internal organs, the first monkey proceeded to consume the thigh and leg of the frog. We were not able to observe the complete consumption of the frog as the monkey moved into the higher canopy with the remains of the frog carcass.

With the recent documentation of *C. apella* as an introduced primate species in Trinidad (Narang *et al.* 2010), little is currently known of its diet in the forests of the Chaguaramas peninsula. Further research is required to understand the ecology of this introduced species, including their taxonomy, behaviour and diet. Such information is important for understanding and managing their potential impact on the two endemic primate subspecies in Trinidad, and the wider biota of this island.

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**Darshanjit Singh Narang[1]** and **Howard Nelson[2]**

1. Environmental Management Authority,
   Trinidad and Tobago.
   *dsn95@yahoo.com*

2. *howien@hotmail.com*

# An Interesting Reptile Dispersal Event from Continental South America to Trinidad, Trinidad and Tobago

During the period 19 to 21 August, 2010, a very large quantity of water hyacinths (*Eichhornia* sp.) appeared and washed ashore in Mayaro Bay in south-east Trinidad. Mats of the hyacinths dotted the beach for about three kilometres. Many of these mats were approximately 6 m² to 15 m². Three species of reptiles were found in association with these mats of vegetation on the beach between 10° 13' 28.42" N, 61° 00'10.82" W and 10° 14' 24.59" N, 61° 00' 04.43" W.

At 1630 h on 20 August, a juvenile Green Anaconda, *Eunectes murinus* (SVL 1300 mm, T 220 mm) was found coiled in a small mat of hyacinths on the beach close to Frontin Road. Shortly thereafter at 1715 h and at the same locality, a juvenile Spectacled Caiman, *Caiman crocodilus* (SVL 263 mm, T 252 mm) was spotted emerging from the surf onto the beach. Later that evening, at 2010 h and 2040 h in the vicinity of Baywatch Boulevard, a sub-adult (SVL 420 mm, T 207 mm) and an adult (SVL 602 mm, T 130 mm) Water Mapipire, *Helicops angulatus* were found in large tangled mats of hyacinths on the beach. Finally, at 1600 h on 21 August a juvenile *H. angulatus* (SVL 204 mm, T 62 mm) was found in a small mat of beached vegetation near Frontin Road. All the animals, with the exception of the last noted, seemed in good physical condition. The juvenile Water Mapipire appeared quite weak when first observed, and possibly suffered heat stress from being exposed on the beach for a much longer period than the other animals. All of the animals were collected, given fresh water and photographed. The anaconda and the caiman were eventually released further north at the Nariva and the Ortoire Rivers respectively, while all the Water Mapipires were deposited in the University of the West Indies Zoology Museum at St. Augustine, Trinidad under accession number UWITT.2010.27.2. In addition to the reptiles noted, a small Synbranchid eel (total length - 200 mm) and a large Belostomatid water-bug (total length - 91 mm) were observed in association with the beached water hyacinths.

Several authors have noted over-water dispersal events of fauna including reptiles (assumed to be from the Orinoco Delta of Venezuela) to the south-east, south and south-west coastal regions of Trinidad (Underwood 1962; Boos 2001; Kenny 2008). The timing of the observations recorded here coincide with the annual peak flow rate of the Orinoco River of approximately 70,000 $m^3s^{-1}$, known to occur in the middle of the rainy season in August (Muller-Karger *et al*. 1989). These seasonally increased flow rates of the Orinoco result in exceptionally low salinity levels of surface waters in the Gulf of Paria and the Columbus Channel (Kenny 2008), which would permit usually freshwater and brackish water habitat specialists a chance to survive for some time in the marine environment; especially if floating rafts of vegetation can provide them with some degree of insulation from the seawater below and from direct exposure to sunlight above. Four of the five reptiles observed were in good condition after their sea crossing and might well have been capable of unaided movement from the beach into any of the nearby small streams which empty into Mayaro Bay. Such dispersal events from the mainland to Trinidad may be regular annual occurrences and may be a source of continued addition to the gene pool of resident reptile populations associated with coastal freshwater and brackish water systems.

It might be well worthwhile for naturalists and wildlife management authorities to monitor the coastlines of southern Trinidad after heavy rainfall is noted along the Orinoco River system, and particularly when large rafts of water hyacinths are seen along the shore, in order to keep track of continued immigration of reptiles (and other fauna) into already established resident populations in Trinidad, as well as to record and appropriately respond to any new potentially colonizing species.

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**Stevland P. Charles**
Department of Biology, Howard University,
415 College Street, N.W. Washington DC, 20059.

# Notes on Abundance of High Quality Cocoa Varieties in Grenada, West Indies

There are three general varieties of cocoa (*Theobroma cacao* L.) recognized based on morphological traits and geographical origins. This includes the main genetic groups, "Criollo" and "Forastero" and a third group, "Trinitario", consisting of "Criollo"×"Forastero" hybrids (Motamayor *et al.* 2008). Forastero is the world's most widely cultivated variety accounting for close to 90% of the world's chocolate and is grown mainly in Africa (The Field Museum 2007). The low price and basic chocolate flavor make the Forastero a good "bulk" cocoa and it is most often used by milk chocolate makers (Wood and Lass 1985). The Criollo is the earliest known variety of cocoa and produces some of the highest quality cocoa. However, Criollo varieties are less commonly grown by farmers because they produce fewer seeds, are less vigorous and tolerant to diseases than Forastero varieties, and require more stringent shaded growing conditions that closely mimic the wild conditions under which the plant first evolved in the Amazon Basin (Cheesman 1944; Wood and Lass 1985; The Field Museum 2007). The Trinitario is a cross of the Criollo and the Forastero developed in Trinidad and is believed to be the most dominant cocoa variety in the Caribbean. The Criollos and the Trinitarios are known as "fine or flavor cocoa" because they produce a higher quality bean sought after by artisan chocolate makers due to the more complex and intense quality chocolate flavors such as fruitiness (Presilla 2001).

Cocoa was first introduced to Grenada in the early 1700s by the French. Since then Grenada has become one of only eight exclusive (100%) "fine or flavor cocoa" exporters by the International Cocoa Organization (ICCO), making it home to some of the world's best cocoa. However, few researches have attempted to census the different varieties of cocoa that make up Grenada's unique high quality cocoa.

Teamed with the Grenada Cocoa Association and Larry Burdick Chocolates, a total of 60 randomly selected farms across all parishes (except St. George) were sampled during the months of July and August of 2009. Censuses were designed to conduct a thorough but rapid assessment of cocoa varieties in each farm generating a general picture of which varieties are most dominant and to establish a standardized sampling method that can be used in the future by other researchers or farmers.

At each farm, one randomly selected continuous 20 m x 20 m survey plot was created. For each cocoa tree inside the plot a clone ID number was recorded based on leaf, pod, and flower structure and a GPS point was taken. Each clone identified was assessed for Criollo content through use of CocoaGenDB's (http://cocoagendb.cirad.fr/index.html) germplasm clone ID search; a new online database that allows complex queries combining existing genetic and phenotypic information.

A total 1139 trees and 37 clones were documented during this study. There were 12 clones identified as having high Criollo content: GS10, GS19, GS29, GS36, ICS32, ICS89, ICS95 (Johnson *et al*. 2004), UF221, UF650, UF654, UF667 and UF668 (Johnson *et al*. 2007). These clones made up 71% of the total tree count. Only two clones were identified as having high Forastero content (ICS1, to a lesser extent, and IMC67, an Upper Amazon Forastero) and these clones made up 3% of the total tree count. The GS29 Criollo-like variety was by far the most common planted variety of cocoa in Grenada occurring on over 96% of the farms sampled and accounting for over 37% of the entire 1139 trees sampled (see Table).

The average age of Grenada's cocoa famer is 59 years and younger generations are leaving the farms in pursuit of job opportunities in urban areas. The changing demographics of Grenada's cocoa farmers put cocoa farming in Grenada at risk. Promoting and raising market awareness for Grenadian chocolate is essential to the survival of this industry. Recently, there have been efforts to revitalize the industry by the Cocoa Farmers Future Initiative, Grenada Chocolate Company Ltd. and the Grenada Cocoa Association in conjunction with the Cocoa Research Centre. These actors have made great strides in promoting the Grenadian chocolate industry and may serve as a model for sustainable cocoa farming in the Caribbean. The Cocoa Farmers Future Initiative (www.cffigrenada.org) was established in 2001 in order to aid cocoa growers as they recover and re-establish their farms post-hurricanes, add value to their crops, encourage the next generation of growers, and maintain the island's biodiversity. The Grenada Chocolate Company Ltd. was founded in 1991 with the vision of creating an Organic Cocoa Farmers' and Chocolate Makers' Co-operative. This co-operative system ensures that all workers, from the farmers to the chocolate makers, are paid the same rate and that cocoa is grown and produced sustainably. This co-operative now includes over 200 acres of organic cocoa farms which produce small batch chocolate with solar-electric powered machines. In 2012, more initiatives such as the "Cocoa Farmer Field Schools" were rolled out by the Grenada Cocoa Association in conjunction with the Cocoa Research Centre, Trinidad. This program, funded by the Centre for Development of Enterprise, will educate

**Table.** Results of Cocoa Surveys in Grenada, July and August of 2009.

| Clone ID | Variety | Total Count | % Total Count | % Farms Present | Average Count per Farm |
|---|---|---|---|---|---|
| GS29 | Criollo-like | 428 | 37.58 | 96.67 | 7.13 |
| GS19 | Criollo-like | 135 | 11.85 | 73.33 | 2.25 |
| GS36 | Criollo-like | 113 | 9.92 | 70.00 | 1.88 |
| ICS95 | Criollo cross | 82 | 7.20 | 70.00 | 1.37 |
| GS17 | unk | 44 | 3.86 | 43.33 | 0.73 |
| GS46 | unk | 36 | 3.16 | 28.33 | 0.60 |
| GS53 | unk | 36 | 3.16 | 31.67 | 0.60 |
| GS67 | unk | 25 | 2.19 | 26.67 | 0.42 |
| GS26 | unk | 23 | 2.02 | 25.00 | 0.38 |
| ICS01 | Forastero | 23 | 2.02 | 30.00 | 0.38 |
| GS18 | unk | 18 | 1.58 | 26.67 | 0.30 |
| GS48 | unk | 17 | 1.49 | 26.67 | 0.29 |
| ICS06 | unk | 17 | 1.49 | 11.67 | 0.28 |
| ICS32 | Criollo cross | 12 | 1.05 | 13.33 | 0.20 |
| ICS89 | Criollo cross | 11 | 0.97 | 11.67 | 0.18 |
| GS43 | unk | 11 | 0.97 | 18.33 | 0.18 |
| UF221 | Criollo cross | 10 | 0.88 | 13.33 | 0.17 |
| GS71 | unk | 10 | 0.88 | 11.67 | 0.17 |
| GS65 | unk | 9 | 0.79 | 11.67 | 0.15 |
| IMC67 | Forastero | 9 | 0.79 | 6.67 | 0.15 |
| GS55 | unk | 8 | 0.70 | 6.67 | 0.13 |
| GS77 | unk | 7 | 0.61 | 8.33 | 0.12 |
| GS78 | unk | 7 | 0.61 | 8.33 | 0.12 |
| UF667 | Criollo cross | 6 | 0.53 | 8.33 | 0.10 |
| GS15 | unk | 6 | 0.53 | 8.33 | 0.10 |
| GS40 | unk | 6 | 0.53 | 10.00 | 0.10 |
| GS76 | unk | 6 | 0.53 | 10.00 | 0.10 |
| GS32 | unk | 5 | 0.44 | 6.67 | 0.08 |
| GS30 | unk | 4 | 0.35 | 5.00 | 0.07 |
| UF668 | Criollo cross | 3 | 0.26 | 3.33 | 0.05 |
| ICS98 | unk | 3 | 0.26 | 5.00 | 0.05 |
| UF650 | Criollo cross | 2 | 0.18 | 1.67 | 0.03 |
| GS14 | unk | 2 | 0.18 | 3.33 | 0.03 |
| GS57 | unk | 2 | 0.18 | 3.33 | 0.03 |
| GS10 | Criollo | 1 | 0.09 | 1.67 | 0.02 |
| UF654 | Criollo cross | 1 | 0.09 | 1.67 | 0.02 |
| GS05 | unk | 1 | 0.09 | 1.67 | 0.02 |

the farmers in Best Practices and Good Agricultural and Management Practices to ensure the most productive and profitable cocoa production systems and value chains.

These efforts are important for creating a sustainable future for Grenada's cocoa economy. They provide financial incentive and protection that make cocoa growing and chocolate making a viable alternative to the urban workforce; this is what will allow for younger generations to return to the Grenadian cocoa industry. Additionally, they create a system of cocoa growing and production that helps to protect and maintain this rare and unusually rich tropical ecosystem that might otherwise be logged, grazed, or sold for resort development.

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**Phillip J. Howard**
Garcia and Associates
2601 Mission Street, Suite 600
San Francisco, CA 94110
*philliphoward85@gmail.com*

**Sarah C. Harvey**
*sarahharvey1986@gmail.com*

# First Record of the Spider *Neotama mexicana* (Hersiliidae: Araneae) from Trinidad and Tobago

The first Bioblitz event held in Trinidad and Tobago was held in Tucker Valley, Chaguaramas in north-west Trinidad from 17 to 18 November, 2012. Field collection yielded an adult female *Neotama mexicana* (O.P. Cambridge). This is the first record of the species for Trinidad and Tobago. Prior to this specimen, the family Hersiliidae was presumed to be present but not confirmed (Sewlal and Cutler 2003). The nearest known collection site was in Guyana (Platnick 2013). Sewlal (2012) confirmed 52 spider families for Trinidad and Tobago. This discovery brings the total to 53.

This specimen (Catalog no. UWIZM.2013.1.1) was deposited in the Land Arthropod Collection of the University of the West Indies, St. Augustine, Trinidad and Tobago. The name of the collector is unknown.

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**Jo-Anne Nina Sewlal**
Department of Life Sciences,
The University of the West Indies,
St. Augustine, Trinidad and Tobago.
*joannesewlal@gmail.com*

# Notes on Lycaenidae (Lepidoptera) Including a New Record for Trinidad, West Indies

The butterflies of Trinidad are fairly well documented and by the time Malcolm Barcant published "The Butterflies of Trinidad and Tobago" in 1970, he had recorded 92 species of the family Lycaenidae for the island. This number has since increased to at least 130 species (Alston-Smith and Cock 2011).

On 14 March, 2010, a lycaenid (Fig. 1) was photographed at 511 Clarke Road, Penal which was later identified by Dr. R.K. Robbins of the Smithsonian Institution as "most likely" a male *Badecla quadramacula* (Austin and Johnson 1997), an "exceedingly rare" species not previously recorded for the island. This species has been rarely collected elsewhere with documented locations limited to Rondonia, Brazil (type locality), Guyane (French Guiana) and Peru (R.K. Robbins, personal communication to M. J.W. Cock 2011). Since *B. quadramacula* is a distinctive species, with no known closely similar species, the name is being used here, although it is possible that when more specimens become available for study there may be some name changes in this group of rare species. The genus *Badecla* is placed in the subtribe Calycopodina. Species for which the biology is known are mostly facultative detritivors (Duarte and Robbins 2010).

At the time it was observed and photographed, the specimen of *B. quadramacula* was amongst a much larger assembly of at least 16 different species of Lycaenidae butterflies in a shed in an ornamental plant nursery between 13 February, 2010 and 20 March, 2010. The shed measured about 3 m x 12 m and housed plants of double chaconier, *Warszewiczia coccinea* var. "David Ayoung", hydrangea, *Hydrangea macrophylla* and a few bromeliads. Adjacent to the shed was a weed-choked ditch where several Lycaenidae rested during the day.

Lycaenidae species present during the gathering were recorded by photographs, so not all can be identified with confidence with the exception of *Electrostrymon hugon*, which was captured. In addition to *B. quadramacula*, the following were observed: *Calycopis cinniana* (Hewitson) (Fig. 2), *C. demonassa* (Hewitson) (Fig. 3) and another *Calycopis* sp. which may have been *C. origo* (Godman and Salvin) or near (Fig. 4), *Celmia celmus* (Cramer) (Fig. 5), *Electrostrymon hugon* (Godart) (= *sangala* Hewitson, =*cyphara* Hewitson*)* (Fig. 6), *Lamprospilus collucia* (Hewitson) (Fig. 7), *Leptotes cassius* (Cramer), *Panthiades bitias* (Cramer) (Fig. 8), *Parrhasius polibetes* (Stoll) (Fig. 9), *Rekoa stagira* (Hewitson) (Fig. 10), *Tmolus echion* (Linnaeus) (Fig. 11), *Ziegleria hesperitis* (Butler and Druce) (Fig. 12) and an unidentified species probably in the genus *Nicolaea* (Fig. 13). In addition to these, two unidentified species were seen but not photographed. The unidentified probable *Nicolaea* sp. has not been matched to any known Trinidad species. *Calycopis origo* has not previously been recorded from Trinidad but it is a common species, one of several lumped under the name *Thecla beon* by earlier workers (M.J.W. Cock, unpublished). *Lamprospilus collucia* is a common Trinidad species which appeared in earlier lists misidentified as *Calycopis orcidia* (Hewitson) (Robbins *et al*. 2010). *Electrostrymon joya* (Dognin) (=*nubes* H. Druce) is also suspected to have been present but because of its close similarity to *Electrostrymon hugon*, differentiation of the two species necessitates the study of captured specimens (Fig. 14).

While no egg laying was observed, two pairs of *Z. hesperitis* were observed mating on 27 February, 2010 and 28 February, 2010 (Fig. 15). The butterflies were not observed in the following year (2011) despite a careful search. Given that it was the height of the dry season, the most likely reason for the lycaenid butterflies to have aggregated in the shed is seeking moisture or humidity.

On 27 September, 2011, a lycaenid (Fig. 16) was photographed at Columbus Bay, Icacos. It was resting on the underside of a leaf of Seaside Grape (*Coccoloba uvifera*). The butterfly was subsequently identified by Dr. Matthew Cock as *Panthiades bathildis* (C. Felder and R. Felder). While this species has been recorded twice from the island (Nicolay 1976; S. Alston-Smith, unpublished), this individual represents the first male of this species recorded in Trinidad. A search of nearby vegetation revealed no other specimens.

## ACKNOWLEDGEMENTS

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**Fig. 1.** ♂ *Badecla quadramacula.*

**Fig. 2.** *Calycopis cinniana.*

**Fig. 3.** *Calycopis demonassa.*

**Fig. 4.** *Calycopis* sp. possibly *C. origo.*

**Fig. 5.** *Celmia celmus.*

**Fig. 6.** ♂ *Electrostrymon hugon.*

**Fig. 7.** ♂ *Lamprospilus collucia.*

**Fig. 8.** *Panthiades bitias.*

**Fig. 9.** *Parrhasius polibetes.*

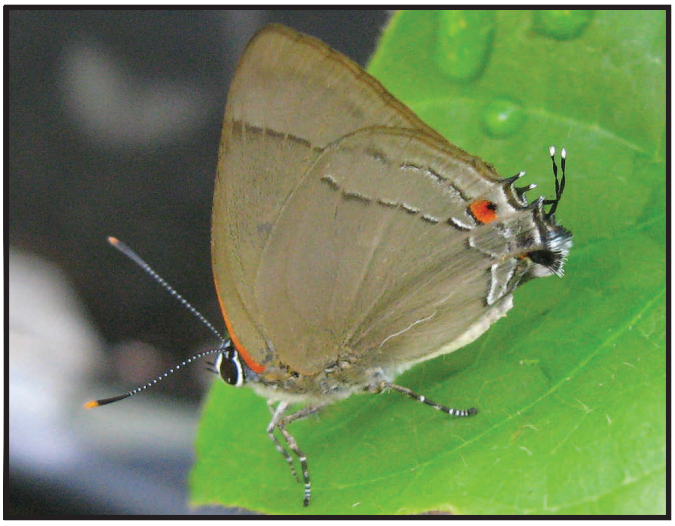

**Fig. 10.** ♀ *Rekoa stagira.*

**Fig. 11.** *Tmolus echion.*

**Fig. 12.** *Ziegleria hesperitis.*

**Fig. 13.** Unidentified *Nicolaea* sp.

**Fig. 14.** ♀ *Electrostrymon hugon* or ♀ *E. joya.*

**Fig. 15.** *Ziegleria hesperitis* mating.

**Fig. 16.** ♂ *Panthiades bathildis.*

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**Kris Sookdeo**
*krsookdeo@hotmail.com*
www.ttnaturelink.com

# New and Updated Records of Terrestrial and Freshwater Gastropod Molluscs for Tobago, West Indies

In June 2012 and March 2013 fieldwork in Tobago was conducted, investigating the presence and distribution of terrestrial and freshwater molluscs. During these visits several species that have not been previously recorded from the island were observed and one species that has not been recorded within at least the last three decades was observed. Tobago has a fairly depauperate gastropod molluscan fauna when it comes to the land and freshwater ecosystems with approximately nineteen species from ten families for the terrestrial snails (Robinson *et al.* 2004) and ten species from seven families for the freshwater species (Bass 2003). In this note we report on six new records representing five new species (Figure) and two new families.

The Helicinidae snail *Helicina nemoralis* Guppy, 1866 is known from Trinidad and northern Venezuela but is rarely encountered as it is thought to be arboreal (Guppy 1864, 1866, 1893; Robinson *et al.* 2004). A single live specimen was found on low vegetation beside the Doctor's River, Speyside, in the north-east of Tobago (N 11.30221°, W -60.53514°, Elevation 5 m) on 18 June, 2012. The specimen was added to The University of the West Indies Zoology Museum (UWIZM) and accessioned under the number UWIZM.2012.33.21.

The Helicarionidae snail *Ovachlamys fulgens* (Gude 1900) is from south-east Asia and has spread to the Neotropics through the horticultural trade, in particular the trade in orchids upon which it is a pest (Robinson 2003). Nine live specimens were found in leaf litter beside the Doctor's River in the north-east of Tobago (N 11.30401°, W -60.53658°, Elevation 15 m) on 18 June, 2012. A single live specimen was also found in an area of secondary forest and crops on a tree trunk on the lower slopes of Flagstaff Hill, Charlotteville (N 11.32508°, W -60.54432°, Elevation 137 m) on 19 June, 2012. This is the first record for Tobago for this family but the species has been known from Trinidad from at least 2004 (Robinson *et al.* 2004). The specimens were accessioned under the numbers UWIZM.2012.33.5 and UWIZM.2012.33.10.

The Neocyclotidae snail *Austrocyclotus rugatus* (Guppy 1864) has been previously recorded only in the north of Trinidad (Guppy 1864, 1893; Robinson *et al.* 2004). A single live specimen was found under a rotting log at the edge of secondary forest near the Hillsborough Reservoir in central Tobago (N 11.21941°, W -60.67224° Elevation 220 m) on 26 June, 2012. This is the first record for this family from Tobago. The specimen was accessioned under the number UWIZM.2012.33.40.

The exotic Ampullaridae freshwater snail *Pomacea diffusa* Blume, 1957 was only recently reported from Trinidad (Mohammed and Rutherford 2012). Many live snails were found in the ditches alongside James Road, Bon Accord (N 11.16189°, W -60.82803°, Elevation 5 m) on 29 June, 2012. A substantial number of the snails were laying eggs on the concrete sides of the ditches indicating the potential for a quick rise in population densities. It is unknown if the presence of this exotic species will have a negative impact on the flora and fauna of the local ecosystems and further monitoring should be undertaken. A specimen was taken and accessioned under number UWIZM.2012.33.67.

A second survey of the southern portion of the island in March 2013 revealed a high density population (>40 $m^{-2}$) on Canoe Bay Road leading into the Cove Eco-Industrial Park (N 11.15068, W -60.79342, Elevation 20 m). Isolated adults were observed at the Bon Accord freshwater wetlands (N 11.15962°, W -60.83006°, Elevation 5 m) and Mc Knight Road (N 11.15382°, W -60.81541°, Elevation 9 m) but no evidence of egg cases noted.

Evidence of a second Ampullaridae freshwater snail *Pomacea urceus* Müller, 1774, commonly known as the Black River Conch, was observed at four sites. Although this species has been recorded from Tobago before (Bland 1861), there have not been any recent records in the literature. Firstly at Mc Knight Road (same as above mentioned site) three living individuals were noted and approximately 200 shells observed within 50 m of drainage. Along the driveway leading into the Seeram Brothers' Ltd. gravel refining compound, ten shells were noted in 200 m of dry river bed (N 11.15491°, W -60.80768°, Elevation 20 m). The third population was noted at a severely dried wetland along Canoe Bay Road (N 11.14911°, W -60.78999°). At this site approximately 200 shells were noted above soil within the dried wetland (≈1$m^{-2}$). This site is similar to the site at Seeram Brothers and has a drainage connection to a freshwater pond. Only one live individual was noted (seemed to be aestivating, but not within a burrow). The last site, also on the Cove Road, was located at the bridge crossing. Here the drainage was converted to a shallow pool (same as the above mentioned site with *P. diffusa*). Approximately 100 adults had recently died (operculum present) and no signs of aestivation burrows were noted on the soft mud substrate. However, the *P. diffusa* were alive and seemed unaffected by the harsh environment. Juvenile shells were noted at all sites mentioned indicating the population is reproducing although potentially threatened by harvesting (for food), anthropogenic impacts such as

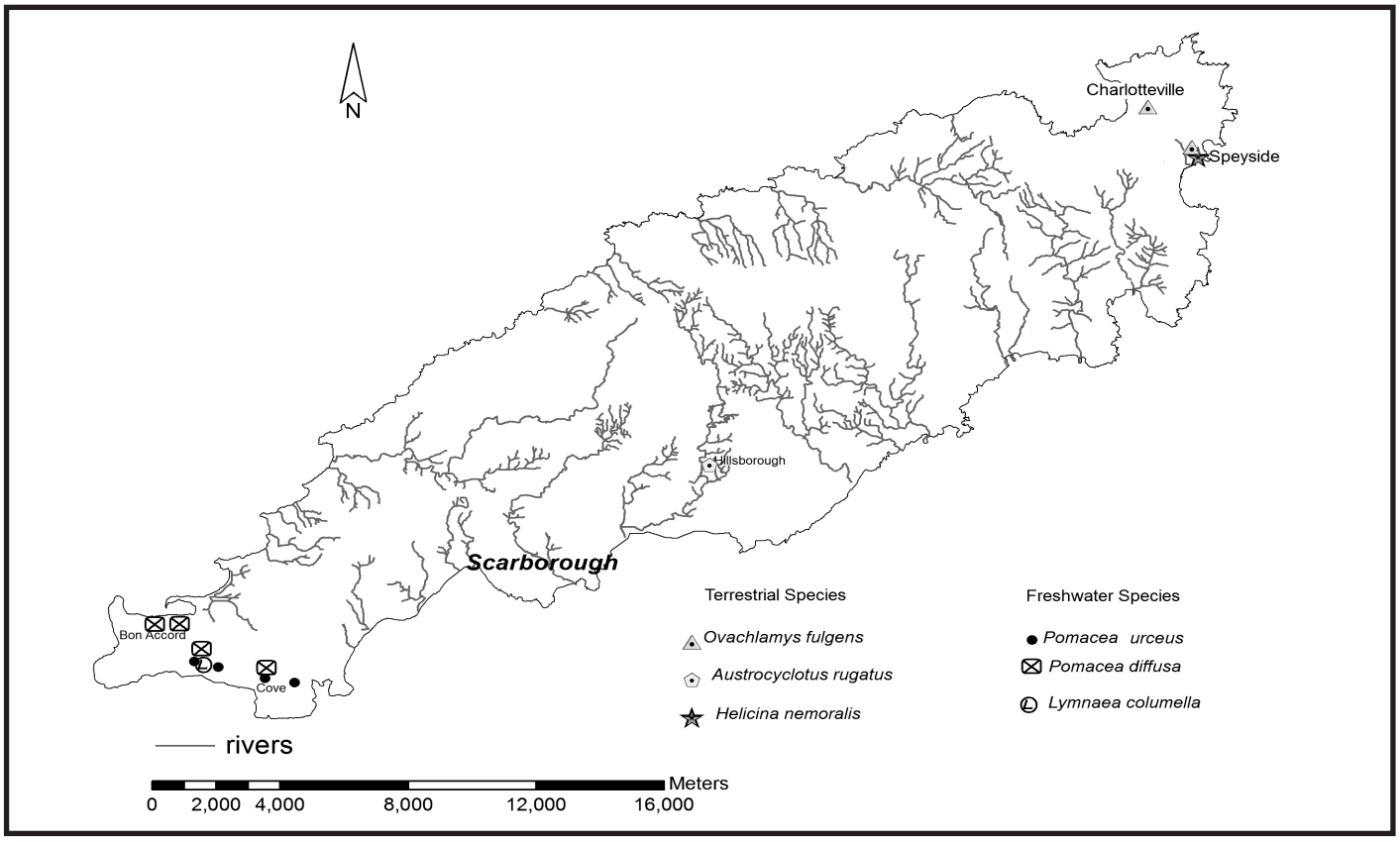


**Figure.** Locations of six new gastropod records for Tobago, W.I., June 2012 - March 2013.

urban, commercial and industrial development and a harsh dry season.

The Pseudosuccinea*, Lymnaea columella* Say, 1817 was recently reported at a single site in Trinidad (Mohammed and Rutherford 2012). A lone individual was also observed at the above mentioned Mc Knight Road site within a shallow pool along the roadside drain.

More research is currently being conducted on the molluscan fauna of Tobago and it is quite certain that new records for the island and potentially species new to science will come to light.

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**Mike G. Rutherford**[1] and **Ryan S. Mohammed**[2]
Department of Life Sciences,
The University of the West Indies,
St. Augustine, Trinidad and Tobago.
1. *mike.rutherford@sta.uwi.edu*
2. *rmohammed@gmail.com*

# Possible Return of the Driftwood Catfish, *Trachelyopterus galeatus* (Family: Auchenipteridae) to Trinidad, Trinidad and Tobago

The mean freshwater and riverine ichthyofaunal species richness for Trinidad and Tobago, according to Phillip (1998), was calculated to be 38.7 using a wide range of species richness estimators, with the recorded observed being 38 fish species. Since then there have been numerous taxonomic disputes causing this richness estimate to change. Mohammed *et al*. (2010) documented an additional species, the gouramy, *Trichogaster trichopterus* in the south-central Oropuche drainage of Trinidad. Prior to this, Kenny (1995) reported 43 freshwater fish species listed for Trinidad and Tobago. In this account, the historical occurrences of the elongate hatchetfish, *Triportheus elongatus* (Family: Characidae) and driftwood catfish, *Trachelyopterus galeatus* (Family: Auchenipteridae) were noted, but both were suspected to be extinct. Neither species were reported in Phillip's (1998) account, and subsequently were absent in the taxonomic keys for freshwater fishes by Phillip and Ramnarine (2001). Recently, *T. elongatus* was reported in south-east Trinidad (Mohammed *et al*. 2010), and *T. galeatus* has been re-discovered in 2011 in the central drainages of the Caroni Plain.

During March 2011, recreational fishermen caught a single specimen of *T. galeatus* in the Caroni River at St. Helena (GPS: 20P 680899° E, 1170784° N) using hook and line. By the time the fish was recognized as being 'a different looking catfish', it had already suffered from having the hook removed; however it was photographed, but unfortunately used as bait. A second specimen was caught, again using hook and line, in the Guayamare River (GPS: 20P 673775° E, 1171240° N) during April 2011 by the same fishermen, but by now they were alerted to the rarity and 'value' of the fish. This specimen was kept alive for several months and the identification confirmed using Bail *et al*. (2000). Based on taxonomic descriptions and comparisons from the photographs, the first specimen was male and the second was an adult female (21.0 cm standard length).

Kenny (1995) reported finding hundreds of dead specimens at the Uriah Butler Highway crossing of the Caroni River in 1959, and stated that this species has a preference for wide-open rivers with slightly brackish conditions. This species occurs in swamps and is well adapted to hypoxic environments (Bail *et al*. 2000). Adults feed on small fishes, arthropods, worms and sometimes on fruits. Interestingly, sperm can be kept in the female's genital tract for several months, owing to a gelatinous emission from the seminal vesicle of the male (Boujard *et al*. 1997). Relatively large, adhesive, gelatinous eggs (approximately 3.0 mm in diameter) can represent as much as 20% of the gravid female's weight (Boujard *et al*. 1997). It can be found in rivers from northern South America to Central America, from Panama to Argentina (Nelson 2006).

It is uncertain if these individuals are representatives of the historical populations or recent introductions. On the one hand, this drainage has been regarded as part of the 'Unstable Relict' zoogeographic zone (Kenny 1995; Phillip 1998). Within the last decade, the odd specimen of *T. galeatus* has been imported in the freshwater ornamental trade, mixed in with shipments of other catfishes or intentionally imported as an oddity. This usually comprised of individuals ranging between 6.0 cm to 12.0 cm (personal communications with Fisheries Division). Both collection sites are within 5.0 km of at least two importation facilities for the ornamental fish trade. Additionally, it is not unheard of for some aquarium hobbyists to release unwanted pets into local rivers, which they assume represent suitable habitats; a practice that should not be condoned due to the unknown ecological impacts.

There are substantial numbers of riverine fishes found in the Orinoco that have been collected in the Gulf of Paria, and can therefore make it to Trinidad. However, not every species that frequents the Gulf of Paria becomes established within Trinidad's drainages. Such examples are the members of the *Brycon falcatus* group (Lasso *et al.* 2010, 2004) and the red-bellied piranha *Pygocentrus nattereri* which has been caught by artisanal fishermen around the south-western peninsula of Trinidad after increased discharges from the Orinoco (author's observations). This is possible due to decrease in salinity below 15.0 ‰ (ppt) in the Columbus Channel and the Gulf of Paria (Kenny 1995).

In conclusion, though it may be tempting to assume that the capture of individuals at the two sites is not coincidental, it is not possible to conclude that these two individuals represent stable breeding populations; such an assessment would depend on the repeated capture of individuals over a longer time span. Further monitoring of Trinidad and Tobago's inland drainage systems therefore needs to be conducted, and freshwater fish assemblages updated. It is recommended that this species should now be reinstated in our archives of biodiversity.

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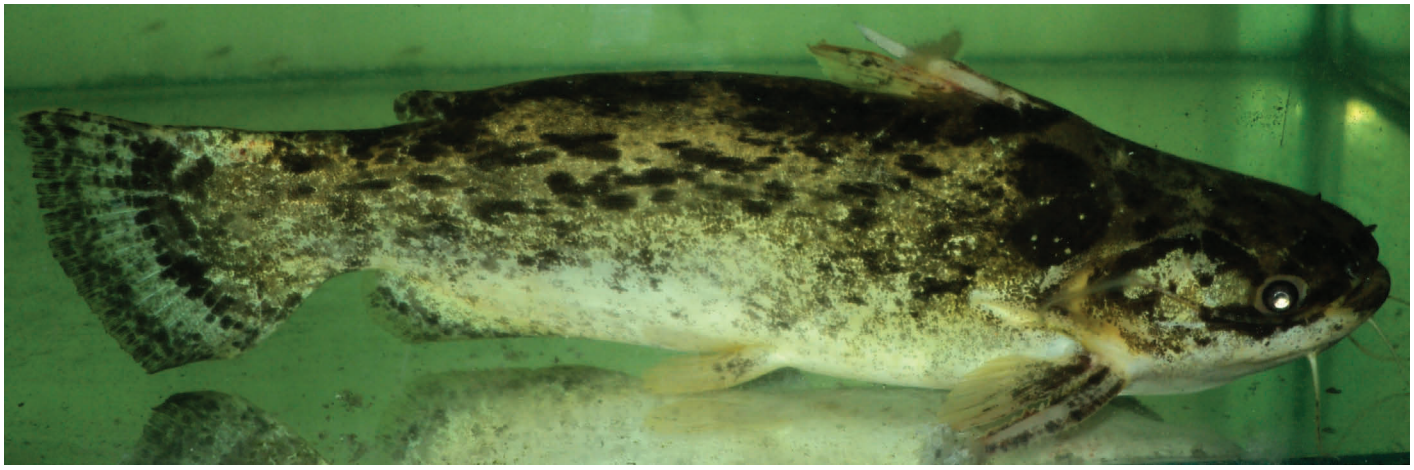

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**Ryan S. Mohammed**[1] and **Harnarine Lalla**[2]

1. Department of Life Sciences, UWI, Trinidad and Tobago.
2. *h.lalla@hotmail.com*

# Range Expansion of the Exotic *Eleutherodactylus johnstonei* (Anura: Eleutherodactylidae) to Tobago, Trinidad and Tobago

*Eleutherodactylus johnstonei* is a small frog native to the Lesser Antilles (Murphy 1997). It was introduced to Trinidad some time prior to 1979 when it was observed by Hans Boos in lands surrounding the port in Port of Spain (Kenny 1979). It has since spread through much of the residential areas of north-west Trinidad from Chaguaramas to La Horquetta (Manickchan *et al*. 2011).

*E. johnstonei* is a very vocal species. It produces a high-pitched whistle throughout the night which is considered by some residents to be a nuisance (Hailey and Cazabon-Mannette 2011). Hedges (1993) suggested that there may be some acoustic interference with other frogs.

*Eleutherodactylus johnstonei*, Tobago, November 2012.

On 6 November, 2012 the author heard one frog calling on the grounds of the Magdalena Hotel in Lowlands, Tobago. The frog was calling from a potted palm within a screen house at grid reference 0742983E, 1133056N. The call was recorded and the frog captured and photographed. Two additional individuals were heard calling in the distance from the residential area of the property.

The frog was euthanized in a benzocaine bath before being preserved in 95% ethanol and lodged in the University of the West Indies Zoology Museum at St. Augustine, Trinidad, accession number UWIZM.2012.34. The species was initially identified by the vocalisations and the specimen confirmed by John Murphy.

This is the first documented record of *E. johnstonei* from Tobago. There is one anecdotal record by Stephen Smith (personal communication) of the frog occurring at the Scarborough Port since November 2008, but no specimens were collected.

It is likely that many of the plants used by the hotel and the surrounding residential area originated in Trinidad and it is possible that the frog was introduced via potted plants. However, the presence in the potted plant may be coincidental and does not necessarily suggest that the frog had just arrived.

## ACKNOWLEDGEMENTS

The author would like to thank Mike Rutherford for preparing the specimen, John Murphy for identifying the specimen and Stephen Smith for sharing his observation of the species at the Scarborough Port.

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**Graham White**
*g.whitett@gmail.com*

# Report on two Checkerbelly Snakes, *Siphlophis cervinus* from Trinidad, West Indies

The Checkerbelly Snake, *Siphlophis cervinus* (Laurenti 1768) is a comparatively rare snake found throughout northern South America from Panama down to Bolivia and across to Brazil. It is also present in Trinidad but with very few specimens having been encountered (Murphy 1997; Boos 2001).

The first sighting was made by Russell Thomas, an employee of the University of the West Indies (UWI), at approximately 800 h on 10 September, 2012. While standing outside his house in Calvary, Arima Valley, Trinidad, he saw the snake crawling up the brick wall of the house about one metre off the ground; there was no vegetation next to the wall but the garden backs on to secondary forest. This species has been recorded from the Arima Valley before but not for several years.

The snake was captured and taken to the UWI campus at St. Augustine where it was eventually given into my care. The snake was kept in a plastic terrarium with a substrate of leaves, twigs and wood shavings and given access to fresh water in a shallow bowl. Over a period of three months the snake was fed approximately twice a week on a variety of small lizards. These included *Gonatodes vittatus*, *Gymnophthalmus underwoodi*, *Hemidactylus mabouia* and *Anolis aeneus*. All lizards were placed into the tank in the evening between 1800 h and 2000 h and although no direct predation events were observed, the lizards would be gone in the morning. Other reports tend to favour a more nocturnal activity pattern as well (Murphy 1997). During the three-month period, the snake shed its skin twice with no complications.

The second sighting was made at the North Deck, Paramin, north-west Trinidad at approximately 1900 h on 8 June 2013. Again there are records of this snake from this area but not for several years.

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**Mike G. Rutherford**
University of the West Indies Zoology Museum,
Department of Life Sciences,
The University of the West Indies,
St. Augustine, Trinidad and Tobago.
*mike.rutherford@sta.uwi.edu*

# Corrigendum

In "First record of the opossum *Didelphis marsupialis* from the island of Gaspar Grande off north-western Trinidad, Trinidad and Tobago" (Charles *et al*. 2012), we submitted our observation as the first published record of the presence of *D. marsupialis* for the satellite island of Gaspar Grande, when in fact there is a reference to the presence of what is most likely this species published in non-scientific literature prior to our record. de Verteuil (1993) makes brief reference to the 'manicou' as the only non-volant mammal found on the island, but gives no details regarding the source of the reference. Our peer-reviewed record (Charles *et al*. 2012) serves to substantiate de Verteuil's claim (de Verteuil 1993).

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**Stevland P. Charles**
Department of Biology,
Howard University,
Washington, DC 20059.

# Tenth Report of the Trinidad and Tobago Rare Birds Committee: Rare Birds in Trinidad and Tobago 2012

**Martyn Kenefick**
36 Newalloville Ave., San Juan, Trinidad and Tobago.
*martynkenefick@hotmail.com*

The abundance and status of our avifauna, especially the common species, are comparatively well-known and described in the available guides (ffrench 2012; Kenefick *et al.* 2012). Of the rarer species, our knowledge is less complete yet rare species comprise 44% of our bird species richness. For these rare species, it takes years of accumulated records to assess status or changes in abundance. Without formal review and archiving, records would be haphazard and confidence in them low, making trends difficult to detect or interpret. The Trinidad and Tobago Rare Birds Committee (TTRBC) was established to assess, document and archive the occurrence of rare or unusual birds in Trinidad and Tobago and thus enable reliable long-term monitoring of our less known species. Archived records including photographic submissions number 937 at the end of 2012.

The Committee has now assessed 104 records submitted during 2012, representing 58 different species. One additional species has been added to the official list of birds of Trinidad and Tobago and two further species have been documented from Tobago for the first time. Of the submissions assessed, in only ten cases did the Committee find the identification inconclusive. The records presented below follow the nomenclature and taxonomic order of the American Ornithologists Union South American Checklist, December 2012.

The Committee comprises the following members: Martyn Kenefick (Secretary), Geoffrey Gomes, Floyd Hayes, Bill Murphy, Kris Sookdeo and Graham White. Records are held at 36 Newalloville Ave., San Juan. Previous reports of this Committee were prepared by Hayes and White (2000), White and Hayes (2002) and Kenefick (2005, 2007, 2008, 2009, 2010, 2011, 2012).

The list of species considered by the TTRBC, together with the Official List of the Birds of Trinidad and Tobago, and details of all accepted records by the Committee can be accessed from our new website at http://rbc.ttfnc.org. We urge finders to document and report their sightings to us.

## RECORDS ACCEPTED

Four **White-faced Whistling-Ducks, *Dendrocygna viduata*** were photographed at Caroni Rice Project on 9 September, 2012, with two birds remaining until 19 September (NL *et al.*). This record forms part of an established pattern of occurrences for this austral wanderer both in terms of site and date.

A **Green-winged Teal, *Anas crecca*** in non-breeding plumage was found associating with a small flock of Blue-winged Teal, *A. discors* at Lowlands, Tobago on 5 November, 2012 (GW). This is the second documented record for Tobago. There have been no records from Trinidad for 14 years.

Three **Lesser Scaup, *Aythya affinis*** in immature or female plumage were photographed on Caroni Rice Project on 29 November, 2011 (JD, TD). This migrant from North America has been seen on several occasions in recent years from Tobago, but this is the first Trinidad sighting since 2003.

Two **American Flamingo, *Phoenicopterus ruber*** were photographed on the tidal mudflats at Orange Valley on 25 February, 2012 (NL). By early July five birds were present and three remained until at least 17 July. This species has now been observed on the west coast in six of the last nine years.

A sub-adult **Gray Heron, *Ardea cinerea*** was found at Bon Accord sewage ponds on 12 March, 2012 (MK). An individual with almost identical plumage was photographed at the same locality on 19 November, 2011. However, the absence of sightings during the interim period at this very well watched site suggests a different individual. There have now been sightings of this wanderer from Eurasia in seven of the last 12 years.

At least two **Little Egret, *Egretta garzetta*** were seen and photographed along the Diego Martin River on 25 March, 2012 (FO, SP) with one bird present at least until 21 December. An additional bird was photographed in a canal close to Piarco Airport on 29 December, 2012 (FO). These are the first documented sightings in the last four years

A pair of **Glossy Ibis, *Plegadis falcinellus*** was photographed and observed mating on 8 September, 2012 in a flooded field at Caroni Rice Project (NL). They were regularly observed flying across the highway to roost in Caroni Swamp and were last seen on 29 September. This species is an occasional wanderer from mainland South America, and has been recorded in Trinidad in eight of the last 17 years.

There are indications of a small population of **Hook-billed Kites, *Chondrohierax uncinatus*** in the forested areas of Cat's Hill. One was photographed on both 1 and 12 August, 2012 and up to three birds were found between

26 and 31 December, 2012 (KS). Two birds were seen separately on 17 and 27 June, 2012 at Point Gourde (KS, MK, FO) indicating a possible resident pair (MK, KS, FO) and a further individual was photographed soaring over Chacachacare on 16 September, 2012 (KS *et al.).* This raptor remains a scarce and localised resident in Trinidad and a casual wanderer to Tobago.

An adult **White-tailed Hawk, *Geranoaetus albicaudatus*** was photographed close to Kernahan Village in Nariva Swamp on 4 January, 2012 (FO, MR) (Plate). This is a rare wanderer to freshwater marsh from mainland South America and only the fifth documented record in the last 12 years.

Historically, **Rufous-necked Wood-Rail, *Aramides axillaris*** was thought to be restricted to the Caroni Swamp mangrove together with small isolated populations on the Bocas Islands. Following a sighting north of Manzanilla in 2009 (Kenefick 2010), one was found in coastal mangrove at Guayaguayare on 21 November, 2012 (GW) and three birds were seen close to Point Fortin, loosely in association with Gray-necked Wood-Rail*, A. cajaneus,* on 22 December, 2012 (KS).

Following a request in our eighth report (Kenefick 2011), documentation for three **Paint-billed Crakes, *Neocrex erythrops*** photographed close to the Aripo Agriculture Station on 5 July, 2010 has been submitted (MC, DR *et al*.). Two birds were seen in watercress beds on Sellier Rd. whilst a third was picked up, uninjured but exhausted, from the roadside on Eastern Main Road. This completes our understanding of an unprecedented arrival of this species, together with other austral wanderers in 2010. Previously, only two live birds and one roadside corpse had ever been documented for Trinidad.

An adult **Azure Gallinule, *Porphyrio flavirostris*** was found on a vegetated sewage pond at Lowlands, Tobago on 10 February, 2012 (MC, NG) (see plate). This is the first record for Tobago.

A **Yellow-breasted Crake, *Porzana flaviventer*** was seen at Lowlands, Tobago on 16 January, 2012 (MKe, FO). This species is widespread in suitable habitat in Trinidad but this is just the second record for Tobago.

Two **Killdeer, *Charadrius vociferous*** were photographed feeding in a vacant lot within a housing development at Carapichaima late on 9 February, 2012 (SP) and they were gone by first light the following morning (see plate). This is a very rare visitor to Trinidad and Tobago from North America, with just three previous sightings in the last 17 years, all January - March.

Three **Double-striped Thick-knee, *Burhinus bistriatus*** were found sheltering in a lightly wooded grove at Trincity Golf Course on 13 July, 2012 (RN). They remained until 29 July at least. A further individual was found feeding along a dusty track on Caroni Rice Project on 2 September, 2012 (MK). An occasional wanderer from mainland South America, there are just six documented records in the last 17 years.

Two **Buff-breasted Sandpipers, *Tryngites subruficollis*** were found in a flooded grassy field on Caroni Rice Project on 3 October, 2012 (MK, FO) (Plate). Three days later, they had increased to a flock of eight birds, the largest number ever observed in Trinidad and Tobago.

A juvenile **Wilson's Phalarope, *Phalaropus tricolor*** was photographed amongst a mixed flock of shore birds in a flooded field on Caroni Rice Project on 8 September, 2012 (MK, RA). Less than a week later, on 13 September, another juvenile was found feeding in a sewage pond at the Lowlands complex, Tobago (MK). These are just the fifth and sixth records of this migrant from North America in the last 17 years. Their usual migration route is far to the west of Trinidad and Tobago.

A juvenile **Pomarine Jaegar, *Stercorarius pomarinus*** was taken into care at Pointe-à-Pierre Wildfowl Trust in March 2012 and subsequently released after veterinary care (PaPWT). Whilst there is a stable wintering population of this deep water migratory sea bird between St. Lucia and St. Vincent, this is just the fourth documented report in the last 17 years.

A first winter plumaged **Franklin's Gull, *Leucophaeus pipixcan*** was photographed amongst the roost of Laughing Gulls, *L. atricilla* at Orange Valley from 26-28 January, 2012 (NL). A total of ten have now been identified in the last 17 years. However their close similarity to and association with the Laughing Gulls on the west coast of Trinidad undoubtedly means that they are under-recorded.

A winter plumaged, adult **Gull-billed Tern, *Gelochelidon nilotica*** was seen foraging over the entrance lake at Lowlands, Tobago on 24 October, 2012 (BM *et al*.). This sighting is the first documented record for Tobago.

During the review period, we received numerous reports of **Scaly-naped Pigeons, *Patagioenas squamosa*** from both Little Tobago and the adjacent scrub forest at Batteaux Bay, Tobago. The only documented sighting was of a single bird on Little Tobago on 9 July, 2012 (GW, MK). It is estimated that up to a dozen birds have now settled on the island.

Up to three **Scaled Doves, *Columbina squammata*** likely to be a pair and offspring were photographed on 24 September, 2012 (KS) close to the Pitch Lake at La Brea, in the same area that they were seen in November 2011 (see plate). This is the first documentary evidence of the species breeding on mainland Trinidad.

A **Striped Owl, *Pseudoscops clamator*** was found on the evening of 3 March, 2012 along the leeward road close to Bloody Bay (MKe). It was then seen on several

occasions during the month. This species is the scarcest and certainly the most elusive of Tobago resident birds. It has never been documented from Trinidad.

A **Short-eared Owl,** ***Asio flammeus*** was photographed in a recently ploughed field on Caroni Rice Project on 26 May, 2012 (NL, SP) (see plate). This is the third documented record of this species for Trinidad. All three were of the race *pallidicaudus* from northern South America, all found at the same general location and all within the last 10 years.

A **Fork-tailed Palm-Swift,** ***Tachornis squamata*** was observed over Lowlands Golf Course, Tobago on 14 September, 2012 (MK). This is just the second documented record for Tobago in the last 17 years of this common Trinidad resident.

A **Brown Violetear,** ***Colibri delphinae*** was photographed visiting sugar water feeders in Speyside, Tobago on 24 November, 2012 (NG, BW). This is just the second documented record for Tobago.

Six different **Aplomado Falcons,** ***Falco femoralis*** were identified during 2012 as follows: single birds were seen at the Caroni Rice Project on 19 June (NL, SP) and 14 August present until 19 September at least (FO); Demerara Road, Arima on 16 August (CC); close to Golconda on 30 August (VJ); Caltoo Trace on 24 September (MK, GW); and finally at Waterloo on 20 December (SP). This is the highest number on record for this seasonal visitor from mainland South America. It has been recorded almost annually during the last 15 years with most records falling between mid-June to late October coinciding with the passage of small shorebird migrants through the islands.

The number of **Small-billed Elaenias,** ***Elaenia parvirostris*** found in Trinidad continues to increase. There were no sightings in 2011, but 11 birds were documented during the review period as follows: up to four birds were feeding on Black Sage berries at South Oropouche from 2 June, 2012 for several weeks(KS *et al.*); one was found on the ridge above La Pastora Village, Lopinot Valley on 10 June, 2012 (GW); up to five present in Mouville wetland, Guayaguayare on 19 August (GW); and a late individual seen in South Oropouche on 28 October (BM *et al.*). This species was observed in 2007 after many years of absence. Since then 20 birds have been documented. Whilst increased observer awareness has obviously contributed to the situation, there appears to be a genuine northward movement in the non-breeding range.

Individual **Variegated Flycatchers,** ***Empidonomus varius*** were found at Asa Wright on 22 July, 2012 (AS, FM), Aripo Agriculture Station on 14 August, 2012 (FO) and Talparo on 17 August, 2012 (MK). Of the ten sightings of this austral migrant in the last 12 years, nine have been during the period 8 June - 17 August.

An adult **Southern Rough-winged Swallow,** ***Stelgidopteryx ruficollis*** was identified amongst a mixed flock of Caribbean Martin, *Progne dominicensis* and Bank Swallow, *Riparia riparia* hawking insects over Bon Accord sewage ponds on 3 February, 2012 (BM *et al*.). Some eight months later, on 24 October, a single bird was found at the same site by the same observer. It is possible, if rather unlikely, that both sightings refer to the same individual bird at this well watched birding site. These are the second and third sightings in Tobago for the past 17 years.

For the third year running, **Lesson's Seedeaters,** ***Sporophila bouvronides*** has been found in suitable breeding habitat in south Trinidad. Throughout August 2012, up to five singing males and a similar number of birds in female or immature plumage were photographed in forest edge (KS *et al*.). Due to inevitable pressure from bird catchers, precise details of the location are being withheld.

At least ten adult male and several female or immature plumaged **Lined Seedeaters,** ***Sporophila lineola*** were photographed feeding on an area of guinea grass at South Oropouche, 21 July, 2012 (MK, SP, FA). This austral wanderer has been found annually in the agricultural and freshwater marshland of south-west and eastern Trinidad since it was first recorded in 2007.

There has been a steady increase in the number of **Yellow-bellied Seedeaters,** ***Sporophila nigricollis*** across north-west and north-central Trinidad over the past few years. Documented sightings during the review period included pairs at Sellier Road, Aripo on 1 February, 2012 (KG); Mt. St. Benedict on 17 February, 2012 (PC); and upper Lopinot Valley on 2 June, 2012 (GW, MK). Single males were photographed north of Caroni Swamp on 29 March, 2012 (FO) and Surrey Village, Lopinot on 5 March, 2012 (GW), whilst at least four birds were found on Monos Island on 26 June, 2012 (FO). Finally, at least three males and two females were found on Chacachacare on 16 September, 2012 (KS).

An unprecedented six sightings of **Summer Tanagers,** ***Piranga rubra*** were documented during 2012 and there was a late report from 2009. One adult male at Las Lapas track was found preening on the same tree and by the same observer (FO) on 2 January and 30 December, 2012. A female or immature was photographed on the Blanchisseuse Road above Paria Junction on 8 January, 2012 (FM, AS). An adult male was seen from the Bloody Bay lookout, Tobago on 2 April, 2012 (PD, WB) and a further two males were photographed along Lalaja Trace on 11 November (SP) and Morne Bleu on 23 December (FO). Additionally, a female was extensively photographed from Surrey Village, Lopinot, initially on 22 December, 2009 (GW). There have been seven records of this migrant from continental North America in the past 12 years, most

within the period November to April.

An immature or adult female **Scarlet Tanager, *Piranga olivacea*** was photographed along the Blanchisseuse Road, close to Morne la Croix, on 2 November, 2011 (JD,TD). Whilst almost annual on its northbound migration, this is just the second occasion one has been found travelling southwards, the previous occasion being at Crown Point, Tobago in November 2006.

An adult male **Orchard Oriole, *Icterus spurious*** was photographed at Carli Bay on 28 February, 2012 (CF) and remained until at least 6 March, 2012 (see Plate). There was one prior record of this migrant from North America for Trinidad in December 2006.

A male **Golden-winged Warbler, *Vermivora chrysoptera*** in non-breeding plumage was seen on Little Tobago island on 10 June, 2012 (NG). Coincidentally, the only other record for Tobago was equally late for a migrant in June 2001.

A male **Cerulean Warbler, *Dendroica cerulean*** was identified in Arena Forest on 29 November, 2012 (AB, KC MRo). This is the second record for Trinidad and Tobago of this globally threatened migrant from North America. The first was in November 2000.

A male **Cape May Warbler, *Dendroica tigrina*** was photographed within the grounds of Blue Waters Inn, Tobago on 25 November, 2012 (BW). This species is an extremely rare migrant from North America with just three records in the last 17 years.

An adult female **Bobolink, *Dolichonyx oryzivorus*** flew over an area of freshwater marsh in South Oropouche on the exceptionally late date of 24 June, 2012. All previous documented sightings of this migrant from North America have occurred between early October and early May.

An immature female **Great-tailed Grackle, *Quiscalus mexicanus*** was photographed at Carli Bay on 22 July, 2012 (FA). It loosely associated with a resident flock of Carib Grackles and was present until the year end (see plate). Its known range is the western USA, Central America, western Caribbean islands and is gradually spreading along the Venezuelan coastline. This is the first record for Trinidad and Tobago. Its origin in Trinidad is possibly ship assisted.

## ADDITIONAL RECORDS

Acceptable records were also received for a further 24 sightings of the following species whose status has already been established: **Masked Duck, *Nomonyx dominicus;* Rufescent Tiger-Heron, *Tigrisoma lineatum;* Crane Hawk, *Geranospiza caerulescens;* Rufous Crab-Hawk, *Buteogallus aequinoctialis;* Great Black-Hawk, *Buteogallus urubitinga;* Black Hawk-Eagle, *Spizaetus tyrannus;* Crested Caracara, *Caracara cheriway*** and **Black-whiskered Vireo, *Vireo altiloquus*.**

## INTRODUCED SPECIES

A small colony of **House Sparrow, *Passer domesticus*** was identified within the Port of Point Lisas complex on 19 November, 2011 (FA). At least four active nests were discovered during 2012. The Wildlife Section of the Forestry Division is monitoring the containment of this invasive species.

## ESCAPED CAGE AND AVIARY SPECIES

During the review period, a number of reports were received of **White-eyed Parakeets, *Aratinga leucophthalma*** from Port of Spain, Paramin and Couva; **Red-and-green Macaws, *Ara chloropterus*** from localities on the south-west peninsula; and a **Village Weaver, *Ploceus culcullatus*** from Caroni Rice Project.

## INCONCLUSIVE RECORDS

Submissions of the following species were deemed inconclusive: **Crane Hawk, *Geranospiza caerulescens;* Great Black-Hawk, *Buteogallus urubitinga;* American Coot, *Fulica americana;* Scaly-naped Pigeon, *Patagioenas squamosa;* Amazon Kingfisher, *Chloroceryle amazona;* Caribbean Martin, *Progne dominicensis;* Indigo Bunting, *Passerina cyanea*** and **Black-and-white Warbler, *Mniotilta varia*.**

## NOMENCLATURE CHANGES

Part of the mission statement of the SACC is to create a standard classification, with English names, for the birds of South America. This is subject to constant revision by the proposal system to allow incorporation of new data. As a result, the following nomenclature change was made in 2012:

***Gray-lined Hawk, *Buteo nitidus*** (formerly Gray Hawk)

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### Legends to Plate

a. White-tailed Hawk, Kernahan Village, Nariva Swamp, 4 January, 2012. Photo: M. Rochford.
b. Azure Gallinule, Lowlands, Tobago, 10 February, 2012. Photo: M. Coleman.
c. Killdeer, Carapichaima, Trinidad, 9 February, 2012. Photo: S. Parasram.
d. Buff-breasted Sandpiper, Caroni Rice Project, 3 October, 2012. Photo: N. Lallsingh.
e. Scaled Dove, La Brea, 24 September, 2012. Photo: K. Sookdeo
f. Short-eared Owl, Caroni Rice Project, 26 May, 2012. Photo: N. Lallsingh.
g. Orchard Oriole, Carli Bay, 6 March, 2012. Photo: G. White.
h. Great-tailed Grackle, Carli Bay, 24 August, 2012. Photo: G.White.


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# Collections of Lepidoptera from Trinidad and Venezuela by Ralph du Boulay Evans (1891–1929)

The Lepidoptera collection of the Natural History Museum, London (BMNH) includes material labelled from Trinidad collected by R. du B. Evans. In preparing my account of the Hesperiidae of Trinidad (this issue and previous papers), I have seen occasional specimens in the BMNH of a small number of such specimens, mainly of the larger species of Hesperiidae. The ones I have seen do not have original locality labels, but were labelled undated from Trinidad, with the collector (R. du B. Evans) and the BMNH Accession Number (1934-29) on a single printed label. W.H. Evans curated the Hesperiidae in the BMNH collection as coming from Trinidad and included them in his listings of the BMNH holdings (Evans 1955 and earlier volumes). Until recently I had no reason to question their provenance (e.g. Cock 2003).

I recently read Bristow's (1991) revision of the genus *Opsiphanes* (Nymphalidae, Brassolini). In this, Bristow noted R. du B. Evans specimens labelled Trinidad in the BMNH, which seemed unlikely to have come from the island. Specifically he noted one specimen of *O. tamarindi mesomerista* Bristow labelled Trinidad, and one of *O. quiteria badius* Stichel labelled Campo Castillo, Trinidad. Neither species is otherwise known from Trinidad, while the two subspecies are restricted to further west in Venezuela, Colombia and Panama. As the late Julius Boos pointed out in Bristow (1991), Campo Castillo is not a recognised Trinidad locality, and Bristow concluded that both these specimens were mislabelled as coming from Trinidad.

Some internet searching revealed that R. du B. Evans was Ralph du Boulay Evans, who played cricket in the UK, 1912–1914, trained as a geologist at Cambridge University, served in the army in World War I, and worked as a geologist after the war until his death in a car crash in California in 1929 (Sandberg 2013, Wikipedia 2013).

His collection of South American butterflies and moths was donated to the BMNH in 1934, together with two notebooks, now in the BMNH Entomological Library. I examined these notebooks recently. One covered the period December 1921 to April 1922, and is a list of captures of butterflies and moths in Trinidad. In December 1921 Evans collected in Port of Spain (mostly Chancellor Road), but from late December collecting was all in Central and Southern Trinidad (Brasso, Tabaquite, Point Fortin, Piparo Road, West Brasso Junction, Williamsville, west of Moruga, Devils Woodyard, Mayo Village, Cunapo Southern Road, Sangre Grande, Tortuga? Almandez blocks, Dunmore Hill, Morne Diablo Road, Rio Claro Forest). The list covers 514 butterflies and 508 moths, making a total of 1,022, although some were of more than one individual of the same species.

The second notebook covers 1923-1925 and sequentially lists captures (many of them moths at light) near Lake Maracaibo, western Venezuela (including Colon District to the south-west of Maracaibo City and Campo Castillo), followed by a spell at Willemstad, Curaçao, in 1924, and then another in Venezuela at Mene Grande on the east side of Lake Maracaibo. It seems a reasonable assumption that these were all field locations connected with Evans' work as an oil geologist. This notebook has 1,041 entries, but they are not broken down into butterflies and moths as they were in the Trinidad note books.

Very few butterflies and no moths were identified in either notebook and most are given as local names from Trinidad, e.g. 'the Trinidad Morpho', comparisons with British butterflies and moths, or by family, often qualified by an adjective, e.g. grey hawkmoth.

I also examined the BMNH accession records for this donation (BMNH Accession Number 1934-29), and learned that the material was recorded as all from Trinidad, comprising 1,359 moths, and 831 butterflies in two lots of 735 and 96, making a total of 2,190. From these numbers, which are a close match to the total number of records in both notebooks, and the labelling of *O. quiteria badius* from 'Campo Castillo, Trinidad', when in fact Campo Castillo is near Maracaibo, it seems rather likely that Evans' entire collection was labelled as coming from Trinidad, when in fact only half did. Hence, all R. du B. Evans material in the BMNH labelled Trinidad with no locality must be considered doubtful and could equally be from western Venezuela (as for the two *Opsiphanes* spp. mentioned above) or Curaçao.

Accordingly, I reviewed my notes on Hesperiidae material in the BMNH. These are not comprehensive, and for many sections of Hesperiidae, in the case of specimens labelled simply Trinidad, I would not normally have noted the name of the collector unless it was an unusual specimen. Nevertheless, I have noted that R. du B. Evans material in the BMNH includes specimens of *Astraptes apastus* (Cramer), *Narcosius parisi* (Williams), *Nascus paulliniae* (Sepp), *Cymaenes tripunctus theogenis* (Capronnier) and *Aides dysoni* Godman. All of these species are known from Trinidad from the work of other collectors, apart from the last. The inclusion of *A. dysoni* in the Trinidad list is based on a single specimen in the BMNH collected by R. du B. Evans, listed by W.H. Evans (1955) and treated by Cock (1982, 2003). In 2003, I wrote 'There is no reason to doubt the validity of

this record, but confirmation would be desirable' (Cock 2003). Now, the record should be considered suspect and *A. dysoni* not considered to occur in Trinidad until other specimens may be located.

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**Matthew J.W. Cock**

*m.cock@cabi.org; mjwcock@btinternet.com*

# Of Snakes and Zoos: The Life of Hans Boos

Hans Boos E.A. is a long-time member and past president of the Trinidad and Tobago Field Naturalists' Club, and author of the definitive work on the snakes of Trinidad & Tobago (Boos 2001). His younger brother Julius (1946-2010) was also a noted naturalist. The following biographical article is mostly drawn from an interview conducted in Trinidad in July 2011, transcribed by Jo-Anne Sewlal and Enid Nobbee. The full interview is archived at the University of the West Indies.

Hans was born in 1939 at the onset of WWII. His father, a self-taught amateur botanist, often took him into the savanna near their house in Port of Spain, where Hans got his first interest in natural history at a very young age. Finding the King Swallowtail butterfly (*Papilio thoas*) laying its eggs on a Bois Chandelle (*Piper* sp.) bush, they brought the caterpillars home and fed them leaves. They were able to watch the caterpillars grow, pupate and emerge as butterflies. They also brought home caterpillars of the Orange Dog butterfly (*Papilio cresphontes*), which feed on citrus, to follow their metamorphosis.

There was always a naturalist component in their lives. In the ponds in the savanna were tadpoles of the giant toad (*Bufo marinus*). They would keep them in a bottle and observe their metamorphosis. And then they began keeping fish, mainly guppies (*Poecilia reticulata*). There might be a tortoise in the bathroom or a squirrel in a cage, and they always had birds. Their mother became a sort of local veterinarian for sick or wounded animals. People would bring them to her, and she would dress their wounds. Hans went fishing with his father and uncles, sometimes for an entire weekend, and so became familiar with many kinds of marine fish.

In roaming about an old coconut estate, Hans and his brother became aware of *Anolis* and *Polychrus* lizards. To their later regret, they read a book that explained how to make blow guns and blow darts. Lizards, as the natural targets, suffered a great many losses in this way, although their father strictly forbade them ever to shoot a bird. Their life was very bush-oriented, and for the first time snakes came into Hans's life. He was able to keep them in cages and watch them feed, a rather gripping thing to watch.

After secondary school, the question of further education arose. It seemed natural that he would become a veterinarian, and it was decided that he would study in Edinburgh. His father's company provided a paid vacation to Britain every three years. The family went by boat to Bristol, then drove to London, visited the London Zoo, and drove on to Edinburgh over a period of a week.

It soon became very plain that he lacked the qualifications to enter university. At the age of 19, he had to go back to school with 14 and 15 year-olds, while on his own in a strange city. He buckled down to give it a try. How-

ever, by the time he had completed Zoology and French, he realized that it would require an additional seven years to qualify as a veterinarian, while his father was close to retirement and would not be able to afford the tuition fees. After two years he gave it up and went home.

Back in Trinidad in 1960, he got a job at Standard Oil. He married Shirley Brash and they had two children, Phillip Anthony and Catherine Marie.

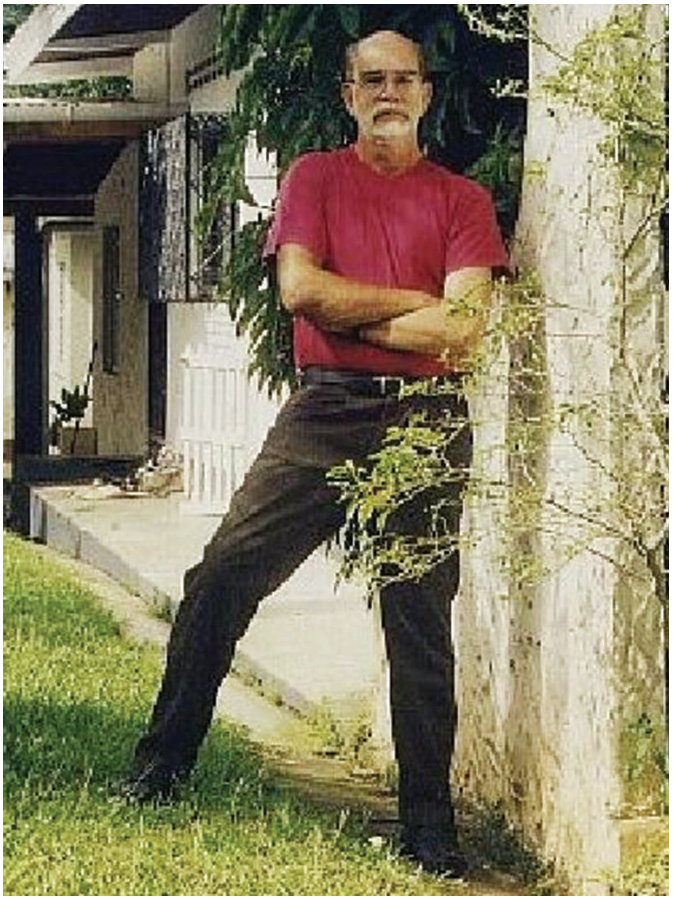
At the national museum he met herpetologist Ludolph Wehekind (1895-1964) and bat specialist Arthur M. Greenhall (1911-1998). Wehekind gave access to his library. He was getting a little too old for fieldwork and saw Hans as someone with the ability and motivation to undertake some of the studies that he (Wehekind) no longer could. Among other things, there were several species of snakes from Trinidad that he had not yet seen. In this situation, Wehekind was only too happy to encourage and mentor Hans as a young amateur herpetologist.

In this period he started to keep snakes in a more serious way. Following in Wehekind's footsteps, he began drawing and keeping notes on what and how often they ate, how often they shed their skin, and their breeding. His first significant original observation was that certain snakes will often engulf their prey without first killing it, so that one could see the prey struggling as it went down. Tree boas, he found, store food in their coils if they have more prey than they can eat at once.

In the ponds he caught frogs, *Mannophryne trinitatis*, to feed his snakes. One day he found a population of thousands of tiny *Bufo* about the same size as the *Mannophryne*. This seemed like a handy source, but would the snakes eat them? He put both *Mannophryne* and *Bufo* toads into a cage with *Liophis* and *Leptodeira* snakes, which went into a feeding frenzy. However, as soon as one caught a *Bufo* it spat it out and began rubbing its mouth against the substrate. There was evidently a sense of taste or smell in the mucosa of the snake's mouth.

In time, his snake-keeping habits became unpopular with the neighbours, so the family moved to a new house where he built a reptile house to accommodate 36 cages and began importing foreign snakes, especially boas and pythons. He had joined the Zoological Society of Trinidad and Tobago and became a member of the council around 1963. At about the same time, he began corresponding with leading specialists, including Ernest E. Williams (1914-1998) of Harvard University.

Very soon after returning from Edinburgh, Hans joined the Trinidad and Tobago Field Naturalists' Club, of which he soon became a leading stalwart. In 2012 he was elected to the rarified group of honorary members. The Club was a very active organization. After it had made a number of field trips to the Bocas Islands in the strait between northern Trinidad and Venezuela's Paria Peninsula, some members proposed that they should look at each island in turn, studying a variety of aspects in a more systematic fashion. Out of this, several members published accounts of the islands within their areas of expertise. Hans treated the reptiles of the Bocas Islands and other small fringing islands.



Hans Boos at home in Trinidad.

The Club took a leading role in efforts to study and protect sea turtles, especially the leatherback turtle (*Dermochelys coriacea*). Archie Carr (1909-1987) came from Florida, gave them tagging tools, and they began searching the nesting beaches at night. The Club also agitated against the government's acquiescence in the Shell Oil Company regularly moving barges through the Caroni Swamp, as the wash was disturbing the Scarlet Ibis (*Eudocimus ruber*) which had stopped nesting there.

After a few years as an accountant at Standard Oil, Hans found that he had no further room for advancement. It was time for a change, and he wanted to do something in natural history. Looking for a promising English-speaking place, he settled on Australia. It was certainly a country of great interest to a naturalist, and Australia had assisted passage for approved immigrants, so in 1968 the family took a ship to Sydney. As it happened, the local Taronga Park Zoo had an opening for a trainee keeper, so Hans had a job right away. He was well prepared, having studied Australian reptiles for years.

Among his successes during this early period as a zookeeper was the first captive breeding of three Australian pythons. He began publishing his results, sending the breeding data to the *International Zoo Yearbook*, as well as two popular articles to *Animals* magazine. One was on the Tobago-endemic lizard *Gonatodes ocellatus* and the other on three colour variants of *Bothrops* snakes from Central America.

The zoo had a special enclosure for Galápagos tortoises (*Chelonoidis nigra*). Hans had never seen one of these in life before, yet something did not look right. There seemed to be two different kinds of tortoises and, by reference to Pritchard's (1967) book, he determined that half of them were not Galápagos but Aldabras (*Aldabrachelys gigantea*). The two species look quite similar to humans and, apparently, to each other, leading to fruitless interspecific mating when kept together. Hans separated the two groups, improved their living conditions and soon after he left Australia, Aldabra tortoises bred successfully in captivity for the first time.

The marriage was not flourishing and Shirley and the children returned to Trinidad. Hans stayed in Australia another two years during which time he advanced to Zookeeper III and at times was effectively the supervisor of reptiles, but then he reached an impasse. After four and a half years, he could go no higher without a degree although he had been studying at night with Australia's leading herpetologist, Harold Cogger.

In the meantime, the curator of the Emperor Valley Zoo had died. With his years of zoo experience and in business, Hans applied. It took the selection committee so long to act that Julius protested to the prime minister, Eric Williams, that they had a very well-qualified candidate in his brother, but were dragging their feet.Through Williams's intervention, Hans was appointed.

He had a month to report for duty, with funding to tour zoos along the way. Together with Martha McMahon, who would become his second wife, he island-hopped from Sydney to Fiji and Hawaii and then to San Francisco and various other American cities, visiting major zoos along the way. As the new curator in Trinidad, he received the VIP treatment at every zoo he visited.

In 1973, the Emperor Valley Zoo had been directionless since the previous curator's death two years earlier, and it showed. There were no paved pathways and almost no fences, no water supply or drainage, no preparation room for the animals' food. Furthermore, the zoo was very short-staffed and had poor work practices. Worst of all, there were few animals, some of which had been ill-advisedly acquired.

Surveying the situation, Hans had to wonder if he had made a mistake in seeking the job. Still, he set to trying to sort out the physical plant, work plan and staff problems, before attending to improving the zoo's set of animals. Among the infrastructural improvements were drainage for the entire zoo, the pathways and roads that exist today, a complete perimeter fence, a complete kitchen with freezers, and underground storage for 64,000 gallons of water.

In this he had the advantage of public goodwill, including fairly generous financial assistance from the government. There was also help from the private sector. Petitioning local businesses, the zoo received 100 hollow clay bricks from a hardware store, for example, while other merchants contributed such things as rolls of wire and a lawnmower.

Using the Hawaii Zoo as a model, Hans set out to design a specifically tropical zoo with an emphasis on Neotropical animals, supplemented with others from elsewhere for comparison or because they were charismatic and did well in captivity. Some species turned out to be unsuitable for this latter reason. The zoo made a number of attempts to keep Silky Anteaters (*Cyclopes didactylus*), for example, but they would not eat properly.

Hans was building an international reputation which aided in acquiring new animals by exchange or gift. Among others were three chimpanzees through his good relationship with Metro Toronto Zoo and ostriches from the Oklahoma Zoo. He also began making trips to Suriname where, for example, he arranged to get a pair of jaguars and several capybaras (*Hycrochoeus hydrochaeris*) in exchange for surplus. At the same time, they were divesting species that did poorly or were more trouble than they were worth, such as bison and red deer.

The zoo also began to breed some species, either for release into the wild or to enlarge and improve its holdings. As an example, its green monkeys (*Chlorocebus sabaeus*) were all from a single (introduced) population in Barbados and showed the effects of inbreeding. This was rectified by introducing new breeding stock from other populations.

Hans Boos's main literary output to date is his snake book (Boos 2001). He began work on it in 1973, gradually compiling notes, photos and references, and then earnestly got to work on it in 1993.

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**Christopher K. Starr**[1] and **Jo-Anne N. Sewlal**[2]
Department of Life Sciences,
The University of the West Indies, St. Augustine,
Trinidad & Tobago.
1. *ckstarr@gmail.com*
2. *joannesewlal@gmail.com*

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