



University of Glasgow

**University of Glasgow Exploration Society
Tobago Expedition 2013
Preliminary Report
20/09/2013**



Overview of Expedition

Tobago, part of the Republic of Trinidad and Tobago, is one of the smallest Caribbean islands yet, home to incredible biodiversity for its size. The Main Ridge forest reserve in the north of Tobago is the first legally protected area of rainforest in the world and has remained untouched since protection was officially established. Additionally, the aforementioned Main Ridge reserve receives a greater volume of rainfall throughout the year than the south of the island. As such, biodiversity has been able to thrive on Tobago. This includes many species of bird, mammal, herpetofauna and invertebrates. The rainforest is highly accessible with several well-established trails. Many tourism companies offer guided tours of Main Ridge.

However, Tobago is not only of zoological importance due to its preserved rainforest. It is one of the most important Caribbean islands for the nesting of the hawksbill marine turtle (*Eretmochelys imbricata*) and the leatherback marine turtle (*Dermochelys coriacea*) between April and September. Green marine turtles (*Chelonia mydas*) have been decreasingly sighted on Tobago over the years due to unsustainable poaching by local people – by both foot and boat. Unfortunately, now that the green turtle has been abused as a resource to the point where individuals are no longer nesting, local attention has turned to the hawksbill turtle which has been subject to considerable poaching in recent times.

Previously, University of Glasgow Tobago expeditions were focussed on leatherback turtle conservation with the non-governmental organisation Save Our Sea Turtles Tobago (S.O.S. Tobago). This NGO is now receiving a high intake of volunteers both locally and internationally, which the younger NGO North East Sea Turtles (N.E.S.T), which patrols north-eastern beaches primarily used by hawksbill turtles, is sorely lacking. Thus, the Glasgow University Tobago Expedition was redesigned for 2012. The expedition offered to volunteer with N.E.S.T. and a new relationship, supported by S.O.S. Tobago, was established. Following a successful season in 2012, the expedition was renewed for 2013 and the relationship with N.E.S.T. strengthened with both parties hoping it will continue in the future.

The move to the north of the island was not only beneficial for N.E.S.T – most of whose members are fishermen unable to patrol every night. In addition to allowing expedition team members to continue their marine turtle conservation efforts, new research on the rainforest fauna could be established. Research on the native froglife was designed for the Tobago expedition by Professor J. Roger Downie, with particular focus on vulnerable or endangered species. Amphibian declines are a major global ecological issue as amphibians are excellent indicator species of environmental health. However, there are many factors which threaten populations and diagnosis for decline is exceedingly difficult. Consequently, scientists need to monitor populations using different survey techniques to provide population assessments year-to-year and identify variables which may be tested as a cause of decline. Only from consistent monitoring can recommendations to halt decline be made and implemented.

In 2013, our frog research was further developed with continued investigations on the population, distribution and ecology of our six target species (*Mannophryne olmonae*, *Flectonotus fitzgeraldi*, *Hyalinobatrachium orientale*, *Pristimantis charlottevillensis*, *Pristimantis turpinorum*, and *Pristimantis urichi*), all of which are listed by IUCN as vulnerable or endangered. Of these, *F. fitzgeraldi* and *P. urichi* also occur on Trinidad; the remainder are Tobago endemics (with *H. orientale* possibly occurring also in Venezuela). Most of these are forest species, associated with Tobago's Main Ridge. We also carried out a project on tick infestations on cane toads (*Bufo marinus*) to follow up previous work in Trinidad. Furthermore, additional investigations into size variation amongst members of a freshwater fish species in Tobago (*Gobiomorus dormitor*) and the effect of storm events in Tobago on the profile of a key beach for nesting Hawksbill sea turtles were conducted.

Expedition Itinerary

Week 1: Introduction

Day 1: Flight to Tobago and travel to accommodation in Charlotteville.

Day 2: Settling into Charlotteville and meeting N.E.S.T. members.

Days 3 – 7: Introduction to expedition projects; expedition members trained in frog identification and beach patrolling for turtle conservation.

Week 2: Identification of sites suitable for surveys of *H. orientale*, *M. olmonae* and *F. fitzgeraldi*; visit from John Murphy and Mike Rutherford to assist in identification of survey sites.

Week 3: Transects set up at survey sites for *H. orientale*, *M. olmonae* and *F. fitzgeraldi*; training of expedition members in surveying; identification of sites suitable for surveys of *P. charlottevillensis*, *P. turpinorum* and *P. urichi*; beach patrols.

Week 4: beach patrols; surveys for *H. orientale*, *M. olmonae* and *F. fitzgeraldi*; transects set up at survey sites for *Pristimantis* species; visit from Malcolm Kennedy to see how expedition is doing and relay methodology for marine turtle thermoregulation study and nesting phase duration investigation.

Week 5-8: beach patrols; surveys for all six target frog species; visit from Roger Downie in Week 7 to see how expedition is doing, observe expedition research and advise individuals conducting individual research projects.

Week 9-10: beach patrols; frog surveys; driving transects; expedition research finished by middle of Week 10 so team can organise equipment to be stored or brought back to Glasgow.

Research Methods

i) Marine turtle conservation

In order to aid the recovery of endangered marine turtles (primarily hawksbill and occasional leatherbacks), the expedition conducted night patrols on the northern beaches, Cambleton Bay and Hermitage Bay, from 8:00pm to 3:00am every night with patrols occurring every 25 minutes. Upon detection of a turtle before or at 3:00am, patrollers would stay with her until she returned to the sea. Patrollers spoke to any locals who visited the beaches and gathered vital data for marine turtle census.

Upon detecting a turtle, expedition members traditionally followed N.E.S.T. protocol. The turtle was allowed to choose a suitable location for laying without any disturbance (visual or vocal) from patrollers. Once she proceeded to dig, patrollers checked on her periodically to identify when laying had commenced. Upon laying, patrollers then began to work on the turtle. Data gathered included carapace measurements, tag numbers, GPS coordinates of the nest, nest triangulation and barnacle identification. If required, untagged turtles were tagged by patrollers or tags replaced if they were gone or coming off. Similarly, if a turtle chose to lay in an unsuitable area of the beach where the nest may become flooded, nest relocations were conducted by patrollers. As the nesting season progressed, nests began to hatch. Following this, patrollers excavated any hatched nests they found and were trained to identify the cause of why certain eggs hadn't hatched.

Day checks of more remote Northern beaches were conducted when possible to track poaching activity and estimate the number of turtles utilising these beaches. Estimations of turtle nests were made based on tracks whilst poaching events were identified by drag marks on the beach.

The 2013 expedition conducted additional work on marine turtles at the request of Glasgow University staff member Malcolm Kennedy. Expedition team members took measurements of egg temperature using an Infra Red laser thermometer. These served as an indication of internal core temperature of turtles and will be used in a comparative study of marine turtle thermoregulation. Furthermore, team members also recorded the duration of each nesting phase using stopwatches, as there has been little investigative work on this subject with regards to hawksbill marine turtles.

Team members on patrol also recorded parasitism of the eyes and cloaca of hawksbill marine turtles. The eyes were parasitised by large shrimp-like invertebrates whilst the cloaca was by an unknown species of leech. The majority of individuals encountered in the first few weeks of the expedition were in possession of these parasites, which were promptly removed by expedition members where possible. This became a routine aspect of turtle data collection with infection noted when observed. Prevalence and rate of infection by these parasites were then monitored throughout the season.

Data gathered on hawksbills by the expedition and the local NGO N.E.S.T. was used to examine the effect of beach profile on the number of nest relocations which were conducted and the variation in return time between nesting by hawksbill sea turtles. Females of this species usually lay 3 or 4 clutches during a season in which they are reproductively active. The time between clutches can vary between 11 and 20 days – the length of which may be dependent on environmental factors.

ii) Frog research

In order to monitor the targeted species (*Flectonotus fitzgeraldi*, *Mannophryne olmonae*, *Hyalinobatrachium orientale*, *Pristimantis charlottevillensis*, *Pristimantis turpinorum*, and *Pristimantis urichi*), audio surveying and visual encounter surveying were conducted in co ordinance with one another. Follow-up surveys of sites visited in 2012 and establishment of new survey sites occurred on the 2013 expedition. Transects of 25m in length were set up at all survey sites. The total length of a transect route was dependent on environmental factors and anticipated population abundance in a given area of rainforest e.g. Main Ridge forest reserve was expected to have the greatest populations of all three *Pristimantis* species thus the transect route was 225m in total. When establishing transects, GPS coordinates were taken at the start of the 25m (and the end if the transects were not continuous) and environmental factors were observed and noted. Those included were light intensity, volume of leaf litter, tree density, foliage type, canopy type and description of both sides of each transect.

Surveys were conducted in teams of three people and started at varying times from 7:00pm to 9:00pm. Upon entering each 25m transect at survey sites, teams conducted a call count for one minute, from which they estimated the number of individuals they believed to be present. This was based on call frequency and call location. Groups then searched each transect thoroughly for 15 minutes and noted sightings of individuals, specifying species and sex where possible. Driving transects occurred in addition to foot surveys, where team members stopped at numerous points on the roadside around the north of Tobago to conduct audio surveying of all species present.

All sites used for *H. orientale*, *M. olmonae* and *F. fitzgeraldi* in 2012, had follow-up surveys conducted at them. An additional three sites were established for monitoring and assessing populations of these three species. However, for *Pristimantis* species, one of the survey sites was drastically changed from 2012 and actually rather damaged. This particular site was closed off by dense vegetation, which had been cleared from other areas to make way for housing and road development. Unfortunately, it was no longer accessible to patrol members. Subsequently, a new survey site (Cambleton Bay forest trail) was established but again problems were encountered. One 25m transect at this new site experienced clearing of vegetation twice during expedition duration. Expedition members continued to survey the transect as species recovery in this area could be tracked over the remaining expedition time and by future expeditions.

Data will be analysed to create species distribution maps for our six target species and identify any change to populations since 2012 and potential causes.

iii) Other research projects

Detailed observations were made on breeding behaviour, development and hatching success in glass frogs (*H. orientale*), and on levels of tick infestations on cane toads (*B. marinus*) in different habitats. Size variation in freshwater fish (*G. dormitor*) was investigated by river profiling to compare habitat and using traps to sample members of this species for weight and length.

Preliminary Results

i) Marine turtle conservation

All data gathered for marine turtle census will be inputted to the NGO N.E.S.T.'s database and supplied by N.E.S.T. to WIDECAST, the Caribbean-wide network for the protection and monitoring of marine turtles. Furthermore, every adult hawksbill adult turtle that came onto the beach when patrollers were present was tagged with flipper tags from the Marine Turtle Tagging Centre (MTTC), based in Barbados. This ensures WIDECAST can link together all tagging projects that take place. In 2013, N.E.S.T. also received leatherback tags (albeit late into the season), which enabled them to tag any individuals of this species that nested on their beaches.

As N.E.S.T. only first received tags in 2012, it is still too early for any turtles tagged during that year to be returning to Tobago's beaches. This is due to the fact hawksbills lay every 2-3 years. However, as of next year, N.E.S.T. and future Tobago expeditions should witness the return of individuals tagged in 2012 and in future years, those tagged in 2013 onwards. Nonetheless, tags in 2013 (and in 2012) enabled patrollers to identify if a turtle was returning to lay or if it was an individual's first clutch. Additionally, it also allowed the expedition to identify if a turtle had switched beaches, contradictory to the assumption that they have high fidelity to beaches on which they lay.

Patrols served as an effective deterrent against poaching. Unfortunately, there was one poaching event on Cambleton Bay (8/7/13) when the expedition was not on the beach as we were not scheduled to start patrolling until Sunday 9th June. Excluding this event though, there were no further poachings on Cambleton or Hermitage Bay – the two beaches the expedition was responsible for and monitored consistently every night. L'Anse Fourmi, Bloody Bay, Dead Bay, Belmont Bay and Starwood Bay experienced several poaching events as revealed by day-checks of the beaches.

At present, the data for the thermoregulation study and phase duration are unanalysed. However, based on the raw data, it is evident there is substantial variation in egg temperature, and consequently internal temperature, between hawksbill and leatherback marine turtles. Hawksbills tended to be 1-2 degrees lower than leatherbacks and amongst hawksbill individuals egg temperature was seen to vary somewhat. However, egg temperature did not vary widely between a clutch of eggs.

The data for phase duration should yield some interesting results as hawksbill individuals differed greatly from one another in this respect. The only phase consistent among individuals was laying, which usually took 17-18 minutes on average. Excluding this, individuals would vary substantially in which phase they devoted most time to. The longest phase tended to be camouflaging but for other individuals, it was covering up, body-pitting or digging.

As for parasitism of marine turtles, the expedition found rate of infection and prevalence to decrease throughout the season. Re-infection, following removal of the parasites, was very rare. Some specimens of each parasite type were preserved and brought back for identification by N.E.S.T. member Grant Walker. However, they are as yet unidentified.

Lunar cycle and tide elevation are thought to be responsible for variation in return time of hawksbill individuals between laying clutches. This is different to effect of storm events, which were first anticipated to affect return time. Furthermore, the dry weather enabled a large number of turtles to nest on the riverbank where nests will inevitably be washed away should extreme rainfall occur in subsequent weeks. As nest relocations by expedition team members can alleviate this problem, the number of relocations conducted may have been higher than it would be under normal weather conditions. In spite of research into the effect of storm events, Cambleton is such a dynamic beach that we cannot predict exactly how the profile of the beach will change following extreme weather.

ii) Frog research and conservation

The Main Ridge forest reserve possessed the biggest population of *P. urichi* out of the three survey sites monitored by the expedition. The *P. charlottevillensis* populations at Pirates Bay and Cambleton Bay forest trail were relatively consistent with one another, whereas Main Ridge forest reserve had few nights where *P. charlottevillensis* could be heard. There may be cause for concern for this population of this species. After our second consecutive year of searching for *P. turpinorum* and not finding or hearing individuals of this species, it is possible the *P. turpinorum* is on the verge of extinction or extinct.

Survey Site	No. of Field Visits	Species surveyed
Pirates Bay	13	<i>P. charlottevillensis</i> , <i>P. urichi</i> , <i>P. turpinorum</i> , <i>F. fitzgeraldi</i>
Cambleton Bay forest trail	11	<i>P. charlottevillensis</i> , <i>P. urichi</i> , <i>P. turpinorum</i>
Main Ridge forest reserve (Spring trail)	11	<i>P. charlottevillensis</i> , <i>P. urichi</i> , <i>P. turpinorum</i>

Table 2. A summary of the number of field visits made to each survey site utilised by expedition members and which species were surveyed for at each. Field visits were only made at night as the *Pristimantis* species only call during this time of day.

Team member Steven Duncan is responsible for the data analysis of surveys for *H. orientale*, *F. fitzgeraldi* and *M. olmonae* as these species are the subject of his research: ‘An investigation into the population, distribution and ecology of *Mannophryne olmonae*, *Flectonotus fitzgeraldi*, *Hyalinobatrachium orientale*’. He is currently out of the country and will not be back before the preliminary report is due. From his raw data, Steven had expressed concern for *M. olmonae* and *F. fitzgeraldi* as there were few sightings by expedition team members in comparison to last year. He believes this may be due to lack of rainfall this year in comparison with 2012, resulting in many breeding pools for *M. olmonae* drying out. The outlook is better for *H. orientale*, which was sighted regularly and heard frequently. However, sightings were less frequent than last year.

Survey Site	No. of Field Visits in day	Species surveyed	No. of Field Visits at night	Species surveyed
Louis D’or	5	<i>M. olmonae</i>	7	<i>H. orientale</i>
Hermitage River	5	<i>M. olmonae</i> , <i>F. fitzgeraldi</i>	7	<i>H. orientale</i> , <i>F. fitzgeraldi</i>
Doctor’s Road River	5	<i>M. olmonae</i> , <i>F. fitzgeraldi</i>	7	<i>H. orientale</i> , <i>F. fitzgeraldi</i>
Unknown “Mystery” River near Main Ridge	5	<i>M. olmonae</i>	7	<i>H. orientale</i>
Main Ridge forest reserve (Spring trail)	5	<i>M. olmonae</i>	7	<i>H. orientale</i>

Table 1. A summary of the number of field visits made to each survey site utilised by expedition members and which of Steven Duncan’s study species were surveyed for at each.

iii) Other research projects

Expedition members Steven Duncan, Mairi Hilton, Chris Pollock, Melissa Craig and Kirsty Earle all conducted investigations on the 2013 Tobago Expedition. As yet, none have started their data analysis as they are not back in Glasgow until the beginning of university term. Copies of their completed research will be supplied in January with the expedition final report.

Discussion

i) Marine turtle conservation

Tagging projects are a crucial method for census of marine turtles as few other methods have the same longevity as tagging can provide. However, there are several issues with this census method, which the expedition is aware of. Firstly, there are ethical issues with regards to the stress and pain that may be induced on individuals during tagging. It is for this reason that N.E.S.T. and the expedition only tag when a turtle is laying as she is believed to have decreased awareness of her surroundings and substantially less range of movement. Additionally, although patrollers are trained to tag on the first inner flipper pad, they do not tag pads which are very fleshy or pads with barnacles on them. This increases the chance of a tag going on properly and staying on. Nonetheless, despite patroller tagging efficiency, tags may still come off over time due to turtle behaviour in the open ocean, where they feed and rest in coral beds.

There is yet another concern with tags, as they are a potential source for infection of turtles – particularly if they rip the flipper pad and expose more flesh thus attracting harmful bacteria and potential predators. Similarly, perhaps expedition members should not have removed parasites from infected turtles as minor wounds may have been created. However, the benefits of tagging for census of turtle populations are believed to outweigh the ethical concerns and risk of tag loss and expenditure. Furthermore, tagging projects have much greater cost effectiveness when compared with tracking projects which use GPS or data loggers. Furthermore, the assumed “stress” of tagging may be a potential research project for future expeditions using temperature spikes or blood testing to identify increase in stress.

The expedition and N.E.S.T. do not rely on tagging alone to census marine turtles utilising Tobago’s Northern beaches. Patrols are conducted whenever possible. In some cases, this may be every night or in others the occasional night patrol or day check. During day checks, a nest was evident where there were clear in and out tracks visible on the beach, which led to and from a disturbed area of beach. However, nests discovered during day checks were all labelled as estimated lays as patrollers can’t be certain. The only way to confirm these nestings would be to disturb the nest which could result in the death of any eggs discovered.

Patrolling not only enables census through sheer number counts, it is a deterrent to any poaching activity. Many locals do not wish to be seen taking a turtle due to laws which now forbid it and incur monetary fine or imprisonment if the fine can't be paid. Therefore, the presence of expedition members and N.E.S.T on beaches is crucial in protecting nesting individuals, their nests and their hatched offspring.. However, future expeditions should consider ways in which they can help N.E.S.T. reach more beaches at night as many of the more remote beaches in the North are unpatrolled at night. Consequently, numerous adults may be taken from these beaches.

A key component of N.E.S.T. protocol for patrolling beaches and interacting with nesting turtles is that they must not be disturbed more than necessary before laying. In order to conduct the phase duration investigation though, patrollers had to monitor a turtle from when they first saw her. Thus, to minimise any disturbance, they did not speak, maintained substantial distance from the turtle and used red light only when necessary to see what she was doing.

An area of the expedition which requires greater attention and development, is education of local people with regards to conservation. Due to timing of the expedition in 2012 and 2013 this has been difficult to establish in local schools, which finish for summer before expedition members arrive. However, N.E.S.T is continuing to develop as a young NGO and is now organising education days to teach the importance of marine turtle conservation to young locals up to age of 17. In 2013, the first of these occurred when the expedition had finished however, for future expeditions, this should be a main focus and they should offer to volunteer their services at these events from organisation to involvement on the day.

ii) Frog Research

Habitat degradation, in addition to the lack of rainfall, is a particular suspect for population changes in sites monitored since 2012. The problem of habitat degradation appears to be worsening in Tobago in favour of new roads and housing thus only continual monitoring will tell what impact this has on the frog species, which already have specific habitat requirements. Irregularities with the Main Ridge population of glass frogs were also observed. This population was particularly small and appeared to exist without the presence of broad leaves (such as *Heliconia*). No information regarding this has been encountered throughout research on glass frogs and thus the Main Ridge may be a separate population. It could have resulted from the destruction of broad leafed vegetation by leaf cutter ants at Main Ridge causing glass frog individuals to use palm leaves for laying their egg clutches. Steven Duncan's analysis of his findings will likely illuminate several environmental factors, which may affect the distribution and presence of his three study species.

Despite the local destruction of transects, *P. charlottevillensis* and *P. urichi* were sighted and heard calling consistently by team members whilst surveying. However, *P. turpinorum* continued to escape detection, which may be in part due to the elusivity of its call (described as a low, nearly inaudible click). There is extreme doubt that *P. turpinorum* does in fact still exist on Tobago. More specific twilight searches by expedition team members did not yield any results therefore population status outlook is grim. Several frog individuals collected by team members whilst surveying had the potential to be a *P. turpinorum*. Yet, after using identification keys, none actually were. Recommendations will be made for specialised searches for this particular species. It is possible that *P. turpinorum* was never a new species and individuals classified as members of this species were in fact juveniles of other species of the genus *Pristimantis*. Furthermore, *P. charlottevillensis* is experiencing diversification with the appearance of many different colour morphs. This adds further to the confusion surrounding *P. turpinorum* as this species may actually be a different colour morph of *P. charlottevillensis*. Alternatively, *P. turpinorum* individuals collected in the past may have been the last surviving members of a critically endangered species, after which the population could no longer reproduce and sustain itself subsequently collapsing. Again, further research would be required to determine this – potentially with the usage of DNA sequencing.

Future expeditions should consider more development into habitat comparison studies for Tobago's frog life and expanding their surveys to include all species which inhabit the north of this island. Particular focus should be given to comparisons of degraded areas and areas converted for agriculture, which still possess substantial pools of water, with natural areas such as Main Ridge forest reserve. This would enable assessment of which habitat types Tobago's amphibians are able to utilise and whether habitat recreation may be a feasible option for conservation of vulnerable species.

Acknowledgements

The 2013 Tobago expedition would like to thank Grant Walker for assisting the expedition on site for six weeks, without whom many team members would have been unable to receive training in tagging of marine turtles. He became an honorary team member whilst in Tobago assisting the expedition in their nightly beach patrol efforts and in day checks.

The expedition would also like to thank Glasgow University Honorary Professor Roger Downie for making time to visit Tobago. His advice and assistance helped the team to refine and improve many of the expedition projects. Honours project students were especially grateful to receive some objective insights and reassurance.

John C. Murphy (Field Museum Chicago) and Mike Rutherford (University of West Indies) are to be thanked for helping the expedition identify sites suitable for frog surveying during their visit to Tobago at the start of the expedition. They also furthered the species identification skills of team members who previously only had photos and descriptions of frog species on Tobago.

University of Glasgow staff member, Professor Malcolm Kennedy, deserves mention and the expedition is glad to have been able to assist him with his thermoregulation study. He has also inspired future research ideas for marine turtles on Tobago.