

**Project Anuran: An ecological research project concerned with the assessment and monitoring of anuran populations in the region around Las Cuevas, Chiquibul Forest Reserve, Belize.**



**Phase III**

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By

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## **The Declining Amphibian Population Crisis**

The decline in amphibian populations was first reported by herpetologists in the late 1970s (Barinaga 1990; Bury 1999), and appeared to be occurring in areas distributed across the surface of the globe. Concern arises because amphibians are integral components of many diverse ecological ecosystems. In some ecosystems they are the most abundant vertebrates (Blaustein *et al* 1994, Blaustein & Wake 1995) and so their absence can seriously disrupt the functioning of the rest of the ecological community. They provide a prey base for other tropical vertebrates (Beebee 1996) as well as predated upon many invertebrates, especially arthropods (Wake 1991). Therefore their demise can have many repercussions elsewhere in the trophic system. This apparent decline in amphibian populations is disturbing in its own right, but it is also worrying because amphibians serve as excellent bio-indicators of the overall health and resilience of their environment (Blaustein & Wake 1995; Alford & Richards 1999). They have a bi-phasic lifestyle, living on both land and in water at different stages of their life cycle. Their moist skin is thin enough to allow respiration and their eggs lack shells, allowing direct exposure to soil, water and sunlight (Duellman & Trueb 1994; Lips 1998). Frogs also provide a good reflection of local conditions because they exhibit highly philopatric behaviour (Blaustein & Wake 1995). All these factors therefore make amphibians more sensitive to environmental disturbances than other terrestrial vertebrates.

It has been proposed that the declines could be the coincidental effect of natural population fluctuations (Pechmann *et al* 1991; Pechmann & Wilbur 1994; Marsh 2001). However, this is unlikely to be a ubiquitous explanation due to the large number and wide distribution of reported declines. Decreases in amphibian populations have occurred on a global scale, indicating more general environmental problems. In order to monitor and respond to the alarming problem of amphibian declines, the Declining Amphibian Population Task Force (DAPTF) was founded in 1990 under the Species Survival Commission of the International Union for Conservation of Nature (Wake 1991; Flan 1991).

Declines in frog populations may of course lead to local extinction. This can have drastic effects particularly on species that are of limited range, and also live in fragmented habitats - thus hindering migration between communities making opportunities for re-colonisation low or non-existent (Wake 1991; Marsh & Trenham 2000). There have been many causative factors of amphibian declines proposed in the literature. Some will be due to the natural stochastic population fluctuations, but many have been attributed to direct or indirect anthropological activities. These include habitat destruction, poaching, and the introduction of exotic predators and pathogens (Alford & Richards 1999).

Alarmingly, amphibians have reportedly disappeared from pristine areas or areas presumed to be undisturbed by human interference (Blaustein & Wake 1995, Bury 1999, Alford & Richards 1999; Houlahan *et al* 2000; Alford *et al* 2001; Carey *et al* 2001; T.A. Gardner in press). A number of amphibian population declines and local extirpations have been reported in neighboring countries to Belize (Meyer & Foster 1996; Campbell 1998). Campbell (1998) indicates that 19 of the 49 species of anurans in the Monteverde region of Costa Rica have mysteriously disappeared in the last decade. Disappearances from protected areas such as this are distressing, especially as such areas are perceived to be immune to most human disturbances (Blaustein & Wake 1995; Bury 1999). The declines in such remote areas are thought to be caused by the indirect effect of human activity (see Gardner (forthcoming) for a comprehensive review). Depletion of stratospheric ozone and resultant increase of UV-B radiation at the Earth's surface damages frog embryos, thus reducing their chances of survival

(Blaustein & Wake 1995; Berger *et al* 1998). The enhanced UV radiation may also contribute indirectly to decline by decreasing the supply of aquatic insects for the frogs to feed on (Lips 1998). Recent remote sensing data from Central America has identified an increase in the levels of UV-B in areas of reported amphibian declines (Middleton *et al* 2001). Increasing acidity of aquatic habitats caused by acid rain also has major deleterious effects on amphibian distribution (Carey *et al* 2001). This is also true of pesticide contaminants that can persist in the environment for a long time and travel long distances via the atmosphere (Lips 1998; Relyea & Mills 2001). Alterations in local weather conditions caused by global climate change can also be harmful to frog populations. A reduction in rainfall, brought on by deforestation, can have a detrimental effect on amphibian reproduction as the specific timing and duration of rainfall act to trigger breeding (Blaustein & Wake 1995; Lips 1998; Alexander & Eischeid 2001). The effects of all these factors reinforce the claim that amphibians can act as valuable bio-indicators of the environment. Furthermore, as Wake stated in 1991, modern amphibians are highly resilient, having been on this planet for more than one million years. Therefore a decline in population now is clearly significant and the potential deleterious consequences this could have for other species is excellent justification for continued research into their global status.

### **Role of Project Anuran Phase III**

There is a critical absence of a consensus on the distribution, extent, and causes of the global amphibian population decline, due to the dearth of short and long-term comprehensive monitoring studies (Wake 1998). Recent empirical evidence suggests that the number and distribution of population declines is presently increasing (Alford *et al* 2001), especially in tropical areas, and with particular relevance to this study in sites across tropical Latin American (Young *et al* 2001). Despite growing levels of concern as to the wider ecological implications for both biodiversity and ecosystem health, there are still three main questions surrounding amphibian declines in which a large amount of uncertainty remains; (1) How to determine real population declines from natural or stochastic population fluctuations? (2) The relative importance of global versus local factors in determining amphibian population dynamics? and (3) Whether agents of decline can be attributed to human-induced changes in the environment? During field seasons in 2000 and 2001 Project Anuran has been able to contribute towards our understanding of the first two questions by collecting data on the patterns of variability in species assemblage composition, species relative abundance, reproductive behaviour, and environmental associations. Understanding natural variability in amphibian population dynamics is becoming increasingly recognized as fundamental to understanding both the mechanisms that drive population processes and the level of extinction risk (Alford & Richards; Marsh & Trenham 2001; Marsh 2001).

Aside from providing a uniquely comprehensive assessment of amphibian populations, Project Anuran complements similar studies by focusing on an area and species group that remains largely unstudied. There remains a desperate need for studies in the tropics (Pearman *et al* 1995; Wake 1998; Houlahan *et al* 2000), and especially in the neotropics (Young *et al* 2001). Although notable work has been done at high altitude neotropical sites (Guyer 1990; Lips 1998), very little has been done at lowland tropical and subtropical sites – of which Belize contains some of the most pristine and extensive stretches in Central America (Furley 1998). Furthermore, Belize provides a haven for much of the wildlife that has vanished from neighboring countries (Romney *et al* 1959; Hartshorn *et al* 1984; Meyer & Foster 1996), and retains some 75% of its natural vegetation (Harcourt 1984). However,

despite this the ecology of many amphibian species in Belize remains largely unknown (P.J.Stafford<sup>1</sup> pers comm, J.R. Meyer<sup>2</sup> pers. comm.) – reflected by the discovery of 5 of the 33 known species between 1990-1995 (Meyer & Foster 1996). The DAPTF are presently co-ordinating a monitoring program entitled the Maya Forest Anuran Monitoring Program (MAYAMON), as part of a large, internationally funded biological monitoring project of the entire Selva Maya region (Carr & de Stoll 1999). The information collected by Project Anuran is fed into a regional picture collated by MAYAMON using data from studies throughout Belize, the southern states of Mexico, and the Péten of Guatemala. Our study site is able to provide a good comparison against many more disturbed areas in other parts of the region.

Extensive data has already been collected during the breeding season of 2000 and 2001, describing the relative abundance of species, their spatial distribution, and temporal distribution patterns in presence/absence and reproductive activity, alongside abiotic environmental correlates. Project Anuran has identified Las Cuevas as the most diverse site in Belize with respect to amphibian fauna (Miller & Miller 1995), and has collected one of the most comprehensive amphibian population level databases in Belize (J.Meerman pers. comm.<sup>3</sup>). Project Anuran has been able to contribute significant information with respect to amphibian population dynamics (Gardner & Fitzherbert 2001; forthcoming articles). This substantial database provides a unique groundwork for highly valuable repeat studies in future years. Project Anuran Phase III will continue to provide an assessment of the study sites monitored during the first two field phases, both for vocalising and non-vocalising species, thus providing 3 years of comparable data. The ability to provide valuable interpretation of the inter-annual variability in the population attributes of our study populations is enormously enhanced with the addition of a further field phase. Phase III will also be able to contribute significantly in a number of additional directions; (1) a continuation of previous attempts to assess the effectiveness of alternative methods to monitor the highly cryptic ground dwelling group of species – a factor that is poorly understood across all of the neotropics (Donnelly & Guyer 1994; Pearman *et al* 1995), (2) Expand present survey sites of both species groups (vocalising and non-vocalising species) to the area of the Raspaculo river basin – an almost completely unstudied habitat of unique ecological importance (C.Minty pers. comm.<sup>4</sup>, and (3) conduct an intensive survey of the deciduous gallery forest fragments in the area of Caribbean Pine (*Pinus carribea*) in the Mountain Pine Ridge where two individuals of an unknown species of the genus *Rana* (J.C. Lee pers. comm.<sup>5</sup>) were collected during preliminary surveys in 2000 and 2001.

During Phase II Project Anuran established collaborative links with a research group from University California Davis, led by the conservation biologist Professor Tim Caro. Professor Caro is a leading scientist involved in ongoing research studying the use of umbrella species in the design of biodiversity conservation reserve areas (Caro 2000, see also Simberloff 1998; Andelman & Fagan 2000). In a world of limited resource conservation biology exists largely as a damage limitation exercise, and as such it is important to find opportunities whereby the efficiency and effectiveness of conservation can be improved. Tim Caro's group have been working in Tanzania and Belize to assess the degree of complementarity between the home ranges of possible alternative umbrella (conservation 'focal') species and the level of

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<sup>1</sup> Mr Peter Stafford, Research Biologist, Natural History Museum (London)

<sup>2</sup> Dr Jack Meyer, Co-ordinator DAPTF Maya Forest Anuran Monitoring Program (MAYAMON)

<sup>3</sup> Dr Jan Meerman, Green Hills Butterfly Farm, Belize.

<sup>4</sup> Mr Chris Minty; Las Cuevas Research Station Manager.

<sup>5</sup> Professor J.C. Lee; University Miami, Florida.

biodiversity across different vertebrate taxa. Following initial collaboration during Phase II, Project Anuran Phase III stands in an excellent position to contribute to this aim by providing an assessment of the amphibian fauna of four sites in the vicinity of Las Cuevas –each characterised by having a high occurrence frequency of four umbrella species; collared peccary (*Tayassu tajacu*), jaguar (*Panthera onca*), spider monkey (*Ateles geoffroyi*) and tapir (*Tapirus bairdii*). This is proposed to be done as an extension of the main ongoing aims of project anuran, using established transect survey methods which have proved to be effective in characterising ground dwelling fauna (Gardner & Fitzherbert 2001).

Few conservation projects in developing countries have the levels of expertise, money or time necessary for thorough ecological assessments (Pearman et al., 1995). It is our belief that undergraduate projects such as Project Anuran have access to all these requirements, and that through the collaboration of student communities from countries rich in resources and expertise, with students from developing countries where so many conservation projects are focused, a great deal of progress can be made.

The continuation of Project Anuran as a valuable contribution to our understanding of amphibian populations has been given the official support of both the DAPTF-IUCN, and the Natural History Museum of London (see attached letters).

### **Aims and Objectives**

Research Aim : To contribute to the understanding of the ecology and conservation of amphibian populations via intensive assessment of the status of species at the neo-tropical site of Las Cuevas (N16°44' W88°59').

#### Research Objectives :

- 1) To continue monitoring of nine sites previously assessed during 2000 and 2001 using tested profitable survey methods
- 2) To compliment the present monitoring effort by the addition of a number of further sites, incorporating a broader range of sub-habitat types – notably the river basin of the Raspaculo.
- 3) To concentrate effort to compare alternative monitoring methods for assessing the diversity and population status of leaf litter anurans at sites identified as being suitable / known habitat type.
- 4) To incorporate an extended period of survey work at Rio Frio – a region of Caribbean Pine (*Pinus carribea*), with special emphasis on searching for further evidence of an individual of unknown identity collected during 2000 and 2001 (*Rana* sp.).
- 5) To conduct survey work to compare the diversity and population status of ground dwelling amphibian fauna at four sites in the Las Cuevas area, in order to assess the congruence of amphibian diversity with the presence/absence of four key umbrella species.

#### Further Objective

- 6) To continue efforts to establish firm links with a collaborative student group from the University of Belize, with an aim to consolidating closer ties between the student community from both institutions who are concerned about ecology and conservation management in Belize. Collaboration will build on firm contacts already established not

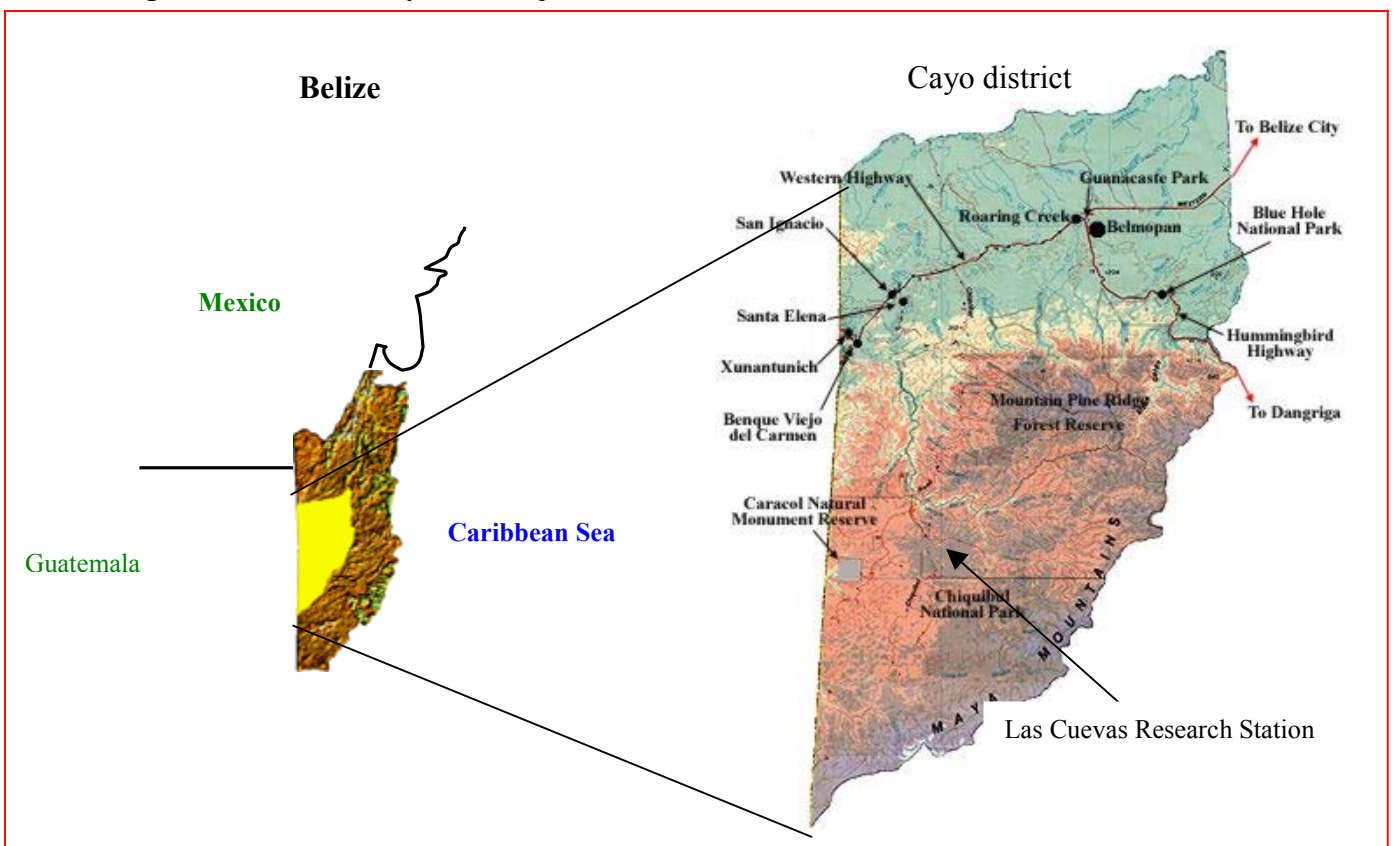
only in the University of Belize, but also San Ignacio Sixth Form, and local Mayan communities.

## Methodology and Approach

### Site description

Our work is conducted in the vicinity of Las Cuevas Forest Research Station (N16°44' W88°59'), Belize. The station is maintained as a joint initiative between the Natural History Museum (London) and the Forestry Department of Belize, and is situated in the Chiquibul Forest Reserve, north of the main Maya Mountains divide. It stands at roughly 500 m a.s.l. with an annual rainfall of between 1500 and 2000 mm, with vegetation consisting of mostly lowland subtropical moist forest (Hartshorn *et al.* 1984). Since the collapse of the Mayan civilisation c. AD 750-1000 there have been no permanent inhabitants of the region around Las Cuevas, although recent years have seen temporary disturbance due to logging, chicle harvesting, and the natural impact of hurricanes.

**Map 1: Research Study Site Project Anuran.**



### Methodology and Approach

Monitoring projects are by their very nature limited to following the protocol of previous years to enable a comprehensive and sensible assessment of any changes in species diversity or population status. In consideration of this, considerable advice of the highest quality was sought as to the most appropriate protocol to follow for Project Anuran (during both Phase I and Phase II), both to enable maximum return and a wide applicability with respect to other, similar Mesoamerican survey work. For the main direction of our work, the assessment of hylid frogs, the following methods have been constructed which are ideal for our aims.

Our methodological approach falls under two directions; that for vocalising species (Field Study 1), and that for non-vocalising species (Field Study 2).

#### Field Study 1: Monitoring and assessment of vocalising species

Most anuran species, especially in the tropics congregate *en masse* around breeding sites (Duellman & Trueb 1994; Beebee 1996), making the monitoring of vocalising choruses often the most effective technique by which to assess a population (Alford & Richards 1999).

Eight sites have been chosen during (Phase I – 2000), representative of a number of different sub-habitats of the forest around Las Cuevas. Pond site selection was made following advice from local guides, and night walks around the area. During Phase II this number was complemented by an additional two sites making a total of 10 for Phase III. Effort will be made to add an additional two sites in the riparian habitat of the Raspaculo River.

Surveys of these breeding ponds will run from 1900 hours to 0200 hours. Each pond will be surveyed over at least 5 repeats in concordance with data from Phase II. Measurements to be taken on arrival at a pond include; depth of pond (deepest part), collection of water sample for pH and conductivity measurements, and a summary weather report. Following this, half-hourly recordings of species abundance and calling activity will be made. Measures of abundance follow the Maya Forest Anuran Monitoring Project (MAYAMON) protocol (Meyer 1999) – this is the use of vocalisation categories to assess the abundance of each species for the first fifteen minutes of every hour – categories are as follows (Table 1).

In addition to the vocalisation category an attempt will be made to assess calling activity over and above species presence *per se*. This can be done using a measure (analogous to the above) of calling intensity - measuring the frequency of calls of an average individual of each species for the first fifteen minutes of every hour. One call is taken as each noticeably distinct vocalisation per individual (Table 1). This is a method devised during Phase I, and proved to be a highly profitable addition to the protocol during the Phase II field phase.

Vocalisation Category (VC)	VC definition	Vocalisation Intensity (VI)	VI definition
1	1-5 individuals	A	1 or <1 calls per 15 minutes
2	6-20 individuals	B	2-14 calls per 15 minutes
3	21-50 individuals	C	5-10 calls per 5 minutes
4	>50 individuals	D	2-5 calls per minute
		E	6-10 calls per minute
		F	11-20 calls per minute
		G	21-40 calls per minute
		H	>40 calls per minute

**Table 1.**

In addition to the above the air and water temperature is recorded every half hour. Values observed for the entire night are; maximum and minimum temperature, volume of rainfall and duration and number of rainfall events. For each pond an assessment of the floral diversity has been made. A re-assessment of this will be made during Phase 3 to monitor any local changes in vegetation from previous years, and additional sites can be individually assessed accordingly. Assessment is made by mapping the area surrounding the pond and noting all tree species with a DBH > 10cm within 10m of the pond edge.

Identification of vocalizations in this study follow reference to a tape produced by J. Meyer and J.C. Lee. Additionally Project Anuran (Phase I) has made its own minidisc recordings of nearly all species encountered at the Las Cuevas site. This represents an important contribution to future assessment of local populations and will be updated during Phase III. Visual identification of all species is aided by a practical field guide compiled by Project Anuran (Phases I and II) with reference to texts; Meyer & Foster 1996, Lee (1996), Campbell (1998), Lee (2000) and the Belize Biodiversity Information database.

In addition to the standard survey protocol outlined above, all anecdotal recordings of these species will be noted separately, detailing location, time of day, species type and number, and any relevant natural history notes.

#### Field Study 2: Non-vocalising and leaf litter species

The monitoring of leaf litter and stream dwelling frogs is subject to a variety of methods the effectiveness of which can vary greatly between geographic locations, amphibian species assemblages and local habitat conditions (Pearman *et al.* 1995). To allow for a comparison in the effectiveness of different methods in assessing inter site variation in species composition and relative abundance, 6 permanent transect lines were established during 2001 alongside the 8 x 8 m plots established during 2000. Phase II assessments of transect lines proved to provide a significantly greater return than quadrat plots. Following this during Phase III we will assess their effectiveness further by establishing transect lines in other habitat types and monitoring at higher levels of effort, both day and night.

Transect lines are stratified around areas presumed to be of both high diversity (creeks and the river), and areas noted to be ecologically distinct in terms of forest habitat. Each line is cut to be 500 m in length and 2 m in width. Transect lines are surveyed by two people (selected at random), who walk slowly down the line each disturbing the leaf litter / branches on one half of the transect. Search effort is standardised using a time restraint of one hour per transect, producing an average searching speed of 0.5 km per hour. All individuals sited are noted with respect to species, number, location (nearest 50 m), time and any relevant behavioural observations. A minimum of 5 repeats will be conducted per transect, for both the day and night, and searches will be spaced evenly across the study period.

Identification of specimens for both transect lines and traps will follow the relevant guides; Lee (1996), Meyer & Foster (1996), Campbell (1998), and Lee (2000).

In addition to the standard survey protocol outlined above, all anecdotal recordings of these species will be noted separately, detailing location, time of day, species type and number, and any relevant natural history notes

### Weather

Daily recordings will be made at 0900 of rainfall volume and duration for the previous 24 hours, maximum and minimum temperature, relative humidity and cloud cover. These will be taken using standard equipment from the weather station at the Las Cuevas site – to be newly updated during 2002. To allow for consideration of the spatial variability in rainfall patterns, two more rain gauges will be established – one at the Aguada (4 km East LCRS), and one at Millionario (5 km West LCRS). This allows an explicit quantitative consideration of rainfall patterns with respect to amphibian activity.

### Itinerary

Project stage	Month	Description
Pre – Expedition	December	<ul style="list-style-type: none"> <li>Commence sponsorship / fundraising program</li> </ul>
	January + Term 2	<ul style="list-style-type: none"> <li>Commence inoculation programme</li> <li>Start general familiarisation of literature / keys and procedures for members.</li> <li>Updating of existing project website at <b>www.ProjectAnuran.com</b></li> <li>Finalise arrangements with Belizean collaborators to enable their full integration into the project at this early stage</li> </ul>
	Easter	<ul style="list-style-type: none"> <li>Amphibian handling practice and field trials of methods weekend (DAPT)</li> <li>LSTS survival course (5 days) for new 2001 members</li> <li>Project member training programs to be completed e.g. first aid courses and expedition orientated work shops and skills courses</li> <li>Attend biodiversity assessment course / conference at the RGS (BP)</li> </ul>
	Term 3	<ul style="list-style-type: none"> <li>Purchase / order of equipment still withstanding</li> <li>Final preparations</li> </ul>
Field Stage	Departure week 0	<ul style="list-style-type: none"> <li>Start July</li> </ul>
	Week 1	<ul style="list-style-type: none"> <li>Introduction to Belizean collaborators, followed by one weeks acclimatisation and site familiarisation at Las Cuevas</li> </ul>
	Weeks 2-7	<ul style="list-style-type: none"> <li>Monitoring programme of vocalising sites and non-vocalising areas as outlined in methodologies. This will continue on a rotational basis for 6 weeks.</li> </ul>
	Week 8	<ul style="list-style-type: none"> <li>Consolidation and processing of data and rest</li> </ul>
Post Expedition	End Oct	<ul style="list-style-type: none"> <li>Preliminary report completed</li> </ul>
	Oct 2002 – Jan 2003	<ul style="list-style-type: none"> <li>Lecture circuit, final report writing and any forthcoming articles</li> </ul>
	Easter 2003	<ul style="list-style-type: none"> <li>Final report published + distributed</li> </ul>

## Risk Assessment

Any expedition to an isolated area bears inherent dangers regarding on the spot treatment and adequate medical facilities, when the environment being visited is the home of numerous lethal animals and other life threatening illnesses the dangers are all the more real. This section will highlight in brief the precautions and avoidance measures that will be taken to minimise the risk of any avoidable injury. During previous expeditions (2000 & 2001) there have been no accidents, despite this the team will all be briefed fully on onsite emergency and evacuation procedures and previous years precautions shall be adhered to unless updated. As stated in the itinerary all the team will be undertaking a British Red Cross first aid course.

Health : (Belize is a relatively disease free country with no vaccination requirements by law but the following require precautions and avoidance measures)

Vaccinations and preventative medicine and avoidance measures applicable to Belize

- Rabies; A course of 3 doses over one month will be administered prior to departure – to be completed before commencement of anti-malarial drugs
- Hepatitis B; Full course of 3 injections over 6 months prior to departure to commence in January
- Malaria; Belize is not a high-risk area removing the necessity for drugs such as Mefloquine. However, the risk is a definite threat and a course of chloroquine will be taken commencing 1 week prior to departure. Preventative measures will be taken to reduce chance of a bite, to include; sleeping under small mesh (needed to prevent penetration by sandflies) nets soaked in repellent – premethrin, long leg/sleeved clothing to be worn after dusk – also loose to reduce chance of biting through cloth, use of DEET based repellent (although where possible naturally based deterrents such as citronella will be used in consideration of amphibian sensitivity to environmental degradation).
- Childhood vaccines – tetanus, polio, diphtheria and Hep A all to be boosted as necessary
- Typhoid vaccination. Care to be taken in basic hygiene procedures
- Dengee Fever; a disease spread by mosquitoes. No available vaccine – precautionary measures noted above to be taken
- Leshmaniasis; skin disease caused by parasites carried in sandflies. Above bite avoidance measures applicable, thin mesh size on nets (above). To seek medical help (see later) if abnormal skin lesions appear.
- Chagas disease; a late onset neurodegenerative disorder transmitted by Assassin bugs. No known vaccine or cure – avoided by bite precaution measures above.
- River Blindness; rare but possible in Belize. Passed by a blackfly vector found near fast flowing water – above precautionary measures.

Snake Bites :

Familiarisation of all venomous snakes will be undertaken before departure and during a two-day safety and survival course on arrival at LCRS (Las Cuevas Research Station). The species noted for observation are ground dwelling pit vipers (*Bothrops asper*, *Atropoides nummifer*, and *Porthidium nasutum*), and rattlesnakes (*Crotalus durissus*). They are all easily camouflaged on forest floor, and so sturdy booted footwear is needed. The tree dwelling species *Bothriedhis schlegelii* needs careful note in low branches and shrubbery. Coral snakes *Micrurus* spp. are brightly coloured but demand careful consideration.

- General precautions; Full clothing to be worn in dense undergrowth, ditches caves and root cavities to be treated with special care, to always carry a torch at night.
- In event of emergency; only in extreme circumstances will anti – venom be administered by unqualified persons – to avoid dangerous shock responses (the procedure detailed in the LCRS health and safety document will be memorised by all members). However, a supply of anti-venom available from LCRS will be carried at all times in the group medical kit. Reference to A Guide to the Reptiles of Belize for familiarisation to occurrence and precaution.
- Emergency evacuation will be undertaken if necessary – see emergency procedure and cover.

#### Other animals:

There are a number of other possibly dangerous animals such as the jaguar and wild pig (warree), which the group will become familiar with measures to allow identification and avoid disturbance.

#### Medical Kits:

Each individual will carry a personal medical kit (plasters, disinfectant, bandages, diarolite, insect repellent – deet based – anti histamine tablets, paracetamol, suncream, NHM guide to snake bites, whistle, torch). The group will hold a more comprehensive kit. Furthermore an extensive camp kit is held at LCRS and the Station Manager Chris Minty and Chapal Bol are both qualified first-aiders familiar with its use.

#### Medical Training:

Robert Forbes and Heather Anderson are qualified first aiders. Remaining members will attend a field safety and first aid course ran by Life Support Training Services in Cumbria (a course which proved excellent during 2000). All members will be familiar with the NHM field safety manual available from NHM.

#### Hygiene:

- Water; water supply at LCRS comes from a cave system and is quite safe. During phases away from LCRS Iodine will be used to purify which is deemed sufficient without the additional need to filter. Dehydration is acknowledged as a problem and care will be taken to take at least 4 litres per day with salts available at all times
- Latrines; during phases away from LCRS care will be taken to dig appropriate pits with disinfectant available for hand washing.
- Food; treated water to be used in all cooking. Supplies kept sealed and off the ground during storage. All waste to be burnt or carried out in sealed containers.

#### Field Safety:

Sensible measures to be taken whilst surveying in field; no forays into jungle unaccompanied, emergency packs and radio carried at all times, large scale map and compass to be carried at all times. One of the largest causes of fatality in the tropics is falling of dead timber, care will be taken in observing canopy whilst trekking and laying camp.

#### Political situation and climate:

The political situation in Belize is stable and not a cause for concern. Hot and humid climate with temperatures averaging 25 during the day and as low as 5 at night – see above for dehydration precautions. During period of stay cyclones and hurricanes are not uncommon and weather reports are monitored regularly at the station for early warning.

Insurance cover:

The relevant cover will include: early curtailment – return flight to UK, medical expenses incorporating search and rescue (£2,000,000), hospital benefit (£300), legal liability.

Emergency contingency:

The group is covered by insurance for medical evacuation, early return to UK and foreign treatment costs. A VHF radio available from LCRS will be carried at all times. The procedure in emergency follows: (1) Administer first aid if feasible (2) To return to LCRS with patient if practical (3) To inform LCRS station manager immediately line of contact if no reply – 25 Flt Army Corp on GMP 2000 satellite phone at LCRS, Belize Communications Ltd (Channel 7 or 8), British High Commission (Channel 6), Forest Dept Belize (Channel 2). Evacuation will commence depending on severity Luma Luz hospital (3 hours by road) in Santa Elana or Belmopan hospital. Air evacuation (24 hour cover) time to Belize Medical Associates, Belize City is 30min. A 2 hour flight can reach Houston hospital in the USA. This procedure was observed to be highly efficient during the 2000 field stage.

The above was complied with help by; Professor Warrell (Oxford Centre for Tropical Medicine), Dr Tim Brown (Ed University Health Service) and Chris Minty (station manager at LCRS), Toby Gardner (ex Project Anuran Co-ordinator). Reference to texts; RGS Expedition Medicine by D.Warrell & S.Anderson, Tropical Forest Expeditions by C.Jeremy & R.Chapman, University Health Service documents, LCRS Health and Safety document. A copy of a recent risk assessment by Dr Sutton of NHM.

## **Team Members**

### **Heather Anderson (23)**

Role: Fundraising Coordinator and International Liaison Officer.

Heather is a second year Biological Science student at Edinburgh University looking to do honours in Ecology. She has a keen interest in conservation issues demonstrated through working with BTCV and Trees for Life in Scotland. She also has extensive fieldwork experience abroad having spent six months working at Nelspruit Game Reserve in South Africa. She is a qualified first-aider, a keen photographer, and has the Duke of Edinburgh Silver award, all providing desirable skills useful in the field. Her enthusiasm for ecology is further shown by her involvement in the University Ecological Society. The above experiences and her commitment and passion for conservation make Heather an ideal candidate for the team.

### **Katie Finlinson (20)**

Role: Project Coordinator.

Katie is a third year Biological Science student at Edinburgh University looking to do honours in Zoology. She has a strong desire to work in scientific field research and has spent time working both along side a veterinary surgeon and as a volunteer research assistant within Edinburgh University. This has given her the opportunity to apply her scientific background to challenges presented both in the laboratory and in the field. Her close

involvement with the University Expedition Society (Exped) has further reinforced her ambition to plan and participate in an expedition of this nature. This desire coupled with her enthusiasm serve to make Katie a dedicated member of the team.

**Robert Forbes (23)**

Role: Scientific Coordinator and Chief Medical Officer.

Robert is presently a third year Biological Science student at Edinburgh University planning to take honours in Zoology. He has spent a lot of time abroad in Brunei, Saudi Arabia, Oman, and Gabon, which has given him the opportunity to gain extensive experience at surviving in harsh conditions along with excellent practical field skills. He is a qualified first-aider, has successfully completed the Ten Tors on Dartmoor, and has experience in jungle survival through training with the Gurkhas. He has an enthusiastic attitude to biology and his keen interest in Parasitology in particular, led him to spend last summer working for the London School of Hygiene and Tropical Medicine. The above all give Robert a firm background for participating in an expedition of this nature making him a valuable member of the team.

**James Humble (21)**

Role: Logistics Officer and Treasurer.

James is currently a third year Biological Science student at Edinburgh University looking to do honours in Zoology. He has gained previous experience of expedition planning by being part of a recent mountaineering expedition to the Greek Island of Kylimnos. This also enabled him to gain practical skills valuable in the field, such as first aid and survival techniques. His strong interest in the environment and cultures of different countries has led him to travel independently to both Eastern Europe and Venezuela. His extensive experience in planning past ventures in addition to his enthusiasm make James a definite asset to the team.

**Budget**

This is inclusive of the expenses for four Edinburgh members and two Belize students.

	Type	Cost per person (£)	Cost per group (£)
Pre-departure	Flights <sup>6</sup>	600	2400
	Tax	50	200
	Accommodation at Las Cuevas <sup>7</sup>		1500
	Film <sup>8</sup>		150
Training	Survival medicine course	75	150
	London workshops at the RGS	50	200
	Vaccinations <sup>9</sup>		150
	Medical supplies		100
	Personal and scientific equipment		350
	Administration		150
In Field	Food <sup>10</sup>		2000
	Research permit		75
	In country travel		200
Post expedition	Report printing and distribution		600
	Photographic development		150
Total			8375
10% contingency			837.50
Total			9212.50
Less personal contribution		400	1600
<b>Target remaining</b>			<b>7612.5</b>

<sup>6</sup> Via Cancun because it is the cheapest option.

<sup>7</sup> As per LCRS costing Dec 2001, includes bench costs and full use of facilities of the station

<sup>8</sup> This cost may be reduced, as action is underway to secure sponsorship from photography companies

<sup>9</sup> This cost is only to supplement and replace the existing first aid supplies, which are fortunately still comprehensive

<sup>10</sup> This is estimated from 2000 costs for 6 people, includes taking 2 weeks of catering at LCRS

## **Project Output and deliverables**

Project Anuran Phase I has already produced a full report of the findings of fieldwork during 2000 (available upon request). The full report for Phase II is currently undergoing completion. Further examples of output are a number of articles in relevant newsletters – Herpetological Bulletin (Winter 2001), Cuevas News (Autumn 2000), Frog Log DAPTF (*in press*), Animal Biodiversity and Conservation (*in press*), Journal of Herpetology (*in press*). A number of presentations have been given of the project work, including to the 2<sup>nd</sup> and 3<sup>rd</sup> Conferences on UK research in Belize, held in September 2000 and 2001. Project Anuran work has been well received by the DAPTF and the Natural History Museum (London), both of whom serve to benefit considerably from its continued findings. Other recipients of project reports both from Phase I and Phase II include: Belize Audubon Society, Belize Tropical Education Centre, British Ecological Society, British Herpetological Society, Ministry of Natural Resources of Belize, Royal Geographic Society, Royal Scottish Geographic Society, Royal Scottish Zoological Society, University of Belize, University of Edinburgh and WWF Central America.

Project Anuran Phase III will continue to produce the same degree of output, centred on both a preliminary report (within one month of return), and a full report (within six months of return), alongside continued presentations and lectures. As indicated in the justification of this proposal a number of further directions of consideration and analysis will be possible following the third year of work, as data can be used from all 2000 – 2002 field stages. It is hoped that our work will receive continued interest in the relevant scientific press, gaining increasing significance with the continuation of this study.

In addition to producing the hard copy reports, Project Anuran Phase III will host its findings on a website alongside existing reports and species descriptions (see [www.projectanuran.org](http://www.projectanuran.org)). Importantly this will allow our data and findings to be easily accessed by other such research groups throughout the world, and crucially by collaborative agencies such as the DAPTF, whose operation requires quick and simple access to continued research output.

## **Contacts**

The following have provided helpful information and ideas used in the compilation of this proposal;

Toby Gardner (Project Anuran Phases I & II), Adriana Dinu (International Co-ordinator, Global Conservation Alliance), Chris Minty (Station Manager, LCRS), Daniel Bennett (University of Aberdeen), Dr David Sutton (NHM, London), Dr Graham Russel (IERM, Univ. Edinburgh), Dr Jack Meyer (Chair of DAPTF working group for Belize), Dr Peter Stafford (NHM, London), Dr Malcolm Penn (Project Leader, LCRS – London), Dr Tim Brown (Univ. Health Services), Ivan Scales (Rainforest Foundation), John Wilkinson (International Co-ordinator DAPTF), Professor Steven Blackmore (Royal Botanical Gardens, Edinburgh), Dr Yan Meerman (Director, Green Hill Butterfly Farm Belize and Government ecological advisor), Major Alisdair Rogers (Leader of a number of joint services Expeditions to Belize), Margaret Jackson (Edinburgh University), Nicodemus Bol (Natural History Museum), Pio Saqui (University College Belize), Professor Bill Sutherland (University East Anglia), Professor Bob Allison (Geography Dept, Univ. Durham), Professor David Warrell (Centre for Tropical Medicine, Oxford), Professor Julian Lee (Miami University), Professor Peter Furlley (Geography Dept. Univ. Edinburgh), Rosie Trevalyn (Director, Tropical Biology Association), and Sharon Matola (Director, Belize Zoo).

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