

Natural history contributions of the University of Glasgow Exploration Society to Scotland and the World

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ABSTRACT

Expeditions with a natural history focus have been organised by University of Glasgow staff and students since the 1930s. The educational benefits of such expeditions to students have been reported by Harper *et al.* (*Journal of Biological Education* 51, 3-16; 2017). Here, we present a short history of these expeditions, concentrating on their scientific achievements. In addition to expedition reports, a large number of PhD theses, masters and honours project reports and scientific papers have been based on expedition work. Many biological specimens have been deposited in museums, including some new species. We provide case histories of four expedition locations, to demonstrate the variety of work done, and the value of returning many times to the same place: Scotland, Trinidad and Tobago, North Cyprus and Ecuador. A major problem for expeditions is funding. For many years, the Carnegie Trust for the Universities of Scotland ran a funding stream that was crucial to the viability of Scottish university expeditions, but this has sadly now closed. For Glasgow University expeditions, the Blodwen Lloyd Binns Bequest has provided a reliable source since 1994, and we hope that it will continue to do so.

INTRODUCTION

The first University of Glasgow staff-student expeditions with a natural history focus that we know of were to the inner Hebridean island of Canna in 1936 and 1937 (Table 1A). After a hiatus of a dozen years, partly explained by the Second World War, the next such expedition was to the Garvellach Islands in 1949 and then to St. Kilda in 1956. Thereafter, one or two expeditions took place most years until the early 1980s (Table 1). Initially, these expeditions were organised by interested groups of staff and students, who applied to the University Court for approval and financial support, and to external sources, especially the Carnegie Trust for the Universities of Scotland (hereafter, Carnegie Trust). In 1959, the Carnegie Trust instituted a specific funding stream for University Expeditions (Walker, pers. comm.). Another important funding

source that began around the same time was the Royal Geographical Society's expedition grant scheme (1956).

We have not been able to locate any documents relating to the foundation of the University of Glasgow's Exploration Society (GUExSoc), but the first expedition reports held by the University Library which acknowledge the existence and support of GUExSoc are for Finland (1970) and Calabria (1970), and we were told that Morocco (1970) was also organised through GUExSoc (Hansell, pers.comm.).

Some of the expeditions in the late 1960s to early 1980s were essentially field research trips for the final year class in Topographic Science, aimed at gathering data for final year dissertations. Although the Carnegie Trust initially supported these under the University Expeditions scheme, they later took the view that Universities should fund dissertation work themselves. Later Topographic Science expeditions such as Maam, 1978 and Inchnadamph, 1979 (Table 1) therefore received no Carnegie funding.

Membership and equipment lists and accounts survive for the early years of GUExSoc, 1972-1982. Membership averaged about 30 per year and cost £0.25. The Society had an equipment store mainly comprising tents and other camping equipment. Excluding the Topographic Science field trips, an average of two expeditions per year occurred over that period.

In 1988 after a few years of inactivity, GUExSoc was re-constituted with the full support of the University Principal at that time, Sir Alwyn Williams, and the University Court, and, crucially, with a new funding procedure. The 1988 settlement established a new body, the Exploration Council, technically a sub-committee of Court and composed of a small number of senior staff with relevant interests. As first chair of the Council, Ian Thomson, Professor of Geography, steered this new arrangement through its initial years.

Year	Location	Themes and Outcomes
A) Scotland		
1936, 1937	Canna (Inner Hebrides)	+ Geology, ecology, zoology. Published papers on natural history of Canna and Sanday (Bertram, 1939), birds of Canna (Carrick & Waterston, 1939), and parasites of birds and mammals (Carrick, 1939). Also a report on expedition provisioning (Blair, 1936)
1949	Garvelloch Isles (Inner Hebrides)	Geology, zoology. Six published papers on marine lamellibranchs (Hunter, 1951), geology (Hunter & Muir, 1954), insects (Muir, 1954), birds (Dunn <i>et al.</i> , 1954), ecology (Hunter, 1954) and molluscs (Hunter, 1953)
1956	St. Kilda (Outer Hebrides)	# Zoology (two papers: Hamilton (1963), Fraser <i>et al.</i> , 1957)
1962, 1964	South Uist (Outer Hebrides)	+ Zoology. Insect specimens collected
1974	Callanish, Lewis (Outer Hebrides)	* Geography (TS)
1975, 1976	Durness (Sutherland)	* #Zoology, Botany. The full report for 1975 exists; for 1976, only a hand-written plant list
1976	Scourie (Sutherland)	*Geography (TS)
1979	Inchnadamph (Sutherland)	* Geography (TS)
1980	South Uist (Outer Hebrides)	~ Carnegie funded; no other record
1980, 1982	Foula (Shetland)	# Bird ringing and other data collection (several papers built on data collected, notably Furness, 1981; Furness Todd, 1984)
B) Beyond Scotland		
1963	Narvik (Norway)	*Geography
1964	La Causse du Larzac (France)	*Geography
1965	Austria	*Geography
1965, 1966	Iceland	Geography. Glacier mapping
1966	Portugal	+ Zoology (fish, entomology); book chapter by Miller (1986)
1966	Yugoslavia	* Geography
1969	Norway	* Geography (TS)
1970	Morocco	# Zoology
1970	Finland	# Geography (TS)
1970	Calabria (southwest Italy)	* Geography (TS)
1971	Valais (Switzerland)	* Geography
1972	Iceland	* Zoology and Geology
1973	Grimsel Pass (Switzerland)	Geography (glacier mapping)
1973	Morocco	~ Carnegie funded; no other record
1974	Finland	* Geography
1975	Czechoslovakia	~Carnegie funded; no other record
1975	Pyrenees	~Carnegie funded; no other record
1977	Pyrenees	~Talk given and Carnegie funded
1977	Seychelles	Zoology. Report may be lost. Two research papers on fairy terns (Houston, 1979), and skinks (Brooke & Houston, 1983)
1978, 1980	Maam (Finnish Lapland)	* Geography (TS)
1978	Corsica	* Geography
1979	Faroe Islands	~Carnegie funded; no other record
1980-81	Crete	~Carnegie funded; no other record
1982	Cwm Idwal (Wales)	* Geography (TS)
1983	Newborough Warren (Wales)	* Geography (TS)

Table 1. University of Glasgow Expeditions 1936-1983. Usage of * denotes report in University of Glasgow Library; + denotes specimens deposited in the Hunterian Museum; TS denotes Topographic science class field trips; ~ denotes expeditions known only from the records of the Carnegie Trust for the Universities of Scotland or from GUExSoc minutes books.

Year	Number and Years	Themes
a) Scotland		
Islay (inner Hebrides)	Three: 2014-16	+ Zoology
b) Europe		
Azores	Two: 1989, 2003	Ornithology
North Cyprus	Eight: 1992-98	+ Marine turtle conservation/biology; feral donkeys
Cyprus (RAF Akrotiri)	Fourteen: 2000-16	Marine turtle conservation/biology
Iceland	Eighteen: 1992-2002 and 2008-16	First series: glaciology; second series: wildlife biology/conservation
Spitzbergen	1996 only	Geography
c) Africa		
Canary Islands	Two: 2000, 2016	Geology
Egypt	Five: 1990; 2013-16	First, mainly geography, plant ecology; later series ecology
Gambia	Four: 2005-08	Animal welfare, zoology
Kenya	Two: 1998, 2016	First, zoology; more recent, sustainable development
Seychelles	1996 only	Zoology
Tanzania	Eight; 1991, 1998, 2008-15	Mainly geographical, but also zoology
Zambia	Two; 2006, 2008	Aquatic plant ecology, zoology
d) Asia		
Borneo	1999 only	Zoology
Himalayas	1993 only	Geography
Kazakhstan	1998 only	Ornithology
Oman	1990 only	Ornithology
e) Australasia		
Kimberley (Australia)	1996 only	Geography
Tutamoe (New Zealand)	1995 only	Geography
f) North America		
Canada	1997 only	Wildlife conservation
g) South America and the Caribbean		
Bolivia	Eleven: 1998-2016	+ Zoology, ornithology
Brazil	Three: 1999-2003	Aquatic plants, zoology
Costa Rica	2005 only	Zoology
Ecuador	Twelve: 1997; 2000-2012	+ Zoology, ecotourism development
Guyana	1995 only	+ Zoology
Peru	Seven: 2006-2015	Zoology
Trinidad and Tobago	Thirty five expeditions: 1989-2016: two to T and T; 20 to Trinidad alone; 13 to Tobago alone	+ Zoology, some plant ecology, geology

Table 2. University of Glasgow Expeditions 1989-2016. Usage of + denotes specimens deposited in the Hunterian Museum; reports for most expeditions are available in the University Library and/or on the GUExSoc web-site; we have not attempted to collate the large number of publications resulting from these expeditions; see the text, especially the case histories.

Council was given an annual budget and the task of overseeing the activities of GUExSoc, especially of scrutinising expedition proposals, deciding whether or not to approve them, and then deciding on the level of funding to provide. GUExSoc itself began afresh in 1988 with a new constitution. The first of the new era of expeditions took place in 1989 (Table 2: Trinidad and Tobago; Azores). The constitution made clear that the main aim of expeditions should be the advancement of science; approval and support would not be given to proposals that simply involved adventurous travel.

The conditions of funding from the Carnegie Trust were important to all Scottish Universities which organised expeditions. The Trust's rules were that expeditions should mainly be for undergraduate students with staff providing support and training; that the sponsoring University should provide formal approval of each expedition proposal and some level of financial support; and that work aimed at student dissertations should not be the main purpose of an expedition. Correspondence with the Trust clarified that individual students were not barred from carrying out dissertation research as long as this was not the focus of the expedition as a whole; also that full-time staff presence was not essential. In the early years, Trust grants were a few hundred pounds per expedition; when the scheme ended in 2014, the maximum award was £2K per expedition. Of the seven Scottish Universities which benefitted from Trust expedition grants, GUExSoc was the most active (Table 3).

Glasgow Natural History Society (GNHS) has had an important role in GUExSoc expeditions following the establishment of the Blodwen Lloyd Binns Bequest (BLB) in 1993. The BLB committee agreed in 1994 that undergraduate expeditions were one of the activity categories that would be eligible for support. In the period 1994-2010, the Bequest supported 59 expeditions, granting a total of £33.5K, 22% of its annual grant expenditure (Downie *et al.*, 2012), and a similar level of support (£5K per annum) has continued since then. In addition, GNHS has hosted many talks on these expeditions in its talks programme, and for a few years, *The Glasgow Naturalist* included short reports on BLB funded

projects, including expeditions (e.g., Trinidad 2000 in *TGN* 23(6), 2001; Azores 2003 in 24(2) 2004). More recently, summary expedition reports have appeared in the GNHS quarterly newsletter and full reports have been accessible via GUExSoc's web-site (<http://glasgowexsoc.org.uk/>).

The educational value to students of participating in expeditions has been reported by Downie *et al.* (2008), describing the potential of expeditions for students undertaking final year research projects, and by Harper *et al.* (2017) who emphasise the transferable skills/graduate attainment value of organising and taking part in expeditions. In this paper, we focus on the natural history research outcomes of the long series of expeditions run by GUExSoc. Given the very large number of expeditions organised through GUExSoc, it would be impossible to do justice to them all. We therefore have adopted a case-history approach and present four themes: Scotland, Trinidad and Tobago, North Cyprus, and Ecuador.

EXPEDITION CASE HISTORIES

Scotland

All the earliest expeditions were to Scottish localities, some visited more than once, from the earliest to Canna in 1936 up to Foula in 1980 and 1982 (Table 1A). The first location, Canna plus neighbouring Sanday, was visited in consecutive years and produced high quality results published in peer-reviewed journals (Bertram, 1939; Carrick, 1939; Carrick & Waterston, 1939). These described many aspects of the natural history of the islands: physical geography, botany, terrestrial and freshwater invertebrates, birds and mammals. The impressive range of coverage was the product of the students plus a considerable number of experts who helped identify pre-sorted specimens. Bertram (1939) wrote that 'The original object was to survey an island in the West of Scotland with a view to providing data which would serve as a basis for future ecological studies'. Sadly, the Second World War got in the way of the planned future work. The standard of the directly published outputs from the two Canna expeditions has never been exceeded.

University	Number of grants	Total awards (£: rounded thousands)	Percentage of total awards
St. Andrews	29	£16K	2.9
Edinburgh	106	£125K	23.6
Glasgow	160	£243K	45.9
Aberdeen	83	£77K	14.6
Dundee	25	£29K	5.6
Stirling	15	£12K	2.4
Napier	13	£26K	4.9
Joint SUs	1	£.5K	0.1

Table 3. University expedition grants awarded by the Carnegie Trust for the Universities of Scotland, 1959-2014. Data kindly provided by Professor Andy Walker, Secretary and Treasurer of the Trust.

Twelve students were involved over the two years, mainly zoologists but including two botanists. The expedition's logistics also were published as a guide to future similar endeavours. Blair (1936) noted that an investigation into dietary needs on expeditions would have been of interest but that "one could not risk impairing the members' efficiency by experiments in another sphere of science".

The next expedition was to the Garvellach Isles (1949). This also led to an impressive list of six papers, after some delay (Table 1A). One of the students and authors, David A. Muir, who went on to a career in malaria research, has provided some reminiscences of the expedition, which had the grand title: Scottish Ecological Expedition to the Garvelloch Islands (SEEGI). Note that the name of these islands in English is a version of the Gaelic Garbh Eileach; in the 1940s this was given as Garvelloch, but more recently as Garvellach; we use the latter spelling here, except for the titles of the original publications. There are some butterfly specimens in the Hunterian Museum with these apparently enigmatic initials on their labels (Muir, 1954, is a short note on the Garvellach insects). The students were accompanied by staff member Bill Russell Hunter, who later had a distinguished career in the USA. Muir provides a piece of doggerel commenting on Hunter's cooking skills:

'Poor Hunter, marooned with his mutinous crew
And all because of his pemmican stew!
He cooked it in secret with weird incantations
And added some nettles to spin out the rations.
He served it up steaming and reeking and rich,
Dark golden in colour and sticky as pitch.
But of course all the 'gannets' with palates of leather
Simply couldn't detect the delectable flavour!
They complained it was gritty and cooked in a hurry
And proceeded to drown it in Worcester and curry.
By this time the Dixie was only half emptied
But the 'gannets' shied clear and refused to be tempted
For only a staunch and redoubtable few
Would dare a repeat of that pemmican stew.
Yes, Hunter concocted many a brew,
But never a one like the pemmican stew!'

St. Kilda (1956) also had published results (Table 1A) but thereafter the main outcomes were expedition reports, descriptive of the projects undertaken. An important purpose of these was to provide funders with prompt accounts of the work achieved, and they remain the only account of most of these activities. The practice of depositing a copy in the University Library began in the 1960s but was not always adhered to (Tables 1 and 2).

The two expeditions to the Shetland island of Foula (1980, 1982) were exceptional, firstly in having participants from several other organisations. Of the 11 members of Foula (1982), six were Glasgow based and the others from Durham, Edinburgh, Peterborough and London. Secondly, these expeditions did have published outputs (Table 1A). In addition, Furness (pers. comm.) reports that these expeditions collected baseline data that contributed to several later papers, notably an important paper in *Nature* by Votier *et al.* (2004), demonstrating the huge value of long-term datasets in ecology.

After a gap of three decades, in response to the needs of students who could not afford the expense of overseas expeditions, and also who planned careers in UK conservation and environmental management, GUExSoc introduced the idea of a 'Remote Scotland' expedition in 2013. This clearly met a need, as many students applied, even though the location was initially undecided. Islay was soon chosen (not, perhaps, particularly 'remote') partly because of the input of the RSPB and also because of correspondence with the Islay Natural History Trust which was enthusiastic about the idea. The 2017 Islay expedition was the fourth in succession. In addition to the normal reports, the expeditions have helped add to the biological records of the island (Fig.1).



Fig. 1. Leaders Lorna Archer and Angus Lothian checking wildflower identification, Islay 2015 (photo credit: Richard Thompson)

Trinidad and Tobago

When GUExSoc was re-constituted in 1988, one of the first expeditions was to Trinidad and Tobago in 1989. Why there? One of us (JRD) had already established a research link in Trinidad and was aware of the potential of the islands as a location for a student expedition. In addition to its under-researched biodiversity, the country was peaceful, relatively small and therefore accessible, English-speaking and mostly free of troublesome tropical diseases. In Trinidad, also, the University of the West Indies (UWI) campus at St. Augustine offered a base with laboratory facilities, should we need them. Even with these advantages, it is unlikely that any of the 1989 participants envisaged that they would be the

first of 35 expeditions spanning (by the end of 2016) 27 years (Table 2).

Looking back, the 1989 expedition was almost recklessly ambitious. The total personnel list included 33 people, a mix of staff, post-graduates and undergraduates, led by Richard Rutnagur, a PhD student with Trinidadian family connections. The expedition worked on both islands with the Trinidad team based near UWI, and the Tobago team split between two locations; marine biologists in the south at Buccoo and botanists in the north at Charlotteville. Funding an expedition of this size was difficult and co-ordinating activities in the days before mobile phones (in a country with a barely functioning telephone system) was more so. Despite these problems, the expedition produced a report of nearly 100 pages, covering the results of a very diverse set of projects: the state of Tobago's coral reefs; regeneration of the Tobago Main Ridge forest following the devastation caused by Hurricane Flora in 1965; the distribution and habits of an endangered endemic bird, the Trinidad piping guan; the nesting activities of leatherback turtles on Trinidad's east and north coast beaches; conservation measures suitable to protect the collared peccary whose populations are heavily affected by hunting; and several projects on the reproductive ecology of Trinidad's frogs.

The second expedition (1991) was similar, also with 33 participants and with work on both islands, generating a report of 123 pages: in Tobago, only on the coral reefs in the south; in Trinidad, more on marine turtles, the piping guan, frog reproduction and new projects on dragonfly territoriality and veterinary aspects of public health, involving vultures and goats.

Thereafter, expedition teams were smaller and based on only one of the islands: 20 more expeditions to Trinidad (1993-2016, almost yearly) and 13 consecutive visits to Tobago (2004-16). Most of the expeditions have included several distinct projects (five on average) with staff and students

working together in flexible teams. Table 4 shows the distribution of project themes.

Work on frogs and marine turtles has dominated, reflecting the research interests of the staff members mainly involved. Other themes have often resulted from interactions with local organisations: for example, studies on monkeys and bats arose from requests by the Trinidad Government's Wildlife Section, and marine turtle monitoring on Tobago from 2004 resulted from interactions with local NGOs, Save Our Sea Turtles (SOS) and North East Sea Turtles (NEST). Each expedition has produced a report, available in the Glasgow University Library, with most also available on GUExSoc's web-site (www address: <https://glasgowexsoc.org.uk>). In addition, five PhD students have carried out their field research in association with Trinidad expeditions, and several Masters students and many undergraduates have undertaken their research projects on the islands. All this research has contributed to over 90 scientific papers in peer-reviewed journals. In addition, the work has contributed to a recent field guide to the reptiles and amphibians of Trinidad and Tobago (Murphy *et al.*, 2017) and to a book chapter on the conservation status of the islands' frogs (Auguste *et al.*, 2017). Some might think this a surprising outcome for work mainly done by undergraduate students, but if such work is properly supervised, there is no reason why it should not produce competent and publishable science, especially from locations holding such an abundance of biodiversity and where basic natural history observations are still needed. One of the pleasing outcomes of the Trinidad and Tobago expeditions is how often they have helped young scientists to achieve their first publications. Of the 90+ papers derived from these expeditions, over 60 of the authors were undergraduates when they did the work (see Downie, 2012 for a complete list of the publications to 2010). In addition, many Trinidad and Tobago expedition participants have progressed to distinguished careers in science. What has all this effort achieved? We present a short selection of highlights.

	Themes
51.1	Frogs: reproductive ecology, behaviour, treefrog adhesion, distribution, new species, phylogeny, conservation
20.9	Marine turtles: nest monitoring and conservation, nesting behaviour and physiology, hatchling behaviour
13.2	Invertebrates: crab behaviour, insect systematics and ecology, corals- fossil reefs and reef conservation
7.1	Birds: diversity, behaviour, ecology
4.9	Mammals: wild pig conservation, monkey behaviour, bat diversity
1.6	Lizards: diversity and behaviour
1.1	Fish: diversity, ecology

Table 4. Distribution of Trinidad and Tobago expedition project themes, from 35 expeditions and 182 projects.

The golden tree frog *Phytotriades trinitatis* (Fig.2) is one of Trinidad's most iconic species. Living in the water tanks enclosed by the leaves of the giant bromeliad *Glomeropitcairnia erectiflora*, this frog is found only near the summits of the island's highest mountains. Using molecular phylogenetic methods, Jowers *et al.* (2008) established that this species should be classed in a genus on its own and that it is not closely related to frogs in the genus *Phyllodytes* to which it was previously assigned. More recently, Brozio *et al.* (2017) have established the value of the new method of environmental DNA for detecting these frogs without having to destroy their host plants. Monitoring the health of the golden tree frog population should be much easier in future.



Fig. 2. The golden tree frog, *Phytotriades auratus*, El Tucuche, Trinidad (photo credit: Gillian Simpson)

Before our work, the stream frog *Mannophryne trinitatis* was considered to occur both in Trinidad and in the nearby Paria Peninsula of Venezuela, and possibly also in Tobago. Manzanilla *et al.* (2007) showed that the Venezuelan and Tobagonian populations belong to different species, confirming *M. trinitatis* as a Trinidad endemic (and the Tobago species *M. olmonae* as a Tobago endemic). In *Mannophryne* species, males guard the eggs on land, then carry the hatched tadpoles to water (Fig.3). Downie *et al.* (2001) showed that transporting males are careful to avoid depositing their tadpoles in water containing predators and that they can carry their tadpoles for several days in search for a suitable pool or stream. An early assessment by IUCN suggested that this species is amongst the frog species threatened with extinction, but our recent results (Greener *et al.*, 2017) show that it is highly abundant and widespread in suitable habitat in Trinidad.

The first two Trinidad expeditions included monitoring of the east and north coast beaches for nesting marine turtles, at the request of the Wildlife Section's director, Dr Carol James. The findings from these expeditions (later written up by Godley *et al.*, 2001a, b) contributed to the discussions between

government and local communities that led to the establishment of a set of NGOs whose role was to protect nesting turtles and to educate visitors about them. Our later expeditions have worked with several of these NGOs: at Matura, Grande Riviere, Matelot and Fishing Pond (in Trinidad) and with SOS and NEST in Tobago. Our work has helped clarify the sizes of the nesting populations and to map the beaches where they occur (Walker *et al.*, 2015).



Fig. 3. A male Trinidad stream frog, *Mannophryne trinitatis* transporting his tadpoles (photo credit: Joanna Smith)



Fig. 4. Entomologist Jeanne Robinson sampling from a bromeliad, Arima Valley, Trinidad (photo credit: Geoff Hancock)

Several new species of Diptera (flies) have been named and described as a result of our Trinidad expeditions. The phorid *Megaselia nidanuræ* was discovered to lay its eggs in the foam nests of the burrow-nesting frog *Leptodactylus fuscus* (Downie *et*

al., 1995). A new species in the Mycetobiidae, *Mycetobia downiei* was found as larvae in sap runs of mature Saman and Mora trees (Hancock, 2016). Arising from observations made in bromeliads of fly larvae while monitoring the golden tree frog (Fig.4), some projects were planned. Hoverflies were reared from bromeliads and similar phytotelmatous habitat and three new species *Copestylum elizabethae*, *C. louisae* (Rotheray *et al.*, 2007) and *Quichuana longicauda* (Ricarte *et al.*, 2012) were revealed.

North Cyprus

In 1992, the first Glasgow University Turtle Conservation Expedition (GUTCE) to Northern Cyprus took place, in many ways resulting from the Trinidad and Tobago expeditions of 1989 and 1991. Plans to study wild birds on the 1989 Trinidad and Tobago expedition were abandoned at the last minute due to permit issues and instead it was suggested that the group work on marine turtles.

Brendan Godley (BJG) was part of the 1989 team and returned (with ACB) as leader in 1991 to continue the work on marine turtles. Meanwhile, a fortuitous meeting took place in Cyprus in the summer of 1991, between Kutlay Keço, Ian Bell, and Celia Moorley-Bell of the Society for the Protection of Turtles in Northern Cyprus (SPOT), and a friend of University of Glasgow staff members Sally Solomon and Roger Tippet. The need to do more to protect the turtles in Cyprus was discussed, and aware that Sally had conducted research on turtles, the friend suggested that the SPOT team write to Sally to ask if there was a group of students who might come out to Cyprus to help. Knowing that BJG had been involved in monitoring marine turtles in Trinidad and Tobago, Sally passed on the letter and asked BJG if he could get a group of students together to go out to Cyprus in the summer of 1992. The project was born and a group of 14 students, led by BJG and ACB and supported by University of Glasgow staff members including Sally Solomon, Roger Tippet and JRD took part in the first GUTCE expedition.

In 1992, our main base was at the Fire Station in Yesilkoy on the Karpaz peninsula, and as we explored all of the 80+ turtle nesting beaches over the season, we quickly came to realise the importance of Alagadi Beach, situated on the north coast of the island, which was also conveniently where SPOT President Kutlay Keço lived. In that first year we camped on the beach, which was pretty tough after a night shift, trying to sleep in the heat of the day! Over that summer however, Ian and Keço came to the conclusion that we were a hard-working and eager group and asked us to return the following year, generously renovating an old building at Alagadi for us, named the 'Goatshed' (Fig.5) after the previous inhabitants! During the summer of 1993 we came to realise that there was a wealth of research to be conducted on the turtle populations in Cyprus and thanks to Sally's persistence, both ACB

and BJG were awarded University of Glasgow post-graduate scholarships to conduct the fieldwork for their PhDs in Cyprus. This amazing opportunity secured the long-term future of the project and formed a platform for both academic careers.



Fig. 5. The turtle team at The Goatshed, main base of the marine turtle project, North Cyprus (photo credit: Annette Broderick)

Although mostly focusing on marine turtles, other studies have been conducted on crabs, frogs, birds, dune vegetation and a separate GU expedition was mounted to study the feral donkeys. The project has continued each year since and is now in its 25th year, although it subsequently moved with BJG and ACB to the University of Swansea (1999) and then Exeter (2003). Now named the Marine Turtle Conservation Project, it is a collaboration with the Society for the Protection of Turtles in Northern Cyprus (SPOT) and the Environment Protection Department and accepts volunteers from all around the world. The Goatshed is still our main base on the island and also now has a small information centre for visitors and local people to come to find out about turtles and if possible arrange to see nesting and/or hatchling turtles.

Overall the project has led, in total or in part, to eight PhD theses, with a further five underway, and has resulted in over fifty peer-reviewed scientific papers. In addition, data from the project have provided the basis for the designation of five Special Environmental Protected Areas (SEPAs) containing turtle nesting beaches. These sites have also been identified as potential Natura 2000 sites and are awaiting designation by the European Union. The duration of the project means that over 1200 students have been able to experience a summer of challenging ecological research, environmental education and direct conservation action, with many moving on to careers in these sectors. The student group has always had an international feel with students from across the world partaking. In recent years, growing numbers of Cypriot students studying veterinary and life sciences have been working as part of the project which augments the effectiveness

of the project and the cultural experience for all involved.

A full list of publications can be found at <cyprusturtles.org> but a highlight has been the satellite tracking studies over the years that have told us so much we didn't know about the life histories of both green (*Chelonia mydas*) and loggerhead (*Caretta caretta*) turtles. We have described their foraging locations - mostly along the north African coast, their over-wintering behaviour - moving offshore to deeper waters in the colder months where they do little but breathe - indeed we recorded the longest dive of an air breathing vertebrate - a loggerhead turtle whose dive lasted 10.5 hours and made it into the *Guinness Book of Records*! A second highlight has been that two of our PhD students have married Cypriot scientists and they are now living in Cyprus with their families and all working on ecological/environmental issues with NGOs or Universities.

Funding has always been a challenge, given the political sensitivities of working in the north of Cyprus, yet small pots of money from numerous funding bodies and hundreds of self-funded student volunteers who have worked day and night over the years have enabled the project to continue annually for more than two decades. We thank them all for their support.

Sadly, Ian Bell and Sally Solomon are no longer with us but the legacy of their generous mentorship and support continues.

Ecuador

A one-off expedition to northeast Ecuador took place in 1997, working on bird populations in degraded forest, and on begonias. However, a later series of University of Glasgow expeditions to Ecuador came about due to one of those happy coincidences that happen only very occasionally. Glasgow Zoology graduate Nan Swannie (a member of the Trinidad expedition in 1993) visited Ecuador on holiday and sampled some ecotourist experiences. By chance, wandering along the road in the Amazonian oil town of Coca she met a tour guide called Darwin Garcia and took his tour up the Rio Payamino to the community of San José de Payamino. Not long after she returned home, Nan visited Glasgow to give a talk on her experiences in Ecuador to the student Zoological Society. At the end of her presentation she mentioned that Darwin was keen to have scientific research conducted in the Payamino area. SW was in the audience and already a veteran of multiple student expeditions to Trinidad. He chatted to Nan over the usual post-lecture cheese and wine and, despite already having committed to a Trinidad expedition, agreed to propose an Ecuador expedition for the following summer, 2000.

The Ecuador Expedition proposal went down well with students in Exploration Society and after

interviewing over 40 applicants a group was selected. The first Ecuador expedition was comprised of two research groups, a bird group led by Stewart White and an insect group led by GH from the Hunterian Museum and Graham Rotheray from the National Museums of Scotland. Both groups spent an initial period of three weeks at the private cloudforest reserve of Otonga in the Andes south of Quito. After this initial period of research the bird group travelled on to Amazonia and met up with Darwin and his brother Edwin to travel to Payamino. The first year saw many teething problems, inevitable when taking a group of students to a country for the first time and particularly when only two of the group had very basic Spanish and no knowledge of kichwa. The expedition was enough of a success, however, to encourage Stewart to arrange with Darwin and Giovanni Onore the owner of Otonga to make regular future visits.

At the time of writing there have been 12 University of Glasgow Ecuador expeditions, with the focus of the visits having gradually moved towards concentrating on Payamino. Well over 100 Glasgow undergraduate and postgraduate students have visited Ecuador on expedition, conducting research on leafcutter ants, butterflies, dragon and damselflies, fish, frogs and mammals. The bird research has continued to be the main project with the species list for Payamino now standing at 340 species and with several thousand individually marked birds flying around the rainforest carrying Swedish aluminium bands marked 'University of Glasgow', plus a few marked 'University of Dundee', but's that's another story!

As well as expeditions, an undergraduate field course, part of the final year Tropical Rainforest Ecology option has been running for the last 11 years. This gives the students the chance to study the rainforest ecosystem first hand and conduct short group research projects. The students selected have to pay a personal contribution but the field course is heavily subsidised by the University - evidence that the value of field teaching in such a biodiverse environment is appreciated.

The expeditions and field courses have given the students involved a unique experience and several who visited as 'ordinary' expedition members later returned as expedition leaders and in two cases as members of staff on University field courses in Payamino. Several of the students have gone on to post-graduate study and all would say that the Ecuador Expedition or field course was the most memorable part of their time at University. Along with the University of Manchester and Universidad Estatal Amazonico in Puyo we have been able to found a permanent research station at Timburi Cocha on the bank of the Rio Payamino (Fig.6). This now welcomes researchers from Ecuador, North America and Europe and has seen the publication of

several papers in peer-reviewed journals (e.g. Muir & Muir, 2011; White & Patino, 2017), with more in preparation. From entomological work during two of the Otonga cloud forest expeditions a number of hoverflies (Syrphidae) were reared from bromeliads and decaying plant material of two new species, *Copestylum ontongaensis* and *C. tapiai* (Rotheray *et al.*, 2007). All this was the result of a chance meeting in the dusty streets of Coca.



Fig. 6. Glasgow students and local people interacting at the Rio Payamino community, Ecuador (photo credit: Stewart White).

EDUCATION AND OUTREACH

Expeditions are educational in many ways: the participants learn a lot about the places they visit, develop new skills and learn about their own capabilities, as discussed by Harper *et al.* (2017). The results presented in the many publications derived from expeditions provide information on the places visited. However, expeditions have additional educational roles. In most cases, they work in collaboration with local organisations, sometimes government agencies, more often NGOs, as outlined in the earlier case histories. These collaborations provide many opportunities for two-way learning. In addition, many expeditions have built into their aims explicit educational activities. In the marine turtle focused expeditions run in both North Cyprus and at the RAF base at Akrotiri in the south, educating beach visitors about the turtles, threats to them and how to avoid causing harm have been constant activities. For several years, the Trinidad expeditions were involved in a British Council sponsored link between Glasgow and Trinidad schools; this involved working in Glasgow schools, carrying out educational activities related to the people, culture, environment and biodiversity of Trinidad; and in Trinidad schools, briefing students on Scotland, but also helping them to learn about their own biodiversity, based on our expedition findings; sadly, local biodiversity is poorly covered in the Trinidad school system, and the field trips the expeditions arranged for school groups were very popular. The Islay expeditions work closely with the Islay Natural History Trust and, through school visits, help

children to learn about their local wildlife. Many other examples could be given; for more information, read the expedition reports in the GUExSoc archive.

DISCUSSION

It is clear from the account provided here that University of Glasgow expeditions have generated a vast amount of natural history information, both in Scotland and abroad, and that the size and scope of the expedition enterprise has grown hugely since the 1930s. It is also clear from this account and the research by Harper *et al.* (2017) that the expedition experience has been of great benefit to young people starting their careers in science. To finish this historical review, we ask some questions on sustainability and future aims. The loss of Carnegie funding has been very damaging to expeditions organised by Scottish Universities, and we hope that in time, the Trust will re-consider and develop a new scheme. Despite the demonstrable value of expeditions, the University of Glasgow itself does not have a clearly ear-marked method for funding them. We hope that this can be resolved in the near future. The Blodwen Lloyd Binns Bequest has been a valuable and reliable source of grants, but it does not possess the resources to be a major funder. As for the student population, the large number who attend the annual proposals meeting, where the next summer's expeditions are outlined, and students are invited to apply for places, shows no signs of diminishing enthusiasm. Students recognise the value of an opportunity to carry out real research which they have helped plan themselves, and which is carried out in a location far from their previous experience. However, although the students raise some of the funds through their own activities and personal contributions, the ever-rising costs of expeditions indicate the need for reliable external funding. As we have shown, Glasgow expeditions have been to locations both in Scotland and abroad. Both have generated valuable results and experiences, and we hope that they can continue into the future. Although Scottish based expeditions are less expensive and easier to organise, Scotland has a long history of engagement with other countries, and it is still the case that in many countries, the experiences, skills and interests of Scottish researchers and students can make valuable contributions to the expansion of knowledge.

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