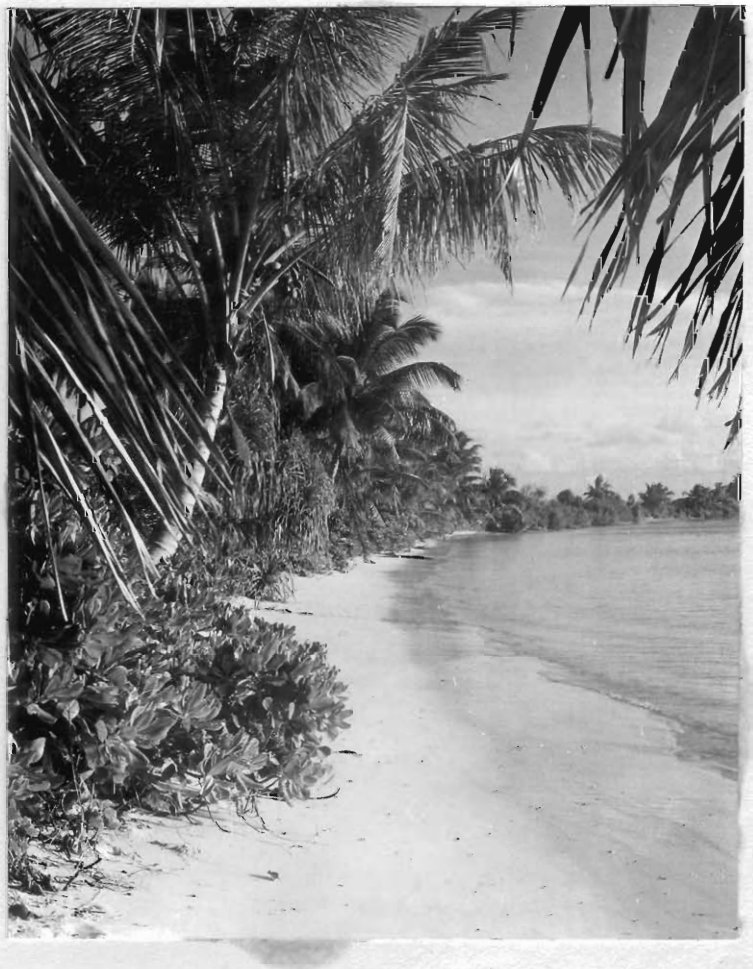
IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY

MALDIVE ISLANDS EXPEDITION

1972

PRELIMINARY REPORT



NOVEMBER 1972

PRELIMINARY REPORT

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Front Cover LAGOON SHORE, VILIGILI LOOKING SOUTH FROM CAMP.

1. INTRODUCTION

The expedition took place from 15th August 1972 to 27th September 1972. For the majority of this period the expedition camp was based on the island of Viligili, in the Addu Atoll, the southern most atoll in the Maldive Islands. The work of the expedition was entirely Botanical and Zoological; the aims of the former were to collect specimens of all the plant species on the island, to roughly map the vegetation of the island, to carry out quantitative studies of transects across the island from seaward to lagoon shore, and to analyse certain typical well-defined vegetation types. The Zoological aims were to collect specimens of terrestrial Crustacea and Arachnida, and to study the ecology of the land hermit crabs (Genus: Coenobitidae) by collecting data relevant to habitat, shell and food preferences, and rhythmicity.

EXPEDITION MEMBERS AND THEIR NON-SCIENTIFIC TASKS

	Age		Function
J.H.W. GIPPS.	25	3rd. Year Zoology Undergraduate	Leader
Mrs. C.V. GIPPS.	24	Psychology Postgraduate	Medical Supplies and General Stores
D.M. NEWBERY	21	3rd. Year Botany Undergraduate	Camping Gear
A.B. RYLANDS	21	3rd. Year Zoology Undergraduate	Food and Catering Supplies
R.A. SPICER	21	Botany Postgraduate	Scientific Equipment

2. ACKNOWLEDGEMENTS

Without the help that we received before, during, and after the expedition, it would have been completely impossible for us to have gone at all. Firstly, we are most grateful to the Maldivian Government for permission to work on the Addu Atoll, and to the Director of Movements, Royal Air Force, for arranging our flights to and from R.A.F. Gan. During our stay in Addu, we received much assistance from the Royal Air Force on Gan. We would like to thank the Commanding Officer, Group Captain R.S. Salmon, for extending to us the facilities of the base, and our Liaison Officer, Flight Lt. I.A. Rodgers, for his assistance. During our stay, many people, too numerous to mention individually, helped us greatly.

We are indebted to Ahmed Sidi Ali Didi, the Chief of the Atoll, for permission to work on Viligili, and for his help. In particular, also, we should like to thank Mohammed Saeed, who gave us much assistance; without his great help and hospitality, the expedition would not have been nearly so trouble-free or enjoyable.

The expedition was obviously expensive, and we are, therefore, very grateful to the following bodies which helped us financially:-

Imperial College Explorations Board
The Royal Geographical Society
The F.C. Gregory Fund
The Gilchrist Educational Trust
The British University Students Travel Association
The Munro Trust
The Slater Trust
Gloucestershire Education Authority
Dr. D.R. Stoddart

Before our departure, many people helped us with advice, both scientific and otherwise. Our thanks therefore go to:-

Dr. D.R. Stoddart
Major W.W.A. Phillips
Dr. A. Rice
Dr. J. Taylor
Dr. R.W. Ingle
Dr. D.C. Siggee
Dr. E.W. Groves

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All our equipment was shipped to Gan free by the P. & O. General Cargo Division, in free packing cases given to us by Triwall Containers Limited, taped up with free waterproof packaging tape supplied by Advance Tapes Ltd., and strapped with free steel banding, supplied and put on by Signode Ltd. To all these firms, we are much indebted.

The following firms most generously supplied us with food or equipment, free or at a discount:-

Beecham Research Laboratories. W.B. Pharmaceuticals Ltd. Smith & Nephew Ltd.	Medical Supplies
Black & Edgington Ltd. W. Ingram & Associates Ltd.	Camping Equipment
Avon Rubber Company Ltd. (Inflatables Division)	Inflatable Rubber Boat
Ailsa Craig Ltd.	Outboard Engine
Metal Box Company.	Various Containers
Carrs of Carlisle. Keymarkets Ltd. C. Shippam Ltd. W.A. Baxter & Sons Ltd. Unilever Export Ltd. Glaxo Laboratories Ltd. Tate & Lyle Refineries Ltd. General Foods Ltd. Batchelor Foods Ltd. Quaker Oats Ltd. Whitbread & Co. Ltd. Edgar J. Saxon Ltd. Whitworths Holdings Ltd. The Ryvita Co. Ltd. Bowyers (Wiltshire) Ltd.	Food
Jeyes (U.K.) Ltd. Venus Easterbrook Ltd. Channel Marine (Sales) Ltd.	Miscellaneous Equipment

Without exception, all the food that we took (which left U.K. on 9th July 1972, and a small quantity of which returned to England during October 1972), stood up extremely well to tropical conditions; not a single item of dried or tinned food went bad during our stay. (All dried food being packed in airtight tins, supplied by the Metal Box Company).

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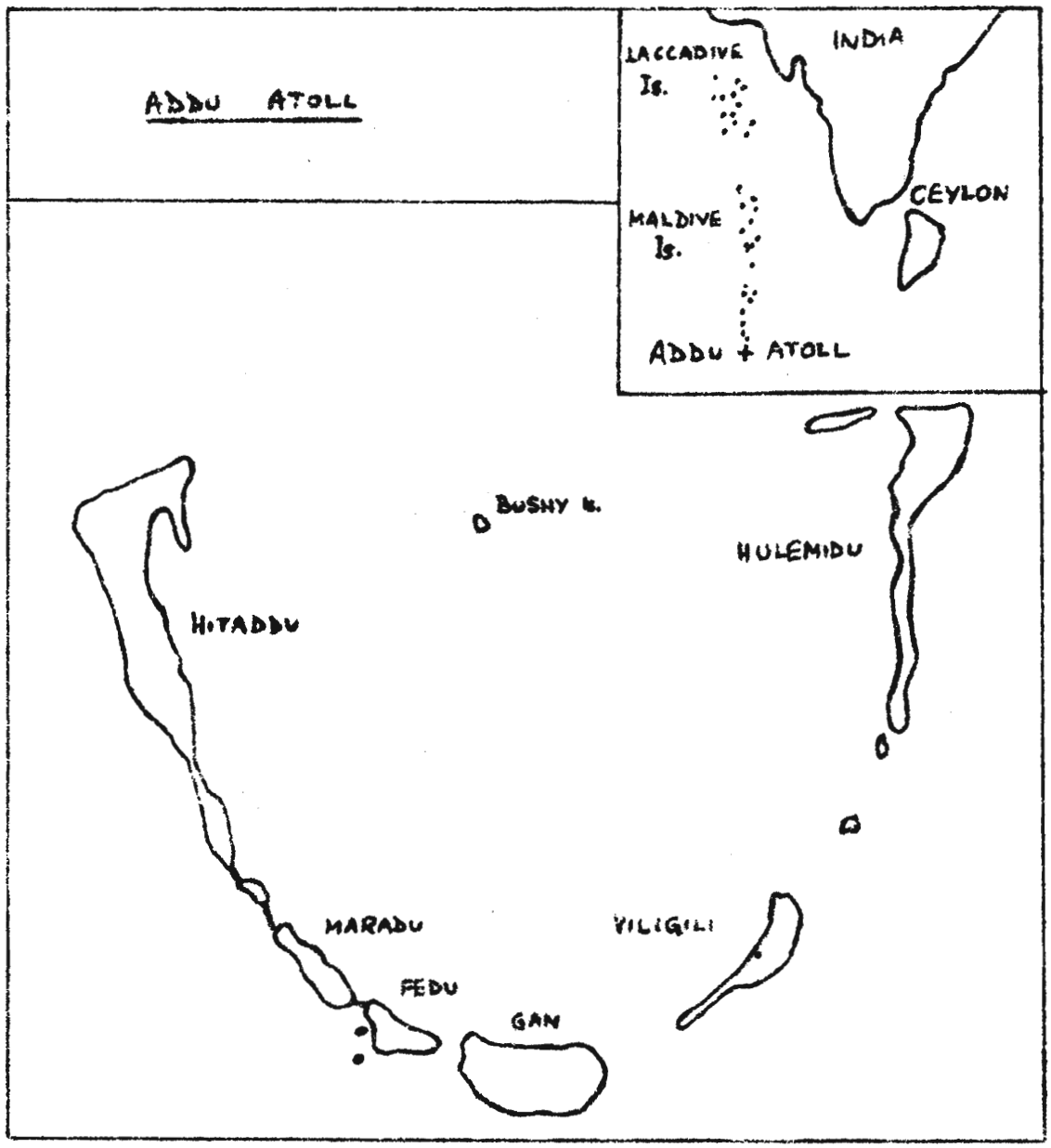
The army most kindly lent us some camping equipment.
Russell Elmer of Bacton, Suffolk built the Actographs.

Now that the collections of plants and animals have arrived back in U.K., we shall undoubtedly receive assistance in sorting and indentification. Similarly, all the quantitative data collected still remains to be analysed, and we shall certainly need professional help. The full expedition and scientific report should emerge during the first half of next year, and in it all assistance will again be acknowledged.

3. ADDU ATOLL AND PREVIOUS EXPEDITIONS TO THE MALDIVE ISLANDS

The Addu Atoll is the most southern atoll in the Maldive islands, lying about 30 miles south of the Equator. The atoll is triangular in shape (see map) with 6 main islands. Gan is occupied entirely by the Royal Air Force, who use it as a staging post. Hitaddu, Fedu, and Maradu are densely populated, with populations of around 6000, 2000 and 2000 respectively. Hulemidu is most sparsely populated with a population of 2000 also. Viligili is virtually uninhabited.



Apart from Gan, which obviously has very atypical vegetation due to the presence of the R.A.F., the uninhabited parts of all the islands are largely covered with coconut trees. Thus the vegetation of the islands cannot really be said to be undisturbed, except in a few regions where coconut trees are not present; Viligili is uninhabited, and these little-disturbed regions are larger and more common than on other islands of the atoll.

Previous expeditions to the Maldives, such as that of J. Stanley Gardiner in 1900, and the John Murray expedition (1933-1934), were primarily concerned with collection and classification of both plant and animal species found there, and relatively little ecological work has been done in these islands. In 1964, D.R. Stoddart led an expedition to Gan, but this was largely concerned with the geomorphology of the atoll and with reef studies, and was limited to the island of Gan and a small area of Hitaddu. The Botanist present on that expedition, Dr. D.C. Siggee, said in the expedition report, (Smithsonian Institute, Atoll Research Bulletin, No. 116) that studies, particularly of the vegetation, on a less disturbed island than Gan could prove valuable for comparative work, not only with other islands in the Maldives, but also with other groups of islands in the Indian Ocean. It is hoped that the present expedition has, at least in part, achieved results useful to this end.

4. PREPARATION

Initial approaches were made to the Imperial College Exploration Board, the Maldivian Government via the Foreign Office and the British High Commissioner in Colombo, and the Royal Air Force, in December and January 1971. As a result of an Exploration Board meeting in May it was decided to help the expedition financially with a sum of £200; permission to go to the Addu Atoll was received in April and at the same time, the Royal Air Force offered to fly the expedition members to and from Gan. The expedition equipment was collected and packed during May and June 1972, and left U.K. from Tilbury in M.S. TAIREA, a vessel of the P. & O. General Cargo Division on 9th July, 1972 and arrived at Gan on 15th August. The expedition members flew from R.A.F. Brize Norton on 15th August 1972 arriving at Gan at 03.35 local time on the 16th.

5. NON-SCIENTIFIC PROGRAMME

A short precis of the expedition diary, kept by Caroline Gipps.

August

Wed. 16th. We arrived at Gan at 3.35 a.m. local time and spent the rest of the night in the Blue Lagoon transit hotel on Gan. Next morning we met our liaison officer, Flight-Lieutenant Rodgers, who together with Mohammed Saeed, the senior Maldivian on Gan, decided that we should camp and work on Viligili. This was because there was a mild Typhoid epidemic in the atoll and since this island is virtually uninhabited, it was considered the most suitable for us; a signal was sent to Male to seek official permission from the Maldivian Government. R.S. 'Tairea' with our equipment on board was anchored in the lagoon, but none of it had yet been off-loaded.

Thurs. 17th. A reply came from Male giving us permission to go to Viligili, so Mohammed Saeed took us over to see the island. We met the three sole inhabitants, chose a possible camp site, and had our first coconut. Two crates were off-loaded from 'Tairea' to Gan in the afternoon.

Fri. 18th. All the rest of the gear came off Tairea by mid-afternoon, including our inflatable rubber boat and outboard motor so that Ant Rylands, Bob Spicer and Dave Newbery were able to go to Viligili to set up an advance camp.

Sat. 19th. We hired two local boats and took all the rest of the equipment over to Viligili from Gan. We unpacked and pitched the rest of the tents to the stares of the three inhabitants of the island, whom we had met two days previously.

Sun. 20th. We made a tour of the south end of the island and got badly bitten by mosquitoes which seem also to have found our camp. Both Botanists and Zoologists started collecting specimens; this collection continued throughout the rest of the expedition.

Mon. 21st. Jo, Caroline and Ant went over to Gan for fresh water. Bob and Dave put up tatter flags with the unsolicited but very useful help of one of the Maldivians. When they got back from Gan, Jo and Ant assembled the actographs and did trials with some crabs.

Tues. 22nd. Bob and Dave started on their first transect across the island and had trouble in getting through one particularly dense area of vegetation, so we all went to give them a hand and found a path (of a sort) past a mangrove swamp. Jo and Ant set up the actographs at a permanent site, slightly away from the camp. They were then maintained twice daily, and the Activity records collected when necessary.

Wed. 23rd. Bob and Dave went to Gan for water. They came back having bought a sarong for each of us (much the coolest and most comfortable garment in the high temperatures) and then completed their first transect. Jo and Ant labelled and preserved some crab specimens they had collected.

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Thur. 24th. Bob and Dave collected at the south end of the island; Jo, Ant and Caroline went collecting at the north end of the island, helped by one of the Maldivians, and found a large fresh water lake on which several herons were observed and filmed. During the night the wind blew up and there was a real danger of tents blowing over; luckily, however, this did not occur.

Fri. 25th. The three Maldivians, whose names we had now discovered were Ismael, Ibrahim, and Mohammed, brought us some fish, and in payment we gave them some Moon-Tigers, coils which, when smouldering, keep the mosquitoes at bay. Jo and Ant did some writing up, sorting of crabs and collecting. Bob and Dave started on a new transect across the island at a point further North than their first. During the evening, Mohammed, Ismael, Ibrahim brought us a crayfish which they had just caught on the seaward reef, the tide was very low, and there was a full moon. We later went out on the reef to try our luck, but were unsuccessful.

Sat. 26th. Bob and Dave finished their second transect and dug soil pits across it. Jo was very sunburnt and had to stay in the shade, so Ant and Caroline went to Gan for water. During the afternoon, Jo and Ant started the systematic sampling programme of the island, in which the whole island was to be sampled on a regular grid.

Sun. 27th. Bob and Dave dug soil pits on their transect all day. Jo and Ant continued sampling.

Mon. 28th. Bob and Dave started their third transect. Jo and Ant weighed and measured the crabs that had been collected yesterday. Ibrahim's son appeared and as he spoke some English, the botanists were able to ask him the Maldivian names of some plants.

Tues. 29th. Bob and Dave went to Gan for water, Jo and Ant measured crabs and decided to discontinue weighing them as the hermit crabs were much smaller than they had expected and their spring balances were not sensitive enough. Thus it was decided that each crab would have to be wrapped and preserved individually for weighing on return to U.K. They sampled some more of the island in the afternoon and Bob and Dave got further across the island on their third transect.

Wed. 30th. Bob and Dave finished the third transect and measured 600 leaves from their species No. 16 (as yet unidentified) for a study on phenotypic variation. Jo and Ant measured crabs and then collected some more. The actographs continued to be used and traces collected.

Thurs. 31st. Bob and Dave dug soil pits and measured more leaves. Jo and Ant disturbed a wasp's nest while sampling, getting stung in the process.

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September

Fri. 1st. We were visited by the Atoll Chief, Ahmed Sidi Ali Didi, Mohammed Saeed and various henchmen. They brought a whole branch of bananas as a present for us and amongst other things showed us how to entice crabs out of their burrows with a piece of banana leaf on the end of a fishing line. We showed them what scientific work we were doing and some of the animals and plants that we had collected. We walked with them down to the huts where Ismael, Ibrahim and Mohammed live, and where the coconuts are stored. They took us to look at a cultivated area at the North end of the island, after which we ate sweetcorn à la Maldivian - thrown into the smouldering embers of a coconut husk fire for five minutes to char. They also gave us some of the solidified milk which forms in a germinating coconut, which is considered, and is, a real delicacy. Ismael had given us a germinating coconut once before, and not surprisingly had appeared rather taken aback when we planted it; we had been supposed to eat it! The Chief spotted a spare Maldivian seat (a wooden frame with netting to sit on, rather like several deck-chairs joined together), and insisted that we have it for our camp; this was because we had previously said that the only thing that we really lacked in our camp was something comfortable to sit on!

Sat. 2nd. A very wet day: Jo and Ant sampled while Bob and Dave measured leaves.

Sun. 3rd. Bob and Dave set up their first 10 by 10 metre sampling area of a homogeneous area of vegetation, sub-sampling a hundred $1m^2$ quadrats, but under very difficult conditions as the island was full of Maldivians collecting fire-wood! Jo and Ant sampled as before, and did some cine-photography. This sample area (forest, north west of the camp) appeared completely devoid of hermit crabs.

Mon. 4th. Bob and Dave went to Gan, and then sampled another site. Ant and Jo sampled in the forest area and found no hermit crabs for the second day running.

Tues. 5th. Because this was half way through the expedition, and also Jo and Caroline's wedding anniversary, we had celebration drinks at lunchtime (duty-free rum and coke from Gan!) and then took the afternoon off. We all went swimming on the reef, and had a celebration meal in the evening, with more drinks!

Wed. 6th.)
Thurs. 7th.) Jo and Ant continued sampling. Bob and Dave collected plant specimens at the north end of the island.

Fri. 8th.)
Sat. 9th.) Jo and Ant sampled. Bob and Dave sampled two more 10 x 10 metre sites.

Sun. 10th. We went over to the tiny island called Bushy (see map) which is totally uninhabited. Bob and Dave found several new species of plant. The trip was rather curtailed by torrential rain.

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Mon. 11th -)
Thurs. 14th.) The weather was very wet during this period and a lot of time was spent inside the mess tent; also, several members were suffering from minor ailments. Jo and Ant continued to sample and measure the crabs, Bob and Dave continued throwing quadrats at various new sites.

Fri. 15th. As the weather was good, we spent some time swimming and drying out our clothes. Later, Jo and Ant prepared for a food preference experiment while Bob and Dave collected specimens.

Sat. 16th.
Sun. 17th. Jo and Ant sampled, Bob and Dave finished some more quadrats. On the Sunday afternoon, Ant was taken ill and that evening Jo and Bob went over to Gan for a boat, which came and took him to the R.A.F. hospital.

Mon. 18th. Bob and Dave measured leaves of species 16, for the phenotypic variation study, while Jo and Caroline went over to the hospital to see Ant, who was not at all well. In the afternoon Jo and Caroline continued the sampling programme and measured some crabs from the previous day's collecting.

Tues. 19th. Bob and Dave went to see Ant who was not much better; his temperature was going up and down and had been as high as 104+°F. Sampling and collecting continued.

Wed. 20th. The weather was terrible with torrential rain and very strong winds, so the whole day was spent inside the mess tent measuring either crabs or leaves. Ant's tent blew over and all his belongings had to be salvaged in the pouring rain.

Thurs. 21st. Bob and Dave went to Gan to see Ant, who was much better and hoped to be out in three or four days. Jo and Caroline finished the sampling programme (having now covered the whole island), and this was the final day of the food preference experiment.

Fri. 22nd. Bob and Dave finished their sampling, doing three sites in one day, bringing the total number of sites to twenty, Caroline and Jo measured the last of the hermit crabs and went to see Ant, who was now feeling fine, but rather weak!

Sat. 23rd. Bob and Dave went to see Ant who then left the hospital and booked in at the Blue Lagoon hotel. Jo started packing some equipment while Bob and Dave collected their last few specimens to complete the plant collection.

Sun. 24th. We were picked up by a boat at about 10.00 a.m. and went over to Fedu to meet Mohammed Saeed, picking up Ant from Gan on the way. We were taken on a tour of the three islands Fedu, Maradu and Hittadu by Mohammed Saeed, who gave us a very pleasant lunch at his house with the Atoll Chief. During our stay we visited two of the Maldivian schools.

Mon. 25th. During the morning, we hired a Maldivian boat to take the first of our packing cases containing our equipment over to Gan, where we spent the remainder of the day arranging the transport of the gear home. During the afternoon we visited the heronry on Gan and did some cine-filming (to date, we had taken about 80 minutes of cine-film). We returned to Viligili in the evening.

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Tues. 26th. The weather was fine again, so we spent the day swimming. We all went over to Gan in the late afternoon and spent the evening in the Blue Lagoon Hotel. At 10.30 p.m. Jo and Caroline departed from Gan on a V.C. 10 to Brize Norton.

Wed. 27th. Bob, Ant and Dave did some more filming and more swimming, and finished the packing of the equipement.

Thurs. 28th. Bob, Ant and Dave broke camp on Viligili, went over to Gan with the last of the gear for packing, and caught the Singapore flight to Brize Norton, departing from Gan at 10.30 p.m.

25 October 1972.

All the expedition equipment has arrived back in U.K. The Plant specimens have gone to the British Museum (Natural History); the Zoological Specimens are being sorted for identification. The full analysis of the quantitative data collected will be done after final examinations which take place in April 1973.

6a. SCIENTIFIC PROGRAMME - BOTANICAL

In 1902 Alexander Aggassiz described the vegetation of Viligili as being .." perhaps as luxurious as that of any island in the Maldives."

The present study of the vegetation of the island was undertaken not only to make a comprehensive collection of plants from a largely undisturbed island, but also to try and investigate the distribution of plant species and their communities. One of the first tasks that was carried out on arrival on the island was to set up three transects across the island from the lagoon side to the seaward side. At the ends of these transects and also in the vegetation midway along the lines, tatter flags were set up to give an indication of the comparative exposure of the seaward and laggon facing shores.

Two flags were set up at each station 1 metre above the ground and 1 metre apart. The flags were then left for the duration of the stay i.e. 36 days. The vegetation was sampled every metre along the transects by noting those species which crossed the transect line in the previous metre length. Every 20 metres along the transects, soil pits were dug down to a depth of 30 - 40 cm. Soil samples and pH readings were taken at 5, 10 and 20 cm depths and a description of the soil profile was made. Thus it is hoped that it will be possible to relate changes in the vegetation to changes in soil and exposure across the island. Whilst doing this a collection of plants occuring along the transects was made and we were able to acquaint ourselves with the geography of the island.

Following this study, a subjective map of the major constituents of the island vegetation was made. This was done by walking over the island and noting the positions of any species that was considered to contribute significantly to the cover in that area. This in practice usually turned out to be the most conspicuous species in terms of size. This method had the advantage of being fairly rapid and was particularly suitable where access was limited due to the density of the undergrowth.

A more quantitative approach was then adopted to compare various different communities that were considered to be homogeneous and that had been detected during the vegetation mapping. It was known that in previous studies of Indian Ocean islands, e.g. The Seychelles, a site size of 10 metres square was found to be suitable and thus, since time was limited, this size was adopted for the objective study whereas normally a species area curve would have been constructed to find the optimum site size.

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A 10 metre square site was marked out with strings over a selected area, and this was then subdivided into 100 metre squares with further strings. In each of 35 randomly chosen 1 metre square quadrats the presence or absence of any species in that quadrat was noted. A soil pit was also dug at each of these sites and soil samples and pH readings were taken at 5, 10 and 20 cm depths. In all 20 sites were studied.

Throughout these various studies the collection of plants was increased until, by the time of our departure, we had collected all the species known to us which we believe represents the majority of the islands flora; these are at present lodged in the British Museum (Natural History) where Mr. E.W. Groves has kindly offered to identify them. When this has been done further analysis of the vegetation from the data collected will be carried out. The results of this work will appear in the final expedition report.

6b. SCIENTIFIC PROGRAMME - ZOOLOGICAL

Land crabs occur on many coral islands in the Indian Ocean. They are often so abundant that their roles as scavengers and detritus feeders can be of considerable importance to the ecology of the coral island.

The main intention of the zoological work was to study certain aspects of the ecology of the Land Hermit crab (Genus Coenobitidae).

The first aim was to make a collection of Land crabs found on the island. This was continued throughout the duration of the expedition. Three species of Land Hermit crab were identified. At the same time a collection of Arachnida was made.

After a few days work, a means of studying the habitat preference of the Land Hermit crabs became evident. This involved regular sampling over the whole island using a grid system. (Samples, using a metre square quadrat, were taken every 30 metres along transects running E - W across the island, the transects being 30 metres apart).

The numbers of 2 species of Land Hermit crab (C. perlatus and C. rugosus) in each quadrat were noted. The following environmental data of the quadrats was also recorded.

1. Canopy cover - presence or absence and type (coconut or other).
2. Bush Cover - presence or absence and type.
3. Ground cover - (creeper, leaf litter, twigs, Palm fronds, or rotting).
4. Ground - (soil, sand, coral chips etc).
5. Ground state - (wet, damp, dry).
6. The percentage of incident daylight.
7. Wet and dry temperatures

From this data it is hoped to be able to draw a map showing the distribution of the two crab species and investigate the relationship between numbers of each type recorded for each quadrat, and the environmental parameters measured. Also, the botanical work included the making of a rough distribution map of the most abundant plant species on the island and it is hoped to be possible to relate this to the distribution of the two species of Hermit crabs.

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The C. rugosus and C. perlatus individuals found in the quadrats were identified as follows:-

1. Species
2. Sex
3. Molluscan "Host" shell type

The carapace width and cheliped length and the length of the "Host" shell were measured for each crab. They were then labelled and stored individually in 6% Formalin so that the relative wights of the crab and shell could be measured on return to England. They were not weighed in the field, since it was found that the crabs caught were lighter than expected, and that the spring-balances which it had been intended to use were not sensitive enough. Using this data, it is hoped to examine possible indication of "Host" shell preference and possible correllations between size and weight of crab and size,, weight and type of "Host" shell. The occurence of any live Molluscs present in areas where the shell of that Mollusc was being used by Hermit crabs was also recorded. In general, however, it was not possible to carry out any study on Mollusc "Host" shell availability.

During the whole of the expedition, 4 actographs were in use. These consisted of a simple platform pivoted about its mid-line in the bottom of a box; attached to the platform was a lever system which activated a pen writing on paper on a revolving clockwork drum. On the whole, however, the crabs did not react very well to these actographs, and the traces obtained were not as clear-cut as had been hoped. However, several long traces were obtained for C. perlatus and it is hoped that these may exhibit at least trends towards rhythmic activity.

A simple food preference experiment was also carried out for C. rugosus