



BELIZE '86



# **CORAL CAY CONSERVATION**

## **EXPEDITION REPORT**

CAMBRIDGE AND UNIVERSITY COLLEGE  
WALES JOINT UNIVERSITY EXPEDITION  
TO THE BELIZE BARRIER REEF, JULY-  
SEPTEMBER 1986

COXON et al



Pete Kaine

CORAL CAY CONSERVATION

BELIZE '86

EXPEDITION REPORT

Cambridge University and University  
College of Wales, Aberystwyth expedition  
to the Belize Barrier Reef

9th July - 23rd September

1986

Coxon et al

"We wandered where the dreamy palm,  
murmured above the sleeping wave,  
and through the waters clear and calm,  
looked down into the coral cave."

J.C.P  
U.S,N. Expl. Exped.

This report is dedicated to the young  
people who got off their behinds and  
did something for themselves, and for one  
of the Atlantic's last untouched treasures.

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### Patrons

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Pembroke College  
Cambridge University

### Scientific Adviser

Dr David Stoddart  
Department of Geography  
Cambridge University

### Expedition Members

Chris Coxon (Leader)  
Peter Raines (Scientific Officer)  
Colin Coxon (Treasurer and Equipment Officer)  
Mark Evans (Photographer)  
Stephen Pearse (Medical Officer)  
Doron Cohen (Diving Co-ordinator)  
Graham Saunders (Diving Officer)

### Acknowledgements

Our warmest thanks to our patrons and all of our sponsors without whom the project would have been impossible. Our gratitude must also go out to all of those who contributed in kind, namely: Bristol Pneumatics, Camping Gaz, Thos. Tweddles, T.J. Harrison, Schwartz Spices, St Regis Ltd, Safeways, Almay, Coppertone, Kenco, Park Cakes, St Ivels, Tate and Lyle, Tilly, Eastern Airlines, and all those involved in the Block Order and Medical Schemes.

To all of those in Britain who helped us: Sue Wells at the IUCN, Mary Stafford Smith, Ursular Barrow, Jacs and Trish, Dr Grove, Dr Selwyn Williams, Bob Bearchell, the Zoology Department at Aberystwyth, CUUEG and Aberystwyth SAC. To our many friends made in Belize: Mr Ford Young, Miss Bowman, Mr Paul Hunt, The Belize Audubon Society, Mo, Mr Auil, Mr Nigel Price, The Sisters of Mercy and our many friends in the Forces, especially Sq Ldr Ric Atkinson, C Troop (Maritime Wing) of the RCT, the instructors on St Georges Cay, J.C., all of the staff at the APC Hospital and all of the guys in the Joint Services Diving Club.

Finally from myself to my parents, friends and loved ones who suffered me then as now, and to the rest of the team, Pete, Col, Steve, Mark, Mic, Doron and Graham, all of my love and deepest thanks.

C.C

## Introduction

The newly independent state of Belize has the Atlantic's longest barrier reef running along the entire length of its coastline. This is a unique feature, proposed as a World Heritage Site by UNESCO and hence it is of great importance both to the developing country of Belize and the rest of the world. It is a region of largely untapped resources with great potential for tourist fishing and mining developments. Despite the considerable amount of work that has been carried out on the reef ecosystem, there has been little to bridge the gap between the pure sciences and the practical considerations of conservation. Thus in late 1985, I decided to form an expedition to go to Belize to carry out a research project whose results would be of direct use to concerned conservationists. This report is an outline of the events that followed and aims to give an honest account of the expedition to provide information for our sponsors, ideas for those interested in organising similar ventures, and to provide a lasting record for ourselves.

C.C

## P R E P A R A T I O N

### Administration

The planning of the expedition began in late 1985, and with hindsight, we can say that this was too late and many jobs were rushed. Different aspects of the planning were allotted to certain individuals who took all of the responsibility for them. Meetings were held at either end, with varying regularity, and Pete and I tried to keep each other informed of our teams progress. The initial decisions over destination, personnel, research proposals, dates and patrons were rushed along so that our time could be devoted to the real bugbears of expeditioning; finding money and equipment. The various aspects are dealt with individually. Our seahorse logo was designed by Mr Simon Cohn and this was used on all of our stationery. So we could be identified in the field, we wore seahorse T-Shirts designed and made by Miss Patricia Crane. I designed a prospectus that was sent in all of our communications.

Once in Belize, we tried to keep administration to a minimum. Most of it was sorted out by Pete and I who went out a week early as an advance party. This week was vital and our time was full sorting everything out, so that on the day after the rest of the team arrived, we could head straight out to Cay Chapel. We went to see all of the people to whom we had written, to introduce ourselves and keep them informed of our plans. Paul Hunt, the Audubon Society and Her Majestys' Forces were all very kind and gave us much useful information. We had some problems getting our equipment through customs and we had to go to the Ministry of Finance in Belmopan to sort it out. For postage, we used the facilities kindly provided for us by Mrs Barrow although we soon changed to the Poste Restante at the BGPO. Fortunately, security presented no real problem. Paper valuables were kept in a safety deposit box at Barclays Bank and the Belize Defence Force kindly lent us a locker at their Maritime Wing base where we left many larger items. Security could have been a problem on Cay Chapel and South Water Cay and so we never left the camps unattended. The army presence on St Georges Cay assured our security. There was almost no formal administration on the Cays apart from keeping logs and ensuring that the data was recorded. Upon returning to Belize City, the main task was to say thank you to all those who had helped us, close the bank account and send off the crate. This was all simply done.

Upon returning to Britain, everyone was given specific sections of the report to write. Reports will be sent to all those involved with the expedition. Three are being produced. Firstly a short publicity report suitable for commercial sponsors, secondly this report aimed at expeditioners and finally a scientific report. We hope that people interested in our expedition will contact us if they require more specific information or advice.

### Discovering About Belize

This proved quite awkward at first (Belize? West Africa I think) but finally we managed to get hold of everything we needed so that when we were in the field we never found ourselves unprepared. Quite a bit of general information was available from the Belize High Commission and the RGS, whilst Miss Ursula Barrow, a Belizean studying at Cambridge gave us much first hand information



and a copy of the Belize Yellow Pages. It was easy to purchase sea charts of the area but they were often inaccurate, especially north of St Georges Cay. Scientific information dealing with the reefs was available from Sue Wells at the IUCN, Dr Stoddart at the Department of Geography, Cambridge, and Mary Stafford-Smith at the TMRU at York. In Belize, several people in the forces were very helpful, especially Squadron Leader Ric Atkinson, but unfortunately none of those out there when we were will be there now. Paul Hunt at the Fort George Hotel sorted out permission for us to stay on the various islands and the Belize Audubon Society gave us useful local pieces of information about the reefs. See pages 38 and 39 for useful books and addresses.

#### Diplomatic Clearance

There were very few hassles in our dealings with the Belizean Government as they were generally supportive and interested in our affairs. We did encounter some bureaucratic black spots but with a bit of patience we were able to overcome these. The Government replied quite quickly to our letters, usually within a month and we found that having a large selection of letters was very useful in dealing with local officials. UK Citizens needed no visas and the two Australians and one Israeli in the party all got visas at the airport and extended them when necessary with no trouble. We obtained permission for the project from both the Ministry of Natural Resources and the Ministry of Commerce, Industry, Fisheries and Cooperatives. Permission was obtained from the Ministry of Finance to import and export all of our equipment without paying any taxes or duties. Permission to export specimens was obtained from the Ministry of Commerce, Industry, Fisheries and Cooperatives. The Department of Tourism gave us a large package of information but the Fisheries Department were quite unhelpful.

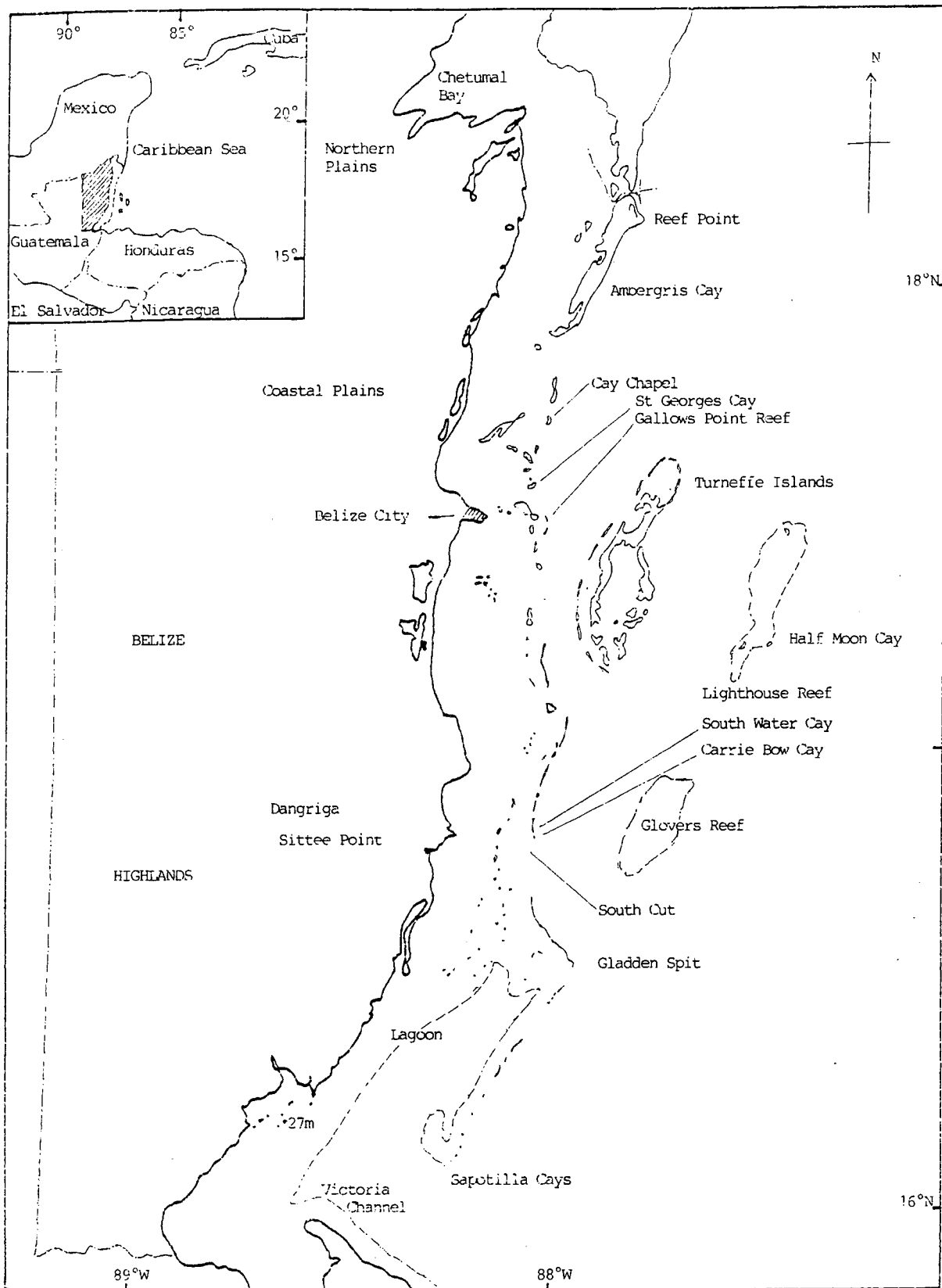


Figure 1: General Map of Belize

### Insurance

We insured with Alexander Stenhouse (UK) Ltd, the company recommended by the RGS Expeditions Advisory Centre. This was one of the least satisfactory sections of the whole expedition. They were the only company we found willing to insure our venture and so we expected the high premium. The standard policy was really quite insufficient for our needs. The worst situation that we would have had to cater for would have been air evacuation to Miami, and treatment there in a Decompression Chamber. This would probably have exceeded the £50,000 limit we were insured for. Originally the equipment was insured for £3,000 with a limit of £500 per article. Again, being divers with boats, engines and compressors, this was insufficient and consequently we had to pay an extra premium to cover these articles. However the company was extremely slow in altering our policy and persistently neglected to send out details of it. This all caused a great deal of concern (panic) just before departure when we needed it least, and made borrowing some items of equipment difficult. The equipment was insured separately during freighting through the Shipping Agents, Thos. Tweddles.

### Freighting

Our aim was that, once in the field, we would be totally self-sufficient in terms of the equipment needed to live, dive and move around. This necessitated gathering together in Britain about 1.5 tons of equipment to our packing point in Aberystwyth. This was done in a series of trips around the country by the expedition members. Our crate was made in Nottingham and measured 2.8 cubic metres. This crate was expensive, cheaply made and poorly designed. But it lasted...just. This was then taken to Liverpool by the Aberystwyth team and there taken by the shipping company. Thos. and Jas. Harrison. I cannot praise our shippers and their agents, Thos. Tweddles enough for the smooth job they did and the patience they took in explaining the intricacies of shipping 1.5 tons of gear half way across the world.

Their charges reflected their generous interest in us and were specially reduced for us. In Belize we had some problems with customs, despite a letter from the Minister of Finance excluding us from duties, which necessitated a trip to Belmopan and a few phone calls before it was sorted out.

On the return journey, the loading and shipping was no problem, although to ensure that nothing was filched, we accompanied the crate until it was safely sealed inside a container. Once it had arrived in Liverpool, some of the Cambridge team picked it up and spent two days driving around the country delivering it all to its respective owners.

#### Travel to Belize

We investigated a variety of routes to Belize and contacted all of the major airlines with a view to discounts. The cheapest and simplest route was via Miami. Eastern Airlines generously gave us a discount flight as far as Miami and we booked a local airline from there. Some members flew with Challenge Airlines who were nothing but trouble with delays, and others flew with Taca Airlines who provided an excellent service. This routing also had the great advantage that we were also allowed a 70 kg baggage allowance.

C.C

I N B E L I Z E

Expedition Diary

July 1986

- 9th Pete and Chris leave Gatwick as an advance party.
- 10th Arrive in Belize City.
- 11th Start administration and releasing the crate from customs.
- 15th Colin, Steve, Mark, Doron and Graham arrive.
- 16th Arrive on Cay Chapel.
- 26th Pete despatched to the Army Hospital.
- 30th Leave Cay Chapel aboard the sailing vessel "Mechanic".

August 1986

- 4th Arrive on South Water Cay. Pete rejoins the team.
- 11th Doron and Graham depart for the U.K.
- 12th Michelle arrives from the U.K.
- 17th Depart South Water Cay aboard RPL 02 Forth (RCT).
- 18th Arrive on St Georges Cay.
- 27th Depart St Georges Cay.
- 29th Crate delivered to the docks for shipping home.

The expedition formally ends.

September 1986

- 23rd Final expedition member arrives back in the U.K.

### Transport in Belize

This was a major problem, for, as a moving expedition with only an inflatable boat at our disposal, we had a great deal of gear to move several times. On the mainland, we got around using the excellent bus service or occasionally a taxi. The only overland route for our equipment which had to be made was between the container port and the Belize Defence Force Maritime Wing which is where we left our crate. Upon our arrival, we borrowed a truck and driver from the British Army and on the return we hired a local truck B\$50.00. After returning to the mainland in September, we toured the central highlands in a hired landrover for B\$40.00 per day.

For the bulk of the expedition however we were out on the islands, taking the equipment from the mainland to three islands and then back again. It all weighed 2 tons. On all of the islands, there were boats passing regularly and we used these for our regular supplies. Occasionally we used our own boat, but this interfered with the research programme. Fuel was only available on Cay Chapel. The rest had to be ferried in.

The only problems occurred with the two large journeys of us and all of our equipment from Cay Chapel to South Water Cay and then back to St Georges Cay. No commercial boats would do the run for less than B\$800.00. Unfortunately they cancelled at the last minute on both of the journeys. However whilst on Cay Chapel we met Captain Mo, of the Sailing Vessel "Mechanic", a 75 ft steel boat. He offered to take us to South Water Cay for B\$250.00. We took him up on the offer and had a very pleasant journey south with him. For the return journey, Mark approached Major Birkenshaw R.C.T and arranged with him to divert one of the R.P.L.s (large landing craft) on one of its supply journeys to come and pick us up. This happened smoothly and they took us as far as Belize City. From there we rode out to St Georges Cay on an L.C.V.P (small landing craft). As well as being very generous, this was also free. We made the final trip back to Belize City on this same L.C.V.P.

All of the running around on the islands was done with our own boat. Navigation was always potentially dangerous, especially considering the natures of coral reefs and rubber boats. At first we tried to get local advice and then feel our way tentatively. No charts were sufficiently accurate to be useful. It is worth noting that the army boats use a road atlas at sea north of South Water Cay. Running aground on sand banks in the lagoons proved more of a problem than coral. Basically we had to be cautious and the only damage sustained was a slight dent on one of the propellor blades.

### Special Hazards

We were pleasantly surprised to find that there were few of these although the potential was certainly there. It was the hurricane season whilst we were there but we never experienced more than medium strength storms and a few squalls. On these days we restricted our work to inside the barrier. Generally though conditions were superb. Hot sunny days with a light breeze. We had a VHF radio receiver and weather bulletins were transmitted regularly from Belize City. The national awareness and preparation for hurricanes seemed quite comprehensive. In case of an emergency, each island had a two way transmitter. Cay Chapel had an airstrip and we had arranged with the RAF for helicopter evacuation in an emergency from the other two islands.

Specific hazards related to diving and general health are dealt with elsewhere. Generally though it was a healthy environment where simple and sensible precautions did prevent any dangers; eg. the fuel dump was located away from the campsite and in the shade. The sea itself contained few "nasties" and apart from Pete's accident we had no trouble in it. Insects were a nuisance on Cay Chapel and there were a few on St Georges Cay, but they presented no real health risk.

#### Other Activities

Apart from the research diving we all took every opportunity to do as much adventurous diving as possible. The best opportunity for this occurred on the six day cruise that we had with Captain Mo aboard the Mechanic on our way to South Water Cay. We cruised out to the three atolls of Belize; the Turneffe Islands, Lighthouse Reef and Glovers Reef. The highlight of this was on Lighthouse Reef where we stayed on the idyllic reserve of Half Moon Cay. From there we dived in the famous Blue Hole, in Belize's only Marine Reserve and explored some of the many wrecks lying on top of the reef crest.

Once the research project was finished we enjoyed our last few weeks in Central America travelling inland. As different people were returning to Britain at different times, we had a varied itinerary. For the first week we all stayed together and hired a Land Rover. We travelled to Altun Ha, a superb Mayan temple and the carefully managed Belize Zoo before heading inland to Mountain Pine Ridge. The army had generously lent us a house at Scottish Lookout, a secluded site miles from the main roads across steep and winding jungle tracks. We travelled around the Mayan Mountains seeing superb waterfalls, temples and rainforests. We visited several traditional Indian Farmers and looked in on the Mennonite settlement. The best day was a trip down the Hummingbird Highway to an inland Blue Hole and then for some excellent caving in the stunningly beautiful and untouched Herman Caves.

After this we split up, Colin and Pete returned home leaving Mark and Michelle to go to the Yucatan province of Mexico and Steve and myself to go to Guatemala. Currency proved a problem in Guatemala as US\$ were the only acceptable currency. As an Australian, I had untold hassles getting a suitable visa. However it was worth it as Guatemala is a beautiful country with the world's finest Mayan temple complex at Tikal and a tranquil Spanish heritage lovingly preserved at Antigua. After I had left Steve to return home, he managed to get in to El Salvador for a few days. On arriving back in Belize City he enjoyed the carnival and fun of Belize's Independence Day Celebrations.

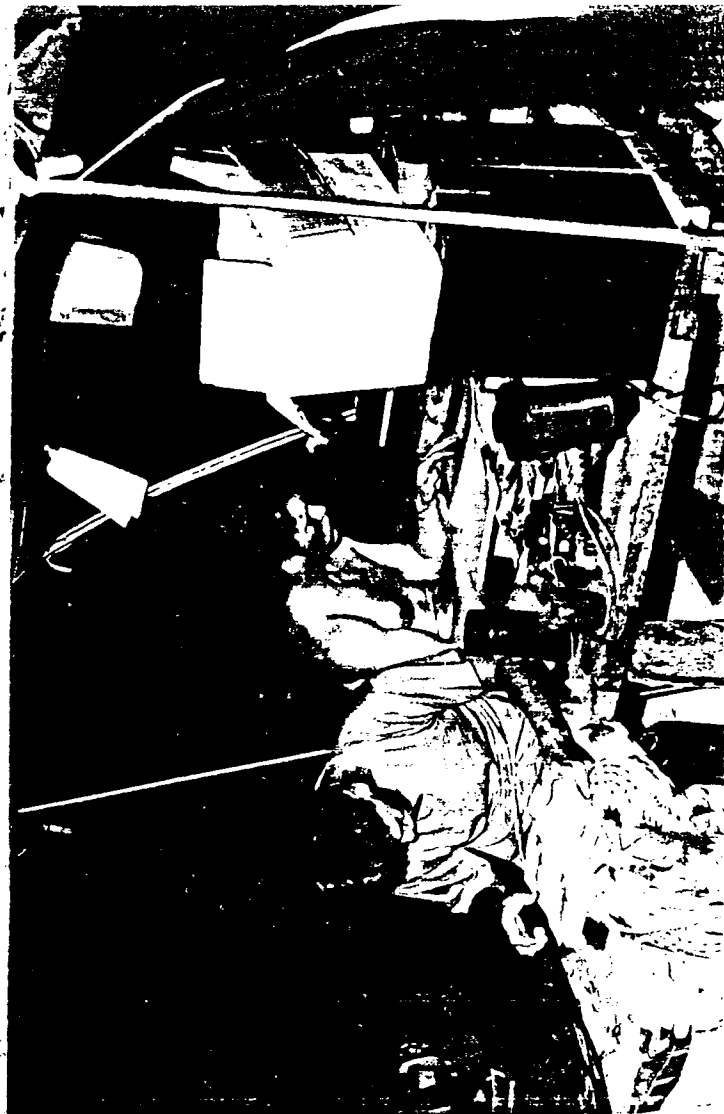
C.C



(Above) The Expedition gets underway; the crate at the B.D.F. (Maritime Wing) prior to unpacking and moving out to Cay Chapel

(Top Right) The camp at Cay Chapel

(Right) At work: a view inside the camp at Cay Chapel





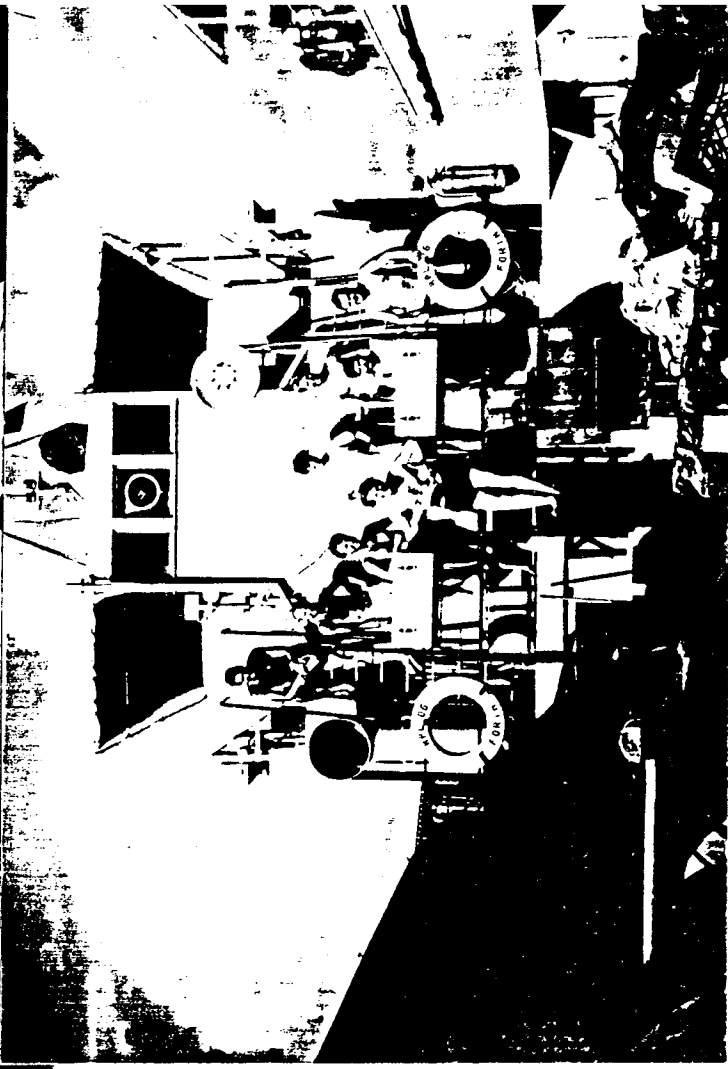
(Right) Half Moon  
Cay, Lighthouse  
Reef



(Above) Loading "The Mechanic", Cay Chapel,  
30th July 1986



(Right) (From L  
to R) Colin,  
Chris and Mark  
with the boat  
on Half Moon  
Cay



(Above) South Water Cay  
 (Top Right) Heading North from South Water Cay to  
 Belize City, aboard RFL 06 ("FORTH")  
 (Right) The team, at Belize City

MEMBERS REPORT

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## SCIENTIFIC OFFICERS REPORT

### Introduction

The scientific aims of this expedition were to evaluate, using a "Reefwatch" Survey (Tropical Marine Research Unit, York University), any outstanding biological differences at three geographically separated sites along the Belize Barrier Reef, and to report on any significant observations relating to the effects of the fisheries industry at each site.

Choice of site was restricted to ease of access from the mainland, and to the facilities available in the area. The three sites chosen were, from north to south: Cay Chapel, St. Georges Cay (opposite Belize City), and Southwater Cay (near Dangriga).

Since the majority of fisheries effort is concentrated on the reef adjacent to, and north of Belize City, it was reasoned that any major biological disturbance to the reef from overfishing would be most evident in this area when compared with underfished areas to the south (i.e South Water Cay).

### Equipment

A makeshift laboratory was set up in the main ridge tent in which all scientific equipment was stored, and results collated at the end of each survey. This accommodation was also used for cooking (and in some cases sleeping), and as a gathering spot, making life difficult for those involved in data sorting; the more 'permanent' accommodation provided at South Water Cay was a Godsend!

Most of the scientific equipment routinely used proved sturdy enough to withstand the rigours of the environment, and gave little trouble. An environmental probe (measuring pH, temperature, salinity, and dissolved oxygen content), the only piece of electronic equipment taken into the field, failed within a week. Fish counts were recorded using all-plastic tally counters, which proved indispensable for counting the more numerous species such as squirrel and parrot fish.

Samples preserved in 4% formalin (in seawater) were transferred to 70% ethanol prior to shipment back to Britain.

### Reef Surveys

Once base camp was set up, the proposed reef site was surveyed by pairs of divers to assess its suitability for further study; a suitable site was one considered characteristic of the entire area. Each diver was asked to complete a general reefwatch questionnaire of the area dived.

Once a suitable site had been established, its exact position was bouyed for future reference.

Three 100 m sections of rope, marked off at 10 m intervals, were laid at sites adjacent to this reference bouy, along regions corresponding to the forereef, reefcrest, and backreef, secured to the coral substrate. In addition, 100 m transect lines were laid on seagrass beds immediately adjacent to the shore. The forereef transect was orientated northeast-southwest along a reef ridge, while both the reefcrest and backreef transects were laid running parallel to the barrier reef. We experienced some difficulty in laying lines at the reef crest site due to heavy wave action. Once laid, each end was bouyed and the position of each bouy accurately measured. The site was then allowed 24 hrs to recover before survey work began.

Initially divers were asked to survey a particular species or group of species throughout the entire survey period in order to reduce errors in identification. However, as they gained more experience, this became unnecessary.

On arrival at the site, the first divers in measured temperature (glass-mercury thermometer) and current flow (estimated from the distance travelled per unit time of released fluorocene dye) at each site. Fish surveys were made by counting the total number of particular species occurring within a 2 m column of water, 1 m either side of the transect line, along the entire length of line. On reaching the end of first sweep, divers would change sides and repeat the count, back to the starting point. In addition to this count, a record was kept, where possible, of the number of species observed outside the 2 m survey area. Results were recorded on waterproofed photocopies of the appropriate Reefwatch forms, and collated immediately on arrival back at camp, ready for the next dive. This system proved a very quick and reliable method for estimating the number of particular species in any given area. It also allowed several consecutive surveys to be performed on the same transect, although care was taken to survey first those species which may be easily disturbed from the site by the presence of divers (eg. groupers). Counting the number of individuals outside the 2 m limit proved difficult, and was often abandoned in order not to sacrifice the accuracy of the 2 m transect counts.

Quadrat analysis of the benthic communities were made at 10 m intervals along each transect line. Once each quadrat was laid, a photographic record was made prior to a descriptive analysis of the substrate type (percentage cover of coral, sand, bare rock, etc), and identification of invertebrate species present. As identification of soft corals proved to be difficult on site, a number of samples had to be taken back to shore for further study.

Once both the fish and invertebrate surveys had been completed at each site, an area approximately 5 m each side of the transect line was photographed, and the major coral species mapped. In addition, topographic maps of this region were constructed in order to provide some perspective as to the type of environment in which each study was performed.

Of immense value to on site identification of reef life (especially corals) were underwater identification slates and waterproof guides (Seahawk Press, Miami). A waterproof guide to the octocorals would have been very useful.

The results from each days work were collated by either Chris or myself. Although tedious, at least it ensured that this was done promptly. Prepared photocopies of each Reefwatch form proved of great value in making this task easier. In addition, a log was kept of the surveys performed by each diver that day in order to simplify the following days research plan.

#### Some Gripes and Some Suggestions

On the whole, the research went smoothly and suprisingly efficiently, considering the limited resources available to us. In order to maximise bottom time to perform each survey properly, we were limited to two dives per day in most cases, reducing the number of surveys and repeats of the same surveys at each site that could be preformed. On average we spent less than 14 days on each Cay. As a result, it was almost impossible to repeat surveys (a couple of stormy days during the research program often put paid to certain plans). On reflection, it would perhaps have been wiser to study two sites only, St Georges Cay and South Water Cay, in order to allow repeat surveys to be performed. It would certainly have made possible a study into the diurnal migrations of certain fish and invertebrate species, as well as the populations of certain nocturnal species such as the long spined urchin, Diadema spp..

We had planned to sample water for the presence of hydrocarbon pollutants, by extraction and subsequent analysis back in Britain. Indeed, we obtained the co-operation of the Fisheries Minister to do so. Similarly, we had taken with us all the equipment necessary to perform plankton surveys. Sadly, due in part to a certain lack of motivation, this was never achieved. This is unfortunate since some useful indicators as to the ecological stability of the area may have come to light.

After four weeks of continued research work, our appetite to continue became jaded. Instead of pushing on, we would have been wiser to take a weeks break, perhaps spending it on the mainland, and return to the work refreshed. A point was reached when certain crucial decisions concerning the research program were hampered unnecessarily by those who became frustrated with the tedium of the daily routine...a case of too many chiefs and not enough indians! One solution to this problem may have been to split the research into smaller groups, each responsible for a particular facet of the overall research objectives. Any problems that may have arisen from their work would be more likely to be resolved rapidly, and I am sure a lot less painfully!

The number of physical measurements that can be made in the field are limited without the back up of a suitably equipped laboratory. Time permitting, a study of the diurnal temperature variations at depth may have proved useful in conjunction with diurnal variations in fish counts. Inverted thermoclines were experienced at times.

Although waterproofed photocopies of the Reefwatch survey sheets were useful in recording data underwater, their use as underwater guides were limited. An underwater slate with photographs of the species under study, and a space alongside each species for notes, would have been of more use, and would not be difficult to make.

P.R

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### Treasurers Report

Below is a list of the details of our budget. This however is only the final results of this, the most traumatic and important part of expedition organising. No money, no expedition. Simply, raising money was incredibly hard and every member of the expedition made large personal sacrifices to be able to go. Without personal contacts to work on, industrial sponsors were largely a dead duck with the important and generous exceptions being BP and Barclays. Many manufacturers were more prepared to donate goods as opposed to hard cash and despite this generosity, there was still a great need for money. Most of our money came from academically orientated trusts and funds and being a joint University expedition we were open to relatively more of these. Many items were donated, especially food and camping gear and all proved very useful in the field. In Belize, we received support from the Audubon Society and much material support from Her Majesty's Forces in the form of transport, storage, accommodation and supplies. However we found that Belize was not a cheap country, except for fuel and we were fortunate that apart from living essentials there was little that we needed to buy there.

The budget drawn up in the U.K differed from that shown below considerably. Despite the many enquiries made before leaving it was impossible to correctly estimate our likely expenditures because our contacts in Belize had some difficulty picturing a student expedition. (Basically we would all stay in the cheapest doss house in town and eat bananas all day.) Thus before our arrival, the cheapest quoted hotel price in Belize City was \$40.00 per person whilst we soon found one at \$12.00 for a double. The budget was therefore the best we could come up with.

The expedition banked with Barclays because branches could be found in all of the major Belizean towns. We took our money across in travellers cheques and opened up a new account at Barclays in Belize City. \$US are ready currency in Belize and probably would have been more use in Belize. As banks were frequently unavailable, we had to carry up to B\$1000 with us at a time. Colin and Chris handled this. We opened a security box at the bank in Belize City in which expedition members could leave their paper valuables. For larger items, we were loaned a good lockup at the Belize Defence Force Maritime Wing in Belize City.

C.C and C.R.C

#### Income

|                             |     |
|-----------------------------|-----|
| British Petroleum           | 200 |
| David Richards Fund         | 220 |
| Royal Geographical Society  | 350 |
| Cambridge Expeditions Fund  | 300 |
| Loughborough Grammar School | 100 |

Cont...

Income (Cont)

|                                    |              |
|------------------------------------|--------------|
| Tide and Capitula Fund             | 300          |
| Crown Hire                         | 25           |
| British Sub Aqua Club Jubilee Fund | 250          |
| Mary Euphrasia Mosley Fund         | 300          |
| Gilchrist Educational Trust Fund   | 250          |
| Barclays Bank                      | 400          |
| Girton College                     | 100          |
| Albert Reckitt Memorial Fund       | 500          |
| The Belize Audubon Society         | 165          |
| Fund raising activities            | 165          |
| Sales of equipment                 | 200          |
| Personal donations                 | <u>4,205</u> |
|                                    | <u>8,130</u> |

Expenditure

|                     |              |
|---------------------|--------------|
| Flights             | 3,500        |
| Shipping            | 600          |
| Brokerage           | 100          |
| Insurance           | 700          |
| Transport in GB     | 300          |
| Transport in Belize | 215          |
| Fuel                | 125          |
| Food                | 1,175        |
| Accommodation       | 200          |
| Administration      | 500          |
| Equipment           | 300          |
| Medical kit         | 61           |
| Film                | 104          |
| Others              | <u>200</u>   |
|                     | <u>8,080</u> |

### Equipment Officers Report

As a diving expedition, we were especially reliant on a great deal of intricate equipment. This report describes the major items, especially in relation to diving and the problems that we had with them. This is aimed at future diving expeditions and equipment manufacturers. Scientific and camping equipment are dealt with separately.

The first problem was the impossibility of checking any of the equipment from Cambridge before it arrived to be packed and sent. This allowed little time for repairs or testing. The approximate value of all of the diving gear was about £10,500 and it was all either borrowed, owned or hired at very reasonable rates. Total hire charge, £250.00.

Most important was the compressor. No possibility of spares or replacements in the field and so unlike any other pieces of equipment. We wrote to all of the major manufacturers and did not receive a single reply. Finally, after a couple of phone calls, we managed to talk Bristol Pneumatics into lending us a 5.2 cubic foot diesel compressor. We prayed that it would prove reliable as to our knowledge there was no air on any of our chosen islands. This turned out to be untrue and with a great deal of inconvenience and cost we could possibly have managed. Fortunately we had no trouble and our popularity would locally increase however whenever it was discovered that we had reliable air. We took 4 filters owing to their reduced life expectancy in humid conditions. As it turned out, in the 76 hours of running time, we only needed two. Filter life can be prolonged by compressing in the evening when it is drier. We manually purged the system every 15 minutes to reduce the possibility of the oil and water in the separator contaminating the filter. We felt that by not using the automatic purge, we could again lengthen the filters life. The compressors Petter Motor was a dream and always started first time, to the delight and surprise of all concerned. It used 3 litres of 10/40 oil and 22 gallons of diesel. The compressor itself functioned perfectly except for one burst "o" ring in the filter tower which we managed to repair using three borrowed rings of a smaller size. Considering the poor working conditions, I was extremely impressed by this Bristol compressor and I would recommend them highly to anyone. Its only disadvantage was its weight, requiring 4 men to lift it, but this is what you have to sacrifice for a reliable diesel engine.

The other major item was the boat and engine. We had to take an inflatable because they are so easy to transport. It was a 16 ft Humber work boat with a 55 hp Johnson outboard, both hired from Aberystwyth SAC. Both were about 1 year old and consequently in good condition. The engine was serviced just prior to leaving and probably ran for about 35 hours in the field. There were no problems with it. It used about 90 gallons of fuel and there was no trouble obtaining this. As Johnsons were quite popular in Belize, we do not think servicing or spares would have been much of a problem. However the fuel cans were troublesome. We had 2 five gallon cans which both developed leaks in the air release system. This resulted in fuel leaks when the cans were shut. Thus the cans had to be left open to prevent a vacuum developing.

The boat also performed well but some problems occurred owing to the repeated expansion of the tubes in the heat of the day. A careful eye had to be kept on the boat to ensure that it did not rupture itself whilst on the beach, and that it was not under inflated when in use. This stretching caused the glues on the protective edging and some handles to peel off.

Some items of diving equipment caused a great deal of trouble and servicing facilities were almost non-existent in Belize. Surprisingly the pillar valves on the tanks caused a considerable amount of trouble with three of the nine developing leaks. This was a problem regularly experienced by other divers out there and so we would recommend taking the correct spare O rings. As the air was so humid, all of the tanks would need internal maintenance on their return, despite the filters on the compressor. Three of the Spiro Atlantic ABLJs developed leaks in their direct feeds but these were repairable. One Seaquest Stab Jacket suffered from torn material and did not really seem made for the conditions experienced. The DVs needed a great deal of routine maintenance. The hoses seemed to perish very quickly as did the mouthpieces. Two contents gauges also broke.

We tried to take a comprehensive tool kit and we felt confident to deal with most problems. As it turned out, most of the gear in it was unused but better safe than sorry. Items that were particularly useful on a day to day basis included a mallet, an axe and a saw. One vital item we neglected to take and bought in Belize was a shovel for latrines and digging the tents.

One set of items which we knew that we would be needing but did not take out because of their bulk were jerry cans. We were loaned ten five gallon fuel cans for petrol and diesel and six for water by the army. These were extremely useful and greatly extended the time that we could spend in the field.

Overall the equipment functioned very well and no diving was lost due to failures and breakdowns. I believe this to be mainly the result of servicing before leaving the U.K and careful handling during the expedition. Even so at all times in the field different individuals were careless in the maintenance and handling of the equipment. Although this sounds obvious, constant reminding to look after the gear was necessary to prevent damage.

C.R.C

### Medical Report

From the medical point of view, CCC was to be a series of surprises, which, given the nature of medical problems, were not usually pleasant ones. Before we left England we were largely in the dark as to the possible health effects of eight weeks camping and diving in and around tropical waters. Although diving expeditions to tropical areas had obviously been before us, the amount of specifically diving related health information we could glean beforehand was rather limited.

There were of course a few major precautions to be taken before we left. Vaccinations required for Belize are: Typhoid, Typhus, Polio and Tetanus. Gamma globulin for Hepatitis is also recommended. Dengue Fever is also considered to be somewhat of a problem in Belize, but obtaining a vaccine against it here in Britain was not possible. The other obvious precaution was the use of malaria pills. Malaria has taken on a new vitality in the world since its considerable decline in the mid 1970's, and Belize, as a generally low lying, swampy country is particularly prone to it. Indeed, shortly before we arrived, the British Forces in Belize, with whom we had considerable contact and are heavily indebted to on the medical front, suffered a fatality from malaria. Some members of our expedition took Chloroquine, others Paludrin, and one member a combination of the two. Infact Paludrin by itself would have been the better of the two drugs, as Chloroquine is used as the curative medicine by the Forces out there. However, despite considerable contact with mosquitoes, especially in the first two weeks, no-one developed any sign of a malarial infection.

One other possible problem which we knew about in advance was the occurrence of 'Tropical Ear'. This is a condition particularly pertinent to divers because they enter and leave the water very frequently. It involves water remaining inside the outer ear after leaving the sea, and consequently producing an unpleasant sensation and impairing hearing, as well as possibly introducing infection. This problem is solved by the daily application of a drop or two of Aluminium Acetate solution into each ear which dries out any residual water there, and prevents any infection from starting. Throughout our diving this solution proved invaluable, and no-one had any ear problems (apart from the unpleasant sensation lasting at the most a couple of days) at any time.

Once we had all arrived in Belize, we moved straight out to the Cayes. Cay Chapel was our first site, and it was here that we discovered the rigours of camping on the beach on a tropical island. It may sound idyllic, but without the taken-for-granted benefits of running water, shade and a place to relax, such an environment becomes somewhat gruelling. It was impossible to totally rid the sleeping areas of sand and salt, and as by necessity the cooking had to be done in essentially the same area (cooking outside was impossible because of the wind) many insects were also attracted. Had it not been for the hotel, with bar, about a mile away, then I am quite sure our general health, not to mention our enthusiasm, would have deteriorated considerably.

As it was, the major health problem that we did encounter throughout the expedition was undoubtedly started on Cay Chapel. This, as we later found out, was a staphylococcus infection, caused by repeated exposure to the salt water, coupled with the inability to totally rinse this off. Eventually everyone suffered from it, although initially, as only one person developed symptoms, we thought that it was probably a personal reaction. The symptoms were spots which gradually developed into larger, more painful abscesses like boils. When these began to appear on two others as well, we considered that these might have been insect bites which were becoming infected. However, it soon became apparent that these 'boils' were appearing where there had been no insect bites. There was also another type of spot, more like a pus-filled blister, but which in fact was far less painful. These two types together tended to concentrate on the legs. Their intensity varied from perhaps one or two very large abscesses, which grew without producing a head for lancing, to many smaller spots distributed more widely. At various stages throughout the expedition, members were unable to dive because of the pain and inconvenience caused by this infection.

Our initial reaction to this problem was simply to clean the infected areas with antiseptic, and possibly to lance some of the more painful and swollen abscesses. However, by the time this treatment was seen to be inadequate, the two other members who were suffering from it at this time had developed one or two particularly bad abscesses, and as we were out at sea at the time, and unable to contact a doctor, we decided to administer antibiotics in an effort to prevent the infection from spreading further. We administered two courses of Ampicillin, and one of Erythromycin, both as general antibiotics, not knowing which might prove the more effective. It is difficult to say whether these antibiotics worked or not. Certainly in a couple of cases the infection appeared to stop growing, even if it did not get much better.

On arrival at South Water Cay the three who were showing the most serious symptoms went into Dangriga (Stann Creek) to see a local doctor. He prescribed an oral sulphonamide antibiotic, plus a french antibiotic cream, called 'Neosporin'. Coupled with the considerably better living quarters that we managed to obtain on South Water Cay, these three all made a significant recovery. However, the infection had not disappeared, for at this point the others began to develop the same symptoms. Infact, the infection only finally disappeared after we had stopped diving. At this point two of us had to go back to a doctor, and so as we were in Belize City we saw Dr. Steve Milner, of the Armed Forces, at the Airport Camp Hospital. With the help of a further antibiotic, this time 'Magnopen', and the sterile dressings given, this was the last of the problems we had in this respect. As mentioned, however, this was after the expedition proper had been completed! It is difficult to see how this infection could have been avoided, given the nature of the work being undertaken, and the conditions in which we were living. Certainly it would have been useful to have had the antibiotic cream initially, although whether this would have prevented the infection from catching hold is questionable. Nonetheless, I would recommend that any future expedition have something similar available.

The Staphylococcus infection was without doubt the major health problem from which we suffered, although it was by no means the most dramatic. Whilst at Cay Chapel, Pete was unfortunately stung by a small Yellow Stingray. This in itself, apart from being very painful, should not have been very drastic, for the venom contained in a small sting is not enough to do any real harm to a human being. The hand where he had been stung swelled up immediately, but then subsided after about 36 hours. We had, of course, cleaned and sterilized the wound as much as possible, and thus when the swelling subsided we assumed all was well. However, after a further couple of days, the hand began to swell up again, and then, overnight, started to spread up the arm as well. At this juncture we were naturally all becoming very concerned, and so contacted the British Forces at APC. This was how we first came into contact with Dr. Steve Milner (see above). As a result of our description of the symptoms, he was sufficiently alarmed to demand that Pete go to the APC hospital immediately. It was soon diagnosed that he had septicaemia, and consequently he was operated on to drain the abscess soon after he arrived at the hospital. It was only after this that we were informed that if the wound had been left untreated for very much longer, then the consequences could have been considerably worse. As it was, Pete made a total recovery, although he unfortunately missed some of the beautiful islands of the outer reefs of Belize whilst convalescing. The whole episode gave us a very healthy regard for marine life in the future, and made us realise just how quickly an infection can spread and become dangerous when in the Tropics.

#### General Health and Medicines

The above represent the major health-related events of the expedition. At the day to day level, our health was very good; we had no stomach or bowel problems, no-one suffered from heat-stroke or dehydration, and no-one became any more exhausted than to be expected from a hard days work in the sun(!). We took out with us a well stocked kit of basic medicines for every-day use, plus stronger drugs and applications in case anyone was ever seriously ill or hurt, and needed to be sustained until help arrived. This kit was purchased through the Cambridge Expeditions Medical Scheme, to whom we are very grateful.

The most frequently used products were the basic ones. Plasters, cotton-wool, antiseptic creams and solution, and tape were all used extensively. 'Betadine', which is an antiseptic iodine paint, and which stays on the skin more readily than plasters or cream, was also exceptionally useful. Living on the beach, one was always treading on small, sharp pieces of thistle or broken shell, or brushing against coral whilst diving. In the tropics, and especially when one is frequently going in and out of the water, any cut stays open for considerably longer than it would here in Britain. Thus we all had examples of cuts sustained in the first few days of diving which were still present some weeks later. Only regular cleaning and use of Betadine kept these from becoming infected.

The mild painkillers were the next most commonly used drugs. Aspirin, paracetamol and (for us) Sinutabs (for the relief of pressure related headache) were indispensable. These also proved to be very useful and welcome gifts to some of the poorer Belizeans, such as the fisherman, with whom we had contact.

The insect repellants were also very extensively used! We took out several tubes of 'Flypel' with us, an insect repellant gel from ICI. This was quite effective, but by no means as good as the repellant given to us by the Forces! This stuff, in bottled or aerosol form, is strong enough to dissolve plastics, including watches and seat-covers! It was, however, very effective, and in many instances was a real necessity.

Finally, there were the sun-creams and lotions. These too were imperative for everyone for the first couple of weeks; after that their use became more one of personal choice. The high protection-factor creams for the nose, ears and neck were particularly useful.

### Conclusions

As can be seen, apart from the stingray episode and the staphylococcus infection, we had a generally very easy and healthy stay in Belize. Although the leg infection remained present for almost the whole time spent diving, it only seriously inconvenienced the expedition or the individuals concerned for a few days at the most. However, it is worth stressing how important daily rinsing with fresh water to remove sand and salt is in this kind of environment. It is not just a pleasant luxury; rather it is a health necessity. Apart from our first two weeks spent on Cay Chapel, we managed to obtain daily access to showers, and this undoubtably played a beneficial part in our general good health.

S.J.P

LIST OF DRUGS AND MEDICINES

Chloroquine and Paludrin anti-malarial pills \*\*

150 Aspirin (tablets)\*\*

150 Paracetamol (tablets)\*\*

120 Sinutabs\*

50 Senokot

100 Codiene Phosphate

50 Piriton

60 Hibi-tane Throat Lozenges\*

160 Ampicillin\*\*

80 Trimethoprim

60 Erythromycin\*\*

40 DF118 tablets

40 Flucloxacillin

40 Metoclopramide

7 8 ml pots Betadine Antiseptic Paint\*\*

2 16 fl ozs Savlon liquid\*\*

50 Electrosol tablets

1 50g tube lorexane

4 15g tubes Hydrocortistab\*

7 sticks Lip Salve\*

7 30g tubes Lanolin Cream

4 bottles Calamine Lotion\*

7 38g tubes 'Uvistat' sun-protection cream\*\*

2 Eye Baths\*

1 tube Brolene Eye Ointment

1 7g packet Cavit

1 small bottle Tooth Tincture

3 3yd. strips gauze\*\*

5 2oz. packets cotton wool\*\*

6 3" Cotton Bandages\*

3 3" 3yd. Crepe

3 3" 3yd. Elastic adhesive\*\*

1 triangular cloth bandage

10 Butterfly Closures

5 2 1/2 " 1yd. Strip dressing\*\*

3 1/2 " 5yd. Zinc Oxide adhesive plaster\*

2 Wound Dressing No.15 BPC

2 Shell Dressing

10 tubes 'Flypel' Insect repellent gel\*\*

2 drums Dusting Powder

1 Thermometer\*

1 Pair scissors\*\*

1 Packet safety pins\*

1 Pair tweezers\*

1000 Puritabs\*

\*\* indicates that the drug/medicine was extensively used.

\* indicates that the drug/medicine was used.

## LOGISTICS REPORT

This report is concerned primarily with two practical aspects of the expedition in the field, which may prove useful to other expeditions in terms of either experience or reference. These are the setting-up and running of the camp on a day to day basis, and the acquisition and organisation of the food supply.

### Camping

We had fully intended camping for the whole of our working stay in Belize, and therefore took quite a considerable amount of equipment. This included four two-man sleeping tents, of variable size and quality, and a large "family" type tent. The idea was that the smaller tents should be used for sleeping and storing personal possessions, and the larger tent for general living purposes, including cooking, eating and working. By and large this was exactly how we organised it in the field, although due to the amount of diving gear we had in excess of everything necessary for camping, space always seemed to be at a premium! However, I would strongly recommend to other groups that, if intending to camp for a long period of time, a large, central tent to be used as a meeting place be considered an absolute-essential, and not a luxury to be fitted in only if space permits. Other equipment included a camping gas stove (mounted on its own shelves - anything to be able to keep food off the ground is very useful), another single gas burner, several gas lamps, one Tilly lamp, a cool-box (which remained largely unused until St Georges Cay due to lack of ice!), and numerous pots and pans. In retrospect, if small foldaway chairs and a table had been available and could have been fitted in, they would have proved extremely useful; as it was we managed to construct our own from pieces of driftwood etc. which we collected from the islands.

The first time we set-up camp we were unfortunately extremely pressed for time. It had been a very busy day getting all the equipment unpacked from the crate, and then across to the first cay, and so by the time we begun to strike camp we had only about an hour of light left. It was thus no real surprise when the following morning and subsequent days revealed several errors in our choice of site and location of tents.

We had the main tent at the centre of a sort of semi-circle of the smaller tents. Straight away this meant that at least one of the smaller tents was shielded from the wind, making it very hot at night. The wind was in fact the major difficulty encountered throughout, because not only was it very consistent, therefore putting considerable strain on a tent pitched only in sand, but also at times became extremely strong; necessitating on one memorable occasion all seven of us holding on to the poles and bracing the canvas to stop the whole thing blowing away! In this respect the smaller tents were no problem at all.

Heat was also a big problem, as the main tent provided the only real shade at any time of day, but was nonetheless very, very hot. Also, because all the food was stored (and cooked and eaten) in there as well, it attracted many insects, and at times both inside and outside seemed to be equally unbearable!

We were all agreed that actually under-water was the most pleasant and relaxing environment we found. The siting of the main tent at the first site could have been improved by pitching it to face into the wind, for this would have made through ventilation considerably easier to achieve, and may well have improved some of the situations remarked upon above. It would also have made the tent stronger in the face of the wind, for on this particular tent the side with the 'front' door had more supports than any other. However, by the time this was realised it was impractical to relocate and repitch the tent until we moved on to the next site.

On a day to day basis we organised ourselves very informally, with the notable exception of a cooking and washing-up rota which, as expected, produced some strife every now and then! Unwashed breakfast bowls with dried and congealed porridge remains always seemed to provide the greatest argument, with everyone claiming innocence!

### Food

Food never constituted any real problem in terms of lacking something to eat, but did require some considerable planning. Due to our largely non-existent storage facilities, supply runs to the nearest mainland town had to be fairly frequent, although they were expensive and time-consuming. Consequently we were restricted to the cheaper staple foods such as rice and potatoes which would last that little bit longer. We therefore suffered more from a lack of quality and choice rather than quantity.

It is worth noting that Belize is quite an expensive country to live in, for it is small and un-industrialised, and therefore all manufactured goods (as well as much of the more basic food) has to be imported. We were fortunate enough to have been donated a quite considerable amount of dried food, as well as herbs and spices (to liven-up those deadly vegetable stews!), which proved invaluable throughout, and especially during the first weeks when we had yet to master the techniques for catching our own fish! If many of these type of goods had had to be purchased in Belize, then the cost of this aspect of the expedition could have been considerably greater. Keeping food away from all the sand, salt and insects was not easy, and, as mentioned, the foldaway shelves upon which the stove was mounted were particularly useful in this respect. Otherwise, black plastic bags did much to ripen bananas exceedingly rapidly, but little to preserve them! Because of the humidity, moisture got everywhere, and we made the mistake of purchasing too much rice the first time, which subsequently went mouldy despite every attempt to keep it dry. Fruit of any description over-ripened very rapidly - we found that the locally produced oranges and limes were the best to keep, as well as being very cheap. However, to prevent this sounding as if we experienced every single inconvenience, let me hasten to say that we were very fortunate in having bread baked daily for us on Cay Chapel and South Water Cay, and that with Belizean honey this formed our midday meal for days on end! Furthermore, on St Georges Cay many of the problems of acquisition and storing of food were solved for us by the proximity of the Forces, who were very kind to us, and made our stay there the easiest we had on any of the Cays. In general, the problems we had were to be expected considering the limited equipment we had, and the situation we had placed ourselves in and so it is largely up to any individual group to decide what is best, and how to cope with it, for themselves.

As regards fresh water, we were very fortunate in having been provided with six 2.5 litre water cans by the Forces, which we were able to keep throughout the expedition. The water supply on every Cay was good, and more importantly, clean. The puritabs we took remained largely unused save on one occasion when algae was discovered coating the inside of one of the cans. This did not appear to affect the water in any way, however, and as no-one developed any stomach complaints (at any time, in fact) their use was dropped again after only a couple of days. As all the fresh water on the Cays is collected by tanks from rain-water, however, care had to be taken not to be extravagant with it (as people coming from a country like Britain tend to be). On Cay Chapel we actually had to use the boat to motor round to the water source, whereas on St Georges Cay and South Water Cay the supply was very close and the water obtainable by hand.

#### Final Remarks

It is difficult to make any concrete recommendations about this part of an expedition, for by their very nature logistics tend to be very particular to every enterprise. As regards Belize, however, it is worth bearing in mind that, a) the general cost of living is quite high, b) the water supply is good and c) transport (as long as there is not too much equipment) is relatively straight forward. In essence, other countries and other places might have produced considerably greater logistical problems and made day to day living much more demanding.

S.J.P

### Diving Officers Report

This report covers all of the diving that took place between the 15th July and the 12th August 1986, although the general comments apply throughout the expeditions length.

Expedition diving took place on the often spectacular Barrier Reef off Belize. It was all very pleasurable and an excellent experience for all concerned. All members of the expedition were qualified to BSAC Sports Diver Standard or above whilst several members also had tropical diving experience.

BSAC diving methods and tables were strictly adhered to on all expedition dives. Although the waters were consistently warm with excellent visibility, all dives were no-stop dives and more than two repeat dives were not undertaken. No decompression diving took place as the nearest chamber was in Miami. (After Doron had left, some decompression dives were undertaken off South Water Cay and St Georges Cay. It was felt that by that time we had built up enough experience of the local conditions to carry out the dives successfully).

The expedition presented new challenges for all of the divers, especially with the new survey techniques that were utilised. At first the time required for the scientific work was often beyond that planned and this led to modifications of our diving methods being adopted following the first survey on Cay Chapel. These had the desired effect of increasing the work capability. Nevertheless, practice and familiarity increased efficiency and with time all of the divers found the best ways of completing their allotted tasks and so reducing the amount of their dive time devoted to the project. Free bottom time was normally spent on exploring the local reefs.

The main task facing the DO was to organise the diving logistics. The most efficient use of the divers and the boat waves in the time available required detailed planning each day. A close check was maintained throughout the day on each diver. As often as was possible, deep and shallow dives were worked into each dive plan, avoiding two deep dives per diver and so allowing a longer work schedule.

It was important in the planning to allow for reduction in the total dive time available caused by medical problems, runs to the mainland, and guard duties at the camp. Planning problems and overwork were avoided by settling into a consistent routine. Buddies were often kept along with specific research tasks to increase efficiency. Delegation of general diving duties, such as boatman, were important to ensure a smooth running operation.

Some problems occurred with the weather. Heavy swells prevented work on the shallow sites sometimes although only one day was lost entirely due to a heavy storm. It was the hurricane season! The wind was the main culprit with all hands needed some days to hold the tents down although most affected were our highly competitive volleyball games!

In general, personal diving practices were good, although some complacency did develop and the team needed a few safety reminders. Depth gauges caused a few heated words to fly at well known manufacturers. Large variations were found and so the deepest depth had always to be used.

Any deviations were avoided at all costs. Too often the overuse of PADI tables by local or U.S divers tempts divers to go past our BSAC tables. The DO on an expedition must ensure that this does not happen. (Just before our arrival in Belize, one U.S and one local diver both died in a blue hole in Cay Caulker, just north of Cay Chapel. These clear waters were just as potentially dangerous as any others. C.C)

By keeping to BSAC rules on safety and tables, we ensured that no incidents were reported by any of the divers. Despite the initial problems caused by illness and acclimatisation, all of the divers adapted well to the local conditions and the research requirements. There was no shark menace although there were frequent encounters. Barracudas and remoras proved to be very curious although again there were no incidents. As for the stingers, Pete's episode is related in the medical report and there were many stingrays around. We all received mild stings from fire coral and portugese men 'o' war were spotted from the boat.

It has to be said that the diving was excellent in the consistently clear and warm waters. During a brief interlude from the research work, some excellent dive spots were found on the various atolls to the east of the main reef. At Lighthouse Reef we dived in a 408 ft Blue Hole and in Belizes only Marine Park. Many of the sites we encountered were still intact and the local conservationists are trying to keep them that way. Fishing has had a marked effect in some areas though, and it would be a terrible shame to see these untouched reefs go the way of so many others. By both our work and our diving practices, we tried to show that divers should be the first to abide by a good code of conservation practice. We hope that all future diving expeditions will follow similar guidelines.

(After Doron left, Colin became our DO and the same guidelines were followed. As time progressed however we became more adventurous, going night diving, doing compression stops and diving deeper. This included dives to 50 m).

D.C

### Photographic Report

As with most aspects of the expedition, to keep costs down as much equipment as possible had to be borrowed. There was no exception with the major items of photographic gear; they were all borrowed. The usual round of letters to photographic companies had given no joy supplying any required equipment. Some frantic pleading during the last two weeks before the advance party left resulted in us being able to borrow a Nikonos V camera and an Ocean Pro flash gun. Unfortunately because camera and flash were loaned by different people and at such short notice we did not receive them until the day before the main party flew out. We were unable therefore to run any test film through to check that both camera and flash were working. We were able to borrow a Nikonos I from Aberystwyth's geography department, and this was well tested before leaving for Belize and worked perfectly. However we did not have a flash gun for this camera so it could only be used in well illuminated situations.

All of our film stocks were kindly supplied by Kodak at trade prices. Most of the work was to be carried out using Kodachrome 64, this was to be supplemented by small quantities of Ektachrome 200 and Ektachrome 400. In addition to this we took some Plus X black and white film to be used mainly for testing cameras. To keep costs down this was bought in bulk and loaded into reusable cassettes. All of the film was transported in its original packaging, care was taken to insist on hand searches at airports so the film never went through any X-ray machines. In Belize the film was kept in a cool box only being taken out when required and immediately replaced when finished with. With much of the work being photographed looking very similar it was very important to keep a very good record of what was taken on each film. The Kodachrome film being prepaid was sent for developing as soon as we returned to Britain. We developed all of the ektachrome film ourselves using a Photocolour E6 kit and mounted the slides in Gepe plastic slide mounts. Again this was done as a cost saving measure. All of the black and white film that we used was developed in Belize. For this we took out a small developing kit consisting of Paterson universal developer, a solution of 2% acetic acid stop bath and Paterson acufix fixer. We were never short of enough fresh water to develop these films but out on the Cayes it was nearly impossible to find any water at less than 30°C. This created problems with the developer solution which was not intended for use at such high temperatures. This was overcome by using an extremely dilute working solution and short development times. The results were then perfectly good.

The films were washed in 7-8 baths of water as a running supply was not available. It was decided to make contact prints of all of the black and white films to help in finding any camera faults and to aid in identifying certain coral and sponges. For this we had taken out a Paterson proof printer and some Kentmere 10 x 8 glossy enlarging paper. The light source to expose the paper was supplied by a divers halogen torch with paper over the lens to diffuse the beam. The prints were developed in the same chemicals as for the films. Results were again very satisfactory.

The main uses of photography on this expedition were for the following:-

- 1) To provide a record of all the species of flora and fauna that were being studied. This included macro shots of coral heads to aid in their identification.
- 2) To give a record of all of the quadrats surveyed to supply an unbiased account of the percentage cover of the various species and aid in identification of any unknown species. This required two shots of each quadrat one from above and a second from the side.
- 3) To provide a photographic record of the entire area of the reef where the surveys were made, and a record of the areas of beach adjacent to the reef being surveyed.
- 4) To produce a series of shots of divers at work.

We suffered only two major mechanical problems with the camera and flash. The first occurred when the leaves of the vertically running shutter started to stick together during the winding on. This resulted in the shutter opening slightly at the top of two adjacent frames of film and re-exposing the film. This was soon discovered when a test film was run through and the remedy was quite simple; a lenscap had to be placed over the lens when winding on. Luckily not many shots were lost before the fault was discovered. The second major problem occurred with the flash gun. The flash had an inbuilt Nicad battery pack which had to be recharged. This was easily done because all of the cays had generators which we could use. But the flash would not hold its charge and even when fully charged would only last for one film. Eventually this became less and less until eventually the flash would not recharge at all. This was impossible to repair out there so we were stuck without a flash for two weeks. This left us having to shoot in very shallow water when possible or using fast film and losing much of the natural colour of subjects. Both of these problems could probably have been overcome had the camera had a thorough testing in Britain.

Most members of the expedition had no previous experience of any underwater photography and this showed up in a lot of the results. Common errors were the subject being out of focus or blurred because of camera shake. During the first few weeks of the expedition the camera was being used too often for personal use rather than for the expedition. A tighter control on who should use the camera and when should have been maintained. If everyone could have had trial goes with the camera in a pool before going to Belize again these problems could have been avoided.

M.R.S.E

### Personnel Report

All of the 7 expedition members selected in November 1985 came out to Belize. The only necessary requirement was to be a Sports Diver or above (BSAC trained). Otherwise, previous expedition experience or specialised knowledge was considered a great asset. Two members, Doron and Graham, returned to England on the 11th July as arranged owing to work commitments. In return, Michelle Aldridge joined us on the 12th and stayed until the conclusion. Although, for administrative purposes, Michelle was not an expedition member, she joined in all of our activities and became a useful member of the research team.

I feel that it is important, especially with regards to future expeditions, that I comment on the interactions that occurred within the group. I am being subjective, so sorry everyone. Many of the problems could have been avoided and this should be of interest to future leaders. At first I was the only link between the Cambridge and Aberystwyth teams and we did not all get together until we were all standing on the tarmac at Belize Airport. This meant that internal communications within the team during planning should have been a priority to maintain both interest and commitment. Not surprisingly there were several ups and downs during the planning and the decision to actually go could not be finalised until May owing to shaky finances. Two expedition members who did not pull their full weight during the planning did the same in the field, causing some friction with the others. Some arguments also occurred with people interfering in each others fields, no matter how good their intentions were. Some cliques developed which did not help foster a good team spirit at teams. Obviously it is hard to comment on ones own leadership, but I feel on reflection that many of these problems could have been avoided if I had been more assertive in delegating specific jobs and ensuring their completion. We found that volleyball was a good way of relaxing and venting frustrations. One day each week was set aside as a rest day.

However, it is unjust to dwell on these aspects alone. When I consider that we were a group of 7 young men, 5 of whom were new to expeditioning, who were placed together on a series of small islands with a busy work schedule to complete, we all showed a great deal of maturity. We all had a fantastic time and good friendships were formed both within the group and with many of those that we met. Perhaps the best way to judge the overall feeling is by looking at the enthusiasm shown over the Christmas reunion.

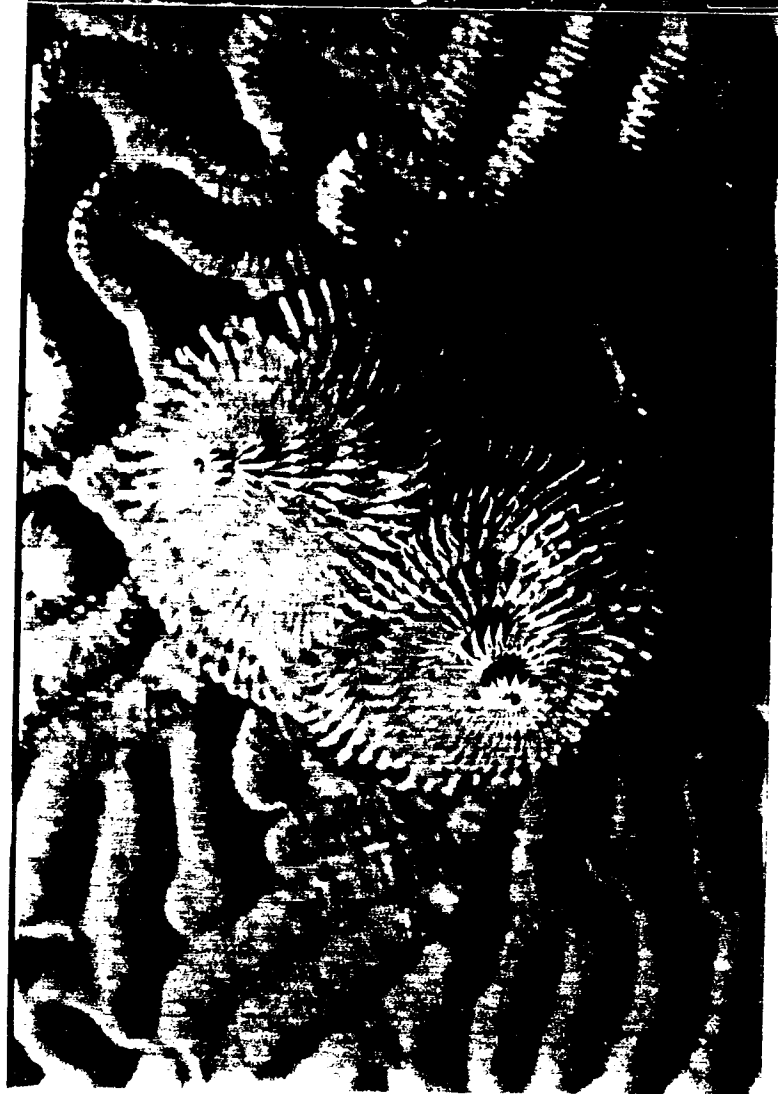
C.C



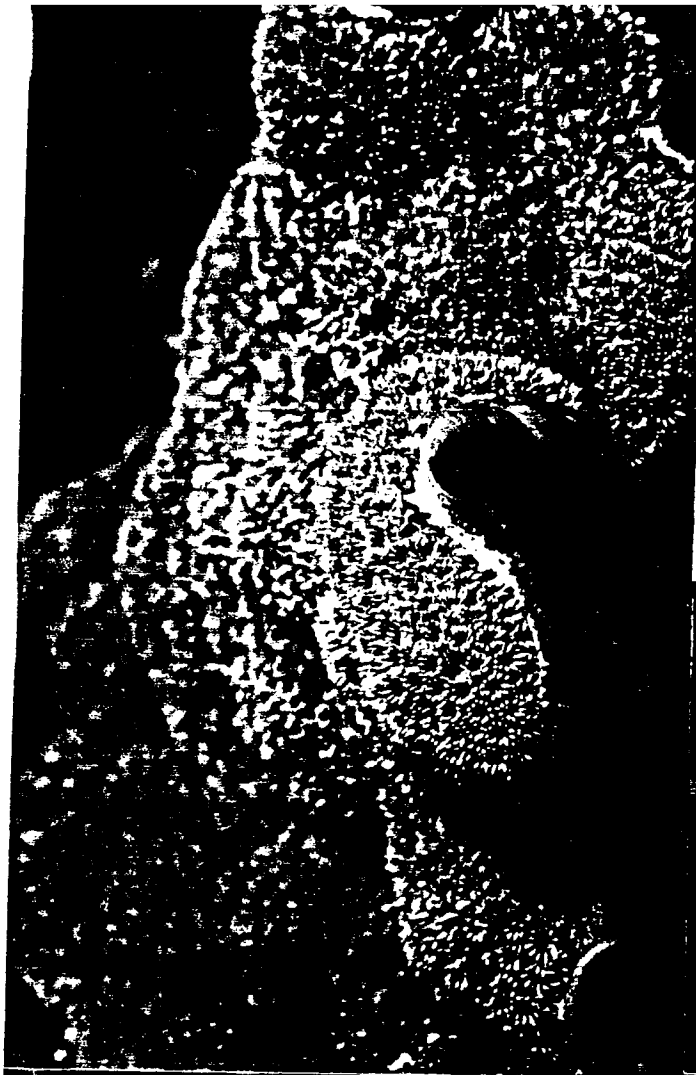
(Above)

Grooved Brain Coral (*Diploria*  
*Labyrinthiformis*) (to foreground) and  
 Mountainous Star Coral (*Montastraea*  
*Annularis*) Queen Triggerfish (*Ballistes Vetula*)  
 Stand of *Acropora Palmata*, with transect  
 line in foreground



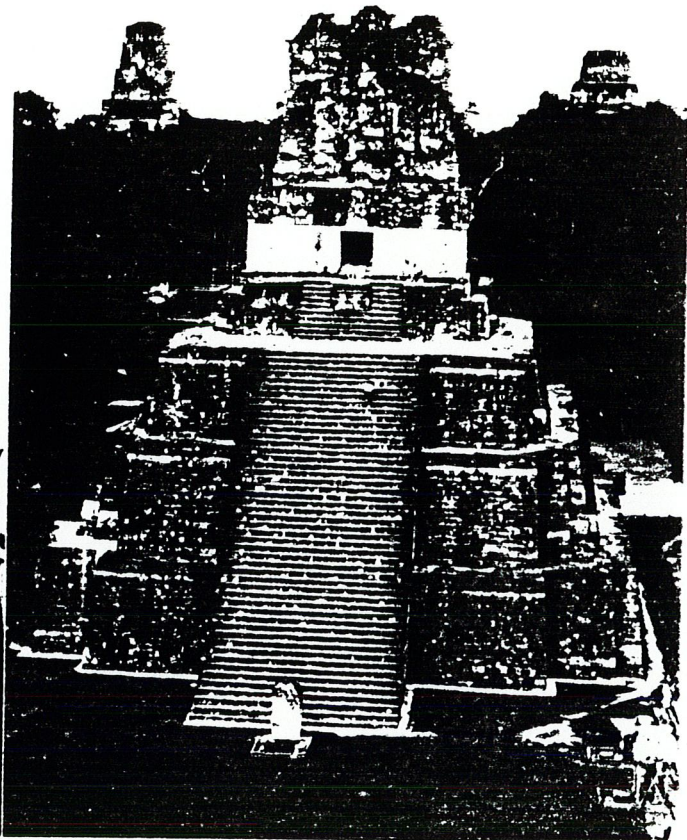


(Above) Plume Worm on Grooved Brain Coral  
(Diploria labyrinthiformis)  
(Top Right) Close up of Mustard Hill Coral  
(Porites Astreoides)  
(Right) Bristlestar on Millepora (Macro)





(Above) Reggae Drummer playing Turtle-Shell drums on Belize's 5th Anniversary of Independence, 21st September 1986



(Above) The excavated and restored ruin of the Mayan Temple at Tikal Guatemala



(Left) Touring the Belizian Highlands in a hired Landrover

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In Belize:

Her Majesty's Forces  
APC Camp, Ladyville, Belize BFPO 12.

Mr Paul Hunt  
Fort George Hotel, Belize City, Belize.

A P P E N D I C E S

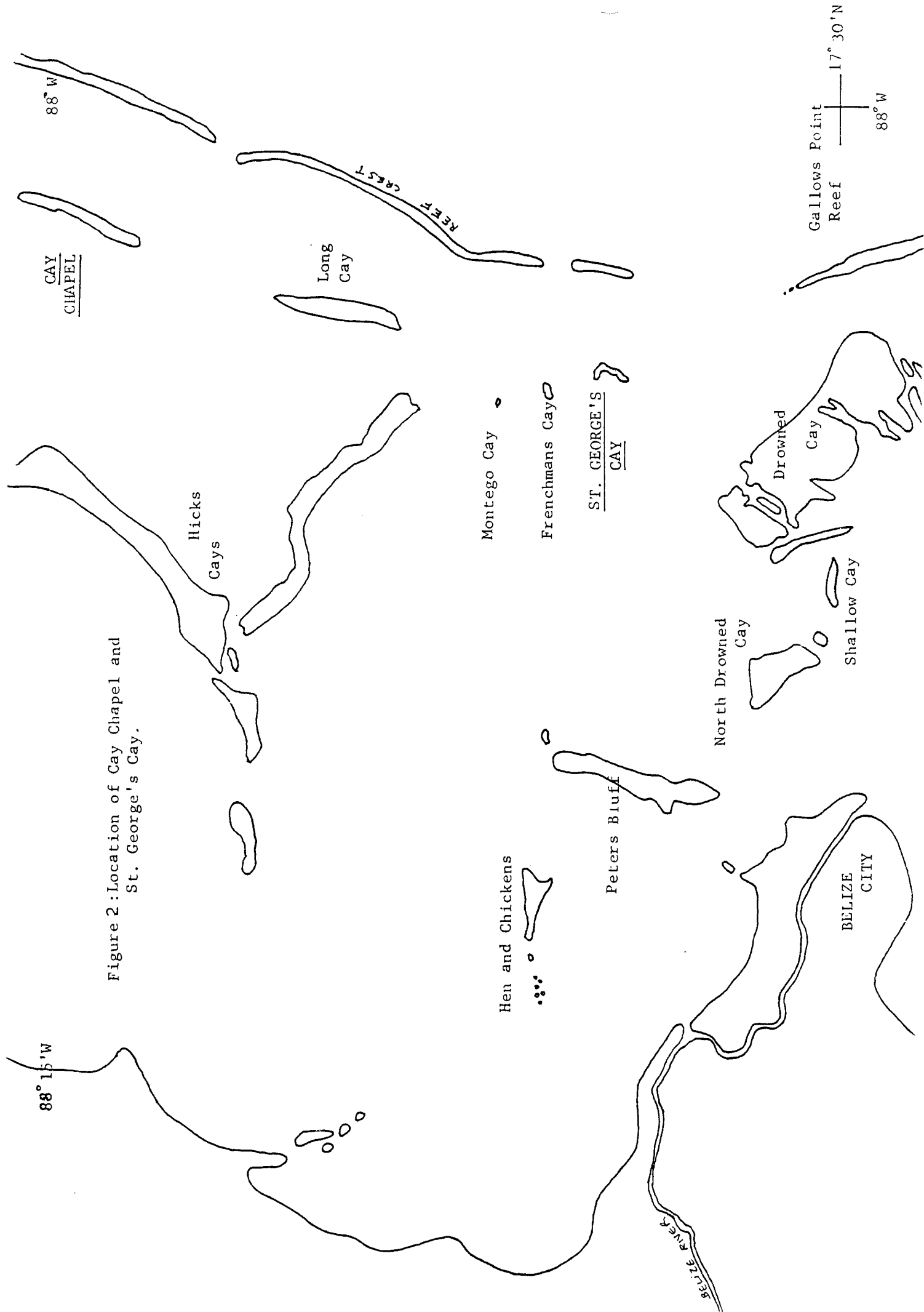


Figure 2: Location of Cay Chapel and St. George's Cay.

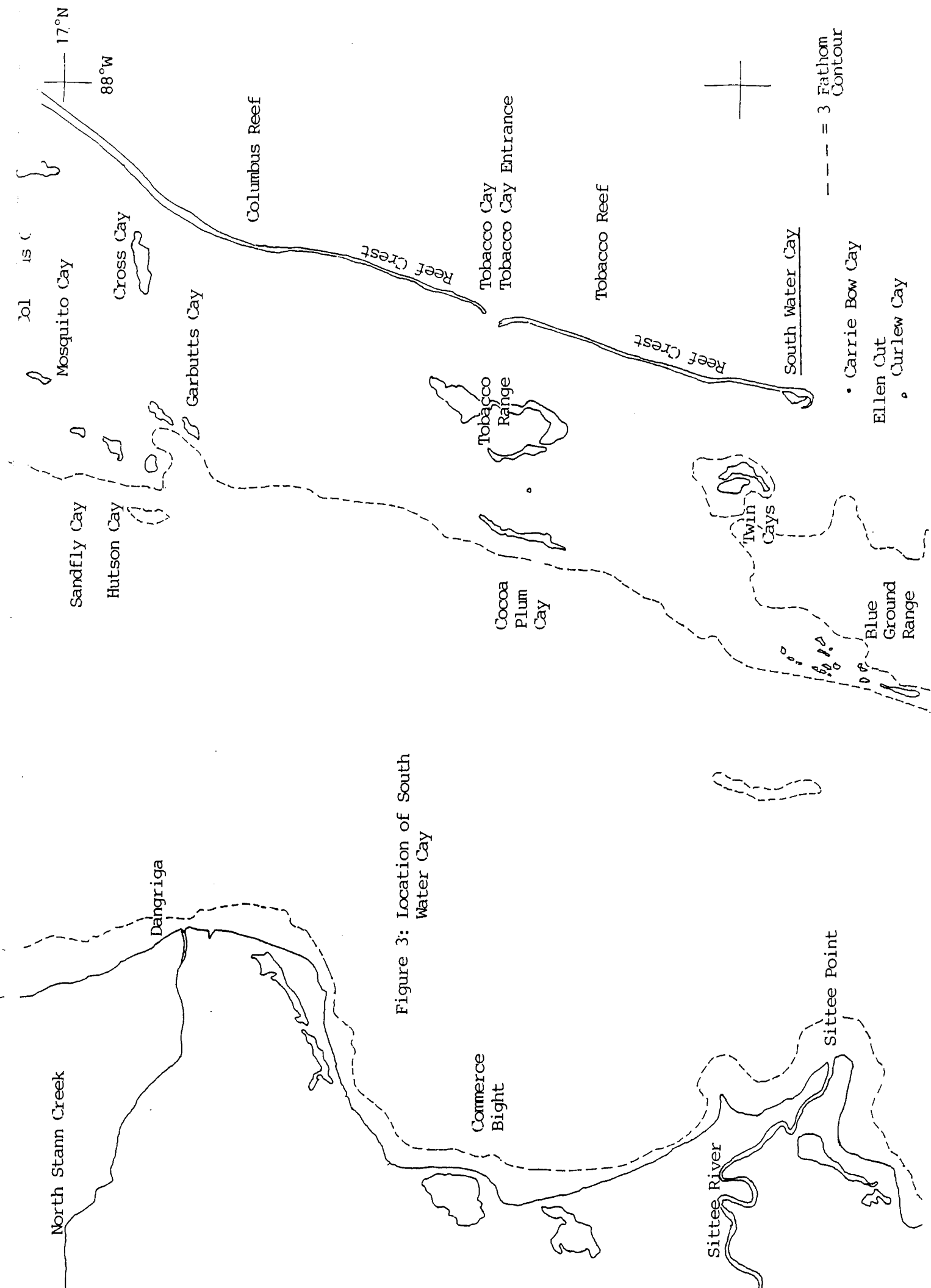


Figure 3: Location of South Water Cay

### Salinity, Temperature, P.H and Current Velocity

On all dives involving survey work the first pair of divers would attempt to measure the above for that particular site. We had the use of an Environmental Probe for this work but unfortunately this piece of equipment did not stand up well to the rigorous conditions on site. After its demise on our second Cay the salinity readings had to be halted, temperatures were measured by hand thermometer and P.H was then measured by litmus paper.

P.H readings over all three sites were very consistant with about 95% of all the readings being 7.0. The occasional reading of 7.5 was recorded but this may well have been due to operator error.

Water temperature on site was also remarkably consistant not only over the three different Cays but also over the three sites we surveyed on each Cay. 60% of all readings taken were of 29'C and all other readings were between 28.5'C and 30.5'C. The variation in readings is not related to the sites. All readings were taken at the mid-point of each transect line.

Salinity tended to vary between 27 parts per thousand (hereafter referred to as p/t) and 33.5 p/t but the majority of readings were in the upper half of this range. (Only two readings were below 29 p/t). Because of the failure of the environmental probe we only have data for the first 3 and a half weeks. (Out of a total of 7 weeks on site).

Current Velocity was found to be very difficult to measure as it was often very slight or totally nonexistent. No accurate readings were obtained.

### Explanatory Notes for the Reef Fish Surveys

All surveys were carried out by two divers who swam down each side of the transect line and then back up the opposite side. The divers each did a count of fish numbers within a two meter strip on the line on their side as well as a count of all other fish present in the area. The two numbers given in each box therefore represent each individual divers fish count for that survey. A second survey was then carried out at a later date. In the data shown here the first survey is called "Dive 1" and the second survey is called "Dive 2".

The above is true for most of the fish surveyed and the exceptions are listed below.

TRIGGERFISH, PUFFERS and TRUNKFISH: Because of the very small numbers of these fish seen they are not listed as "on transect" and "in area" but as a total seen on that survey. They are under the "No's on transect" section.

PARROTFISH and SQUIRRELFISH: These fish are also given as a total number seen on the survey and they are under the "No's on transect" section. Because of the large numbers of parrotfish, the number of species and particularly the large number of juveniles they were found to be very difficult to identify. After attempting to survey each species we soon realised the difficulties and converted to the total count.

Further information concerning positions and depths of the transect lines, the exact methods used on the surveys and a criticism of those methods can be found in earlier sections of this report.

CAY CHAPEL

|                                                                 | <u>PROP-OFF</u>  |        |                 |        | <u>FORE-REEF</u> |        |                 |        | <u>BACK-REEF</u> |        |                 |        |
|-----------------------------------------------------------------|------------------|--------|-----------------|--------|------------------|--------|-----------------|--------|------------------|--------|-----------------|--------|
|                                                                 | No's on transect |        | Present in area |        | No's on transect |        | Present in area |        | No's on transect |        | Present in area |        |
|                                                                 | Dive 1           | Dive 2 | Dive 1          | Dive 2 | Dive 1           | Dive 2 | Dive 1          | Dive 2 | Dive 1           | Dive 2 | Dive 1          | Dive 2 |
| <u>ANGELFISH</u>                                                |                  |        |                 |        |                  |        |                 |        |                  |        |                 |        |
| Gray Angel<br>( <i>Pomacanthus arcuatus</i> )                   | --               | 1      | --              | 1      | --               | --     | 1               | --     | 5                | --     | --              | --     |
|                                                                 | --               | 1      | --              | 1      | 2                | --     | --              | --     | --               | --     | 5               | --     |
| Rock Beauty<br>( <i>Holacanthus tricolor</i> )                  | 2                | 4      | 2               | 2      | --               | --     | 1               | --     | --               | --     | --              | --     |
|                                                                 | 3                | 5      | 3               | 4      | 1                | --     | --              | --     | --               | --     | --              | --     |
| French Angel<br>( <i>Pomacanthus paru</i> )                     | --               | --     | --              | --     | 1                | --     | --              | --     | --               | --     | --              | --     |
|                                                                 | --               | --     | --              | --     | --               | --     | 1               | --     | --               | --     | 1               | --     |
| Queen Angel<br>( <i>Holacanthus ciliaris</i> )                  | --               | 1      | 1               | --     | --               | --     | --              | --     | --               | --     | --              | --     |
|                                                                 | --               | --     | --              | 1      | --               | --     | --              | --     | --               | --     | --              | --     |
| Blue Angel<br>( <i>Holacanthus bermudensis</i> )                | --               | --     | --              | --     | --               | --     | --              | --     | --               | --     | --              | --     |
|                                                                 | --               | --     | --              | --     | --               | --     | --              | --     | --               | --     | --              | --     |
| <u>DAMSELFISH</u>                                               |                  |        |                 |        |                  |        |                 |        |                  |        |                 |        |
| Yellow-Tailed Damselfish<br>( <i>Microspathodon chrysurus</i> ) | 21               | 31     | 1               | 7      | 31               | 18     | 2               | 14     | 5                | 1      | 2               | 3      |
|                                                                 | 16               | 9      | 5               | 4      | 42               | 26     | 13              | 8      | 4                | 5      | 4               | 1      |

SOUTN WATER CAY

|                                                             | <u>DROP-OFF</u>  |        |                 |        | <u>FORE-REEF</u> |        |                 |        | <u>BACK-REEF</u> |        |                 |        |
|-------------------------------------------------------------|------------------|--------|-----------------|--------|------------------|--------|-----------------|--------|------------------|--------|-----------------|--------|
|                                                             | No's on transect |        | Present in area |        | No's on transect |        | Present in area |        | No's on transect |        | Present in area |        |
|                                                             | Dive 1           | Dive 2 | Dive 1          | Dive 2 | Dive 1           | Dive 2 | Dive 1          | Dive 2 | Dive 1           | Dive 2 | Dive 1          | Dive 2 |
| <u>ANGELFISH</u>                                            |                  |        |                 |        |                  |        |                 |        |                  |        |                 |        |
| Gray Angel<br>( <i>Pomacanthus arcuatus</i> )               | --               | --     | --              | --     | --               | --     | --              | --     | --               | --     | --              | --     |
| Rock Beauty<br>( <i>Holacanthus tricolor</i> )              | 6                | 1      | --              | 1      | --               | --     | --              | 1      | --               | --     | --              | --     |
| French Angel<br>( <i>Pomacanthus paru</i> )                 | 1                | 2      | --              | --     | --               | 2      | --              | --     | --               | --     | --              | --     |
| Queen Angel<br>( <i>Holacanthus ciliaris</i> )              | --               | --     | --              | --     | 1                | --     | 1               | 2      | --               | --     | --              | --     |
| Blue Angel<br>( <i>Holacanthus bermudensis</i> )            | --               | --     | --              | --     | --               | --     | --              | --     | --               | --     | --              | --     |
| <u>DAMSELFISH</u>                                           |                  |        |                 |        |                  |        |                 |        |                  |        |                 |        |
| Yellow-Tailed Damsel<br>( <i>Microspathodon chrysurus</i> ) | 1                | --     | 1               | 1      | 22               | 53     | 8               | 14     | --               | --     | --              | --     |
|                                                             | 3                | 1      | --              | --     | 21               | 29     | 15              | 21     | --               | --     | --              | --     |

ST. GEORGE'S CAY

|                                                              | <u>DROP-OFF</u>  |        |                 |         | <u>FORE-REEF</u> |          |                 |          | <u>BACK-REEF</u> |          |                 |          |
|--------------------------------------------------------------|------------------|--------|-----------------|---------|------------------|----------|-----------------|----------|------------------|----------|-----------------|----------|
|                                                              | No's on transect |        | Present in area |         | No's on transect |          | Present in area |          | No's on transect |          | Present in area |          |
|                                                              | Dive 1           | Dive 2 | Dive 1          | Dive 2  | Dive 1           | Dive 2   | Dive 1          | Dive 2   | Dive 1           | Dive 2   | Dive 1          | Dive 2   |
| <u>ANGELFISH</u>                                             |                  |        |                 |         |                  |          |                 |          |                  |          |                 |          |
| Gray Angel<br>( <i>Pomacanthus arcuatus</i> )                | 2                | --     | --              | --      | --               | 1        | 1               | --       | --               | --       | --              | --       |
| Rock Beauty<br>( <i>Holacanthus tricolor</i> )               | 3<br>2           | 3<br>1 | 2<br>4          | --<br>5 | --<br>--         | --<br>-- | --<br>--        | --<br>-- | --<br>--         | --<br>-- | --<br>--        | --<br>-- |
| French Angel<br>( <i>Pomacanthus paru</i> )                  | --               | 2      | --              | --<br>2 | --               | --       | --              | --       | --               | --<br>2  | --              | 2        |
| Queen Angel<br>( <i>Holacanthus ciliaris</i> )               | --               | --     | --              | --      | --               | --       | --              | --       | --               | --       | --              | --       |
| Blue Angel<br>( <i>Holacanthus bermudensis</i> )             | --               | --     | --              | --      | --               | --       | --              | --       | --               | --       | --              | --       |
| <u>DAMSELFISH</u>                                            |                  |        |                 |         |                  |          |                 |          |                  |          |                 |          |
| Yellow-Tailed Damself<br>( <i>Microspathodon chrysurus</i> ) | --               | --     | --              | --      | --               | 1        | --              | --       | --               | 1        | --              | --       |

CAY CHAPEL

|                                                                                                                     | <u>DROP-OFF</u>  |        |                 |        | <u>FORE-REEF</u> |        |                 |        | <u>BACK-REEF</u> |        |                 |        |
|---------------------------------------------------------------------------------------------------------------------|------------------|--------|-----------------|--------|------------------|--------|-----------------|--------|------------------|--------|-----------------|--------|
|                                                                                                                     | No's on transect |        | Present in area |        | No's on transect |        | Present in area |        | No's on transect |        | Present in area |        |
|                                                                                                                     | Dive 1           | Dive 2 | Dive 1          | Dive 2 | Dive 1           | Dive 2 | Dive 1          | Dive 2 | Dive 1           | Dive 2 | Dive 1          | Dive 2 |
| <u>CHROMIDS</u>                                                                                                     |                  |        |                 |        |                  |        |                 |        |                  |        |                 |        |
| Blue Chromid                                                                                                        | 33               | 67     | 69              | 41     | --               | --     | --              | --     | 6                | 2      | 5               | 1      |
| (Chromis cyaneus)                                                                                                   | 80               | 52     | 28              | 73     | --               | --     | --              | --     | 4                | 1      | 7               | 2      |
| Yellow-edged Chromid                                                                                                | 1                | --     | --              | --     | 2                | --     | --              | --     | --               | --     | --              | --     |
| (Chromis multilineatus)                                                                                             | --               | --     | --              | --     | --               | --     | --              | --     | --               | --     | --              | --     |
| <u>SURGEONFISH</u>                                                                                                  |                  |        |                 |        |                  |        |                 |        |                  |        |                 |        |
| Ocean Surgeon                                                                                                       | 1                | --     | --              | --     | --               | --     | --              | --     | --               | --     | --              | --     |
| (Acanthurus bahianus)                                                                                               | --               | --     | --              | --     | --               | --     | --              | --     | --               | --     | --              | --     |
| Doctorfish                                                                                                          | --               | 1      | --              | 12     | --               | 30     | --              | --     | --               | --     | --              | --     |
| (Acanthurus chirurgus)                                                                                              | --               | 10     | --              | 1      | --               | --     | --              | 30     | --               | --     | --              | --     |
| Blue Tang                                                                                                           | 12               | 31     | 30              | 35     | 155              | 37     | 34              | 103    | 2                | 4      | 4               | 10     |
| (Acanthurus coeruleus)                                                                                              | 23               | 42     | 2               | 38     | 119              | 81     | 61              | 80     | 5                | 10     | 1               | 7      |
| <u>PUFFERS and TRUNKFISH</u>                                                                                        |                  |        |                 |        |                  |        |                 |        |                  |        |                 |        |
| Because of the very small numbers of these fish they were survey as a group and the figure given is for total seen. | 3                | --     |                 |        | 1                | --     |                 |        | 7                | 3      |                 |        |
|                                                                                                                     | 2                | --     |                 |        | --               | --     |                 |        | 4                | 4      |                 |        |

SOUTH WATER CAY

|                                                                                                                     | <u>DROP-OFF</u>  |        |                 |        | <u>FORE-REEF</u> |        |                 |        | <u>BACK-REEF</u> |        |                 |        |
|---------------------------------------------------------------------------------------------------------------------|------------------|--------|-----------------|--------|------------------|--------|-----------------|--------|------------------|--------|-----------------|--------|
|                                                                                                                     | No's on transect |        | Present in area |        | No's on transect |        | Present in area |        | No's on transect |        | Present in area |        |
|                                                                                                                     | Dive 1           | Dive 2 | Dive 1          | Dive 2 | Dive 1           | Dive 2 | Dive 1          | Dive 2 | Dive 1           | Dive 2 | Dive 1          | Dive 2 |
| <u>CHROMIDS</u>                                                                                                     |                  |        |                 |        |                  |        |                 |        |                  |        |                 |        |
| Blue Chromid                                                                                                        | 51               | 23     | 42              | 35     | 50               | 21     | 7               | 43     | --               | --     | --              | --     |
| (Chromis cyaneus)                                                                                                   | 46               | 150    | 48              | 97     | 50               | 15     | 19              | 24     | --               | --     | --              | --     |
| Yellow-edged Chromid                                                                                                | --               | --     | --              | --     | --               | --     | --              | --     | --               | --     | --              | --     |
| (Chromis multilineatus)                                                                                             | --               | --     | --              | --     | --               | --     | --              | --     | --               | --     | --              | --     |
| <u>SURGEONFISH</u>                                                                                                  |                  |        |                 |        |                  |        |                 |        |                  |        |                 |        |
| Ocean Surgeon                                                                                                       | 1                | --     | --              | --     | --               | 1      | 3               | --     | --               | --     | --              | --     |
| (Acanthurus bahianus)                                                                                               | --               | --     | --              | --     | 2                | --     | --              | --     | --               | --     | --              | --     |
| Doctorfish                                                                                                          | 2                | --     | --              | --     | 3                | 3      | 1               | 1      | 36               | --     | 5               | --     |
| (Acanthurus chirurgus)                                                                                              | --               | --     | --              | --     | 16               | 1      | 2               | --     | 2                | --     | 30              | --     |
| Blue Tang                                                                                                           | 2                | 5      | --              | 40     | 43               | 12     | 96              | 3      | 37               | 11     | 53              | 30     |
| (Acanthurus coeruleus)                                                                                              | 2                | 3      | 5               | 45     | 103              | 11     | 57              | 14     | 7                | 22     | 62              | 16     |
| <u>PUFFERS and TRUNKFISH</u>                                                                                        |                  |        |                 |        |                  |        |                 |        |                  |        |                 |        |
| Because of the very small numbers of these fish they were survey as a group and the figure given is for total seen. | --               | 1      |                 |        | --               | --     |                 |        | --               | --     |                 |        |
|                                                                                                                     | --               | --     |                 |        | --               | --     |                 |        | --               | --     |                 |        |

ST. GEORGE'S CAY

|                                                                                                                     | <u>DROP-OFF</u>  |        |                 |        | <u>FORE-REEF</u> |        |                 |        | <u>BACK-REEF</u> |        |                 |        |
|---------------------------------------------------------------------------------------------------------------------|------------------|--------|-----------------|--------|------------------|--------|-----------------|--------|------------------|--------|-----------------|--------|
|                                                                                                                     | No's on transect |        | Present in area |        | No's on transect |        | Present in area |        | No's on transect |        | Present in area |        |
|                                                                                                                     | Dive 1           | Dive 2 | Dive 1          | Dive 2 | Dive 1           | Dive 2 | Dive 1          | Dive 2 | Dive 1           | Dive 2 | Dive 1          | Dive 2 |
| <u>CHROMIDS</u>                                                                                                     |                  |        |                 |        |                  |        |                 |        |                  |        |                 |        |
| Blue Chromid                                                                                                        | 60               | 35     | 46              | 112    | --               | --     | --              | --     | --               | --     | --              | --     |
| (Chromis cyaneus)                                                                                                   | 61               | 52     | 30              | 93     | --               | --     | --              | --     | --               | --     | --              | --     |
| Yellow-edged Chromid                                                                                                | --               | --     | --              | --     | --               | --     | --              | --     | --               | --     | --              | --     |
| (Chromis multilineatus)                                                                                             | --               | --     | --              | --     | --               | --     | --              | --     | --               | --     | --              | --     |
| <u>SURGEONFISH</u>                                                                                                  |                  |        |                 |        |                  |        |                 |        |                  |        |                 |        |
| Ocean Surgeon                                                                                                       | 21               | 15     | 8               | 3      | 102              | 57     | --              | 90     | 69               | 87     | --              | 75     |
| (Acanthurus bahianus)                                                                                               | 23               | 10     | 8               | 13     | --               | 79     | 100             | 80     | --               | 43     | 55              | 13     |
| Doctorfish                                                                                                          | --               | 7      | --              | --     | --               | 3      | --              | --     | 23               | 7      | 57              | 23     |
| (Acanthurus chirurgus)                                                                                              | --               | --     | --              | 7      | --               | --     | --              | 3      | 12               | 19     | 39              | 29     |
| Blue Tang                                                                                                           | 5                | 12     | 8               | 6      | 108              | 13     | 30              | 7      | --               | --     | --              | --     |
| (Acanthurus coeruleus)                                                                                              | 11               | 7      | 21              | 9      | 28               | 10     | 123             | 15     | --               | --     | --              | --     |
| <u>PUFFERS and TRUNKFISH</u>                                                                                        |                  |        |                 |        |                  |        |                 |        |                  |        |                 |        |
| Because of the very small numbers of these fish they were survey as a group and the figure given is for total seen. | --               | --     |                 |        | --               | --     |                 |        | --               | --     |                 |        |
|                                                                                                                     | --               | --     |                 |        | --               | --     |                 |        | --               | --     |                 |        |

CAY CHAPEL

|                          | <u>DROP-OFF</u>  |        |                 |        | <u>FORE-REEF</u> |        |                 |        | <u>BACK-REEF</u> |        |                 |        |
|--------------------------|------------------|--------|-----------------|--------|------------------|--------|-----------------|--------|------------------|--------|-----------------|--------|
|                          | No's on transect |        | Present in area |        | No's on transect |        | Present in area |        | No's on transect |        | Present in area |        |
|                          | Dive 1           | Dive 2 | Dive 1          | Dive 2 | Dive 1           | Dive 2 | Dive 1          | Dive 2 | Dive 1           | Dive 2 | Dive 1          | Dive 2 |
| <u>BUTTERFLYFISH</u>     |                  |        |                 |        |                  |        |                 |        |                  |        |                 |        |
| Foureye butterflyfish    | 2                | 5      | 5               | 1      | 2                | --     | 3               | --     | 2                | 4      | --              | --     |
| (Chaetodon capistratus)  | 5                | 2      | 6               | 4      | 1                | --     | 3               | --     | 4                | 1      | --              | --     |
| Reef butterflyfish       | --               | --     | 1               | --     | --               | --     | --              | --     | --               | --     | --              | --     |
| (Chaetodon sedentarius)  | --               | --     | --              | --     | --               | --     | --              | --     | --               | --     | --              | --     |
| Banded butterflyfish     | --               | --     | 1               | --     | 1                | --     | --              | --     | --               | --     | --              | --     |
| (Chaetodon striatus)     | --               | --     | --              | --     | --               | --     | 3               | --     | --               | --     | --              | --     |
| Longsnout Butterflyfish  | --               | --     | --              | --     | --               | --     | --              | --     | --               | --     | --              | --     |
| (Prognathodes aculeatus) | --               | --     | --              | --     | --               | --     | --              | --     | --               | --     | --              | --     |
| Spotfin butterflyfish    | --               | --     | --              | --     | --               | --     | --              | --     | --               | --     | --              | --     |
| (Chaetodon ocellatus)    | --               | --     | --              | --     | --               | --     | --              | --     | --               | --     | --              | --     |
| <u>SQUIRRELFISH</u>      |                  |        |                 |        |                  |        |                 |        |                  |        |                 |        |
| Longspine squirrelfish   | 67               | 21     |                 |        | --               | --     |                 |        | 1                | 3      |                 |        |
| (Holocentrus rufus)      | 47               | 8      |                 |        | --               | --     |                 |        | 3                | 2      |                 |        |

SOUTH WATER CAY

|                                                     | <u>DROP-OFF</u>  |          |                 |          | <u>FORE-REEF</u> |          |                 |          | <u>BACK-REEF</u> |          |                 |          |
|-----------------------------------------------------|------------------|----------|-----------------|----------|------------------|----------|-----------------|----------|------------------|----------|-----------------|----------|
|                                                     | No's on transect |          | Present in area |          | No's on transect |          | Present in area |          | No's on transect |          | Present in area |          |
|                                                     | Dive 1           | Dive 2   | Dive 1          | Dive 2   | Dive 1           | Dive 2   | Dive 1          | Dive 2   | Dive 1           | Dive 2   | Dive 1          | Dive 2   |
| <u>BUTTERFLYFISH</u>                                |                  |          |                 |          |                  |          |                 |          |                  |          |                 |          |
| Foureye butterflyfish<br>(Chaetodon capistratus)    | 3<br>5           | 4<br>3   | 6<br>3          | 3<br>--  | --<br>3          | 15<br>5  | 5<br>5          | 1<br>9   | 2<br>4           | --<br>-- | 4<br>1          | --<br>-- |
| Reef butterflyfish<br>(Chaetodon sedentarius)       | --<br>1          | --<br>-- | --<br>--        | --<br>-- | --<br>--         | --<br>-- | --<br>--        | --<br>-- | --<br>1          | --<br>-- | --<br>--        | --<br>-- |
| Banded butterflyfish<br>(Chaetodon striatus)        | 2<br>--          | 2<br>--  | --<br>--        | --<br>2  | 1<br>--          | --<br>-- | --<br>--        | --<br>1  | 1<br>--          | --<br>-- | --<br>--        | --<br>-- |
| Longsnout Butterflyfish<br>(Prognathodes aculeatus) | --<br>--         | --<br>-- | --<br>--        | --<br>-- | --<br>--         | --<br>-- | --<br>--        | --<br>-- | --<br>--         | --<br>-- | --<br>--        | --<br>-- |
| Spotfin butterflyfish<br>(Chaetodon ocellatus)      | 2<br>--          | --<br>1  | --<br>--        | 1<br>--  | 4<br>--          | --<br>-- | --<br>3         | --<br>-- | 2<br>--          | --<br>-- | --<br>--        | --<br>-- |
| <u>SQUIRRELFISH</u>                                 |                  |          |                 |          |                  |          |                 |          |                  |          |                 |          |
| Longspine Squirrelfish<br>(Holocentrus rufus)       | 30<br>47         | 15<br>15 |                 |          | 19<br>23         | 12<br>8  |                 |          | 2<br>1           | --<br>-- |                 |          |

ST. GEORGE'S CAY

|                                                     | <u>DROP-OFF</u>  |          |                 |          | <u>FORE-REEF</u> |          |                 |          | <u>BACK-REEF</u> |          |                 |          |
|-----------------------------------------------------|------------------|----------|-----------------|----------|------------------|----------|-----------------|----------|------------------|----------|-----------------|----------|
|                                                     | No's on transect |          | Present in area |          | No's on transect |          | Present in area |          | No's on transect |          | Present in area |          |
|                                                     | Dive 1           | Dive 2   | Dive 1          | Dive 2   | Dive 1           | Dive 2   | Dive 1          | Dive 2   | Dive 1           | Dive 2   | Dive 1          | Dive 2   |
| <u>BUTTERFLYFISH</u>                                |                  |          |                 |          |                  |          |                 |          |                  |          |                 |          |
| Foureye butterflyfish<br>(Chaetodon capistratus)    | 5<br>1           | 7<br>4   | 1<br>1          | 1<br>2   | --<br>--         | --<br>-- | --<br>--        | --<br>-- | --<br>--         | --<br>-- | --<br>--        | --<br>-- |
| Reef butterflyfish<br>(Chaetodon sedentarius)       | --<br>--         | --<br>2  | 1<br>--         | --<br>-- | --<br>--         | --<br>-- | --<br>--        | --<br>-- | --<br>--         | --<br>-- | --<br>--        | --<br>-- |
| Banded butterflyfish<br>(Chaetodon striatus)        | 4<br>3           | 2<br>--  | 1<br>4          | 2<br>1   | 2<br>3           | --<br>1  | 2<br>2          | --<br>2  | 1<br>2           | 2<br>3   | 1<br>1          | 1<br>1   |
| Longsnout Butterflyfish<br>(Prognathodes aculeatus) | --<br>--         | --<br>-- | --<br>--        | --<br>-- | --<br>--         | --<br>-- | --<br>--        | --<br>-- | --<br>--         | --<br>-- | --<br>--        | --<br>-- |
| Spotfin butterflyfish<br>(Chaetodon ocellatus)      | 2<br>--          | 2<br>2   | 2<br>3          | --<br>3  | 3<br>1           | 1<br>2   | 2<br>2          | 1<br>--  | --<br>--         | --<br>-- | --<br>--        | --<br>-- |
| <u>SQUIRRELISH</u>                                  |                  |          |                 |          |                  |          |                 |          |                  |          |                 |          |
| Longspine squirrelfish<br>(Holocentrus rufus)       | 25<br>25         | 32<br>48 |                 |          | 21<br>27         | 12<br>19 |                 |          | 1<br>1           | 2<br>1   |                 |          |

CAY CHAPEL

|                                                                                                                 | <u>DROP-OFF</u>  |        |                 |        | <u>FORE-REEF</u> |        |                 |        | <u>BACK-REEF</u> |        |                 |        |
|-----------------------------------------------------------------------------------------------------------------|------------------|--------|-----------------|--------|------------------|--------|-----------------|--------|------------------|--------|-----------------|--------|
|                                                                                                                 | No's on transect |        | Present in area |        | No's on transect |        | Present in area |        | No's on transect |        | Present in area |        |
|                                                                                                                 | Dive 1           | Dive 2 | Dive 1          | Dive 2 | Dive 1           | Dive 2 | Dive 1          | Dive 2 | Dive 1           | Dive 2 | Dive 1          | Dive 2 |
| <u>TRIGGERFISH</u>                                                                                              |                  |        |                 |        |                  |        |                 |        |                  |        |                 |        |
| Queen triggerfish                                                                                               | 1                | --     |                 |        | --               | --     |                 |        | --               | --     |                 |        |
| (Balistes vetula)                                                                                               | 1                | --     |                 |        | --               | --     |                 |        | --               | --     |                 |        |
| Gray triggerfish                                                                                                | --               | --     |                 |        | --               | --     |                 |        | --               | --     |                 |        |
| (Balistes capricus)                                                                                             | --               | --     |                 |        | --               | --     |                 |        | --               | --     |                 |        |
| Ocean triggerfish                                                                                               | --               | 1      |                 |        | --               | --     |                 |        | --               | --     |                 |        |
| (Canthidermis sufflamen)                                                                                        | --               | 1      |                 |        | --               | --     |                 |        | --               | --     |                 |        |
| Black Durgon                                                                                                    | 1                | 2      |                 |        | --               | --     |                 |        | --               | --     |                 |        |
| (Melichthys niger)                                                                                              | --               | 3      |                 |        | --               | --     |                 |        | --               | --     |                 |        |
| <u>PARROTFISH</u>                                                                                               |                  |        |                 |        |                  |        |                 |        |                  |        |                 |        |
| Because of the difficulty of accurate identification of parrotfish (Scarus) the figure given is for total no's. | 33               | 58     |                 |        | 21               | 19     |                 |        | 52               | 11     |                 |        |
|                                                                                                                 | 33               | 42     |                 |        | 33               | 18     |                 |        | 28               | 14     |                 |        |

SOUTH WATER CAY

|                                                                                                                 | <u>DROP-OFF</u>  |        |                 |        | <u>FORE-REEF</u> |        |                 |        | <u>BACK-REEF</u> |        |                 |        |
|-----------------------------------------------------------------------------------------------------------------|------------------|--------|-----------------|--------|------------------|--------|-----------------|--------|------------------|--------|-----------------|--------|
|                                                                                                                 | No's on transect |        | Present in area |        | No's on transect |        | Present in area |        | No's on transect |        | Present in area |        |
|                                                                                                                 | Dive 1           | Dive 2 | Dive 1          | Dive 2 | Dive 1           | Dive 2 | Dive 1          | Dive 2 | Dive 1           | Dive 2 | Dive 1          | Dive 2 |
| <u>TRIGGERFISH</u>                                                                                              |                  |        |                 |        |                  |        |                 |        |                  |        |                 |        |
| Queen triggerfish                                                                                               | 2                | --     |                 |        | 1                | 1      |                 |        | --               | --     |                 |        |
| (Balistes vetula)                                                                                               | 1                | --     |                 |        | 2                | 3      |                 |        | --               | --     |                 |        |
| Gray triggerfish                                                                                                | --               | --     |                 |        | --               | --     |                 |        | --               | --     |                 |        |
| (Balistes capriscus)                                                                                            | --               | --     |                 |        | --               | --     |                 |        | --               | --     |                 |        |
| Ocean triggerfish                                                                                               | --               | --     |                 |        | 1                | 1      |                 |        | --               | --     |                 |        |
| (Canthidermis sufflamen)                                                                                        | --               | 1      |                 |        | --               | 2      |                 |        | --               | --     |                 |        |
| Black Durgon                                                                                                    | --               | --     |                 |        | 13               | 10     |                 |        | --               | --     |                 |        |
| (Melichthys niger)                                                                                              | --               | --     |                 |        | 5                | 10     |                 |        | --               | --     |                 |        |
| <u>PARROTFISH</u>                                                                                               |                  |        |                 |        |                  |        |                 |        |                  |        |                 |        |
| Because of the difficulty of accurate identification of parrotfish (Scarus) the figure given is for total no's. | 76               | 84     |                 |        | 133              | 48     |                 |        | 153              | 98     |                 |        |
|                                                                                                                 | 87               | 88     |                 |        | 74               | 33     |                 |        | 179              | 124    |                 |        |

ST. GEORGE'S

|                                                                                                                 | <u>DROP-OFF</u>  |        |                 |        | <u>FORE-REEF</u> |        |                 |        | <u>BACK-REEF</u> |        |                 |        |
|-----------------------------------------------------------------------------------------------------------------|------------------|--------|-----------------|--------|------------------|--------|-----------------|--------|------------------|--------|-----------------|--------|
|                                                                                                                 | No's on transect |        | Present in area |        | No's on transect |        | Present in area |        | No's on transect |        | Present in area |        |
|                                                                                                                 | Dive 1           | Dive 2 | Dive 1          | Dive 2 | Dive 1           | Dive 2 | Dive 1          | Dive 2 | Dive 1           | Dive 2 | Dive 1          | Dive 2 |
| <u>TRIGGERFISH</u>                                                                                              |                  |        |                 |        |                  |        |                 |        |                  |        |                 |        |
| Queen triggerfish<br>(Balistes vetula)                                                                          | 1                | --     |                 |        | 5                | 1      |                 |        | --               | --     |                 |        |
| Gray triggerfish<br>(Balistes capriscus)                                                                        | --               | 1      |                 |        | 8                | 3      |                 |        | --               | --     |                 |        |
| Ocean triggerfish<br>(Canthidermis sufflamen)                                                                   | --               | --     |                 |        | --               | --     |                 |        | --               | --     |                 |        |
| Black Durgon<br>(Melichthys niger)                                                                              | --               | --     |                 |        | --               | --     |                 |        | --               | --     |                 |        |
| <u>PARROTFISH</u>                                                                                               |                  |        |                 |        |                  |        |                 |        |                  |        |                 |        |
| Because of the difficulty of accurate identification of parrotfish (Scarus) the figure given is for total no's. | 179              | 257    |                 |        | 55               | 63     |                 |        | 118              | 83     |                 |        |
|                                                                                                                 | 173              | 313    |                 |        | 74               | 56     |                 |        | 162              | 103    |                 |        |

CAY CHAPET

[illegible]



ST. GEORGE'S CAY

## GROUPERS

[illegible]

### Explanation of the Coral Survey Data

Each quadrat on each of the nine surveyed zones was drawn on 10 x 10 cm diagrams. The information on each of these was enumerated and the results are shown over. Firstly the substrate covers were evaluated and then the hard coral areas were given scores to show their cover and the sociability (ie groupings) of each coral species. This method was adapted for corals by G. Scheer (1975).

| Quadrat Number.       | 1                 | 2   | 3   | 4   | 5  | 6   | 7   | 8   | 9   | 10  |
|-----------------------|-------------------|-----|-----|-----|----|-----|-----|-----|-----|-----|
| <hr/>                 |                   |     |     |     |    |     |     |     |     |     |
| Substrates (%)        |                   |     |     |     |    |     |     |     |     |     |
| Sand                  |                   |     | 40  | 5   | 80 | 20  | 10  | 4   |     | 40  |
| Bare Rubble           | 50                | 70  |     | 2   |    | 20  |     |     |     |     |
| Algal Rubble          | 50                |     | 55  |     | 18 | 20  |     |     |     |     |
| Encrusted Rubble      |                   |     |     |     |    |     |     |     |     |     |
| Bare Rock             |                   |     |     |     |    |     |     |     |     |     |
| Algal Rock            |                   | 20  |     | 63  |    | 20  | 10  | 6   | 10  | 55  |
| <hr/>                 |                   |     |     |     |    |     |     |     |     |     |
| Species Present       | Cover Sociability |     |     |     |    |     |     |     |     |     |
| <hr/>                 |                   |     |     |     |    |     |     |     |     |     |
| Acr. cervicornis      |                   |     |     |     |    |     |     |     |     |     |
| Acr. palmata          |                   |     |     |     |    |     |     | 1.2 |     |     |
| Por. porites          |                   |     | 1.2 |     |    |     |     |     |     |     |
| Por. furcata          |                   |     |     |     |    |     |     |     |     |     |
| Por. astreoides       |                   |     |     |     |    |     |     |     |     | 1.2 |
| Mad. decactis         |                   |     |     |     |    |     |     |     |     |     |
| Mad. mirabilis        |                   |     |     |     |    |     |     |     |     |     |
| Mad. annularis        |                   | 2.2 | 2.2 | 3.4 | +1 | 2.2 | 5.4 | 5.5 | 5.5 | 1.1 |
| Sid. radians          |                   |     |     |     |    |     |     |     |     |     |
| Sid. siderea          |                   |     |     |     |    |     |     |     |     |     |
| Eus. fastigiata       |                   |     |     |     |    |     |     |     |     |     |
| Dich. stokesii        |                   |     |     |     |    |     |     |     |     |     |
| Fav. fragum           |                   |     |     |     |    |     |     |     |     |     |
| Mon. cavernosa        |                   |     |     |     |    |     |     |     |     |     |
| Sol. hyades           |                   |     |     |     |    |     |     |     |     |     |
| Ag. lamarcki          |                   |     |     |     |    |     |     |     |     |     |
| Hel. cuculata         |                   |     |     |     |    |     |     |     |     |     |
| Ag. agaricites        |                   |     |     |     |    |     |     |     |     |     |
| Ag. tenuifolia        |                   |     |     |     |    |     |     |     |     |     |
| Dip. labyrinthiformis |                   |     |     |     |    |     |     |     |     |     |
| Dip. strigosa         |                   |     |     |     |    |     |     |     |     |     |
| Dip. clivosa          |                   |     |     |     |    |     |     |     |     |     |
| Col. natans           |                   |     |     |     |    |     |     |     |     |     |
| Den. cylindrus        |                   |     |     |     |    |     |     |     |     |     |
| Mean meandrites       |                   |     |     |     |    |     |     |     |     |     |
| Myc. lamarckiana      |                   |     |     |     |    |     |     |     |     | +1  |
| Millepora sp.         |                   |     |     |     |    |     |     |     |     |     |

Table 1a: Basic data gathered from the quadrat survey on Cay Chapel Back Reef.

| Quadrat Number.       | 1                 | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  |
|-----------------------|-------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| <hr/>                 |                   |     |     |     |     |     |     |     |     |     |
| Substrates (%)        |                   |     |     |     |     |     |     |     |     |     |
| Sand                  |                   |     |     |     |     |     |     |     |     |     |
| Bare Rubble           |                   |     |     |     |     |     |     |     |     |     |
| Algal Rubble          |                   |     | 99  | 99  | 45  | 40  | 99  | 54  | 48  | 5   |
| Encrusted Rubble      |                   |     |     |     | 50  | 50  |     | 40  | 30  |     |
| Bare Rock             | 20                | 10  |     |     |     |     |     |     | 10  | 40  |
| Algal Rock            | 15                |     |     |     |     |     |     |     | 10  | 40  |
| <hr/>                 |                   |     |     |     |     |     |     |     |     |     |
| Species Present       | Cover Sociability |     |     |     |     |     |     |     |     |     |
| <hr/>                 |                   |     |     |     |     |     |     |     |     |     |
| Acr. cervicornis      |                   |     |     |     |     |     |     |     |     |     |
| Acr. palmata          |                   | 5.5 | r.1 | r.1 | +1  | 2.3 | r.1 | 2.3 | 1.1 |     |
| Por. porites          |                   |     |     |     |     |     |     |     |     |     |
| Por. furcata          |                   |     |     |     |     |     |     |     |     |     |
| Por. astreoides       |                   |     |     |     |     |     |     |     |     |     |
| Mad. decactis         |                   |     |     |     |     |     |     |     |     |     |
| Mad. mirabilis        |                   |     |     |     |     |     |     |     |     |     |
| Mad. annularis        | 4.5               |     |     |     |     |     |     |     |     |     |
| Sid. radians          |                   |     |     |     |     |     |     |     |     |     |
| Sid. siderea          |                   |     |     |     |     |     |     |     |     |     |
| Eus. fastigiata       |                   |     |     |     |     |     |     |     |     |     |
| Dich. stokesii        |                   |     |     |     |     |     |     |     |     |     |
| Fav. fragum           |                   |     |     |     |     |     |     |     |     |     |
| Mon. cavernosa        | 2.3               |     |     |     | 2.3 | 1.2 |     |     |     |     |
| Sol. hyades           |                   |     |     |     |     |     |     |     |     |     |
| Ag. lamarcki          |                   |     |     |     |     |     |     |     |     |     |
| Hel. cuculata         |                   |     |     |     |     |     |     |     |     |     |
| Ag. agaricites        |                   |     |     |     |     |     |     |     |     |     |
| Ag. tenuifolia        |                   |     |     |     |     |     |     |     |     | 2.3 |
| Dip. labyrinthiformis |                   |     |     |     |     |     |     |     |     |     |
| Dip. strigosa         |                   |     |     |     |     |     |     |     |     |     |
| Dip. clivosa          |                   |     |     |     |     |     |     |     |     |     |
| Col. natans           |                   |     |     |     |     |     |     |     |     |     |
| Den. cylindrus        |                   |     |     |     |     |     |     |     |     |     |
| Mean meandrites       |                   |     |     |     |     |     |     |     |     |     |
| Myc. lamarckiana      |                   |     |     |     | +1  |     |     |     |     |     |
| Millepora sp.         | 2.2               |     |     |     |     |     |     |     |     |     |

Table 1b: Basic data gathered from the quadrat survey on Cay Chapel Fore Reef.

| Quadrat Number.       | 1                 | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9    | 10  |
|-----------------------|-------------------|-----|-----|-----|-----|-----|-----|-----|------|-----|
| <hr/>                 |                   |     |     |     |     |     |     |     |      |     |
| Substrates (%)        |                   |     |     |     |     |     |     |     |      |     |
| Sand                  |                   |     |     |     |     |     |     |     |      |     |
| Bare Rubble           |                   |     |     |     | 48  | 20  | 7   | 20  | 40   | 20  |
| Algal Rubble          | 51                | 30  | 50  | 40  | 40  | 20  | 13  | 20  | 54   | 20  |
| Encrusted Rubble      |                   | 39  | 43  |     |     |     |     |     |      | 30  |
| Bare Rock             |                   |     |     |     |     |     |     |     |      |     |
| Algal Rock            | 40                |     |     | 43  |     | 20  |     | 20  |      |     |
| <hr/>                 |                   |     |     |     |     |     |     |     |      |     |
| Species Present       | Cover Sociability |     |     |     |     |     |     |     |      |     |
| <hr/>                 |                   |     |     |     |     |     |     |     |      |     |
| Acr. cervicornis      |                   |     | 1.2 |     |     |     | 2.4 | 3.3 |      |     |
| Acr. palmata          |                   |     |     |     |     |     |     |     |      |     |
| Por. porites          |                   |     |     |     |     | 1.2 |     |     |      |     |
| Por. furcata          |                   |     |     |     |     |     |     |     |      |     |
| Por. astreoides       |                   |     |     |     |     |     |     |     |      |     |
| Mad. decactis         |                   |     |     |     |     |     |     |     |      |     |
| Mad. mirabilis        |                   |     |     |     | 1.2 |     |     |     | 2.3  |     |
| Mad. annularis        |                   |     |     | 2.3 | 1.2 |     |     |     |      | 2.4 |
| Sid. radians          |                   |     |     |     |     |     |     |     |      |     |
| Sid. siderea          |                   |     |     |     |     |     |     |     |      |     |
| Eus. fastigiata       | 1.2               |     |     |     |     |     |     |     |      |     |
| Dich. stokesii        |                   |     |     |     |     |     |     |     |      |     |
| Fav. fragum           |                   |     |     |     |     |     |     |     |      |     |
| Mon. cavernosa        | 1.2               |     |     |     |     |     |     |     |      |     |
| Sol. hyades           |                   |     |     |     |     |     |     |     |      |     |
| Ag. lamarcki          |                   |     |     |     |     |     |     |     |      |     |
| Hel. cuculata         |                   |     | 1.2 |     |     |     |     |     |      |     |
| Ag. agaricites        | 1.2               |     |     |     |     |     |     |     |      |     |
| Ag. tenuifolia        |                   | 3.3 |     | 1.2 | 1.2 | 3.4 | 3.4 | 2.3 |      | 2.3 |
| Dip. labyrinthiformis |                   |     |     |     |     |     |     |     |      |     |
| Dip. strigosa         |                   |     |     |     |     |     |     |     |      |     |
| Dip. clivosa          |                   |     |     |     |     |     |     |     |      |     |
| Col. natans           |                   |     |     |     |     |     |     |     |      |     |
| Den. cylindrus        |                   |     |     |     |     |     |     |     |      |     |
| Mean meandrites       |                   |     |     |     |     |     |     |     | + .1 |     |
| Myc. lamarckiana      |                   |     |     |     |     |     |     |     |      |     |
| Millepora sp.         |                   |     |     |     |     |     |     |     |      |     |

Table 1c: Basic data gathered from the quadrat survey at Cay Chapel Dropoff.

| Quadrat Number.       | 1                 | 2   | 3  | 4   | 5   | 6   | 7  | 8   | 9   | 10  |
|-----------------------|-------------------|-----|----|-----|-----|-----|----|-----|-----|-----|
| <hr/>                 |                   |     |    |     |     |     |    |     |     |     |
| Substrates (%)        |                   |     |    |     |     |     |    |     |     |     |
| Sand                  |                   | 40  | 30 |     | 30  | 5   | 20 | 50  | 50  | 60  |
| Bare Rubble           |                   |     |    |     |     |     |    |     |     |     |
| Algal Rubble          | 48                | 20  | 37 | 18  |     | 80  | 20 | 49  | 48  | 10  |
| Encrusted Rubble      |                   | 20  |    | 40  | 50  | 13  | 20 |     |     |     |
| Bare Rock             |                   |     |    |     |     |     |    |     |     | 29  |
| Algal Rock            | 50                | 18  | 30 | 40  | 19  |     | 37 |     |     |     |
| <hr/>                 |                   |     |    |     |     |     |    |     |     |     |
| Species Present       | Cover Sociability |     |    |     |     |     |    |     |     |     |
| <hr/>                 |                   |     |    |     |     |     |    |     |     |     |
| Acr. cervicornis      |                   |     |    |     |     |     |    |     |     |     |
| Acr. palmata          |                   |     |    |     |     |     |    |     |     |     |
| Por. porites          | +2                | +2  |    | +2  | r.1 | r.1 | +1 | r.1 | +2  | r.1 |
| Por. furcata          |                   |     | +2 |     |     |     |    |     |     |     |
| Por. astreoides       |                   |     |    |     |     |     |    |     |     |     |
| Mad. decactis         |                   |     |    |     |     |     |    |     |     |     |
| Mad. mirabilis        |                   |     |    |     |     |     |    |     |     |     |
| Mad. annularis        | r.1               |     |    |     |     |     | +1 |     |     |     |
| Sid. radians          |                   |     |    |     |     |     |    |     |     |     |
| Sid. siderea          |                   |     |    |     |     |     |    |     |     |     |
| Eus. fastigiata       |                   |     |    |     |     |     |    |     |     |     |
| Dich. stokesii        |                   |     |    |     |     |     |    |     |     |     |
| Fav. fragum           |                   |     |    |     |     |     |    |     |     |     |
| Mon. cavernosa        |                   |     |    |     |     |     |    |     |     |     |
| Sol. hyades           |                   |     |    |     |     |     |    |     |     |     |
| Ag. lamarcki          |                   |     |    |     |     |     |    |     |     |     |
| Hel. cuculata         |                   |     |    |     |     |     |    |     |     |     |
| Ag. agaricites        |                   |     |    |     |     |     |    |     |     |     |
| Ag. tenuifolia        |                   |     |    |     |     |     |    |     |     |     |
| Dip. labyrinthiformis |                   |     |    | r.1 | r.1 |     |    |     |     |     |
| Dip. strigosa         |                   |     |    |     |     |     |    |     |     |     |
| Dip. clivosa          |                   |     |    |     |     |     |    |     |     |     |
| Col. natans           |                   |     |    |     |     |     |    |     |     |     |
| Den. cylindrus        |                   |     |    |     |     |     |    |     |     |     |
| Mean meandrites       |                   | r.1 |    |     |     |     |    |     |     |     |
| Myc. lamarckiana      |                   |     |    |     |     |     |    |     |     |     |
| Millepora sp.         |                   |     | +2 |     |     | 1.2 | +1 |     | 1.1 |     |

Table 2a: Basic data gathered from the quadrat survey at St Georges Cay Back Reef.

| Quadrat Number.       | 1                 | 2    | 3   | 4    | 5    | 6    | 7   | 8    | 9   | 10   |
|-----------------------|-------------------|------|-----|------|------|------|-----|------|-----|------|
| <hr/>                 |                   |      |     |      |      |      |     |      |     |      |
| Substrates (%)        |                   |      |     |      |      |      |     |      |     |      |
| Sand                  |                   |      |     | 25   |      |      | 5   |      |     |      |
| Bare Rubble           |                   |      |     |      |      |      |     |      |     |      |
| Algal Rubble          | 49                | 49   | 70  |      | 30   | 54   | 37  | 25   | 50  | 99   |
| Encrusted Rubble      |                   |      |     |      |      | 40   | 30  |      |     |      |
| Bare Rock             |                   |      | 9   | 10   |      |      | 25  | 25   |     |      |
| Algal Rock            | 50                | 49   | 20  | 60   | 68   | 5    |     | 48   | 49  |      |
| <hr/>                 |                   |      |     |      |      |      |     |      |     |      |
| Species Present       | Cover Sociability |      |     |      |      |      |     |      |     |      |
| <hr/>                 |                   |      |     |      |      |      |     |      |     |      |
| Acr. cervicornis      |                   |      |     |      |      |      |     |      |     |      |
| Acr. palmata          |                   |      |     |      |      |      |     |      |     |      |
| Por. porites          |                   |      |     |      |      |      |     |      |     |      |
| Por. furcata          |                   |      |     |      |      |      |     |      |     |      |
| Por. astreoides       |                   | r.1  |     |      |      | + .1 |     |      |     |      |
| Mad. decactis         |                   |      |     |      |      |      |     |      |     |      |
| Mad. mirabilis        |                   |      |     |      |      |      |     |      |     |      |
| Mad. annularis        |                   |      |     |      |      |      |     |      |     |      |
| Sid. radians          |                   |      |     |      |      |      |     |      |     |      |
| Sid. siderea          |                   | r.1  |     | + .1 |      |      |     |      |     |      |
| Eus. fastigiata       |                   |      |     |      |      |      |     |      |     |      |
| Dich. stokesii        |                   |      |     |      |      |      |     |      |     |      |
| Fav. fragum           |                   | r.1  |     |      |      | r.1  | r.1 | r.1  |     | + .2 |
| Mon. cavernosa        |                   |      |     |      |      |      |     |      |     |      |
| Sol. hyades           |                   |      |     |      |      |      |     |      |     |      |
| Ag. lamarcki          |                   |      |     |      |      |      |     |      |     |      |
| Hel. cuculata         |                   |      |     |      |      |      |     |      |     |      |
| Ag. agaricites        |                   |      |     |      |      |      |     |      |     |      |
| Ag. tenuifolia        |                   |      |     |      |      |      |     |      |     |      |
| Dip. labyrinthiformis |                   | + .1 |     | + .2 |      |      | 1.2 |      | r.1 | + .2 |
| Dip. strigosa         |                   |      |     |      |      |      |     |      |     |      |
| Dip. clivosa          |                   |      |     |      |      |      |     |      |     |      |
| Col. natans           |                   |      |     |      |      |      |     |      |     |      |
| Den. cylindrus        |                   |      |     | + .1 |      |      |     |      |     |      |
| Mean meandrites       | r.1               |      |     |      | + .1 | + .1 |     |      |     |      |
| Myc. lamarckiana      |                   |      |     |      |      |      |     |      |     |      |
| Millepora sp.         | r.1               |      | r.1 |      |      | + .1 |     | + .1 |     | r.1  |

Table 2b: Basic data gathered from the quadrat survey at St Georges Cay Fore Reef.

| Quadrat Number.       | 1                 | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  |
|-----------------------|-------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| <hr/>                 |                   |     |     |     |     |     |     |     |     |     |
| Substrates (%)        |                   |     |     |     |     |     |     |     |     |     |
| Sand                  | 60                |     |     | 10  | 60  |     |     |     |     |     |
| Bare Rubble           |                   | 90  | 85  | 40  |     | 45  |     | 50  | 50  | 90  |
| Algal Rubble          |                   |     |     |     |     |     |     |     |     |     |
| Encrusted Rubble      |                   |     |     |     |     |     |     |     |     |     |
| Bare Rock             | 40                |     |     | 40  | 35  |     | 90  | 45  | 40  |     |
| Algal Rock            |                   |     |     |     |     | 45  |     |     |     |     |
| <hr/>                 |                   |     |     |     |     |     |     |     |     |     |
| Species Present       | Cover Sociability |     |     |     |     |     |     |     |     |     |
| <hr/>                 |                   |     |     |     |     |     |     |     |     |     |
| Acr. cervicornis      |                   |     |     |     | r.1 |     |     |     |     |     |
| Acr. palmata          |                   |     |     |     |     |     |     |     |     |     |
| Por. porites          |                   |     |     |     |     |     |     |     | r.1 |     |
| Por. furcata          |                   |     |     |     |     |     |     |     |     |     |
| Por. astreoides       |                   | 1.2 |     |     | 1.2 | 1.1 |     |     | r.1 | +1  |
| Mad. decactis         |                   |     |     |     |     |     |     |     |     |     |
| Mad. mirabilis        |                   |     |     |     |     |     |     |     | r.1 |     |
| Mad. annularis        |                   |     | +1  |     |     |     |     | 1.2 | +2  | +1  |
| Sid. radians          |                   |     |     |     |     |     |     |     |     | r.1 |
| Sid. siderea          |                   | r.1 | +2  |     | r.1 | 2.2 | 2.3 |     |     |     |
| Eus. fastigiata       |                   |     |     | r.1 |     |     |     |     |     |     |
| Dich. stokesii        |                   |     | r.1 | 1.1 | r.1 |     |     |     |     |     |
| Fav. fragum           |                   |     | +1  |     |     |     |     | r.1 | r.1 |     |
| Mon. cavernosa        |                   | r.1 |     |     |     |     | r.1 |     |     |     |
| Sol. hyades           |                   |     |     |     |     |     |     |     |     |     |
| Ag. lamarcki          |                   |     |     |     |     |     |     |     | r.1 | r.1 |
| Hel. cuculata         |                   |     |     |     |     |     |     |     |     |     |
| Ag. agaricites        |                   | 1.2 |     |     |     | 1.1 | +1  |     |     |     |
| Ag. tenuifolia        |                   |     | 2.3 |     |     |     |     | +1  | 2.3 |     |
| Dip.labyrinthisformis |                   |     |     |     |     |     | r.1 |     |     |     |
| Dip. strigosa         |                   |     |     |     |     | +1  |     |     |     |     |
| Dip. clivosa          |                   |     |     |     |     |     |     |     |     |     |
| Col. natans           |                   |     |     |     |     |     |     |     |     |     |
| Den. cylindrus        |                   |     |     |     |     |     |     |     |     |     |
| Mean meandrites       | r.1               |     | 1.2 | r.1 |     | r.1 |     | 1.2 | r.1 | r.1 |
| Myc. lamarckiana      |                   |     |     |     |     | r.1 |     |     |     |     |
| Millepora sp.         |                   |     |     |     |     |     |     |     |     |     |

Table 2c: Basic data gathered from the quadrat survey on St Georges Cay Dropoff.

| Quadrat Number.       | 1                 | 2   | 3   | 4    | 5    | 6   | 7    | 8   | 9   | 10  |
|-----------------------|-------------------|-----|-----|------|------|-----|------|-----|-----|-----|
| Substrates (%)        |                   |     |     |      |      |     |      |     |     |     |
| Sand                  | 50                | 40  | 45  | 60   | 55   | 60  | 30   | 60  | 60  | 50  |
| Bare Rubble           |                   |     |     |      |      |     |      |     |     |     |
| Algal Rubble          | 35                | 37  | 37  | 38   | 38   | 34  | 34   | 35  | 32  | 35  |
| Encrusted Rubble      |                   |     |     |      | 5    |     | 10   |     |     |     |
| Bare Rock             | 10                | 10  | 5   |      |      |     | 10   |     |     |     |
| Algal Rock            |                   | 10  | 10  |      |      |     | 10   |     |     | 10  |
| Species Present       | Cover Sociability |     |     |      |      |     |      |     |     |     |
| Acr. cervicornis      |                   |     |     |      |      |     |      |     |     |     |
| Acr. palmata          |                   |     |     |      |      |     |      |     |     |     |
| Por. porites          | 1.1               |     | 1.1 | 1.2  | + .2 |     | + .1 |     | 1.2 | r.1 |
| Por. furcata          |                   | 1.1 |     |      |      |     |      |     |     |     |
| Por. astreoides       | 1.1               | 1.1 | 1.1 |      | + .1 | 1.2 | 2.3  | 1.2 | 1.3 | 1.3 |
| Mad. decactis         |                   |     |     |      |      | 1.2 |      |     | 1.2 | 2.3 |
| Mad. mirabilis        |                   |     |     |      |      |     |      |     |     |     |
| Mad. annularis        |                   |     |     |      |      |     |      |     |     |     |
| Sid. radians          |                   |     |     |      |      |     |      |     |     |     |
| Sid. siderea          |                   |     |     |      |      |     |      |     |     |     |
| Eus. fastigiata       |                   |     |     |      |      |     |      |     | 1.2 |     |
| Dich. stokesii        |                   |     |     |      |      |     |      |     |     |     |
| Fav. fragum           | r.1               |     |     | + .1 |      | r.1 |      |     |     | r.1 |
| Mon. cavernosa        |                   |     |     |      |      |     |      |     |     |     |
| Sol. hyades           |                   |     |     |      |      |     |      |     |     |     |
| Ag. lamarcki          |                   |     |     |      |      |     |      |     |     |     |
| Hel. cuculata         |                   |     |     |      |      |     |      |     |     |     |
| Ag. agaricites        |                   |     |     |      |      |     |      |     |     |     |
| Ag. tenuifolia        |                   |     |     |      |      |     |      |     |     |     |
| Dip. labyrinthiformis |                   |     |     |      |      |     |      |     |     |     |
| Dip. strigosa         |                   |     |     |      |      |     |      |     |     |     |
| Dip. clivosa          |                   |     |     |      |      |     |      |     |     |     |
| Col. natans           |                   |     |     |      |      |     |      |     |     |     |
| Den. cylindrus        |                   |     |     |      |      |     |      |     |     |     |
| Mean meandrites       |                   |     |     |      |      |     |      |     |     |     |
| Myc. lamarckiana      |                   |     |     |      |      |     |      |     |     |     |
| Millepora sp.         |                   |     |     |      |      |     |      |     |     |     |

Table 3a: Basic data gathered from the quadrat survey on South Water Cay Back Reef.

| Quadrat Number.       | 1                 | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  |
|-----------------------|-------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| <hr/>                 |                   |     |     |     |     |     |     |     |     |     |
| Substrates (%)        |                   |     |     |     |     |     |     |     |     |     |
| Sand                  |                   |     |     |     | 35  | 50  |     |     |     |     |
| Bare Rubble           |                   |     |     |     |     |     |     |     |     |     |
| Algal Rubble          | 35                |     | 40  | 20  |     | 49  | 70  | 40  |     | 35  |
| Encrusted Rubble      | 20                |     |     |     |     |     |     | 40  |     |     |
| Bare Rock             | 30                | 15  |     | 20  | 40  |     |     | 17  | 40  | 40  |
| Algal Rock            |                   |     | 30  |     |     |     | 15  |     |     |     |
| <hr/>                 |                   |     |     |     |     |     |     |     |     |     |
| Species Present       | Cover Sociability |     |     |     |     |     |     |     |     |     |
| <hr/>                 |                   |     |     |     |     |     |     |     |     |     |
| Acr. cervicornis      |                   |     | +2  |     |     |     |     | r.1 |     |     |
| Acr. palmata          | r.1               | 5.5 | +2  |     | 2.3 |     | 2.3 |     | 4.5 | 2.3 |
| Por. porites          | r.1               |     | 1.2 |     | 3.5 |     | +2  | +2  |     |     |
| Por. furcata          |                   |     |     |     |     |     |     |     |     |     |
| Por. astreoides       |                   |     | 2.3 |     |     |     |     | 1.2 |     |     |
| Mad. decactis         |                   |     |     |     |     |     |     |     |     |     |
| Mad. mirabilis        |                   |     |     |     |     |     |     |     |     |     |
| Mad. annularis        |                   |     |     |     |     |     |     |     |     |     |
| Sid. radians          |                   |     |     |     |     |     |     |     |     |     |
| Sid. siderea          | 1.1               |     | +1  |     |     |     |     |     |     |     |
| Eus. fastigiata       |                   |     |     |     |     |     |     |     |     |     |
| Dich. stokesii        | 1.1               |     |     |     |     |     |     |     |     |     |
| Fav. fragum           |                   | r.1 |     |     |     |     |     | r.1 |     |     |
| Mon. cavernosa        |                   |     |     |     |     |     |     |     |     |     |
| Sol. hyades           |                   |     |     |     |     |     |     |     |     |     |
| Ag. lamarcki          |                   |     |     |     |     |     |     |     |     |     |
| Hel. cuculata         |                   |     |     |     |     |     |     |     |     |     |
| Ag. agaricites        | r.1               |     |     |     |     |     |     |     |     |     |
| Ag. tenuifolia        | 1.3               |     |     | 1.3 |     |     |     |     |     | 1.2 |
| Dip. labyrinthiformis |                   |     | 2.3 |     |     |     |     |     |     |     |
| Dip. strigosa         |                   |     |     |     |     |     |     |     |     |     |
| Dip. clivosa          |                   | +2  | 1.2 |     |     | 1.2 |     |     |     |     |
| Col. natans           |                   |     |     |     |     |     |     |     |     |     |
| Den. cylindrus        |                   |     |     | 3.5 |     |     |     |     |     |     |
| Mean meandrites       |                   |     |     |     |     |     |     |     |     |     |
| Myc. lamarckiana      |                   |     |     |     |     |     |     |     |     |     |
| Millepora sp.         |                   |     |     |     |     |     |     |     |     |     |

Table 3b: Basic data gathered from the quadrat-survey on South Water Cay  
Fore Reef.

| Quadrat Number.       | 1                 | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  |
|-----------------------|-------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| <hr/>                 |                   |     |     |     |     |     |     |     |     |     |
| Substrates (%)        |                   |     |     |     |     |     |     |     |     |     |
| Sand                  |                   |     |     |     | 40  |     |     |     | 75  |     |
| Bare Rubble           | 10                |     |     |     |     | 10  |     |     |     | 15  |
| Algal Rubble          | 60                | 60  | 50  | 45  | 45  | 50  | 60  | 15  |     | 50  |
| Encrusted Rubble      | 10                | 10  |     | 40  |     | 15  |     |     |     | 20  |
| Bare Rock             |                   |     | 5   |     |     |     |     |     |     |     |
| Algal Rock            | 10                | 20  | 25  |     |     |     |     | 60  | 5   |     |
| <hr/>                 |                   |     |     |     |     |     |     |     |     |     |
| Species Present       | Cover Sociability |     |     |     |     |     |     |     |     |     |
| <hr/>                 |                   |     |     |     |     |     |     |     |     |     |
| Acr. cervicornis      |                   |     | r.1 |     |     |     |     |     |     |     |
| Acr. palmata          |                   |     |     |     |     |     | +1  |     |     |     |
| Por. porites          |                   |     | 2.3 | 1.2 | 1.1 |     |     | r.1 | 1.1 |     |
| Por. furcata          |                   |     |     |     |     |     |     |     |     |     |
| Por. astreoides       |                   |     |     |     |     |     |     |     |     |     |
| Mad. decactis         |                   |     |     |     |     |     |     |     |     |     |
| Mad. mirabilis        |                   |     |     |     |     |     |     |     |     |     |
| Mad. annularis        |                   | 1.2 | +1  |     |     |     | 2.2 |     |     | 1.2 |
| Sid. radians          |                   |     |     |     |     | 1.1 |     |     |     |     |
| Sid. siderea          | 2.3               |     |     |     | 2.2 | +1  |     |     | 1.2 |     |
| Eus. fastigiata       |                   |     |     |     |     |     |     |     |     |     |
| Dich. stokesii        | 1.2               | r.1 |     |     |     | 2.4 |     |     |     |     |
| Fav. fragum           |                   |     |     |     |     |     |     |     |     |     |
| Mon. cavernosa        | +2                | 1.1 |     |     | 1.1 | +1  |     |     | +1  | 1.1 |
| Sol. hyades           |                   |     |     |     | 2.3 |     |     |     |     |     |
| Ag. lamarcki          |                   |     |     |     |     |     |     |     |     |     |
| Hel. cuculata         |                   |     |     |     |     |     |     |     |     |     |
| Ag. agaricites        |                   |     |     |     | +1  | 2.3 |     |     |     |     |
| Ag. tenuifolia        | r.1               | r.1 | 2.4 | 2.3 |     |     | 1.2 |     |     |     |
| Dip. labyrinthiformis | 1.2               |     |     |     |     |     |     |     |     |     |
| Dip. strigosa         |                   |     |     |     |     |     |     | 3.4 |     |     |
| Dip. clivosa          |                   |     |     |     |     |     |     |     |     |     |
| Col. natans           |                   | 1.2 |     |     |     |     |     |     |     |     |
| Den. cylindrus        |                   |     |     |     |     |     |     |     |     |     |
| Mean meandrites       | +1                | r.1 | +1  |     |     | 1.2 | 3.4 | 1.3 | 2.3 | 2.3 |
| Myc. lamarckiana      |                   |     |     |     |     |     |     |     |     |     |
| Millepora sp.         |                   |     |     |     |     |     |     |     |     | 1.1 |

Table 3c: Basic data gathered from the quadrat survey on South Water Cay Dropoff.

PLANS AND PROFILES  
OF THE  
SURVEYED SITES

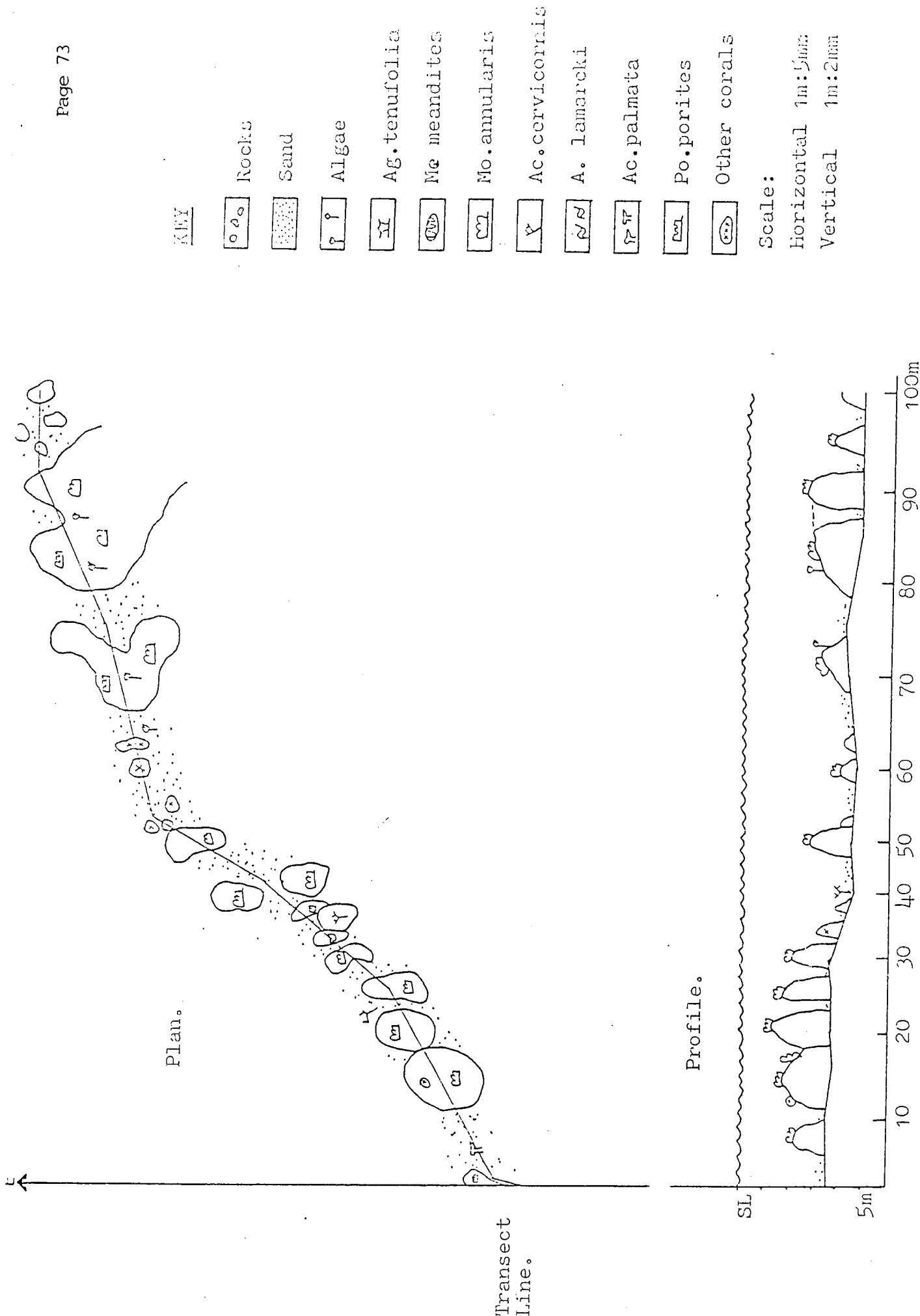


Figure 4a : Plan, profile and simple substrate map of the sample zone at Cay Chapel Back Reef.

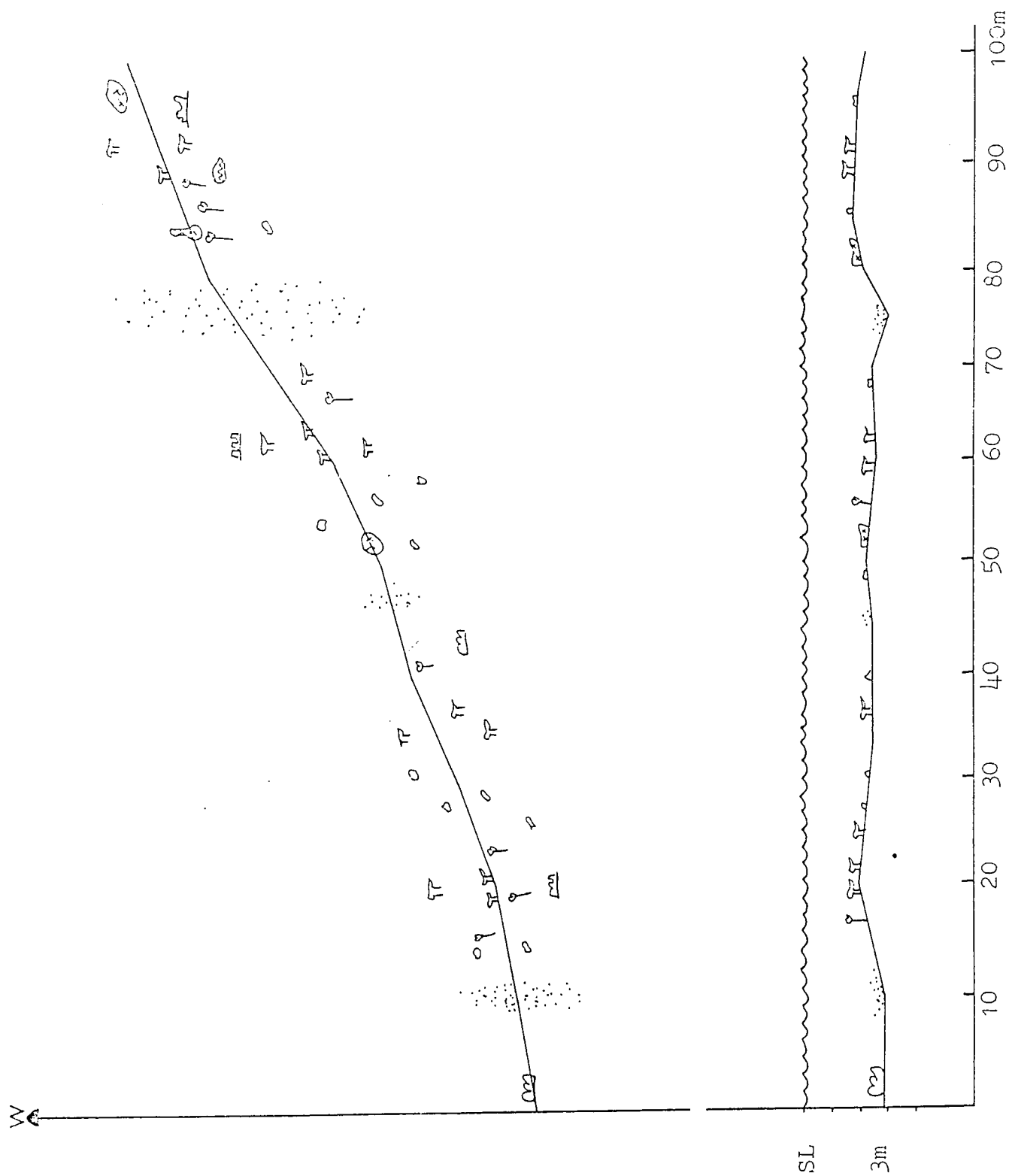


Figure 4b : Plan, profile and simple map of the sample zone at Cay Chapel Fore Reef.



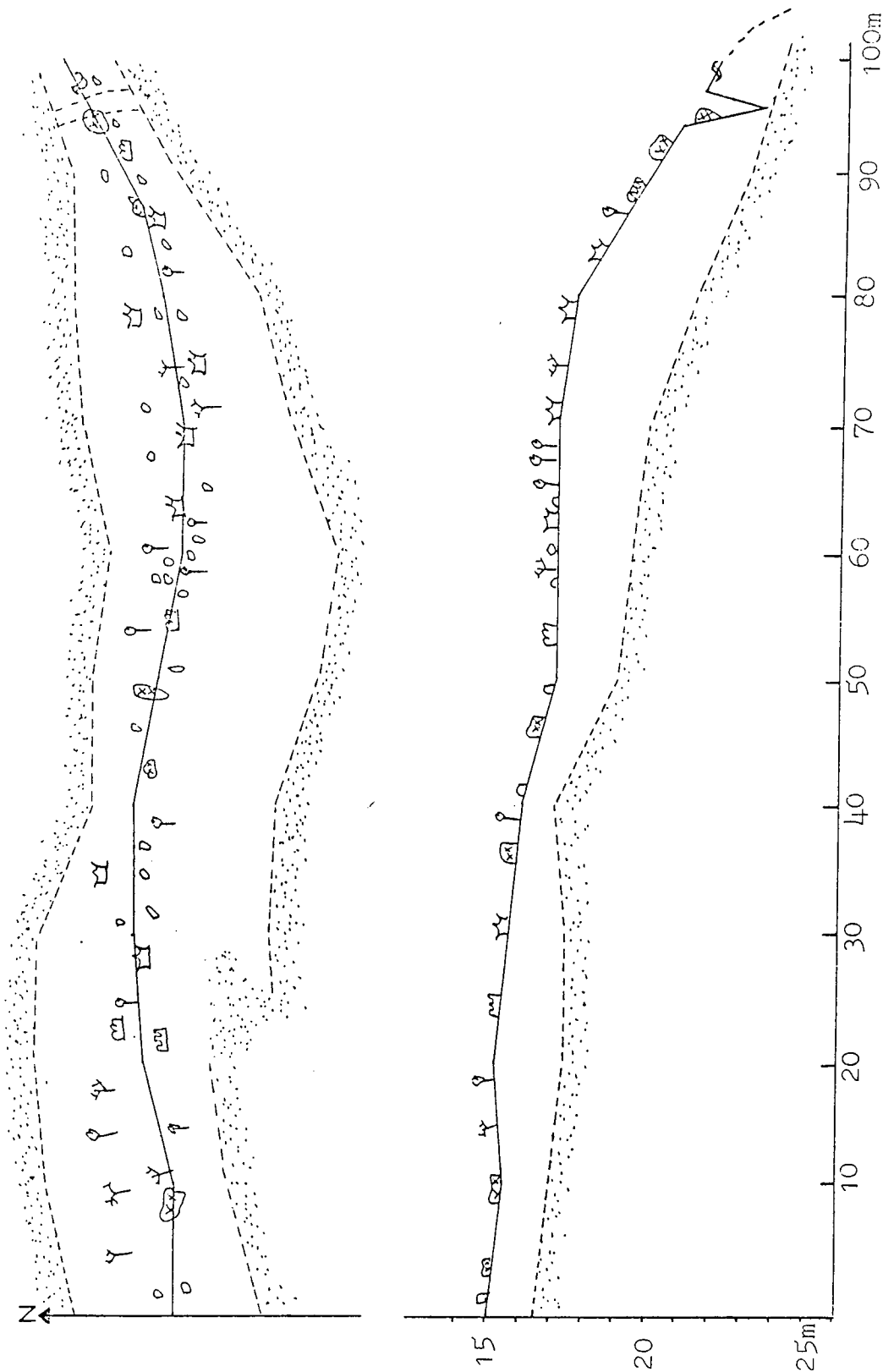


Figure 4c : Plan, profile and simple substrate map of the sample zone at Cay Chapel Dropoff.

Margins of the ridge with the sand gullies.

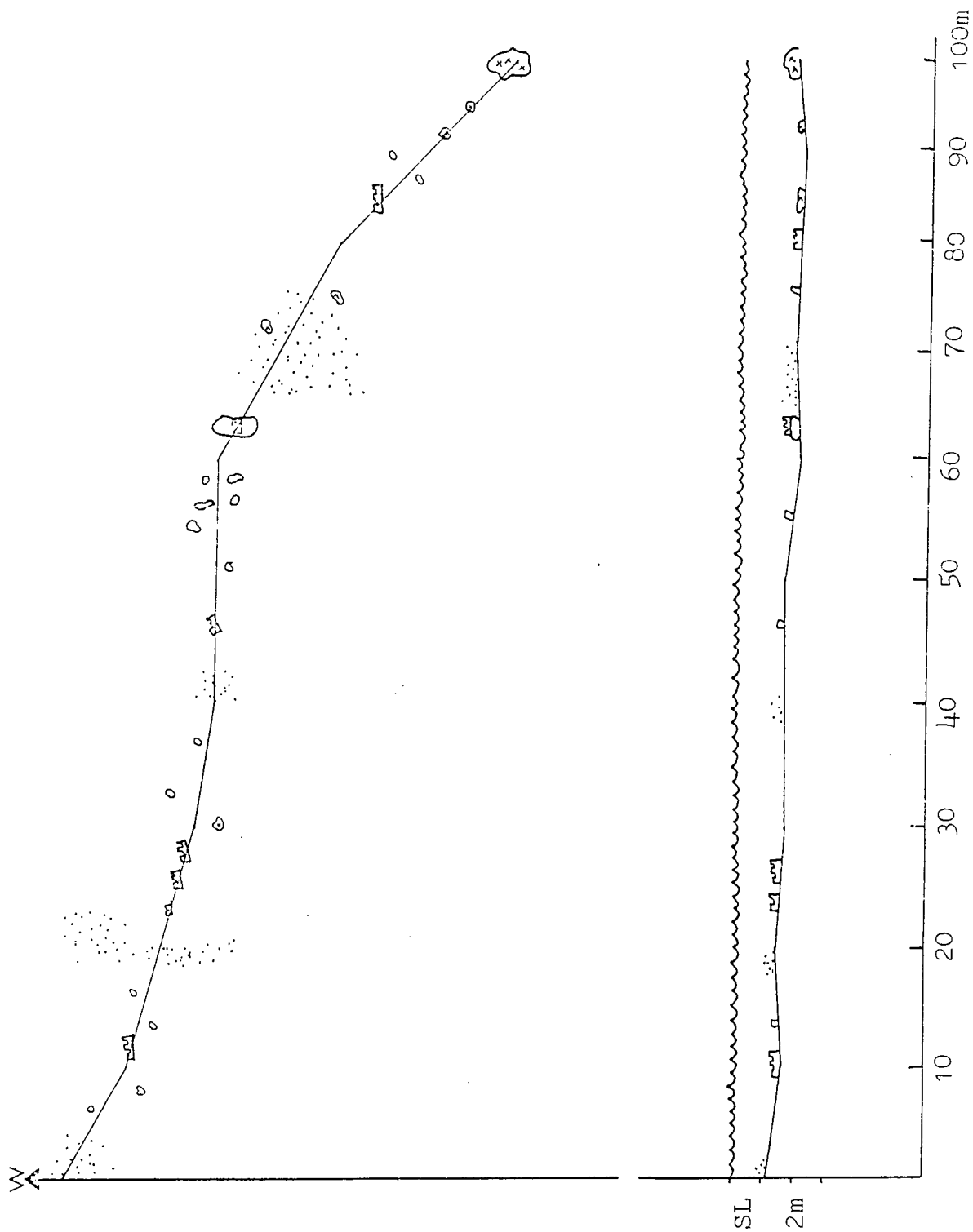


Figure 5a: Plan, profile and simple substrate map of the sample zone at St Georges Cay Back Reef.

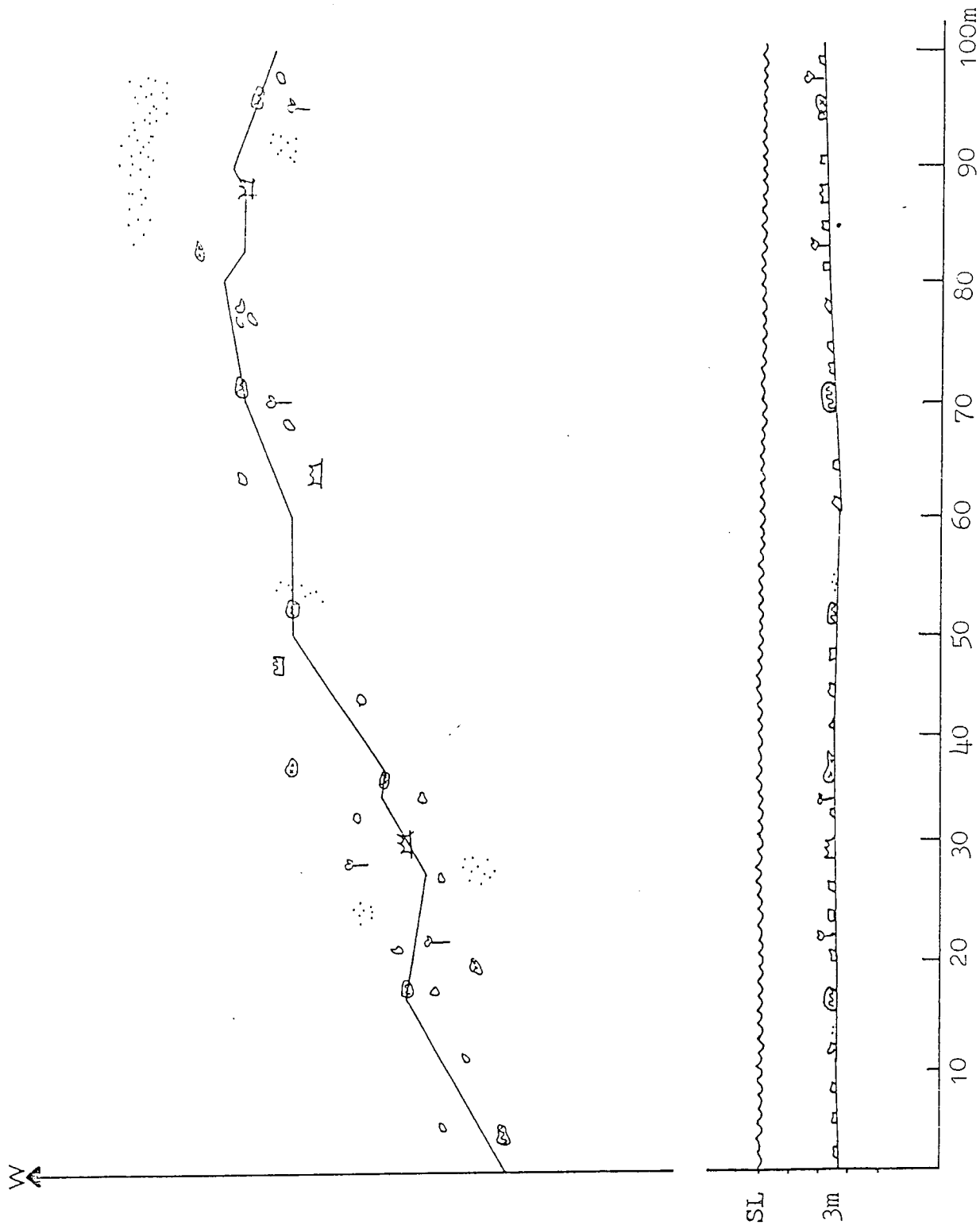


Figure 5b : Plan, profile and simple substrate map of the sample zone at St Georges Cay Fore Reef,

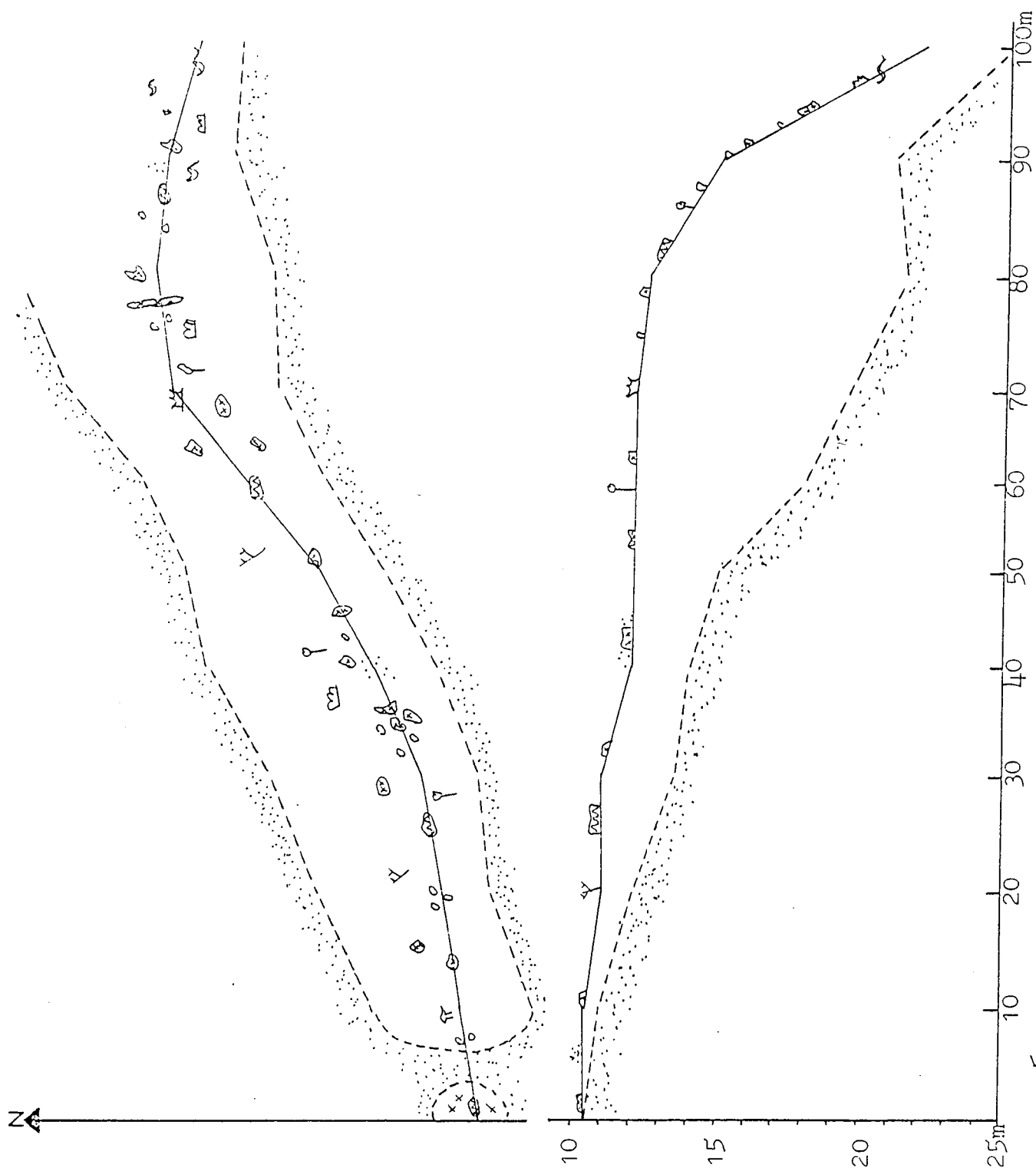


Figure 5c : Plan, profile and simple map of the sample zone at St Georges Cay Dropoff.

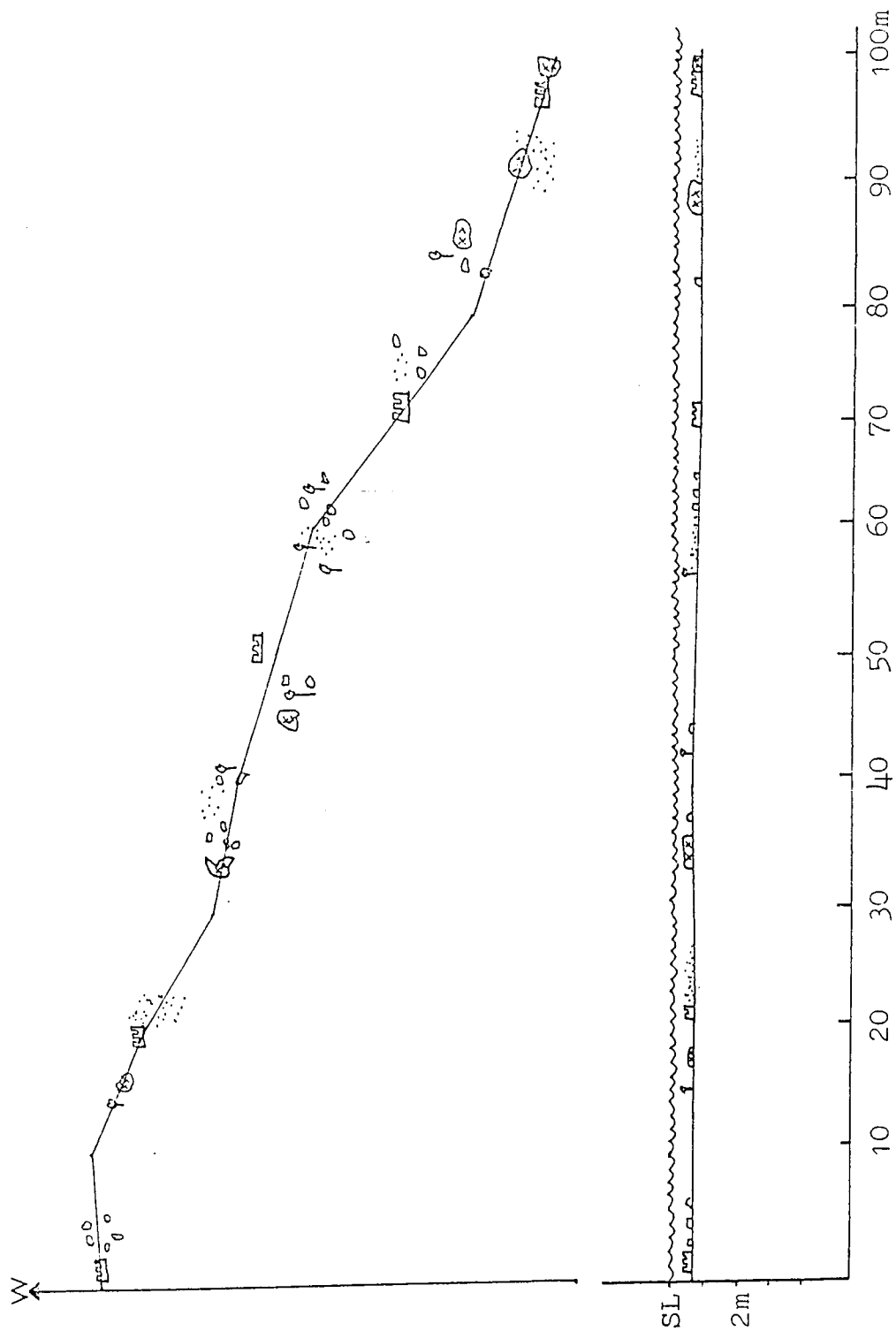


Figure 6a : Plan, profile and simple substrate map of the sample zone at South Water Cay Back Reef.

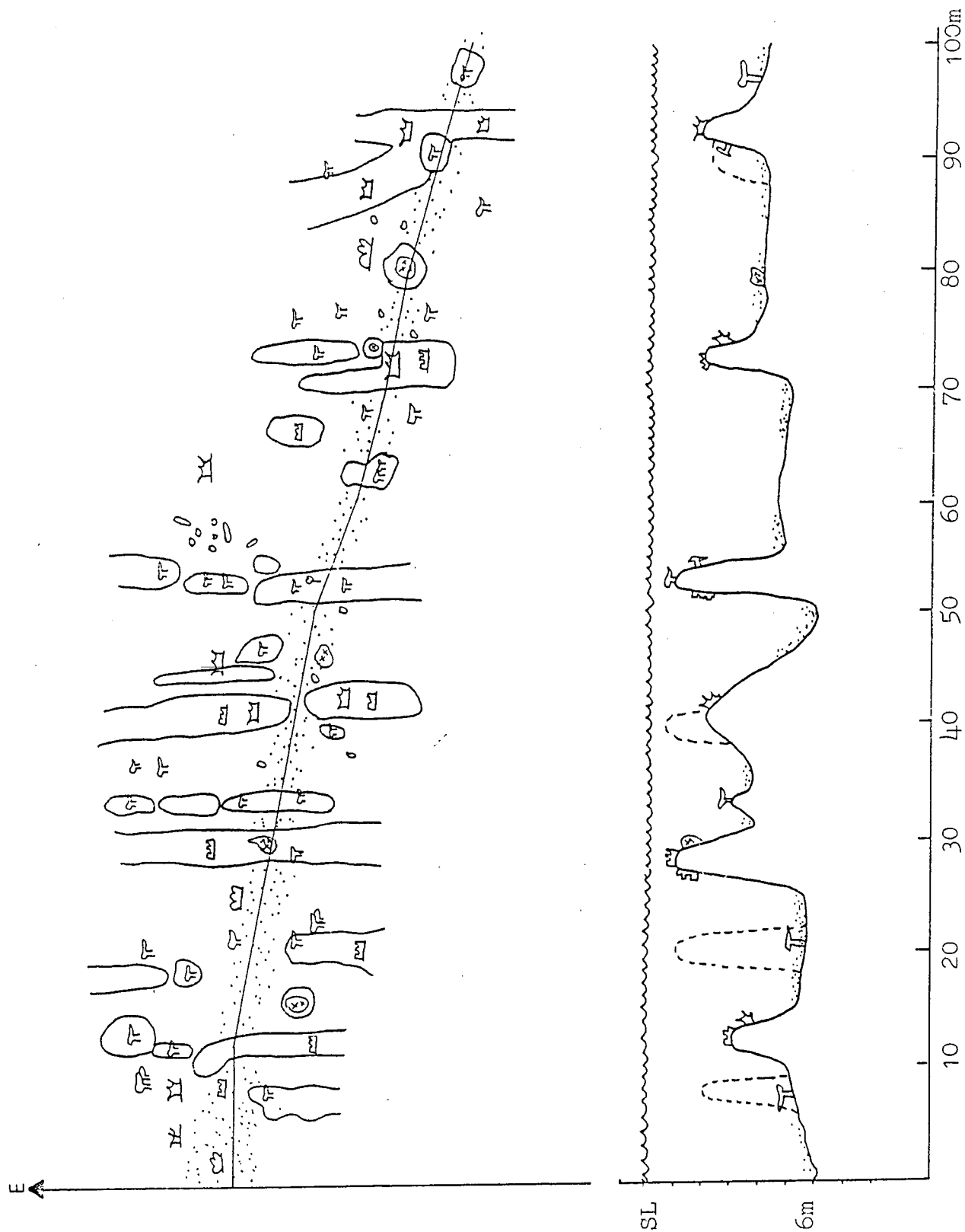


Figure 6b : Plan, profile and simple substrate map of the sample zone at South Water Cay Fore Reef.

