

CCC-REL-25

CORAL CAY CONSERVATION

FIELDWORK REPORT 1990

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INDEX

- 1 SUMMARY
- 2 THE CORAL CAY CONSERVATION PROGRAMME 1990
 - 2.1 Introduction
 - 2.2 The 1990 Expedition
 - 2.3 Collaboration and Education
 - 2.4 List of Expedition Members
- 3 METHODS
 - 3.1 Site Positioning
 - 3.2 Survey Technique
- 4 RESULTS
 - 4.1 Introduction
 - 4.2 Site 1
 - 4.21 Site Location
 - 4.22 General Description
 - 4.23 Impacts
 - 4.3 Site 2
 - 4.21 Site Location
 - 4.22 General Description
 - 4.23 Impacts
 - 4.4 Site 3
 - 4.31 Site Location
 - 4.32 General Description
 - 4.33 Impacts
 - 4.34 Species List
 - 4.5 Site 4
 - 4.41 Site Location
 - 4.42 General Description
 - 4.43 Impacts
 - 4.44 Species List
 - 4.6 South Water Cay
- 5 COMMENTS
- 6 APPENDICES
 - 1 List of Sponsors
 - 2 Survey site bearings

LIST OF FIGURES

Figure 1	Map of barrier reef showing the survey site
Figure 2	A physical recording form
Figure 3	A biological recording form
Figure 4	Map showing the four survey sites
Figure 5	Map showing the location of Site 1
Figure 6	The seagrass bed, Site 1
Figure 7	Map Showing the location of Site 2
Figure 8-11	Transects of Site 1 showing bathymetric profile and kite diagrams of bottom cover
Figure 12	The outer fore reef, Site 2
Figure 13	Coral damage on the Drop off, site 2
Figure 14	Map Showing the location of Site 3
Figure 15-18	Transects of Site 3 showing bathymetric profile and kite diagrams of bottom cover
Figure 19	Queen conch in the seagrass bed, Site 3
Figure 20	Map showing the loacation of Site 4
Figure 21-24	Transects of Site 4 showing bathymetric profile and kite diagrams of bottom cover
Figure 25	A sting ray in the cut between South Water Cay and Carrie Bow Cay
Figure 26	The drop-off at Site 4
Figure 27	A patch reef on Site 4
Figure 28	A map of South Water Cay

1 - SUMMARY

During 1990 Coral Cay Conservation (CCC) continued its work helping Governmental and Non-Governmental Organisations in Belize by gathering the baseline data on marine resources necessary to effectively manage and conserve the Great Atlantic Barrier Reef. During the months of October, November and December 1990, 42 CCC volunteers surveyed sites around Twin Cays, South Water Cay, Carrie Bow Cay and Curlew Cay. Survey dives were carried out on four main sites. The sites are described and data is presented for each, to include transects of the area, species lists and data on human impact. During the course of the expedition three Belizean biologists from the Belize Centre for Environmental Studies, were trained to diver and biologists from Hol Chan Marine Reserve and the Department of Agriculture and Fisheries were taught the marine survey techniques used by CCC.

2 - THE CORAL CAY CONSERVATION PROGRAMME 1990

2.1 Introduction

The Coral Cay Conservation expeditions began in 1986 when a small research team from Britain visited Belize to assess the impacts of tourism and the fishing industry on the ecological balance of reefs and lagoons along the Belize barrier reef. Repeat surveys by a similar sized expedition were made at the same locations in 1987. In 1989, Coral Cay Conservation - Belize '89, a joint British Universities expedition of 38 members, carried out extensive survey work in the area.

The primary aim of Coral Cay Conservation is to gather the necessary baseline data required by the Government and Non-Governmental Organisations in Belize as a prelude to the development of a management plan for the sustainable use of marine resources in the area. South Water Cay is the proposed site for Belize's second marine protected area.

2.2 The 1990 Expedition

Between October and December 1990 CCC mounted an expedition of 42 members to continue baseline surveys of areas surrounding South Water Cay. All expedition members financed themselves or sought sponsorship from industry. Sponsorship in terms of money and equipment was given by a number of organisations, to which CCC remains grateful. A full list of sponsors appears in Appendix 1.

The research programme undertaken by the expedition was formulated after consultation with the appropriate government and non-government organisations in Belize; the ministry of Agriculture and Fisheries, the Belize Audubon Society and the Belize Centre for Environmental Studies. The research programme was also endorsed by the following organisations

The Royal Geographical Society
The Universities of London, Wales and St Andrews
The Marine Conservation Society

The expedition was fully equipped with inflatable boats, dive compressors, generators as well as an extensive mobile laboratory and library. The survey work was directed by qualified marine biologists and extensive training was given to all survey participants before each stage of work.

The results presented here form part of an ongoing research programme currently being undertaken by Coral Cay Conservation to provide data for the Coastal Zone Management Plan for Belize.

2.3 Collaboration and Education

During the course of the 1990 expedition CCC carried worked closely with Governmental and Non-Governmental Organisations in Belize.

Earl Young a biologist from the Belize Department of Agriculture and Fisheries joined the Programme for ten days to contribute his local knowledge and learn the CCC survey techniques.

Melanie Dotherow a biologist from the Hol Chan Marine Reserve visited the island for two weeks, took part in CCC survey work and learned the techniques used.

Suzzette Miller a biologist from the Belize Centre for Environmental Studies, joined the expedition and was taught to dive by Coral Cay instructors.

Matt Miller a biologist from the Belize Centre for Environmental Studies, joined the expedition and was taught to dive by Coral Cay instructors.

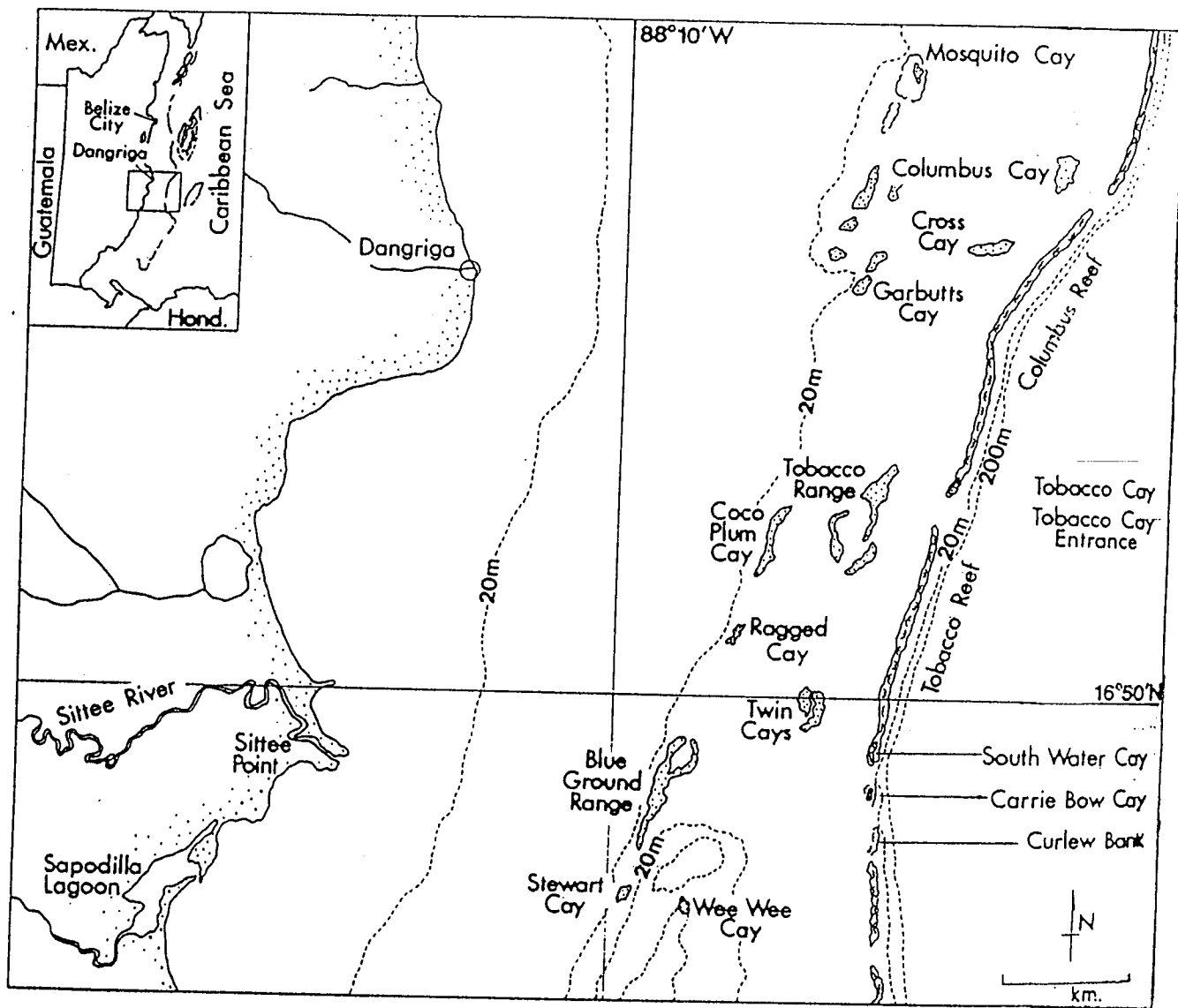
Evan Cayatano a biologist from the Belize Centre for Environmental Studies, joined the expedition and was taught to dive by Coral Cay instructors, he gained his PADI Open Water diving certificate while with CCC.

Donations - at the end of the expedition, CCC donated photographic equipment to the Belize Centre for Environmental Studies.

CCC organised through **ALDUS UK** the donation of Pagemaker desktop publishing software to the Janet Gibson and the Hol Chan Marine Reserve.

2.4 Expedition Members

ALLAN, JACKY
ALLAN, JOHN
ALLEN, ANTHONY
BAGLIETTO, LUZ GONZALEZ
BALSILLIE, ANDREW
BIRD, HELEN
BIRD, MARK
BROOKSBANK, JOANNE
COPPINGER, STEVE
CRAIK, IAN
DAVIDSON, POLLY
DAVIES, JON
DOBINSON, TONY
EMMETT, CHRISTOPHER
GILBARD, SUE
GUNNENSEN, DAVID
HAIGH, ANNA
HARRISON, HAZEL
HORDER, GRAHAM
HOWLETT, JULIA
JOHNSTON, CHARLOTTE
MARDALL, ELIZABETH
MCGURNAGHAN, YVONNE
MCKENZIE, RUPERT
MERRIDEN, TREVOR
MOORE, DEBORAH
NAYLAN, ISABELLE
PALMER, ROBERT
PARKES, NEIL
PARKINSON, ANDREW
PERRYMAN, SARAH
PINNELL, CLAIRE
RAINES, PETER
RICHARDS, NIGEL
RIDLEY, JON
SPRAGG, MARTIN
STANSFIELD, PETER
STILWELL, SCOTT
TAYLOR, GEOFF
WATT, IAN
WORRALL, SHIRLEY
ZIOLKOWSKA, MARGARET



3 - METHODS

3.1 Site Positioning

The boundaries of survey sites were laid out using boundary marker buoys (BMB). The positions of these were carefully recorded using bearings taken from landmarks on the islands using sighting compasses. To survey a given site grids were marked out by placing buoys at set distances along transects between BMBs. The distance between one buoy and the next was initially measured by a 200 m length of SMB line. The time taken to traverse the distance between the two buoys by boat at a constant speed was recorded. Subsequent buoys were set using these same intervals. This technique was then repeated to lay all the buoys in a grid. Each buoy was assigned a reference number.

3.2 Survey Technique

Divers surveyed transects in teams of three. One diver navigated between marker buoys, one recorded the plants and algae present, the third recorded the invertebrates and fish. Spot dives were carried out either directly below buoys or at fixed positions between marker buoys.

Surveys were carried out using a system based on that recommended by SPC/UNEP (1984) and those used by the Marine Nature Conservation Review of the British Nature Conservancy Council (Hiscock, 1990).

For every dive a "physical recording form" was completed (Figure 2). This recorded data on the location of the dive site, its physical characteristics: wind; currents; depth. Each recorder also wrote a general description of the site and made notes of any human impacts including: boat activity (fishing, diving, commercial etc) plus any litter, sewage or coral damage present.

For each dive a number of "biological recording forms" were completed (Figure 3). The exact number of these used depended upon the number of different habitats present. For example a dive made on a patch reef surrounded by seagrass beds, would generate two biological recording forms, one for the patch reef habitat and one for the seagrass habitat. Data recorded on the biological recording forms as well as a general description of the area, included the nature of the substratum, its biological cover (estimated on a scale between 1 and 5), the species present and their approximate numbers.

Where possible the bathymetry along each transect was recorded using echolocation. Boats travelled at a fixed speed between buoys and echolocation data was recorded using a video recorder. This data remains to be processed.

Recording forms were returned to the UK for analysis.

Figure 2 A physical recording form

CORAL CAY CONSERVATION

Physical Recording Form

Site No. Site Name

Repeat visit? ☐ Area

Date / / Start Time : End Time :

This is your ☐ dive/snorkel in Belize

Recorders Depth limits Upper m
name(s) Lower m

Site Position

Lat/Long

Centre		°N		°W
From		°N		°W
To		°N		°W

Bearings/Transits

Type of survey

Spot Dive ☐
Transect ☐
General mapping ☐
Photography ☐
Sounding ☐
Other ☐

Photography

Photographer ☐
Number taken ☐
Wide Angle ☐
Close up ☐
Other ☐

Location

Barrier reef ☐
Patch reef ☐
Channel/cut ☐
Lagoon ☐
Mangrove ☐
Other ☐

Current strength

Strong ☐
Medium ☐
Weak ☐
None ☐

Current direction

North ☐
North East ☐
East ☐
South East ☐
South ☐
South West ☐
West ☐
North West ☐

Wind strength

Beaufort
(1 - 9)

Wind direction

North ☐
North East ☐
East ☐
South East ☐
South ☐
South West ☐
West ☐
North West ☐

Impacts

Litter ☐
Sewage ☐
Coral damage ☐
Lobster potting ☐
Algal bloom ☐
Other ☐

Human impacts

Boats	No. seen	Reg. No.	No. occupants	Active?
Were they-				
Fishing				
Diving				
Pleasure				
Commercial				

Your impression of the site (aesthetic and biological)

Excellent Very good Good Average Poor

Aesthetic	☐	☐	☐	☐	☐
Biological	☐	☐	☐	☐	☐

Site Description

(Describe general location of the site, topography, main habitats (coral, sand, etc.) and depths, your impression of the site)

Site number

Site Profile/Plan Drawing

(Note depths, distances and zones)

Figure 3

A biological recording form

CORAL CAY CONSERVATION

Biological Recording Form

Site No. ☐ Site Name _____

Habitat No. ☐ Date ____/____/____

No. of habitats ☐ Start Time : End Time :

Position _____
(widely spaced habitats)

Recorders _____
name(s) _____

Depth limits Upper m
Lower m

Zone

Outer reef
Back reef
Reef crest
Inner fore
Outer fore
Ridge
Drop off

Lagoon

Sediment
Seagrass
Patch reef
Mangrove
Other

Substratum

Live coral
Dead coral
Sand
Mud
Rubble
Mangrove

(0-5)

Biological Cover

Live hard corals
Soft corals
Sponges
Invertebrates
Algae
Seagrass
Mangrove

(0-5)

Growth Forms

Hard Corals

Branching
Massive
Encrusting
Foliose
Plate

(P or D)

Soft Corals

Whips
Fans
Rods
Other

(P or D)

Sponges

Encrusting
Barrel
Vase
Tube
Branching

(P or D)

Algae

Turf
Filaments
Foliose
Halimeda
Bottlebrush

(P or D)

Habitat Description

(Describe substratum, depths, main animal/plant groups and growth forms)

Hard corals

- Elkhorn
- Staghorn
- Smooth brain coral
- Giant brain coral
- Grooved brain coral
- Leaf coral
- Ribbon coral
- Sheet coral
- Flower coral
- Pillar coral
- Finger coral
- Elliptical star coral
- Cavernous star coral
- Mountainous star coral
- Starlet coral
- Mustard hill coral
- Fire `coral'

[illegible]

Soft corals

Sea fans
Sea whips
Sea rods

Sponges

Barrel
Vase
Tube
Branching
Sheet like

Invertebrates

- Conch
- Lobster
- Starfish
- Short spined sea urchin
- long spined sea urchin
- Sea cucumber
- Clam
- Bivalve
- Cowrie
- Topshell
- Sea anemone
- Crab
- Shrimp

[illegible]

Vertebrates

Turtle
Dolphin
Manatee

Seagrass/plants

Turtle grass - *Thalassia testudinum* ☐
 Manatee grass - *Syringodium filiforme* ☐
 Mangrove ☐

1111

Fish

Wrasse
 Damselfish
 Parrotfish
 Stoplight parrotfish
 Grunts
 Snappers
 Angelfish
 Grey angelfish
 French angelfish
 Queen angelfish
 Triggerfish
 Queen triggerfish
 Butterflyfish
 Fourspot butterflyfish
 Groupers
 Surgeonfish
 Squirrelfish
 Chromids
 Blue chromis
 Pufferfish
 Sharpnose pufferfish
 Gobies
 Sharks and Rays
 Nurse shark
 Eagle ray
 Sting ray
 Barracuda
 Tarpon
 Moray eels
 Hamlets/Baslets/Bigeyes
 Jacks
 Yellowtail jack
 Goatfish
 Flatfish
 Rainbow plaice
 Filefish
 Trunkfish
 Burrfish/Porcupines

[illegible]

Green algae

- Filamentous - loose tufts
- Sheet-like
 - Ulva* species
- Disc-like
 - Acetabularia* species
- Lacy
 - Anadyomene* species
- Brush-like
 - Caulerpa* species
 - Caulerpa cupressoides*
 - Caulerpa paspaloides*
 - Rhipocephalus phoenix*
 - Penicillus capitatus*
 - Penicillus dumetosus*
 - Penicillus pyriformis*
- Blade-like
 - Avrainvillea* species
 - Cladocephalus luteofuscus*
 - Udotea flabellum*
 - Udotea wilsonii*
 - Udotea occidentalis*
- Cup-like
 - Udotea cyathiformis*
- Marble-like
- Calcified
 - Halimeda* species
 - Halimeda incrassata*
 - Halimeda opuntia*
 - Halimeda monile*
 - Halimeda goreaui*
 - Halimeda copiosa*
 - Halimeda tuna*

[illegible]

Red algae

Sheet-like
Fine branched
Coarse branched
Calcified
Amphiroa species
Encrusting
Filamentous
Filamentous

[illegible]

Brown algae

- Pyramid-like
 - Turbinaria species
- Fine branched
 - Dictyota species
- Blade-like
 - Lobophora variegata
 - Padina species
- Leaf-like
 - Sargassum species

[illegible]

4 - RESULTS

4.1 Introduction

Four main sites were surveyed in the study area (Figure 4). Sites 1 and 2, immediately east and west of South Water Cay were studied in detail during the course of the Coral Cay 1989 expedition (O'Toole et al 1990). This work was expanded to cover a larger area on each site. Sites 3 and 4 were studied in greater depth and detailed results are presented here.

4.2 Site 1

4.21 Site Location

Site 1 was positioned in the lagoon immediately to the west of South Water Cay. The boundaries of Site 1 were established by placing marker buoys at set distances west of the northern (Blue Marlin Lodge toilet) and southern (low prominent bush) ends of South Water Cay. These formed the eastern-most boundaries of the site. The positions of the northern and southern buoys were fixed by taking bearings from prominent features in the area (see Appendix 2). The site was surveyed by placing buoys at intervals of 200 m from the north buoy on a bearing of 110 deg., this was then repeated to form a grid (Figure 5).

4.22 General Description

The lagoon was surveyed in 1989 and following preliminary observations from spot dives, the seagrass communities appeared normal and undisturbed. Therefore it was decided not to conduct biological surveys in this area. The site was predominantly beds of mixed seagrasses (*Thalassia testudinum* and *Thalassia syringodium filiforme*), with areas of finely sorted bare sand interspersed throughout the area, prominent coral patches were not present.

4.23 Impacts

In locations near the shoreline there was evidence of pollution (discarded bottles, cans, sewage and other anthropogenic debris), particularly towards the northern extreme of the site. Little fishing or other boat activity was observed during the work on this site.

4.24 Species List

A full species list can be found in Coral cay Conservation 1989 report (O'Toole et al 1990), however, below is a brief list of some species of interest.

Shaving brush (*Penicillis capitatis*)
Halimeda incrassata
small orange sponges (unidentified)

Small anemones (possibly *Bartholomea* sp.)
Sea cucumbers (possibly *Astichopus* sp.)
Sea urchins (*Eucidaris* sp.)
Small butterprint brain coral (*Meandrina meandrites*)
Small grooved brain coral (*Diploria labyrinthiformis*)
Small finger coral (*Porites furcata*)
Arrow crab (*Stenorhynchus seticornis*)
Damselfish (*Pomacentrus* sp.)
Juvenile French grunt (*Haemulon flavolineatum*)
Numerous small shoals of juvenile fish

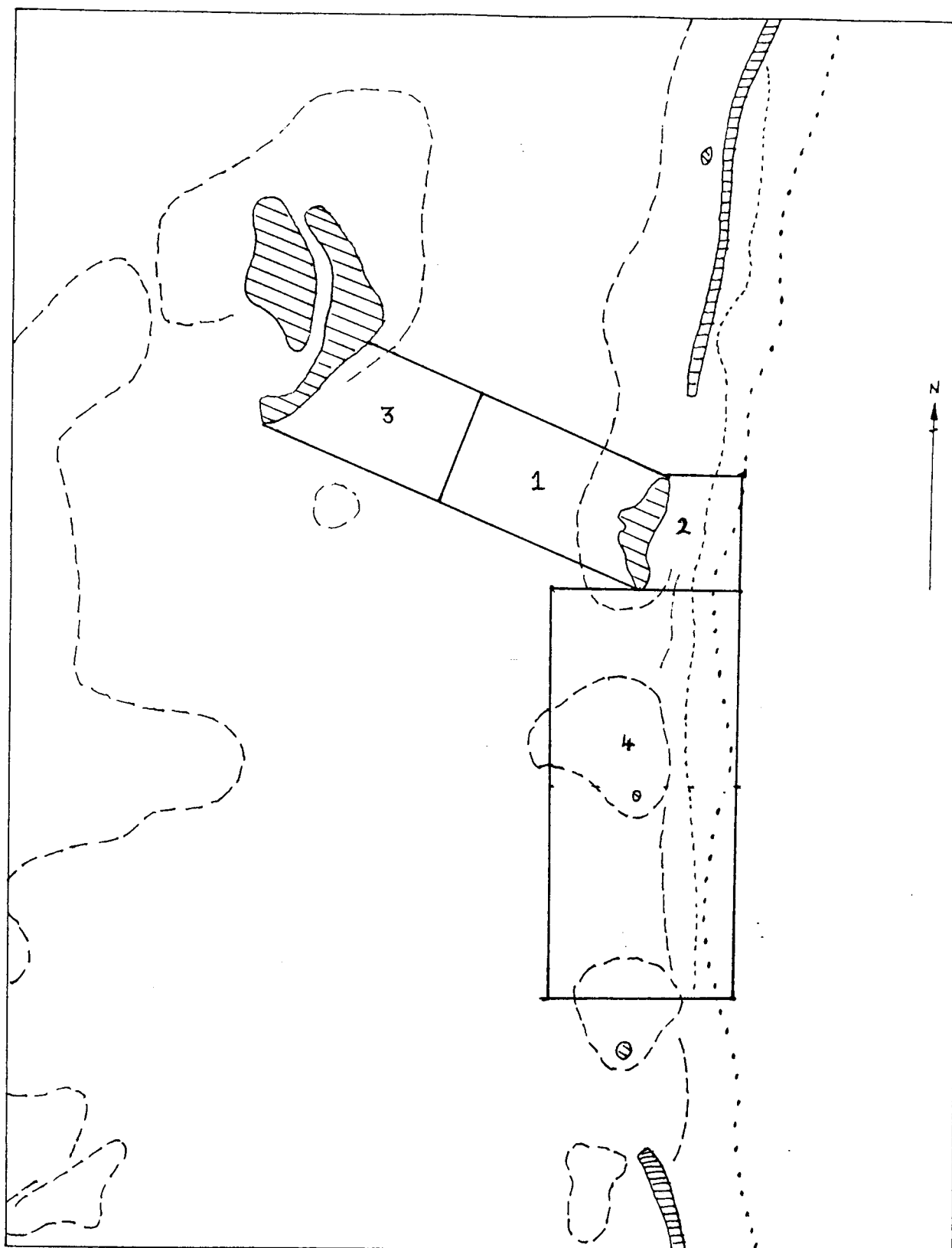


Figure 4 Map showing the four survey sites

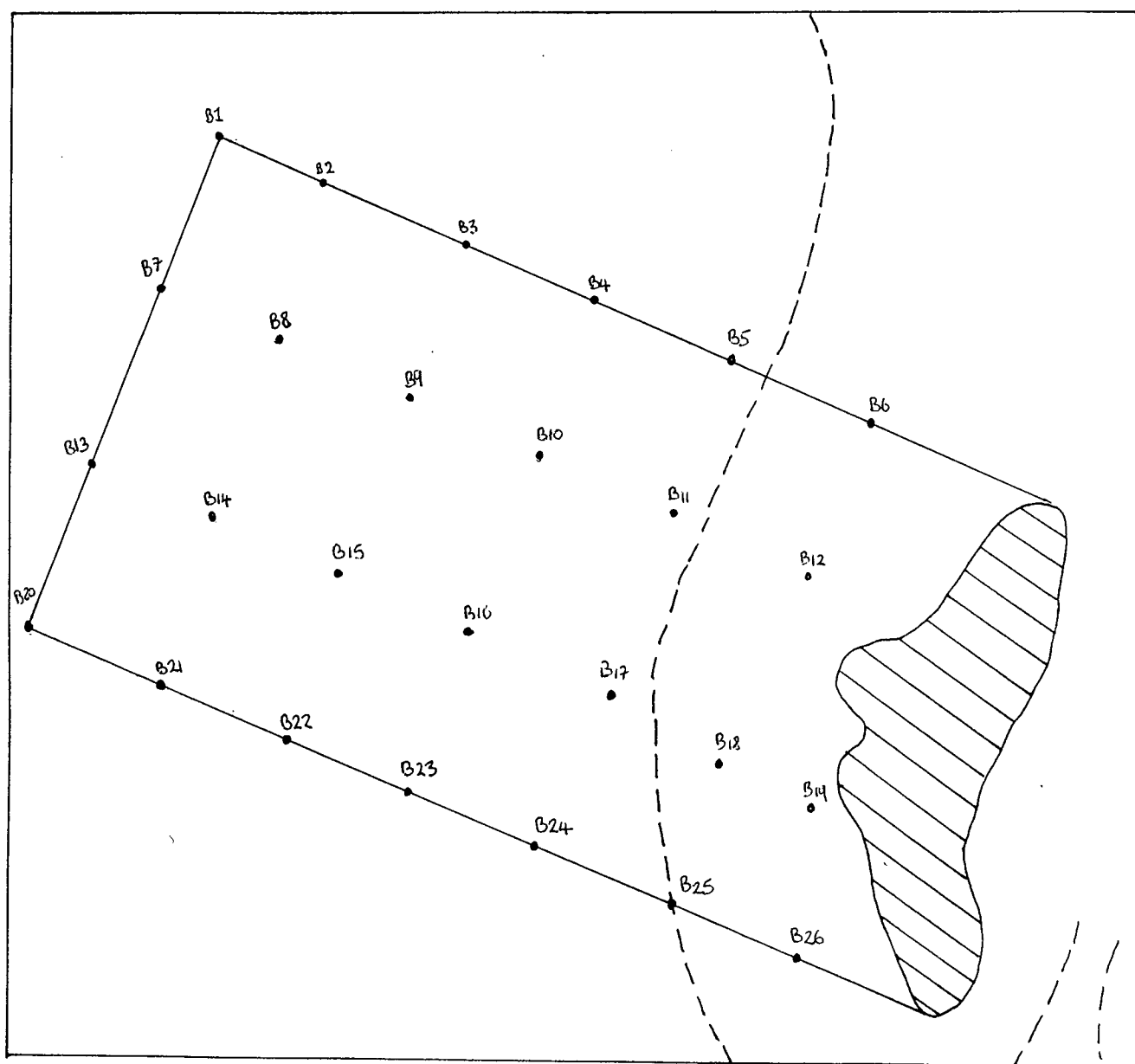


Figure 5 Map showing the location of Site 1

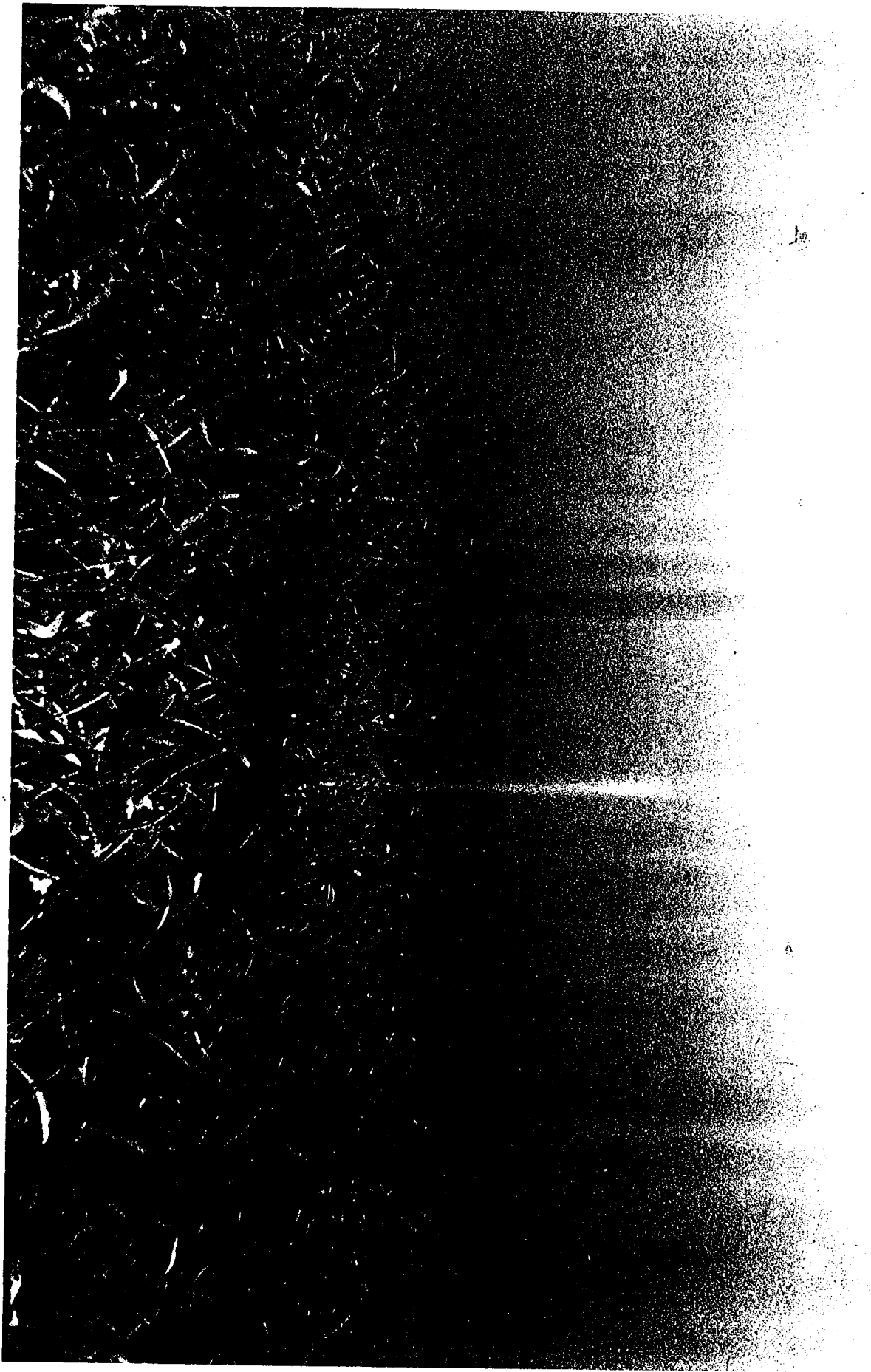


Figure 6

4.3 Site 2

4.31 Site Location

Site two was situated due east of South Water cay, between the island and the drop off. The boundaries of Site 2 were marked by placing BMBs east of the cay at known intervals between the southern and northern ends of the island. Each BMB was positioned using a system of 'leading lights'. Each leading light comprised of a pair of conspicuous markers placed on the cay in an east-west orientation. By aligning each pair of leading lights such that they lay exactly one behind the other, each BMB could be positioned precisely due east of South Water Cay.

The southern-most pair of leading lights were positioned on the southeast tip of SWCay. All subsequent pairs were positioned due north from this point at measured distances from each other. The northern-most pair of leading lights were positioned adjacent to the northern end of the most eastern facing building (painted green) belonging to the Blue Marlin Lodge Hotel. This position, however, did not correspond with the northern most extremity of South Water Cay.

BMB's were tied to dead coral heads on the top of the dropoff ridge by teams of divers. The bathymetry of the transect from each BMB to the corresponding pair of leading lights on the shore was determined by echolocation, and buoys laid at known depth contours along these transects, as shown below (Figure 7).

4.32 General Description

The reef in this area was described in detail by CCC in 1989. Typically, the outer fore reef comprised of three distinct zones: a coral wall descending from the dropoff ridge at a depth of 15 m to a sand gully at 30 m depth, rising gradually over an area of coral rubble to the mark delineating the outer/inner forereef zones. Divers completed three Biological Assessment Forms, one for each of the zones traversed during the survey dive (see Figures 8-11). The reef was generally in excellent condition. The reef in this area is generally diverse and in good condition. 11 conch were sighted during survey dives but only 3 lobsters reported. The long-spined urchin population appeared healthy with 14 separate sightings.

4.33 Impacts

There was little evidence of human impact on this site. Litter was sparse and largely confined to the strandline. Localised algal blooms in shallow water were reported possibly due to sewage outfalls on the island. Some coral damage was reported, mainly on the inner fore-reef and probably of storm origin. Perhaps more worryingly, soft coral damage was documented on the drop-off and is probably diver-inflicted (Figure 13).

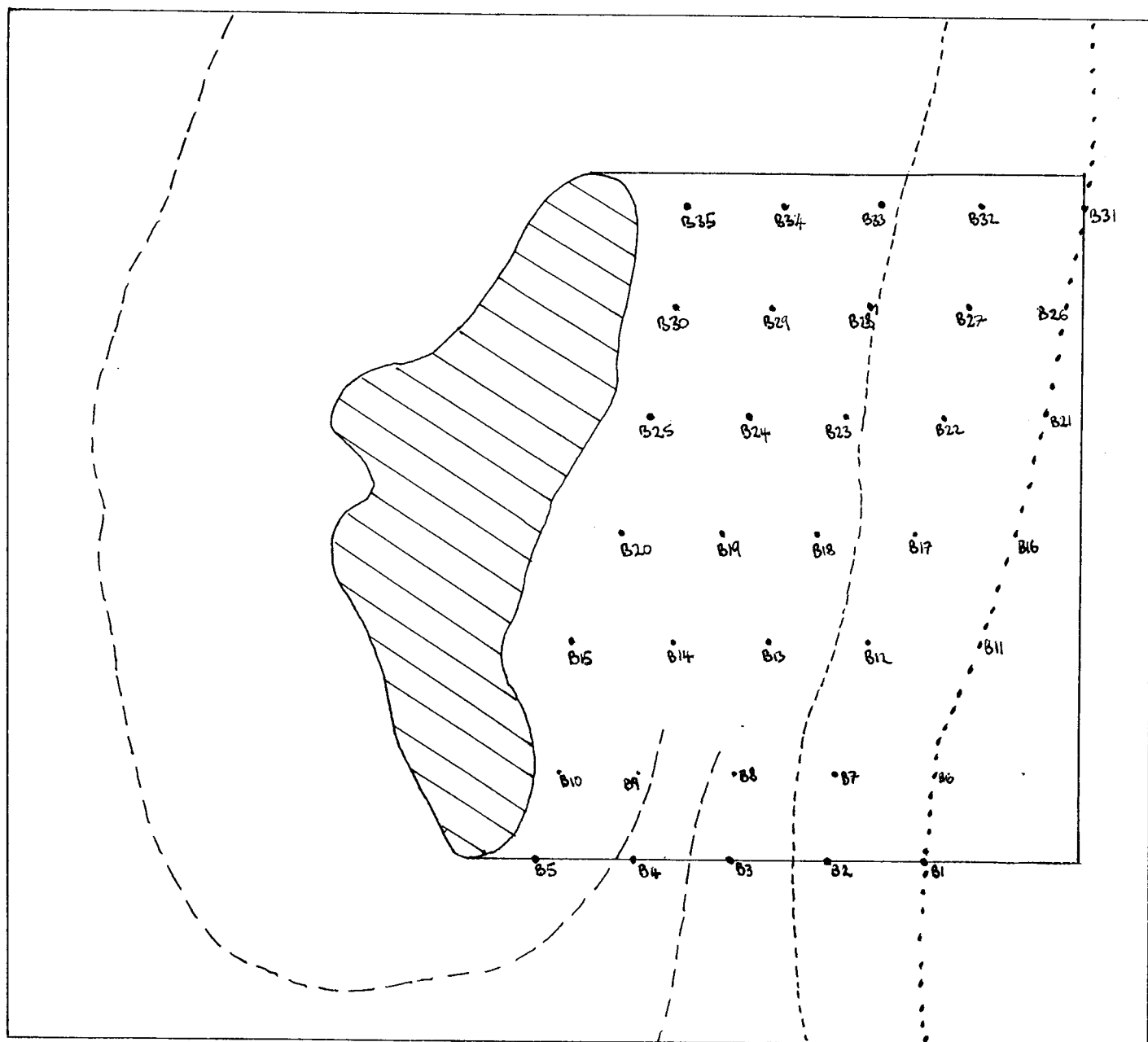
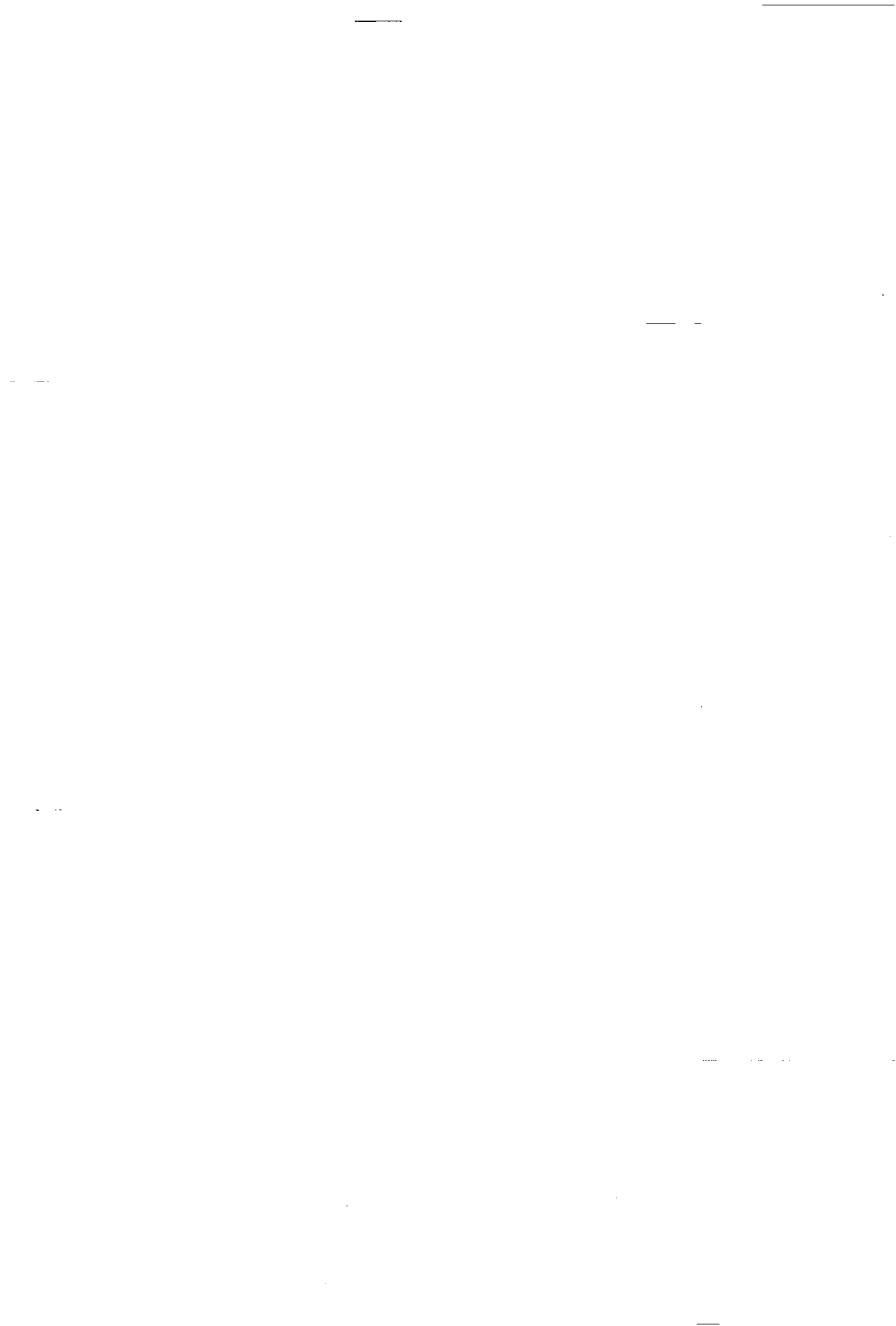


Figure 7

Map Showing the location of Site 2

Figure 8-11 **Transects of Site 1 showing bathymetric profile and kite diagrams of bottom cover**



Site Two Transect One

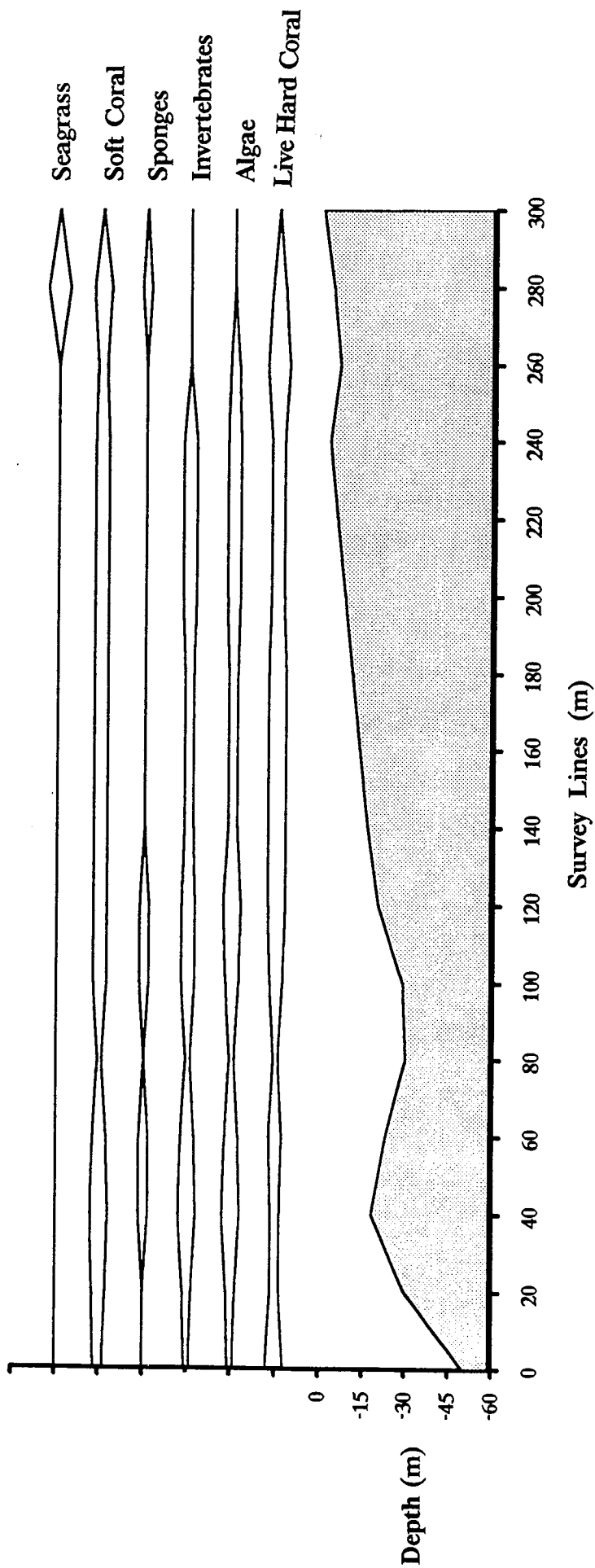
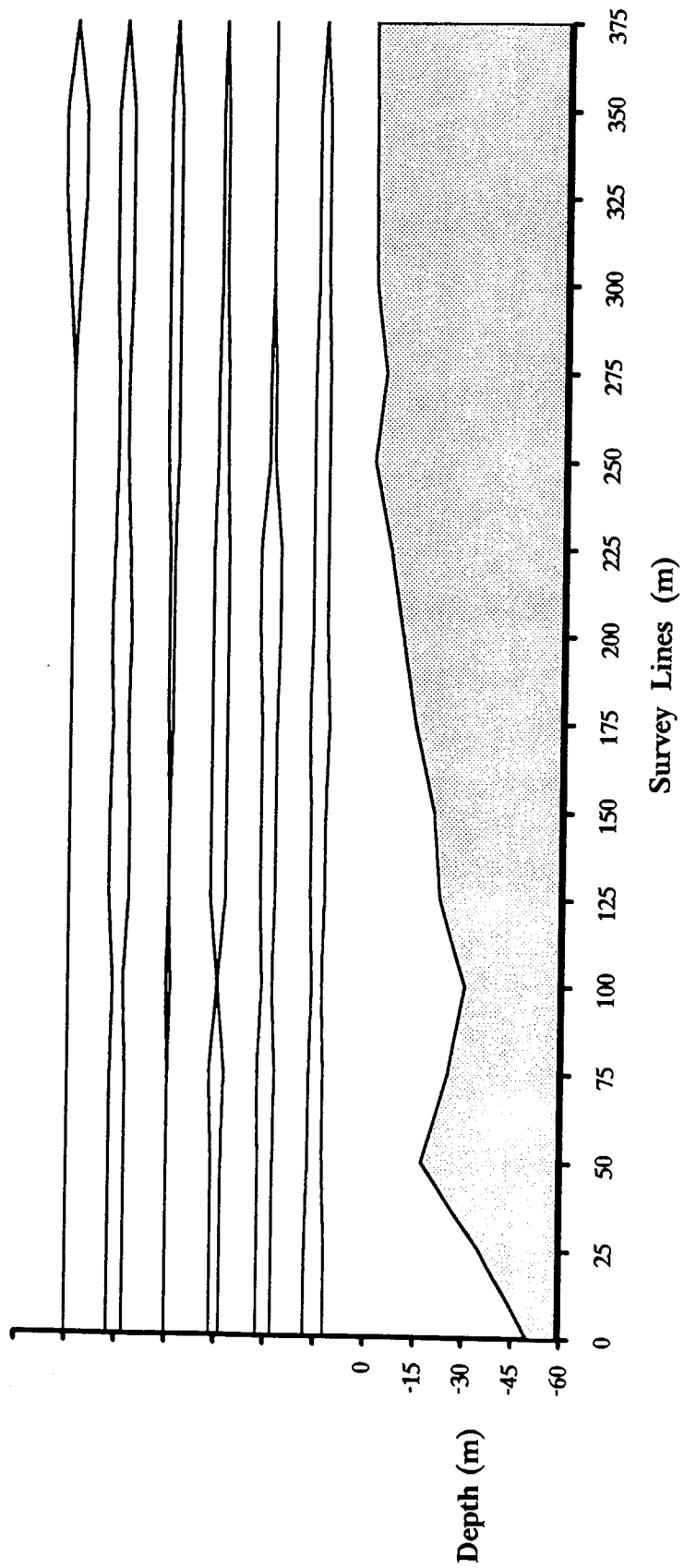
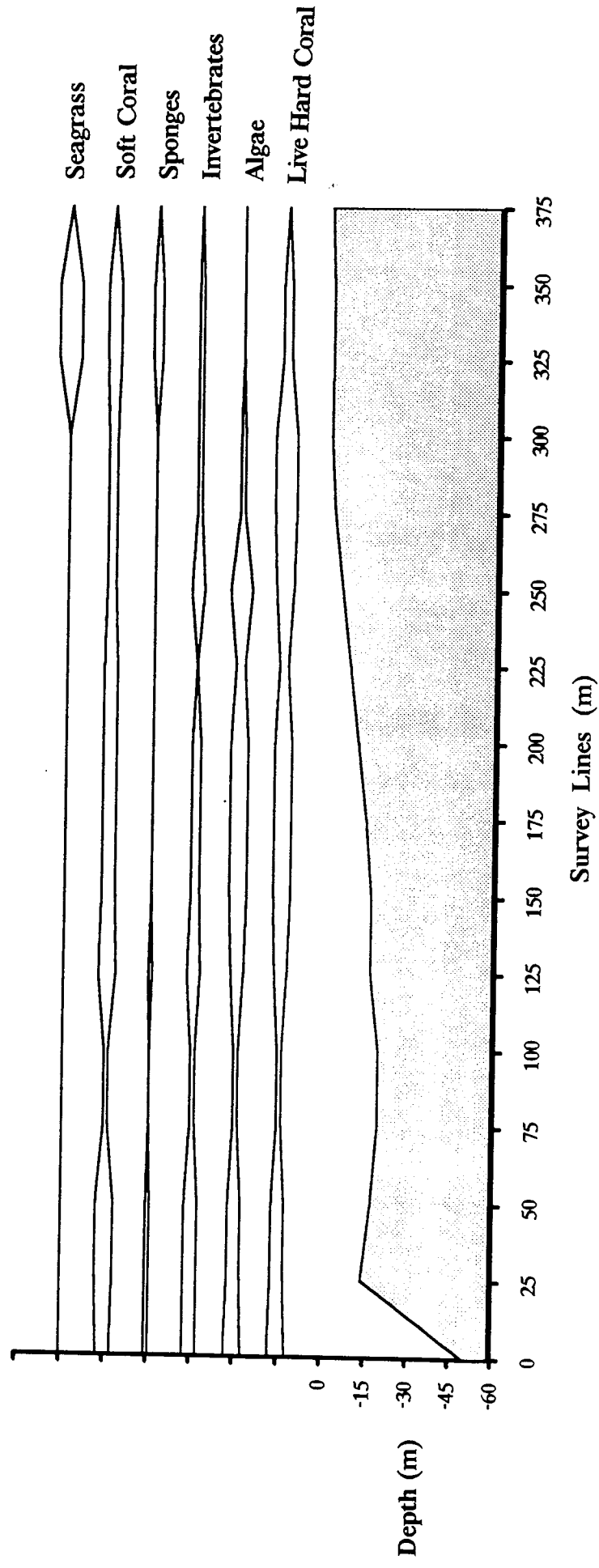


Figure 1 is a depth profile graph showing the distribution of various biological communities along survey lines. The y-axis represents Depth (m) from 0 to -60, and the x-axis represents Survey Lines (m) from 0 to 375. The communities profiled are Seagrass, Soft Coral, Sponges, Invertebrates, Algae, and Live Hard Coral. The bottom profile is shaded.



Site Two Transect Five



Site Two Transect Six

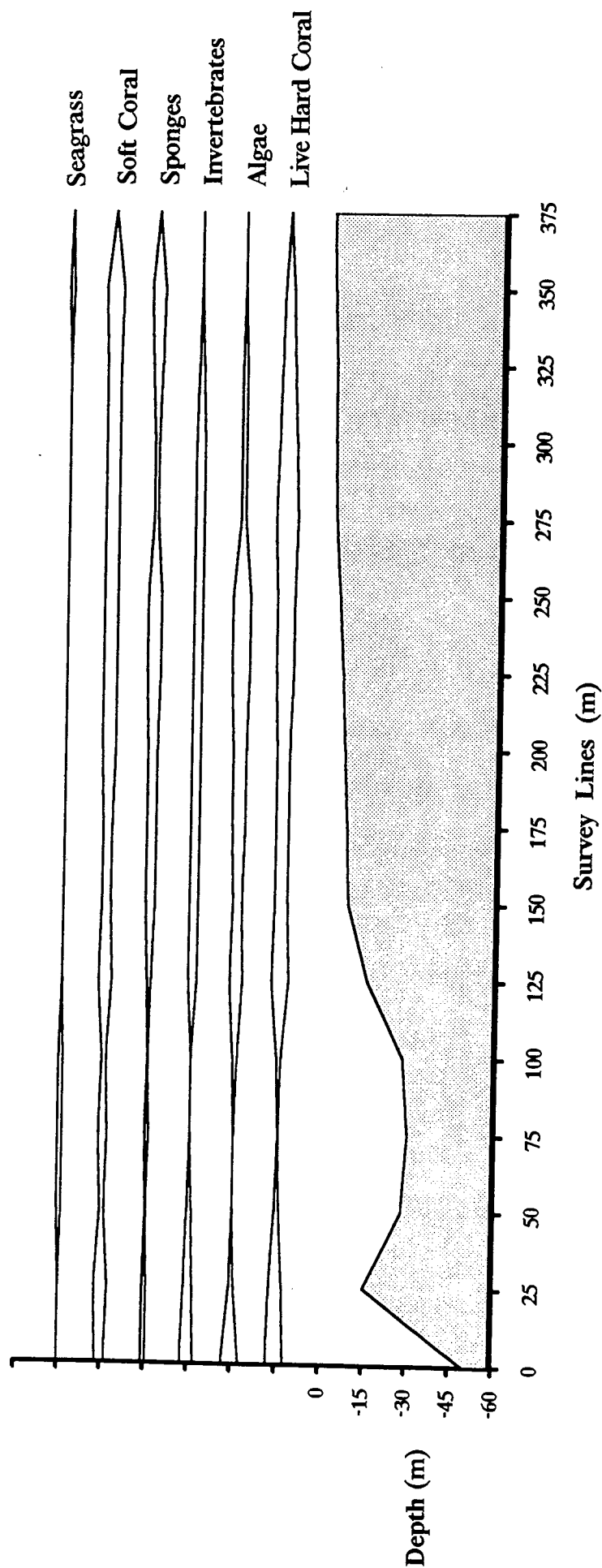




Figure 12

Figure 13



4.4 Site 3

4.41 Site Location

Site 3 was situated on the east side of Twin Cays. Buoys were laid along four transects towards South Water Cay. Bearings to different land marks were taken from boundary marker buoys at the end of each transect (Appendix 2). In addition to the transects surveyed, a series of spot dives was conducted between the transects (Figure 14).

4.42 General Description

Site 3 is a shallow area of lagoon no deeper than 10m depth. There was little discernable current in the area, when present, these were weak and southerly in direction. The substratum throughout the area was predominantly fine sand, with small patches of silt and mud. Large, coral rubble was reported in the deeper water towards the eastern end of transect one. Dives conducted at the western limit of each transect encountered mud, except at the end of transect 1 the southern tip of the island. The biological cover recorded on the scale of one to five is presented in Figures 15 to 18 along with profiles of the transects. As can be seen from these transects, seagrass cover is almost ubiquitous except in the north western corner of the site where sand gave way to mud. The dominant species of seagrass was *Thalassia testudinum*. A small patch of mangrove was reported. At first site this area appears relatively uniform, however on closer examination a large variety of species were observed (see below). Algal cover was predominantly *Halimeda* and *Penicillus* sp. Encrusting and filamentous red algae were reported mainly in the south east sector of the site at the ends of transects 2 and 3 and in the middle of transect 1.

30 live conch and 4 dead conch were reported over the whole of site 3. These were generally reported as being relatively small, although no separate attempt at measuring them was conducted (Figure 19). 9 specimens of spiny lobster were reported over the survey area.

4.43 Impacts

Litter was reported widely spread over this site. This consisted mainly of discarded cans and bottles, however four large oil drums and a quantity of sheet metal were also reported in the area. On closer inspection the drums were found to be harbouring many juvenile lobster (as many as 30 per drum). There were a number of lobster pots in the area with animals inside and the drums may have been placed there purposely to attract juvenile animals. Two fishing boats were reported in the area. Several divers recorded evidence of coral damage, however, given the small amount of coral coverage in the area, this may infact be sitings of natural coral rubble. Algal blooms were reported on two survey dives.

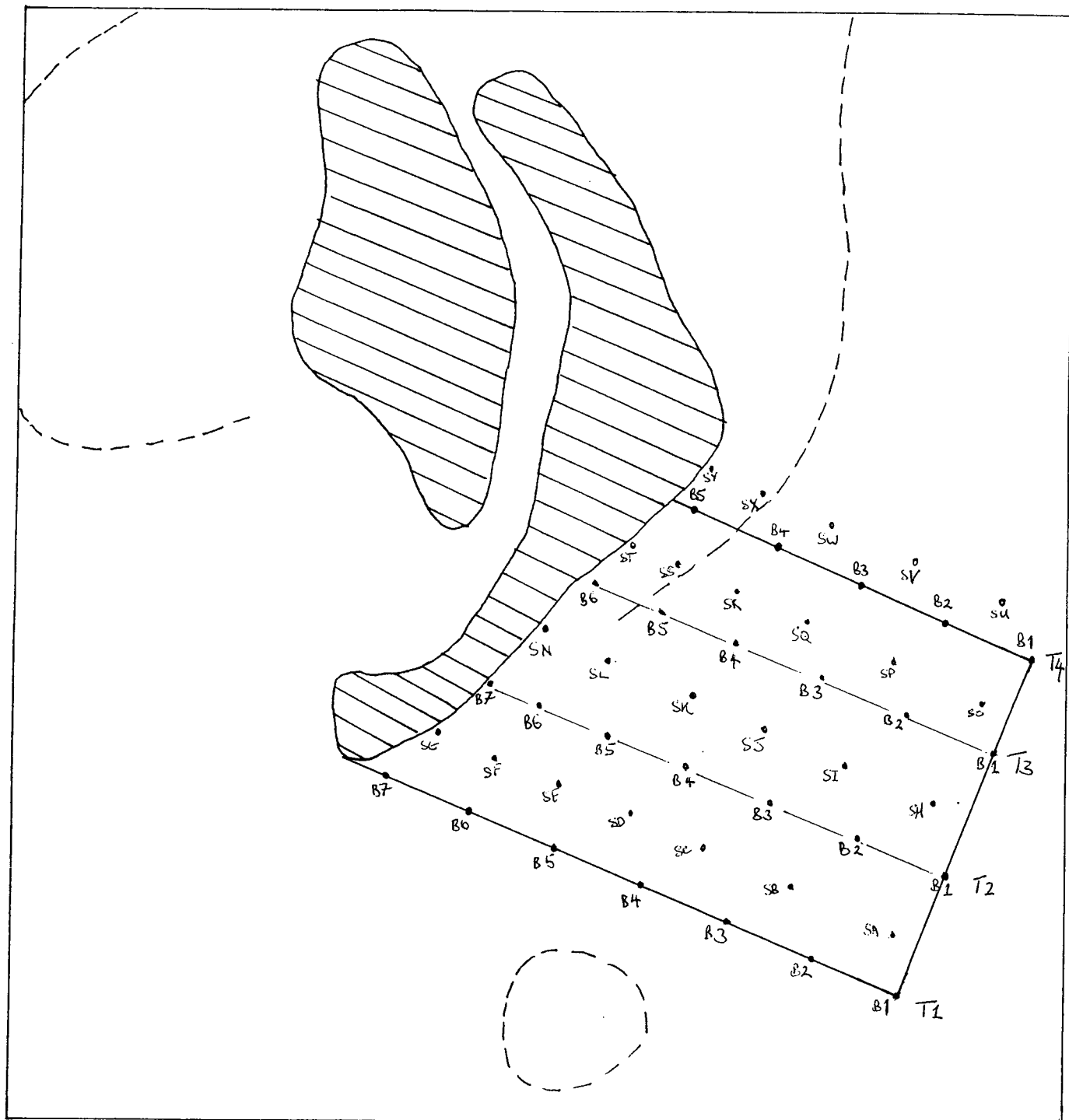
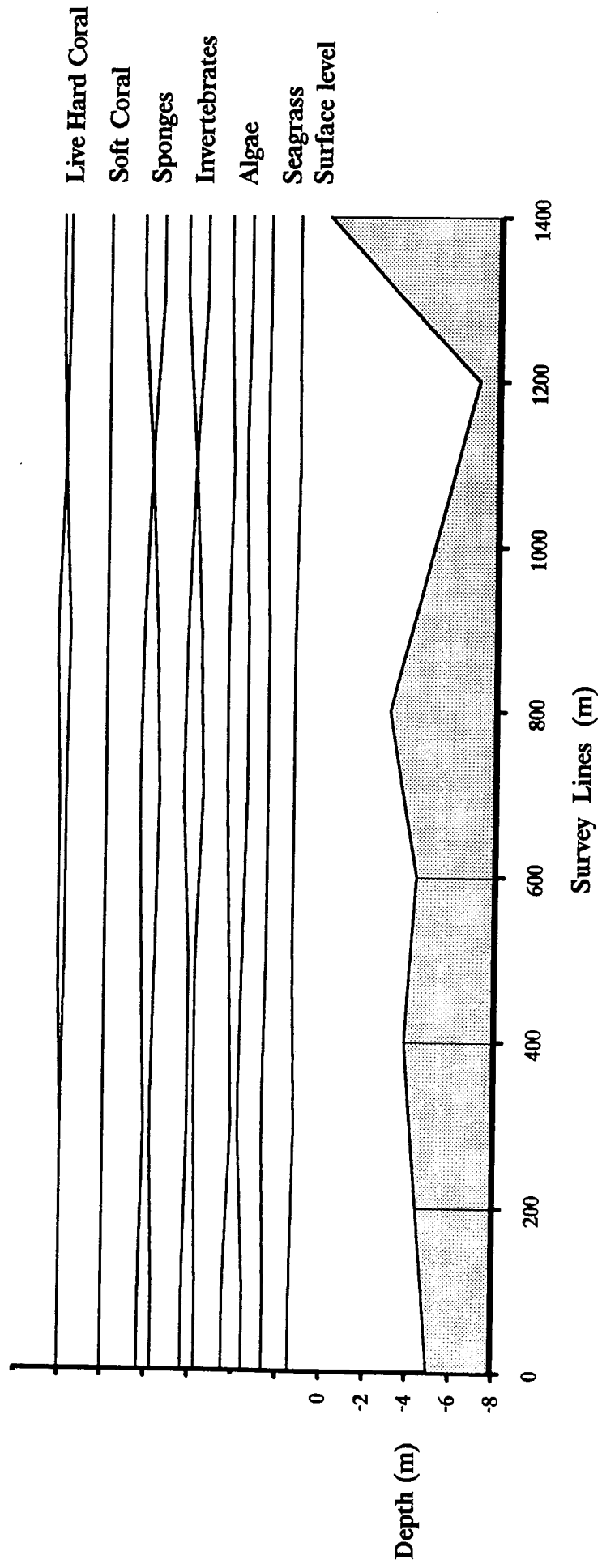


Figure 14 Map Showing the location of Site 3

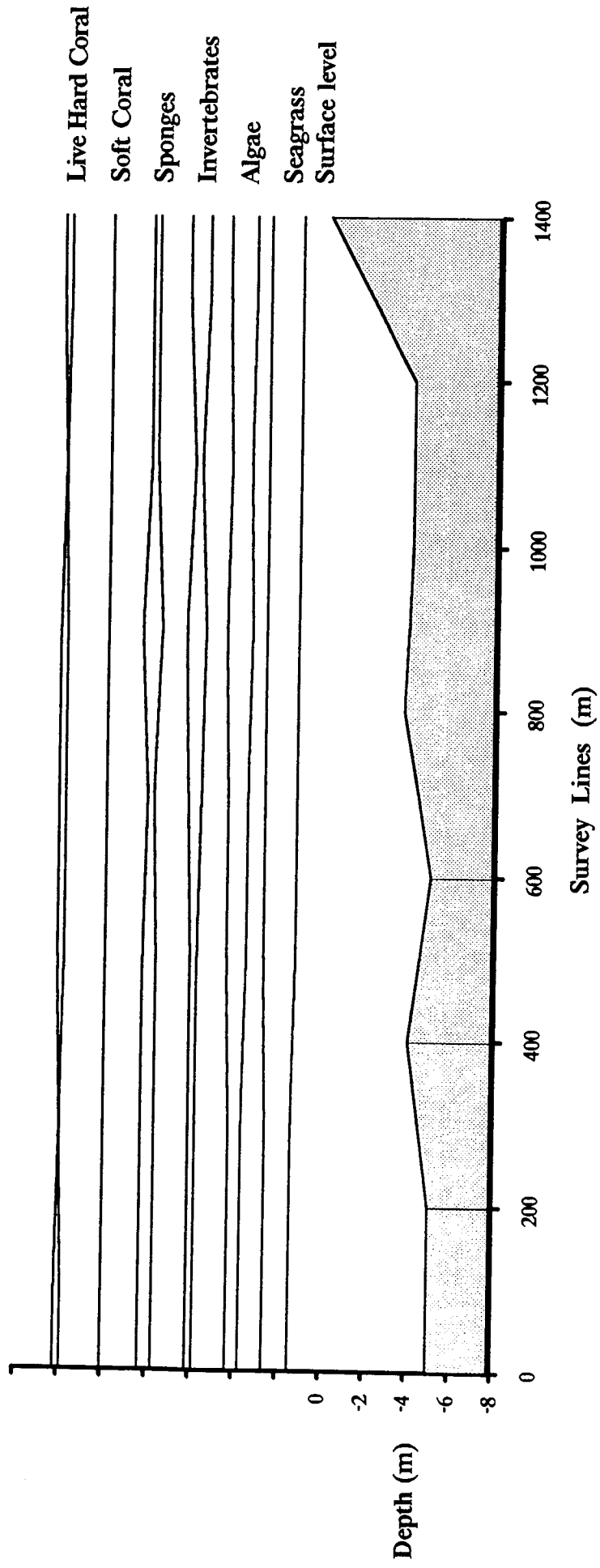
Figure 15-18 **Transects of Site 3 showing bathymetric profile and kite diagrams of bottom cover**



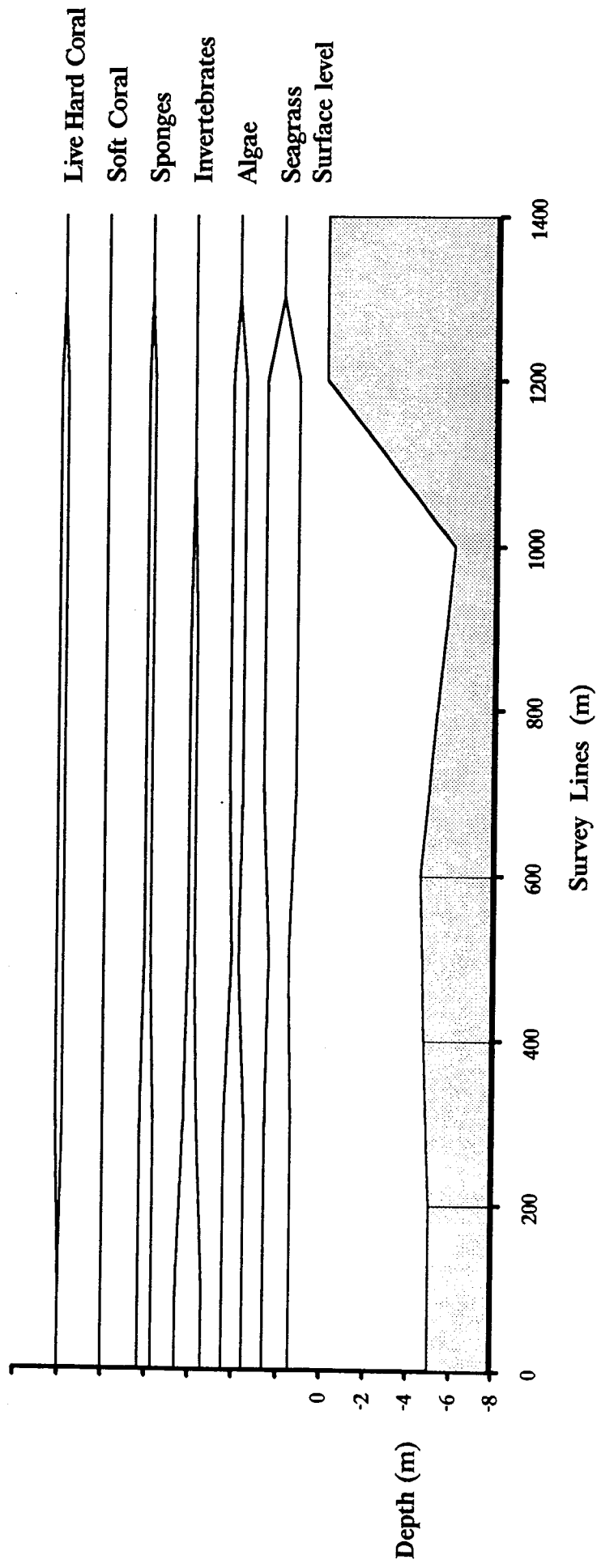
Site Three Transect One



Site Three Transect Two



Site Three Transect Three



Site Three Transect Four

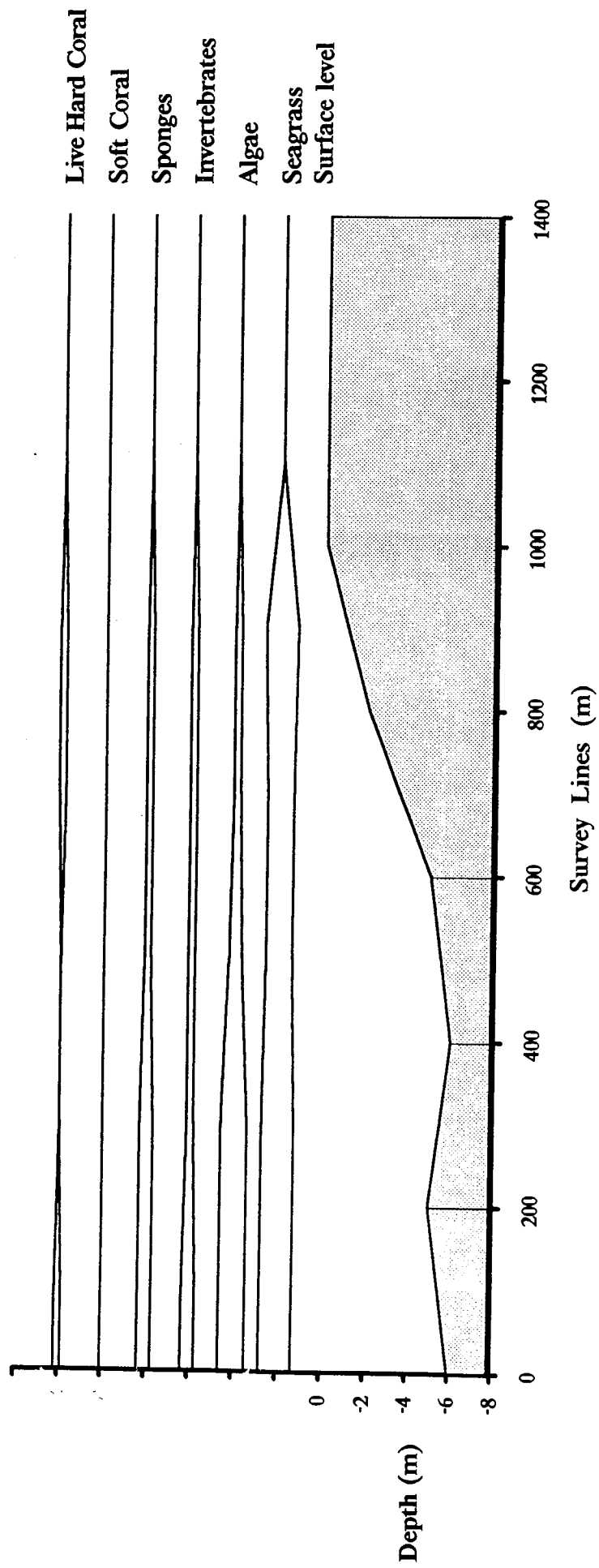




Figure 19

4.44 Species List

<u>Common Name</u>	<u>Latin Name</u>
Rose Coral	Porites sp. including Porites asteroides Millipora sp. Meandrina meandrites Diploria labyrinthiformes Manicina areolata Eusmilia fastigiata Madracis mirabilis
Sponges	Tethya crypta Haliclona rubens
Sea grass	Syringodium filiforme Thalassia testudinum
Algae	Valonia ventricosa Dictyosphaeria cavernosa Caulerpa paspalordes C. prolifera C. cuspressoides Halimeda opuntia H. incrassata H. mosile H. opuntia H. copiosa H. dumetosus H. coulthropales H. inerassata Udotea cyathiformis U. fabellum U. flabella U. wilsonii U. occidentalis Avrainvillea longicaulis A. nigricans Penicillus capitatus P. pyriformis P. rhipocephalus P. dumetosus Rhipocephalus phoenix Lobophora variegata Dictyota divanicata Oreaster reticulatus

Anemones

Lebrunia danae
Condylactis gigantea
Stoichactis helianthus
Bartholomea annulata

Urchins

Lytechinus variegatus
Tripneustes esculentus
Diadema antillarum
Meoma ventricosa

Worms

Sabellid Worm
Hermodice carunculata
Sabellastarte magnifica
Eupolymnia nebulosa

Others

Portunus sebae
Stenorhynchus seticornis
Mithrax sculptus
Pinna carnea
Panulirus argus

Mantis Shrimp

Sepioteuthis sepioidea

Beaded Periwinkle

Pen Shell Bivalves

Astraea phoebid
Laevicardium laevigata

White Painted Shrimp

Hermodice sp
Annelida sp.

Plume Worms

Sponge Crab

Long Spined Star Shell

Fish

WRASSE:

Green Razorfish

Clown Wrasse

Slippery Dick

Hemipteronotus splendens

Halichoeres maculipinna

Halichoeres bivittatus

DAMSEL:

Beaugregory

Juvenile Beaugregory

Yellowtail Damsel

Dusky Damsel

Long Fin Damsel

Sergeant Major

Cocoa Damsel

Stegastes leucostictus

Microspathodon chrysurus

Stegastes fuscus

Stegastes diencaeus

Abudefduf saxatilis

Stegastes variabilis

GRUNTS:

Caesar Grunt	<i>Haemulon carbonarium</i>
Cottonwick	<i>Haemulon melanurum</i>
Porkfish	<i>Anisotremus virginicus</i>
White Grunt	<i>Haemulon plumieri</i>
French Grunt	<i>Haemulon flavolineatum</i>

PARROT FISH:

Bucktoothed Parrot	<i>Sparisoma radians</i>
Green Blotch Parrot	<i>Sparisoma atomarium</i>
Princes Parrot	<i>Scarus taeniopterus</i>
Striped Parrot	<i>Scarus iserti</i>

SNAPPERS:

Yellowtail Snapper	<i>Ocyurus chryurus</i>
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ANGELS:

French Angel	<i>Pomacanthus paru</i>
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BUTTERFLIES:

Foureye Butterfly	<i>Chaetodon capistratus</i>
Reef Butterfly	<i>Chaetodon sedentarius</i>

SURGEONS & TANGS:

Doctorfish	<i>Acanthurus chirurgus</i>
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PUFFER:

Sharpnose Puffer	<i>Canthigaster rostrata</i>
Bandtail Puffer	<i>Sphoeroides spengleri</i>

BLENNIES:

Rosy Blenny	<i>Malacoctenus macropus</i>
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HAMLETS & BASSLETS:

Shy Hamlet	<i>Hypoplectrus guttavarius</i>
Indigo Hamlet	<i>Hypoplectrus indigo</i>
Black Hamlet	<i>Hypoplectrus nigricans</i>
Barred Hamlet	<i>Hypoplectrus puella</i>

JACKS:

Yellow Jack	<i>Caranx bartholomaei</i>
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FILEFISH & TRUMPET FISH:

Orange Spotted Filefish	<i>Cantherhines pullus</i>
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BASS:

Harlequin Bass	<i>Serranus tigrinus</i>
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SCORPIONFISH:

Spotted Scorpionfish
Plumed Scorpionfish

Scorpaena plumieri
Scorpaena grandicornis

MISC:

Sunshine fish
Eagle Ray
Sand Diver
Barred Cardinal
Eyed Flounder

Coryphopterus sp.
Chromis insolata
Aetobatus narinari
Synodus intermedius
Ogcocephalus nasutus
Bothus ocellatus

Balloon Fish
Sand Tilefish
Pilot Fish
Batfish
Honeycomb Catfish

Diodon holocanthus
Malacanthus plumieri

4.5 Site 4

4.51 Site Location

Site 4 was a large area stretching from South Water Cay in the north to Curlew Cay in the south and including Carrie Bow Cay. The eastern margin was the drop off, and the site extended well into the lagoon. Ten transects were surveyed east to west between the southern end of South Water Cay and the northern tip of Curlew Cay (Figure 20). Transects varied in length due to the positions of the islands. A section of reef encompassing a permanent survey site utilised by the Smithsonian Institution, on the eastern side of Carrie Bow Cay was left unsurveyed. A patch reef in the lagoon east of Carrie Bow was surveyed separately.

4.52 General Description

Site 4 included many varied habitats within its area (see Figures 25-28). These included the barrier reef itself, two reef cuts and the lagoon. Transects across the reef itself was split by a sand trough. This variation in habitat is reflected in the number of species recorded (see section 4.54). Figures 21 to 24 show profiles of a section of transects across the site to include the major bottom coverage. A clear distinction can be made between the end of the barrier coral coverage and the start of the lagoon. The transects started from the drop off, descended into the sand trough, then climbed gradually up to the reef crest drop. Beyond this was a rubble and coral pavement zone which gradually gave way to the sand and sea-grass of the lagoon. In the lagoon currents were generally weak and north easterly towards South Water Cut.

31 conch were recorded over the site. The majority of these were recorded in the lagoon the 3 in very shallow water around Carrie Bow and Curlew and 2 in the sand trough between Carrie Bow and Curlew. 14 spiny lobster were present in the area the majority immediately west of Carrie Bow Cay. A number of these were recorded as juveniles. 8 specimens of long-spined sea urchins were observed, five of these on transects 1 and 2.

4.53 Impacts

Litter was reported mainly in shallow water around Carrie Bow Cay and at a single survey dive on the drop off, however a car tyre was reported in the lagoon. Coral damage was widely reported on the reef in the north eastern quarter of the site. There was much boat activity recorded with 15 separate sightings of fishing vessels, 6 of diving boats and 4 other craft.

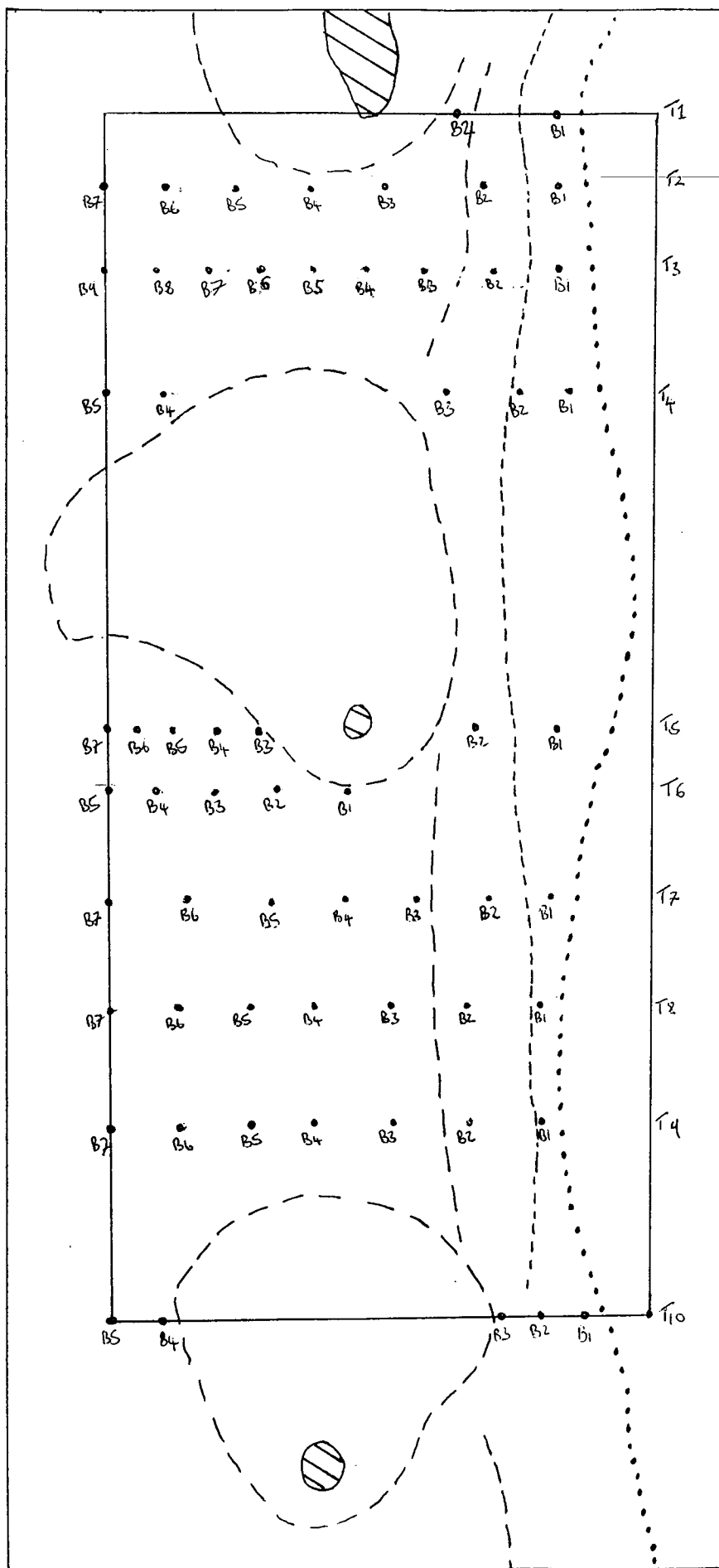
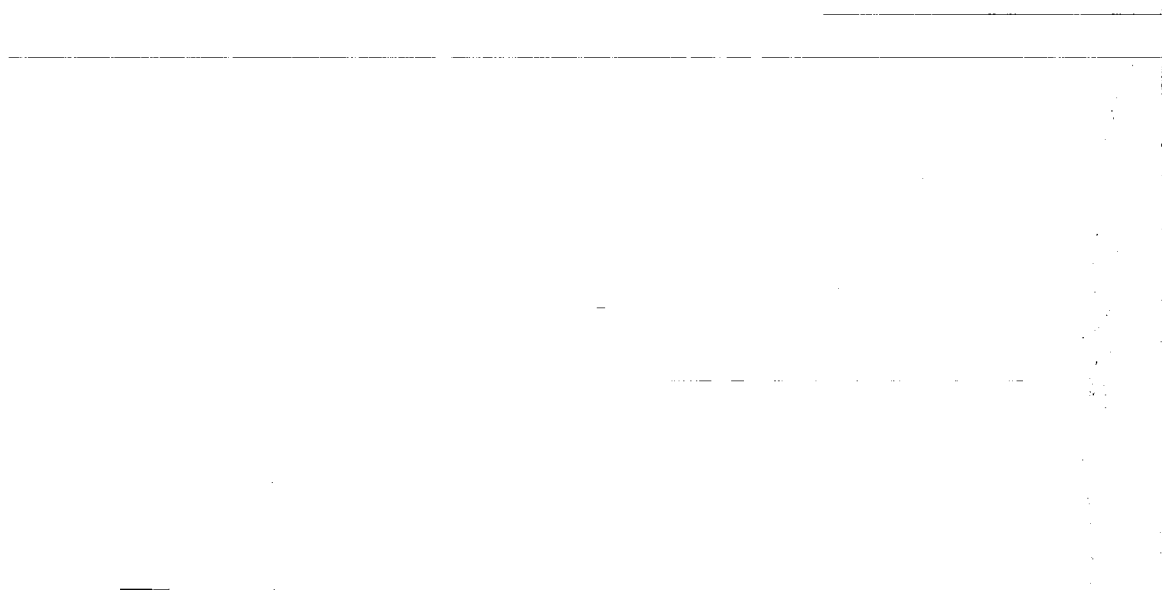
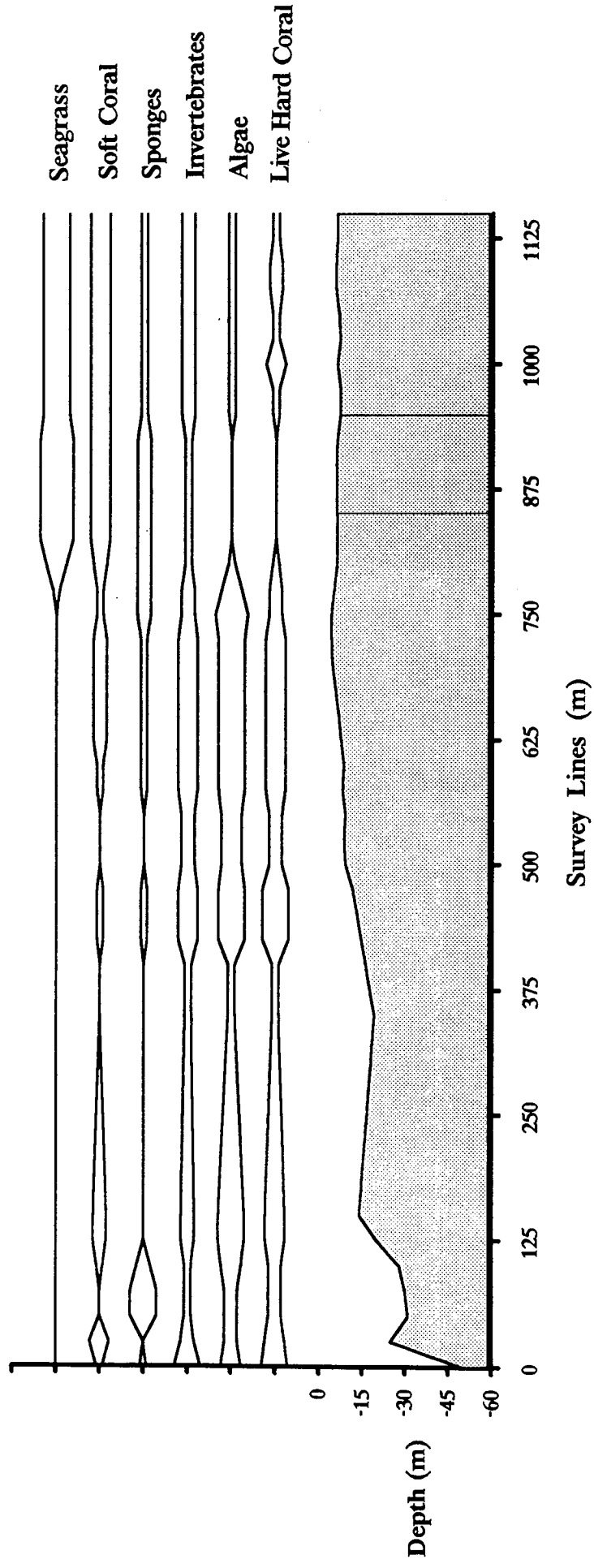


Figure 20 Map showing the location of Site 4

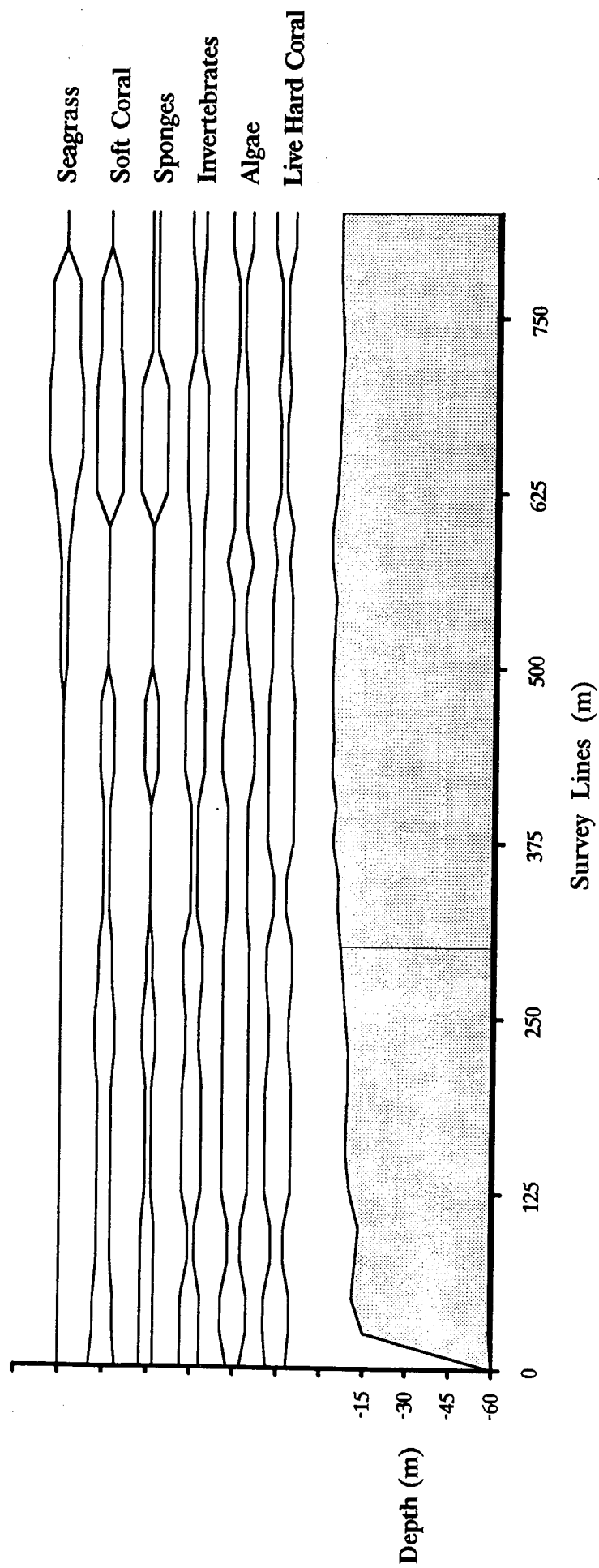
Figure 21-24 **Transects of Site 4 showing bathymetric profile and kite diagrams of bottom cover**



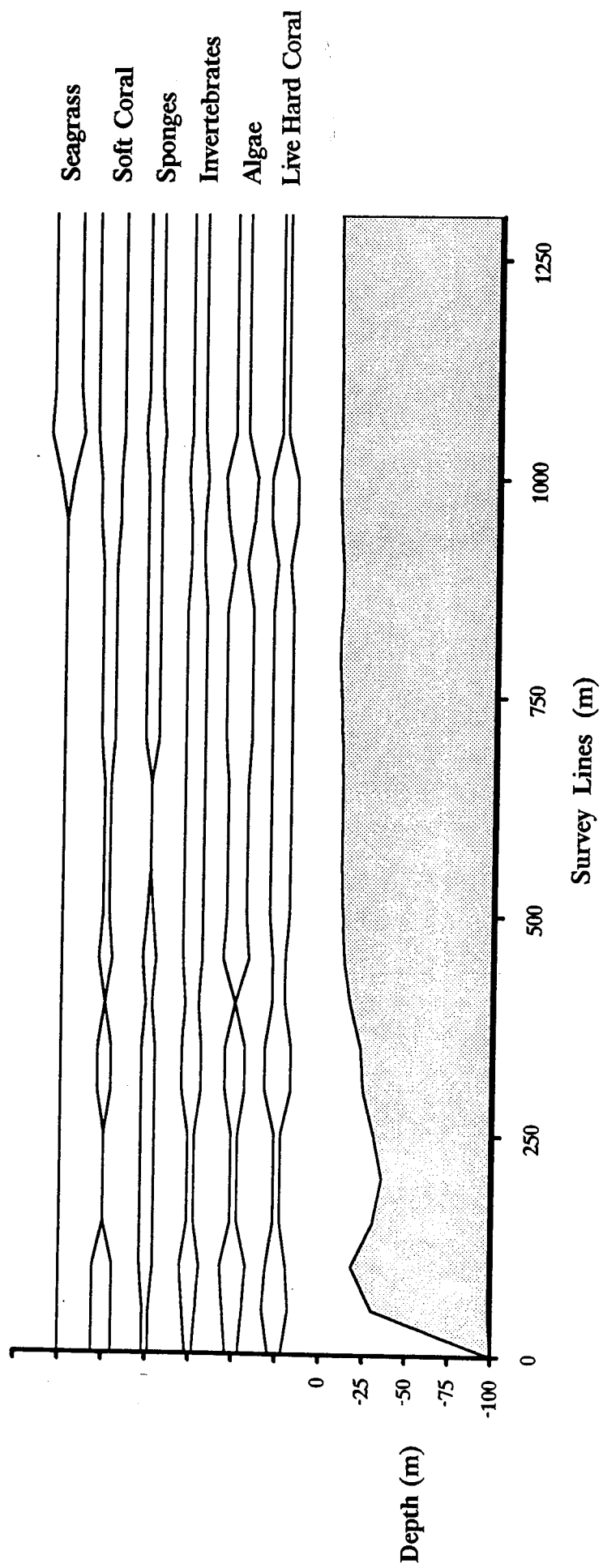
Site Four Transect Two



Site Four Transect Three



Site Four Transect Seven



Site Four Transect Nine

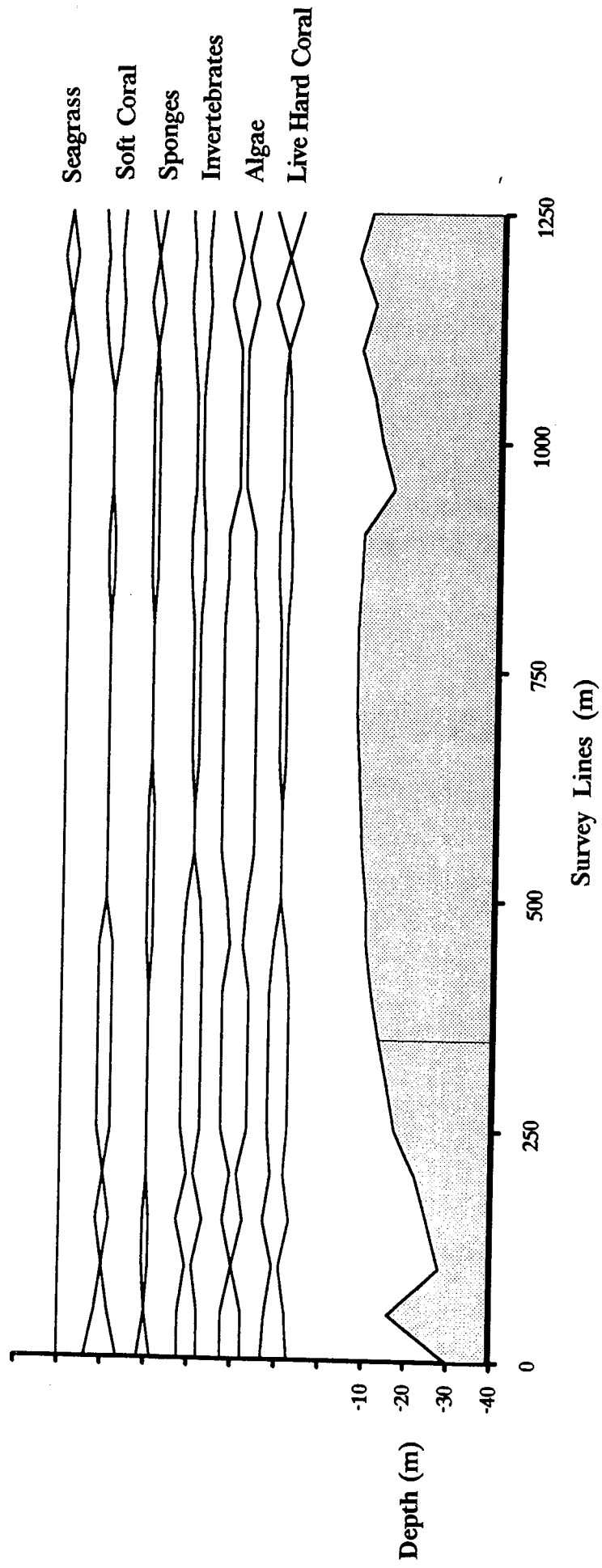




Figure 25

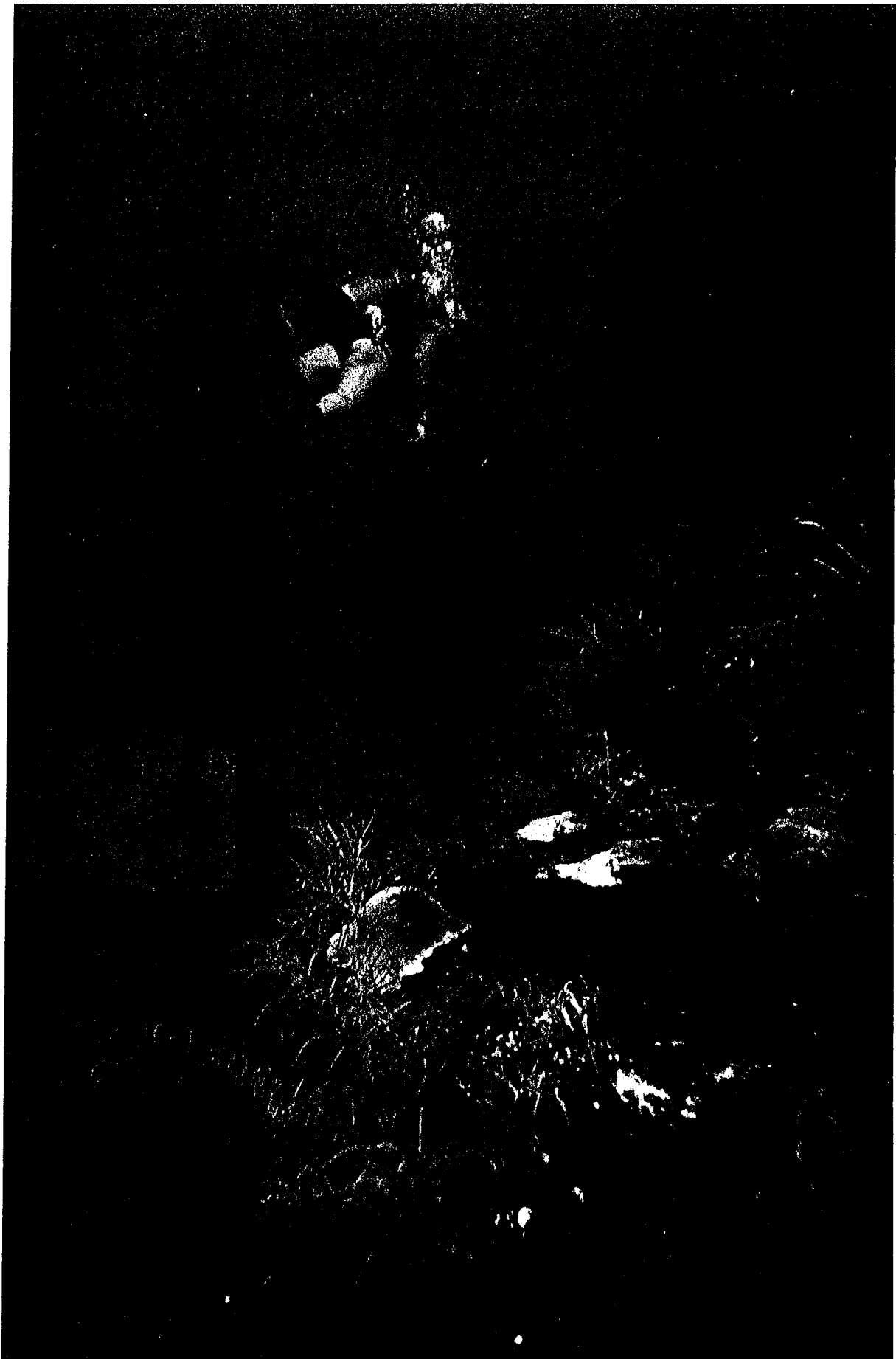


Figure 26

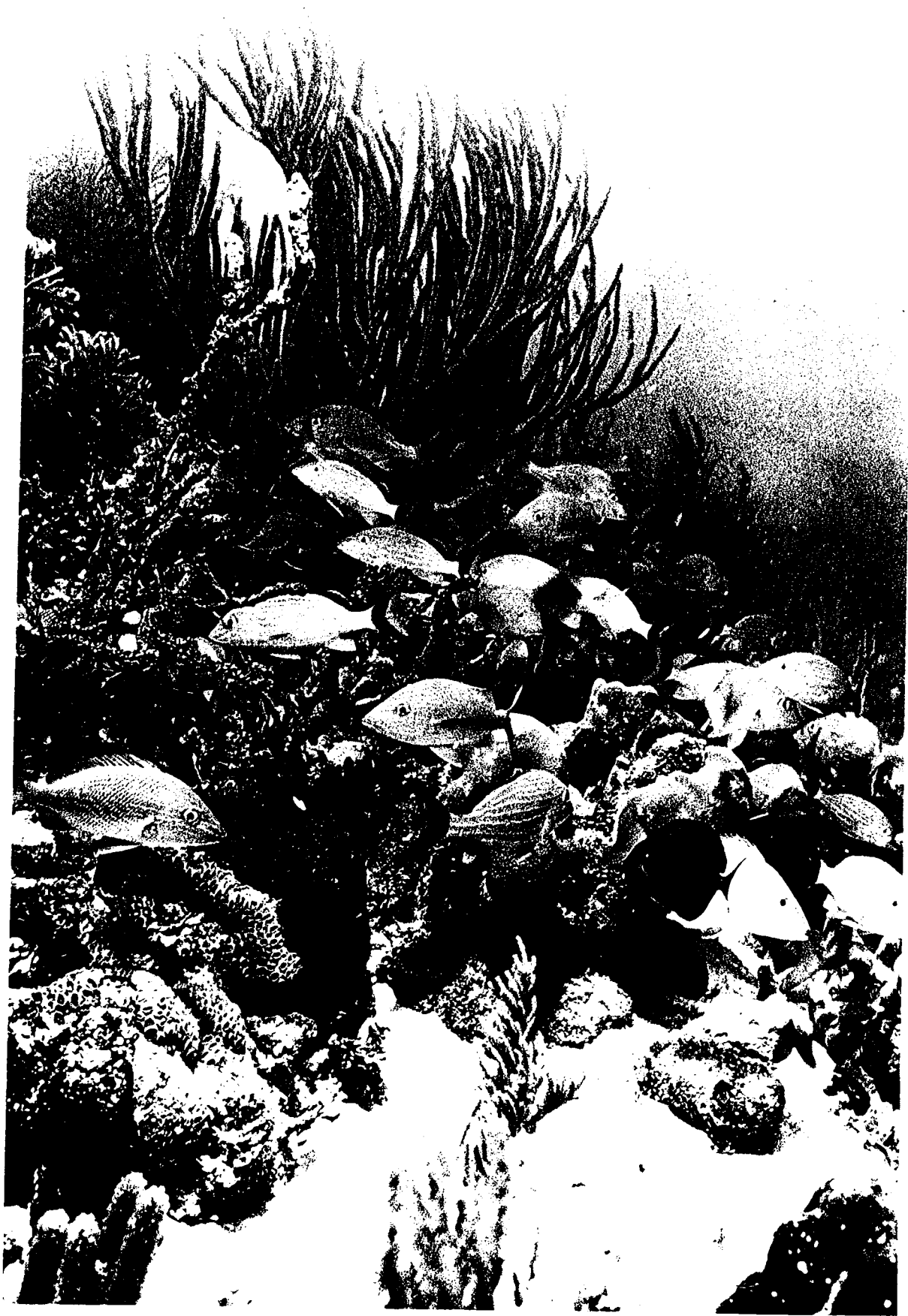


Figure 27

4.54 Species List

<u>Common Name</u>	<u>Latin Name</u>
Hard Corals	Acropora cervicornis Acropora palmata Madracis mirabilis Stephanocoenia michelinii Montastreae annularis M. cavernosa Diploria isophyllastrea Porites porites P. asteroides P. furcata Dichocoenia stokesi D. stellaris Meandrina meandrites Agaricia agaricites Siderastrea siderea Isophyllia sinuosa Mycetophyllia aliciae Millepora alcicornis Plexaura homomalla Pterogorgia citrina Stichopathes lutkeni
Sponges	Mycale laevis Tethya crypta
Algae	Halimeda incrassata H. copiosa H. discoidea H. opunta Udotea flabellum U. cyathiformes Penicillus capitatus P. dumetosus P. pyriformis Rhypocephalus phoenix Ventricaria ventricosa Caulerpa mexicana Acanthophora specifera Syringodium filiforme Champia parvula Lobophora dictiopterus Valonia ventricosa Wrangelia argus Wranglia ordasya Sargassum hystrix Coelothrix irregularis

Soft Corals

Antipathes tanacetum

Anemones

Bartholomea annulata
Condylactis gigantea

Misc. Invertebrates

Spiny Lobster

Panulirus argus

Arrow Crab

Stenorhynchos seticornis

Tube worm

Moon Jellyfish

Aurelia aurita

Peacock worm

Bivalve

Pteria colymbus

Christmas Tree Worm

Spirobranchus giganteus

Brittle Stars

Slate Pencil Urchin

Eucidaris tribuloides

W. Indian Sea Star

Oreaster reticulatus

Crinoids

including *Nemaster rubiginosa*
Cnidaria

Squid

Pen shell Bivalve

Pinnae sp.

Mithrax sp.

Flamingo Tongue

Cyphoma gibbosum

Sea Gooseberry

Stenopus hispidus

Sabellastarte magnifica

Echinometra vindex

Byphora gibbseum

Fish

WRASSE:

Green Razorfish

Hemipteronotus splendens

Clown

Halichoeres maculipinna

Slippery Dick

Halichoeres bivittatus

Yellow headed

Halichoeres garnoti

Green

Blue headed

Thalassoma bifasciatum

Dwarf

Doratonotus megalepis

Creole

Ctepticus parrai

DAMSEL:

Beaugregory

Stegastes leucostictus

Dusky

Stegastes fuscus

Long Fin

Stegastes diencaeus

Cocoa

Stegastes variabilis

Fivespot

Threespot

Stegastes planifrons

Blue chromis

Chromis cyanea

Bicolor

Stegastes partitus

GRUNTS:

Caesar	<i>Haemulon carbonarium</i>
Porkfish	<i>Anisotremus virginicus</i>
French	<i>Haemulon flavolineatum</i>
Smallmouth	<i>Haemulon chrysargyreum</i>
Tomtate	<i>Haemulon aurolineatum</i>
Bluestriped	<i>Haemulon sciurus</i>

PARROT FISH:

Bucktoothed	<i>Sparisoma radians</i>
Green Blotch	<i>Sparisoma atomarium</i>
Princes	<i>Scarus taeniopterus</i>
Striped	<i>Scarus iserti</i>
Redband	<i>Sparisoma aurofrenatum</i>
Redtail	<i>Sparisoma chrysopteron</i>
Stoplight	<i>Sparisoma viride</i>
Yellowtail	<i>Sparisoma rubripinne</i>
Rainbow	<i>Scarus guacamaia</i>

SNAPPERS:

Yellowtail	<i>Ocyurus chrysurus</i>
Grey	<i>Lutjanus griseus</i>
Schoolmaster	<i>Lutjanus apodus</i>
Mutton	<i>Lutjanus analis</i>
Dog	<i>Lutjanus joco</i>

ANGELS:

French	<i>Pomacanthus paru</i>
Queen	<i>Holocanthus ciliaris</i>
Rock beauty	<i>Holocanthus tricolor</i>
Grey	<i>Pomacanthus arcuatus</i>

TRIGGERFISH:

Queen	<i>Balistes vetula</i>
French	
Black Dungeon	<i>Melichthys niger</i>

BUTTERFLIES:

Foureye	<i>Chaetodon capistratus</i>
Reef	<i>Chaetodon sedentarius</i>
Spotfin	<i>Chaetodon ocellatus</i>
Banded	<i>Chaetodon striatus</i>
Long snout	

SURGEONS & TANGS:

Doctorfish	<i>Acanthurus chirurgus</i>
Ocean	<i>Acanthurus bahianus</i>
Blue tang	<i>Acanthurus coeruleus</i>

GOBIES:

Neon	Gobiosoma oceanops
Cleaner	Gobiosoma genie

PUFFER:

Sharpnose	Canthigaster rostrata
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BLENNIES:

Rosy Blenny	Malacoctenus macropus
Blackhead	Emblemaria babamensis
Barfin	Malacoctenus versicolor
Quillfin	Labrisomus filamentosus

GROUPERS:

Tiger	Mycteroperca tigris
Yellowfin	Mycteroperca venenosa
Rockhind	Epinephelus adscensionis
Redhind	Epinephelus guttatus
Nassau	Epinephelus striatus
Coney	Cephalopholis fulvus
Graysby	Cephalopholis cruentata

SQUIRREL FISH:

Longjaw	Holocentrus marianus
Longspine	Holocentrus rufus

HAMLETS & BASSLETS:

Shy Hamlet	Hypoplectrus guttavarius
Indigo Hamlet	Hypoplectrus indigo
Black Hamlet	Hypoplectrus nigricans
Barred Hamlet	Hypoplectrus puella
Blue Hamlet	Hypoplectrus gemma
Tobaccofish	Serranus tabacarius
Fairy Hamlet	

JACKS:

Yellow Jack	Caranx bartholomaei
Blue runner	Caranx crysos
Horse-eye Jack	Caranx latus
Crevalle Jack	Caranx hippos
Bar Jack	
Creolefish	Paranthias furcifer

FILEFISH & TRUMPET FISH:

Trumpetfish	Aulostomus maculatus
Scrawled filefish	Aluterus scriptus
Pipe fish	
White spotted filefish	Cantherhines macroceros
Sand Tilefish	Malacanthus plumieri

BASS:

Harlequin
Lantern

Seranus tigrinus
Seranus baldwini

MISC:

Eagle Ray
Southern Stingray
Spotted Moray Eel
Green Moray Eel
Trumpet Porgy
Jolthead Porgy
Pluma
Bermuda Chub
Spanish Hogfish
Great Barracuda

Aetobatus narinari

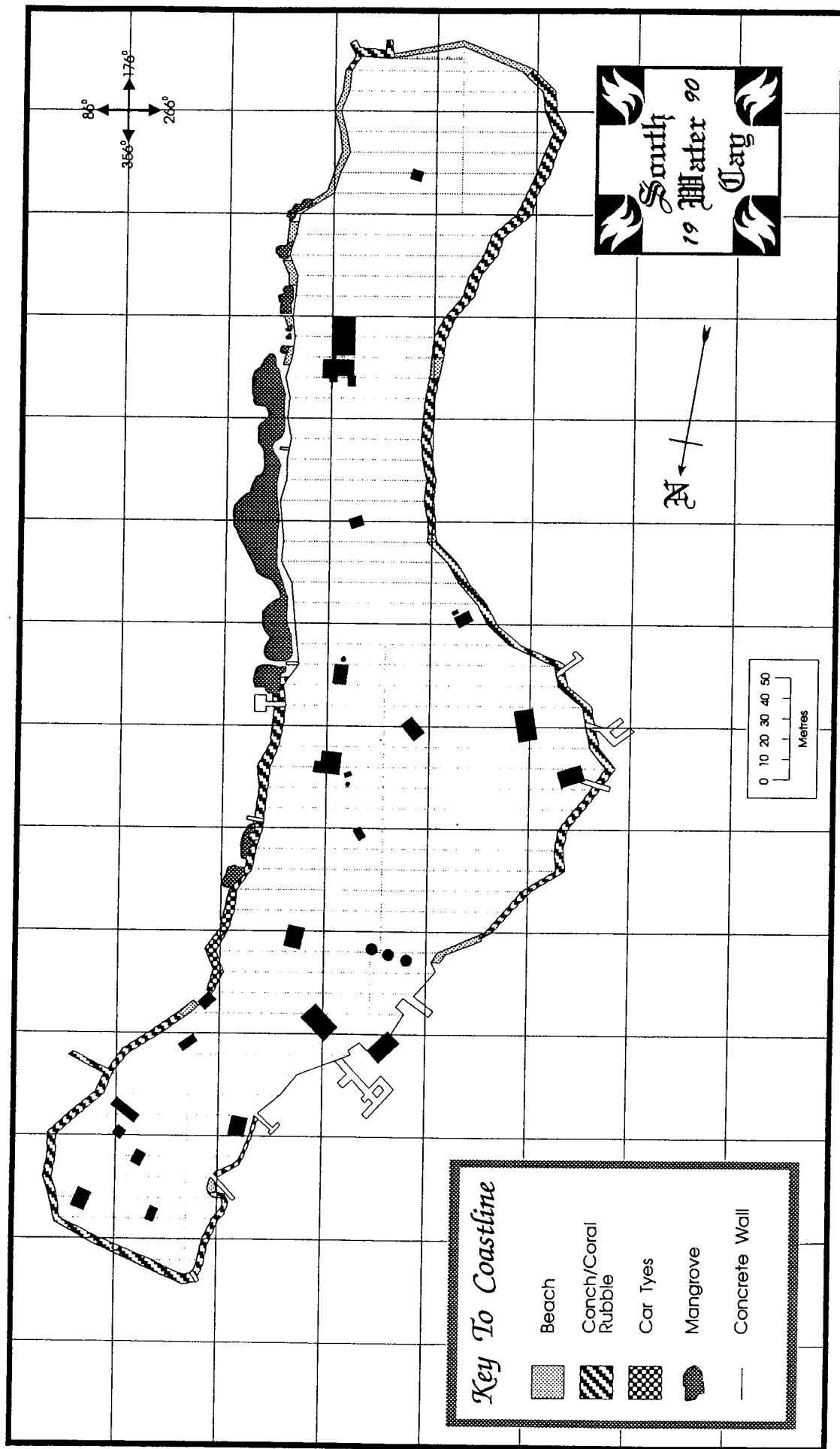
Gymnothorax moringa
Gymnothorax funebris

Calamus bajonado
Calamus pennatula
Kyphosus sectatrix

Sphyrna barracuda

4.6 South Water Cay

In recent years the Northern end of South Water Cay has been extended and a small Hotel, The Blue Marlin Lodge built on the island. In order to assess the status of the flora and fauna, the island was carefully surveyed and the main features carefully mapped. Surveying was done using a sighting compass and 100m tape measure. Figure X shows the main features of the island. The vegetation will be identified and mapped in detail in a future expedition.



5 - COMMENTS

- 1 The survey methods used by CCC provide a useful basis for producing an inventory of marine resources along the Belize barrier reef.
- 2 Assessment of the 'impacts' at a particular site will be particularly valuable in future resource management.
- 3 CCC is now generating large amounts of data which should now be handled by a suitable computer system.
- 4 CCC spot divers in association with satellite imagery would dramatically increase the area that could be covered by CCC divers.

6 - BIBLIOGRAPHY

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7 - APPENDICES

7.1 SPONSORSHIP 1990

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7.2 Bearings For Site Positioning

Bearings Site 1

	Bearing from Mark 1	
	North buoy	South buoy
North end - SWCay	106	080
South end - SWCay	135	107
South end - Twin Cays (last tree)	274	-
Centre - Carrie Bow Cay	153	140
Centre - Tobacco Cay	017	015
Centre - Man O' War Cay	345	-
North buoy	--	025

	<u>Buoy No.</u>							
	1	5	7	11	13	18	20	25
S End - SWCay	135	156	127	155	116	154	110	110
N End - SWCay	105	110	098	080	086	-	080	-
S End - Twin Cays	274	278	279	280	284	288	297	293
Centre - Man o' War Cay	345	339	345	339	345	341	345	340
Centre - Carrie Bow Cay	153	-	154	-	145	170	144	165

Bearings Site 2

Distances between shore marks (leading lights)

Mark	Distance (m)
5	Southern tip SWCay
5 - 10	104
10 - 15	96
15 - 20	94
20 - 25	104
25 - 30	102
30 - 35	(35 = northern tip SWCay)

SWCay Carrie Bow Cay Tobacco Cay Man o' War Cay

Mark	S N	Centre	Centre	Centre
2	275 322	205	006	334
3	278 329	194	010	339
4	273 344	194	009	not vis.
7	265 316	200	005	335
8	256 319	198	010	337
9	255 338	187	012	not vis.
12	259 317	203	004	335
13	256 321	200	003	337
14	235 337	191	010	337
17	242 302	199	007	335
18	236 313	195	004	334
19	Insufficient depth			
22	239 299	198	009	336
23	235 302	197	008	336
24	217 324	189	009	336
27	227 285	195	002	334
28	221 286	196	008	334
29	201 305	186	009	337
32	221 268	195	006	333
33	215 268	193	008	335
34	199 270	185	009	335

Bearings Site 3

	<u>TRANS 2</u>		<u>TRANS 3</u>		<u>TRANS 4</u>	
	B7	B1	B6	B1	B5	B1
Twin Cays N Tip	---	---	015	327	002	320
Twin Cays S Tip 270	287		262	280	150	272
Tobacco Cay Centre	---	020		025 018	023	018
Water Cay N Tip	100	087		105 094	109	105
Water Cay S Tip 115	115		121	124	124	131
Carrie Bow N Tip	133	143		139 148	141	152
Man O' War Cay		---	346	---	---	---

Bearings Site 4

	<u>TRANS 1</u>		<u>TRANS 2</u>			
	B1	B2	B1	B2	B3	B7
Twin Cays N Tip	---	---	---	---	---	327
Twin Cays S Tip ---	---		---	296	302	
Tobacco Cay Centre	345	010	006	009	005	014
Water Cay N Tip	335	343	338	343	---	---
Water Cay S Tip304	297		315	311	052	
Carrie Bow Centre	209	194	216	205	---	---
Carrie Bow N Tip	---	---	---	---	209	147
Man O' War Centre	006	---	---	---	---	---

	<u>TRANS 3</u>				<u>TRANS 4</u>		
	B1	B2	B3	B9	B1	B2	B6
Twin Cays N Tip	---	---	320	---	---	---	---
Twin Cays S Tip 196	297	300	305		301	300	310
Tobacco Cay Centre	355	356	005	---	356	006	---
Water Cay N Tip	341	345	---	010	342	347	010
Water Cay S Tip116	323	324	030		325	330	023
Carrie Bow Centre	---	---	---	150	---	---	127
Carrie Bow N Tip	230	233	220	---	246	250	---
Man O' War Centre	---	---	---	---	---	---	340

	<u>TRANS 6</u>		<u>TRANS 7</u>	
	B1	B7	B1	B7
Tobacco Cay Centre	007	---	005	---
Water Cay S Tip346	019		007	
Carrie Bow Centre	310	070	308	---
Man O' War Centre	---	245	---	343
Wee Wee Cay	238	233	240	235

