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Founder, Presd. The late Dr. HUGO FLECKER.

OBJECTS—The furtherance of the study of the various branches of Natural History and the preservation of our heritage of indigenous fauna and flora.

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By Gwen Holmes, when a student at Trinity Bay High School.

(From a paper presented to the Youth Ecological Seminar of the Cairns Branch of the Wildlife Preservation Society of Queensland, 4.5.72)

"Each Author is responsible for the opinions and facts expressed in his or her article"

BIOLOGICAL SURVEY OF MICHAELMAS CAY

Topography and Physical Conditions.

Michaelmas Cay is situated approximately 25 miles north-east of Cairns on the Great Barrier Reef at 16°36.5' south by 145°59' east. It is a popular tourist charter boat rendezvous, and its under-water wonderland of delicately coloured marine life attracts many visitors.

Lying in an east-west direction, Michaelmas Cay has a length of 1,200 feet and breadth of 160 feet.

My first visit, on 19 December 1971, found the Cay a more or less oval shape with two bays, one facing the outer reef and the other facing Cairns. At low tide, sand flats exposed at both ends with a large area opening out on the Cairns side. Fairly deep water at the other side restricted exposure but further along towards the eastern end patches of live coral dried. It was only at a very low tide that reef exposed at the far eastern end.

Before my second visit, 29 January 1972, cyclone Althea had caused seas to become moderate to rough and south-east to north-east winds to blow at gale force speed. These unusually high winds and seas combined with nine feet high tides had caused dramatic changes in the shape of the Cay and the area surrounding it — showing how unstable coral cays are during cyclonic conditions.

On this visit, the only familiar sights were a row of three parallel rocky out-crops facing Cairns on the eastern end, a six feet high post half way up the beach, and the birds. Now the Cay had built up two horns facing in a south-east direction and curving into two bays which then formed a point in the centre. Low tide revealed other changes. Part of the original sand flats at either end had been covered by the sand forming the horns, the eastern end being the most changed. Now large expanses of live coral and reef were exposed with no sand except at the extreme edge of the Cay. Cairns side lay mostly under water except in the immediate vicinity of the rocky out-crops where there was rubbly sand merging into the live reef. Winds had caused the edges of the Cay to become quite steep and eroded, with some plants being uprooted. Approximately half the total area of Michaelmas at about half tide is covered with vegetation.

(A subsequent visit, 9 August 1972, found the shape of the Cay had again changed considerably. See sketch maps.)

No weather reports specific to Michaelmas Cay could be obtained. The closest available were from Cairns, with the average annual rainfall being about 70 inches, the mean minimum temperature 57°F. and the mean maximum 85°F. Soil samples from various parts of the Cay revealed a pH of 5.5-6, which is the same as for the surrounding sea water. In areas where birds were nesting, organic wastes were evident. Relevant winds are mainly from the south-east to north-east directions.

An established fact concerning the development of the Great Barrier Reef is that reef building corals cannot flourish below about 30 fathoms or 180 feet, where penetrating daylight can no longer maintain plant life. The sinking of an experimental bore through Michaelmas Reef in 1928 found no semblance of basic rocks to a depth of 600 feet, only calcareous material. Two reasonable explanations are popularly accepted. One is the gradual subsidence of the shallow sea floor and the other is based on slow changes in the level of the ocean waters with which the upward growth of the coral banks has kept pace.

Collection of Data, and Results

My first visit to the Cay was for a twelve inch tide at 4.10 a.m. on Sunday 19 December 1971. Light westerly winds were blowing and seas were smooth to

slight. On my second visit, for a nine inch tide at 3.48 a.m. on Sunday, 30 January 1972, the winds were 10-15 knots and the seas slight, with showers in the vicinity.

Species recorded and collected from the Cay are listed below. Where possible, the scientific as well as the common name is included. I have seen or collected some 300 different species of flora and fauna during my two visits, leaving no doubt as to the great diversity of life which may be found if more time were available.

LIST OF SPECIES RECORDED

PHYLUM ARTHROPODA.

Crabs (Class Crustacea): *Hapalocarcinus marsupialis* (Gall Crab) *Dardanus megistos* (Hermit Crab) *D. deformis* (Hermit Crab) *Ocypode ceratophthalma* (White Ghost Crab) Purple Ghost Crab *Atergatus floridus* (Shawl Crab) various reef species.
Crayfish: *Panulirus longipes* (Painted Spiny Lobster) *Stenopus hispidus* (Banded Coral Shrimp) various reef prawn.
Insects (Class Insecta): Various species around vegetation on Cay various species around reef.

THE WORMS.

Platyhelminthes or flatworms: *Euborlasia quinquestriata* (Ribbon Worm).
Annelid or Ringed Worms: *Spirobranchus giganteus* (Coral Worm) *Terebella* (Sand Tube Worm) *Eurythoa complanata* (Salmon Bristle Worm) ½" long bristle worms in sand.

PHYLUM PROTOZOA

Foraminifera: *Alveolina Baculogypsina Calcarina Polystomella*.

PHYLUM PORIFERA

Phyllospongia foliascens (Cup Sponge) *Tethya* (Orange Sponge)

PHYLUM ECHINODERMATA

Starfish: *Protoreaster nodosus* (Rhinoceros Starfish) *Linckia laevigata* (Blue Starfish) *Laganum depressum* (Sand Dollar) *Nardoia novaecaledoniae* *Acanthaster planci* (Crown-of-Thorns Starfish) *Turbinaria ornata* (star in weed washed up on beach).

Sea Urchins: *Heliocidaris erythrogramma* (Black-spined Urchin) *Tripneustes gratilla* (White-spined Urchin) *Breynia australisae* (Sand Urchin)

Brittle Stars: *Ophionereis schayeri* *Ophiarachna incrassata*.

Beche-de-mer or Trepang:

Holothuria feucospilata (Black Cotton Spinner) *H. argus* *Stichopus chloronotus* (Dark green Spined Trepang) *S. variegatus*.

PHYLUM COELENTERATA

True Reef Coral (Scleractinia): *Acropora Humilis* (Stag-Horn) *A. hyacinthus* *Fungia actiniformis* (Mushroom) *F. fungites* (Slipper) *Platygyra lamellina* (Brain) *Goniopora tenuidens* *Porites lutea* *Echinopora lamellosa* *Goniastrea pectinata* *Seriatorpora conferta* *Lobophyllia Montipora*.

Soft False Corals (Alcyonaria): *Tubiphora musica* (Organ Pipe Coral) *Xenia elongata* *Sarcophyton trocheliophorum* *Sinularia Labophyllum pauciflorum*.

Stinging Coral (Hydrozoa): *Millepora platyphylla*.

Anemones (Actinaria): *Pelythoa caesia* (Colonial Anemone) *Calliactis miriam* *Physobranchia ramsayi*.

Jelly-fish: *Physalia physalis* (Portuguese Man-o'-War, Blue Bottle).

PHYLUM MOLLUSCA

Bubble Shells (Fam. Bullidae): *Ampulla bulla* (Pacific Bubble) *Hydatina physis* (Rose Petal Bubble)

Helmet Sheels (Fam. Cassidae): *Cassis cornuta* (Giant Helmet) *Casmaria ponderosa* *Casmaria erinacea*.

Ceriths (Fam. Cerithiidae): *Cerithium nodulosum* (Giant Knobbed Cerith) *C. cumingi* *C. fasciatum* *Rhinoclavis vertagus*.

Cones (Fam. Coniidae): *Conus textile* (Cloth of Gold Cone) *C. imperialis*

(Imperial C.) *C. ammiralis* (Admiral C.) *C. magus* *C. imperator* (Emperor C.)
C. generalis (General C.) *C. flavidus* *C. capitatus* (Captains C.) *C. miles*
(Soldier C.) *C. tessulatus* *C. marmoreus* (Marble C.) *C. aulicus* (Court C.)
C. sanguinolentus *C. omaria* (Pearl C.) *C. eburneus* (Ivory C.) *C. virgo* (Virgin C.)
C. coronatus (Crowned C.) *C. litteratus* (Letter Marked C.) *C. saturatus* (Stinging C.)
C. lividus (Livid C.) *C. episcopus* *C. arenatus* (Sand Grained C.) *C. pulchricornis*
C. frigidus *C. distans* (Distant C.) *C. vexillum* (Flag C.) *C. nussatella* *C. striatus*
(Striated C.) *C. leopardus* (Leopard C.) *C. quercinus* *C. rattus* (Rat C.) *C. catus*
(Cat C.).

Cowries (Fam. Cypraeidae): *Cypraea annulus* (Ringed Money, Gold Ringer Cowrie)
C. vitellus (Pacific Deer, Milk Spotted C.) *C. moneta* (Money C.) *C. cribraria*
(Sieve C.) *C. arabica* (Arabian C.) *C. tigris* (Tiger C.) *C. errones* (Wandering C.)
C. erosa (Eroded C.) *C. isabella* *C. carneola* (Orange-banded C.) *C. caurica*
C. eglantina *C. staphylaea* (Pustulose C.) *Ovula ovum* (Egg Cowrie) *Calpurnus*
verrucosus (Little Warty Egg Cowrie).

Band Shells (Fam. Fasciolaridae): *Peristernia australiensis*.

Abalones (Fam. Haliotidae): *Haliotis asinina* (Asses Ear) *H. varia*.

Mitre (Fam. Mitridae): *Mitra mitra* (Giant or Episcopal Mitre) *M. sophaea*
Neocancilla papilio (Butterfly M.) *Cancilla filaris* *Swainsonia casta* (Gaste M.)
S. olivaeformis (Olive shaped M.) *Vexillum exasperatum* *V. plicarium* (Plicate M.)
Imbricaria conica (Common Imbricaris M.) *I. punctata* *Pterygia conus* (Cone
Mitre).

Murex (Fam. Muricidae): *Murex brunneus* (*Aolustus Murex*) *Transtrafer longmani*.

Olives (Fam. Olividae): *Oliva erythrostoma* (Red Mouth Olive) *O. episcopalis*
(Purple Mouth O.) *O. tessellata* (Tessellated O.) *O. annulata* (Annulated O.)
O. miniacea *O. carneola*.

Strombs, Spiders (Fam. Strombidae): *Strombus mutabilis* (Mutable Stromb) *S.*
variabilis (Variable S.) *S. lentiginosus* (Freckled, Silver S.) *S. aurisdianae* (Diana's
Ear S.) *S. gibberulus* (Hunch-back, Humped S.) *S. luhuanus* (Luhu, Red Mouth,
Blood Mouth S.) *S. bulla* (Bubble Conch) *S. erythrinus* *Lambis lambis* (Common
Spider) *Terebellum terebellum*.

Auger Shells (Fam. Terebridae): *Terebra cerithina* (Waxen Auger) *T. crenulata*
(Crenulated A.) *T. chlorata* (Yellowish A.) *T. affinis* *T. aerolata* (*Muscaria* A.)
T. dimidiata (Divided A.) *T. nebulosa* *T. guttata* (Eyed A.) *T. maculata* (Spotted
or Marlin-spike A.) *T. felina* (Tiger A.) *T. subulata* (Subulate A.) *Hastula lanceata*
(Lanced A.) *Hastilina casta*.

Top Shells (Fam. Trochidae): *Trochus maculatus* *Angeria delphinus*.

Vase Shells (Fam. Vasiidae): *Vasum turbinellum* (Pacific, Spiky Vase).

Volutes (Fam. Volutidae): *Cymbiolacca wisemani* (Wiseman's Volute)

Aulicina rutila (Blood-red Volute) *Melo amphora* (Bailer) *Amoria maculata*
(Carols Volute).

Clams (Fam. Tridacnidae): *Tridacna gigas* (Giant Clam) *T. crocea* *T. noea* (Fluted
Giant Clam) *T. maxima* (Reef Clam) *Hippopus hippopus* (Horse-hoof Clam).

Other Bivalves: *Lioconcha castrensis* (Tent Marked Venus Shells) *Lentillaria*
paytenorum *Frogum unedo* (Strawberry Cockle) *Periglypta reticulata* *Promantellum*
parafragile (Swimming File Shell)

Seahare (Fam. Aplysiidae): *Aplysia dactylomela* (Spotted Hare) *Triangular shaped*
seahare.

Chiton (Class Amphineur): *Acanthozostera Gemmata*.

Nudibranches: Various species.

Octopus (Class Cephalopoda): Apricot and light blue octopus

PHYLUM CHORDATA

Fish: *Cephalophalis miniatus* (Trout) *Ephinephelus lanceolatus* (Grouper)
Lutjanus sebae (Red Emperor) *Lutjanus fulviflamma* (Moses Perch) *Lethrinus*
nebulosus (Spangled Emperor) *L. chrysostonus* (Sweet Lip) *Caranx emburyi*
(Turrem) *C. gymnostethoides* (Bludger) *Scomberomorus queenslandicus* (Mackeral)
Mugil cephalus (Sea Mullet) *Caramloides letieaudis* (Trevally) *Lates calcerifer*
(Giant Perch) *snapper barracuda chinaman maori wrasse* various cod shark
Hemiscyllium ocellotum (Epaulette Cat Shark) *Dacysyllus* (Humbug Fish) *Synanceja*
trachynis (Stone Fish) various tropical fish.

Reptiles: Various sea snakes, turtles.

Birds: *Larus novae hollandiae* (Silver, Sea Gull) *Sterna bergii* (Crested Tern) *S. bengalensis* (Lesser Crested Tern) *S. anaetheta* (Bridled Tern) *Anous stolidus* (Greater Noddy).

PHYLUM THALLOPHYTA

Seaweeds: Reef-binding pink and grey-green algae blanket weed kelp Genus *Lithophyllum/Porolithon* *Hormosira banksii* (Neptune's Necklace) *Padina gymnospora* (Brown Cup Seaweed) *Phyllospora comosa* (Bubble Weed) *Ulva lactuca* (Sea Lettuce) coralline seaweeds.

Plants: Family *Zygophyllaceae* (creeper forming clumps on ground, yellow flowers prickly 5-sided seed case).

Sesuvium portulacastrum (succulent stems, waxy leaves, tiny purple flowers) Family *Aizoaceae*, probably Genus *Mollugo* (Pig-face). Two other unidentified plants and two types of grasses. Mangrove seeds and plant of *Avicennia*. *Thalassia australis* (dugong-grass)

Discussion

There are three main different habitats around Michaelmas: 1. Live reef and coral rocks; 2. Coral rubble areas; 3. Sand flats.

1. The reef derives its name from the most common form of fauna - the corals. Corals belong to Phylum *Coelenterata* and consist of true reef or stony corals, i.e. those with calcareous skeletons, and those predominately without skeletons, the soft corals. Organ pipe coral, *Tubifora musica*, is a soft coral with a skeleton and is one of the two corals known whose skeleton retains its colour indefinitely. Its polyps, when expanded, completely cover the skeleton. Stony corals, e.g. brain and staghorn corals, are mainly found with the soft corals in the reef areas. Soft corals are also found in the rubbly areas.

Some shell inhabitants of the reef area, e.g. cones, spiders and strombs, are covered in periostracum or coral growths - an extremely effective camouflage adapted to their habitat. Cowries have their glossy shells covered by a fleshy protective mantle. They are found mostly away from direct sunlight, although some, e.g. *Calpurneus verrucosus*, are found on their coelenterate hosts effectively camouflaged. Other reef dwellers such as star fish, sea hares, sea cucumbers of *beche-de-mer*, octopus and crabs are found fully exposed at low tide, or in sandy pools amongst the reef, where there are also many varieties of small colourful tropical fish. Bristle worms and flat worms are common in sandy patches and pools. Small clumps of dead coral scattered everywhere along the reef appear uninteresting at first, but they will generally reveal a teeming mass of marine fauna when turned over. In contrast to the dead brownish upper surface of the boulder, the under side in nearly every case will show an assemblage of colour. Bryozoans, egg masses of moluscs, sponges, algae, sea urchins, brittle stars and worms are a few of the life forms beneath these boulders. Such boulders must be turned back again. It is impossible to shell out a reef, as export figures confirm, but it is very easy to destroy a reef within a short time by not returning the coral heads to their original positions.

2. In contrast, the rubbly areas have few inhabitants. Fauna such as cones, strombs, ceriths, star fish, sea cucumbers, sea urchins, crabs, octopus and others are found. Octopus occupy a so-called nest in some convenient cavity it clears for itself in the surface of a coral bank. Such sites may have a low crater-like mouth with the margins comprised of small debris which often includes empty bivalves.

3. On the sand flats, periostracum free shells such as augers, cones, mitres, volutes and olives are found in characteristic marks and tracks left by the shells as they search for food. On my first visit to the Cay there was evidence of many sand shells, most common being the red and white Mitre mitre, which were all about two inches long. However, due to the dramatic changes in the geography of the Cay which could have affected both food and habitat, these shells were rare in January. At low tides, especially during the night tides, the beaches surrounding Michaelmas become alive with ghost crabs exhibiting white and purple nippers. Many small bristle worms approximately half an inch long are found in the sand, which consists of broken corals, shells and other materials.

During the last two to three years I have collected five Crown of Thorns starfish, *Acanthaster planci*. One of them on my first visit to Michaelmas in December. However I found none in January. A pair of banded sea shrimps, *Stenopus hispidus*, was found on my second visit,

A small Portuguese man-of-war was washed up on the Cay. Carried by the northern branch of the warm South Equatorial Current, these normally pelagic free floating blue colonies of coelenterates are swept up the Queensland coast, along the outer Barrier Reef. Strong south east winds drive them on to northern beaches especially during summer.

Sea hares of Genus *Aplysai* have an elongated foot and a pair of lateral lobes, the parapodia, on the back. By separating these, the outline of the fragile internal shell can be seen, transparent and almost flat, with only a suggestion of a loose spiral. In nudibranches, the colourful sea slugs, there is no shell at all. When disturbed, sea hares and their relatives eject a purple fluid which rapidly colours the surrounding water, acting like a smoke screen against predators. Sea hares have two pairs of head appendages: a pair of cephalic tentacles and dorsally behind them another pair, known as rhinopore, which are highly sensory organs. A more or less triangular-shaped sea hare was found which exhibited the two pairs of head appendages, reduced parapodia, and a fairly deep-set shell. Two of this species were found joined together, the anterior end of one joined to the posterior of the other. It is known that these organisms are hermaphrodite, i.e. possessing both male and female organs, but these may only function if specimens are solitary in the breeding season.

Feeding habits are related to the habitats and the types of food eaten by the animals. Herbivores consist of: detritus feeders - those feeding on plant material sifted from the sand; filter feeders - those filtering microscopic plants and animals from the sea water; browsers - those rasping plant material off the rocks. Carnivores consist of predators and scavengers.

The earliest molluscs are believed to have fed on fine organic particles gathered from the sea floor by means of a rasp-like structure called the radula, situated in the floor of the mouth. Variously modified, the radula is still an important feeding organ in most modern gastropods. Some, e.g. cones, volutes, murex and augers, have their radula teeth reduced to one or three per row and specialised for killing prey. All cones produce venom in a long coiled secretory duct which opens into the proboscis and has a muscular venom storage sac at its inner end. The radula is greatly modified and consists of a series of hollow barbed shafts which are pushed, as required, into the proboscis cavity where they are bathed in venom. The proboscis itself is very elastic and can be extended out of the mouth for a distance about equal to the shell length. It can "feel" around, and when its tip touches a victim, the shaft is thrust into the body and embedded there. Retraction of the proboscis then pulls the prey inward and the venom, a powerful neurotoxin, subdues it before it is swallowed whole. In some fish-eating species, the mantle and indeed the whole body of the cone can be expanded to swallow prey as much as twice the size of the cone. Murex shells drill holes in the shells of their prey by the joint action of a rotating radula and acid secretions from a gland in the floor of the mouth. Abalones and trochus shells have a simply structured radula consisting of a flexible chitinous strip bearing many transverse rows of cusps or teeth, which is rubbed over their food.

Nudibranches or naked gilled sea-slugs and flatworms relish the nematocyst-laden tissue in sea anemones. Remarkably, they do not suffer any ill effects from the stinging capsules, which they are able to transfer through their own digestive tracts to their tissues without discharging. The animals then knowingly use them for their own defence and food catching. Flatworms envelop their food by wrapping themselves around and excreting a mucus over the victim. A funnel-like pharynx is then extruded through the mouth on the under side of the body and the food is digested before it is swallowed.

In sea urchins and sand dollars, the mouth, which is on the under side, is surrounded by five strong teeth or jaws supported in a most complex apparatus known as Aristotle's Lantern. These herbivorous animals use these powerful jaws to scrape the algal film off the rocks.

Starfish pull open bivalves by working their hundreds of tube feet in relays to tire the shells' closing muscles. As the bivalve opens, the starfish extrudes its stomach to envelop and digest the soft parts exposed.

Some beche-de-mer are plankton feeders, trapping the small organisms on tentacles around the mouth. Others swallow great quantities of sand from which they extract microscopic particles of food. Sea hares also do this and dissection reveals lengths of sand filled intestine.

Many symbiotic, predatory, and commensal relationships exist between the various fauna. A commensal or one-sided association is that of the anemone, *Calliactis miriam*, which attaches itself to the shells of hermit crabs, thus sharing the food and gaining a means of locomotion. The cowrie, *Calpurnus verrococus*, is always found in association with the alcyonarian or false coral on the polyps of which it feeds. Pairs of the banded coral shrimp, *Stenopus hispidus*, are found in pools with their white antennae waving in the water to attract fish, which remain still while the shrimps pick at the parasites, injured tissue and fungal growths on their bodies and fins. Under natural conditions of territoriality, the ghost crabs with white nippers and those with purple nippers are fairly harmonious neighbours with each staying close to its burrow. However, when placed together in a bucket for a few hours, the white crab will leave the purple crab devoid of both legs and nippers.

The vegetation on Michaelmas Cay forms a covering about one and a half feet deep over part of the top of the Cay. Of the seven genera of plants, all are herbs, i.e. small, green and non-woody, and all are Halophytes, i.e. able to survive high salt concentrations in the surrounding sand. A general characteristic of the vegetation is the fleshy water-storing leaves and stems. To survive the harsh conditions, some plants are ephemeral annual or they have a thick water-storing tap root. In December-January three of the plant genera had all stages in the development of flowers, while two others showed no sign of reproduction. One of the two types of grasses had young plants in the vicinity with the seeds still attached to the fibrous root systems. A plant with a thick tap root was the most affected by the cyclonic winds and seas and a month later they were still being washed about by the tides. Also washed onto the Cay by the south east winds and currents were coconuts and numerous types of mangrove seeds, including *Avicennia* which I had not previously seen so far from the coast. Several mangrove seeds had germinated and died, while one had grown to 16 inches before dying. A coconut palm in the centre of the Cay had grown to a height of 3 feet before it died.

Various types of sea weeds I had not seen on the exposed reef were washed up on the Cay, with many small molluscs mixed up in it. An orange floating sponge of *Phylum Porifera* was also washed up. Other natural debris deposited along the high water mark at all times of the year includes cuttlefish shells, drift wood, pumice stone, dead coral and shells. The tides also bring rubbish from passing boats; boxes, shoes, light bulbs, bicycle tyres; while visitors leave the Cay untidy with bottles, tins and plastic containers.

An important ecological fact observed in January was the succession of blanket weed over the rocky outcrops on the eastern end facing Cairns - the first time I had seen blanket weed growing around Michaelmas. The weed had a rotten stench and could be pulled off the rocks in long strips.

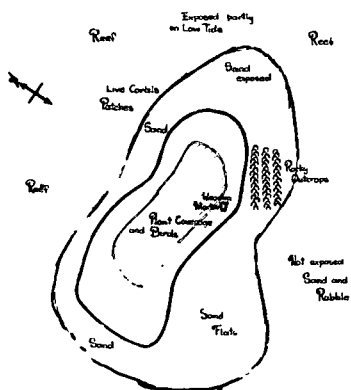
Always present at Michaelmas are the many thousands of birds: terns of several species, noddies, and the aggressive silver gulls which eat the eggs of the other birds when they fly off to fish. No eggs of the silver gull were noticed. Birds, nests and eggs were everywhere. The nests usually just a shallow depression,

with a single egg. Territorial instinct in the breeding birds is very strong. All day and night birds fly around above the Cay, noisy the whole time.

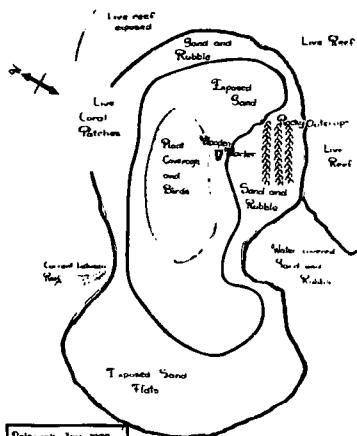
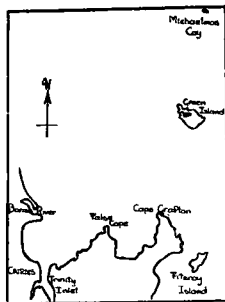
Michaelmas Cay is under the protection of the "Fish and Oysters Acts, 1914 and 1945", which provide authority for the control and protection of fisheries, corals and other forms of marine life. However, bills should be extended to protect the Cay from littering and abuse by irresponsible visitors.

Conservation of the sea is not quite the problem it is on land. Populations of most marine animals are extremely resilient and recover quickly after disaster. The majority of reef life in shallow water lives also in deeper waters. Thus if a reef or sand cay becomes "fished out", it will probably be repopulated from deeper water if left for a few years, and provided it is free from pollution or other changes.

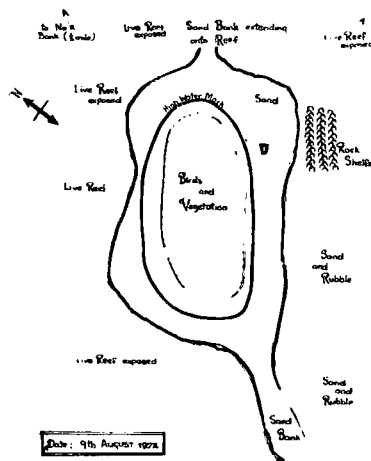
On the basis of this report alone, Michaelmas Cay and the surrounding reef stand as an area of much interest in every sense. Its intrinsic scientific and aesthetic values are important assets. Therefore I strongly stress that the area should not be subject to man-made alteration or interference without careful consideration of the ecological consequences which may result.



Date: 18th Dec. 1971



Date: 19th Jan. 1972



Date: 9th August 1972