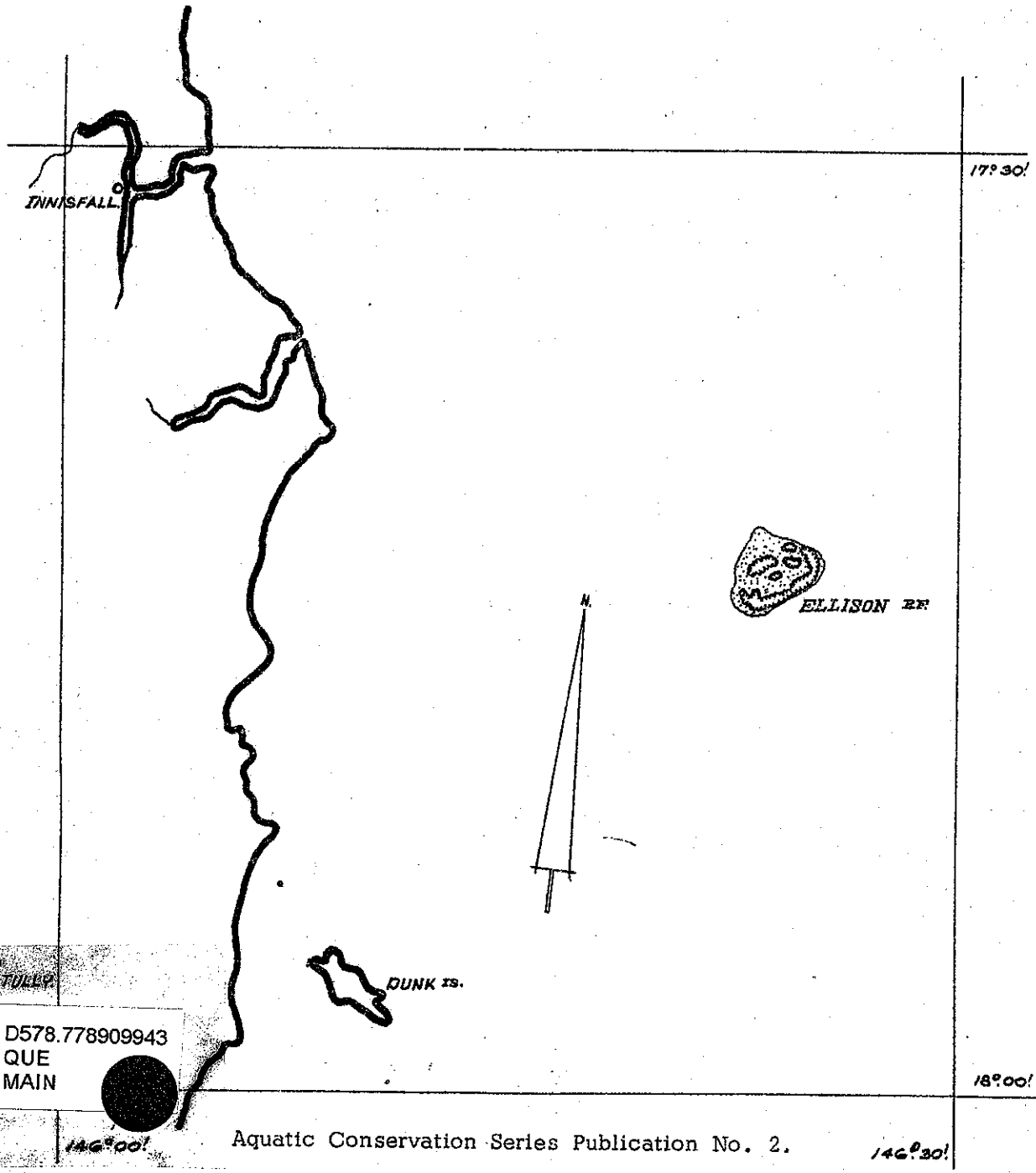
The Queensland Littoral Society

ELLISON REEF REPORT

MARCH 1968



A BIOLOGICAL SURVEY OF ELLISON REEF, NORTH QUEENSLAND

By

The Queensland Littoral Society

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I Introduction

This report is the result of a survey of Ellison Reef undertaken by the Queensland Littoral Society during 29th Oct. - 2nd Nov., 19th and 23rd Nov., 1967. The Socicty feels that the survey is of importance in view of the fact that an application to mine coral sand and rubble from Ellison Reef has been lodged with the Queensland State Department of Mines.

Under the Queensland system, applications to mine are granted by the Queensland Minister for Mines on the recommendations of a Mining Warden's Court. Such a court was convened at Innisfail during Sept. and Nov. 1967 for the purpose of hearing objections to the granting of the Ellison Reef lease, and the Mining Warden's decision not to recommend the granting of the lease was handed down on Dec. 8, 1967. However, at this time of writing, the Queensland Minister for Mines (The Rt Hon. R.E. Camm) has not yet announced his decision.

II Sponsors

The Society wishes to thank the following for their coöperation, financial support and encouragement:-

The Wildlife Preservation Society of Queensland

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J. and A. Büsst of the Innisfail Branch of the Wildlife Preservation Society of Queensland

Mr. Eric McIlree of Dunk Island

The Underwater Adventurers' Club of Queensland

Numerous private individuals

III A General Description of the Reef and the Survey

(a) The Reef

(See cover map of this report - from Admiralty Chart No. 2349.)

Ellison Reef, 146°24' E and 17°43' S, is situated between the outer barrier and the continental shore, approximately eighteen miles E.S.E. of Mourilyan Harbour, near Innisfail, and occupies a fairly extensive area approximately four nautical miles long and two and a half wide at its widest point. It is oval in shape, running N.E. to S.W. and is surrounded by from 33 to 44 meters of water. Like the majority of patch reefs from Hinchinbrook Island to Cairns, it forms a solid coral rampart exposed only at low tide on the eastern and south-eastern faces. The remaining areas consist of a shallow bank gradually deepening to the north and west, with numerous and extensive smaller patch reefs forming irregular northern and western faces, and with huge and spectacular coral "bommies" further out in deeper water. Many of these growths are up to eleven meters high and are barely covered at low tide. In deeper water, "bommies" four to six meters high have been detected with an echo sounder in depths of about 24 meters.

(b) The Survey

The areas surveyed are illustrated approximately in the sketch map (Fig. 1).

The team arrived at Location 1 on Ellison Reef shortly after noon on Sunday, 29th October, 1967. Each of the survey team members then spent over three hours carrying out underwater observations.

On the following morning the boats were moved to Location 2. The topography of the northern end of the eastern face of the reef was examined by echo sounding, after which the team entered the water about noon to begin underwater observations. Weather conditions were ideal and underwater visibility was from twenty-five to forty feet.

On the following day a transect line was run out 800 meters from the reef crest to a depth of twenty-two meters of water, in order to determine a reasonably accurate cross section profile of the reef structure. This was followed by the first dye current measurements and further underwater observations were made until dark. During these observations, an extensive area along the reef slope and drop-off was covered, and the current was used to such advantage by the divers, that an area of perhaps 800 meters in length from the outer drop-off slope up to the reef crest was surveyed. It was felt that this gave a rough but wide-ranging coverage of the shallow zone of the reef slope and drop-off immediately outside and east of the proposed mining area. A night excursion at low tide was made by one team member to collect molluscs.

On the following morning, 1st November, a strong south-easterly wind was blowing, which made further underwater work on the outside of the reef crest impossible. The boats were then moved to a relatively sheltered anchorage on the northern face where the team awaited low tide. The second dye current measurement was then carried out on the flooding tide at the datum post, and extensive observations were made in the shallow water of the reef flat in and around the proposed mining lease. This was followed by a survey and photography of the exposed regions of the reef crest.

On Thursday (2nd Nov.) conditions had deteriorated even further, and the day's activities were restricted to examining the same area of exposed reef crest on the low tide as had been examined the previous day. Consequently, a good picture of this section of the reef was obtained, although many of the fish species on the reef flat would not have been recorded, due to the observations being restricted by turbid water conditions.

On Friday, (3rd Nov.) strong winds made it necessary to leave Ellison Reef. The party then moved to the shelter of the North Barnard Islands and carried out a brief survey of this area for comparison with Ellison Reef.

On Sunday (19th Nov.) two members of the original group, E. Hegerl and P. Brockel, returned to Ellison Reef and carried out surveys in the areas indicated on the sketch map (Fig. 1). One and one half hours of surface observation was carried out in Locations 4A, 4B and 4C, and attempts were made to collect unidentified fish species by spearing. The team then moved

to Location 4D, where one half hour of S.C.U.B.A. observations to depths of 12 meters were made. A 100 meter transect line was run N.-S. along the reef crest.

On the day following the court hearing (22nd Nov., 1967), Mr. Eric McIlree provided a light aircraft so that aerial photographs could be taken of the reef.

On Thursday (23rd Nov.) E. Hegerl and P. Brockel again returned to Ellison Reef, this time accompanied by a reporter from "The Australian", and a local skin diver. Conditions were particularly favourable for underwater work on this day, with calm seas and reasonable underwater visibility permitting the recording of a considerable number of new fish species along the eastern face.

IV Characteristics of the Areas Surveyed

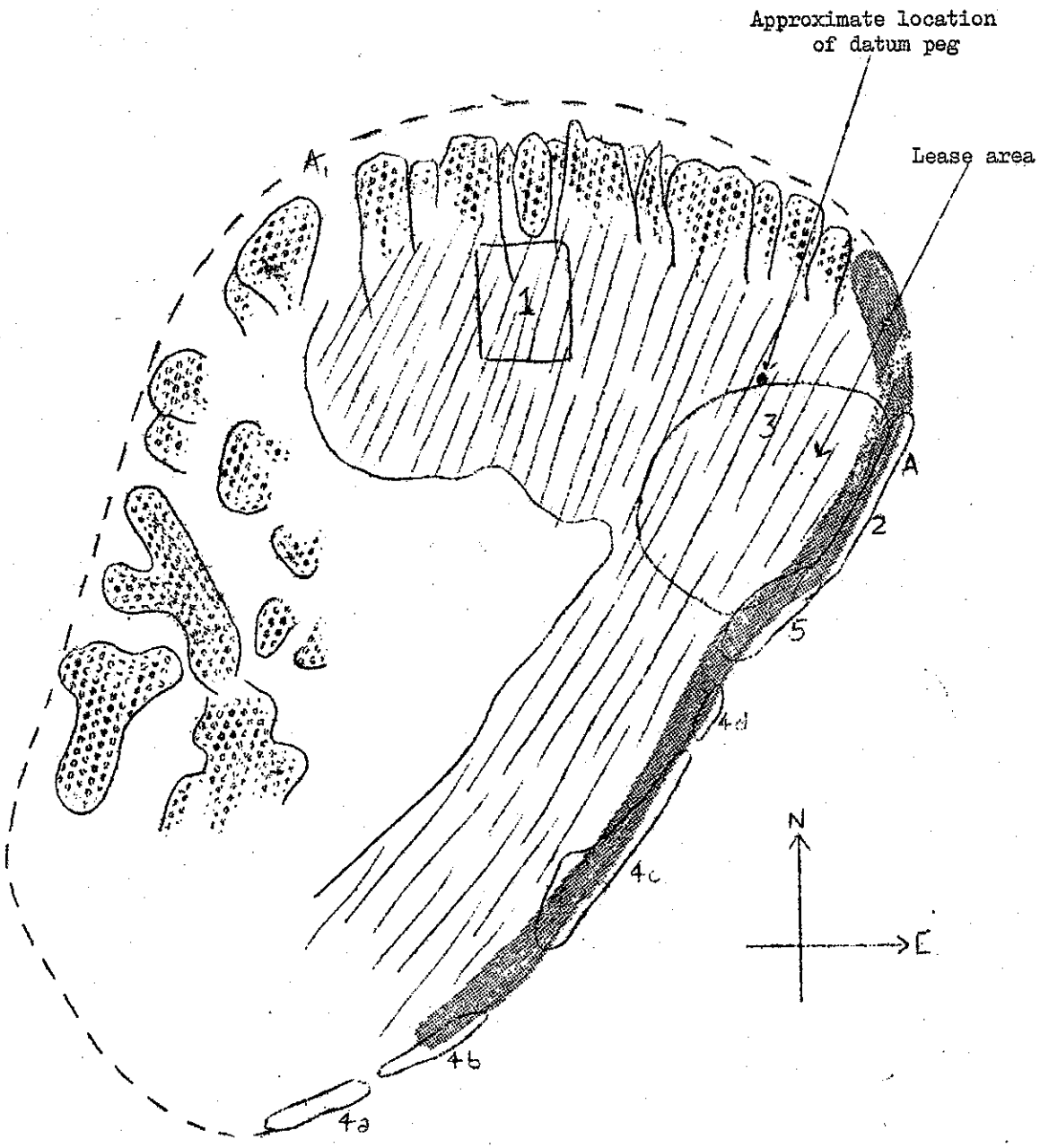
(An explanation of terms used in the descriptions of locations is contained in the profile diagram of the reef - Fig. 2.)

Location 1

Located on the northern face of the reef, approximately one nautical mile behind the eastern rampart, in the general area designated "Location 1" in Fig. 1.

This area consists of patch reefs converging on each other toward the rampart, and running into the main reef flat and diverging towards the west. The channels between these reefs, which are covered with a fine sediment substrate, are from nine to twelve meters deep in the survey area and shelve away to deeper water to the west. The patch reefs rise relatively abruptly from the floors of these channels, to within two thirds to two meters of the surface at low tide, a reef flat of this depth being formed from the upper surface of each patch reef. Coral "bommies" of from 4 to 8 meters in height and with a diameter of 3 to 12 meters are interspersed between patch reefs, especially around the peripheries of the patch reefs. The patch reefs are from 100 to 800 meters long and up to several hundred meters wide.

Fig. 1. DIAGRAM OF ELLISON REEF SHOWING SURVEY LOCATIONS:-
COMPOSITE DIAGRAM DERIVED FROM ADMIRALTY CHART 2350
AND AERIAL PHOTOGRAPHS



Reef Crest

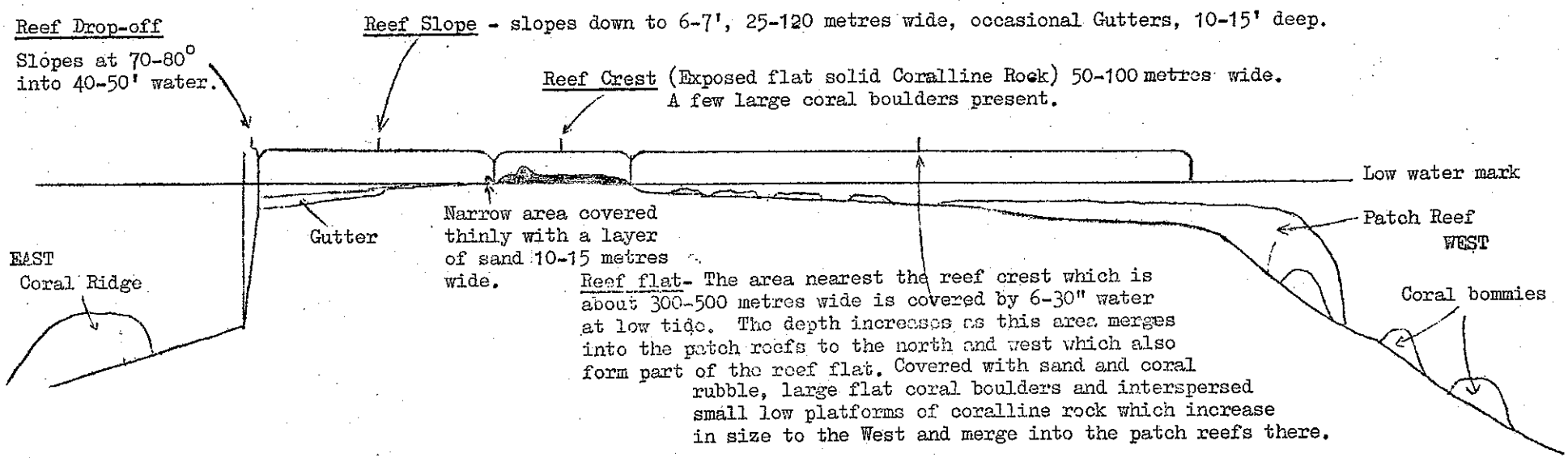
Main Reef Flat

Patch Reef Areas

Areas surveyed in various locations are enclosed thus.

Fig. 2. DIAGRAMMATIC REPRESENTATION OF A PROFILE About AA_1 in Fig. 1 THROUGH ELLISON REEF IN AN APPROX. SE-WNW DIRECTION AT THE NORTHERN END OF THE REEF.

NOTE:- FOR CONVENIENCE LINEAR DISTANCES HAVE NOT BEEN REDUCED TO SCALE.



The full list of hard coral species observed in this area is contained in the fauna list, but briefly, nineteen genera were recorded, containing thirty-four species (fifteen species and three genera of which were not observed in the other two localities). The reef flat area contains abundant growth of millepore corals which are the most abundant form and thus characterise the area. Stylaster, Acropora, Seriatopora and Pocillopora growths were also common. The drop-off slope from the reef flat to the channel floor contains most species found in this location, although corals are not as common here as they are on the flat. Porites spp. are dominant especially on the sides of "bommies". The reef flat was estimated to have about 20-30% coverage of live coral, and the reef drop-off about 10-15 per cent.

Sixty-seven species of fish were recorded in this area during three hours of underwater observation, despite the fact that the horizontal underwater visibility was approximately fifteen feet.

Giant clams (Tridacna gigas), two species of sea-cucumber (Holothuria sp.), the blue starfish (Linckia laevigata), were fairly common on the reef flat. Crown-of-thorns starfish (Acanthaster planci) were only occasionally observed. Two species of sea fans (Gorgonacea) were noted on the steep sides of coral "bommies".

The shallow waters of this area, viewed under more favourable conditions (i.e. clearer water) would be of considerable interest to the average tourist with limited skin-diving experience. Fishing could be expected to be fairly good in this locality, as some large Sea Perch (Lutjanidae) were observed, and Sweetlip Emperors (F. Lethrinidae) appeared to be abundant despite the poor underwater visibility.

Location 2

Located on the eastern rampart as indicated in the sketch map (Fig. 1). Structurally, it consists of a shelving reef slope seventy to one hundred and twenty meters wide, extending from the low water mark on the reef crest to the edge of the reef drop-off. The reef slope deepens to about two meters on the outer slope, with gutters in some areas two and one half to four meters in depth. The reef drops off at an angle of seventy to eighty degrees to a depth of ten to twelve and one half meters beyond the outer edge of the reef slope. The actual slope is composed of an open mesh of dead acropora corals which

form a substrate for the growth of some species of live corals. Exploration from seventy-five to one hundred meters outward from the reef drop-off in eighteen to twenty meters of water, revealed that most of this area consists of irregular five to seven meter high coral ridges separated by gutters with a bottom of very fine sand.

In all, twenty-seven genera of live corals were found at Location 2 (the highest number from the three locations) containing fifty species (also the highest number from the three localities), twenty-eight species of seven genera of which were not found in the other localities.

Acropora corals predominated on the reef slope, but Seriatopora, Styllophora, Favites and Pocillopora were also common. The reef drop-off at this locality as compared with Location 1, contains fewer species, most of these being concentrated on the reef slope.

The coverage by live coral of the reef slope varied from 70-80 per cent. in areas of good growth, to 5-10 per cent. in areas of Acanthaster planci infestation. However, many small areas were almost covered with species of Acropora.

Location 3

This location (Fig. 1)encompassed the main reef flat and the reef crest area and took in most of the proposed mining lease area. The reef flat area consists generally of a shallow sand substrate of a depth of from six to eighteen inches on a coralline rock bottom, with numerous small, flat coral boulders of from one half to two or three meters in diameter scattered over the area. The area was covered by from six to thirty inches of water at low tide. Coral growths were found attached to most large objects - shelves, boulders, etc.

The reef crest, which is exposed at low tide, consists of a relatively flat platform of coralline rock, though with occasional small shallow sand-filled depressions (one quarter to one and one fifth meter in diameter by two and one half to thirty centimeters deep), often containing small flat pieces of dead coral. A few small, live coral growths occur around the sides of these depressions. Almost the entire surface of the platform is covered with an algal mat, which is occasionally up to five centimeters thick.

The reef crest extends from the upper edge of the reef slope of Location 2, to from fifty to one hundred meters to the west. The main reef flat shelves gradually for three to five hundred meters more into deeper water to the west.

Corals

Seventeen genera of corals containing thirty-seven species were found within the lease area on the reef flat and up to the western edge of the reef crest. Three genera and seventeen species found here were not observed in other localities. Considerably more time was spent at this location than at Location 1, which no doubt accounts for the fact that more coral species were recorded at this locality.

Other Fauna

More than sixty species of molluscs were found in this area on the reef crest and reef flat. Green turtles (Chelonia mydas), a protected animal in Queensland, were abundant on the reef flat. Numerous representatives of a number of animal phyla normally found on coral reefs were observed during the process of examining the corals and molluscs of the reef flat and reef crest. These included crabs, polychaete worms, sponges, soft corals, starfish, sea-cucumbers, brittle stars and crinoids.

The fish fauna of the area was best observed on the rising tide when feeding activity is greatest. During our observations, more than forty species of fish were observed, the majority feeding on algal covered surfaces, but others were noted feeding on molluscs, polychaets, etc., which were foraged from the sand.

Location 4 (a), (b), (c), (d)

Only one diver was available on 19th November, and observations were limited to fishes. All but about twenty-four of the fishes recorded on this day had been noted in other areas of the reef. Casual observation while work on fishes was in progress indicated that probably several previously unrecorded species of corals were present. In general, the area surveyed on this day resembled Location 2, but has a more gentle drop-off gradient.

Location 5

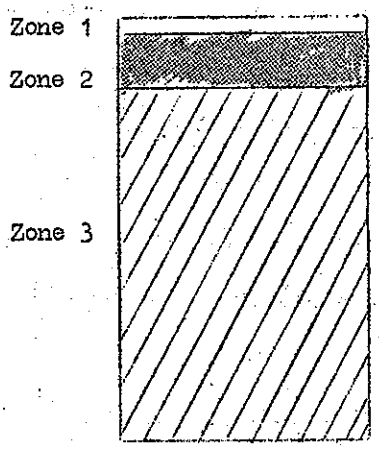
Examination of the outer slope of the eastern face revealed a similar situation to Location 2. although a substantially greater species diversity exists in this area. One hundred and fifteen species of fish were noted in a little over an hour in an area approximately fifty to 100 meters, in depths of water from two and one half to eighteen meters. Some thirty-six of these species had not previously been recorded in any of the locations examined.

It is reasonable to assume that if the corals of this area had been examined, the total number of living hard coral species recorded during the survey would have been far greater.

V Description of the Structure of Ellison Reef and its Biological Components with an Attached Fauna List

A coral reef consists of an area of the sea floor in tropical regions, exposed to strong sunlight and covered by shallow waters. These conditions are favourable for the growth of attached algae which constitute an important source of primary production on patch-type coral reefs such as Ellison Reef. This algal growth is not apparant to the casual observer, as the standing crop present at any time is generally low. However, productivity is high, which indicates that the algae grow fast and are eaten fast. It would appear that floating plants (phytoplankton) are relatively unimportant as a food source for coral reef organisms. Under the conditions of shallow water and suitable temperature, reef corals can grow and are responsible for the building up, maintenance, and expansion of the reef's structure. Reef corals, because of their abundance, extravagant shapes and colours and the large surface area they present, superficially characterise coral reefs. They are important in that they maintain the reef's structure but they do not appear to contribute a great deal in terms of consumable energy to other reef organisms. Because of physiological limitations, reef corals are found only on certain portions of the reef, and thus, large areas may be characterised by an almost total lack of live coral. Coral growths are most abundant around the growing edges of the reef and are lacking in areas which are partially or wholly exposed at low tide. Areas devoid of, or with reduced coral cover are important as they provide

Fig. 3. Diagramatic Representation of the surface of a reef of the Ellison Reef type showing areas of abundance and lack of live corals and attached algae.



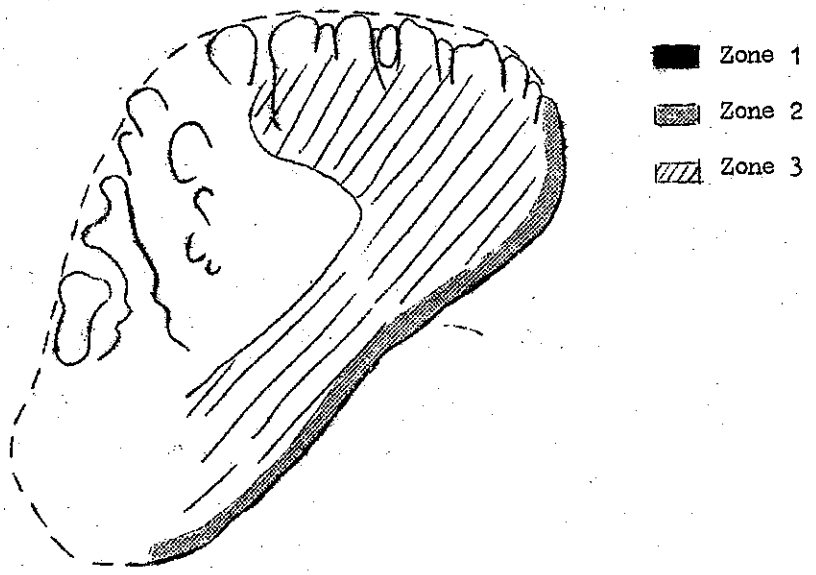
Zone 1:- Reef slope and other growing faces - an area of high live coral density and relatively low algal density.

Zone 2:- Reef crest - exposed at low tide, an area of solid coralline rock with very few coral growths but high algal densities.

Zone 3:- Reef flat - covered with shallow water at low tide, consists primarily of coralline rock overlaid by a thin layer of coral sand and rubble with numerous coral boulders. Contains scattered minor coral growths, high algal density.

Fig. 4.

Diagram of Ellison Reef showing various zones from Fig. 3.



a substrate for the growth of attached algae which constitute an important food source or "pasture" for many reef herbivores.

Zone 2. and especially Zone 3. (Fig. 3) contain very large proportions of the attached algal component of the reef over which large schools of herbivorous fishes, such as parrot and surgeon fishes (F. Scaridae and F. Acanthuridae) move and graze at high tide. These fishes in turn provide food for sport fishes such as cod and groper (F. Serranidae). Further, the crevices, sand and coral rubble of these two zones (especially Zone 3.) provide food and shelter for many small herbivores (molluscs, polychaet worms, crabs, shrimps, other crustacea, echinoderms) and are also nursery grounds for juvenile fishes. These animals in turn support populations of many sport fishes such as the Stripey (Lutjanus carponotatus) and the Sea Perch (Lutjanus johni) which are utilized in turn as food for larger fishes. It can be seen that there are relatively large areas of a coral reef which to outward appearances are "dead" because of the relative paucity of live coral growths. However, as noted above, these areas provide an essential substrate for the algal growth upon which a high proportion of grazing animals are dependant. Therefore, any large-scale disturbance of these areas will have considerable repercussions in terms of the whole reef.

Ellison Reef exhibits all the characteristics of a typical platform reef as has been outlined above. (See Fig. 4.) The abrupt eastern face projects into the deep water of the Geranium passage and forms a growing face for the expansion and maintenance of the reef in that direction, and contains the greatest density and species diversity of live corals observed. The growing faces of the patch reefs to the northern and western sides of the reef contain reasonable amounts of live coral, but with greater densities on the deep coral "bommies". There are extensive reef crest and reef flat areas behind the eastern face, and between it and the patch reefs and the sloping western face. Each of these areas - the growing faces, reef crest and reef flat - exhibits the characteristics outlined earlier in Fig. 3. with respect to live coral and algal growths. Correspondingly, the reef crest and reef flat are biologically very important, as outlined above.

Some measure of the species abundance of Ellison Reef may be determined from the accompanying fauna lists, which, it must be stressed,

were compiled from information gathered in only a very short time, under not particularly favourable conditions, by the two survey team members responsible and equipped for the work. Only three groups of fauna were covered, and some extrapolations can be made as to what would have been found in a more intensive and extensive survey of the area.

Reef corals, molluscs and fish recorded.

Thirty-four families of living hard corals, containing 88 species; 34 families of molluscs, containing 96 species (19 species in the Family Conidae); 45 families of fish containing 226 species were observed on Ellison Reef during the limited observation period.

This compares very favourably with the number of species found at Heron Island where a research station has been functioning for about ten years. Jones and Endean (1967)+ state, "The diverse fauna of the Reefs is illustrated by the fact that approximately 100 species of coral, 700 species of fish, 34 species of Conidae (a single family of molluscs) and 25 species of sea cucumbers have been recorded from the shallow waters of the reef flat at Heron Island..." On Ellison Reef, at least 45 species of live corals were found on the reef flat and the great majority of molluscs found were also found there - including almost all of the Conidae.

+ O. A. Jones and R. Endean. "The Great Barrier Reefs." Science Journal, November 1967. Vol. 3, No. 11, pp. 44-51.

LIVING HARD CORALS

KEY A = Abundant NUC = Not Uncommon rf = reef flat rdo = reef drop off
C = Common UC = Uncommon rs = reef slope

Genus	Species	Location 1		Location 2		Location 3	
		Site	Abundance	Site	Abundance	Site	Abundance
Acropora (18 spp.)	pulchra	rf	NUC	–	–	rf	UC
	delicatula	rf	C	–	–	–	–
	squamosa	rf	C	rs	C	rf	C
	intermedia	rf	NUC	rs	C	–	–
	variabilis	rf	C	rs	C	rf	UC
	microphthalma	–	–	rs	NUC	–	–
	striata	–	–	rs	C		
	digitifer	–	–	rs	NUC	–	–
	acuminata	–	–	rs	NUC	–	–
	cuneata	–	–	rs	NUC	rf	UC
	exilis	–	–	rs	NUC	–	–
	humilis	–	–	rs	C	–	–
	hebes	–	–	–	–	rf	UC
	sp. a	rf	NUC	–	–	–	–
	sp. b	rf	C	–	–	–	–
	sp. c	–	–	rs	NUC	–	–
	sp. d	–	–	rs	C	–	–
	sp. e	–	–	–	–	rf	UC
Millepora (2 spp.)	tenera	rf	A	rs	UC	rf	NUC
	platyphylla	rf	NUC	–	–	rf	NUC
Seriatopora (5 spp.)	hystrix	rf	NUC	–	–	–	–
	sp. a	rf	NUC	–	–	–	–
	sp. b	rf	UC	–	–	rf	NUC
	sp. c	–	–	rs	C	–	–
	sp. d	–	–	rs	C	–	–
Stylaster (1 sp.)	sp.	rf	NUC	–	–	–	–
Porites (3 spp.)	sp. a	rdo	C	rs	NUC	rf	C
	sp. b	rdo	C	–	–	–	–
	sp. c	–	–	rs	C	–	–
Acanthastrea (1 sp.)	sp.	rdo	NUC	rs	C	–	–
Pleisiastrea (1 sp.)	sp.	–	–	rs	NUC	–	–
Lepastrea (3 sp.)	sp. a	rdo	UC	–	–	–	–
	sp. b	rdo	UC	–	–	–	–
	?sp. c	rdo	UC	–	–	–	–
Cyphastrea (2 sp.)	serailia	–	–	–	–	rf	UC
	sp.	–	–	–	–	rf	UC
Goniastrea (6 spp.)	sp. a	rdo	C	rs	NUC	–	–
	retiformis	–	–	rs	NUC	–	–
	pectinata	–	–	–	–	rf	C
	sp. b	–	–	rs	C	rf	C
	sp. c	–	–	rs	NUC	rf	C
	sp. d	–	–	rs	NUC	rf	C
Turbinaria (4 spp.)	sp. a	rdo	UC	rdo	NUC	rf	UC
	sp. b	rdo	NUC	–	–	rf	UC
	sp. c	–	–	–	–	rf	UC
	?sp. d	–	–	rs	UC	–	–

Genus	Species	Location 1		Location 2		Location 3	
		Site	Abundance	Site	Abundance	Site	Abundance
Fungia (3 spp.)	fungites	rdo	NUC	rdo	UC	–	–
	echinata	rdo	UC	rdo	NUC	–	–
	paumotuensis	–	–	rdo	NUC	–	–
Galaxea (3 spp.)	sp. a	rdo	NUC	rs	NUC	–	–
	claveis	–	–	rs	NUC	–	–
	sp. b	–	–	rs	NUC	–	–
Stylophora (1 sp.)	mordax	rf rdo	NUC	rs	C	rf	NUC
Lobophyllia (2 spp.)	hempridii	rdo	UC	–	–	–	–
	sp.	rdo	UC	–	–	–	–
Symphyllia (2 spp.)	sp. a	–	–	rdo	UC	rf	UC
	nobilis	–	–	–	–	rf	NUC
Echinophyllia? (1 sp.)	sp.	–	–	rdo	UC	–	–
Trachyphyllia (1 sp.)	geoffroyi	–	–	rdo	UC	–	–
Favia (2 spp.)	sp. a	–	–	–	–	rf	C
	sp. b	–	–	–	–	rf	C
Favites (4 spp.)	virens	–	–	rs	C	rf	UC
	sp. a	–	–	rs	C	–	–
	sp. b	–	–	–	–	rf	C
	sp. c	–	–	–	–	rf	NUC
Tubipora (1 sp.)	musica	–	–	rs	NUC	rf	UC
Montipora (4 spp.)	sp. a	–	–	rdo	UC	rf	C
	tuberculosa	–	–	–	–	rf	UC
	cactus	–	–	–	–	rf	NUC
	sp.	–	–	–	–	rf	UC
Astreopora (1 sp.)	myriopthalma	–	–	–	–	rf	UC
Pavona (4 spp.)	sp.	rdo	UC	–	–	–	–
	?sp.	rdo	UC	–	–	–	–
	decussata	–	–	–	–	rf	UC
	sp.	–	–	–	–	rf	UC
Psammocora (1 sp.)	sp.	–	–	rs, rdo	C		
Pocillopora (1 sp.)	damicornis	rf	C	rs	A		
Hydnophora (2 spp.)	microconos	–	–	rs	UC	rf	UC
	rigida	–	–	rs	UC	–	–
Dendrophyllia (1 sp.)	nigrescens	–	–	80–100	?	–	–
Leptoria (1 sp.)	phrygia	–	–	rdo	NUC	–	–
Pachyseris? (1 sp.)	sp.	–	–	rs	NUC	–	–

Genus	Species	Location 1		Location 2		Location 3	
		Site	Abundance	Site	Abundance	Site	Abundance
Unidentified (6 spp.)	sp. a	rdo	UC	-	-	rf	UC
	sp. b	rdo	UC	-	-	-	-
	sp. c	rdo	NUC	-	-	-	-
	sp. d	-	-	rs	NUC	-	-
	sp. e	-	-	rdo	UC	-	-
	sp. f	-	-	rdo	C	-	-
No. genera	No. spp.	No. spp. (gen.)	Endemic spp.(gen.)	No. spp. (gen.)	Endemic spp.(gen.)	No. spp. (gen.)	Endemic spp.(gen.)
34	88	34 (19)	15 (3)	50 (27)	28 (7)	37 (17)	17 (3)

Molluscs of Ellison Reef — C = Carnivore H = Herbivore

PHYLUM MOLLUSCA — Total of 32 Families containing 95 spp.

CLASS AMPHINEURA

FAMILY CHITONIDAE — H

Acanthozostera gemmata

1 unident. sp.

CLASS GASTROPODA — C or H

2 unident. Opisthobranchs

FAMILY HALIOTIDAE — H

Haliotis asinina
H. ovina
Haliotis sp.

FAMILY CYPRAEIDAE — H

Cypraea lynx
C. vitellus
C. tigris
C. arabica
C. annulus
C. errones

FAMILY CONIDAE — C

Conus (conus) marmoreus
C. (lithoconus) litteratus
C. (virroconus) obraeus
C. (virroconus) coronatus
C. (virroconus) miliaris
C. (virroconus) imperator
C. (virroconus) lividus
C. (virroconus) ceylonensis
C. (puncticulis) arenatus
C. (rhizoconus) vexillum
C. (rhizoconus) miles
C. (rhizoconus) rattus
C. (virgiconus) emaciatus
C. (virgiconus) flavidus
C. (darioconus) omaria
C. (cylinder) textile
C. (strioconus) striatus
C. (textile) spectrum
C. nussatella

	FAMILY TROCHIDAE	H
Trochus niloticus		
T. maculatus		
Trochus sp.		
Trochus sp.		
	FAMILY NATICIDAE	C
Mammilla simiae		
Polinices recluziana		
Naticarius onca		
1 unident. sp.		
	FAMILY MITRIDAE	C
Mitra mitra		
Chrysome circumerina		
	FAMILY TEREBRIDAE	C
Terebra dimidiata		
T. crenulata		
T. albida		
T. muscaria		
	FAMILY BULLIDAE	C
Bulla adamsi		
B. punctulata		
	FAMILY STROMBIDAE	H
Lambis lambis		
Strombus luhuanus		
S. variabilis		
S. sp. unident.		
	FAMILY THAISIDAE	C
Mancinella mancinella		
3 spp. of the family		
	FAMILY CASSIDIDAE	C
Casmaria vibex		
	FAMILY VOLUTIDAE	C
Meloamphora sp.		
Amona maculata		
Cymbiolacea sp.		
	FAMILY CERITHIDAE	H
Cerithium asperum		
Rhinoclavis obeliscus		
5 unident. spp.		
	FAMILY CYMATIDAE	C
Choronia tritonis		
2 unident. spp.		

	FAMILY TONNIDAE	C
Cadus perdix		
	FAMILY NASSARIIDAE	C
Nassarius bicolor		
	FAMILY TURBINIDAE	H
Turbo petholatus		
Lunella argyrostoma		
Herpetopoma atrata		
2 unident. spp.		
	FAMILY PYRAMIDELLIDAE	C
Otopleura aurixati		
	FAMILY	
1 unident. sp.		
	CLASS LAMELLIBRANCHIATA	Filter-Feeders
	FAMILY TRIDACNIDAE	
Tridacna gigas T. maxima Tridacna squamosa		
Hippopus hippopus		
	FAMILY OSTREIDAE	
Saxostrea amosa		
Ostrea hyotis		
	FAMILY PTERIIDAE	
1 unident. sp.		
	FAMILY ISOGNOMONTIDAE	
Isogonomen isognomum		
	FAMILY ARCIDAE	
Anadara maculosa		
Naviçula ventricosa		
Arca? (Barbatia?) sp.		
	FAMILY MERETRICIDAE	
Liocconcha castrensis		
	FAMILY GLYCYMERIDAE	
Tucetoma amboinensis extra		
	FAMILY CARDIIDAE	
Fragum fragum		

FAMILY LIMIDAE

Promantellum parafragile

FAMILY CHAMIDAE

Chama fibula

FAMILY

1 unident. sp.

CLASS CEPHALOPODA

1 unident. cuttlefish sp.

Fishes of Ellison Reef

Family ORECTOLOBIDAE Cat Sharks, wobbegongs, etc.

Hemiscyllium punctatum (Muller and Henle)

Family CARCHARHINIDAE True sharks, whalers, etc.

Carcharhinus sp.

1 unident. sp.

Family TRIAKIDAE

Triaenodon obesus Fowler White-tip shark.

Family RHINOBATIDAE

Rhinobatos typus Bennett, E.T.

Family DASYATIDAE Stingrays

Dasyatis sp.

Family MOBULIDAE Manta Rays

1 unident. sp.

Family CLUPEIDAE Herring-like Fishes

At least 1 unident. sp. of pilchard

Family MURAENIDAE Moray Eels

Echidna nebulosa (Ahl)

2 unident. Cymnothorax spp.

Family HEMIRHAMPHIDAE Garfish

Hemirhamphus sp.

Family EXOCOETIDAE Flying Fish

1 unident. sp.

Family AULOSTOMIDAE

Aulostomus chinensis (Linne)

Family FISTULARIDAE

Fistularia petimba Lacepede

Family SYNGNATHIDAE — Pipefishes, seahorses

1 unident. Pipefish

Family HOLOCENTRIDAE — Soldier fishes

Holocentrus spiniferum

Honocentrus sp. probably H. diadema (Lacepede)

Holocentrus sp.

Family SPHYRAENIDAE — Barracudas

Sphyraena jello Cuvier and Valenciennes

Sphyraena obtusata Cuvier and Valenciennes

Family SERRANIDAE — Cods and Groupers

Epinephelus fasciatus (Forskal)	Black-tipped Rock Cod
Epinephelus merra Bloch	Wire Netting Cod
Epinephelus summana (Forskal)	Summana Rock Cod
Epinephelus tauvina (Forskal)	Greasy Cod
Epinephelus fuscoguttatus (Forskal)	Flowery Cod
Plectropomus maculatus (Bloch)	Coral Cod or Coral Trout
Cromileptes altivelis (Valenciennes)	Barramundi Cod or Hump-backed Cod

Anyperodon leucogrammicus (Cuvier and Valenciennes)

Cephalopholis miniatus (Forskal)	Coral Cod or Coral Trout

Cephalopholis sp.

Family DIPLOPRIONIDAE

Diploprion bifasciatum Kuhl and van Hasselt	Yellow Emperor

Family APOGONIDAE — Cardinal fishes

4 unident. spp.

Family CARANGIDAE — Turrum, Trevally, etc.

Caranx emburyi (Whitley)

1 unident. sp.

Family PEMPHERIDAE — Bullseye fish

3 unident. spp.

Family LUTJANIDAE — Sea Perch

Lutjanus carponotatus (Richardson) — Stripey

Lutjanus fulviflamma (Forskal) — Moses Perch

Lutjanus johni (Bloch) — Spotted-Scale Sea Perch

Lutjanus malabaricus (Bloch and Schneider) — Nannygai

Lutjanus nematophorus (Bleeker) — Chinaman-fish

Lutjanus sebae (Cuvier and Valenciennes) — Red Emperor

Lutjanus sp.

Caesio sp. probably C. erythrogaster Cuvier and Valenciennes

Subfamily PENTAPODINAE

Pentapus setosus Valenciennes — Whiptail

Family SCOLOPSIDAE — Spinecheeks

Scolopsis temporalis (Cuvier)

Scolopsis sp. probably S. margaritifer (Cuvier and Valenciennes)

Scolopsis sp.

Family PLECTORHYNCHIDAE — Sweetlips, blubberlips

Plectorhynchis goldmanni (Bleeker)

Plectorhynchus nigrus (Cuvier and Valenciennes)

Plectorhynchus pictus (Thunberg)

Plectorhynchus chaetodonides Lacepede

2 unident. Plectorhynchus spp.

Family LETHRINIDAE — Sweetlip Emperors

Lethrinus chrysostomus Richardson

Lethrinus mahsena (Forskal)

Lethrinus nebulosus (Forskal)

Lethrinus sp. possibly L. fletus Whitley

Lethrinus sp.

Family MULLIDAE — Goatfishes

Pseudupeneus sp. possibly P. indicus (Shaw)

1 unident. sp.

Family PLATACIDAE — Batfishes

Platax pinnatus (Linne)

Family CHAETODONTIDAE Butterfly-fishes

Chaetodon aureofasciatus Macleay

Chaetodon auriga Forskal

Chaetodon citrinellus Cuvier

Chaetodon ephippium Cuvier

Chaetodon lineolatus Cuvier and Valenciennes

Chaetodon lunula Jordan & Evermann

Chaetodon melannotus Bloch

Chaetodon plebeius (Gmelin)

Chaetodon rainfordi McCulloch

Chaetodon triangulum Cuvier and Valenciennes

Chaetodon trifasciatus Mungo Park

Chaetodon vagabundus Linne

2 unident. Chaetodon sp.

Chelmon rostratus (Linne)

Heniochus acuminatus (Linne)

Megaprotodon strigangulus (Gmelin)

Subfamily POMACANTHINAE Angelfishes

Pomacanthus imperator (Bloch)

Pomacanthus semicirculatus (Lesson)

Euxiphipops sexstriatus (Cuvier and Valenciennes)

Centropyge bicolor (Bloch)

Family AMPHIPRIONIDAE Anemone fishes

Amphiprion bicinctus Ruppell

Amphiprion sp.

3 unident. spp. Amphiprion sp. possibly A. polymnus
Amphiprion sp. possibly A. melanopus
Amphiprion sp. possibly A. unimaculatus

Family POMACENTRIDAE Demoiselles, coralfishes

Abudefduf curacao (Bloch)

Abudefduf palmeri (Ogilby)

Abudefduf saxatilis (Linne)

Abudefduf sexfasciatus (Lacepede)

Abudefduf sp. probably A. melas (Cuvier)

Chromis caeruleus (Cuvier)

Dascyllus aruanus (Linne)

Dascyllus trimaculatus

Dascyllus sp.

Pomacentrus pavo. (Bloch)

Pomacentrus sufflavus Whitley

Pomacentrus apicalis (De Vis)

At least 13 other unident. spp.

Family LABRIDAE — Wrasses, tusk-fishes, etc.

Choerodon transversalis Whitley

Choerodon sp.

2 unident. Coris spp.

Lienardella fasciatus (Gunther)

Epibulus insidiator (Pallas)

Chelio sp. possibly C. inermis (Forskal)

Chelinus fasciatus (Bloch)

Chelinus undulatus Ruppell

2 unident. Chelinus spp.

Anampses sp. similar to A. twisti Bleeker

Gomphosus varius Lacepede

Thalassoma hardwicki (Bennett, J.W.)

Thalassoma janseni Bleeker

Thalassoma lunare (Linne)

Thalassoma umbrostigma (Ruppell)

Hemigymnus melapterus (Bloch)

Labroides dimidiatus (Valenciennes)

Labrichthys cyanotaenia Bleeker

2 unident. Halichoeres spp. probably H. nebulosus (Cuvier and Valenciennes) and H. margaritaceus (Cuvier and Valenciennes)

Stethojulis strigiventer (Bennett)

At least 19 other unident. spp.

Family SCARIDAE — Parrotfishes

Scarus fasciatus Valenciennes

Scarus ghobban Forskal

Scarus microrhinos Bleeker

Scarus oviceps Cuvier and Valenciennes

Scarus sexvittatus Ruppel

Scarus sordidus Forskal

Scarus venosus Cuvier and Valenciennes

Scarus brevifilis (Gunther)

Scarus formosus Cuvier and Valenciennes

Scarid sp. probably Chlorurus bicolor

At least 5 other unident. spp.

Family PARAPERCIDAE Sand Divers

Parapercis cylindrica (Bloch)

Family BLENNIIDAE Blennies

Meiacanthus temnicki

5 other blennie spp.

Family TEUTHIDAE Spinefeet

Teuthis doliatus

Teuthis lineatus (Valenciennes)

Teuthis spinus

Teuthis vulpinus (Schlegel and Muller)

Teuthis sp.

Family ACANTHURIDAE Surgeon fishes

Ctenochaetus strigosus (Bennett)

Acanthurus dussumieri Valenciennes

Acanthurus nigrofuscus (Forskal)

Acanthurus triostegus (Linne)

Acanthusus xanthopterus Valenciennes

3 unident. Acanthurus spp.

Zebrasoma scopas (Cuvier)

Zebrasoma rostratum (Gunther)

Zebrasomo veliferum (Bloch)

Naso lituratus

Naso unicornis (Forskal)

2 unident. Naso spp.

Family SCOMBEROMORIDAE Mackerel

Scomberomorus commersoni (Lacepede)

Family ISTIOPHORIDAE Marlin

1 unident. sp.

Family GOBIIDAE Gobies

2 unident. spp.

Family SCORPAENIDAE Scorpion-fishes

3 unident. spp.

Family BALISTIDAE Triggerfishes

Balistes chrysopterus Schneider

Balistes aculeatus Linne

Balistes sp. possibly B. undulatus (Park)

2 other unident. spp.

Family MONACANTHIDAE Filefishes

Oxymonacanthus longirostris (Schneider)

Monacanthus sp.

Family OSTRACIONIDAE Boxfishes, cowfishes

Ostracion tuberculatus Linne

Family TETRAODONTIDAE

Arothron nigropunctatus (Schneider)

Arothron sp.

Family CANTHIGASTERIDAE Sharp-nosed puffers

Canthigaster cinctus (Richardson)

Canthigaster sp.

Family DIODONTIDAE Porcupine-fishes

Diodon sp.

In addition to the above fishes, four species were observed whose identity was completely unknown.

Additional Notes of Fishes

(i) Two hundred and twenty-six species of fish, representing 45 families, were recorded in fourteen hours of underwater observation. Of these, 112 species are thought to be positively identified, and about one third of the remainder identified at least to generic level.

(ii) Of the fishes listed, three species were observed only from the boat. These were Marlin (F. Istiophoridae), Flying-Fish (F. Exocoetidae), Manta ray (F. Mobulidae).

(iii) Seventeen species, mainly apogonids and pomacentrids were collected by spearing for identification, but have yet to be identified.

(iv) Handlines were set where possible and the fourteen species caught were identified as Carcharhinus sp., Cephalopolis miniatus, Cromileptes altivelis, Ephinephelus merra, E. summana, Lethrinus chrysostomus, L. nebulosus, Lethrinus sp., Lutjanus carponotatus, L. malabaracus, L. johni, L. sebae, Plectorpomus masculatus, Triaenodon obesus.

The number of species recorded was restricted by a number of factors:-

(a) Poor visibility. Horizontally averaging 20-25 feet, with a maximum horizontal visibility of 35-45 feet on two days (October 30th and November 1st).

(b) The limited time available did not permit coverage of all reef areas. No work was carried out in depths exceeding 80 feet on the western face, or on the western end of the permanently submerged portions of the reef flat. Although wide coverage of the eastern side of the reef was obtained, the number of species listed would have been far greater if entire days could have been spent working small areas of this face.

(c) In view of the fact that many species exhibit distinct juvenile and/or sexually different forms, care was taken to ensure that only definite species were recorded. Because of the paucity of literature available on this subject, there are probably quite a few additional species (especially in the Family Labridae) which were not recorded.

(d) No nocturnal observations were made.

(vi) It is felt that if intensive work were carried out by a number of workers using rotenone etc. for collecting, the total number of fish species on Ellison Reef would exceed 600 species.

VI Currents of the Ellison Reef Area

This account of the surface current system operating in the Ellison Reef area at the time of the survey is based on:-

(a) Experiments with marker dye.

(b) Observations of movements of planktonic organisms in the current.

(c) Observations of vessel movements with changing tidal conditions

(d) The larger movement of Pacific Waters in the region of the Coral Sea.

(a) Marker dye was released into the water on the flood tide for about ten minutes at Sites A and B (Fig. 5a). Site B contains the mining lease Datum Peg. The resultant flows, as deduced from the direction of the movement of the dye, are indicated by arrows on the map.

There is an indication of current movement on the flood tide in a N.E.-S.W. direction around the eastern reef face and across the reef flat. In some cases the rate of movement of marker dye indicated a current speed of from one and one half to at least two knots.

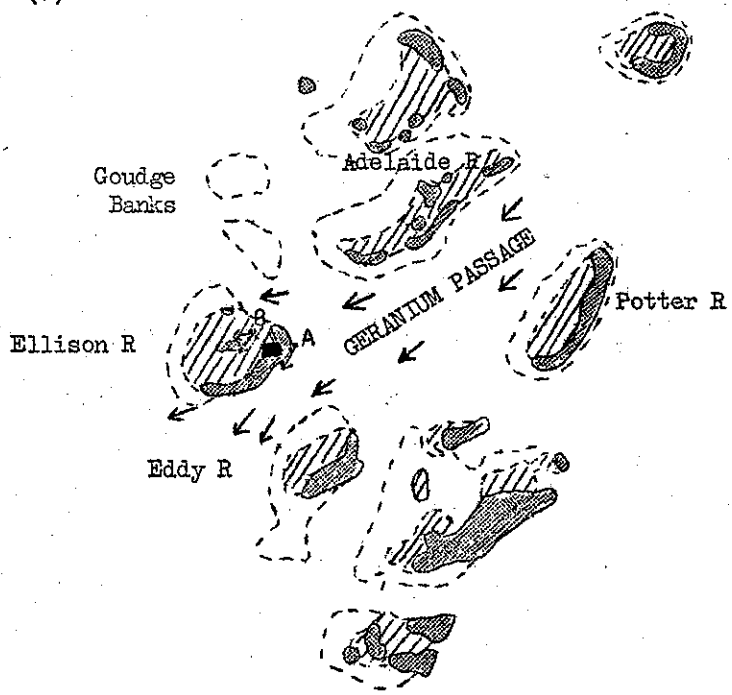
(b) (i) Observations of the movement of planktonic organisms (salps etc.) past the anchored boat in Site A on the flooding tide, support the marker dye experiments in this area. (ii) Observations of the movement of plankton in Site A past the anchored boat on the ebbing tide, also indicate a N.E.-S.W. current flow at this tidal phase, though of low velocity (up to 3/4 knot);

(c) A boat was anchored in Site A for a period of approximately 40 hours, with a dingy and another boat being moored to this first boat. During this period, the direction in which the boat lay (i.e. bows to a N.E. direction) over the whole period indicated a N.E.-S.W. current flow over the entire 24 hour period.

(d) Pacific Waters in the region of the Coral Sea have been shown to exhibit offshore movements of large water masses in this area such that one of the results of this is the generation of a major current flow in a general southerly direction down the eastern coast of Queensland over much of the year.

Fig. 5 CURRENT MAP (MAP FROM ADMIRALTY CHART No. 2349)

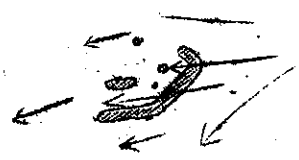
(a)



● Approximate Site of Proposed Lease Area

(b) Low tide flow

(c) High tide flow



Conclusions

Although the experiments with marker dye were crude, they effectively demonstrated visually, the general current flow present in the area at the time of the survey.

With the Coral Sea mass of water moving down the east Queensland coast, any break in the Barrier Reef would probably be utilised as a means of relieving some of the pressure in this area by channelling some of the water in behind the Barrier Reef towards the coast. The Geranium Passage provides such a break, and as such, a current of water moves in a N.E.-S.W. direction, past the eastern face and around the northern end of Ellison Reef (Fig. 5a). At low tide, the exposed eastern rampart affords protection to the reef flat area immediately behind it, but even so, there is till some water movement in the area not given protection. With the flooding tide, the protected area diminishes and the flow over the reef flat increases until high tide, when with complete submergence of the reef, the water current moves directly across the top of the reef. This movement at low and high tides is also substantiated by the difficulties encountered in diving in the reef flat area, which were caused by the flow. See Fig. 5, B and C.

VII Biological Consequences of Mining Ellison Reef

There is considerable evidence in the literature to show that mining or dredging operations in aquatic situations produce large quantities of sediments which affect aquatic organisms by both direct and indirect means. Two main effects on reef organisms could result from mining operations on Ellison Reef.

(a) Effect on Ellison Reef biota

(b) Effects on the biota of other reefs

(a) Effects on Ellison Reef Biota

(i) From the conclusions reached in Section 5 (Current Systems) of this report if currents in the area follow the pattern indicated through the year, any sediment produced as a result of mining operations would probably be carried out and disseminated in a general southerly direction over much of the area of Ellison Reef.

(ii) Numerous references are available in the literature which show that (a) sediments may destroy algae on a large scale in affected areas and

(b) sediments may destroy other sessile organisms on a large scale in affected areas.

(c) The effects of sediment on alevins (larval fishes) and especially fish eggs are often disastrous.

(d) Sediments may clog and abraid the gills of many fish and molluscs, resulting in their death.

(e) Silted areas are avoided by adult fishes of some species.

(f) Sediments may induce changes in the chemical and physical characters of the environment, causing oxygen depletion, causing the formation of noxious compounds, and causing disturbances in pH and in carbonate balances.

(iii) The effects of sediments and their movements would result not only in direct effects on individuals by physical and chemical means resulting in their death, but also by indirect effects on food chains by destruction of attached algae which are the primary products sustaining the chains, as well as destruction of higher levels of food chains i.e. herbivorous (parrot and surgeon) fishes and carnivores (cod etc.) which include sport fishes. Coral populations will also suffer from heavy prolonged sedimentation.

(b) Effects on the Biota of other Reefs

The biota of other reefs could be affected by depletions of animal populations on Ellison Reef as the vast majority of reef fishes, polychaet worms, crustacea, corals, molluscs and echinoderms have planktonic larvae which stay in the water mass for varying periods and which are carried varying distances. This results in "seeding" other reefs with juvenile stages which grow to maturity to contribute to part of the adult populations of these reefs. Thus, if the initial source of larval production is depleted (as could result on Ellison Reef with mining) this may also result in depletions in other reef areas both near and far.

At the present stage of scientific knowledge of the ecology of the Great Barrier Reef, no predictions can be made as to the scale or consequences of this depletion.

VIII The Survey Team

The survey team consisted of three members of the Queensland Littoral Society - Edward Hegerl, D. Ross Robertson and Peter Brockel. The team was led by E. Hegerl.

(1) Edward Hegerl:- Founder of the Queensland Littoral Society. President 1965-1967. For the past two and a half years he has carried out the field collecting for the Venoms Research Section, Zoology Department, University of Queensland.

Experience - In addition to extensive field work for Queensland University along the south Queensland - northern New South Wales coast, he has participated in biological surveys of fifty-four reefs for the Queensland Littoral Society. On the Great Barrier Reef he has examined Green Island and reefs in the Whitsunday and Capricorn Groups, as well as inshore areas in central Queensland. In late 1966 at the request of the Queensland State Harbours and Marine Dept., he led an underwater team composed of Harbours & Marine and Littoral Society personnel in a biological survey of the coral areas of Moreton Bay. He has had sixteen years of underwater experience, eleven of which have been with Scuba apparatus. His underwater experience commenced in Florida and involved investigations on both tropical and sub-tropical reefs along 250 miles of coast-line. Before migrating to Australia, he assisted diving biologists from Florida Universities. He has contributed to one paper in the press and has several others in preparation. Mr. Hegerl worked on fish during this survey.

(2) D.R. Robertson, B.Sc. (Qld) Major in Zoology, Post-graduate Research Student and Demonstrator in the Zoology Department, University of Queensland. President of the Queensland Littoral Society.

Experience - He has had intermittent diving experience on reefs in Papua and New Guinea over a period of twelve years, as well as eighteen months of Scuba experience. He has participated in six Queensland Littoral Society surveys of reefs in south-east Queensland and has made observations at Heron and Green Islands on the Great Barrier Reef. He worked on corals and molluscs on this survey.

(3) P. Brockel - a resident of Brisbane with over five years of Scuba diving experience. In the eighteen months that he has been a Qld. Littoral Society member, he has carried out underwater photography and "fish counts" on surveys of nine reef areas. He was the underwater photographer for this survey.

ERRATA

Page 1.

Line 9.	for	"Componant"	read "Component"

Fig. 1.

(Opposite Page 4) (omitted) Scale: 2 inches = 1 Nautical Mile

Unpaginated Fauna List

Third Page.

Line 32.	for	Conus (conus) marmoreus	read	Conus (Conus) marmoreus
	"	C. (lithoconus) litteratus	"	C. (Lithoconus) litteratus
	"	C. (virroconus) obraeus	"	C. (Virroconus) ebraeus
	"	C. (virroconus) coronatus	"	C. (Virroconus) coronatus
	"	C. (virroconus) miliaris	"	C. (Virroconus) miliaris
	"	C. (virroconus) imperator	"	C. (Virroconus) imperator
	"	C. (virroconus) lividus	"	C. (Virroconus) lividus
	"	C. (virroconus) ceylonensis	"	C. (Virroconus) ceylonensis
	"	C. (puncticulis) arenatus	"	C. (Puncticulis) arenatus
	"	C. (rhizoconus) vexillum	"	C. (Rhizoconus) vexillum
	"	C. (rhizoconus) miles	"	C. (Rhizoconus) miles
	"	C. (rhizoconus) rattus	"	C. (Rhizoconus) rattus
	"	C. (virgiconus) emaciatus	"	C. (Virgiconus) emaciatus
	"	C. (virgiconus) flavidus	"	C. (Virgiconus) flavidus
	"	C. (darioconus) omaria	"	C. (Darioconus) omaria
	"	C. (cylinder) textile	"	C. (Cylinder) textile
	"	C. (strioconus) striatus	"	C. (Strioconus) striatus
	"	C. (textile) spectrum	"	C. (Textile) spectrum
Sixth Page				
Line 27	"	"2 unident. Cymnothorax"	"	"2 unident. Gymnothorax"
Seventh Page				
Line 7	"	Honocentrus sp.	"	Holocentrus sp.
Page 12.				
Line 14	"	L. malabaracus	"	L. malabaricus
Line 15	"	Plectorpomus maculatus	"	Plectropomus maculatus
Page 14.				
Line 12	"	"there is till"	"	"there is still"
Page 15.				
Line 7	"	"abraid"	"	"abrade"