ReeflectionS

GREAT BARRIER REEF MARINE PARK AUTHORITY

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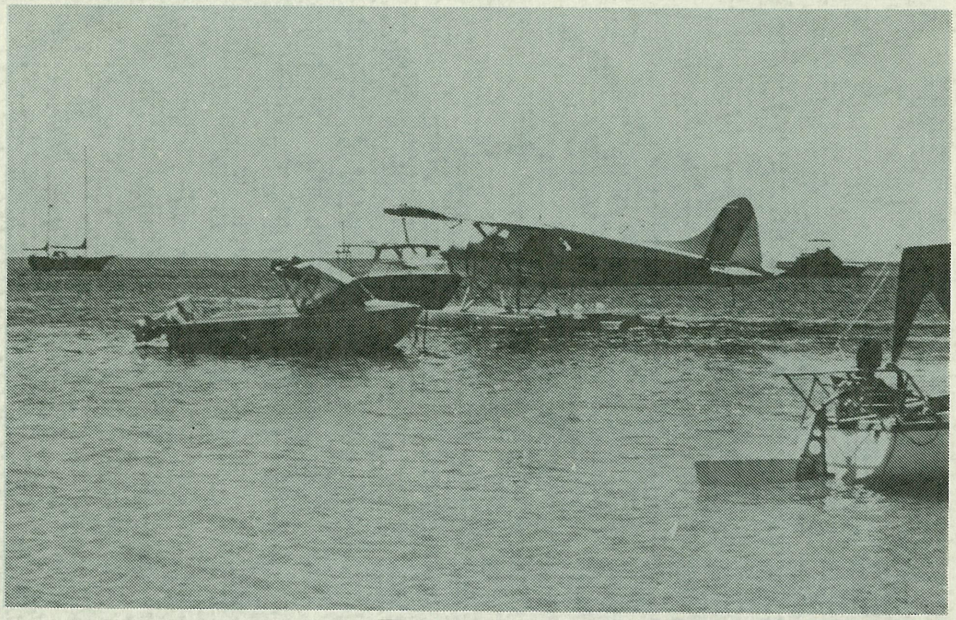
Park Management

Seaplanes at Green Island



Green Island, off Cairns, is perhaps one of the most popular tourist destinations in the Great Barrier Reef Region with a peak visitor rate of about 1000 per day. Almost all visitors arrive on the island by ferry but access is also possible by private boat or by charter seaplane.

Naturally the most popular beach area is heavily used for swimming, snorkelling and watersports and there is the possibility of conflict between these uses of the area and transport facilities. Some complaints have been received about the noise of seaplanes affecting the amenity of resort guests and of the potential danger of seaplanes to snorkellers.

To assist the Authority in making informed decisions about seaplane operations, a study of the situation on Green Island was recently commissioned. It was undertaken by A.L. Brown of the Institute of Applied Environmental Research, Griffith University.

The study was based in part on a questionnaire completed by a large proportion of visitors to Green Island on each of three days. These days differed from each other with respect to the amount of seaplane activity.

On all three days 90% of visitors surveyed noticed the coming and going of seaplanes. Although the seaplane operating during this study is almost inaudible when alighting and while taxiing, the noise made at start up and take off is clearly noticeable on the beach and jetty. However, the way visitors responded to this differed.

Over half the visitors said that the seaplanes made no difference to their enjoyment of Green Island. A group of visitors (30% to 44% depending on the day) considered that the seaplanes increased their enjoyment; they were considered a novelty and interesting to watch. A smaller group (5% to 15%) considered that the presence of the seaplanes decreased their enjoyment. Visitors made a similar response, although the actual numbers differed somewhat, about the effect of boat traffic on their enjoyment of Green Island.

It is interesting that increased frequency of seaplane operations resulted in a significant shift in day-visitor attitudes. On the day of highest seaplane activity fewer visitors reported that seaplanes increased their enjoyment and more reported that they reduced their enjoyment. Noise and conflicts on the beach area were the major causes of concern. It is noteworthy that the consultant considered the risk of a serious incident is high.

The waters around Green Island are within the Cairns Section of the Great Barrier Reef Marine Park and, under the Zoning Plan for this Section, the operation of seaplanes in this area requires a permit from GBRMPA. The results of this study suggest that some control of seaplanes, but not their complete exclusion, may be appropriate. Various strategies for reducing the conflict between boats, visitors and seaplanes remain to be explored but will probably involve physical separation of some activities.

This study is part of the continuous process of collecting information on which to base management decisions. GBRMPA makes these decisions on the best information available and particular emphasis is placed on public contributions when deciding on zoning and use of the Marine Park. In this case, GBRMPA is looking seriously at ways of reducing the risk and inconvenience of conflicts between seaplanes and visitors at Green Island.

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Research

Controlling Crown of Thorns Starfish

During the past few months the Authority has been undertaking trials to determine if crown of thorns starfish can be controlled on selected reefs of importance to science and tourism. Large-scale manual eradication programs have been undertaken elsewhere in the Pacific but most were not considered successful. Early trials on the Great Barrier Reef also indicated that it would be impossible to contain a large infestation of these starfish. Subsequent attempts at reducing numbers in small isolated infestations have however been successful. As part of the important program of studies on crown of thorns starfish currently in progress, GBRMPA is looking more closely at the feasibility of small-scale manual controls. Among the aspects considered to date are the use of volunteers and fencing possibilities.

History of crown of thorns starfish controls

Several attempts have been made over the past twenty years to use teams of SCUBA divers to control the starfish on reefs of the Great Barrier Reef, Southern Japan and some Pacific Islands. When the starfish infested Green Island in the early 1960s, divers attempted to kill them by cutting them up. However, it was realised that they may be able to regenerate from small parts as can other kinds of starfish. On Beaver Reef the starfish were collected with hooks and they were taken ashore and buried. The injection of copper sulphate solution using an injector gun was subsequently found to be more efficient. In trials conducted on Green Island, divers injected over 130 starfish each hour resulting in a 95% mortality rate.

The largest starfish control programs ever undertaken were by the Japanese. Fishermen were paid a bounty to collect the starfish which were brought ashore, counted and buried. Over ten million crown of thorns have been killed in the Ryukyu Islands at a cost of about 600 million yen (over $A 3.6 million). Despite this vast effort the eradication program was considered a failure. Most of the damage had been done by the time funds became available for the program and ultimately many starfish were left because it was no longer economic to continue removing them.

In Australia efforts to save a small area of Green Island Reef for coral viewing after the severe infestation of the 1960s proved impossible but limited areas of Beaver and John Brewer Reefs have been saved by tourist operators. In one case in Japan, and another in Hawaii, small isolated populations were successfully eradicated. On the GBR a population of 500-1000 starfish threatening the Cod-Hole was also successfully eradicated by the Authority in 1984 using the injection method.

Management options

As scientists do not know whether the outbreaks are a natural or man-induced event, even the necessity for large-scale control programs has been questioned. Because of this, and the Japanese experience, GBRMPA has limited its controls to small-scale tactical measures intended to save special areas of reefs, e.g. important tourist areas. Rather than expend huge amounts of money on controls of dubious value, GBRMPA has channeled funds into research to find out more about the starfish, the causes of the outbreaks, the effects on the users of the Marine Park and the potential of biological controls. An evaluation of manual control methods and the feasibility of using volunteers to reduce costs are included in the research program.

The use of volunteers: Grub Reef trials

In July, 1986 the Authority undertook a control program on Grub Reef off Townsville using volunteer divers from the Royal Australian Navy to determine if divers could clear a limited area of reef. Scientists accompanying the expendition tested the effectiveness of quicklime for mass control of the starfish and conducted a number of experiments to assess the ecological effects of the copper sulphate used by the volunteer divers, and of the quicklime. They also investigated the natural rate of predation and extent of migration.

Research workers from the Australian Institute of Marine Science initially surveyed the reef to determine the distribution and number of crown of thorns present. The reef was also surveyed soon after the completion of the trials and will be surveyed again next year to assess the long-term success of the exercise.

The volunteers were professional divers and midshipmen from HMAS **Creswell,** the RAN training base at Jervis Bay. During the two weeks of the trial fifteen divers each made three or four SCUBA dives a day, spending a total 261 hours under water. They swept over 100 ha of lagoon and coral patches and injected 3175 crown of thorns starfish. Although most divers were spiked by the starfish and there were several other minor problems treated by the diving medical officer, the dive operations were considered very successful.

Follow-up surveys of some coral patches which had been cleared showed that some of the starfish were well-hidden and overlooked and that other starfish were moving into a cleared patch of reef overnight. There were many starfish back in the area only one month after the exercise, suggesting that the effects of clearing were short lived.

To determine whether quicklime could be used for mass controls, scientists erected enclosures on reef tops and artificially stocked them with large numbers of starfish to simulate a large infestation. Quicklime granules were then uniformly spread over the reef top from a small boat. Where they came in contact with a starfish the granules burnt a small spot; if sufficient granules hit a starfish it died within several days. However the application was only partially effective as many of the starfish were hidden or partially hidden in corals and escaped most of the granules. The quicklime granules also killed corals and other organisms they came in contact with.

Fencing trials

Migration of starfish from neighbouring areas was a major problem but the enclosures which were erected for the quicklime trials suggested that once an area was cleared, it might be possible to place a barrier around it to stop re-infestation. To determine whether it is feasible to use enclosures to protect small areas of corals, scientists from James Cook University tested a range of barriers in further trials in September.

Thirteen different enclosures made from a variety of commercially available fencing and netting were erected near the 'Reeflink' pontoon at John Brewer Reef. Designs included simple rigid and flexible barriers, tangle nets, wire net with an overhang at the top, and various combinations of these. Starfish were placed in each enclosure and were monitored hourly, day and night, for about five days.

The starfish were masters of escape. A dinner-plate sized starfish could squeeze through holes the size of a cup. However most designs with smaller mesh were at least partially successful and the wire net with overhang was very effective. The starfish crawled up the vertical sides without problem but they had insufficient grip on the overhanging wire to hang up-side-down and repeatedly fell back into the enclosure. This design will be tested on a larger scale in the near future.

These trials suggest that tourist operators on reefs affected by crown of thorns might be able to preserve areas of reef for coral viewing and diving by injecting starfish with the killing agent, copper sulphate, and then enclosing the area with a barrier to keep out neighbouring starfish. Further information on these trials should become available as the major crown of thorns research program continues over the next two years.

Zoning

Reef Users Give Zoning Plan the Thumbs Up

In anticipation of the forthcoming Capricornia Section Zoning Plan review, the Authority commissioned a private consulting firm to measure reactions to the current Zoning Plan and management of the Capricornia Section. The project, undertaken by Environmental Science and Services, has pioneered new ground for natural resource planning in Australia and is one of the few occasions where a government planning agency has openly sought public judgement of its performance.

The consultant's final report, containing the results of almost nine months of intensive data collection and analysis, is the culmination of the most ambitious program of Reef-user surveys yet undertaken in any Section of the Great Barrier Reef Marine Park. The results include the views of more than 1 700 people in the Capricornia Section from a wide variety of user groups including:

- Commercial fishermen,
- Private motor-boat owners,
- Island resort managers,
- Charter boat operators,
- Permit holders,
- Island residents,
- Island campers,
- Heron Island Resort visitors,
- Lady Elliott Island Resort visitors,
- Charter boat passengers,
- Day-visitors to Lady Musgrave Island,
- Research Station directors, and
- User clubs and organisations.

The overall public response to the Zoning Plan and day-to-day management is very positive. It is widely accepted that the Marine Park is playing a worthwhile role in helping to protect the Great Barrier Reef. While many people expressed some reservations about certain aspects of the Zoning Plan and day-to-day management, most expressed a view that the levels of inconvenience they are suffering are acceptable if it means that this Section of the Great Barrier Reef will be protected for future generations.

The surveys indicate that commercial fishermen feel they have been more disadvantaged by the Zoning Plan than other Reef-user groups. They cite loss of traditional fishing grounds and a lack of equivalent restrictions on recreational fishermen as evidence that they are disadvantaged. On the other hand there appears to be a consistent point of view from other Reef-user groups that opportunities for commercial fishing within the Section should be reduced when the Capricornia Zoning Plan is reviewed.

There is evidence to suggest that many users perceive the Capricornia Section as a 'national park' rather than in its true role as a multiple-use park. The message that 'reasonable use' and 'limited extraction' are part of the Marine Park philosophy has so far eluded many people.

The level of knowledge and understanding of the technical aspects of the Zoning Plan is generally low — even amongst people who spend a large amount of their working or leisure time in the Section. This does not necessarily mean that there is widespread ignorance of the zoning provisions. Although people may not be aware of the zone names, for example, there is a general awareness amongst regular users of where and when activities are permitted. There is a tendency amongst less experienced users to assume that use restrictions are more severe than in fact they are.

Strong preferences were expressed by a number of groups that opportunities for extractive activities such as line-fishing, trawling and shell collecting should be reduced when the Zoning Plan is reviewed. The notion of bag limits on recreational line and spearfishing received strong support from almost all user groups.

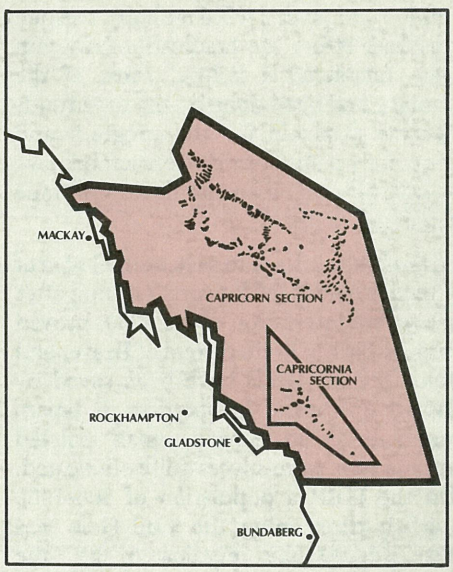
The image of Marine Park rangers was favourable amongst most user groups although there appears to be little contact between rangers and a number of significant user groups, particularly those who visit the southern part of the Section.

Confusion exists amongst many users as to the relative roles of the Authority and the Queensland National Parks and Wildlife Service in the Capricornia Section. This confusion is even apparent amongst some users who have had close contact with both agencies.

There is a widespread feeling amongst users that the legal provisions of the Zoning Plan are not being adequately enforced. Many respondents feel that surveillance is inadequate and that there is a general reluctance on the part of responsible agencies to seek prosecution of known offenders.

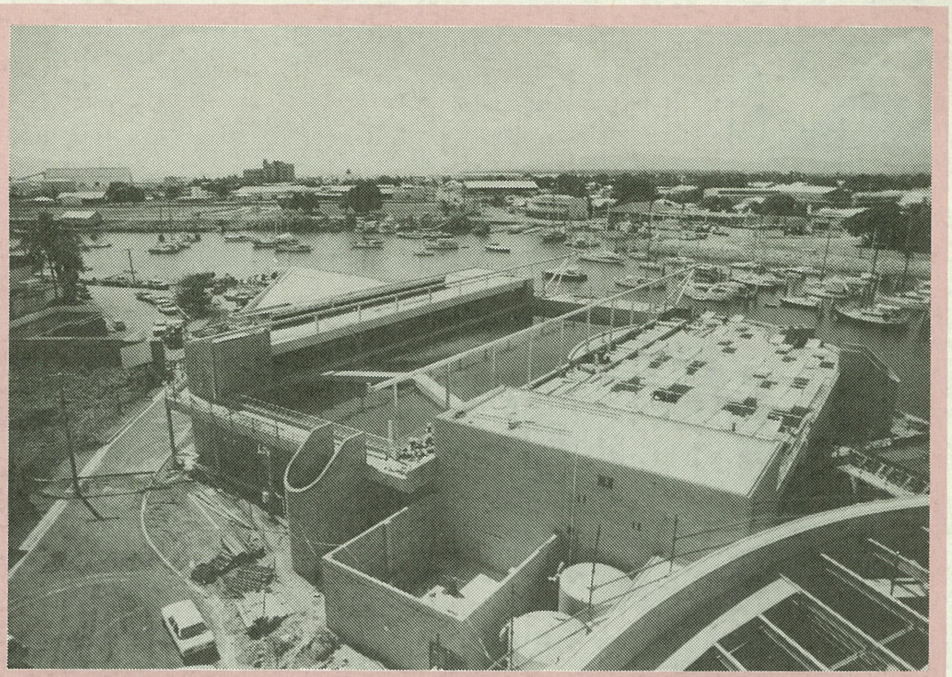
Overall the survey highlights a general public acceptance of the Capricornia Section Zoning Plan and day-to-day management. An overwhelming majority of respondents from all user groups agree that the Zoning Plan has helped to protect the Great Barrier Reef. At the same time the survey has raised a number of issues which will be addressed by GBRMPA during the review of the Capricornia Section Zoning Plan. One of the most pressing of these issues concerns public perceptions of what are and are not acceptable levels of fishing and collecting from the Section, and how these perceptions might best be incorporated into the Zoning Plan. The survey has also identified some specific areas that warrant the attention of day-to-day managers in the Capricornia Section. Most of these are concerned with education, extension and enforcement activities.

The research project was also undertaken as a pilot exercise to develop and test evaluation procedures for Marine Park planning. The methodology that has been developed has proven to be successful and is equally applicable to other Sections of the Marine Park. The Authority's initiative in commissioning this research project has established it as a leader in both the methodology and practice of plan evaluation.



This high angle shot illustrates the progress being made in the construction of the aquarium component of the Great Barrier Reef Wonderland. At this stage the aquarium is filled with freshwater to 'cure' the reinforced concrete of which it is constructed.

For the first time the huge size of the tanks can be readily seen. The predator tank is in the foreground with the larger coral reef tank beyond. To the right of the photograph is the algal scrubber area where water from the tank will be passed over algal mats for oxygenation and removal of nutrients.



Fringing Reefs and Tourism

Co-operation between Reef users, managers and scientists can greatly enhance the tourism industry according to participants of a recently organized Fringing Reef Workshop, held at Magnetic Island. The Magnetic Island Workshop aimed to bring together scientists, tourist operators and Marine Park managers to encourage further co-operation between these groups and to emphasise the value of fringing reefs for tourism.

Mr. Kelleher, Chairman of GBRMPA, said in his opening address that fringing reefs are very vulnerable because they are so accessible. 'Making use of the environment without using it up is one of the key challenges and prerequisites for success. The Authority has adopted a management philosophy based on the belief that any use of the Reef or associated areas should not threaten the Reef's essential ecological characteristics and processes.'

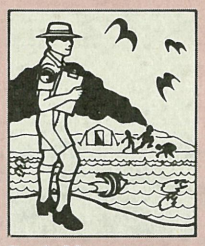
'Without scientific input, we cannot understand the resource and monitor it; without managers the information cannot be fully used and without input and support from the tourism industry, appropriate research will not be done', he said.

Some valuable recommendations came out of the workshop.

They were:

1. Tourist operators requested that GBRMPA organise a course or workshop for tourism operations closer to their point of business e.g. in the Whitsundays or on actual islands or fringing reefs. It may still need to be demonstrated to some tourist operators that engaging scientifically trained people or training their own staff in coral reef ecology could be beneficial to their business.
2. A 'symbiotic' relationship should be encouraged between resorts and near-by research stations, whereby researchers could offer some interpretation of research in progress and resort operators could facilitate monitoring of reefs that are used by their operations.
3. Research on fringing reefs should be focussed on effects of siltation, temporal variation on specific sites, more baseline surveys, integration of remote sensing and ground truth techniques, and more extensive monitoring.

It was difficult to bring together a variety of people with different needs and expectations into a workshop setting in the hope that all would find answers to the challenges of fringing reefs. The common bond — a realisation of the need for sustainable use of the Great Barrier Reef and its resources —seemed to pervade the setting and assist in achieving the objectives of the Workshop to a considerable extent.



Park Management

Shell Collecting

The reefs and coastline of the Great Barrier Reef Region house a great diversity of shelled molluscs, over 4 000 species, many of which are much sought after by collectors.

A study of shell collecting on the Great Barrier Reef has been commissioned by GBRMPA with the object of developing a profile of this activity. The aims of the study are to determine who is collecting, to identify the major collecting sites and to define which species are most heavily collected. The information obtained from this study will assist the Authority in making future management decisions regarding shell collecting. The consultant undertaking this study, Bryony Barnett, has, until recently, been involved in research on marine zooplankton and lobster larvae in the Department of Marine Biology, James Cook University.

Recreational shell collecting, like most activities, is regulated in those Sections of the Great Barrier Reef Marine Park for which zoning plans have been developed, and is allowed in the General Use Zones 'A' and 'B', subject to possession of a permit. Permits are issued for periods of up to 12 months and permit holders are required to submit a collection report with each application for renewal. This information is an important source of data for studies such as the present one.

Removal of Tridacnid clams, the helmet shell, *Cassis cornuta*, the trumpet shell, *Charonia tritonis* and shells on egg masses is prohibited. The permits authorise only the taking of shells for private collecting and for limited exchange.

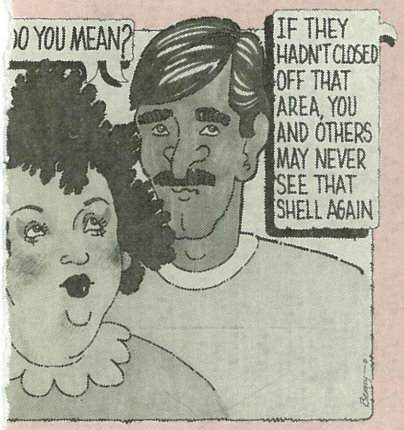
Serious specimen collectors usually seek representatives of selected taxa, local and worldwide. Live animals are often preferred, to ensure that good quality shells are obtained. Many such collectors belong to shell clubs, of which there are eleven on the Queensland coast. The larger clubs produce regular newsletters, which include news of collecting activities, species descriptions and reviews. For several clubs the annual shell show is a major event including some spectacular displays, both competitive and educational. These reflect a great commitment on the part of the members.

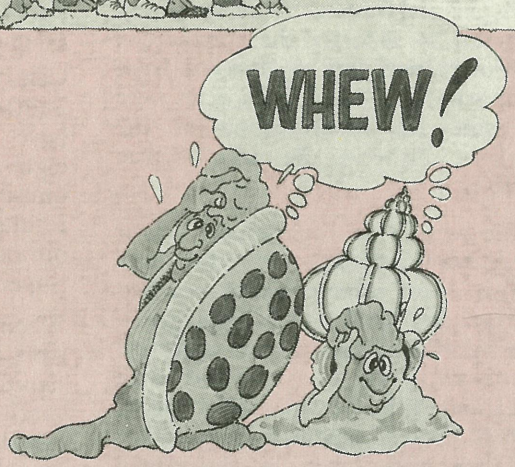
The major groups sought by specimen collectors are the cowries (Cypraeidae), cones (Conidae), volutes (Volutidae), strombs (Strombidae), olives (Olividae), mitres (Mitridae) and murex (Muricidae), all gastropods. With development of a collection, more obscure shells are sought, or a specilization in a particular group may develop.

The more casual shell collectors are found amongst tourists at reef resorts and on charter vessels, visitors to fringing reefs, divers and sailors, all of whom are attracted to the natural beauty of shells as souvenirs and ornaments.

Whatever the interest it is important to note that removal of a living animal from its environment may have some effect, however small, either by reduction of the breeding population or by damage to the habitat. Club collectors emphasise the collecting code:

- do not break coral to look for shells;
- return all overturned rocks with care;
- take only sufficient for your own needs;
- do not remove juveniles, shells on eggs or egg-cases;





- leave adult shells with scars and breakages to breed.

For those who merely seek a reef souvenir the dead shell should suffice. A live shell, like all animals on the reef, has a role to play in a very complex system. In addition, much work is involved in cleaning a live shell, inside and out, and a pretty souvenir can rapidly became an unpleasant problem as the remains of the body, tucked far inside the spiral shell, decompose. All too often shells are rejected at this stage; an unnecessary waste.

As an alternative to shell collecting, a great deal of pleasure can be derived from observing the live animals on the reef, on muddy and rocky shores and on sandbanks. A carefully lifted rock can reveal shells clinging to the undersurface — cowries with their glossy shells concealed by a colourful mantle. Sandy pools between coral rubble on the reef flats are the preferred habitat of the common spider shell, often well camouflaged by algal growths. Cone shells, their distinctive patterns obscured by the thin skin or 'periostracum' on the live shells, occupy a similar habitat; a few species have the reputation of inflicting fatal stings, so all should be treated with caution. A surface trail on a sand bank may be a clue to a buried mollusc, and even a close look at mudflats can offer unexpected colour in the tiny necklace nerite.

Each of these animals is of significance in its particular habitat. Removal of large numbers of shells from one area is likely to have an impact on other dependent organisms. There are still many questions to be answered on the subject and the current study hopes to address some of these by improving our knowledge of the level of collecting and the species collected and relating this information to what is known of the biology of the molluscs. This information will assist the making of better management decisions, with the aim of ensuring a sustainable yield of the resource whether this yield is collected specimens or the appreciation and enjoyment of the live animals on the reef.

National Fishing Survey Report

A national survey has revealed for the first time that recreational fishing is a giant industry in its own right, contributing more than $2.2 billion annually to the Australian economy and regularly involving a third of the country's population.

The survey, based mainly on a national household survey conducted by PA Management Consultants and Reark Research Pty. Ltd., was commissioned by the Australian Recreational Fishing Confederation with a Commonwealth Government grant. It found that recreational fishing is the most popular single outdoor recreation in Australia (excluding activities such as walking which require no special skills or equipment).

Summary of main findings

- In the year of the survey 4 500 000 people (aged 10 and over) went fishing in Australia
- More than one in every two Australian households (56%) own some type of recreational fishing equipment
- The value of fishing equipment already owned (tackle, boats, special clothing, vehicle and camping units) exceeds $6.5 billion
- Expenditure on recreational fishing and fishing-related equipment in 1983/84 totalled $2.2 billion (not including expenditure on fishing trip accommodation and the like)
- While collectively, fishers spend a lot of money on their activity, the recreation remains affordable to those of limited income. Fishing is attractive to and attainable by all income and occupation groups, and whereas participation in most other outdoor activities declines with age, fishing retains the interest of people as they get older. In other words, the popularity of fishing extends over all regions, age and social groups.
- Adults in the survey regions travelled nearly 2.5 billion kilometres for fishing in the 12 months to July, 1984
- The typical fisher makes 15 fishing trips a year and travels 100 kilometres per trip
- Typically, two out of three fishers are male and one out of two males aged 13 to 44 years is a fisher
- Most fishing is done in saltwater and estuaries and the most popular platforms are beaches and rocks, followed by boats in estuaries/bays, and jetties/wharves
- Fishing is a very social activity, with married people fishing mostly with family and unmarried people with friends. Only 10% of fishers fish mostly by themselves.

Planning

Reef Fish in Trawl Catches

Gerry Goeden and Clive Jones, Northern Fisheries Research Centre, Cairns, Queensland Department of Primary Industries.

Catching non-commercial species is an unavoidable part of the process of prawn trawling throughout the world. Prawn trawling in Queensland waters is no exception and there are regular reports of deposits of dead 'trash fish' washed up along northern beaches. While the biological consequences to fish populations of this additional mortality are unknown, the sociological impact is very apparent and very real: recreational fishermen and other Marine Park users are in disagreement with commercial fishermen over the capture of these unwanted species.

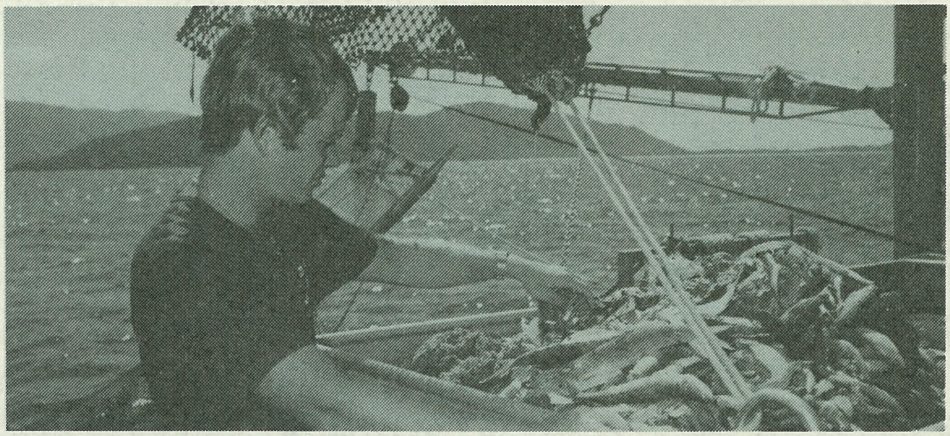
At least eight families of fish, typically found on reefs or in inter-reef areas, are represented in the by-catch of commercial trawlers working in North Queensland. But not all the species within these families are true coral reef dwellers, consequently, some claims of exploitation of juvenile 'reef fish' may, by definition, be unwarranted.

The Great Barrier Reef Marine Park Authority (GBRMPA) and the Queensland Department of Primary Industries (QDPI) Fisheries Research Branch (FRB) recently joined forces in an effort to determine if commercial prawn trawling operations may detrimentally affect the recruitment of these 'reef fish' to nearby reef areas. This research program focussed on species associated with the coral reef areas, whose adults are of commercial or recreational importance.

These included the red emperor *(Lutjanus sebae)*, large-mouthed nannygai *(Lutjanus malabaricus)* and small-mouthed nannygai, *(Lutjanus erthropterus)* collectively referred to as 'redfish'.

'Redfish' catch data were supplied by fishermen on eight commercial trawlers operating between Hinchinbrook Island and the Torres Strait, from 1980 to 1983. In addition, more detailed information was obtained during 1984 from a series of trawl surveys carried out in the Cairns region using the QDPI's fisheries research vessel **'Gwendoline May'.**

Four trawl surveys were conducted on recognised commercial prawning grounds near Cairns using standard, paired, six-fathom, commercial prawn nets. The grounds surveyed were at Low Isles, Double Island and Fitzroy Island.



Catch material from each shot was sorted on board to separate the commercial catch of prawns and bay lobsters from the remainder. All reef fish species were set aside for identification at the Northern Fisheries Research Centre (NFRC).

Of the reef fishes represented in our survey trawl catches, only the three 'redfish' — red emperor, large-mouthed nannygai and small-mouth nannygai — were significant due to their collective importance to commercial and recreational fisheries. All individuals of 'redfish' species caught were juveniles and they were taken in very small numbers.

Using both the commercial trawl data and the **'Gwendoline May'** survey data, we obtained a measure of the incidence of 'redfish' in trawl shots by examining the proportion of shots which produced one or more individuals of these reef species.

The combined fishing effort convered a total trawled distance of 9 100 km (an area of 4 290 hectares) for a total catch of 571 juvenile 'redfish' from many tonnes of by-catch. This represented an average catch rate of 0.06 'redfish' per kilometre trawled or about 0.13 'redfish' per hectare of ocean bottom. The proportion of trawl shots that contained 'redfish' ranged from a low of 21% at Low Isles in August, 1984 to a maximum of 67% at Double Island in December of that year.

Analysis of the commercial trawl data and our survey data indicated a large variation between vessels in the catch of 'redfish' per kilometre of trawling. Although some of this variation may be due to different gear and/or trawling speeds, it is most likely that 'redfishes' have a patchy distribution over the trawl grounds.

Conspicuously high catches of juvenile 'redfish' over short periods of fishing have been recorded in fishermen's logbooks. These instances are, however, unusual and tend to bias the catch rate results. High variability in catch rates means that the population is 'superdispersed' or patchy.

When analyses were used which took this variation into account, there was no significant difference in total 'redfish' catch between the different areas sampled by the **'Gwendoline May'.** Low Isles, Double Island and Fitzroy Island all had similar 'redfish' populations and none stood out as nursery grounds.

Adult 'redfishes' are know to spawn in reef waters during summer and multiple spawnings by the same individual within each season are possible. Postlarvae and/or juveniles from these spawnings migrate to nursery grounds which apparently overlap with prawn trawling areas. Our results suggest that the larger juveniles migrate back to reef waters and continue to move eastwards as they grow. As a result, the biggest fish are typically found on the outermost reefs.

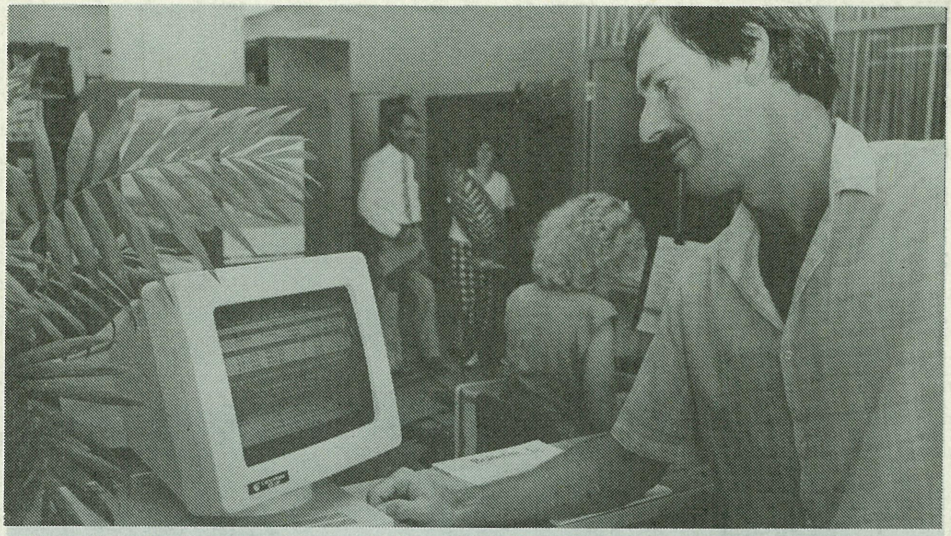
The size range of the 'redfish' landed by the **'Gwendoline May'** and commercial trawlers clearly demonstrated that only juvenile fish were taken by the nets. The absence of larger fish suggests that with increasing size, 'redfishes' had either become capable of avoiding capture or had migrated to deeper reef areas. This contention was supported by a comparison between two surveys carried out in the Fitzroy Island area in May and August, 1984. Analysis showed a significant decrease in abundance of all

'redfish' species over the three-month period. Unfortunately, data collected throughout the year from commercial vessels at a variety of sites were not sufficient to provide an estimate of relative seasonal abundance in specific fishing areas along the Queensland coast.

Calculations of age and mortality rates of 'redfish' have been carried out by scientists at the NFRC. This information shows that most of the 'redfish' caught by line fishermen are four to five years old and that they can live for a maximum of about eight years (although some deeper water specimens are a little older). In the very broadest terms, this represents a survival rate of about 50% per year (that is: for each year of the fish's life it has about a 50% chance of surviving and thus the abundance of offspring from a particular year decreases by about half every 12 months.)

Using the estimated survival rate of 50% per year, the average-sized fish (about four years old) caught by anglers and commercial line fishermen is a survivor of a stock which was between 15 and 20 times more numerous as young-of-the-year fish. From the line fisherman's point of view, it would require between 15 and 20 juvenile 'redfish' to be caught by a trawler to equal the removal of a single adult from the reef line fishery.

This research suggest that the incidence of juvenile 'redfish' amid the by-catch of commercial prawn trawlers is probably insignificant from a line fisherman's point of view. It is evident that 'redfish' display quite specific habitat requirements at different stages of their life cycle, and it is this changing distribution that is the most likely explanation for the conflict among fishermen. It is also evident that the population of 'redfish' at Low Isles is not significantly different from those at Double Island and Fitzroy Island and even though juveniles are regularly taken by trawlers, there is little evidence to support the view that Low Isles is an important nursery ground for these species.



What's the weather like now at John Brewer Reef?

The illustration shows a display unit in the foyer of GBRMPA's Townsville office from which one can read the current weather conditions on John Brewer Reef. It is possible to do this because of a remote weather station system which has been developed by scientists, technicians and engineers at the Australian Institute of Marine Science (AIMS).

The remote station records a variety of data including wind speed and direction, barometric pressure and air and sea temperature. This information is transmitted by radio signal to the AIMS computer from where it is retransmitted to the remote weather station network outlet in the GBRMPA office.

Letter to the Editor.

In **Reeflections** 17 the editor undertook to publish letters received in response to the article 'Campers Surveyed on Attitudes to Fishing Bag Limits'. The following letter has been received.

Dear Sir,

I write on behalf of the Queensland Sport and Recreational Fishing Council in response to your article 'Campers Surveyed on Attitudes to Bag Limits' (**Reeflections** No. 17) by Terry Walker of Q.NPWS.

Queensland Sport and Recreational Fishing Council is the body recognised by the State Government as representing the interests of more than one million Queensland sport and recreational fishers. We thus represent the largest user group of the Great Barrier Reef Marine Park and have a vital interest in any suggested introduction of fishing bag limits.

This Council has consistently opposed the use of bag limits as a management tool, except where there has been proven biological need to such limits, as was the case with the examples quoted by Mr Walker viz Barramundi and Australian Bass. The bag limit on Spanner Crabs was introduced as a trial measure and is presently under review by the Fish Management Authority. In our view bag limits should not be used as a means of restricting the catch of any one section of the fishing community be they recreational fishermen as opposed to commercial fishermen, or as your article suggests, the serious expert fisherman as opposed to the casual holiday angler.

I would suggest that some of the responses supporting bag limits may have been prompted by 'sour grapes' at the obvious success of a small number of anglers. Your Authority's own research has indicated that the major proportion of the amateur catch is caught by a relatively small number of fishermen. Bag limits should not be used to bring these experienced and successful fishermen down to a lower common denominator.

QSRFC has as one of its objectives the conservation of this State's fisheries resources for future generations. Obviously research is essential to determine if there has been any change in fish populations. As stated previously Council would seriously consider bag limits as part of an overall management regime if fish stocks were proven to be seriously depleted.

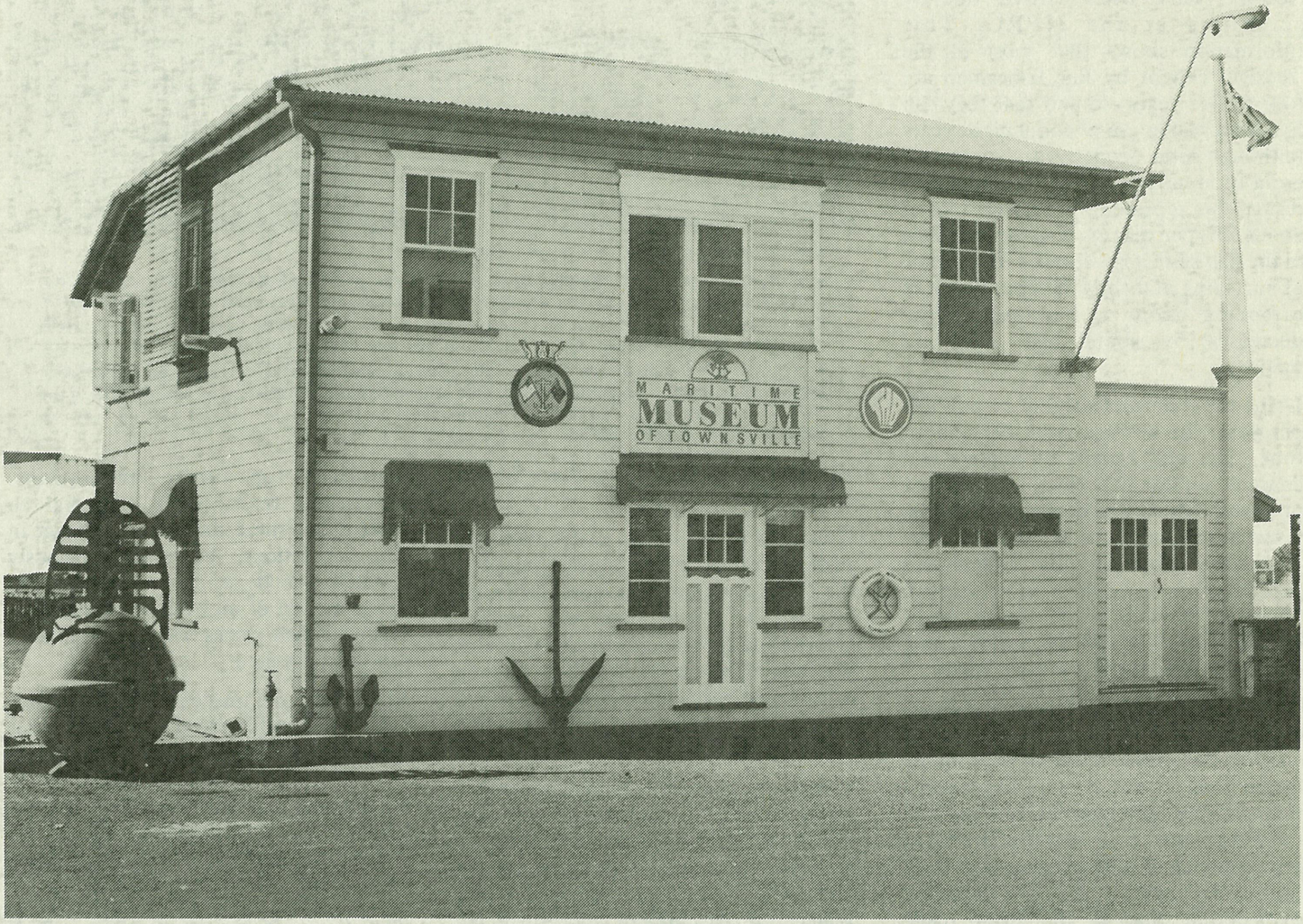
In our view the introduction of arbitrary bag limits would indeed lead to ill feeling towards Q.NPWS rangers and the GBRMPA. However, as was the case with Barramundi and Australian Bass, if there is a proven need for bag limits, then Sport and Recreational fishermen will generally support and adhere to such limits.

The Great Barrier Reef Marine Park Authority has built up a considerable amount of good will amongst the fishing fraternity through its processes of discussion and consultation in respect to the various zoning procedures. The Queensland Sport and Recreational Fishing Council feels most strongly that any destruction of this good will through arbitrarily imposed bag limits would not be in the best interests of the Authority or the fishing fraternity.

Yours sincerely
Denis Griffith
Chairman
Queensland Sport and Recreational Fishing Council

Editoral Note: Readers should note that Mr Walker's article did not suggest that bag limits were to be introduced and certainly not arbitrary bag limits. The Authority would not consider introducing bag limits without very wide prior consultation with users of the Marine Park.

New Maritime Museum opened in Townsville.



The brand-new Maritime Museum of Townsville has been established, and is being operated by the Seafarers Association of Townsville. This Association is made up of former and serving Merchant and Service Naval personnel, and it is their love of the sea, and the co-operation of the Townsville Harbour Board which has brought about this local nautical attraction.

Early in 1986 the Townsville Harbour Board was refurbishing the former Piermaster's Office building, between berths 4 and 6 at the port, with a Commonwealth Employment Programme grant, in order to establish in it a port information and observation centre. The Chairman of the Board invited the Seafarers Association of Townsville to establish a Maritime Museum on the upper floor of this building. The members took up this challenge, something they had been considering for some time and the projects came to fruition with the official opening of the Port Information and Observation Centre and the Maritime Museum of Townville, by the Mayor of Townsville, Alderman Mike Reynolds on 15th July, 1986.

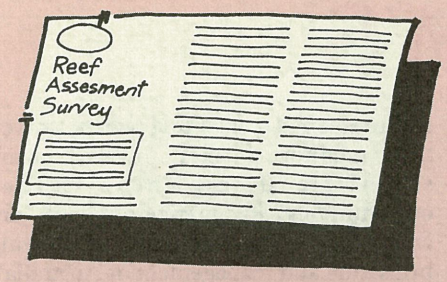
The museum project is based on the realisation that North Queensland has a rich maritime heritage, and on the desire to preserve and display it for the benefit of everyone — from local school children to overseas tourists. According to the President of the Seafarers Association of Townsville, Peter Nielsen, the museum will concentrate mainly on ships that have visited, or operated out of, the port of Townsville.

Many interesting items are already on display. For example, the ship's bell from the ill-fated **SS Yongala** is on loan and is displayed in pride of place, together with portholes and other recovered articles.

The pride of the members of the Seafarers Assocation, says Mr Nielsen, is the reproduction of the wheelhouse of a vessel as it approaches Townsville at night. The port and starboard beacons of Platypus Channel flash realistically ahead and, with genuine binnacle and wheel, one gets the illusion of being on a 50 year old ship. Navigational paraphernalia — charts, sextant, tide and star charts, chronometer, parallel rule etc — lying on the chart table enhance the atmosphere and the antique telescope and binoculars can be seen through the viewing window.

The mammoth ongoing task of research and updating is very much recognised by the Museum staff, and there are plans in hand to extend the Museum, which will include a library.

The Museum is open on weekdays from 1000 to 1200 hours and 1300 to 1600 hours manned by a Townsville Harbour Board 'Information Officer'. At weekends the Museum will open from 1300 to 1600 hours and is manned by members of the Seafarers Association of Townsville.



Reef Users Can Assist in Coral Assessment Survey

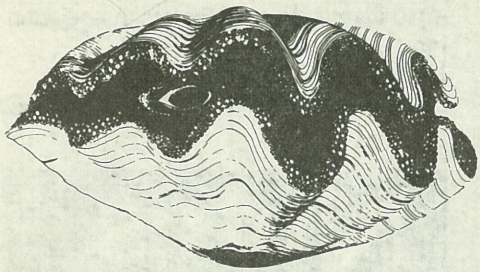
The Authority would like divers, charter boat operators and marine scientists visiting coral reefs to assist in its monitoring program. All reef users are requested to complete a simple form on each reef they visit.

In the past the Authority has relied strongly on reports from reef users to track the crown of thorns infestations and has compiled a computerised database of sightings. These reports are very valuable and an important way of keeping track of changes in the Reef without undertaking extremely expensive scientific surveys. However most of the past reports simply reported where the starfish were seen, and did not indicate where they were not present. This is equally important if an overall picture is to be obtained.

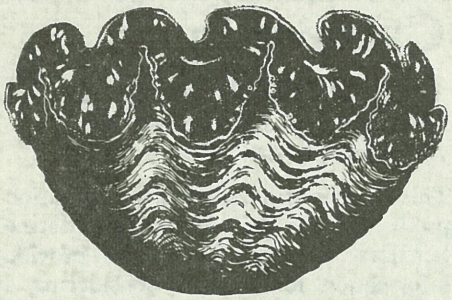
The new forms are simple to complete and attractive in presentation in an effort to increase returns. As with the old crown of thorns sightings forms, they are postage-paid in Australia. They are available at the Authority's Townsville office and Q.NPWS regional offices. They will be distributed among dive clubs, charter boat operators and others.

So reef users, here is your opportunity to assist in management of the Great Barrier Reef. Complete an assessment form for every reef your visit.

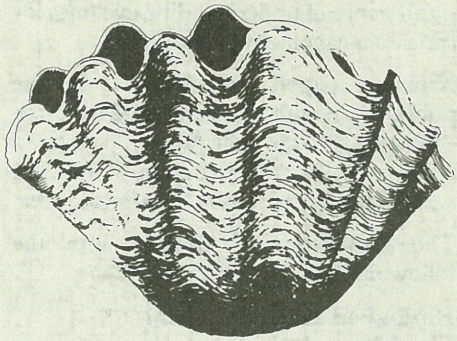
Giant Clam Watch.



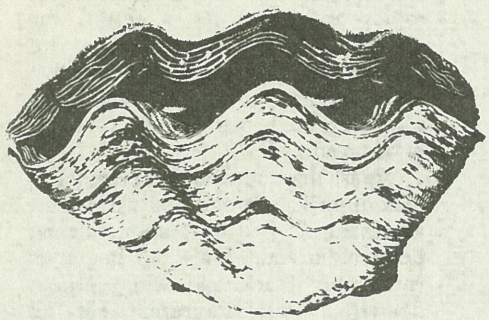
Tridacna gigas



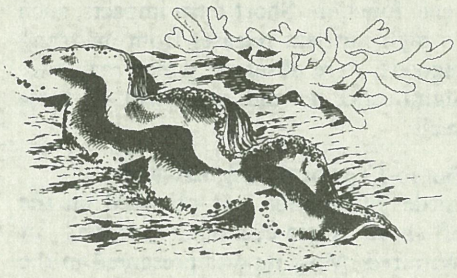
Tridacna maximus



Hippopus hippopus



Tridacna derasa



Tridacna crocea

The Queensland National Parks and Wildlife Service (Q. NPWS) is launching a Great Barrier Reef CLAM WATCH to monitor the health of giant clams on the Great Barrier Reef.

If you are out on a reef and see any giant clams, make a note if they are healthy or dead with empty clean white shells. Let Q.NPWS know where and when you saw the clams.

Over the past year there have been reports of giant clams dying at reefs in the Cairns and Far Northern Sections of the Great Barrier Reef Marine Park. The greatest number of deaths occurred at reefs around Lizard Island in June and July of 1985.

Reports from other reefs have recorded only one or two clams dying with the exception of Thetford Reef where greater numbers have died recently. The major species affected have been *Tridacna gigas* (the largest of the giant clams), *Tridacna derasa* and *Tridacna maxima.*

Q.NPWS Marine Park staff have been monitoring giant clam populations on several reefs for the past year. In addition researchers from James Cook University and Queensland University are investigating the causes of these deaths. A parasite is the prime suspect at the moment.

The Q.NPWS would like to gather more information about the numbers of giant clams dying since the deaths may have serious consequences for tourism and mariculture. Any sightings of clams on the reef will be valuable.

If you are a regular user of the reef, contact the Q.NPWS officers at 41 The Esplande, Cairns and they will forward CLAM WATCH forms which illustrate the various species of giant clams in the area, and list the details needed.

BOOK REVIEWS

The Offshore Effects of Cyclone Winifred.

Proceeding of a workshop held at the Townsville International Hotel, Friday June 20th 1986.
(GBRMPA Workshop Series No. 7) edited by Ian Dutton

A report outlining the findings of the workshop on tropical cyclone Winifred is now available from the Great Barrier Reef Marine Park Authority. The workshop, held in Townsville in June 1986, studied all off-shore effects of Winifred and the significance of understanding cyclones for future management of the Reef.

Nineteen papers are included in the publication, with topics ranging from the ecological effects that Winifred had on coral reefs, to the disruption of tourism and fishing operations in the affected area.

The publication is divided into the following main topics:

Biological and Ecological Significance
While Winifred was not an exceptional cyclone, rating three on the five level Saffir-Simpson Scale, physical damage included the destruction of many branching and plate corals. Follow-up studies show new insights in how some reefs function. Short term impacts, such as high nutrient releases from mainland lagoons, were observed which may have significance to the re-growth of these reefs.

Socio-Economic Significance
Little information was obtained on the off-shore socio-economic impacts of Winifred. Most reports presented in the Workshop rated damage to structures and facilities as only minimal. It is believed that local residents and visitors would have experienced severe, short-term disruption.

Scientific Understanding of the Great Barrier Reef
Winifred provided an excellent opportunity to evaluate the effects of an extreme, short-term phenomenon. Measurement and evaluation of those effects was greatly facilitated by the availability of 'baseline' information on aspects of the impacted area in the form of data obtained from studies undertaken in the week preceding the cyclone. New information was obtained on short and mid-term processes; however, understanding of this will be limited until longer term and comparative data are available.

Human Use
Human use of the offshore area was severely disrupted in the short-term by Winifred. The extensive damage to some reefs and inter-reef areas may cause some disruption to tourism and fisheries operations between Fitzroy and Hinchinbrook Islands.

Management of the Great Barrier Reef
Winifred reinforced the notion that cyclones are one of the most significant forces shaping the Great Barrier Reef. Concern was expressed that, in planning for human use of offshore areas, care should be taken that the proposed activity does not interfere with the inherent ability of natural systems to recover from extreme damage, such as that caused by cyclones.

Copies may be obtained from the Research Section, GBRMPA.

Careers in Marine Science

Australian Marine Sciences Association - 4th Edition, 1986.

This is the fourth edition of a publication produced by the Australian Marine Sciences Association Inc. to provide information for persons considering a career in marine science. It has been devised and written to aid secondary and tertiary students interested in pursuing a career in one of the many branches of marine science.

Since the publication of the previous edition, many new fields of marine science have developed, and several have consolidated and expanded.

Research has now been conducted on Australian marine ecosystems for many years and the results of these studies are now widely available. The application of these data is emphasised in the expanding fields of managing marine ecosystems, providing education and information services and the farming of marine food stocks. The role of marine researchers and managers in the establishment and control of marine and estuarine protected areas, such as the Great Barrier Reef Marine Park, is a good example of this.

A striking feature of marine science is the diversity of careers available in Australia, and the numbers of people working in more than one particular field. This is particularly apparent in the area of marine environmental consulting where survey and monitoring may involve many scientific disciplines. Career opportunities in marine science are continually expanding with the growing utilisation and management of Australia's marine resources.

This booklet is intended to indicate the current scope of marine science in Australia and provide some background information about each discipline or occupation. Additionally, some information regarding typical qualifications required for these careers, and the contact points for details of further information and training are included.

Copies of the booklet cost $1.00 each and can be ordered from the
Australian Marine Sciences Association Inc.
20/8 Waratah Street
CRONULLA NSW 2230

Notes

Reeflections is published by the Great Barrier Reef Marine Park Authority on a quarterly basis with the intention that it should cover a range of topics and serve as a forum for discussion. Your contributions are important to ensure that representative points of view are presented and items of interest are brought to the attention of our readers.

We ask that contributions be kept to a maximum length of 1,500 words and accompanied by the author's name, designation and address. Photographs (preferably black and white prints) drawings and diagrams will be gratefully received.

The Editor will assume that material submitted for publication has appropriate organisational approvals where necessary. The Editor reserves the right to reject or modify contributions. If modification is considered necessary, it will be referred to the author for approval.

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