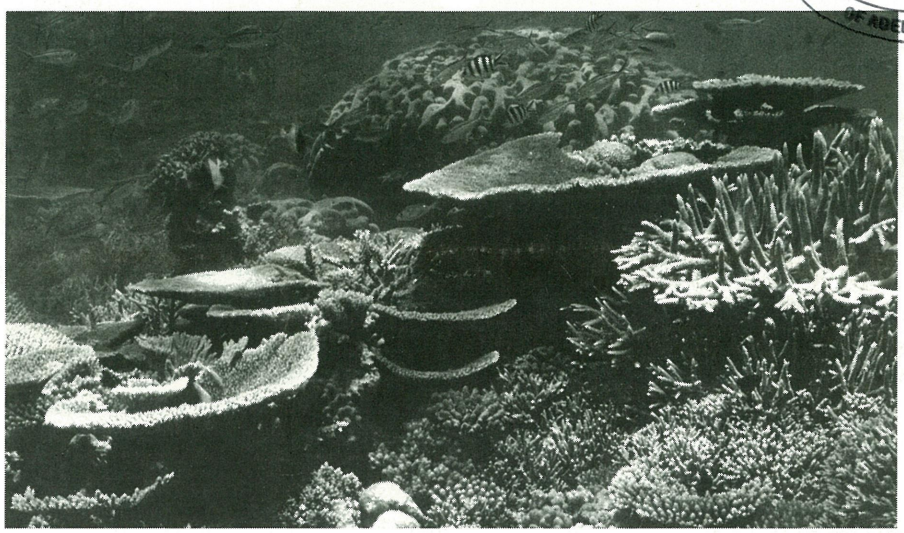
Great Barrier Reef Marine Park Authority

ISSN 0314-6510

Reeflections

THE GREENHOUSE EFFECTS: WILL CORALS SURVIVE?

EDUCATION & INFORMATION



A coral reef's beauty — how many centuries will it last?

Highlight of the Marine Education Society of Australasia's (MESA) Annual Conference in Townsville, September 1988, was the opening address by Professor Ian Lowe, Acting Director of the Commission for the Future, on the **Effects of Greenhouse on the Marine Environment.**

'Greenhouse' refers to the belief that increasing atmospheric concentrations of carbon dioxide and other gases will alter the climate because more heat radiating from the earth's surface to space will be retained in the earth's atmosphere, trapped by the gases acting a bit like the glass walls of a greenhouse. The most relevant concern for marine educators is the predicted rise in sea level and its possible effects on the coastal environment.

Australia will be affected, like other maritime nations, by the expected rise in sea level. There has been an observed increase in sea level of about 15cm this century, and estimates of the further increase range from 24cm to 1.2m in the year 2050, and 60cm to 3.5m by the end of next century. This is an area of considerable uncertainty because of the lack of reliable historical data and the imprecision of estimating the rate of transfer of heat into the oceans, given that the increasing sea level is primarily due to thermal expansion.

Professor Lowe warned local authorities Australia-wide they may soon face legal action for negligence unless they quickly come to terms with the implications of the Greenhouse effect as some stretches of coastline would be reclaimed by the sea as rising temperatures and melting ice caps forced ocean levels up. However, he reassured conference participants that the Sheraton Breakwater Casino Hotel was one of the few buildings designed in Queensland with the Greenhouse effect in mind.

Effects on the Great Barrier Reef

Dr Don Kinsey, Executive Officer, Great Barrier Reef Marine Park Authority (GBRMPA), made the following comments on the rapid short-term sea level rise on the Great Barrier Reef and an increase in water temperature, two likely outcomes of the Greenhouse effect.

Rapid Rise in Sea Level

In the short term (50-100 years), the effects of a rapid rise in sea level on the Great Barrier Reef, on balance, may be beneficial rather than detrimental. Rejuvenation of the largely depauperate reef flats by renewed coral growth will certainly make them appear more pleasing.

In the long term, however, reefs may slowly become submerged. They would not be able to grow fast enough to keep up with predicted rates of sea level rise. As the water depth exceeded 2 to 3m, reefs would be growing at their maximum rates and would maintain high productivity until covered by at least 15m of water.

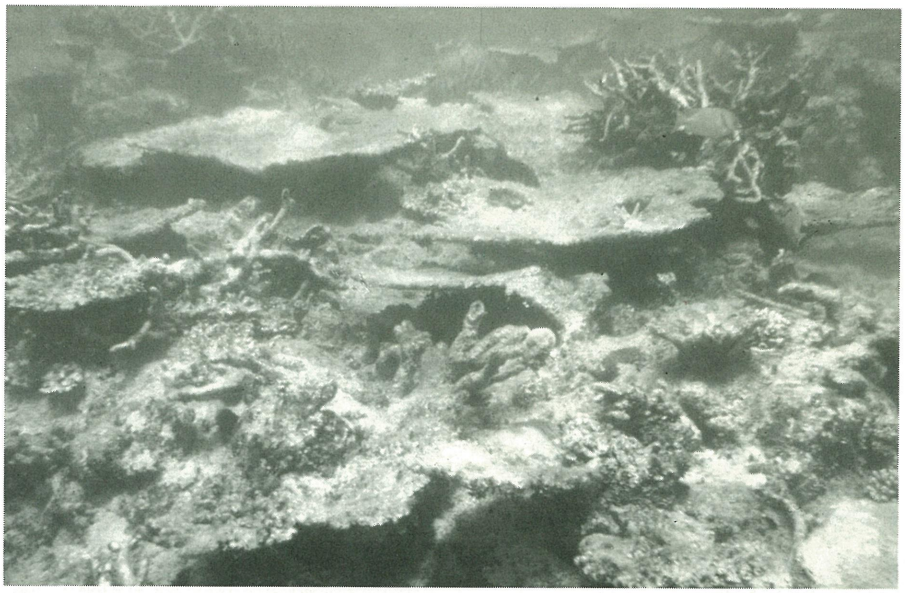
Increase in Water Temperature

This ultimately may disadvantage coral reef organisms. The effect would be most pronounced in the north where present-day summer temperatures already approach the 30°C upper sustained limit of tolerance. Many other aspects of a 'Greenhouse' modified environment may have a more subtle effect, though most would be long term rather than immediate. Increasing cyclone incidence and severity may retard recolonisation of submerging reef tops. Increased rainfall and greater cloudiness may have detrimental effects particularly on inshore fringing reefs, though the presently suggested climatic modifications may be relatively trivial for coral reefs. Changes to runoff, upwelling and oceanic circulation may affect the delicate nutrient status of shelf waters but again the responses are most likely long term rather than short term.

Don Kinsey concluded that other influences such as the effects of developments on the adjacent mainland and high islands and increasing tourist pressure on the Reef itself, may be of greater significance for coral reefs than the 'Greenhouse' effects.

CORAL REGROWTH AT GREEN ISLAND REEF

RESEARCH



The coral reef at Green Island, 3 years after a crown of thorns starfish infestation, is covered in algae and shows no obvious signs of coral recovery.

Dr Vicki Harriott
Assistant Curator
Great Barrier Reef Aquarium

A project funded by GBRMPA, and completed in 1987, studied the rate of natural regrowth of hard coral at Green Island Reef and also investigated the feasibility of increasing the recovery of the reef by transplanting corals from other reefs.

Seriously damaged by crown of thorns starfish in the 1960s and '70s, the reef at Green Island is now showing good signs of recovery, although probably not to its former diversity in the short term. Coral transplants can speed up recovery rates but high costs will limit their use.

Settlement of Fast-growing Corals

The study uncovered many interesting results. In 1986-87, there was still little increase in coral cover at the reef five or six years after the disappearance of the starfish. However, there were very large numbers of small corals growing on the surfaces of the old dead colonies. These corals mainly belong to the fast-growing coral genus *Acropora* which includes many of the staghorn and plate corals. This gave indications of good potential recovery of coral cover at Green Island, and recent observations confirm that coral cover at some sites has increased significantly.

In fact, in an experiment looking at the number of newly settled corals on special plates placed on the reefs to attract coral larvae, the number of new corals was far higher at Green Island than on some other nearby reefs which had good coral cover. This may mean that Green Island acts as a 'sink' reef for coral larvae.

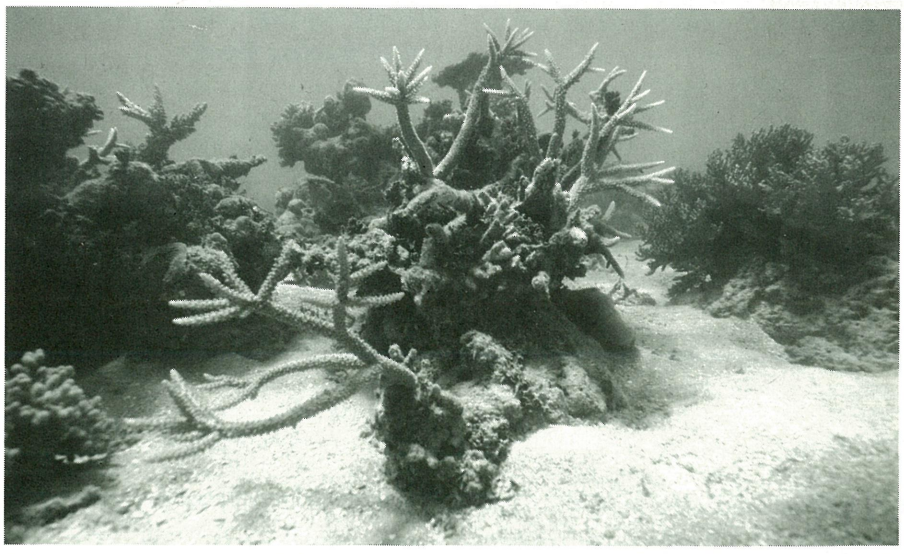
This result supports other studies that show that the mass spawning of corals on the Great Barrier Reef produces larvae that may be carried in ocean currents large distances between reefs. The large number of new corals, while encouraging, still do not signal a return to the reef community that existed before the starfish predation. The new corals belong to relatively few varieties while the previous community was diverse with many very large corals that will take hundreds of years to replace. The regenerating corals are mainly *Acropora* which are the favourite food of the crown of thorns starfish, and this leaves the disturbing possibility that the starfish damage results in the type of coral regrowth that the starfish favour, should they recruit to Green Island in the future.

This aspect of the project has been extended with the COTSAC (Crown of Thorns Starfish Advisory Committee) funding provided from 1986 to the present to continue monitoring of coral recruitment and recovery, while at the same time to examine the recruitment, movement and growth of crown of thorns starfish at Green Island.

Transplant Experiments

In the second part of the study, corals were transplanted to Green Island from a nearby undamaged reef. Experiments looked at the best types of corals to transplant, survival rates, transport methods, the size of colony that does best, methods of orienting and attaching the transplanted corals.

In the experiments transplanted corals generally survived well, about 70% to 90% survival for most corals over 6 months.



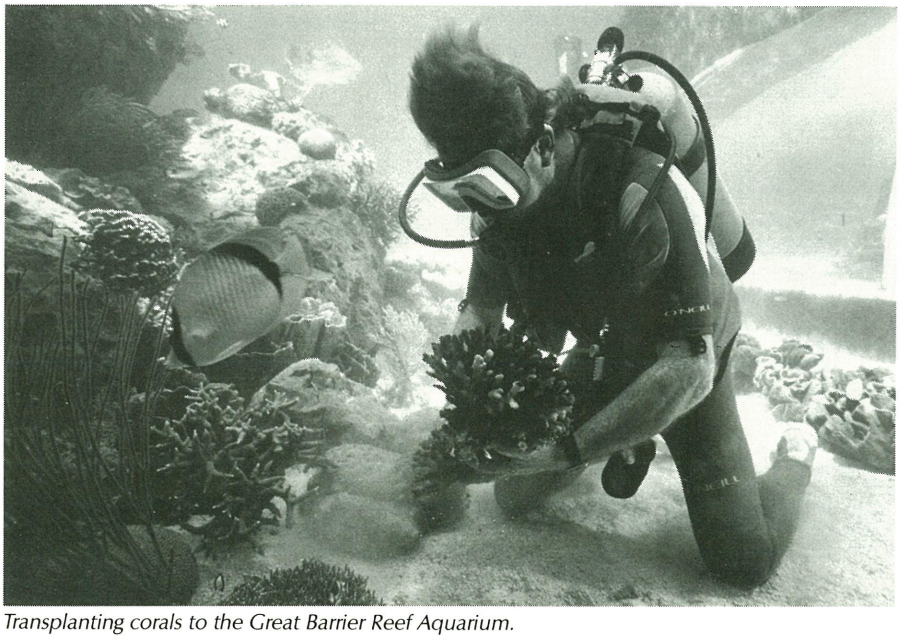
Coral transplants can be used to bypass the slow growth phase of small corals, but transplantation is time-consuming and expensive.

Small corals are not visible to the naked eye until they are at least three years old. They then grow more rapidly.

Larger coral pieces fared better than smaller ones. Coral survival was still high, over 50%, even when corals were transported out of water for 3 hours. The branching *Acropora* corals are recommended as transplants because they survived well, look attractive, are fast-growing and occupy large amounts of space relative to their weight.

Attaching corals to the surrounding reef can be achieved by using strings or plastic cable ties, but is very labour intensive, thus adding to the costs of transplanting. The corals transplanted and attached did not show better survival than unattached corals when weather conditions were calm. However corals transplanted to very shallow water and when the seas are rough would be rolled over and broken if they were not attached. Whether or not to attach transplants is an economic decision that will depend on weather conditions at the site.

Coral transplantation is very labour intensive, and requires specialised diving equipment, so is very expensive. Because of this, the use of coral transplantation is likely to be restricted to areas of high economic value, for example small areas supporting a valuable tourist trade. It is also feasible that the techniques could be used to repair damage caused by human activity, such as a ship grounding or the construction of facilities on the reef. The use of coral transplantation techniques is biologically possible but decisions would need to be made on a cost-benefit basis.



Transplanting corals to the Great Barrier Reef Aquarium.

CROWN OF THORNS REVIEW — GBRMPA VINDICATED

In mid March, the Minister for the Arts, Sport, the Environment, Tourism and Territories, Senator Graham Richardson, released the review into crown of thorns starfish research and management conducted by Professor D. T. Anderson, Challis Professor of Biology at the University of Sydney.

The review was requested by Senator Richardson in December 1988 following allegations made on the television program *60 Minutes* that the GBRMPA had under-estimated the extent of crown of thorns infestation and that it was not taking sufficient action to control outbreaks.

'I am pleased to say that Professor Anderson's report vindicates the GBRMPA both in terms of the direction of its research and the management policy it has adopted,' Senator Richardson said.

Professor Anderson concluded, in particular, that the Authority's policy of limiting direct intervention to areas of special interest is soundly based and takes account of current knowledge of crown of thorns starfish populations on the Great Barrier Reef.

Professor Anderson found that, on the basis of current research and experience elsewhere in the Pacific, large scale eradication of the starfish from the Reef would be impracticable and unaffordable.

Senator Richardson said that Professor Anderson had concluded that research had been efficient and productive. Nevertheless, he had identified a number of problems and difficulties with the existing crown of thorns research program related primarily to co-ordination and procedural matters.

'The crown of thorns starfish is such an important issue that these problems must be rectified,' Senator Richardson said. 'I have asked my Department and the GBRMPA to report back to me as soon as possible about implementation of all Professor Anderson's recommendations.'

Senator Richardson added that he would be personally taking up with the Prime Minister the need to act on Professor Anderson's recommendation that Federal funding for the crown of thorns starfish program be maintained for another three to five years at a minimum level of $1 million per year.

Future issues of Reeflections will report on Professor Anderson's recommendations and their implementation.

INNER-SHELF FRINGING REEFS

RESEARCH

Dr David Johnson
Department of Geology
James Cook University of
North Queensland

Fringing reefs are common around the many islands which lie just offshore between Mackay and Cairns. North of Cairns, these reefs are also growing attached to the mainland coast, something which does not happen to the south. The reefs at Magnetic Island off Townsville, within the Palm Isles and at Dunk Island further north, and surrounding the Low Isles off Port Douglas are good examples.

These fringing reefs are very different to the mid-shelf reefs developed further offshore. For example these inner-shelf fringing reefs are growing within the zone commonly muddied by the river outfalls. Measurements on the seabed, and photographs taken from planes while the rivers are in flood, show rivers discharge muddy waters up to 5 to 10 kilometres offshore.This distance easily reaches most fringing reefs. Even when the river floods have subsided, the waters of the inner-shelf are commonly muddied by the resuspension of bottom sediment stirred up by waves and currents. Compared to the deeper, clearer waters surrounding the mid-shelf reefs, the fringing reefs are growing in an unusually turbid situation.

How does turbidity affect the coral communities?

That is a question which we can only partly answer. Biological surveys have shown the coral communities on the fringing reefs are commonly diverse, and that they contain many species which do not occur offshore. Certainly the corals appear healthy, of good colour and growing strongly.
However we do know from extensive work overseas, particularly on Caribbean coral reefs, that turbid waters do affect and inhibit coral growth. Some corals are better adapted than others to cope with sediment continually raining down upon them, and these species can exist quite happily in turbid waters. But there are limits. Continual sediment rain affects corals in three main ways. Firstly, it cuts down light levels inhibiting the tiny algae (zooxanthellae) which live in the coral tissue, and which help the coral polyp to grow and build its skeleton. Secondly the coral polyp has to waste energy removing sediment, energy it could better use to catch and digest food, or build its skeleton. Thirdly the turbid nature of the water can interfere with supplies of plankton, the food for the coral polyps.

The extensive development of these fringing reefs with diverse coral communities assures us the corals are adapted to turbid waters. However we do not know whether the corals are 'completely happy' or whether they are near the limits of their tolerance of turbidity.

Again overseas research shows there is a spectrum of responses depending on the level of increased siltation. Low turbidity causes decreased growth rates and coral abundance. Moderate turbidity greatly decreases growth rates and abundance and corals alter growth forms to counter the siltation. High turbidity results in death of many corals, severe reduction in abundance and growth rates, and altered growth forms.

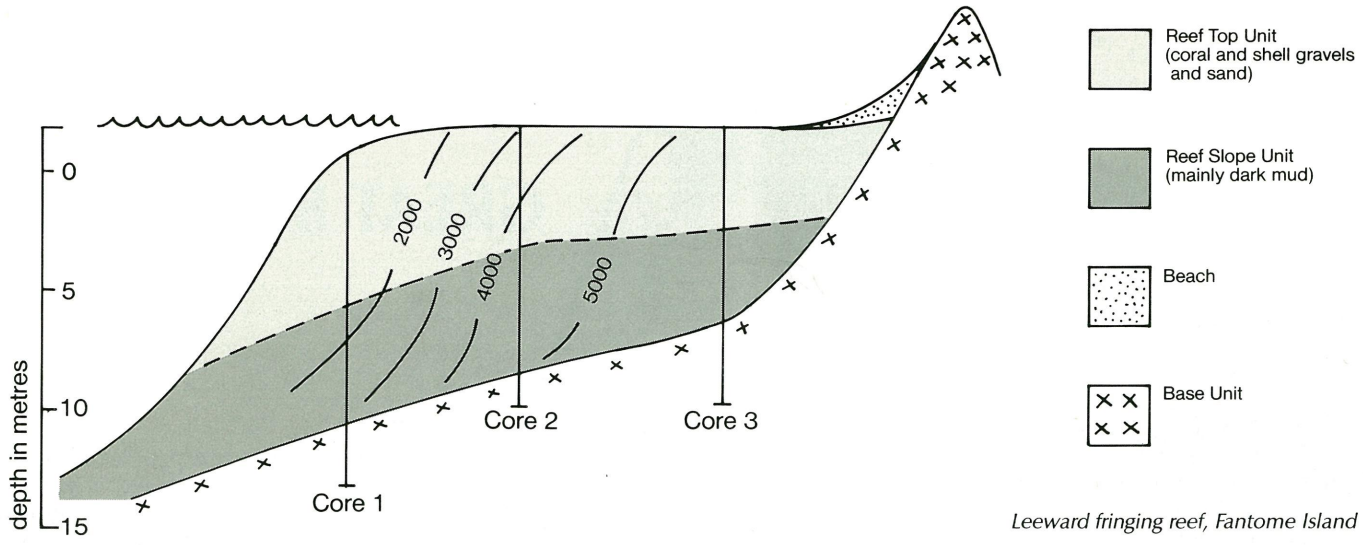
We really need to do a lot more work to determine where our Great Barrier Reef corals lie in this spectrum.

Has the water always been turbid?

Fringing reefs in the Central Great Barrier Reef have always grown in turbid waters. We have several pieces of evidence for this. Firstly, long cores through very large coral colonies have been recovered by Dr Peter Isdale of the Australian Institute of Marine Science, and the corals placed under ultra-violet light. Fluorescing bands towards the tops of the cores in these corals have been shown to correlate with major historical river floods. Yet the fluorescing bands extend down the complete coral cores from the fringing reefs, indicating river outfalls affected coral growth throughout their entire growth history. (It is worth noting these fluorescing bands very rarely occur in the midshelf reefs, which by and large are beyond the reach of river discharges).

Secondly, the continual nature of siltation during fringing reef growth is confirmed by core sampling through the reef. Several reefs have been drilled now, and present a similar story. The diagram (page 5) shows a section across the fringing reef on the leeward side of Fantome Island in the Palm Isles. These core samples show the fringing reefs consist of an upper reef-top unit and a lower reef-slope unit. The upper unit is composed of coral and shelly gravels with sand and mud filling the spaces between the larger fragments. The remains of calcareous algae are also common. The lower unit is very different, and is mainly dark

The islands in the Palm Group, offshore from Ingham, have extensive areas of attractive fringing reef.



Leeward fringing reef, Fantome Island

mud with scattered coral fragments and sand grains. The mud is dominantly mud derived from river discharge, not fine materials formed on the fringing reef from the breakdown of corals and shells. Since this muddy material underlies the entire fringing reef, and since radiocarbon dating shows it is in places older than 5000 years, we can be sure river discharges have always affected growth of these fringing reefs.

The radiocarbon dating also shows an intriguing growth pattern. The oldest part of the fringing reef is adjacent to the island, and the youngest part at the seaward edge — the modern reef slope. While many people might intuitively think the reef would have grown upwards, i.e. first the muddy lower unit, with the gravelly unit being deposited later on top, this is not the case. Clearly the reef has grown outwards. The angled time-lines represent the position of the reef slope at successive times — 5000, 4000, 3000 and 2000 years ago.

Thus it seems continued reef growth depends on deposition and maintenance of mud of the lower reef slope. If that mud is eroded the entire reef flat could become undermined.

Input of Mud — Good or Bad?

It is clear that the rivers have been supplying mud to coastal waters for thousands of years and that this mud has been settling out on the fringing reefs, settling particularly on the lower reef slopes. On the one hand this mud is necessary to maintain the foundation on which the reef is built. On the other hand this mud, in excessive quantities, could smother coral growth. So far the balance has been right — enough mud for the foundation, not too much to kill coral. Our job really is to maintain it that way.

CORAL RINGS GIVE CLUES TO PAST CLIMATE

Dr Peter J. Isdale
Australian Institute of Marine Science

Coral skeletons contain annual rings analogous to tree rings. The rings are revealed as alternating light and dark bands when coral skeletons are X-rayed. A pair of these bands represents one year's growth. The bands are best seen in large rounded coral colonies that grow 0.5-1.5 centimetres in a year. On the Great Barrier Reef, 600-year-old colonies are frequent, and occasional colonies are older than 1000 years. Systematic changes in these rates of coral growth have been found across the width of the Great Barrier Reef from turbid coastal waters to the clear waters of the Coral Sea.

Research in progress at the Australian Institute of Marine Science in Townsville indicates that growth patterns in coral skeletons are a potentially important record of weather and climate trends in the recent past.

The fundamental record in massive corals is a marked annual variation in skeletal density. This was first described in 1972, and is now recognised as a characteristic of many species of coral. The underlying causes of the annual density variation have not been firmly established. The seasonal timing of high and low density growth appears to vary from one part of the world to another.

The density variations probably reflect complex seasonal phenomena, such as cloud cover and nutrition, rather than simple factors, such as temperature. Nonetheless, the annual density bands provide a reliable and accurate temporal record of skeletal deposition. Research shows that a resolution of about 14 days is possible from this density record. The presence of an accurate temporal record makes possible the deciphering of a range of other environmental records that the coral incorporates during growth.

Supra-annual peaks in skeletal density have been found to coincide with El Niño years. Records of the last 30 years can be easily obtained from coral colonies collected from reefs. Longer records canbe obtained only by drilling a core sample along the growth axis of larger colonies. We have thus far obtained about 30 such cores from very large colonies. These cores represent growth over the last 200 to 600 years (shortest to longest cores).

Only one core has been analysed in detail. The core came from Pandora Reef and provided information back to 1862. Pandora Reef lies inside the Palm Islands, close to the mainland. Annual density variations along this core showed a 60 percent correlation with atmospheric pressure at Darwin from 1882 to the present (the extent of the pressure record).

Whereas currently available models are based on only several decades of conventionally recorded weather and hydrological data, new models resulting from our research will derive from weather analogues in the form of bands in coral cores that go back about 1000 years. The goal is to produce seasonal and other long-range forecasts.

Reproduced from *Oceanus* Volume 29, Number 2, Summer 1986.

VISITORS TO T
GREAT BARRIER REEF

Royal visitors, the Duke and Duchess of York, are invited to touch some of the Reef's fascinating creatures by GBRMPA Chairman, Graeme Kelleher. Earlier, hundreds of people had crowded into the Wonderland mall to catch a glimpse of the Royal couple.

Mr Graeme Kelleher (second from left) shows former Prime and Chinese trade delegates some of the touch tank resi

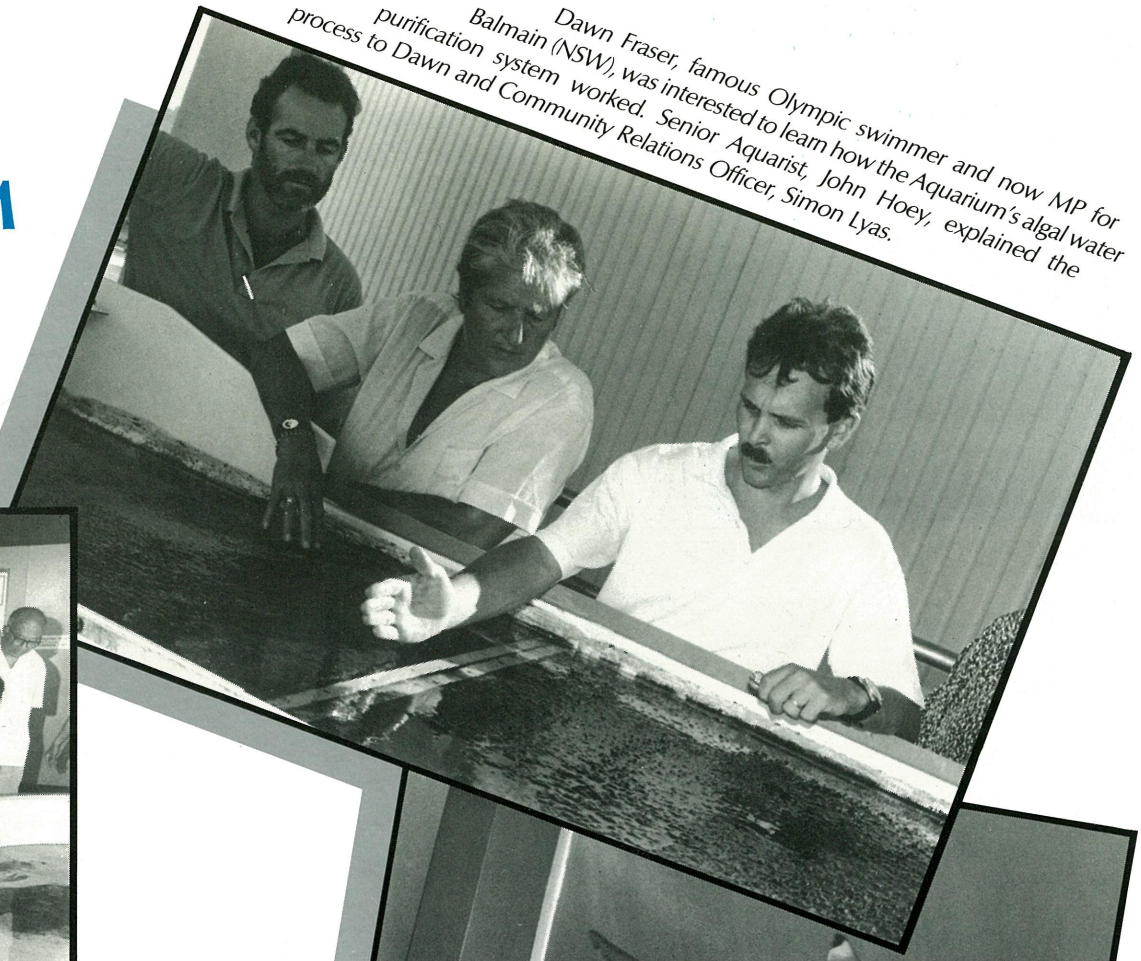
Aquarium Manager Ian Burston co-stars in this tunnel scene with Australian film star, Sigrid Thornton.

Members of Russia's renowned Bolshoi Townsville. Wonderland Manager,

THE AQUARIUM

Minister, Mr Gough Whitlam,
dents.

Ballet visited Wonderland between performances in Marketing Manager, Stuart Jardine, and Aquarium Ian Burston, (centre) escorted them through the complex.



Dawn Fraser, famous Olympic swimmer and now MP for Balmain (NSW), was interested to learn how the Aquarium's algal water purification system worked. Senior Aquarist, John Hoey, explained the process to Dawn and Community Relations Officer, Simon Lyas.

North Queensland Television (NQTV) personalities, Scott Hunt and Kenny Dog Wonder, have given children in the north special insights into the Aquarium on their popular program.

AERIAL SURVEILLANCE OF THE MARINE PARK

PARK MANAGEMENT

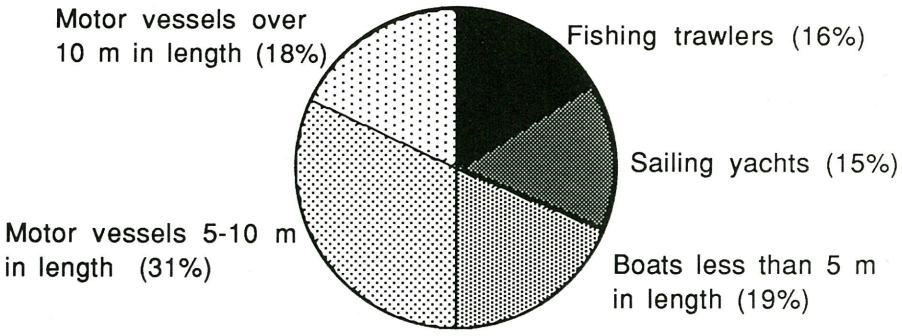


Figure 1. Annual summary of vessels at Capricorn Bunker Reefs.

Terry Walker
Department of Environment and Conservation
Townsville

Reef visitors in small boats are often alarmed by the sudden appearance close above of a surveillance aircraft. Frequent mariners will probably have been 'buzzed' on many occasions and are quite used to such official interest. Government agencies require the aircraft crew to log the position and identity of vessels on the Reef and a close approach is often needed to read the registration number or vessel name. Boat owners can help coastal surveillance by ensuring that their vessel names or registrations are displayed in large letters easily visible from the air.

Around the world a variety of law enforcement agencies use aircraft for patrols over coastal seas. The economic rationale for maritime surveillance flights is based on the twin functions of detection and deterrence of illegal activities. Customs, health, fisheries and immigration agencies have traditionally been involved with such flights. More recently, in some countries, the establishment of marine parks and reserves has added park management organisations to those with an interest in maritime aerial patrols. The Great Barrier Reef Marine Park is larger than Victoria and Tasmania combined and extensive use has been made of aerial surveillance to manage this region.

Surveillance flights are operated by the Federal Sea Safety and Surveillance Centre and by marine park personnel from the Queensland Department of Environment and Conservation. In addition to the use for law enforcement*, the recording of vessel identities and positions is particularly useful for marine park planning and management purposes. Systematic collection and analysis of vessel patterns can identify regions, reefs or anchorages receiving heavy visitation at different times of the year. The types of vessels, their ports of origin and their activities can also be determined and evaluated.

Figure 1 shows a breakdown of vessel types present in the Capricorn and Bunker Reefs as determined from surveillance flights. In this example the vessels have been placed into five categories. Narrower categories can be separated when required for specific management purposes.

Figure 2 shows the annual vessel visitation at individual reefs of the Capricorn and Bunker Groups. In this example the vessels have been grouped into three classes. It is apparent that the popularity of different reefs varies widely and this information is particularly useful in the process of reef zoning.

In the Swain Reefs, surveillance data identified the great majority of vessels as charter vessels or professional line fishing vessels. Mapping of the data by Great Barrier Reef Marine Park Authority staff showed that charter vessels primarily use southern reefs of the Swains while professional fishermen primarily use the northern and western reefs. This information assisted Capricorn Section planners to position Zones to minimise undesirable effects on these user groups.

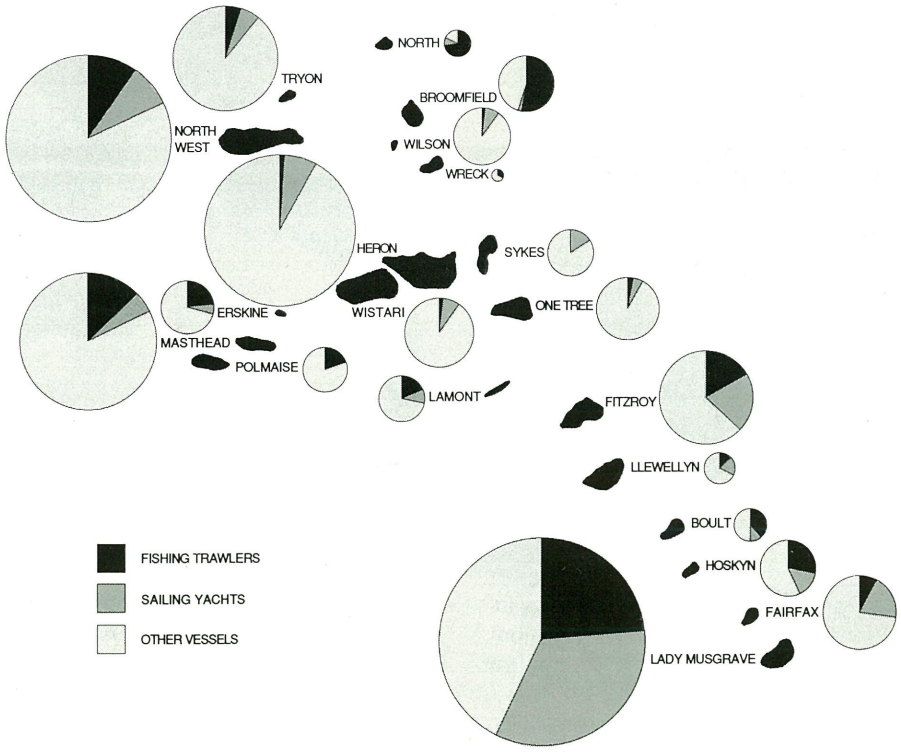


Figure 2. Vessels visiting Capricorn Bunker Reefs in a year.

Coastwatch aircraft operate patrols over the Great Barrier Reef Marine Park.

The origins of vessels can be estimated from cross-indexing of vessel names or registration numbers with registered addresses of owners. This information is useful to identify and give a breakdown of where vessels visiting a reef or region have come from. Figure 3 presents the breakdown of 'home ports' for vessels visiting Capricorn and Bunker Reefs.

Finally it is possible to record in detail the locations of each vessel at a particular reef, whether it is anchored or not, and prepare maps illustrating areas of annual anchoring pressure. Figure 4 is an example of such a map for Lady Musgrave Reef.

In addition to law enforcement and provision of statistics for management planning, the surveillance flights also assist in search and rescue operations, biological reporting (dugong, whales, etc.) and aerial photography of reefs and islands.

* This aspect was covered in more detail in 'Policing the Park' which appeared in **Reeflections** No. 18, September 1986.

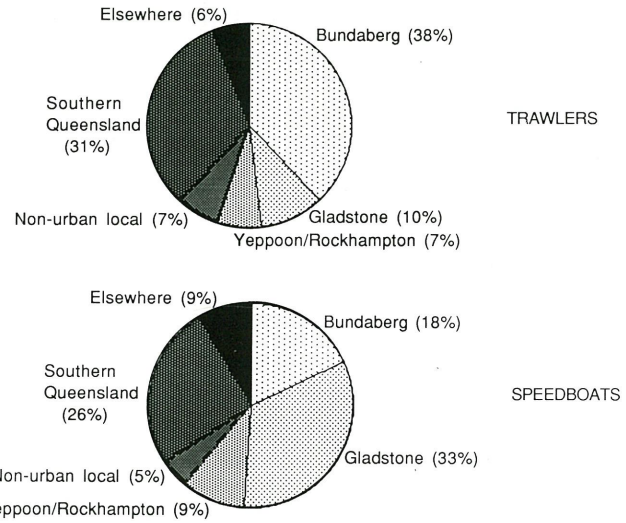


Figure 3. Home ports of trawlers (top) and speedboats (bottom) at Capricorn and Bunker Reefs.

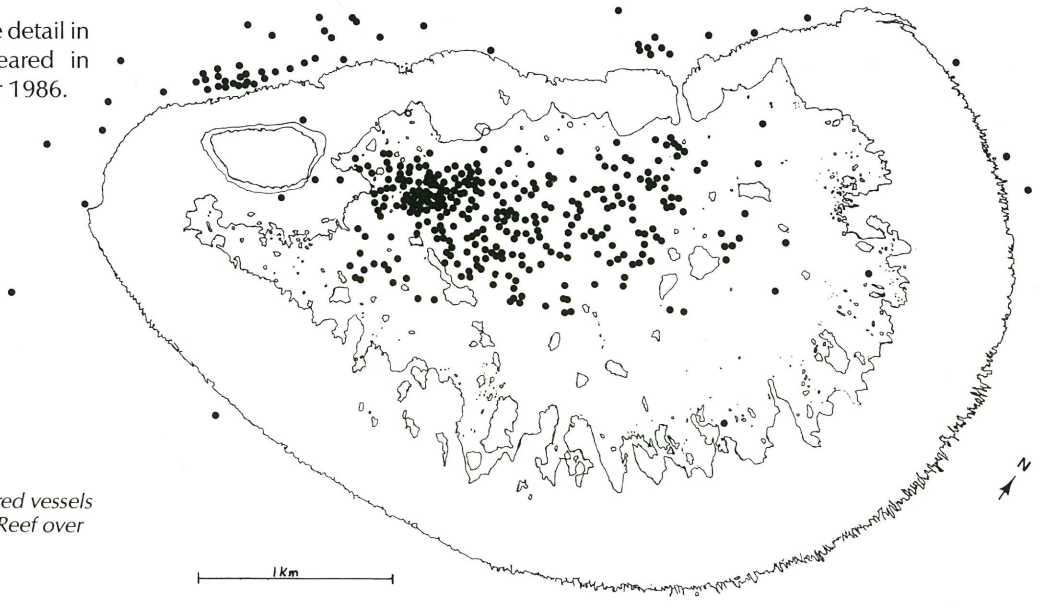


Figure 4. Positions of anchored vessels recorded at Lady Musgrave Reef over one year.

NEWS AND NOTICES

REVIEW OF THE CAIRNS ZONING PLAN

The Great Barrier Reef Marine Park Authority received a good response to its call for public comment on the zoning plan review during the four-month period from 8 November 1988 to 28 February 1989.

With 260 representations handled to date, planning team co-ordinator, Jon Day, is happy with the review's progress. 'Although below our early expectations of up to 400 representations, the comments and inquiries received are certainly providing food for thought,' he said.

When the initial Zoning Plan for the Cairns Section was developed in 1982, the section's only fixed structure was the Green Island Underwater Observatory. There were no large catamarans, helicopters or hovercrafts operating regularly in the Section. No operations involved permanently moored pontoons or floating hotels. All these types of facilities are now operating in the Marine Park.

Organised tourism on reefs close to Cairns has increased by an estimated 30 percent per annum over the last three years.

In the Cairns Section in 1985-86, there were 52 tourist program permits issued of which 23 were site-specific; in 1987-88 this had increased to 185 permits of which 86 were site-specific.

'Tourism management is causing a lot of interest, especially concerning the zoning amendments proposed by GBRMPA,' Mr Day said. 'It is a controversial issue and we can't please everyone. A lot of decisions may have to be compromises.'

In particular, the tourist industry has shown a mixed response to the reef rezoning strategy. The GBRMPA reports that while some operators have welcomed the proposed changes, others see it as restictive to their activities.

The process of analysing the submissions is continuing, with the end result being a draft zoning plan which GBRMPA expects to release around mid 1989. An invitation for public comment on the draft plan will be issued soon afterwards. The GBRMPA hopes to put a revised zoning plan before ministerial and parliamentary consideration in mid 1990.

Richard Kenchington (right) with 4 members of the planning team and the spectacular trophy.

GBRMPA WINS PLANNING AWARD FOR ZONING

The overall award in the Queensland division of the Royal Australian Planning Institute's (RAPI) Bicentennial Awards of Excellence for Achievement and Originality in Environmental Planning and Design has been won by the Great Barrier Reef Marine Park Authority (GBRMPA) in Townsville.

Accepting the Award at a special ceremony in Brisbane was the GBRMPA Senior Planner Mr Richard Kenchington, who said that winning the Strategic Policy Planning Award was an honour that reflected recognition of the high standard GBRMPA had achieved in its planning program for the Marine Park. Judges believed that GBRMPA planners had shown commendable leadership and innovation in preparing plans for the World Heritage area.

'At the outset, we had no conventional plans to follow. We had to develop planning approaches for multiple use marine areas and this now has become a model for marine planners around the world,' said Richard Kenchington.

Mr Kenchington said that GBRMPA's entry was the strategic plan implemented on 1 August 1988 for Zoning the Mackay/Capricorn Section and marked the conclusion of initial zoning of the Great Barrier Reef Marine Park.

'Zoning Plans are strategic plans for conservation and reasonable use of the Reef and its resources. Their establishment has involved extensive public participation and a high degree of collaboration and coordination between Commonwealth and Queensland Government Agencies,' said Mr Kenchington.

SEAWEEK '89

Communities in the Reef Region are joining In a week of 'celebrating the sea' from 15-23 April. Promoted by the Marine Education Society of Australasia (MESA), **Seaweek** will focus attention on the marine environment and maritime activities.

MESA's National Seaweek Co-ordinator, Greg McGarvie, has activity buzzing around the country as well as in his home town of Mackay. The team in Mackay are now distributing Seaweek Resource Kits for Schools.

In Rockhampton, Seaweek is being co-ordinated by marine ecologist Dr Alice Kay, from the Queensland National Parks and Wildlife Service, and Mr Mike Grant, from the Capricornia Institute of Advanced Education. The Capricorn Coast's activities and displays start at Yeppoon on Sunday 16 April. Other activities planned include snorkelling and illustrated talks at North West Island; displays and seminars on the management of marine parks at the Capricornia Institute and a seafood dinner.

Great Barrier Reef Wonderland is the focus of Seaweek in the Townsville area. The opening celebrations on Saturday 15 April invite children to come dressed as their favourite sea creature. Exhibitions prepared by government, community and business organisations on sea safety, coastal navigation and fishing are on view all week. Special exhibitions are showing at the Queensland Museum and the Great Barrier Reef Aquarium. A reef discovery trip to Falcon Island in the Palm Island Group concludes the activities on Sunday 23 April.

Schools in the Townsville area are offered a special program of activities at both the Aquarium and Museum during Seaweek. Further information about Seaweek in Townsville is available from the Education Section of GBRMPA.

Seaweek Resource Kits

Each kit contains a wealth of material including activity guides, games, scientific observations and facts sheets.

To obtain your kit, please contact:
Mackay Regional Development Bureau
PO Box 487
Mackay Qld 4740
Phone (079) 51 4644
Fax (079) 57 2310

Kits are $7.99 each plus $2.50 postage anywhere in Australia.

(L to R) Damian Cumner, Lesley Murdoch, Eddie Thornton, Norm Smith & Helen Smith (Norvan), Bob Precious (Nadicprint), Jean Dartnall, Bill Van Dijk, Marie Deans, Shane Walker, Jan Oliver, Bob Moffatt, Ann Byrnes, Graeme Kelleher.

PROJECT REEF-ED LAUNCH

A new educational book, 'Project Reef-Ed', was launched by the Great Barrier Reef Marine Park Authority on the opening night of the Marine Education Society of Australasia (MESA) Conference.

Written by a team of top marine educators from Australian tertiary institutions and secondary schools and produced by the Great Barrier Reef Marine Park Authority, Project Reef-Ed is an invaluable resource for groups who visit the Great Barrier Reef.

Over 80 guests attended including the media, local dignitaries, conference delegates and staff from Nadicprint and Norvan who produced the book. Ms Ann Byrnes, Project Team Leader, represented the Reef-Ed Team.

Chairman of the GBRMPA, Mr Graeme Kelleher, launched the 400-page book at a poolside reception in Townsville's Sheraton Hotel.

'Project Reef-Ed is an exciting development for marine studies throughout Australia. This book will provide resource materials for schools and other groups interested in visiting the Reef. There are over 150 individual activities to try, from reef walking, to art and craft, to scientific observations,' he said.

Mr Kelleher said that he hoped the book would encourage more people to learn about the Great Barrier Reef.

'Although aimed at senior students, Project Reef-Ed will be of interest to anyone who educates others about this unique environment. Education is the best way to manage the Marine Park. If people, particularly young people, understand and appreciate the Reef, they will want to look after it. This is the goal of the Authority — to look after the Reef now and in the future,' he said.

'Project Reef-Ed is a result of over seven years hard work by many people. In particular I thank the project team for the amount of volunteer time and effort put into creating this publication'.

MESA WAVES AHEAD IN '88

1988 was a great year for marine education in Australia.

In September 1988, over 80 local, interstate and overseas marine educators converged on Townsville for their annual conference.

Exciting new curriculum materials were on display, including the long-awaited launch of the Reef-Ed program. Educational facilities — aquariums, field study centres, interpretive operations, research stations — also set up informative displays.

Keynote Speakers

Professor Ian Lowe (Futures Commission), Ms Ann Coopersmith (University of Hawaii), Dr Ian Robottom (Deakin University), Mr Greg McGarvie (Mackay North State High School and MESA Vice President), Mr Richard Kenchington (GBRMPA), Mr Geoff Kelly (Q.NPWS), Mr Mike Tarrant (Counter-Disaster College), Ms Wendy Richards (Reef Biosearch), Mr Neville Coleman (Sea Australia Resource Centre), Ms Lyn Williamson (Atlantis Aquarium), Dr Leon Zann (GBRMPA), Dr Vicki Harriott (GBR Aquarium), Mr Paul Thomas (Marine Biologist).

Field Trips

Australian Institute of Marine Science, Orpheus Island and Research Station, John Brewer Reef and Floating Hotel and Geoffrey Bay on Magnetic Island.

Workshops

Concurrent workshop sessions provided a range of presentations including a demonstration of 'do-it-yourself' equipment for marine studies; discussion of curriculum development for marine studies at schools and in tertiary education; and discussion of community education issues such as marine pollution and attitudes towards conservation. A comprehensive report on proceedings is being prepared.

REVIEWS

DISCOVERING COASTAL QUEENSLAND

The Complete Guide to the Queensland Coast, Great Barrier Reef, Stradbroke, Moreton and Fraser Islands.
University of Queensland Press 1988
52 pages $14.95

Queensland, the 'Sunshine State' is the most popular holiday state in Australia. This guide has been produced to help holiday makers, primarily motorists, get the most up-to-date information about Queensland's coast.

Colour maps and informative text describe major coastal regions extending from south-east Queensland to Cape York. A large format (420mm x 297mm) has been used to present good size maps.

Facts on major roads, places to stay, things to see and access to the Great Barrier Reef abound throughout. In particular, the Great Barrier Reef Marine Park and coastal National Parks are featured. Chapters on the structure of the Reef, corals, seabirds, plants, shells and fishing help the visitor better understand and appreciate each region's attractions.

This is the guide for people wanting advice about what to do during their motoring holiday, whether it be a low-budget camping holiday staying at national parks or an island hop to the thirty or so offshore resorts.

Zoning plans for the Great Barrier Reef Marine Park are included to help those interested in boating, diving, fishing and collecting.

DISCOVER THE GREAT BARRIER REEF MARINE PARK

Compiled by Lesley Murdoch, Great Barrier Reef Marine Park Authority.
Published by Bay Books 1989.
96 pages $9.95

A new introductory full colour reference book for anyone interested in finding out about the Great Barrier Reef and the Marine Park. Written by a team of reef experts from the GBRMPA, chapters feature the origins of the Reef, history, biology, management and conservation and photographs from Australia's leading underwater photographers.

The Wonder Down Under (1) examines the reasons behind the eighth natural wonder of the world becoming a World Heritage Site and the world's largest marine park managed by the Great Barrier Reef Marine Park Authority.

Reefs, Islands and Coral Cays (2) explores the origins of the Reef, the effect of the ice ages and the formation of various reef shapes and sizes that exist today.

The Reef Community (3) focuses on the inter-relationships between the plants and animals that live together in this complex ecosystem.

All Creatures Great and Small (4) highlights the amazing creatures that can be found on the Reef with photographs.

In Days Gone By (5) — discoveries of the first reef navigators, Cook and Flinders, and early European explorations are described, as well as the wrecks of the Reef.

The Reef and Us (6) focuses on the current use and management of the Marine Park, including a special section on the crown of thorns starfish problem and zoning information.

A Window on the Reef (7) gives an overview of the Reef replica at the Wonderland Aquarium, the Authority's new educative facility in Townsville.

This book is a memorable souvenir for visitors to the Great Barrier Reef and is also an excellent reference book for students and teachers studying the Marine Park.

PROJECT REEF-ED

Ann Byrnes, Sydney College of Advanced Education (Project Co-ordinator)
Philip T. King, Woolgoolga High School, New South Wales
Jack A. Marsh, Brisbane College of Advanced Education
Bob Moffatt, Benowa State High School, Queensland
Janet S. Oliver, St Aidan's School, Brisbane
Antoinette L. O'Neill, The Australian Museum, Sydney
Published by the Great Barrier Reef Marine Park Authority 1988. $19.95

Project Reef-Ed has been produced to assist educators to organise field trips and undertake study projects about the Reef.

Written by a team of leading Australian marine educators, this 400-page plus book contains a wealth of practical information, including:

- Planning a Reef Trip
- Safety in the Marine Environment
- Organising a Study Program
- Group Activities
- Educational Goals of Reef Education

The **Great Barrier Reef Educational Activities** section presents marine environmental activities from a multi-disciplinary perspective. Not only are the wonders of the Reef explored from a scientific perspective but also, issues of conservation and management are investigated as well as opportunities for creative and artistic expression.

There are more than 150 activities to use as they are, adapt or modify them to suit your audience and purposes.

Examples of reef trips and programs using a combination of these activities are given. Appropriate aims, content and learning experiences are discussed in more detail in the appendix. As well there is a very comprehensive bibliography of resources for teaching and learning about the Reef.

Although aimed at senior students, **Project Reef-Ed** is of value to many other types of Reef visitors, including tertiary groups and tourist operators.

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 1500 words and be 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.

Contributions should be sent to:
The Editor
Reeflections
Great Barrier Reef
Marine Park Authority
PO Box 1379
TOWNSVILLE QLD 4810

Printed by: NADICPRINT SERVICES PTY. LTD. Phone: (077) 794711