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NEWSLETTER
OF THE
RESEARCH
AND
MONITORING
SECTION

29

REEF RESEARCH

VOLUME 1 - No. 1 SEPTEMBER 1991



Great Barrier Reef
Marine Park
Authority

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This being the first issue of the Research and Monitoring Section newsletter it seems appropriate that a brief introduction to the functions and staff of the Section be included.

The Section has responsibility for administering research that is relevant to the management and protection of the Great Barrier Reef region and consequently is involved in a wide range of disciplines including biology, oceanography, monitoring, social sciences, water quality and pollution.

A summary of staff of the Section appears elsewhere in Reef Research and will be updated as necessary in further issues. More details about two of the staff members will appear in each issue starting with, surprise surprise, the Section Head and the Editor.

This issue, it is hoped, will introduce the broader community to the range of work that is being carried out as a result of Marine Park Authority and other funding and has no other specific focus. It is envisaged that some of the future issues will be devoted to particular topics that are addressed in our research program. As with all newsletters of this type, particularly those reporting such a heterogenous program, there is always the danger that it will be too specific for the general reader but not detailed enough for the specialist. I would like to think we can strike a happy medium by arousing interest in the casual reader as well as directing the more specifically informed to detailed reports that have been the result of research that has been completed.

The main objectives of the newsletter are to promote a better understanding of the research being carried out in the Great Barrier Reef region, to provide specific information about that research both within newsletter articles and by reference to publications that are available and to promote cooperation between working scientists in tropical reef research and management.

If it achieves any of these objectives then I think it will be worth the effort.

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Readers are invited to submit material for publication, all contributions or inquiries should be addressed to:

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Ed

FOREWORD

Coral reefs in many parts of the world have been substantially degraded by overfishing, construction work, siltation and nutrient loading. Reefs here on the Great Barrier Reef are in a much better condition but some of them have been affected by human activity including over-fishing and anchoring and also possibly by excess nutrients in coastal waters. Reefs are also affected by events such as crown-of-thorns starfish outbreaks which may or may not be linked to human activity. As caretakers of the Great Barrier Reef it is our goal to provide for its protection, wise use, understanding and enjoyment in perpetuity. Coral reefs, like rainforests, are the most diverse ecosystems in the world. Being subjected to unpredictable natural disturbances like cyclones and floods means they are also very dynamic systems. The structure of the animal and plant communities and their physical environment vary from place to place and also from year to year. Predicting the effects of disturbance and managing the effects depends on adequate baseline information and competent research. The program objective of the Research and Monitoring Section of the Great Barrier Reef Marine Park Authority is to obtain, interpret, disseminate and apply information relevant to understanding the Great Barrier Reef and managing the Great Barrier Reef Marine Park on an ecologically sustainable basis. This newsletter "Reef Research" will be an invaluable support in achieving this objective. I wish it every success.



Graeme Kelleher

RESEARCH & MONITORING SECTION STAFF

- Simon Woodley** *Assistant Executive Officer and Head of the section*
- Jon Brodie** *Senior Scientific Officer, Water Quality Project Manager*
- Bruce Mapstone** *Coordinator of the Effects of Fishing program*
- David Lawrence** *Coordinator of the Torres Strait Baseline Study*
- Brian Lassig** *Coordinator of the crown-of-thorns starfish program*
- William Gladstone** *Project Officer - crown-of-thorns starfish program*
- Udo Engelhardt** *Science 1 - crown-of-thorns starfish program and Project Officer for *Drupella* reasearch*
- Ray Berkelmans** *Project Officer - Monitoring*
- Jamie Oliver** *Project Officer - Monitoring*
- Lea Scherl** *Project Officer - Human Use and Social Impact*
- Steve Raaymakers** *Project Officer - Oil pollution, spill and Sea Dumping*
- Christine Dalliston** *Assistant Project Officer*
- Beryl Dennis** *Administration Assistant*
- Trish Sanders** *Administration Assistant and Assistant Editor*
- Steve Hillman** *On secondment to Planning and Management Section*



Simon Woodley

Simon Woodley has been with the Great Barrier Reef Marine Park Authority since 1977. Since then he has been closely involved in all aspects of the Authority's work. Prior to becoming Assistant Executive Officer, Research and Monitoring in September 1990, he was responsible for the development and

implementation of policies and systems for day-to-day management of the Marine Park and also for environmental impact assessment of permitted activities. He has a B.A. in geography and politics and plans to finish an M.Sc in tropical ecology in 1992.

His interests lie in natural resource management, environmental impact assessment, corporate and strategic planning, human resource management and environmental law.



Steve Hillman

Steve Hillman has worked with GBRMPA as a project manager for the past four years and prior to that with Commonwealth Fisheries. He has experience in fisheries management, database systems design and implementation as well as project management in a number of fields. Since coming to the Authority he has developed several

databases related to resources and has managed several projects aimed at devising efficient monitoring strategies. Other interests include remote sensing, geographical information systems and environmental impact management. He is currently outposted from the Section to manage an appeal to the Administrative Appeals Tribunal regarding the establishment of a nickel unloading facility in the Marine Park.

Long-Term Reef Monitoring

The collection of data through monitoring programs is essential for the Authority to be able to understand changes to the Great Barrier Reef which are occurring naturally or through human factors. Over the past several years, the Authority and its consultants have monitored a range of parameters over several different spatial and temporal scales, for a variety of purposes. However, these activities have, until now, been carried out in the absence of a coherent and coordinated strategy for long-term broad-scale monitoring. During the next year, the R&M section will, at last, develop a formal program for long-term monitoring of the Great Barrier Reef Marine Park.

As a first step towards this goal, it is planned to form a Monitoring Advisory Committee which will be composed of representatives from different institutions, government agencies, and other groups with an interest in reef monitoring. This committee will formulate the broad objectives for long-term monitoring and will ensure that there is effective liaison and information exchange between all groups involved in monitoring activities.

While the Monitoring Advisory Committee will address general issues relating to monitoring it is envisaged that there will be one or more technical panels, comprised of individuals with skills and experience in relevant fields, who will provide advice on such matters as experimental design, instrumentation, data analysis and data storage. The Technical Panels would also act as review bodies for specific monitoring projects.

It is hoped that both the Advisory Committee and the Technical Panels will be formed in the next 2-3 months and that a draft plan for long-term monitoring will be prepared in early 1991.

During the next year, the R&M section will develop a formal program for long-term monitoring of the Great Barrier Reef Marine Park.

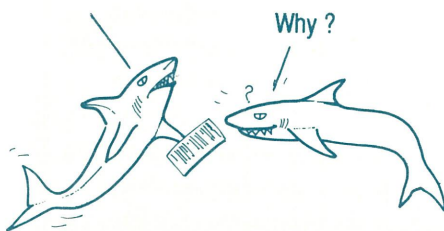
Once the goals and priorities for a long-term monitoring program have been established, and the methodological problems resolved, the next step will be to identify specific tasks and determine how they should be implemented.

Monitoring of the entire Great Barrier Reef Marine Park is a mammoth task, and is presently beyond the capabilities of any single organisation to carry out on its own. It is envisaged that different aspects of the program would be carried out by different organisations and individual consultants and that GBRMPA, with advice from the advisory and technical panels, would play a coordinating role in the acquisition, storage, interpretation and dissemination of monitoring data. Although it is early days yet, we are optimistic that we have laid the groundwork for what will become a major program within GBRMPA, and which will provide vital information for managing the reef for decades to come.

Dr Jamie Oliver

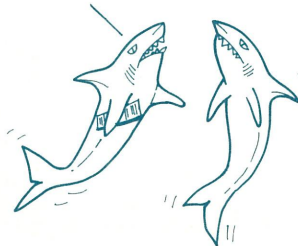
Coralations

Hey I just got this from the Health Department boffins - says to avoid SCUBA divers.



Safe Scuba Diving

They're worried about the spread of exotic diseases



Pongase

Oh yeah ! Anything that encases its ENTIRE body in rubber....



Torres Strait Baseline Study

In 1989 the Australian Prime Minister announced, as part of his Statement on the Environment, that the Commonwealth Government would fund a four year environmental programme to examine the Torres Strait marine environment. This funding was in response to concerns expressed by both Islanders and scientists at the Torres Strait Fisheries Seminar held in Port Moresby in 1985 (Haines et al. 1986). At this meeting the following statement was endorsed:

Because the Fly River is the largest and most important freshwater input into the Torres Strait region, the participants of the Torres Strait Fisheries Seminar wish to express serious concern over the possible effects that dumping of Ok Tedi mining wastes in the Fly River may have, directly or indirectly, on Torres Strait fisheries.

The seminar recommended that a scientific environmental monitoring programme be established as soon as possible to investigate the problem of possible mining pollution in the Gulf of Papua and adjacent Australian waters.

Funds for the Torres Strait Baseline

Study have been provided so that it can acquire data which will assist in determining the extent of influence of Fly River discharge and whether there is evidence of contamination in the sediments and in the biota of the Torres Strait from mining operations in the Fly River catchment area and provide options for management of the marine environment.

The Great Barrier Reef Marine Park Authority has been charged with the management of the study because of expertise, and experience, in managing marine environmental research in northeastern Australia. However, the most northerly section of the barrier reef, which forms the eastern boundary of the Torres Strait, is not within the jurisdiction of the Marine Park Authority. It is however, included within the Torres Strait Protected Zone which was created by the Torres Strait Treaty between Australia and Papua New Guinea.

Regrettably no comprehensive marine management plan exists for the Torres Strait region. Notwithstanding these problems the study has been given positive support by Islander people and will provide important baseline data on the present state of the Torres Strait marine environment.

The objectives of the baseline study programme are: to establish existing levels of trace metals within the

sediments and biota; to identify the important transport, geo-chemical and trophic pathways of trace metals in the Torres Strait marine environment; to determine the potential effects of trace metal concentrations on selected marine organisms; to assess the potential effects of present and future mining operations on sediment loads and trace metal concentrations, and, to provide a basis for an ongoing monitoring programme in the Torres Strait.

The original programme proposal entitled *Programme for Torres Strait Baseline Pollution Study*, was prepared by Marine and Freshwater Research for the then Commonwealth Department of Arts, Heritage and Environment, in 1987. This programme formed the basis for the study and this has, naturally, become outdated in the light of recent industrial developments in Papua New Guinea particularly the recent opening of the Porgera gold mine in Enga Province, and the Kutubu Petroleum Development Project planned for the Kikori region of the Gulf Province. Therefore the scientific programme proposal has been rewritten. Concerns have been expressed about the possible effects of sediment and particulate copper contamination in the Fly River, the estuary region and also in the Strickland River into which Porgera discharges fines and overburden. The marine ecological implication of the disposal of large volumes of mine tailings and overburden into tropical river systems are still largely



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Green Island Economic Study. Economic Associates Australia. Townsville, GBRMPA, June 1983. 68p. ISBN 0 642 52337 1	7.70



Dr David Lawrence

unknown. Possible effects on the environment include increased particulate loading of the Fly River system which may cause significant loss of productivity and increased sediment in rivers may also eliminate bottom dwelling species. However, a more serious problem may be the translocation and incorporation of residual metals from tailings waste into marine sediments, and the subsequent uptake by marine organisms of the Torres Strait. The processes of bio-accumulation are also presently unknown. Therefore the accumulation of trace metals in important commercial and community fisheries, particularly the mackerel, prawn and rock lobster fisheries, have become issues of considerable concern to the northern commercial fisheries industry.

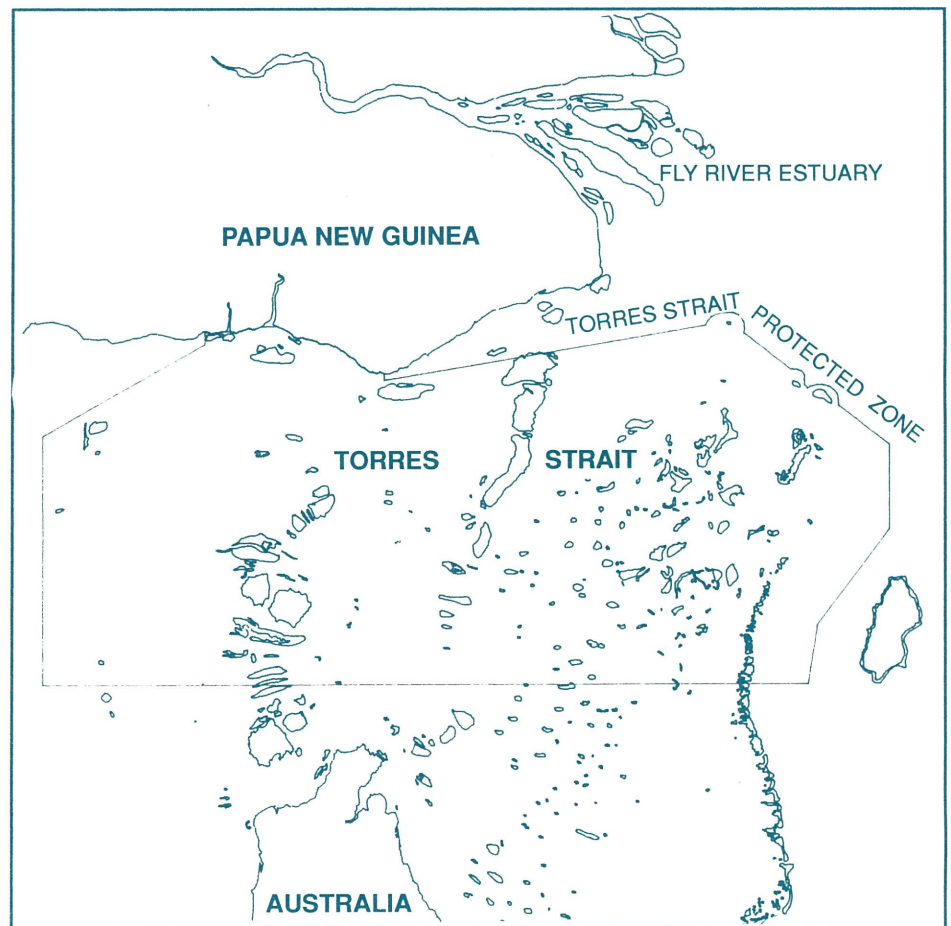
Damage to corals in the Great Barrier Reef region, detrimental effects on endangered species such as dugong and turtle, and the possibility of potential human health problems from increased metal content in seafoods, particularly among Torres Strait Islanders, who have one of the highest per capita consumption rates of seafoods in the world, have also become concerns. Damage to the backswamps, lagoon and creeks which provide fish and drinking water for the villages in the upper and middle Fly River and Ok Tedi region have not been investigated nor have the long-term cultural effects of environmental

damage on subsistence livelihoods of the indigenous peoples of these regions been considered.

The Torres Strait is an area of considerable biological, geographical, ecological and cultural diversity. It is also apparent that the Torres Strait marine environment is perceived, particularly by Islanders, to be at a crucial point in its history. Torres Strait Islanders see their home reefs and the rich marine environment as being under threat from mining

developments from which they receive no benefits, and from developments which are beyond the direct jurisdiction of the Australian Government despite the environmental and cultural provisions of the Torres Strait Treaty between Australia and Papua New Guinea.

Reference
Hains, A.K., Williams, G.C. and Coates, D. (eds) (1986).
Torres Strait Fisheries Seminar Proceedings 1985, AGPS, Canberra.



WATER QUALITY PROGRAM 1991/92

GBRMPA has identified GBR water quality as a major environmental management issue critically requiring resolution, with long term implications for conservation, tourism and fisheries production. Good water quality is fundamental to maintain the GBR in its natural state and for ensuring the viability of the Reef to support fishing and tourism. There has been considerable public concern over the potential effects of coastal run-off of nutrients and sediments on the GBR. At some popular sites such as Green Island there is clear evidence of degradation due to sewage pollution.

Understanding the status and changes in the water quality in the GBR Region is fundamental to the understanding of many management issues which confront GBRMPA. Water quality and water pollution questions are inherent in developments such as marinas, reef pontoons, island resorts, harbour operations, mariculture projects and offshore loaders as well as those terrestrial activities occurring adjacent to but outside the Marine Park such as agriculture (particularly sugar and beef), coastal urban growth and industrial development.

Overseas, changes in water quality due to sewage discharges, agricultural run-off and dredging have led to the destruction or degradation of coral reefs. In Australia such activities in the southern states have led to eutrophic and silted marine lakes, lagoons and estuaries. There is evidence that nutrient levels in the GBR may be approaching levels which have caused degradation of coral reefs overseas.

Coastal water quality should be seen as a complement to the Landcare programs presently being implemented in Australia. Much of the soil and nutri-

ents lost from eroded, overgrazed and overcropped lands adjacent to the GBR ends up in the GBR lagoon where it may impact on the reefs and seagrass.

During the past couple of years the activities of Research & Monitoring in Water Quality and Marine Biology have been consolidated into an identifiable program aiming to answer five broad questions:

- 1. What are the present levels of nutrients in various parts of the Great Barrier Reef Region?**
- 2. What trends are observable in nutrient levels in the region?**
- 3. What are the effects of elevated nutrient levels on coral reef and seagrass communities?**
- 4. Are the effects of elevated nutrient levels that have been quantified overseas detectable in the region?**
- 5. How much of the observed change in nutrient levels and reef degradation is due to human influences and how much to natural change?**

In addition action has been commenced to: introduce new sewage discharge standards for the Park including inspection and documentation of existing systems; investigate guidelines for discharges from mariculture facilities; investigate cost-effective methods for water quality monitoring and update our knowledge of pesticides, TBT and trace metal residues in the Park. An education program will be implemented to enable the public to understand the issue and to develop appropriate behaviour to reduce nutrient and sediment inputs to rivers and the coastal environment.

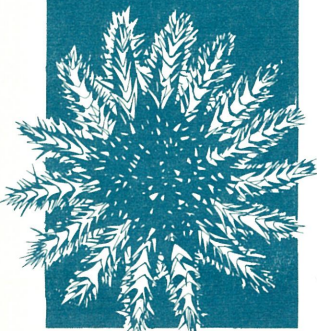
At present the only water quality research projects still being undertaken in the Park with funding from GBRMPA are the final stages of the central GBR nutrient budget project led by Miles Furnas from Australian Institute of Marine Science and the Green Island sewage impacts project led by Andy Steven of James Cook University. However projects supported by GBRMPA in the past are now in the process of being written up and by the end of 1991 we will have a much greater information bank on which to plan management strategies for water quality in the Park. Some of these studies include: the central GBR nutrient budget project; Cecily Rasmussen's doctoral work on river inputs and offshore effects around Cairns; Steve Blake's doctoral work on sedimentation and nutrient processes in the Whitsunday area; Bruce Brady's work on seasonal variability in nutrient levels off Cairns; Reef Biosearch's work on water quality around tourist pontoons; studies of nutrient levels in the Fitzroy River flood plume and water quality monitoring results from a number of development projects. In late 1991, the Water Quality Advisory Committee will be reconvened to advise on the implementation of the program funded from the new policy proposal.

The Authority has now developed a new policy proposal for funding in the 1991/92 financial year to address the above concerns and implement the program.

The Authority is also working closely with groups addressing "Landcare" initiatives and will participate (funding permitting) in both the 'Effects of Agricultural Practices on the Coastal Zone Ecosystem' project being coordinated by the Queensland DPI and the Johnstone River Integrated Catchment Management project.

Mr Jon Brodie

CROWN-OF-THORNS STARFISH RESEARCH IN 1991/92



The damage to coral reefs caused by outbreaks of the crown-of-thorns starfish (COTS) is one of the most serious scientific and management issues on the Great Barrier Reef (GBR). Although there are indications that the current series of outbreaks which started in 1979 is nearing

an end, an estimated one-fifth of the 2900 reefs on the GBR has been affected over the last decade. Public recognition of the seriousness of the issue has been reflected in Federal Government funding for research into the starfish, causes of outbreaks and its effects on the GBR. Since 1985 the Authority has received special funding of around \$6 million for COTS research.

This financial year represents the third and perhaps final year of the current COTS research program which has focused on monitoring the starfish and its effects on corals, predation on post-settlement stages of COTS, reproduction and larval dispersal. The luxury of committed, long-term (three years) funding of around A\$1 million per annum from the Federal Government has meant that we have been able to concentrate on some of these more complex and costly areas of research hitherto un-investigated or under-explored.

Our major projects are continuing in 1991/92: broadscale surveys of COTS and their effects on corals along the GBR by the Australian Institute of Marine Science (AIMS); the role of predation in factors influencing the survival of small juvenile COTS cultured in the laboratory by Dr John Keesing of AIMS; feeding studies on potential fish predators of post-settlement COTS by Dr Hugh Sweatman of James Cook University (JCU); and investigation of factors affecting the reproduction and larval dispersal and nutrition of COTS by Dr Russ Babcock of AIMS.

Less than 10% of the 1991/92 budget has been allocated to new projects. These include: feeding ecology of larval and pre-coral feeding juvenile COTS (Mr Ken Okaji, formerly of the University of the Ryukyus, now at AIMS); the movement of actual starfish outbreaks during the 1980s - unification of the oceanography and biology (Dr Kerry Black of the Victorian Institute of Marine Sciences); testing predictions of reef connectedness using population genetics (Dr John Benzie, AIMS); and an

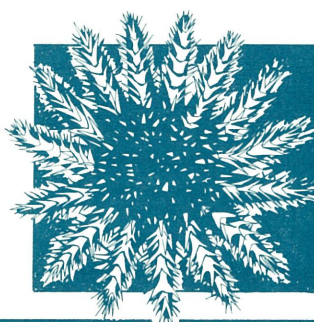
investigation of COTS larval dispersal - field experiments (Dr Kerry Black). The last project will be contracted only if additional funding of around \$50,000 can be arranged from other sources.

A number of existing projects should be completed this financial year. These include: age determination in COTS (Assoc. Prof. John Lucas and Mr Richard Stump of JCU); impact of COTS on massive corals (Mr Lyndon DeVantier of the University of Queensland and AIMS); modelling to assess the impact of predators on COTS populations (Dr Hamish McCallum, University of Queensland and Dr Roger Bradbury of the National Resource Information Centre) and modelling approach to hydrodynamics and the large-scale larval dispersal of COTS (Marine Modelling Unit, JCU).

Thanks to the application of all researchers within the research program we know a great deal more about the biology, ecology and dispersal of the starfish than we did three years ago. Up to February this year there were 718 publications on COTS. As a spin-off from this focus on the starfish, we have also gained considerable insight into many processes and principles operating on the GBR, such as monitoring techniques, larval dispersal, reef connectedness and coral community dynamics.

While most reef-lovers will be thrilled with the declining COTS populations (according to AIMS surveys only 4% of surveyed reefs had outbreaks in 1989/90 compared with 16% in the previous year), the shortage of suitably large populations for study within easy access will be a headache for researchers in future years.

A short time ago we updated the COTS sighting form. This form was designed so that we could get necessary information on the presence or absence of COTS and status of the corals on a wide range of reefs not included in our formal annual surveys. If you plan to visit the GBR for work or pleasure, please give us a call and we'll send you some forms (the forms and their postage are free).



Dr Brian Lassig

STOP PRESS

GBRMPA received good news in the 1991/92 Federal budget with the funding of its new policy proposals for Water Quality and the Effects of Fishing. Budget support of one million dollars was provided for Water Quality allowing a start to be made on the program outlined in this newsletter (pg 6) while nine hundred thousand dollars was provided for the Effects of Fishing program (pg 8). The Torres Strait Baseline Study also received a funding boost of one hundred thousand dollars (pg 4)

RESEARCH INTO THE EFFECTS OF FISHING IN THE GREAT BARRIER REEF REGION

Initiating research into the effects of fishing on the Great Barrier Reef has been a priority of the Great Barrier Reef Marine Park Authority for some years. 1991 has seen the formal commencement of a dedicated programme of research, coordinated by the GBRMPA, to consider the effects of fishing. A multi-agency Advisory Committee on Research into the Effects of Fishing in the GBR Region has been established to develop an experimental research program. The Committee includes representatives from Commonwealth and Queensland fisheries, management and research agencies as well as commercial and recreational fishing groups. The Authority has appointed a coordinator (Dr Bruce Mapstone) for the programme and has made a submission to the federal government for \$A1.525M to commence large scale research in 1991-92. We are confident of obtaining substantial funds from the Federal Government, but details are not available at the time of writing this report.

The general objectives of the research programme are to evaluate the direct and indirect effects on reef communities of recreational and professional line-fishing, inter-reefal trawling (principally for prawns), and the interaction between the two fisheries. In February 1989, the GBRMPA sponsored a scientific workshop to consider some of the issues arising out of these and other fishing activities in the GBR region. In 1990, the Authority commissioned Professor Carl Walters (University of British Columbia, Vancouver) and Dr Keith Sainsbury (Commonwealth Scientific and Industrial Research Organisation (CSIRO), Hobart) to consider the design options for a very large-scale manipulative experiment to assess the effects of trawling and line fishing.

They have recommended a split-plot experimental design involving 8-10 'clusters', each of five reefs. Half of the clusters will be subjected to inter-reefal trawling, and the other half closed to trawling. Within each cluster, up to

four line-fishing treatments will be applied for periods of at least five years. Each treatment will be replicated within at least two clusters to provide estimates of local inter-reefal variation in treatment effects. Their recommendations will dictate the theme of experimental research into the effects of fishing in reef areas over the next 5-10 years. Input from the fishing industries, participating scientists, and external referees will ensure that the details of the research are sound and appropriate to the GBR region.

Independent research already under way will complement the work suggested by Walters, Sainsbury and others. For example, research being done collaboratively by researchers at the James Cook University, the Australian Institute of Marine Science, and the Queensland Department of Primary Industry (QDPI) (Fisheries) involves describing the characteristics of age, growth, diet, and reproduction of several large, commercially important reef fish, especially coral trout, red-throat sweetlip, and red emperor. The work is funded by the Australian Research Council and the Fishing Industries Research and Development Council, and from institutional funds. Commencing in November 1991 will be a detailed investigation of the effects of trawling on benthos, by-catch species, and target species in the Far-North Section of the GBR. This work is being done by CSIRO (Cleveland Laboratory) and QDPI and is currently being funded by CSIRO, although external funding is being sought to sustain the project.

The effects of fishing research programme is a long-term undertaking, covering the next 5-10 years at least. At the end of the work, however, we will have a much better understanding of the interactions between fishing activities and the GBR system and will be able to better manage the marine park to ensure that both fishing and the reef system survive.

Dr Bruce Mapstone