GREAT BARRIER REEF
MARINE PARK AUTHORITY

REEF RESEARCH

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NEWSLETTER OF THE RESEARCH AND MONITORING SECTION

Editorial

Greetings and a happy belated New Year to you all! Well, this issue is certainly a mixed bag of offerings. COTS COMMS provides us with an update on the latest fine-scale survey results. Vicky Nelson discusses the use of fixed transects versus random transects for monitoring reef benthos in *What's Out There?* – this article may be a little 'heavy' for some of you but it presents a good overview of the issues involved. The Effects of Fishing Program has provided us with a précis of the projects it is currently involved in and James Innes discusses indigenous involvement in the management of the Great Barrier Reef World Heritage Area. In *Slick Talk* we hear that the Great Barrier Reef has been witness to five shipping incidents in the past two years – luckily none of these have led to serious pollution but, unfortunately, there' s always a next time. It's great to hear, however, that steps are being made to improve the prevention of shipping incidents in the Great Barrier Reef.

This is my first issue as Editor – having inherited the role from Steve Hillman on his departure (I was previously Assistant Editor). While I can assure you that there will be no major changes to the newsletter, you may see a few new additions here and there. Thanks to all of you who have returned your survey forms. I have received 576 in total. If you haven't yet returned your form please do so as we are updating our mailing list and your comments are invaluable. Over the next few issues I will attempt to have as many of your suggestions for future articles addressed. Oh, and I must apologise for asking surveys to be returned by 31 February 1997 (this date doesn't even exist). Sorry for any inconvenience this may have caused. To 'err is human' after all!

We are running quite late with this issue. It seems to be a busy time for all, including many of our writers. Please bear with me as I endeavour to get us back on track. We are ▶

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Editorial

continued from front page

looking to have the next issue out in May but hope to be back on track for the 'June' issue.

Looking back on 1996, it was a very interesting and busy year for the Authority. We were involved in many issues such as the debate on the ethics of manipulative research and the proposed increase to the Environmental Management Charge on tour operators. Late in 1996 the Federal Government announced that there would be an independent review of the Great Barrier Reef Marine Park Authority: the outcomes should be known later this year. It is also anticipated that the proposed review of the management of tourism use in the Great Barrier Reef Marine Park, endorsed by the Great Barrier Reef Ministerial Council in December 1995, will commence shortly. Terms of reference are currently being finalised. I shall keep you posted.

'Till next time. Happy reading...

Ed.

A FOND FAREWELL...

Reef Research is one of the Great Barrier Reef Marine Park Authority's longer-lived information series. Much of the credit for its continuing success must go to its founding and, until recently, only editor Steve Hillman. Steve has now left the Great Barrier Reef Marine Park Authority to work for the Ports Corporation of Queensland. While he will still be seen around coastal Queensland with a continuing role in the environmental management of the Great Barrier Reef, his guiding influence on *Reef Research* will have to be taken up by others. Steve was known for the cartoons which appeared in *Reef Research* – sometimes the subject of some discussion before publication as to their 'suitability' for an official Great Barrier Reef Marine Park Authority publication. We wish Steve well in his new job and hope to see an occasional cartoon from him.

Jon Brodie
Director, Research and Monitoring Section

by Chris Crossland

Conference Report

The Great Barrier Reef: Science, Use and Management Conference, held at James Cook University of North Queensland in November 1996 provided a welcome expansion of debate on Reef issues, particularly from scientists, managers and conservationists (the three labels don't necessarily contradict each other) who are not formally involved in the Centre. Public interest in the conference was immense and could be gauged by the speed with which the media representatives hit the doors to file copy after some of the more exciting presentations. A packed lecture theatre fell completely silent during the spellbinding, unscripted delivery by Archie Tanna of the Cape York Aboriginal Land Council, an experience which many delegates said later was profoundly affecting.

In stark contrast to the previous conference 13 years ago, almost every speaker had, at the very least, some well planned overheads and PowerPoint technology ruled supreme. Professor Helene Marsh, characteristically, managed to lift 95% of her audience off their seats by unexpectedly blowing a very loud, old-fashioned whistle – to prove a scientific point, of course (that it was impossible to say whether the manipulated scare caused to members of the audience by whistle-blowing would directly affect their fecundity in five years time).

I regret that it was impossible for me to attend each and every session, but in my view, some of the outstanding contributions from speakers external to CRC Reef but closely involved in the Great Barrier Reef as stakeholders, were – in quite random order – these:

Roland Pitcher of the Commonwealth Scientific and Industrial Research Organisation, Cleveland, shifted the focus from line fishing – a topic referred to in passing by many – to the trawl fishery. Sample trawling has been conducted in and adjacent to the cross-shelf closure in the Far Northern Section of the Great Barrier Reef Marine Park by the Commonwealth Scientific and Industrial Research Organisation and the Queensland Department of Primary Industries. Part of the study involved a repeated trawl depletion experiment over 12 plots, which found few significant differences in benthic communities between those trawled and the controls. However, although the impacts of trawling may not be detectable in sparsely or infrequently trawled areas, the cumulative

NEW PUBLICATIONS

NEW RESEARCH AND MONITORING SECTION PUBLICATIONS

	Price
The status of the dugong in the southern Great Barrier Reef Marine Park. H Marsh, P Corkeron, I Lawler, J Lanyon and A Preen. Townsville, GBRMPA, 1996. (Research Publication No. 41) 80 pp. ISBN 0 642 23015 3	$16.20
Standard operational procedure video-monitoring of sessile benthic communities. D Wachenfeld. Townsville, GBRMPA, 1996. (Research Publication No. 42) 15 pp. ISBN 0 642 23016 1	No cost

effect of frequent trawls over the same ground may be substantial. With more information about benthic distribution and trawler effort at global positioning system (GPS) resolution, management agencies should be able to put strategies in place which will ensure that the prawn trawling industry is managed in ecologically sustainable ways.

Terry Hughes from the Department of Marine Biology at James Cook University of North Queensland took some of his audience aback by the assertion that coral reefs are neither fragile nor pristine, but extremely dynamic at spatial and temporal scales. Different coral species vary greatly in how susceptible they are to impacts, whether natural (e.g. crown-of-thorns starfish) or anthropogenic (e.g. a ship-grounding), and their rates of recovery are equally variable. The rates of recolonisation depend critically on the availability of a pool of larvae, and recent genetic and recruitment studies have distinguished between corals which are brooders and those which are spawners. Management zones which protect some species may therefore be quite inappropriate for others.

Kees Hulsman from the Faculty of Environmental Sciences at Griffith University outlined worrying trends in the populations of seabird colonies on the heavily visited Michaelmas Cay. While evidence from the remote Swains group suggests that anthropogenic impacts have little effect on population dynamics, and that detected declines are more likely to have natural causes, most monitoring of seabird numbers on the Great Barrier Reef has been done on an ad hoc basis and usually not using standardised methods. Quality data on the threats to the viability of seabird colonies is required in a hurry. The speaker urged that it could be provided by what he termed 'Action Research'.

Ed Green, representing members of Tourism 2005 issued a timely reminder to the scientific and management communities: if they are exporting their expertise on the conservation of reefs overseas, could they first teach the necessary skills to Australians. He outlined a pilot project run by Marine Park Tourist Operators and their staff which directly involves them in a monitoring program. If successful, it should be possible to transfer the model Reef-wide, to other marine tourism industries, and social scientists and resource management agencies overseas.

Debate on reef conservation issues was raised by speakers with perspectives from different working cultures, yet with much in common. Peter Cullen, Director of the CRC for Freshwater Ecology, made the point that disagreement is fundamental to the advancement of science, but causes havoc with resource managers and the general public. His attempts to foster community support for research projects include walking the land of the Murray–Darling Basin and listening to the farmers, as well as frequently pounding the corridors of Parliament.

Community involvement was the chief focus of Di Tarte from the Australian Marine Conservation Society. Her call for improvement of public input into all aspects of management of the Marine Park was well heeded. However, for myself this debate was crystallised by Ian Lowe from the School of Science at Griffith University and well respected author of the State of the Environment Report. It is our responsibility to future generations and to the world to manage the Reef sustainably, but to do this we must find an integrated approach to environmental problems. We need a less naive approach that does not necessarily mean a well managed economy should be the first priority. Awareness of ecological issues must be built into all levels of social and economic planning if we are to achieve the goal of sustainability.

When questioned from the floor about the need for greater community involvement in the science and management of natural resources, Ian wholeheartedly endorsed the necessity of it. Yes, the community must have a greater say in the proper focus of research. The design of that research, however, should be a responsibility of the scientists. I agree.

While I have referred to the speakers delivering papers in this commentary, many of course had co- or multiple authors. These are all acknowledged in the published Conference Proceedings.

CRC reef Research Centre

An unincorporated joint venture between:

Association of Marine Park Tourism Operators
Australian Institute of Marine Science
Great Barrier Reef Marine Park Authority
James Cook University
Department of Primary Industries

established under the

Cooperative Research Centres Program

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with Steve Raaymakers and Jamie Storrie

REEF SHIPPING – five close calls in two years

The grounding of the *Sanko Harvest* and the causes of the accident which led to significant pollution along the Western Australian coastline were discussed in a recent issue of *Reef Research* (see Slick Talk #17, *Reef Research*, June 1996). The Great Barrier Reef and adjacent waters have been the scene of five shipping accidents over the past two years. None of these incidents has led to serious pollution, but all have had the potential. Several of the incidents were preventable had basic procedures been followed. Of these five incidents it is interesting to note that:

- four were groundings;
- of these four groundings, three occurred between the hours of 2.00 a.m. and 6.00 a.m.;
- three of the groundings (for which the cause is known) were caused by human error; and
- two of the vessels were not calling at Queensland ports.

The five incidents are outlined below.

1. Grounding of Australian flagged tanker *Conus* – Townsville Port

The *Conus*, a 31 950 dry weight tonne oil tanker, grounded in the port channel whilst departing the Port of Townsville on 12 January 1995 (refer to Slick Talk #12, *Reef Research*, March 1995). The vessel grounded on soft seabed and was undamaged by the impact. The *Conus* was refloated forty-five minutes after grounding.

The *Conus* grounded because it had been unable to achieve sufficient speed to maintain steerage against the prevailing winds. This caused the vessel to veer off course into the side of the channel. The incident investigation conducted by the Queensland and Commonwealth Departments of Transport concluded that the port Pilot did not take into account the strength of the wind when making departure plans and that the Master of the *Conus* and the Pilot did not develop a departure plan specific to the conditions: instead they relied upon a standard departure plan.

The grounding did not represent a serious risk of pollution but does serve to demonstrate the ease with which such incidents can occur.

A similar but less serious grounding occurred as the *San Paulo* departed from the Port of Townsville on 12 August 1996.

2. Grounding of German flagged container ship *Carola* – South Ledge Reef

The *Carola* grounded on South Ledge Reef (Far Northern Section) at approximately 5.00 a.m. on 30 March 1995. The vessel grounded hard and caused significant local damage to the reef (refer What's Out There? *Reef Research*, June 1995). The fore peak of the *Carola* was breached and water entered through the bow. The vessel's pumps were able to cope with the influx of water and the *Carola* was refloated approximately six hours after grounding.

The grounding was caused by the Mate falling asleep on watch and failing to wake the Reef Pilot who had to make a course change at a designated way point. The Mate's drowsiness was due to a lack of sleep and the consumption of several beers four hours prior to going on watch. No blame could be attributed to the Pilot.

3. Chinese flagged bulk carrier MS *Ever Bright* – southern Great Barrier Reef

The MS *Ever Bright* was on a ballast passage from Taiwan to Newcastle. The *Ever Bright* experienced mechanical

failure early on 25 April 1995, at the southern end of the Great Barrier Reef. The vessel drifted some 160 nautical miles north-easterly whilst repairs were attempted to the engine. The vessel's engines were tested on 29 April 1995 but failed. The *Ever Bright* then anchored in 90 metres of water off the Swain reefs. A salvage company was contracted by the owners and subsequently the vessel was towed to Gladstone for repairs.

Though the *Ever Bright* had lost power, maritime authorities were not notified of the incident until 27 October 1995. This incident demonstrates the reluctance of ship owners and masters to notify authorities of incidents involving their ships. This is generally due to worries that authorities may place restrictions upon the movement and operation of their vessel. In the case of the *Ever Bright* it is possible that early notification would have seen an intervention order placed on the vessel, forcing the owners to contract a salvage company. Such considerations are part of the reasoning behind the compulsory reporting system for ships which is being implemented throughout the Great Barrier Reef next calendar year (1997).

4. Danish flagged container ship *Svendborg Guardian* – Kurrimine Beach

The *Svendborg Guardian* was en route Townsville to Papua New Guinea when it grounded on Kurrimine Beach (Cairns Section) at about 6.00 a.m. on 24 June 1995. The vessel was undamaged in the incident and refloated twelve hours later. The grounding was serious enough that oil spill response equipment was deployed to the site. The vessel's hull remained intact and no pollution resulted.

Similar to the *Carola* incident, the *Svendborg Guardian* grounded as a result of the Second Mate falling asleep in his cabin when he was supposed to be on watch. The vessel was effectively out of control for five hours and a course correction was not made at 4.00 a.m., some two hours before grounding. The bridge itself was manned only by one crew member during this period, which is contrary to Australian regulations.

Again, similar to the *Carola* incident, the Second Mate fell asleep due to inadequate rest and possibly due to consumption of alcohol prior to boarding the vessel for departure.

5. Grounding of Panamanian flagged refrigerated cargo carrier MV *Peacock* – Piper Reef

The MV *Peacock* grounded on Piper Reef (Far Northern Section) at approximately 2.00 a.m. on 18 July 1996, whilst en route from Singapore to New Zealand via the inner Great Barrier Reef route. The *Peacock* was unladen at the time of grounding, but was carrying 670 tonnes of various fuel oils. The *Peacock* remained grounded for a period of ten days whilst awaiting suitable tides for refloating. None of the vessel's fuel was released by the grounding. The vessel did have a Reef Pilot on board at the time of grounding.

The *Peacock* grounding led to one of the largest response operations to a maritime casualty within the Great Barrier Reef Marine Park. State and National resources were deployed on site to safeguard against possible releases of oil whilst the vessel was stranded. Fortunately the *Peacock* was refloated without incident.

There are as yet no findings as to how the *Peacock* came to ground on Piper Reef. An investigation is currently being carried out by the Commonwealth Department of Transport to determine the reasons behind the grounding.

In recent years significant effort has been directed by State and Commonwealth Governments towards improving prevention of shipping incidents in the Great Barrier Reef including:

- implementation of compulsory pilotage;
- deregulation of reef pilotage and transfer of pilotage control from Queensland to the Commonwealth;
- the identification of alternative routes by the Hydrographer including the charting of an outer Great Barrier Reef shipping route;
- implementation of a vessel reporting system;
- planning and implementation of a reef-wide differential global positioning system and radar system to aid navigation; and
- improving the information supplied to the public and shipping industry about the Great Barrier Reef.

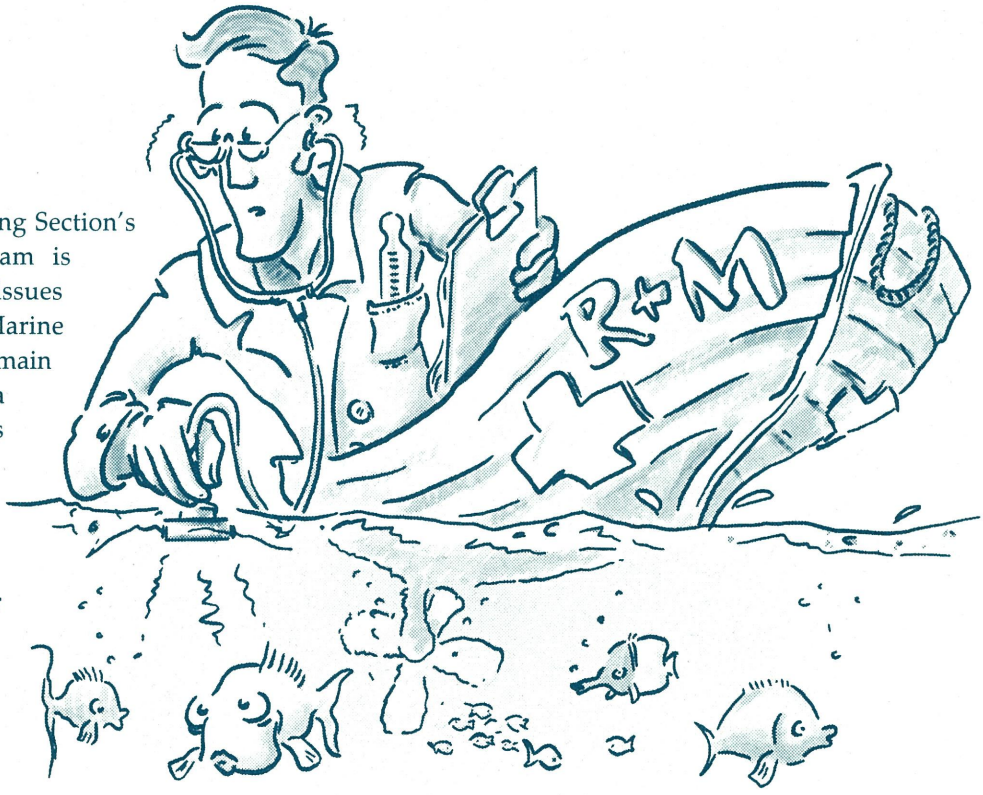
Five concerning incidents in two years suggests such efforts are absolutely vital and may even require enhancement to bring this frequency of incidents down to an acceptable level. Even if transit shipping not calling at Queensland ports is phased out in the Great Barrier Reef inner route, all Queensland ports are undergoing growth with resulting increases in reef shipping.

Improvements in shipping incident prevention systems must address this increasing risk as well as the current risk.

Steve Raaymakers is currently the Environment Manager with the Queensland Ports Corporation. The views expressed by his continued authorship of 'Slick Talk' are not necessarily those of the Ports Corporation nor the Great Barrier Reef Marine Park Authority.
Jamie Storrie is currently Project Officer, Shipping and Maritime Pollution Response with the Great Barrier Reef Marine Park Authority.

FISHING: The effects on the Great Barrier Reef?

Martin Russell



The Research and Monitoring Section's Effects of Fishing Program is involved with fisheries issues relating to the Great Barrier Reef Marine Park and World Heritage Area. The main objective of the program is to gain a greater understanding of the impacts of fishing to ensure ecologically sustainable fishing, the protection of critical habitats and the protection of rare and endangered species. The program has identified a number of critical issues affecting the Great Barrier Reef Marine Park and World Heritage Area which are being addressed through various projects. These are outlined below.

Prawn Trawling

The Effects of Prawn Trawling in the Far Northern Section of the Great Barrier Reef Marine Park research project conducted by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the Queensland Department of Primary Industries is in its fifth and final year. The research was conducted in and adjacent to the cross-shelf closure (Marine National Park 'B' zone) in the Far Northern Section of the Great Barrier Reef Marine Park. The particular emphasis of this study was to:

- describe the fish, benthos, penaeid prawns, by-catch species and sediments of these areas and compare the communities in the cross-shelf closure area with those of adjacent areas where prawn trawling is not prohibited;
- determine the direct and indirect impacts of trawling;
- ascertain the proportion of discards (thrown overboard from trawlers) that float and sink;
- determine the fate of discards and their role in the diet of seabirds;
- identify surface and benthic scavengers; and
- estimate the rate at which individual prawn trawls deplete the benthos – this will give an assessment of the number of trawls in an area that will result in appreciable reduction in structural epi-benthos.

The release of the results for the five-year study is expected early in 1997 and will provide valuable information for the management of trawling impacts in the Great Barrier Reef Marine Park. While it is important to monitor the impact of trawling on seabed communities, it is necessary to determine the recovery dynamics of the seabed after trawling ceases. A project to monitor the recovery of benthos, using underwater video is being conducted by the CSIRO. The recovery relates to benthos in the trawl tracks that were repeatedly trawled in the final year of the research project mentioned above. Preliminary results are expected in mid-1997, from which future monitoring requirements will be determined.

Reef-Line Fishing

The Great Barrier Reef supports a widespread commercial reef-line fishery which is of great economic and social importance to the people of Queensland. The fishery is multi-specific, with most fishers targeting around 10–20 species of the coral reef fish found on the Great Barrier Reef. The major species targeted by the fishery is *Plectropomus leopardus* (common coral trout).

Bramble Reef, in the Central Section of the Great Barrier Reef Marine Park, was closed to fishing in 1992 by the Great Barrier Reef Marine Park Authority due to community concern that the reef fish stocks had been overfished and needed replenishment. A monitoring program was set up prior to the closure to monitor changes in commercially important fish stocks (namely coral trout and red-throat emperor), other reef fish species and coral cover on Bramble Reef relative to similar control reefs, before and during the closure and after the 1995 re-opening. Researchers from Sea Research are providing valuable long-term data sets on the state of the reef fish stocks for Bramble Reef during the closure and re-opening. The Cooperative Research Centre for Ecologically Sustainable Development of the Great Barrier Reef (CRC Reef Research Centre) conducted commercial and recreational fishing surveys to monitor fishing activity, fishing catch and effort, and changes in size and age structure of target species on Bramble Reef during the re-opening in 1995. A comprehensive analysis of the surveys is due mid-1997.

An experiment proposed by the CRC Reef Research Centre will involve research in 'Fisheries Experimental Areas' in the Great Barrier Reef Marine Park. The experiment on selected reefs subjected to different zoning regulations, will quantify the impacts of reef-line fishing and determine the environmental effects of reef-line fishing on targeted fish species and reef communities. The results will be of immediate benefit to all sectors of the fishery and management agencies, and will help maintain fish stocks and sustainable fishing on the Great Barrier Reef in the long term.

The CRC study will provide:

- a reliable estimate of the relative size and status of target fish populations on individual open and closed reefs;
- information on the impact that increased fishing pressure has on target fish populations, other reef species, and the potential for future fishing;
- information on the levels of fishing effort that can be sustained in the long term;
- information on the methods that should be used to monitor the status of fish populations and the fishery and signals from those methods that would indicate developing problems that require direct management action;
- information on what catch rates of coral trout mean in terms of relative abundance of coral trout on a reef;
- information on how quickly coral trout populations and catch rates recover following closure to fishing;
- testing of management options for the fishery; and
- effective adoption of different management strategies designed to conserve fish stocks on the Great Barrier Reef.

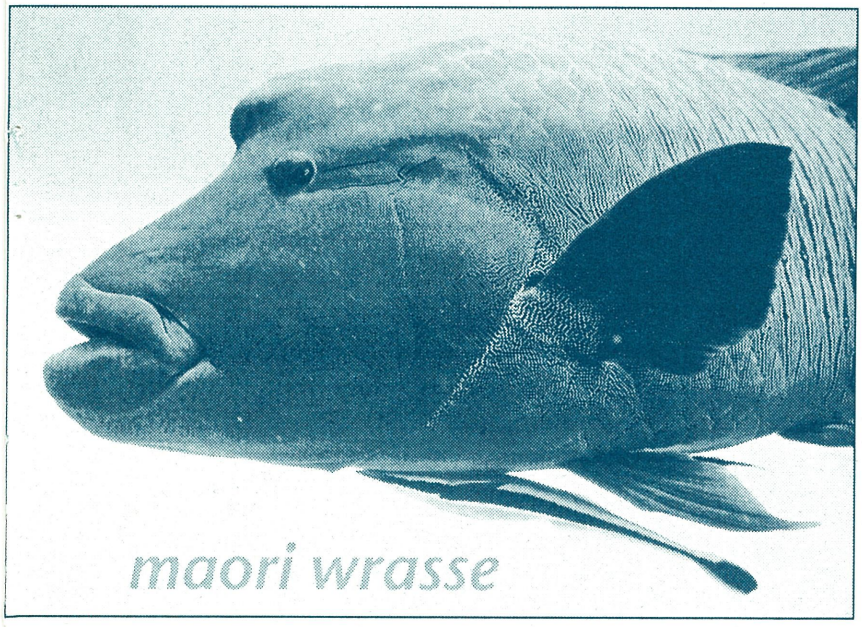
For the research to be conducted, amendments need to be made to existing Great Barrier Reef Marine Park zoning plans by the Great Barrier Reef Marine Park Authority so that Fisheries Experimental Areas can be established for a total of four groups of six reefs in the Cairns, Central and Mackay/Capricorn Sections of the Marine Park. The experimental design was considered by the Senate and the zoning plan amendments were passed through Federal Parliament late December 1996. The Authority has designated the first of the fisheries experimental provisions that will apply to four individual Fisheries Experimental Areas (reefs) from 29 March 1997. These four reefs are designated to be opened to fishing for one year. After the one year opening, the four reefs will then be re-closed. The provisions were made by way of a written advertisement, which appeared in local and state newspapers and in the Commonwealth Gazette. The completion of these processes will then allow the research experiment to begin. After the one year opening of these four reefs an additional four reefs that are currently open to fishing are proposed to be closed to fishing for a period of five years.

Fish Spawning Sites

Currently staff within the Effects of Fishing Program are compiling information on spawning aggregations of coral trout *(Plectropomus* spp.), red-throat emperor (*Lethrinus miniatus*) and maori wrasse (*Cheilinus undulatus*). These spawning aggregations are possibly targeted by the commercial reef-line fishery on the Great Barrier Reef. Spatial and temporal information on spawning for these species is necessary to ensure key spawning sites and seasons are not disturbed or impacted by tourism or fishing.

Mesh-netting and Dugongs

Surveys have detected a dugong population decline in the southern region of the World Heritage Area (south of Cooktown) of between 50–80% over the past eight years, and a patchy decline in the northern region of the World Heritage Area. Research indicates that the population in the southern region can only cope with a loss of less than 1–2% (females) each year. Of the dugong deaths in the Great Barrier Reef World Heritage Area reported to the Great Barrier Reef Marine Park Authority in 1996, 37.5% are confirmed to have been caused by mesh-nets. Based on this evidence the continuing mortality of dugongs in mesh-nets is not sustainable and therefore of great concern to the Authority. Management strategies for mesh-netting in the Great Barrier Reef World Heritage Area are being developed in conjunction with industry and stakeholders with a view to eliminating the risk of mesh-nets to dugong survival. Urgent action is required and a number of options for joint Commonwealth and Queensland emergency measures are being considered to arrest the apparent rapid decline. Data acquisition, analysis and reporting on dugongs and mesh-netting are required. This includes fine scale surveys of dugong distribution and habitat, a bather protection net review, information on the types of mesh-nets used and where the nets are being used in the Great Barrier Reef World Heritage Area, seagrass diseases incidence and implications for dugong, vessel use of dugong habitat, and indigenous hunting. The Great Barrier Reef Marine Park Authority, in cooperation with the Queensland Department of Environment, the Queensland Fisheries Management Authority, the Queensland Commercial Fishermen's Organisation and the Queensland Department of Primary Industries, is to report to the Commonwealth and Queensland Governments by the end of February 1997 on what action is required to ensure that no further dugong mortality occurs as a result of commercial and recreational fishing practices in Interim Dugong Protection Areas.



Trawl Efficiency Devices / Turtle Exclusion Devices (TEDs)

There is increasing concern about the incidental capture of marine animals by prawn trawlers in Australian waters. Current research and management strategies are attempting to address the concern through strategies such as the introduction of Trawl Efficiency Devices (TEDs) (also known as Turtle Exclusion Devices). There is a need for the introduction of TEDs to reduce the incidental capture of sea turtles by prawn trawling in Australian waters. Industry has shown a positive role in the development of TEDs, by taking part in research trials. The introduction of TEDs into the Great Barrier Reef World Heritage Area will provide potential benefits to the industry and the environment by increasing fishing efficiency and considerably reducing sea-turtle mortality. Through a cooperative approach with industry, and the provision of technical support from State and Federal agencies, the implementation and further development of a variety of TED designs to cope with varying conditions and by-catch in the Great Barrier Reef World Heritage Area will be achieved.

Great Barrier Reef Lagoonal Benthic Communities

Little is known of the structure of benthic communities in inter-reefal and lagoonal areas of the Great Barrier Reef Marine Park. To set the results from the *Effects of Prawn Trawling in the Far Northern Section of the Great Barrier Reef Marine Park* project in the context of the whole Great Barrier Reef, a much better description of the benthic communities throughout the Great Barrier Reef is required. The Effects of Fishing Program proposes to compile existing information to develop a broad scale map for inter-reefal and lagoonal benthic communities and where information gaps occur.

The potential impact of fishing activity, both directly on targeted species and indirectly on associated ecosystems, in the Great Barrier Reef World Heritage Area is the primary concern to the Effects of Fishing Program. By addressing the critical issues mentioned above and by collaborating with fisheries management agencies to integrate fisheries and ecosystem management, we hope to ensure that fishing in the Great Barrier Reef World Heritage Area is sustainable and that habitats and rare and endangered species are protected.

DEVELOPING THE LINKAGES

Indigenous involvement in the management of the Great Barrier Reef World Heritage Area

James Innes

Although Aboriginal and Torres Strait Islander peoples have a significant and long standing cultural, spiritual and economic relationship with the Great Barrier Reef World Heritage Area, their interests in the area have only been appreciated at a national and international level during the last decade. From the earliest days, the Great Barrier Reef Marine Park Authority appreciated the need to involve indigenous peoples in the planning process, but lacked the skills and resources to do so effectively. It is only in the past decade that the Authority has been able to develop effective means to identify the interests of indigenous peoples and to include them in the management of the Great Barrier Reef World Heritage Area.

Aboriginal and Torres Strait Islander views on the underlying principles of natural resource management differ markedly from those of Europeans. This is due to their different perception of nature and peoples' places in it. From an indigenous viewpoint coastal landscapes and seascapes are part of an integrated cultural domain made up of owned clan estates to which affiliated kin groups belong. It is from these groups that people derive their identity and customary rights to own and use resources. This is in stark contrast to the European concept of coastal and marine systems as separate domains with marine resources considered as common property.

The majority of Aboriginal and Torres Strait Islander peoples of the Great Barrier Reef World Heritage Area now live in, or near, the major urban areas of the region. They still have strong cultural, spiritual and economic interests in the area mainly due to their continued use of marine and coastal resources and association with traditional land. Away from the urban areas, in Cape York, communities still rely upon fishing, gathering and hunting to supplement their diet. A growing Outstation movement has also led to people being more dependent upon resources in the Great Barrier Reef World Heritage Area.

Aboriginal peoples' association with the land and sea is based upon the belief that landscapes and seascapes were created by Ancestral Beings. These Ancestral Beings also spread social groups and their languages across the landscape in a particular manner. It is from this spiritual belief system that Aboriginal people base the foundation for their culture and connections to land and sea (Young et al. 1991: 108).

An Aboriginal person will usually identify as being a member of a kin group within a particular language area. Language and kin groups are associated with certain tracts of land and sea, commonly referred to as clan estates. Individuals within a kin group share responsibility for the protection and wise use of their estates. This responsibility can be discharged through the performance of ceremonies and the enforcement of customary law (Chase 1980).

Various aspects of customary law govern a person's use of coastal and marine resources. Contemporary cultural meanings and links to the coastal and marine environments are maintained through peoples' continuing use of particular sites and the teaching of stories which relate individual sites to society and history within clan estates. Aboriginal people identify several types of sites within their clan estates that range in significance from:

- sacred sites where visitation is prohibited or restricted to certain people; to
- sites classified as important with restrictions on entry and use; to
- sites with no restrictions other than a requirement to be respectful.

(Chase 1980; Smyth 1992).

In his report to the Great Barrier Reef Marine Park Authority Bergin (1993) identified that Aboriginal and Torres Strait Islander peoples are keen to be involved with the management and use of marine and coastal areas. Individuals and community groups have developed commercial projects using the resources of their area. The Seisia community, for example, operates a camping ground on the tip of Cape York and the

Injinoo community (also at the tip of Cape York) has obtained a licence to harvest 15 tonnes of trochus a year as part of a total 50 tonne limit shared between other Aboriginal and Torres Strait Islander groups. Within many indigenous communities there is also involvement with commercial fishing and a desire to be involved with the management of fisheries resources.

The Great Barrier Reef Marine Park Authority has sought over the last ten years to work more closely with indigenous peoples in some aspects of the management of the Great Barrier Reef World Heritage Area. The *Great Barrier Reef Marine Park Act 1975* made no specific reference to indigenous peoples but it did provide for public involvement in the operations of the Authority. It wasn't until 1983 that indigenous interests were recognised in the first Cairns Section Zoning Plan. Traditional hunting and fishing was identified as a category of use and a definition of traditional inhabitant was provided. The workshop on Traditional Knowledge and the Marine Environment in 1985 (Gray and Zann 1988) was one of the first significant moves made by the Authority to promote knowledge and discussion of indigenous interests in the Great Barrier Reef World Heritage Area.

From 1988 to 1993 a number of reports were commissioned by the Authority to investigate indigenous involvement with and use of the Great Barrier Reef World Heritage Area. All of the reports noted the lack of involvement of Aboriginal and Torres Strait Islander peoples in the management of the Great Barrier Reef World Heritage Area. The result of these reports and internal assessments conducted by Authority staff has led to the following decisions being made to increase indigenous involvement in the management of the Great Barrier Reef World Heritage Area.

- An Aboriginal person was appointed to the Great Barrier Reef Consultative Committee in 1988.
- Aboriginal and Torres Strait Islander interests were directly involved in developing the 25 Year Strategic Plan for the Great Barrier Reef World Heritage Area in 1992.
- A community ranger program was developed and funded jointly with the Australian Nature Conservation Agency for three years.
- An employment strategy was developed and an Aboriginal liaison staff member was appointed to the Authority in 1992.
- Aboriginal and Torres Strait Islander communities were involved in the preparation of a dugong and turtle strategy and permit arrangements for the management of traditional hunting by community based management groups such as the Council of Elders.
- Mrs Evelyn Scott, Chairperson of the Cairns and District Aboriginal and Torres Strait Islander Corporation for Women was appointed to the Marine Park Authority in December 1996 to represent Aboriginal interests in the Great Barrier Reef Marine Park.

The Great Barrier Marine Park Authority has continued to make further decisions that provide for greater involvement of indigenous people in the management of the Great Barrier Reef World Heritage Area. The Authority has developed a good relationship with the indigenous people of the World Heritage Area through extensive involvement of its indigenous liaison officers, training and staff development and the development of a legal and policy framework for effective recognition and involvement of indigenous interests and peoples.

The past ten years have witnessed Aboriginal and Torres Strait Islander peoples becoming more involved and visible in the planning and management of the Great Barrier Reef World Heritage Area. This is due to the efforts of the Great Barrier Reef Marine Park Authority and the pro-active approach taken by indigenous groups in having their rights recognised. Full participation by indigenous groups in the management of the Great Barrier Reef World Heritage Area will be a complex long-term process. Achievement of that goal will ensure that the Aboriginal and Torres Strait Islander peoples of the Great Barrier Reef World Heritage Area are very visibly involved in continuing a long tradition of caring for the country.

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To fix or not to fix? The modern monitor's dilemma

The following article by Vicki Nelson was written as a discussion paper for a recent workshop on the Great Barrier Reef Marine Park Authority/Department of Environment video monitoring program. There had been some debate as to whether it was more appropriate to use random transects instead of fixed transects, and Vicki's paper was intended to highlight some the of the issues involved, and to list the pros and cons of each approach. Since the issue of whether to use fixed or random transects in monitoring programs is a common one, I think it is appropriate to give this paper wider exposure. Vicki has recently left the Research and Monitoring Section to take up a position in the private sector. We wish her well in her career.

Jamie Oliver, Monitoring Coordinator

Monitoring of reef benthos: fixed v. random transect

Vicki Nelson

Any decision regarding the choice between fixed or random transects should be based on the objectives of the monitoring. For example, if the main objective of monitoring is to extend a separate project which uses fixed transects, then sites and transects must be fixed. If the objectives don't define a priori which method to use, deciding which approach to use should be based on knowledge of spatial variation, the cost of reallocating sites, whether permanent sites have advantages for other reasons, and the power of tests from each approach.

The issues are as follows.

Statistical Issues

The re-survey of fixed transects has one major advantage:

1. The error variance in the Analysis of Variance (ANOVA) test is not inflated by natural spatial variability. Green (1993) says 'Re-randomisation does nothing more than cloud the comparison of differences without truly adding error degrees of freedom.' Fixed transects are more appropriate than re-randomised transects (within fixed sites) when we are interested in differences in temporal changes among sites because the error term in a repeated measures analysis will be within-site temporal variation (as opposed to spatial variation among sites).

Some possible disadvantages of a re-survey of fixed transects:

1. Often fewer fixed transects are needed to achieve the same level of power as random transects. Green (1993) claims that this poses questions about the degree of coverage of the site by transects (i.e. representativeness). However, if power is similar between the two methods, then the transects must by

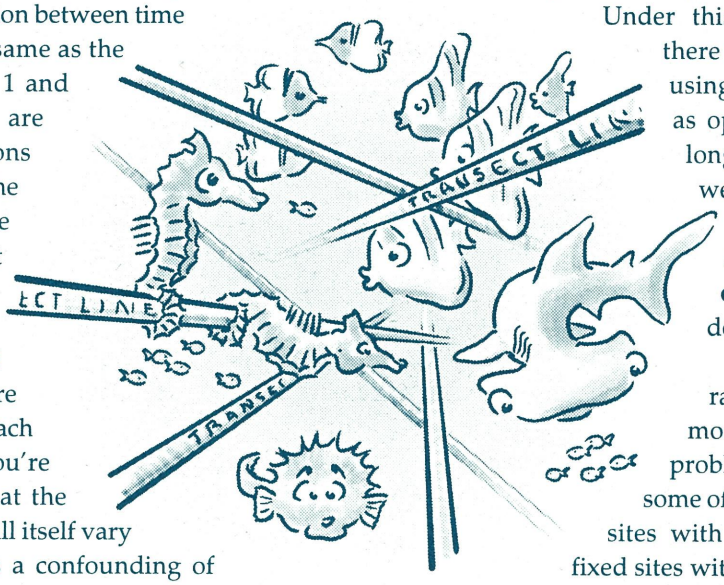
definition be equally representative (since power and representativeness are both functions of within-site spatial variation).

2. Green also claims that the robustness of the test is sensitive to small degrees of freedom in the error term. For the same power, fewer transects are sampled using fixed transects than random ones. This means that assumptions are more difficult to check and that violations are more likely to be serious.
3. If transects are fixed and one is lost or can't be sampled for some reason, there is a statistical problem. Repeated measures ANOVAS do not deal with missing values very well. Either the missing cell must be estimated (with associated problems) or all data for that replicate must be omitted (after 20 years, this could be a bit of a disappointment).
4. Fixed transects are usually not completely fixed. There is an error associated with resampling fixed transects.
5. An error degrees of freedom at each site is lost each time you sample if you use multivariate repeated measures analysis of variance. When the number of times exceeds the total number of replicates, the test is impossible (Green 1993). This means that for a long-term monitoring program, you have to have a lot of replicates or you may not be able to carry out an analysis of the program because there are not enough error degrees of freedom to do the test. This problem is enhanced with more complicated ANOVA models (e.g. unbalanced, nested or multifactorial designs). The multivariate approach to repeated measures analysis is useful because there are no assumptions about correlations through time (compound symmetry, i.e. the correlation between time 1 and time 2 must be the same as the correlation between time 1 and time 6). However, there are ways to adjust for violations of this assumption using the univariate approach but the power of the univariate test is diminished.

A site needs to be sampled more intensively if transects are reallocated each time because each time you revisit the site, you're resampling it. That means that the estimate of spatial variation will itself vary among times so that there is a confounding of temporal with spatial variability. In order to minimise the probability of confusing change over time with spatial variability, you need to make sure that the variance among transects at a site is small relative to temporal variation. The only way to do that without fixing the transects is to sample a lot of them.

Logical Issues

The Department of Environment's monitoring program was initially set up to complement the Australian Institute of Marine Science Long Term Monitoring Program as well as to answer questions about local management issues. If the data is to be comparable with that of the Australian Institute of Marine Science, the designs should be as similar as possible. However, there are some differences in the programs. The Australian Institute of Marine Science only samples the north-east corners of reefs, while sites are distributed around reefs in some of the Department of Environment's sampling. Because of the heterogeneity in designs even among the different Department of Environment programs, there is currently no way of using the data in a broad-scale analysis of all monitoring done by the Department of Environment. There are two ways of dealing with this. The first is to accept it and design programs according to local objectives only. The second is to impose a rigid sampling strategy (the Long Term Monitoring Program's strategy) on all monitoring done by the Department of Environment. Both of these approaches are reasonable, but for different reasons. If the Long Term Monitoring Program's strategy is adopted by all Regions, the monitoring will be comparable across Regions and between the Department of Environment and the Australian Institute of Marine Science. If local Department of Environment Regions define their objectives and design programs to suit their Region, monitoring will not be comparable among programs, but the monitoring is more likely to have the ability to detect defined changes if it is appropriately designed. Under this second scenario, there is no problem with using random transects as opposed to fixed, as long as the sampling is well designed.



A major problem could arise if it is decided in the middle of a program that random transects are more appropriate. The problem with changing some of the sites from fixed sites with fixed transects to fixed sites with random transects within sites is that data will not be comparable across time at those sites, nor will sites with fixed transects be able to be compared with those with random transects. That means we are constrained to a site-by-site or reef-by-reef approach, rather than taking the broader perspective initially intended (comparing among regions).

Logistic Issues

There are logistic difficulties with fixed transects in areas with low visibility. It can be difficult to relocate fixed transects, especially if markers are missing. These difficulties can be overcome by marking transects with more than one stake (the Australian Institute of Marine Science marks 50-metre transects with stakes every 10 metres) and fixing sites with a global positioning system. Careful mapping of sites should also help to relocate fixed transects. Nevertheless, the problem of finding transects with limited field time and constrained budgets is not trivial. Under circumstances with low visibility and limited time, random unmarked transects make sense. The challenge is to make sure that the transects are truly representative of the site and that there are enough of them to provide a good (i.e. small) estimate of within-site variability.

Aesthetic/Ethical Issues

In areas such as the Whitsunday Islands (Queensland) or other highly used sites, the question of whether it is reasonable to scatter stakes all over the reef is a serious one. Visible stakes reduce the beauty of an area for visitors, but probably don't affect the ecology of the place. Whether transects are fixed or not will depend on the social impact of stakes rather than any ecological issue.

Summary

There are both advantages and disadvantages of using either fixed or random transects. The primary reason for choosing one over the other should be which one suits the purpose of the monitoring program better. Issues such as logistical difficulty and statistical problems enter into the decision making process AFTER the decision about objectives has been made. The issue is by no means a simple one and decisions over which type of approach to use must be considered well from many points of view.

Reference

Green, R.H. 1993, Application of repeated measures designs in environmental impact and monitoring studies, *Aust. J. Ecol.* 18(1): 81–98.

AIMS SCIENTISTS WIN PRESTIGIOUS AWARD

Kim Davis

Congratulations to Dr Eric Wolanski and his team at the Australian Institute of Marine Science who won the 1996 Queensland Information Technology and Telecommunication Award for Public Sector Use of Information Technology for developing innovative models of marine processes.

In 1994 Dr Wolanski was awarded a $1.4 million research grant from the IBM International Foundation to develop information technology as a tool for marine science and management. This grant was the only grant awarded by IBM in the Asia-Pacific region and one of only four grants awarded world-wide outside the United States of America.

Dr Wolanski and Dr Brian King were able to collate data on marine ecosystems and produce three-dimensional 'models' to illustrate various marine processes. The funds derived from the grant were used to purchase the necessary computer equipment for such a project, for partial salary support and necessary travel.

The researchers were able to model key environmental issues, including coral and fish recruitment, oil and metal pollution in tropical waters and the movement of cohesive sediment, not only along the coast of Queensland but also in Vietnam, Thailand, China and Malaysia.

Dr Wolanski believes the model is instrumental in assisting the Great Barrier Reef Marine Park Authority and other management agencies in information technology and data evaluation for projects and developments.

For further information on this project contact Dr Eric Wolanski at the Australian Institute of Marine Science on +61 77 53 4211 (or view their home page at http://ibm590.aims.gov.au).

Udo Engelhardt

Update on the latest fine-scale survey results

The third year of sampling in the Cooperative Research Centre for Ecologically Sustainable Development of the Great Barrier Reef / Great Barrier Reef Marine Park Authority fine-scale surveys is well and truly under way, with nine mid-shelf reefs having been resurveyed. All of the reefs sampled to date are located between Lizard Island in the north and the Daintree coast in the south. As anticipated following last year's fine-scale surveys, active reef-wide or spot outbreaks of COTS (crown-of-thorns starfish) were found throughout the survey area. Localised COTS densities of between three and ten times sustainable levels (= 30 COTS per hectare) were detected at every single reef surveyed. As expected, the proportion of mature starfish in outbreaking populations has increased significantly since last year. Large, mature COTS have considerably higher food requirements compared to their juvenile stages that have dominated many populations over the last couple of years. Consequently, levels of coral mortality have also increased at certain reefs. At quite a number of individual survey sites, live hard coral cover has now been reduced to between 0% and 10%. COTS numbers at many sites remain unsustainably high with a further reduction in the mean live coral cover highly likely in the near future.

Table 1 illustrates the observed changes in reef classification and status since the transect-based surveys commenced in 1994–95.

Fine-scale surveys will continue early in the new year (1997) with mid-shelf reefs remaining the primary focus. In an effort to detect early signs of a possible geographic spread of the outbreaks to the south, a number of reefs in the Central Section of the Marine Park (south of the Mission Beach area) will be surveyed for the first time. Further updates on the latest developments in the ongoing COTS saga will be provided in the next issue of COTS COMMS. Stay tuned.

Navy involvement in local-scale COTS controls

Well, the Australian Navy is yet again lending a helping hand. A bunch of Navy divers under Lieutenant Pete Mellick based at HMAS *Cairns* are assisting Cairns-based tour operators in their spare time to locally control active COTS outbreaks. Navy staff have offered their services for free in return for a ride to the Reef. The latest word is that the volunteer divers are really starting to get their eyes in on the elusive starfish and are starting to make a difference in controlling COTS outbreaks. This Navy initiative will surely be welcomed by those currently trying to keep the effects of local outbreaks to a minimum.

COTSWATCH update

The statistics for our Reef-user scheme – 'COTSWATCH' for the period from 13 August 1996 to 6 January 1997 are pretty impressive. Thanks to all those dedicated volunteer observers, the COTS program received some

Reef ID	Reef Name	Latitude	Status 94–95	Status 95–96	Status 96–97
14-143	North Direction Reef	14°45'S	ASO	AO	AO
14-132b	Rocky Islets Reef (b)	14°52'S	ASO	AO	AO
15-019	Long Reef	15°03'S	ASO	AO	AO
15-024	Mackay Reefs	15°08'S	ASO	AO	AO
15-033	Lark Reef (East)	15°17'S	NO	ASO	ASO
15-070	U/N	15°30'S	NO	ASO	ASO
15-084	Irene Reef	15°39'S	ASO	ASO	ASO
15-089	Endeavour Reef (East)	15°46'S	ASO	ASO	ASO
15-095	Evening Reef	15°54'S	AO	ASO	ASO

Table 1.

Summary table of locations and respective status of mid-shelf reefs surveyed for *Acanthaster planci* using fine-scale survey methodology.
AO = Active Outbreak
ASO = Active Spot Outbreak
NO = No Outbreak
U/N = unnamed reef

255 completed survey forms presenting information on 393 individual sites from some 61 different reefs located throughout the Great Barrier Reef Marine Park. However, the focus of both starfish activity and COTSWATCH reporting has remained in the Cairns Section, with most records coming from mid-shelf reefs between Cooktown and Innisfail.

Many thanks to all the new and/or regular COTSWATCHERS out there for continuing to supply valuable information on the latest COTS developments on the Reef.

Valued contributors include:
A Kelly / Great Adventures, Cairns; **A J Lloyd** / Ingham; **A Nichols** / Reef Biosearch, Port Douglas; **B Knuckey** / DoE Gladstone; **B Moors** / Port Douglas; **Staff of Big Cat Green Island Cruises** / Cairns; **C Cattanach** / Trinity Beach; **C Coxon** / Port Douglas; **C Kemp** / Sunlover Cruises, Cairns; **C Packard** / Mareeba; **C Purdon** / DoE Townsville; **C Rowe** / Sunlover Cruises, Cairns; **C Schoenberg** / Townsville; **Staff of Coral Princess Cruises** / Townsville; **D Baird** / Reef Biosearch, Port Douglas; **D Orgill** / DoE Gladstone; **D Schapendonk** / Great Adventures, Cairns; **D Wachenfeld, I Johnston & J Moxham** / Undersea Explorer, Port Douglas; **D Wiseman** / Sunlover Cruises, Cairns; **G Bennett** / Deep Sea Divers Den, Cairns; **G Burns** / Bribie Island; **G Grant** / Sunlover Cruises, Cairns; **G Inglis** / DoE Dungeness; **G Connett** / Port Douglas; **H Larsen** / Cairns; **H Jones** / United Kingdom; **H Malcolm** / DoE Pallarenda; **I Davis** / Great Adventures, Cairns; **I Stapleton** / Nimrod Cruises, Port Douglas; **I Werner** / Germany; **I Poelger** / Holloways Beach; **J C Rowe** / Clovelly; **J Hallback** / Sweden; **J Holcombe** / Kandos; **J Meyer** / Big Cat Green Island Cruises, Cairns; **J Money** / Sunlover Cruises, Cairns; **J Purcell, J Sando, S Wilson, R Schnauer, R Shutte, R Aiello, T Forsyth, M McCarthy, T Lace, M Woodhouse, P Paxton & J Wells** / Great Adventures, Cairns; **J Weisgerber** / Cairns; **J Wildforster** / Reef Biosearch, Port Douglas; **K Robertson** / England; **L Knowles** / Mossman; **L Squire** / Cairns; **M Burnham & M Ford** / DoE Lucinda; **M Greet** / Port Douglas Dive Centre; Port Douglas; **M Walker** / United Kingdom; **Staff of MV Poseidon** / Port Douglas; **N Griffiths** / Sunlover Cruises, Cairns; **N Sorensen** / Cairns; **P Heatherwick** / Port Douglas; **P Mellick** / HMAS Cairns; **P Woolley** / Cammeray; **R Buck** / DoE Mackay; **R McElligott** / Reef Biosearch, Port Douglas; **R Persson** / Sweden; **R Phelan** / Wahroonga; **R Townsend** / Great Diving Adventures, Cairns; **R Fisher** / Rosslyn Bay; **R Op Den Brouw** / Cairns; **S Balson** / Cardwell; **S Brown** / United Kingdom; **S Coulthard** / United Kingdom; **S Fisher** / Mackay; **S Moon** / Ocean Spirit Cruises, Cairns; **S Richards** / Captain Cook Cruises, Cairns; **S Goodhew** / Aquatic Images, Cairns; **T Anger** / Cranbrook; **T Arakawa** / Cairns Dive Centre; **T Ayukai** / Townsville; **V Nelson** / Townsville; **W Mahon** / Sunlover Cruises, Cairns.

Late addition to Panama symposium

Below you'll find a late addition to our list of abstracts of COTS-related papers presented at the recent International Coral Reef Symposium in Panama City (see COTS COMMS, *Reef Research*, September 1996). A paper by Drs Roger Bradbury and Robert Seymour came in as a late entry and thus missed the cut for the previous issue of this newsletter. Anyway, for completeness sake here it is.

Waiting for COTS

R. Bradbury[1] and R. Seymour[2]
[1] National Resource Information Centre
Canberra ACT 2600
[2] University College London, England WC1E 6BT

During the past few years, a significant number of practising scientists have reached broad consensus on the 'cause' of outbreaks of the crown-of-thorns starfish on the Great Barrier Reef. They see the observed series of outbreaks as a novel, system-wide episode of anthropogenic origin. As a result, scientific interest in the outbreaks is shifting from causes to consequences. In particular, our interest is in the consequences of repeated outbreaks on the ecosystem of the Great Barrier Reef. In this paper, we argue that our analysis of the available evidence shows two distinct trends: the outbreak dynamics seem to be changing from a travelling wave to a system-wide pulse; and the proportion of reefs available to host the outbreaks is declining through time. The first trend may signal a qualitative shift in the dynamics, while the second may be the first indication of a long-term degradation of the ecosystem. We await the data on the progress of the current outbreak episode to help clarify these trends.