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NEWSLETTER OF THE RESEARCH AND MONITORING SECTION

REEF RESEARCH

Great Barrier Reef Marine Park Authority

VOLUME 3 – No. 2 JUNE 1993

EDITORIAL

This issue of Reef Research reports on developments in a number of areas of environmental management particularly with regard to the effects of shipping and related activities such as dredging and dumping.

The first meeting of experts to look specifically at prevention, as opposed to remediation, of oil spillage was held in Canberra earlier this year and this is considered to be particularly important by us here at Great Barrier Reef Marine Park Authority (GBRMPA). We are constantly aware of this threat to the Great Barrier Reef ecosystems and, although we fully support the need for contingency arrangements, clearly we would much prefer that they never have to be put into operation except as exercises (see last issue of Reef Research).

Also reported in this issue is the monitoring program that was initiated as a result of the need to deepen and lengthen the approach channel to the Townsville Harbour. Because of the adjacency of ecologically sensitive areas it was decided that the program had to be reactive to the level of not just ameliorating adverse impacts but avoiding them by, if necessary, changing operations or halting work altogether until solutions to problems could be found. As it turned out the program detected minimal impacts and was rigorous enough to allow us confidence that impacts really were minimal. This is a first class example of a truly cooperative and innovative project.

Jon Brodie brings some excellent news to this issue in the form of a report on longer term funding arrangements for a number of our major research areas. This will allow us to much more effectively and efficiently develop strategies for addressing major areas of research that need to be funded on a long term basis. There is no doubt that with the confidence to be able to devise longer term arrangements there will be monetary savings as a major spin-off. That has to be seen as highly desirable by everyone.

Amongst other interesting stuff, there is also an article from one of our intrepid Torres Strait researchers which makes it clear that field trips aren't always the 'jolly jaunts' that they are often made out to be. Still - compared to the office.......... Ed.

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Views expressed in *REEF RESEARCH* are not necessarily those of GBRMPA.

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WHAT'S IN THIS ISSUE

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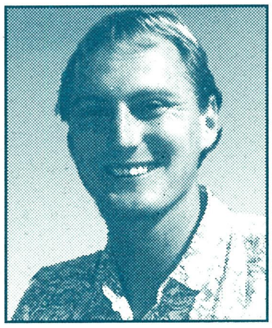
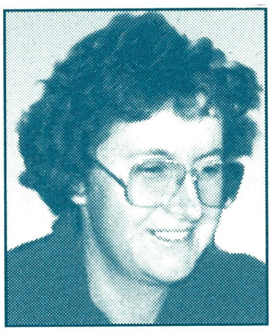


Steve Raaymakers

Steve has been with the Research and Monitoring Section of GBRMPA since April 1990. He manages the Authority's program on ship-sourced pollution (oil spills, ballast, sewage, and garbage), and works on the environmental assessment, monitoring and management of port developments (dredging and sea dumping). He is the pre-appointed scientific support coordinator under REEFPLAN, the marine pollution contingency plan for the Great Barrier Reef. He also works closely with the monitoring cell led by Jamie Oliver, working on the design, development and implementation of multi-disciplinary environmental monitoring programs. Steve recently spent four months on secondment to the Queensland Department of Environment and Heritage as the Environmental Supervisor for the Townsville port expansion. He has a Bachelor of Science in marine biology, zoology and geography and prior to coming to GBRMPA worked in the ecotourism, education, diving and sail-training industries.



Elaine Eager

As SOMER assistant coordinator, Elaine is part of the GBRMPA team preparing the first national State of the Marine Environment Report (SOMER) for the Department of the Environment, Sport and Territories. She worked in GBRMPA's Research and Monitoring Section from 1982 to 1986 as Assistant Project Manager before taking up an Education Officer position in the Education/Information Section. Elaine's tertiary training is in agricultural science and economics with a Master's degree from Melbourne University. SOMER continues her career in information research and dissemination that began in the early '70s in the Department of Primary Industries' Information and Extension Training Branch in Brisbane.

The Research and Monitoring Program in 1993/94

Jon Brodie

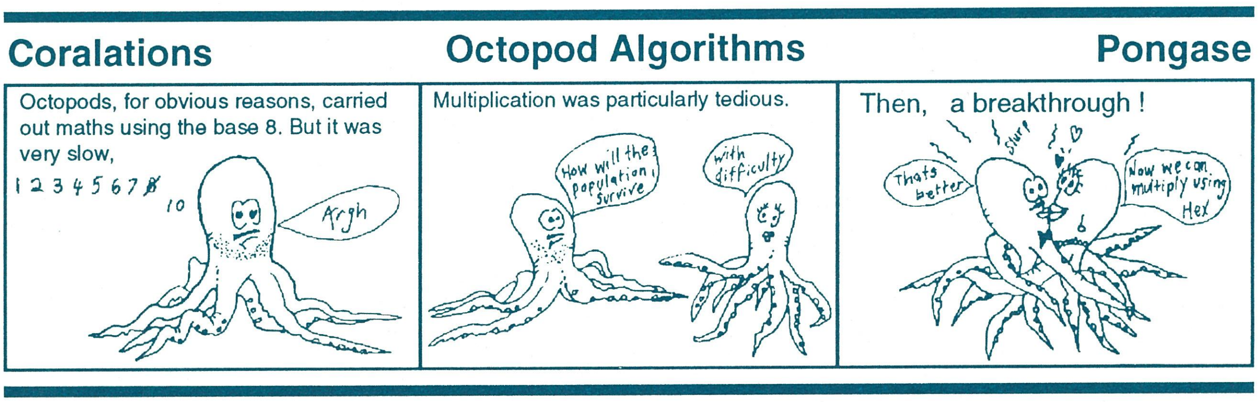
From a position of financial instability, due to changes in government funding, the Research and Monitoring Program of GBRMPA has now entered a period in which funding for the major sub-program areas is stable over the next 4 years. The Prime Minister's environment statement of December 1992, which, it is hoped, will have been given legislative force by the time this issue of Reef Research is printed, restored some of the funding to the Water Quality and Effects of Fishing programs which had been lost in the 1992/93 budget. This restored funding has also allowed a substantial increase in funding for our reef-wide monitoring programs.

GBRMPA now has moderate levels of funding over an extended period for the major sub-program research areas of water quality, effects of fishing and crown-of-thorns starfish with greatly increased funding for monitoring. The program areas of human use and social impact and effects of shipping will continue with funding from the annual GBRMPA appropriation.

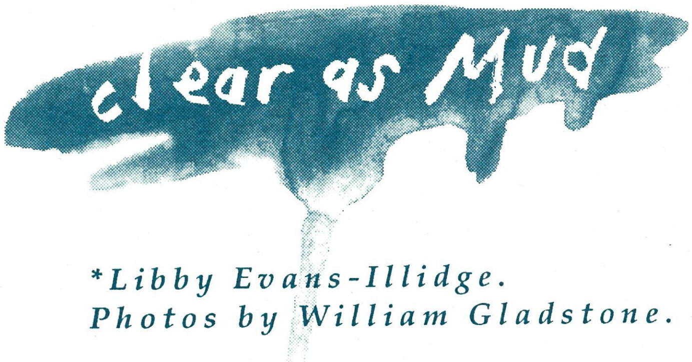
In some areas of the Research and Monitoring program, the Cooperative Research Centre for the Ecologically Sustainable Development of the Great Barrier Reef will provide funding for additional research projects. This Centre is a joint initiative of the Association of Marine Park Tourism Operators, James Cook University, the Australian Institute of Marine Science, GBRMPA and the Queensland Department of Primary Industries and will be conducting research into many areas of interest and relevance to GBRMPA.

The relative merits of oil tankers taking passage outside or inside of the Great Barrier Reef has been debated recently. While claims favouring one option or the other are frequently made these are generally based on limited information. Caltex Oil has now offered substantial funding to GBRMPA so that we can commission a detailed risk assessment of the two options. This project will be completed in the 1993/94 year.

Two other projects administered by Research and Monitoring but focussing on issues external to the Marine Park are the Torres Strait Baseline Study and the State of the Marine Environment Report. Both of these projects, in action for the last few years, are expected to be complete with their final reports submitted by December 1993.



Field Work in the Torres Strait



*Libby Evans-Illidge.
Photos by William Gladstone.

An extensive Torres Strait field program, spanning more than 18 months and involving around 150 days at sea, has recently come to an end. It was the sampling phase for the Torres Strait Baseline Study (TSBS), a federally funded and GBRMPA managed project to establish levels of trace metals in the Torres Strait marine environment.

More than scientific aims were achieved during the field program. In addition, much was learnt (usually the hard way) about practical operations in the often physically and logistically difficult environment of the Torres Strait. What follows is a summary of some of that experience.

The Torres Strait is a mosaic of islands, reefs and other habitats, stretching northwards from Cape York to Papua New Guinea, and eastwards from the Arafura Sea to the Coral Sea. A number of large rivers, particularly the Fly, flow from Papua New Guinea into the Strait. The physical marine environment is a shallow continental platform, bound to the north and south by low lying land masses. Superimposed is a complex pattern of water circulation and consistently strong winds, resulting in a generally shallow, highly productive, diverse and beautiful coastal marine environment. The practical perspective of researchers is, however, less positive, for these conditions also typically spell dirty water, strong currents and rough seas.

Many dives were carried out in limited and sometimes nil visibility; on one occasion, on descending, divers actually finned into the bottom. Poor visibility also made location of sites difficult, as some reefs become invisible with 2m of water over their top. In the absence of landmarks, our portable Global Positioning System was invaluable for keeping us pointed in the right direction. Naturally, working with the tides and currents was essential and in many places we pushed ourselves harder when conditions were right, e.g. low tide and slack water.

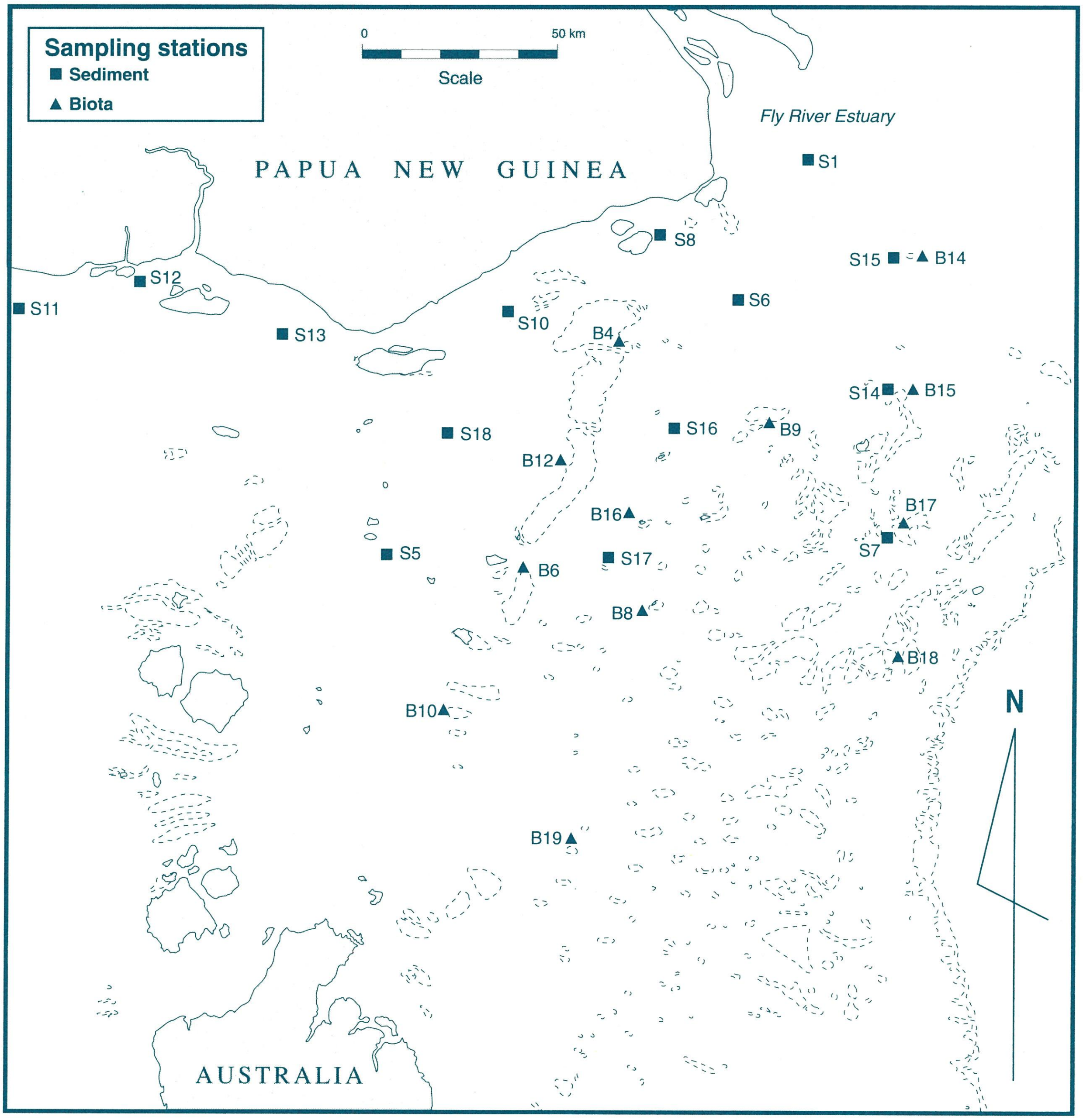
If dirty water and strong currents create difficulties for researchers in a dinghy, imagine the plight of the research vessels' crews. Two research vessels were used: the RV 'Western Venturer' kindly provided by Ok Tedi Mining Limited, and the RV 'Sunbird'. They must navigate their much larger vessel through reef-strewn waters where 50m and 5m depth may look the same from the surface. This problem is further worsened by inaccurate charts.

While the major shipping routes are well marked and charted, the same cannot be said for the nooks and crannies of the Strait that we were required to visit. On the chart, seemingly unencumbered areas are often marred by the words 'unsurveyed', 'numerous shoals and reefs', and 'unexamined coral reefs'. More often, though, inadequacies are not so honestly declared, and reefs are either omitted completely, or marked in the wrong place. Wheelhouse atmosphere was typically tense, as crews were always on visual alert.

Towards the east visibility underwater generally improves, but no place in the Torres Strait escapes strong currents and wind. If their direction is opposite, the result can be large, breaking, standing waves. In dubiously charted waters, the unnerving tactic in these conditions is to head for the largest waves that are breaking the most, as it is there that the current is strongest and therefore the water deepest.

Apart from the physical challenges, working in the Torres Strait is logistically demanding because it is so remote. The closest Australian city is Cairns, some 1100 km from the area's administrative centre of Thursday Island, which in turn is up to 250 km away from our sampling sites. An understanding of the existing infrastructure was essential.

Thursday Island and adjacent Horn Island (the site of the airstrip and a research station) are regularly linked with Cairns via sea and air. When transporting large amounts of gear, the weekly barge service was used. As well as being much more expensive, air freight is not necessarily the faster method. This is because of the limited freight carrying capacity of the small aircraft on the route, and the high probability that freight will be delayed.



Map of Torres Strait showing site locations

Poor visibility often hindered location of sites - the sampling team was frequently in disagreement on which way to go. (L-R: Peter Illidge, Libby Evans-Illidge, Dennis Le Sye, William Gladstone)

Low lying landmass of PNG

Standing waves in Moon Passage, caused by opposing wind and current

Outer islands are also linked to Thursday Island via a regular barge service, but for the purposes of the TSBS, the speed of air delivery was usually essential. This was due to the need to transport fresh, chilled specimens from the field to the research station at Horn Island, where a team of Queensland Department of Primary Industries' chemists waited to prepare them for analysis in a metal free lab area. Eleven outer island communities have air strips with at least daily air services from Horn Island, but as planes are small, again, the likelihood of freight delays was high. To eliminate this risk, we ensured 'confirmed passenger status' for our samples by booking a seat. Hence, Mr H Metal was born, and grew to become quite a celebrity among airline staff (and was said to be one of their highest frequent flier point scorers).

On rare occasions when scheduled flights were unavailable we chartered a plane or helicopter. The high cost of charters was small compared to ship-time and salary costs either spent idle while waiting for freight, or in the worst case, recollecting specimens that had the potential to spoil during delays.

Local government in the outer islands of the Torres Strait is administered through the Island Co-ordinating Council, with membership made up of chairmen of individual communities. Relevant community chairmen, or representatives, were notified ahead of time of our movements, and contacted immediately on arrival at an island when air services were utilised or communities were visited for any other reason.

Hassle free field work anywhere requires a large degree of pre-planning, pre-empting, and self-sufficiency. We carried an extensive spares and tool kit, and were fortunate to secure the services of two skilled field technicians who between them were able to fix or improvise when things went wrong. Naturally, some problems fell outside our resources, and various items had to be sent from 'down south'. A VHF seaphone service is available throughout the Torres Strait, and enabled arrangements for supplies to be sent, as well as regular communication with the outside world. However, on-the-spot support from people in Thursday Island and Townsville was a huge advantage when co-ordinating the purchase and freight of goods.

Despite the challenges, working in the Torres Strait is extremely rewarding. When conditions are good, and to be fair we did get a reasonable share of good days, compensation for any hardship is more than complete. Besides, the Torres Strait has much more to offer than simple aesthetics. Where else can you pull up on a remote coral cay to be swarmed by migrating forest birds, or pause from sampling on a reef slope to watch a lakatoi (traditional sailing dug-out canoe) glide by?

* *Libby was one of the field researchers for. the study and took part in all of the collecting trips.*

UPDATE: STATE of the MARINE Environment REPORT

Elaine Eager and Leon Zann

The first **State of the Marine Environment Report for Australia (SOMER)** is being prepared as part of the long-term Commonwealth Government program, **Ocean Rescue 2000**. The Department of the Arts, Sport, the Environment and Territories (now Environment, Sport and Territories — DEST) commissioned the Great Barrier Reef Marine Park Authority (GBRMPA) in December 1991 to prepare the Report.

The topics to be covered in the Report have been identified through a national workshop and widespread consultation. Leading Australian scientists and environment managers have now been commissioned to prepare about 80 topic review papers. These papers are subject to an 'open peer review' process to ensure their technical accuracy before they are summarised and integrated to produce the main report. The collection of topic review papers will be published as a technical annex. An executive summary will also be prepared, briefly summarising the major findings of SOMER.

Environmental reporting

SOMER will provide the initial marine component of the Commonwealth Environment Protection Agency's (CEPA) national environmental reporting program. It will identify major issues in the marine environment, assess existing data, and consider appropriate environmental indicators. SOMER will contribute to aquatic environment reporting recommended by the Ecologically Sustainable Development Working Group.

Advice and coordination

The SOMER Advisory Committee was established to advise GBRMPA initially on content and potential contributors for the topics to be addressed in SOMER. As the members were sought because of their technical expertise pertinent to SOMER, many have also been coopted to review certain topics. Committee members are currently involved in the peer review process for the topic review papers and will review the main report to ensure it is technically sound.

SOMER ADVISORY COMMITTEE

Dr Don Kinsey	(Committee Chair)
A/Professor Paul Adam	Dept of Biological Science, University of NSW
Dr Eric Bird	Geostudies, Melbourne
Professor Ben Boer	Australian Centre for Environmental Law, Sydney
Dr Des Connell	Qld Government Chemical Laboratory, Brisbane
Ms Pam Eiser	Australian Committee for IUCN, Sydney
Dr Laurie Hammond	ex Victorian Institute of Marine Sciences
Dr Tor Hundloe	Industry Commission, Canberra
Professor Arthur McComb	Dept of Environmental Science, Murdoch University
Professor Jason Middleton	Centre for Marine Science, University of NSW
Dr Russell Reichelt	Fisheries, Bureau of Resource Sciences, Canberra
Dr Graham Ross	Australian Biological Resources Survey, Canberrra
Professor Graeme Kelleher	Great Barrier Reef Marine Park Authority

Observers from DEST Marine and Coastal Section and Commonwealth Environment Protection Agency attend meetings also.

State collaboration is important for achieving a comprehensive report. The nation's main mechanism for intergovernmental coordination and consultation is the Australian and New Zealand Environment and Conservation Council (ANZECC). Following the ANZECC meeting in February 1992, the Commonwealth Environment Minister provided State and Territory Environment Ministers with information about liaison arrangements proposed for the Ocean Rescue 2000 program and particularly sought their support for SOMER. All ministers have expressed their support in principle for SOMER and most have provided contacts for further collaboration.

In late 1992, State contributions were sought to address the subjects of specific problem areas in the marine environment and marine conservation policies and programs.

Public input and involvement have been pursued in several ways. Information provided in submissions from interested individuals and organisations to SOMER and to the Resource Assessment Commission (RAC), has been used to ensure important issues are addressed in the Report. This information is also being used to develop an overview of public awareness of the marine environment and perceptions of its state of health. Contributions have also been sought directly from major non-government organisations at national and State levels.

To ensure coordination of related information gathering through Commonwealth initiatives, there has been considerable communication and cooperation with the RAC's Coastal Zone Inquiry, CEPA's environmental reporting program, Australian National Parks and Wildlife Service's Environmental Resources Information Network, DEST's Marine and Coastal Section, Commonwealth Scientific and Industrial Research Organisation's coastal study, and other Commonwealth programs.

Preparation of the Report

Dr Leon Zann, the SOMER Coordinator, has prepared detailed briefs for each topic review contributor. The table on page 10 shows the broad scope of SOMER. A listing of the topic titles and contributors is available from the Coordinator.

Half of the contributions have been received and are now at various stages in the peer review process. The last of the contributions is due in June 1993. The review and editing process will then take to the end of 1993. Negotiations are in progress for collective publication of the topic review papers by a scientific publisher.

Until the volume is published, specific papers will be made available to interested parties on special request. Several papers have already been supplied to the Ocean Rescue 2000 National Marine Education Program and the Australian Marine Conservation Strategy, and the RAC's Coastal Zone Inquiry.

The topic review papers are being integrated and will be summarised in 200-300 pages. After final checking with the authors and State agencies involved, the draft of the main report will be made available to ANZECC. The draft is expected to be submitted to ANZECC by the end of 1993 and published in mid 1994.

Emerging observations and trends

- The health of most of Australia's marine environment could be described as 'good'. However, the marine environment surrounding the southern capitals and industrial cities (a small proportion of our coast but where most of our population resides) is moderately to seriously degraded.

- Australia has about 27% of all the world's marine protected areas, and could be considered a world leader in marine conservation. We have particular expertise in tropical marine ecology and coral reef management.

- Declining water quality and eutrophication from excessive nutrients, a critical issue in our inland waters, is a growing problem in our southern estuaries, embayments and particularly in coastal lagoons. A problem has been identified in the north also with the decline of some inshore areas of the Great Barrier Reef. Major areas of Australia's temperate seagrasses are disappearing.

THE SCOPE OF SOMER

1. AUSTRALIA'S MARINE ENVIRONMENT
Descriptions of the oceanography, marine ecology, cultural heritage and public perceptions of Australia's seas will provide a setting for SOMER. The interconnectivities of land and sea ecosystems will be emphasised.

2. LEGISLATION, MANAGEMENT AND RESEARCH
Descriptions of the existing management of Australia's seas and their resources; marine education and research will provide a management framework.

3. USAGE BY INDIGENOUS COMMUNITIES
The sea is culturally important to Aboriginals and Torres Strait Islanders. This description will focus on the problems and issues faced by today's communities.

4. MODERN USAGES AND EFFECTS
Disturbance to the marine environment is generally the result of its uses, including those of the catchments. This description of uses will emphasise the connectivities of land and sea, and consider the particular problems regarding estuaries and shores.

5. GENERAL ISSUES
Many issues or problems are the same around Australia. This section will describe the more serious or more frequent of these, and particularly focus on the problem of declining water quality.

6. PROBLEM AREAS
This overview of disturbed areas in each State and Territory in Australia will describe both acutely disturbed areas (where the problems are serious but have been recognised), and chronically disturbed areas (where a particular problem may be less serious, but may become grave if persistent or if additional stresses should occur).

7. AUSTRALIA'S MARINE PROTECTED AREAS: MANAGEMENT AND STATUS
SOMER is intended to provide a background for the establishment of a marine conservation strategy, including a network of marine protected areas. This section will briefly describe existing areas with a focus on World Heritage Areas, their management and problems.

8. MARINE ENVIRONMENTAL MANAGEMENT AND MONITORING: THE FUTURE?
SOMER is also intended to provide a background for future marine environmental reporting. This section will describe the state of the art and suggest future directions.

- There are wide gaps in information on our marine environment.
- Marine research has often been undertaken on an *ad hoc* basis, there are very few long-term monitoring programs in place, and the spatial coverage of our vast waters is invariably poor. Much of the existing information is scattered and unpublished, and only rarely has it been adequately collected and integrated at a multi-disciplinary level.
- The marine environment of our more densely inhabited south has not been well studied and is under-protected.
- Pollution management is having an effect: levels of heavy metals and some other pollutants are declining in at least parts of our coastal waters.

Future products from SOMER

A workshop is planned for September 1993 for further discussion about the information collected by SOMER that pointed to problems of water quality in estuarine and coastal water, and in the urban marine environment.

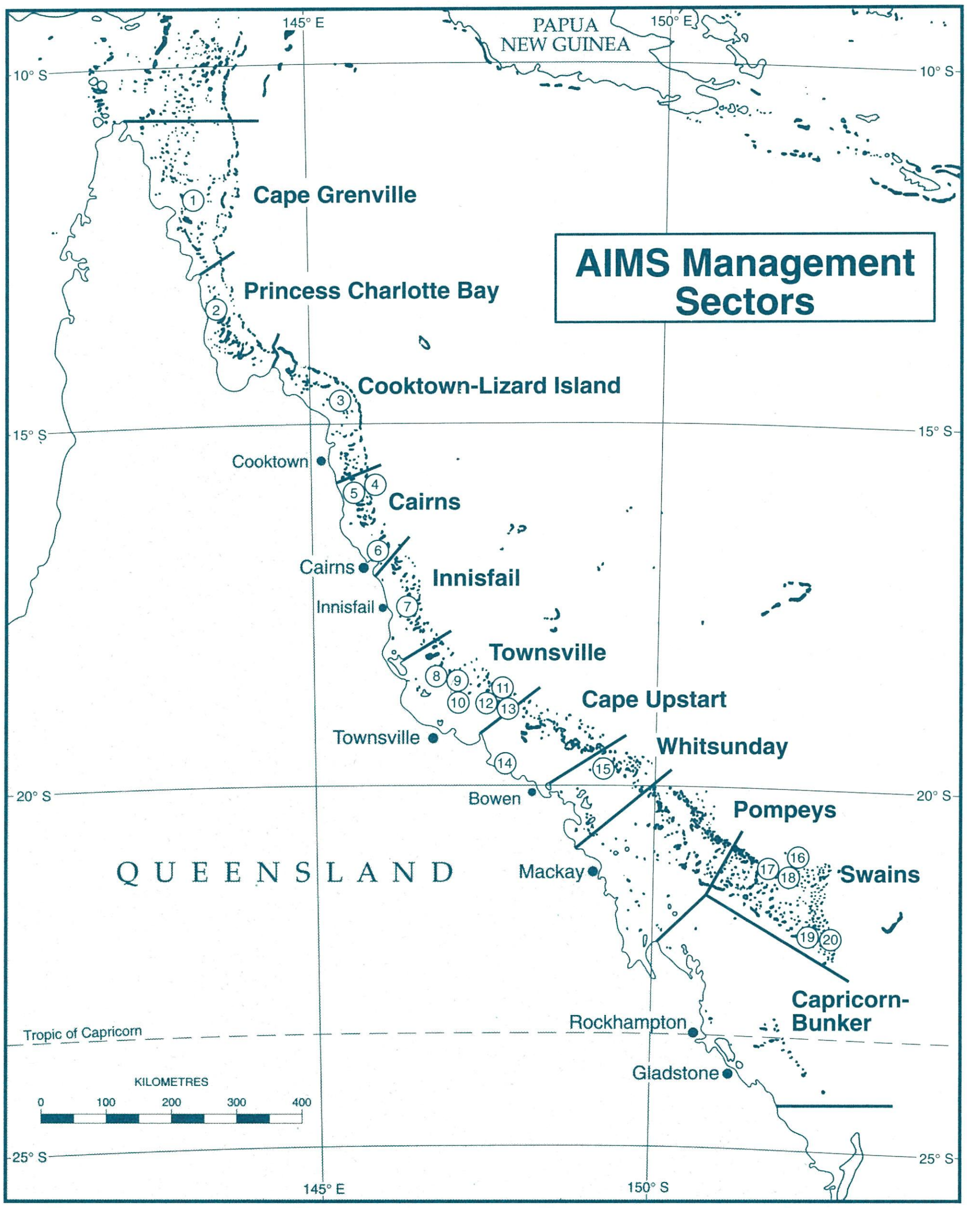
Marine protected area project officers in the states have expressed a need for handbooks about marine environmental monitoring and survey methodologies. Information collected by SOMER could be developed to meet this need by a working group that could include representatives from the Australian Institute of Marine Science, the Victorian Institute of Marine Sciences, the Commonwealth Environment Protection Agency, and relevant state and private sector agencies. R

COTS COMMS

Dr Brian Lassig and Udo Engelhardt

CURRENT COTS

It seems that COTS outbreaks are joining the dinosaurs, full-strength beer, high quality bleached paper and the GST. Since the last issue of COTS COMMS/Reef Research, the Australian Institute of Marine Science (AIMS) monitoring team has completed surveys of reefs in the Cape Upstart and Whitsunday/Pompey sectors of the GBR. A total of 3 COTS were recorded on the seven reefs surveyed in the Cape Upstart sector and another 3 on the four reefs surveyed in the Whitsunday/Pompeys. Three starfish does not an outbreak make.



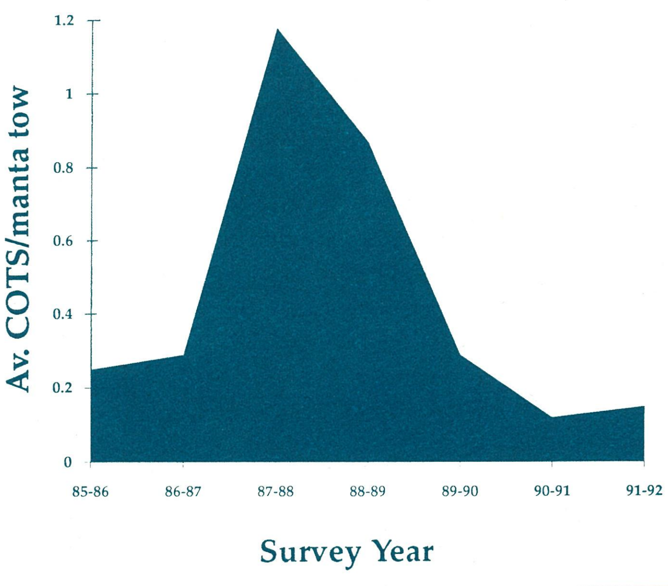
(1) Sir Charles Hardy Island
(2) Blanchard Reef
(3) Lizard Island
(4) Escape Reef
(5) Evening Reef
(6) Green Island
(7) Feather Reef
(8) Rib Reef
(9) John Brewer Reef
(10) Lodestone Reef
(11) Lynch's Reef
(12) Davies Reef
(13) 18-101
(14) Cape Upstart
(15) Hardy Reef
(16) 21-198
(17) 21-155
(18) Lavers Cay
(19) Gannet Cay
(20) Sanctuary Reef

The collated broadscale survey results for 1991/92 have been printed under the title 'Broadscale surveys of crown-of-thorns starfish on the Great Barrier Reef: 1991 to 1992' by V.J. Baker, D.K. Bass, C.A. Christie, I.R. Miller and A.A. Thompson. Copies are available from the Production Editor, AIMS. As an enticement to avid COTS-watchers to acquire the full story, here are some of the highlights.

One hundred reefs were surveyed, 34 of them for the first time. A total of 670 COTS were observed on 45 reefs. 45% of these were on reefs in the Swain sector.

Although the report states that 'the total number of crown-of-thorns starfish observed continues to decline', the reality is that the number was about the same as the previous year (726 on 121 reefs in 1990/91). This stabilisation in terms of total COTS numbers is clearer if the number of manta tows is taken into account.

COTS on the GBR



Active outbreaks of crown-of-thorns starfish were present on 10 reefs [10%] (compared with 8 [7%] in 1990/91). The 10 outbreaking reefs were located in six survey sectors: Cape Grenville (Sir Charles Hardy Island), Princess Charlotte Bay (Blanchard), Townsville (Lynch's and 18-101), Cape Upstart (Bowden), Whitsunday (Hardy) and Swain (Laver's Cay, 21-155, 21-198 and Gannet Cay).

The estimated percentage of reefs with outbreaks adjusted for the stratified nature of the sampling scheme was 8.5%. This is higher than the previous year (5.2%), mainly because of the increased number of outbreaks recorded in the Swains. Despite the numerical increase, the decline of outbreaks in the Central Section of the Reef suggests that the outbreak episode is continuing to abate.

30% of reefs surveyed were recovering from outbreaks of crown-of-thorns starfish which occurred in the last 10 years. The majority of these reefs were located between Lizard Island and Bowen.

Approximately 60% of reefs surveyed during the year showed no signs of having experienced a recent outbreak of COTS. Most of these reefs had few COTS (usually <6 recorded), a live coral cover of 30-50% and a dead coral cover of <10%.

According to the report 'These results indicate that the centre for active outbreaks in the Great Barrier Reef is currently located within the Swain sector. In previous years, outbreaks have been concentrated on reefs further north, out from Townsville and Cape Upstart. Given the distance (450km) and the short interval between the occurrence of outbreaks in both regions, it is unlikely that outbreaks in the Swain sector were derived from those in the Townsville and Cape Upstart sectors. Recent statistical models of the direction and rate of spread of outbreaks during the last 12 years also suggest that this is improbable (Moran et al., 1992). Outbreaks of crown-of-thorns starfish have been observed in the Swain sector for several years (e.g. Gannet Cay, Sanctuary Reef) and consequently those observed in the last year may be explained by larval transport *within* the region.'

This apparent independence of outbreaks at the northern and southern ends of the GBR raises some interesting questions. Unfortunately the expense and logistical difficulties of working in the Swains will probably mean that most won't get answered.

Reference

Moran P.J., De'ath G., Baker V.J., Bass D.K., Christie C.A., Johnson D.B., Miller I.R., and Thompson A.A.

(1992). Broadscale surveys of crown-of-thorns starfish and corals along the Great Barrier Reef: 1982-1992. Australian Institute of Marine Science, Townsville. 30pp.

COTS IN THE NEWS

In times of declining COTS populations its tempting to say that any news is good news in terms of maintaining the issue's public profile, but press articles over the last couple of months haven't generally confirmed this adage.

AIMS issued the following press release on 1 March 1993:
'Aquarium studies, including research into the crown-of-thorns starfish at the Australian Institute of Marine Science have had to be rescheduled to overcome the effects of a mishap in the Institute's salt water system.'

On the evening of Wednesday 24 February the marine aquarium was flooded with fresh water, causing the death of 1,000 juvenile crown-of-thorns starfish as well as a number of other organisms that were being kept for experimental purposes. The loss of these animals to their associated research programs is currently being assessed by the Institute.

The Institute's Director, Dr Meryl Williams, said 'the mishap has affected the progress of several important studies into the early life cycle of the crown-of-thorns starfish, as well as research into the population genetics of giant clams and corals. The Institute is making alternative arrangements to reschedule these studies to minimise the impact.'

Due to the seriousness of losses and ongoing investigations into how the accident occurred, the police were called in late last week. Police are continuing their enquiries this week.'

Subsequent enquiries failed to discover the cause of the accident and alternative arrangements have been made to continue some of the research into early life history stages of COTS that was affected by the mishap. However, research into the predation on juveniles has been severely impacted. The deployment of aquarium-reared starfish to measure predation rates in the field and to test the influence of fish predation on controlling COTS populations will have to be postponed for 18-24 months. ***Location of small juveniles in the field would save this project, so if you discover such hitherto apparently mythical critters, please give me a call.***

The second was a relatively rare event these days, Dr Robert Endean was interviewed for a radio program to discuss his research into COTS and the effects of the starfish on the GBR. Bob was reported as predicting the next outbreak episode in 1995. This matches the prediction of Reichelt et al. (1990) who noted that 'if the peaks of activity witnessed over the last 24 years are periodic rather than irregular, new peaks of outbreak abundance in the central section of the GBR may occur in the late-1990's when coral cover has returned to high levels through growth and recruitment.' With the lag between outbreaks in the central GBR and the origin to the north of Cairns, both predictions are in agreement. Repetition of the 17-year interval between the previous two outbreaks (1962 and 1979) puts the next outbreak at 1996. The possible correlation between El Nino Southern Oscillation events and outbreaks (being investigated by Dr Leon Zann of GBRMPA) also suggests a mid to late 1990's episode. If the correlation extends to magnitude as well as timing, the event may be of a scale not witnessed before on the GBR. If the current El Nino doesn't decay in the next couple of months we may witness a 'treble El Nino' - 3 consecutive years of low rainfall in Queensland, an event that probably occurs once in 100 years.

Given that starfish aren't conspicuous until 2-3 years of age, then whatever triggers outbreaks should occur over the next 12 months if these predictions are true! Perhaps the breaking of the El Nino with considerable terrestrial runoff a\` la Birkeland's hypothesis? Hopefully the probabilities will favour the earnest and the AIMS and GBRMPA monitoring programs will detect any outbreaks at the earliest opportunity.

Reference

Reichelt R.E., Bradbury R.H. and Moran P.J. (1990). Distribution of Acanthaster planci outbreaks on the Great Barrier Reef between 1966 and 1989. Coral Reefs 9: 97-103.

LATEST FINAL REPORTS

We've had a few reports from COTS program projects accepted recently. Summaries (more or less verbatim) follow. Copies of the reports are available if you're interested.

Six years of hard coral recovery following *Acanthaster planci* predation at Green Island (1985-1990).
by D.A. Fisk

Coral recovery at Green Island following predation by *Acanthaster planci* was followed from 1985 to 1990. This report summarises the results and presents an overview of the recovery process of the coral community at Green Island, their current status, and likely future changes.

Recent studies have indicated that the recovery of massive corals following *A. planci* predation may be extremely slow in comparison to the growth of other faster coral taxa such as *Acropora* corals, which are sometimes able to recover to their pre-predation cover in less than a decade. This difference might have important ramifications for the reefs because of the significance of massive corals in forming the structural framework of the reefs. Some reports have suggested that slow growth and low recruitment of some massive species means that recovery of these species will take centuries. It has been suggested this provides evidence that similar levels of starfish predation to that which has occurred in the past few decades must have been uncommon in the more distant past, and lends support to hypotheses that infestations have been triggered by human activity.

This report focuses on the contrasts between the faster growing species (predominantly branching and table *Acropora* spp.) and the slow growing massive colony species. The study of coral community dynamics concentrated on two spatial scales: the population dynamics and growth of juvenile corals in replicate 1 m^2 permanent quadrats; and annual changes in communities using line transect methods (4x30m transects per site).

The fate of the very abundant dead plates left after the 1979-81 starfish outbreak is an important factor in the dynamics of coral recovery. Coral recruits using dead plate surfaces as a settlement substrate were less likely to survive than those which recruited onto solid substrata. This is primarily because of continuous reduction in the surface area of the plates, whereby corals recruiting around the periphery were lost. Coral plates were also occasionally overturned by storms etc., in which case the majority of new recruits would have been killed.

Juvenile corals (min. size 1-2mm) recruited into mapped quadrats in large numbers throughout the 5 years of the study, at a mean rate of 4 to 15 recruits per m^2 per year. Recruitment densities peaked in the quadrats during the 1987-88 time period. The survival rate of all major coral groups in the quadrats did not vary significantly throughout the study period. Growth rates of *Acropora* corals peaked in 1987-88 and then levelled off after this time. The rapid growth period correlates with a change in the dynamics of the coral community whereby the recovering community forms an overtopping canopy of live coral and suitable settlement space may become limiting. Mortality rates of understorey colonies (58% annual mortality) were twice as large as nearby unshaded colonies (22% mortality). There was significantly higher mortality of understorey colonies when shaded by tabulate *Acropora* spp. (68% mortality), in comparison to arborescent *Acropora* species (41% mortality). Massive corals showed marginally lower mortality (50%) in the understorey compared to *Acropora* species (62%).

Acropora colonies were numerically dominant as recruits in the mapped quadrats during this study, comprising 46% of all recruits. They exhibit slow growth in the first 2 to 3 years after which they increase in size very rapidly. In some of the reef slope sites dominated by *Acropora*, live coral approached 50% cover by 1990, which is comparable with sites which have not been affected by major disturbances. Between 1988-90, coral recruitment rates continuously slowed each year and coral growth rate apparently began to slow as the *Acropora* species came into direct contact with each other. This was the status of the coral community at the last survey in 1990.

By 1990, the massive corals were the second most abundant group in terms of number of colonies, though their cover was very low. The Faviidae represent 51% of all massives followed by the Poritidae (29%) and the Mussidae (11%). The dominance of the Faviidae within the massive coral group is much higher than for other studies on similarly affected reefs. Massive corals are not abundant as coral recruits on recruitment plates, relative to either *Acropora* or Pocilloporidae corals. However, they are better represented at the visible recruit stage in mapped quadrats. Growth rates of massive corals were much slower than *Acropora* corals, and colony sizes showed very small increases in size during the study period. Annual survival rates did not vary during the study period, and survival was not significantly different from *Acropora* corals. Survival rate for all massive colonies was relatively high with approximately 70% survival for the 5 years from 1985 to 1990. In this report, recruitment of massive corals was higher than the rate found in other studies, and mean growth rate was slower than that used in models of reef recovery.

Scientific reports of the failure of massive corals to recover in post-*A. planci* coral communities may be due to differences in growth rates with the faster growing species. The massives recruit relatively abundantly, and they survive as well as other taxa but they do not grow rapidly, and therefore they make little impact on percentage live coral cover and structure of the coral community within the time frame reported here i.e. up to 10 years following starfish infestation. The long-term future of the massive corals is dependent primarily on whether or not they are capable of surviving competition with the faster-growing canopy-forming species. If survival remains high and if they continue to grow at their slow but steady rate, they will eventually increase in relative cover. However, if overtopping by arborescent and plate *Acropora* corals reduces their growth or results in increased mortality, their ability to recover to pre-*Acanthaster* levels will take time periods similar to the pessimistic forecasts of other researchers.

It would be expected that the *Acropora* spp. will continue to dominate Green Island communities in the next decade in the absence of further disturbances such as another starfish outbreak or severe storms or cyclones. The fate of all corals (and the massives in particular) in the understorey in subsequent years will be an important question to address if we are to gain a good understanding of the recovery processes. The degree of tolerance to overtopping effects will determine the long-term composition of the communities in the absence of disturbances that can eliminate the canopy.

Postscript: No survey of Green Island reef corals was carried out in 1991 or 1992. In December 1990, cyclone 'Joy' passed through the Green Island area. An opportunistic inspection in February 1992 indicated that an estimated 50-70% of the original coral cover had been removed by the cyclone at some sites.

Regional and local patterns of coral recovery on reefs affected by crown-of-thorns starfish: central Great Barrier Reef.

by T.J. Done, L.M. DeVantier, D.A. Fisk and R. van Woesik

Recovery of hard coral populations on devastated reefs in the central Great Barrier Reef appears to occur as a southward moving 'front', lagging some years behind the front of *Acanthaster planci* populations which damaged the reefs in the first place. This conceptual model was derived from investigations in 1989 and 1990, in which the composition, density and sizes of corals were investigated on reefs at several different positions in relation to the southward moving front of the 1980's *A. planci* disturbance.

Several characteristics of the coral communities were consistent with such a model. An index of percentage coral cover was significantly lower at a more southerly reef (Rib Reef) damaged approximately 7 years before the surveys than it was at two northerly reefs (Green Island and Feather Reef) damaged 7-10 years before the surveys. In a number of abundant and fast and slow growing species, notably some *Acropora* and massive *Porites* spp. respectively, colony sizes were larger in the north than in the south. Faster growing species tended to be larger in 1989 than 1990, but in some rarer or slower growing species, there was no evidence of a change in median size between 1989 and 1990. This was possibly due to lack of net growth, but also partly due to small sample sizes and/or an annual growth which is of the same order as measurement accuracy. For some species, the absence of a disturbance signal in size frequency distributions of post-disturbance corals may be due to overlapping of generations.

The regional scale patterns in coral cover and colony size appear to be reproduced on a local scale within reefs where large *A. planci* populations have had an extended period of residence. At John Brewer Reef, there was a substantial and highly aggregated population (>>1000 individuals) present for at least 4 years (1983-1987). The aggregation's movement over the approximately 10km^2 area of reef slope, lagoon and flat was such that the elapsed time since an *Acanthaster* aggregation was present also probably varied among sites by as much as 4 years, similar to the time taken for the front to move the 300km from Green Island to John Brewer Reef. These elapsed time differences within John Brewer Reef were probably major causes of differences in the densities and size frequency distributions among 24 slope and lagoonal sites at John Brewer Reef. Other potential sources of variation are differences in accessibility of sites to planktonic larvae, and differences in colony survival and growth rate. This variation did not obscure the marked north-south differences between Green Island and Rib Reef (220km apart) but may have been one reason why there were few significant differences between Green Island and Feather Reef (100km apart). Further surveys of adult and newly settled corals would be useful to confirm the patterns and some of the suggested underlying causes.

Assessment of the utility of *Linckia* to test connectedness of reefs with reference to *A. planci* dispersal.
by J.A.H. Benzie

The present study assessed the suitability of the blue starfish *Linckia* as a test organism to assess the predictions of hydrodynamic models for larval dispersal. The specific objectives were to establish methods for detecting genetic variation in *Linckia*, and to assess the level of genetic differentiation among *Linckia* populations.

Methods for detecting genetic variation were successfully developed for seven polymorphic allozyme systems. Promising results were achieved for a key portion of DNA that is most likely to provide sensitive population markers to trace dispersal within high gene flow species such as *Linckia laevigata* and *A. planci*.

Surveys of genetic variation in 500 individuals of *L. laevigata* were conducted on five reefs. Three reefs (Evening, Escape and Lodestone) belonged to one highly connected group of reefs in the hydrodynamic models, and two (Davies and Grub) belonged to another.

Little genetic differentiation was detected among populations within groups. Genetic differentiation was greatest, and statistically highly significant, between the groups of populations thought to belong to two different source sets.

Allozymes may therefore prove useful in testing hydrodynamic models but large sample sizes from given reef populations, and large numbers of populations, would need to be sampled.

COTSREC MEETING

The Crown-of-thorns Starfish Research Committee (COTSREC) will meet (or indeed by the time you read this, will have met) on 27-28 May to consider the 1993/94 research program. The next issue of COTS COMMS will report on the meeting.

COTS: STEPPING STONE OR MILLSTONE

For a lot of scientists, authors, politicians and bureaucrats COTS have been something of a millstone. It's pleasing to report that in the case of Dr Peter Moran of AIMS the burden hasn't been overwhelming. Peter has been appointed as the Leader of the AIMS Coral Reef Ecosystems Program. He succeeds Dr JEN Veron. Dr Tenshi Ayukai has taken over Peter's former role of AIMS COTS Coordinator.

R

What's out there?

Steve Raaymakers/Jamie Oliver

Advances in Reactive Monitoring - The 1993 Townsville Port Development

As part of the need to meet the growing demand for port services in North Queensland the Townsville Port Authority (TPA) has embarked on a staged development program. Stage One commenced in 1992 and involves; deepening of the port entrance channel and existing harbour from around 10.7m to 12m and extension of the channel by approximately 2.7km, reclamation of bunded areas to the south of the port to create strategic port lands and expansion and upgrading of cargo handling facilities (figure 1). The new channel and harbour depth of 12m approximates the limiting draught through Torres Strait and will allow greater payloads on Panamax class bulk carriers using the port.

Developmental dredging of the existing port and reclamation of strategic port lands commenced in mid 1992 and is still underway; developmental dredging of the port entrance channel commenced on 19 January 1993 and finished on 7 April 1993; with some isolated high spots still to be removed, and upgrading of the cargo handling facilities and other wharf-side infrastructure is still underway.

The dredging to deepen the port entrance channel presented the potential for a number of environmental impacts, these primarily being turbidity and sedimentation effects on fringing reefs at Magnetic Island and seagrass beds in Cleveland Bay.

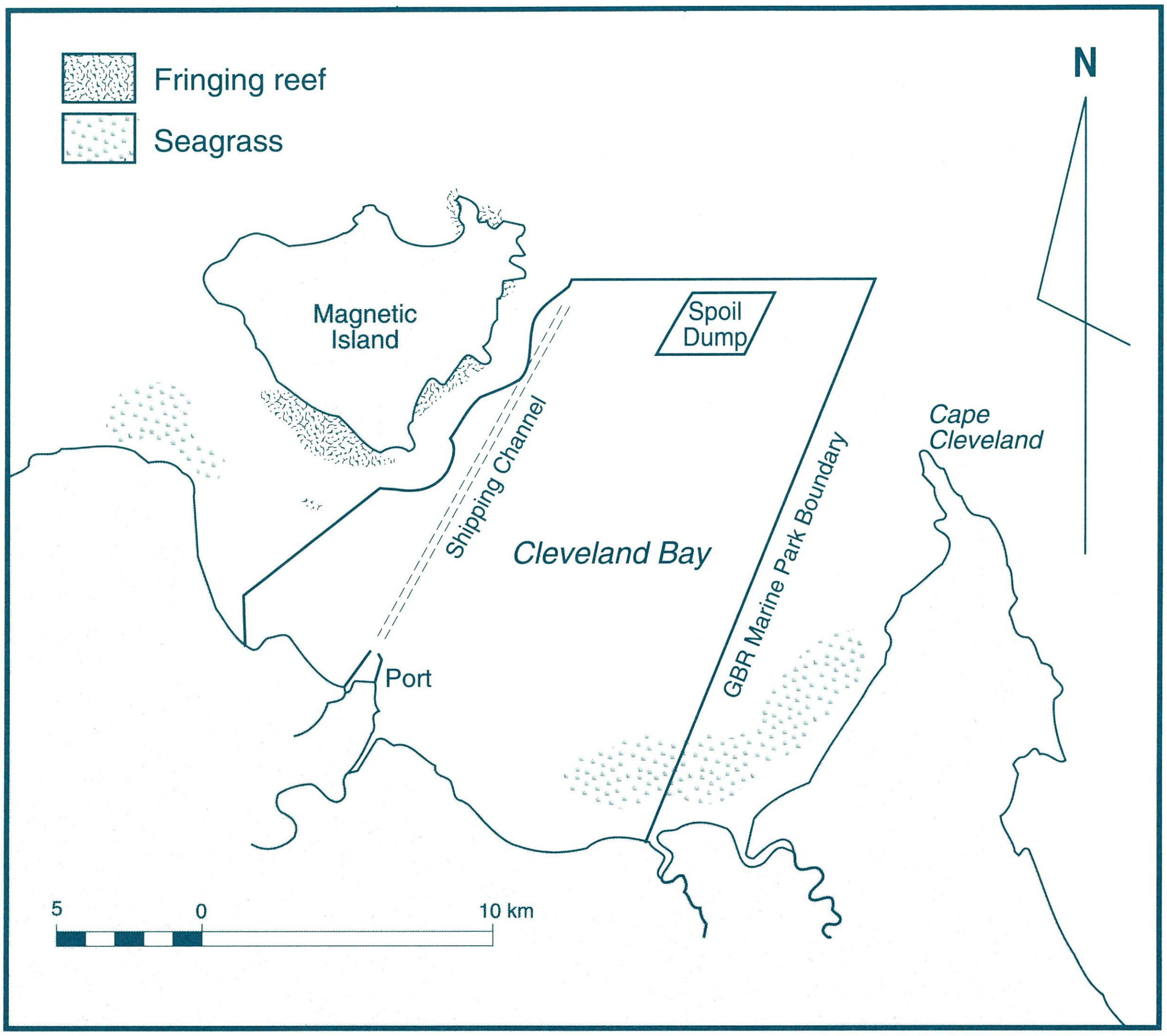


Figure 1. Map of the study aera

The potential for impacts required the development and implementation of an environmental management framework, including a reactive monitoring program. Development of this program relied very heavily on a multi-agency, multi-disciplinary approach, and has been hailed as a model of inter-agency cooperation for similar projects in the future. The program included the appointment of an Environmental Supervisor, who had overall responsibility for ensuring the development works proceeded according to the environmental management framework.

Environmental Concerns

The effects on coral reefs of possible increased sedimentation and light attenuation from sediment plumes is well documented in the literature, and can range from mild coral stress to subtle changes in reef community structure to outright coral mortality and even ecological collapse of the reef should sedimentation or light attenuation be severe enough.

Observations of routine maintenance dredging in previous years and monitoring of a trial developmental dredging in August 1992 indicated that dredge plumes move towards the Magnetic island fringing reefs under certain conditions. The dredging works planned under the Townsville port development were to be conducted over an extended period of some months, and in summer when corals are already existing at the upper levels of their stress tolerance limits.

Although the works were to be conducted outside of the Great Barrier Reef Marine Park, the proposed dredging presented considerable potential to cause significant impacts on the Magnetic Island fringing reefs which lie inside the Marine Park.

The Reactive Monitoring Program

A multi-agency approach was adopted to undertake environmental assessment and management of the project, with a Technical Advisory Committee (TAC) comprising all relevant organisations being formed. Responsibility for regulation of the dredging and issuing of the dredging permit rested with Queensland Department of Environment and Heritage (QDEH), under section 86 of the (Queensland) Harbours Act. Due to the potential for impacts on the Marine Park GBRMPA was able to have significant input through the TAC.

The environmental agencies determined that the dredging could only be permitted subject to a management framework that would allow impending impacts to be detected in time to allow action to be taken to remove the cause of impact. In other words a reactive monitoring program was required that could be linked to the legislative powers of the regulatory agencies in order to ensure the dredging could be modifed or even stopped if necessary.

In designing an environmental monitoring program that would be used to directly manage the dredging works, the question of which parameters should be used to set management triggers was a significant one. Ideally management triggers should be based on the environmental parameters that cause impact, with the trigger levels being set so as to ensure action is taken before impacts occur. In the case of dredging, the 'impact parameters' are turbidity, light attenuation and sedimentation. Measurement of these parameters is relatively straightforward. However, the scientific knowledge is currently such that the background levels and natural variation in these parameters in Cleveland Bay is poorly understood, as are the ecological significance of their various levels. It was, therefore, not possible to responsibly set 'magic numbers' for turbidity, light attenuation and sedimentation, exceedence of which would initiate action to modify or even halt a $65,000 per day dredging operation.

This meant that reliance had to be placed on biological indicators of impact, namely coral condition, for which management triggers could far more reasonably be set. The problem with this approach was that exceedence of a trigger level only occurred after a degree of impact had occurred, thereby significantly limiting the early-warning and preventative capability of the program. The challenge was to set the trigger levels low enough to ensure that impact was reacted to in time to enable it to be stopped, without causing unnecessary and very expensive stoppages to the dredging operation every time some small and natural event occurred.

A scientific advisory group, including coral experts from GBRMPA, the Australian Institute of Marine Science (AIMS) and James Cook University (JCU), oceanographers and modellers from AIMS and JCU, and environmental consultants from Sinclair Knight and Partners (SKP), was established to assist with designing the program.

As our knowledge of exactly how individual coral species react to specific levels of stress is not well developed, it was agreed that it would be necessary to utilise a 'control versus impact' monitoring design in which a detectable degradation of impact sites relative to control sites would, unless data suggested otherwise, be inferred to be dredge related. It was agreed that due to the need to keep costs down, the impact sites would be divided into the primary impact sites of Middle Reef, Geoffrey Bay and Florence Bay and the supplementary impact sites of Nelly Bay and Arthur Bay. The supplementary impact sites were only surveyed initially but would be resurveyed if it was felt that additional information was required during the course of the project. Bay Rock and Rattlesnake Island were selected as the most suitable control sites, although they do differ from the Magnetic Island fringing reefs. In an ideal situation control sites should have physical and biological environments as similar as possible to the impact sites, however the group recognised that there were no other suitable sites in the vicinity.

It was decided that the management triggers would be based on two parameters - coral bleaching and coral mortality, all parties agreeing that more subtle indicators of coral stress such as tentacular expansion and excessive mucus production could not be quantified sufficiently to form the basis of a reactive management framework. Acceptable, natural levels of coral bleaching and coral mortality were agreed to by the group, and management trigger curves were drawn up on graphs showing % of colonies bleached or dead on the x axis against % of sample on the y axis (figure 2). Three management trigger levels were determined for each of the two parameters. If coral bleaching or mortality remained below the first level then no impact was implied and dredging continued unhindered. If the first level was exceeded an Initial Response Group (IRG), comprising the QDEH Environmental Supervisor, the SKP Project Manager, the leader of the JCU reactive monitoring team (which was responsible for field work) and a representative each from the TPA and GBRMPA, would meet to consider the significance of the observations, likely causes and an appropriate response. If the second level was exceeded then an independent Review Panel, comprising extra relevant experts, would be called in to provide the IRG with advice on appropriate action,

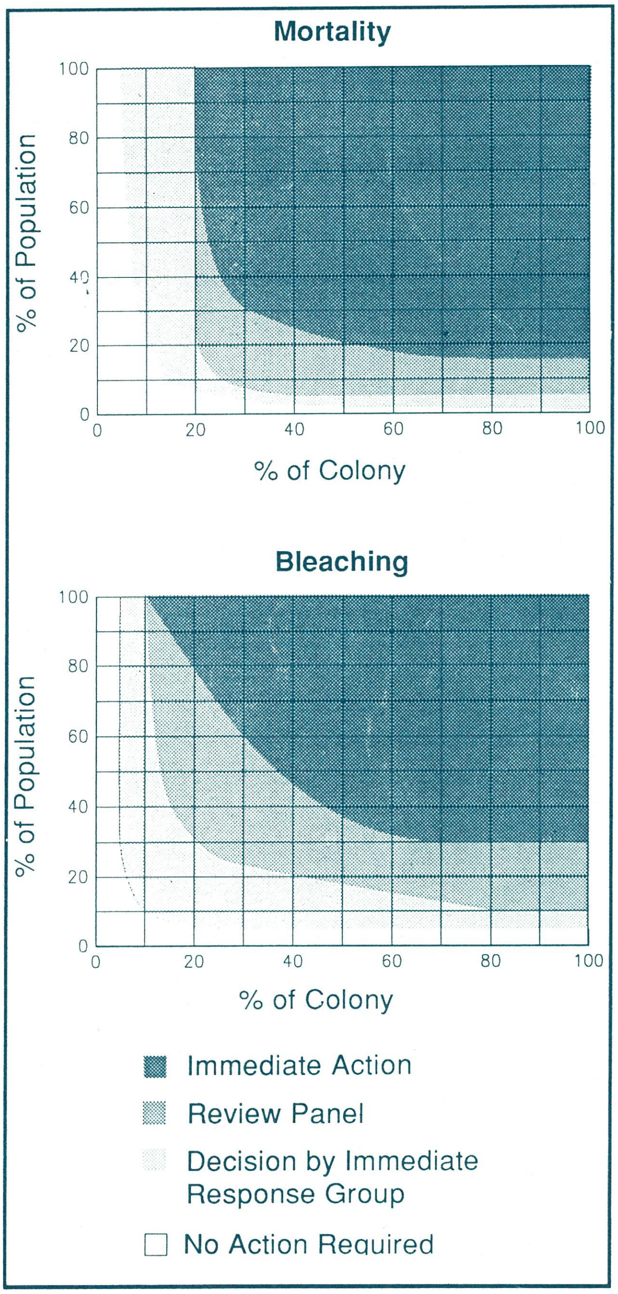


Figure 2. Decision criteria for reactive monitoring

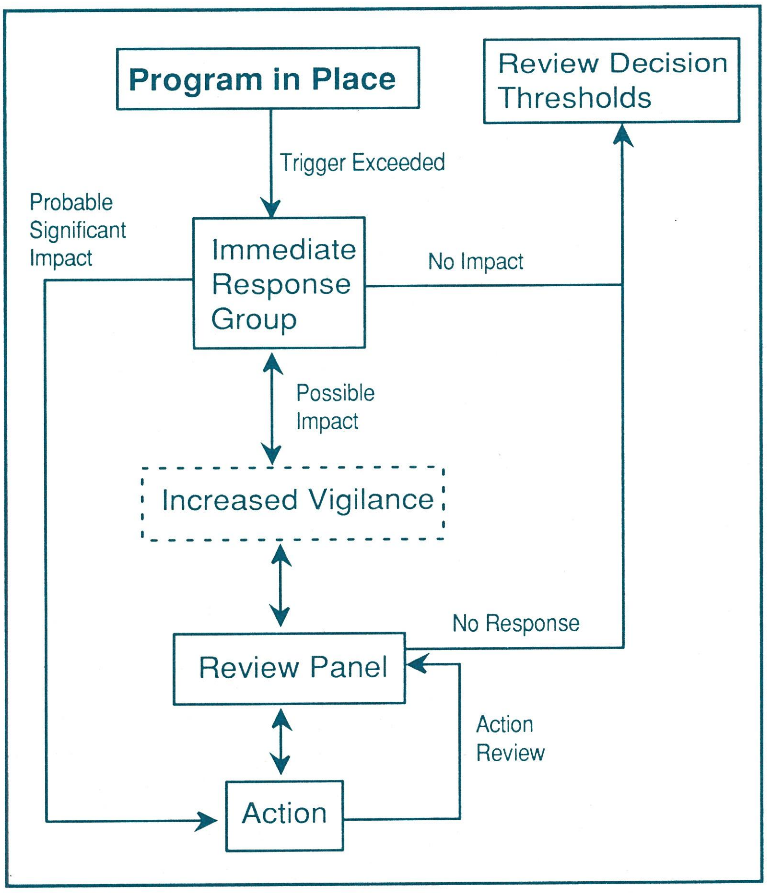


Figure 3. Managment Decision Flow Chart

and if the third level was exceeded then action would be taken immediately to modify or stop the dredging. Management of this process was carried out according to the Management Decision Flow Chart (figure 3). This worked very effectively and ensured all parties involved were fully aware of the process that would take place should management triggers be exceeded.

Four coral species were selected for the monitoring, based on their sensitivity to sediment and their occurrence at Magnetic Island. These were *Acropora latistella, Montipora aequituberculata, Merulina ampliata* and *Pocillopora damicornis.* Twenty colonies of each species were tagged and photographed at each impact and control site. The photographs were laminated and proportions of dead and live tissue marked to provide the pre-dredge baseline. Monitoring involved diver observations of the tagged colonies and marking changes in mortality and bleaching on the photographs. Exact percentages were then calculated using transparent grid overlays with the final data being entered directly onto the trigger level graphs to allow immediate assessment by the IRG. Impact sites were surveyed twice a week and control sites once a week from two weeks before dredging commenced to one week after dredging finished (a total of 15 weeks of monitoring), with a full written report being submitted to the IRG on a weekly basis and verbal reports being made to the QDEH Environmental Supervisor after each field survey.

In addition to the monitoring of tagged corals, general reef swims were conducted to provide a qualitative assessment of a variety of species and turbidity and sedimentation conditions. Also, although the biological parameters constituted the management triggers, physical parameters were also measured in the immediate vicinity of the coral transects, at both impact and control sites, to give an indication of the relationship between these parameters and any biological effects, and the likelihood of biological effects being dredge related. Physical parameters measured included sedimentation rates (using sediment tubes), the percentage cover of sediment on coral surfaces (using visual observations), underwater light attenuation (using permanently deployed data logging light meters) and turbidity levels (using profiling with a hand-held nephelometer and suspended solids sampling).

At no time during the dredging were impacts observed that warranted dredge management action. The initial IRG trigger was only slightly exceeded for coral bleaching during the third to sixth weeks of dredging and after consideration by relevant experts and more detailed monitoring it was concluded that it was unlikely to be dredge related. The levels of bleaching at Magnetic Island reefs decreased as the dredging drew to a close while increasing at the control sites, further indicating a non-dredge cause. Levels of sedimentation and turbidity were recorded at their highest during periods of spring tides, with periods of highest sedimentation at the Magnetic Island impact sites coinciding with periods of highest sedimentation at the control sites, indicating that natural tidal and weather influences may be more significant than the dredging. The overall results of the reactive monitoring program will be contained in a final report to the TPA by JCU who were responsible for implementing the program.

In addition to the reactive monitoring a number of other monitoring programs were conducted to assist with the differentiation of dredge related and naturally caused events, including regular aerial surveillance and photography, satellite imagery, collection of oceanographic and sediment movement data around the spoil dump site and throughout Cleveland Bay, and traditional non-reactive Before-After/Control-Impact monitoring of seagrass and coral communities. The results of these programs will also be contained in reports from the various consultants (mainly JCU) contracted to do the work.

The whole project has constituted the most intensive and comprehensive environmental monitoring program ever conducted in relation to a single development in the Great Barrier Reef Region. It has made substantial advances in linking reactive environmental monitoring with preventative environmental impact management, allowing environmental impacts of development projects to be controlled rather than just measured. It has also provided an extremely large data base on the physical and biological conditions in Cleveland Bay that will be of immense value to both sustainable management of the Bay and pure research.

SLICK TALK 5

with Steve Raaymakers

We cover a variety of topics in this edition of 'Slick Talk', with news on the outcome of a recent oil spill prevention workshop in Canberra, an update on the proposed 1993 Scientific Support Coordinators workshop and some input from Brian King at the Australian Institute of Marine Science on the integrated oil spill trajectory model and coastal resource atlas OILMAP. Many thanks to Brian and once again I would like to reiterate the invitation to researchers and environmental managers involved in oil pollution to submit articles and news items for inclusion in 'Slick Talk'.

MEETING OF EXPERTS ON THE PREVENTION OF OIL SPILLS IN THE GREAT BARRIER REEF REGION

In recent years Australian authorities have come to formally recognise that due to the nature of oil on water and the physical limitations of oil spill response, it is never possible to guarantee prevention of environmental damage and economic loss in the event of marine oil spills, regardless of how well developed oil spill response plans might be. This is particularly the case in areas such as the Great Barrier Reef where a major oil spill could have extremely significant ecological and economic impacts. It is therefore necessary to focus energy and efforts on oil spill prevention.

Although a range of oil spill prevention measures are currently in place for the Great Barrier Reef region, which from the record (or non-record) of spills appear to be working very effectively, the Great Barrier Reef Marine Park Authority (GBRMPA) is concerned about our limited ability to deal with spills should they occur and is therefore seeking to further improve prevention. It was decided that a useful initiative would be to convene a meeting of relevant experts to review prevention measures already in place and to identify and discuss new technologies and measures that can improve oil spill prevention.

The meeting was organised jointly with the Australian Maritime Safety Authority (AMSA), which has national responsibility for shipping safety and ship-sourced pollution, and was held in Canberra on 14 and 15 April 1993. It was the first meeting of experts in Australia to address oil spill prevention specifically.

The meeting involved about forty experts from Federal and Queensland Government departments, the shipping and oil industries, the scientific community and environmental groups.

Current levels of risk

The meeting heard that approximately 2,000 large ships navigate through the Great Barrier Reef region each year, about 100 of which are tankers of up to 90,000 dead weight tonnes (dwt). The majority of these ships are bulk carriers, with some as large as 200,000 dwt carrying significant quantities of fuel oil.

While this shipping intensity is not high by international standards, the nature of the Great Barrier Reef poses many difficulties with navigation, and collision and grounding rates are highest in Australia in the Inner Route of the Far Northern Great Barrier Reef.

While there has not been a major oil spill in the Great Barrier Reef region since the 'Oceanic Grandeur' in Torres Strait in 1970, in which up to 4,100 tonnes of crude oil were spilt, there is still a significant risk. Levels of shipping are likely to increase through the region as Australia imports more oil to compensate for declining domestic reserves and as population growth and industrial development, including exploitation of shale oil, continue to increase along the Queensland coast .

Current prevention measures

The meeting heard that current protection measures include; international conventions (e.g. MARPOL, SOLAS) and implementing Australian legislation controlling the design, construction and operation of ships, and prohibiting all discharges of oil within the Great Barrier Reef region; a program where AMSA surveyors inspect ships visiting Reef ports for compliance with the Convention requirements; an aerial surveillance and enforcement program; provision of navigation aids throughout the region; an ongoing program of updating hydrographic charts, and the recent introduction of compulsory pilotage through the Far Northern Inner Route and Hydrographers Passage.

A number of problems were identified with some of these prevention measures. A recent report of an inquiry into ship safety by the Australian Parliament, entitled *Ships of Shame*, revealed that there is a disturbingly poor compliance with Convention requirements by many flag states and that the existence of 'flags of convenience', the commercial nature of Classification Societies, increasingly poor levels of crew training and experience, and limitations on inspections have resulted in many sub-standard and unsafe ships transiting Australian waters.

New prevention measures

The possibility of excluding shipping from the Great Barrier Reef region, as a means of removing the threat of a major oil spill, has been raised by a number of groups on a number of occasions in the last few years, and received some discussion at the meeting. There are three main obstacles to this option.

1) The Great Barrier Reef region is an international seaway and under international law Australia is obliged to allow 'rights of innocent passage' through its Territorial Sea. For Australia to unilaterally ban shipping from the Reef region would be a contravention of international law, would create a dangerous precedent for similar action by other coastal states adjacent to strategic shipping lanes and would have implications for Australian shipping and commercial activity overseas. In addition, a significant proportion of the Great Barrier Reef region lies outside the Australian Territorial Sea, further reducing the ability of Australia to control shipping through this area.

2) There are a number of major ports on the Queensland Coast, within the Great Barrier Reef region, which are vital to the economic existence of Queensland. Ships must traverse the region in order to access these ports. To close the Reef region to shipping would effectively close down the State of Queensland, which currently has Australia's strongest economy.

3) Closing the Great Barrier Reef region to shipping would mean that ships would have to travel outside the region in the Coral Sea, an area of international waters also containing numerous coral reefs, where navigation aids and charts are poorly developed and where ships are subjected to greater extremes of weather.

GBRMPA is proposing to conduct a quantitative comparative risk analysis between the inner route of the Great Barrier Reef region and the outer route of the Coral Sea.

The efforts of the meeting focussed primarily on technological advances in navigation, including satellite imagery and Laser Airborne Depth Sounding for updating of navigation charts, and Electronic Chart Display and Information Systems and differential Global Positioning Systems for increasing the safety of navigation. The Australian government has small-scale programs and pilot studies underway for all of these technologies. The meeting agreed that they would all substantially decrease the risk of a major oil spill on the Great Barrier Reef and that their full-scale implementation in the Reef region should be accelerated as a matter of priority. However a lack of resources available for such an implementation, and a need to provide such services Australia-wide, means that the recommendations of the meeting will only be implemented if the political will is there to ensure allocation of sufficient resources.

The meeting also considered ship design and construction as a means of enhancing oil spill prevention, and welcomed the amendments to MARPOL regarding introduction of double hulls or similar designs to tankers, and agreed that such requirements could only be implemented through the International Maritime Organisation rather than by unilateral action.

FOURTH NATIONAL SCIENTIFIC SUPPORT COORDINATORS WORKSHOP

As part of its National oil spill responsibilities, AMSA funds regular Scientific Support Coordinator's workshops. The Scientific Support Coordinator (SSC) is a vital player in responding to marine oil spills, providing and coordinating environmental and scientific advice regarding the spill response. The SSC function is provided by the relevant environmental authority in each state, and in the Great Barrier Reef region it is provided by GBRMPA supported by the Queensland Department of Environment and Heritage (QDEH). Each state has a pre-appointed SSC with deputies. Queensland has two pre-appointed SSCs, one from GBRMPA for the Reef region and one from QDEH for areas of the State outside the Marine Park. As well as providing environmental and scientific support to oil spill response in their respective States or areas, the SSCs have formed a national network through which they maintain a flow of information exchange and coordinate input to AMSA regarding environmental and scientific issues on a national scale.

As the state-of-the-art of oil spill response is continually changing and as new research and monitoring results are regularly becoming available it is important that the SSCs get together regularly for information transfer. Also, because the role of SSC is to coordinate as well as actually provide environmental and scientific expertise, and as much of this expertise exists in the wider scientific community and in industry, it is vital that the SSCs maintain an awareness of the expertise that is available and make regular contact with the scientific community and industry.

The SSC workshops provide an excellent forum for these activities, and the next SSC workshop is planned for October 1993, possibly in Adelaide or Port Pirie in South Australia. The exact date and location is yet to be confirmed. At this stage a number of interesting subjects are ticketed for inclusion in the program, including latest developments in spill trajectory models and computerised coastal resource atlases, the role of the oil industry in the scientific and environmental aspects of oil spills, oiled wildlife operations, developments in ecotoxicity testing of dispersants, post-spill damage assessment and monitoring, and recent advances in bioremediation techniques.

There is a need for the SSCs to develop national policy and guidelines for damage assessment and monitoring and the use of bioremediation, and it is intended to 'workshop' these two issues at the gathering.

In addition, if the workshop is held in South Australia it is hoped to conduct a field visit to an area of mangroves impacted in 1992 by the 'Era' spill to inspect ecological recovery and monitoring studies.

The SSCs are keen to have as much participation as possible from the scientific community and industry, and would welcome all expressions of interest in the workshop, including researchers and environmental managers wishing to present papers. However, due to the usual constraints on funding, it will be necessary to restrict participation to those with a genuine involvement or interest in marine oil pollution. For more information contact me on 077 818 811, Julie Harris (NSW SSC) at NSW Department of Transport on 02-268 2943 or Ray Lipscombe at AMSA on 06-279 5929. Programs and registration materials will be available later in the year.

OILMAP HITS AUSTRALIA

Oil spill trajectory and fate models are becoming an essential tool for the modern oil spill response manager, with increasingly sophisticated packages becoming available that include integration of trajectory and fate models with resource atlases, tactical response models, impact assessment models and associated data bases constituting a comprehensive oil spill response decision support system.

The Australian Institute of Marine Science (AIMS), through collaboration with organisations in the United States, is now providing clients with a state-of-the-art trajectory model and response system known as OILMAP. OILMAP was created to make spill modelling accessible to everyone who deals with oil development, production, distribution, response and clean-up operations. It is a user-friendly, DOS based system that can be used to rapidly predict spill trajectories using a standard PC. OILMAP also incorporates a Geographical Information System which can be overlayed onto a spill trajectory, graphically displaying sensitive resource locations (e.g. critical habitats, endangered species locations and industrial sites) in relation to the oil slick.

The basic OILMAP system can also be augmented to:

- predict the weathering of spilled oiled;
- model the subsurface transport of spilled oil;
- predict the probability of various areas being impacted by a spill from a given site;
- perform risk assessments for important resources;
- model the effects of different cleanup options;
- assist in search and rescue operations.

To set up the OILMAP system, AIMS can either provide the basic hardware and software or a complete project management function. Biological resources for the region can be surveyed and entered into the system as well as hydrodynamic data for the model predictions. This systems approach provides a complete and comprehensive management tool for reducing the environmental and economic damage associated with an oil spill and also enables better planning of oil industry support facilities.

At this stage it is not intended to purchase OILMAP for use in the Great Barrier Reef region, as there is already Reef-wide coverage by two oil spill models, the Macintosh based ASAP system operated by GBRMPA and the Macintosh based OSSM system operated by AMSA. However these two systems only give broad-scale coverage and it may be useful to implement OILMAP for specific ports and terminals within the Great Barrier Reef region. Those States that have not yet developed spill models and/or coastal resource atlases should certainly consider the OILMAP system offered by AIMS.

For further information on OILMAP contact:

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