NEWSLETTER OF THE RESEARCH AND MONITORING SECTION

REEF RESEARCH

Great Barrier Reef Marine Park Authority

VOLUME 3 – No. 4 DECEMBER 1993

EDITORIAL

Well, merry Christmas to all our readers at the end of another successful year of research and monitoring in the Great Barrier Reef Marine Park. In the spirit of Yuletide, December's offering is somewhat more relaxed than most.

This issue sees a light-hearted look at some of the reviewers' comments we have received over the past few years, which will hopefully cause some mirth into the New Year. For those that recognise themselves, don't be alarmed, the quotes are anonymous and, anyway, part of the reason to publish the article was to show that you are all in good company.

Another article written in a humorous vein this issue is found in 'What's Out There', the regular monitoring section of the newsletter. It is about a serious subject however, and I urge all researchers to take note, examine consciences and remember all the junk that remains in the Marine Park as a result of your scientific endeavours. It occurs to me that if the scientific community is not prepared to act in a more responsible manner, then what hope is there for us to expect the broader community to embrace the 'take only pictures, leave only footprints' philosophy. New Year's resolutions, please.

Last month saw Steve Raaymakers depart for (hopefully) greener pastures with the Queensland Ports Corporation although he has seen fit to continue to contribute 'Slicktalk' to Reef Research. Steve was with the Authority for nearly four years and, during that time, embraced the issues of ship related matters just when they were becoming more important in the management of the Marine Park. Steve's efforts are greatly appreciated and, as the person responsible for the 'holding pattern' until he is replaced, I will probably miss him and his skills more than most.

Dr Chris Crossland, the Director of the Cooperative Research Centre for the Ecologically Sustainable Development of the Great Barrier Reef (to be known henceforth as the CRC: Reef Research Centre or, more likely, just the 'CRC'), has outlined the program of research that is to be carried out under the auspices of the CRC. Chris has agreed to provide regular contributions to the newsletter and I more than welcome this as a further means of communicating what's happening in the world of reef research.

See you all in 1994.

Ed.

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Readers are invited to submit material for publication. Inclusion is the decision of the Editor. All contributions or inquiries should be addressed to:

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WHAT'S IN THIS ISSUE

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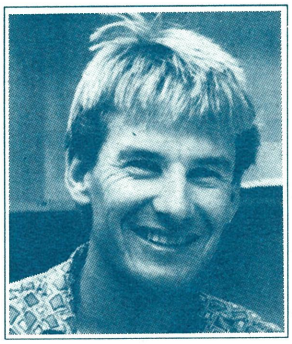

Hamish Malcolm

Hamish has recently joined GBRMPA as an assistant project officer in the monitoring sub-section, and is primarily involved with commercial activities monitoring. Hamish has a good appreciation of both sides of commercial monitoring, having previously worked as a consultant representing commercial operators. Prior to joining GBRMPA, Hamish worked on the monitoring dive team that assessed the effects of dredging on Cleveland Bay corals. Marine science is his third career path, having previously been a commercial fisherman and an underground mine geologist. Hamish has completed a Post-graduate Diploma in Marine Ecology, and intends to begin a part-time masters thesis in marine ecology and fisheries in 1994.

Janine Kuhl

Janine is currently the assistant project officer for the Effects of Fishing Programme. She began working in the Research and Monitoring Section of GBRMPA in August 1992. Her main tasks include; assistance with project management, preparation and dissemination of research reports, establishment and maintenance of databases, and liaising with various agencies and the general public (especially with regards to fishers participating in the fish tagging project). She completed her Bachelor of Science Degree, majoring in Marine Biology at James Cook University in 1992. Prior to this, Janine gained fisheries research experience while employed at the Department of Primary Industry and Fisheries in the Northern Territory. She maintains an interest in marine mammal research and animal behaviour.

What's out there

WHAT'S STILL OUT THERE ?

Scientific research and monitoring in the marine environment often requires the use of hardware being emplaced and left in the water for considerable periods of time. This gear can comprise metal stakes, ropes, floats, traps, lines, flagging tape; the list is endless and bounded only by the imagination and budget of the researcher.

As scientists, it is important to minimise the impact we have on the environment. Regrettably the scientific community has a poor track record in this department and there are increasing signs of dissatisfaction among managers, tourists and the diving fraternity about the amount of research junk left behind.

Areas which have been used for various studies over a long period of time by numerous researchers are starting to resemble the back-lot of a junkyard. Geoffrey Bay at Magnetic Island, which is a Marine National Park 'B' Zone, looks like a porcupine at low tide with the number of old stakes that stick out of the reef-flat. Down the reef slope can also be found numerous old stakes, pieces of rope, and other derelict gear including plastic flagging tape.

As well as the reduction of the aesthetic appeal and the impact on amenity of this area, the safety aspect to other users must be considered. If you abandon a stake that reaches close to the surface, there is the potential for vessels to be damaged and people to be hurt. Also of importance is the pollutant and physical effects that abandoned metal equipment, plastics and ropes can have on the organisms at that location.

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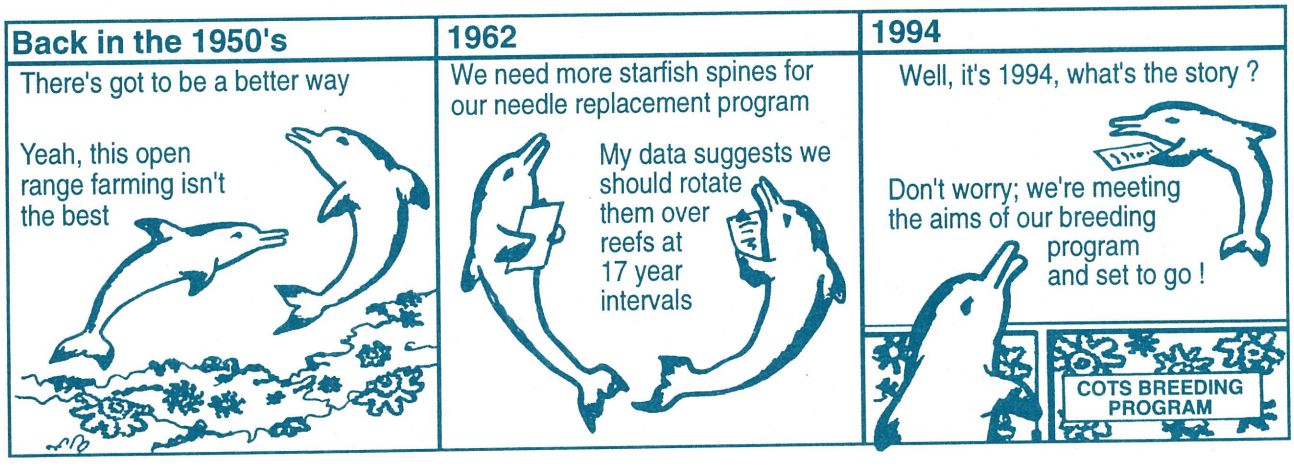
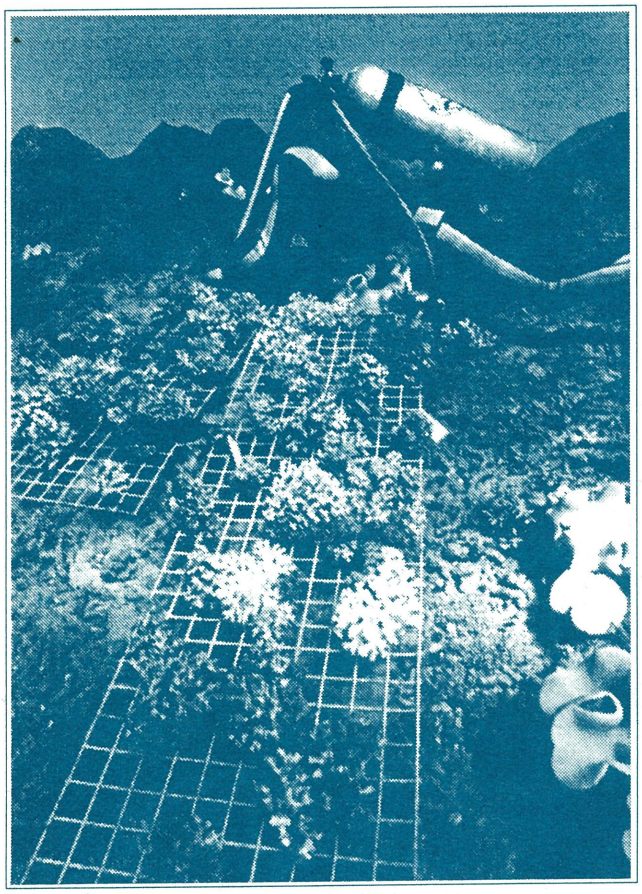
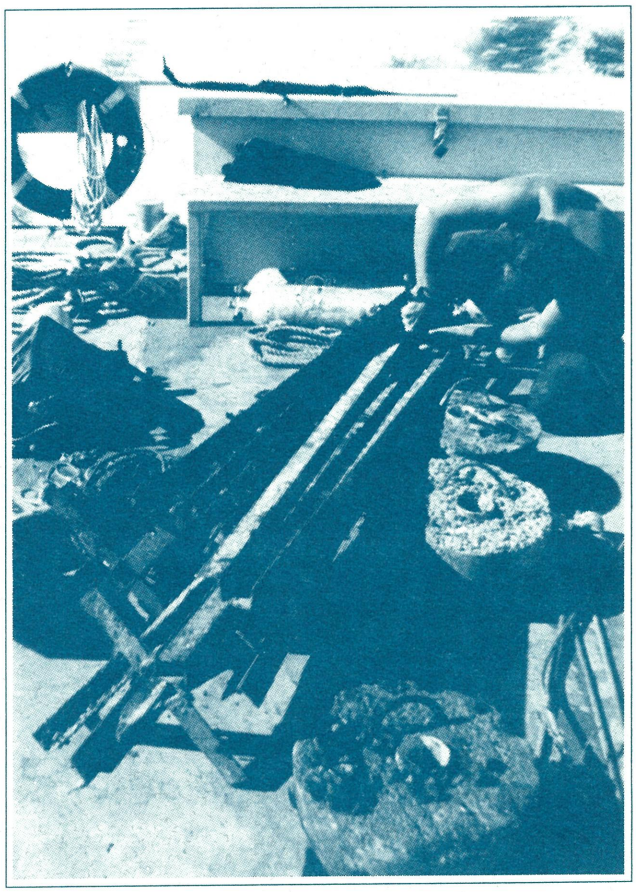




Research often requires the deployment of hardware.
Photo Ray Berkelmans



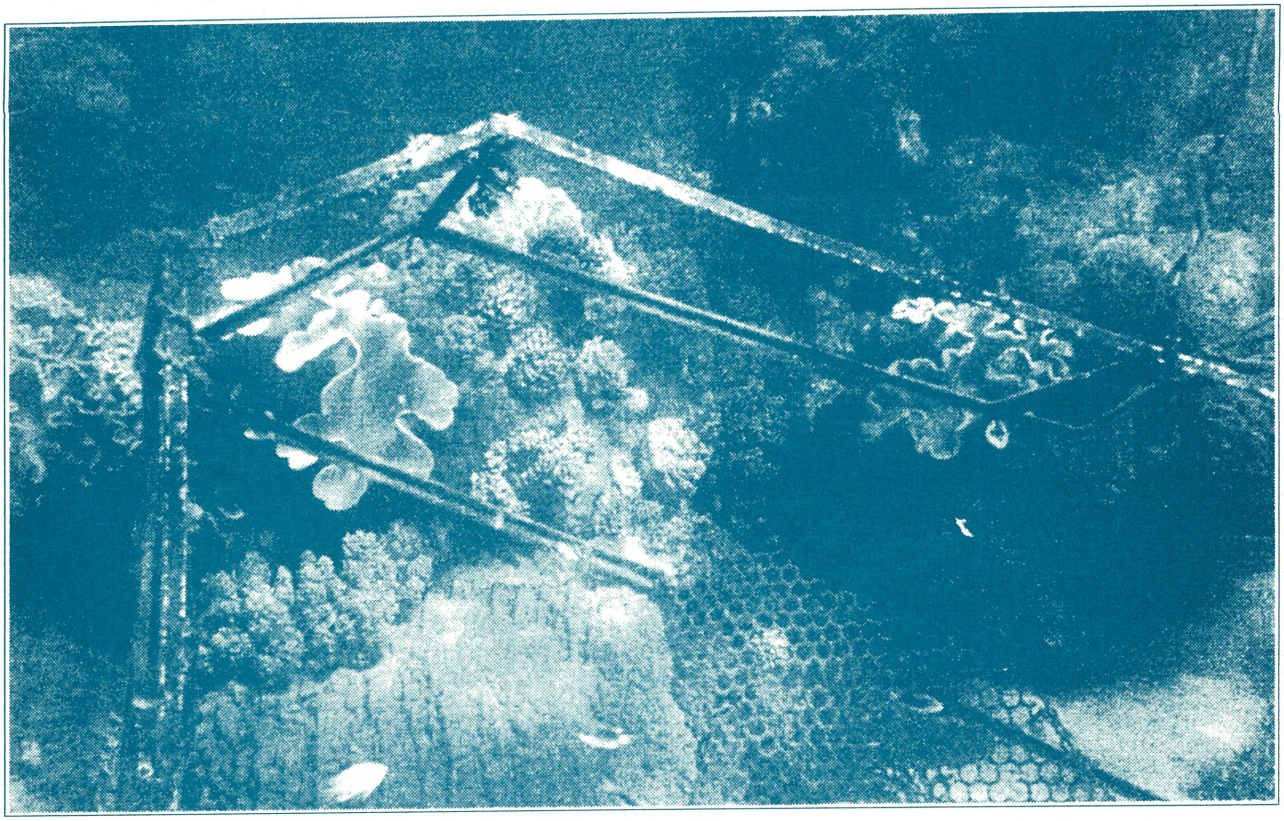
Removing lightmeter stands from Magnetic Island.
Photo Hamish Malcolm.

It may be difficult to organise the time and money to remove hardware on expiry of an experiment, especially after all the agony of collecting and analysing the data and writing up the results, however demobilisation **should** be budgeted for prior to field work beginning. If you are supervising any person without experience in field work, you should make them aware of the effort and cost that can be required to remove gear from the water. It is often a hell of a lot easier to put something in the sea than pull it out.

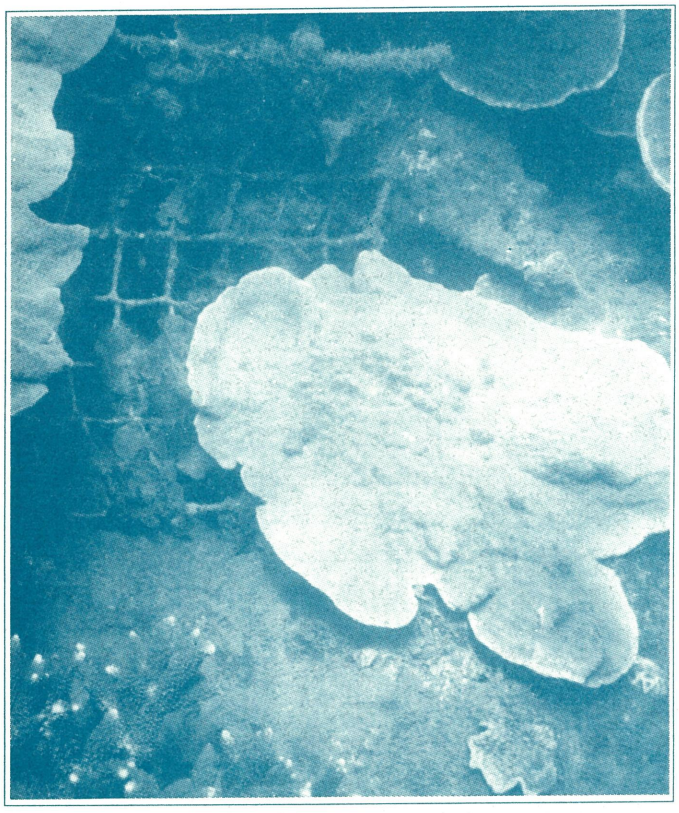
More importantly, funding organisations (including GBRMPA) should insist that clean-up costs are included in proposals and such budget items are not sacrificed when the squeeze is on to find savings.

The monitoring programs set up for the Townsville Port Authority 1993 Capital Dredging (see Reef Research 3(2)), were a good example where demobilisation was required and budgeted for prior to the beginning of a project. CoMarine from the Geology Department at JCU used a fishing boat to pull out all the cables, metal nephelometer stands, sediment trap stands, ropes and floats that they had scattered around Cleveland Bay, and I hear that the pervasive smell of ropes after five months in the water was a real hit at the University. The Reactive Monitoring Team spent three days pulling out sediment traps and stabilising their transects, and the light-meter stands have been removed by the Marine Park Authority in conjunction with the Townsville Port Authority.

The way to reduce the amount of gear which has to be pulled out at the end of a project is to use the right sized and most effective equipment to do the job. If you are new to carrying out your own field work, talk to as many people as possible who have worked in that area. They will have refined their equipment through trial and error over time and will have a good idea of what works and what doesn't. Be innovative about how to



Derelict fishtrap. *Photo Annie Keys*



Discarded mesh in Geoffrey Bay, Magnetic Island.
Photo Hamish Malcolm

mark corals, transects and sites. Are all those star pickets and steel reinforcing bars really necessary? Can short masonry nails be used instead? Flagging tape has a common tendency to stretch and get wrapped around everything, and in my opinion should be avoided at all costs. Mudmaps and photos are a good way to find things underwater without needing to put up large signposts. The use of shore features and photos can be used effectively to locate near-shore sites without needing a pile of surface floats.

A permit requirement of research undertaken in the Marine Park is the removal of all equipment and material used in connection with the research prior to the expiry of that permit. The Marine Park Authority is reviewing its options with respect to scientific junk and one outcome may well be the imposition of a bond on every research permit in the Marine Park. This would be a slap in the face to the scientific community, and a highly undesirable outcome for both managers and scientists. Be warned! It's time to have a close look at what you are doing out there, before we end up living with even more bureaucracy.

Nitrogen & Phosphorus Budgets for the Great Barrier Reef

Miles J. Furnas, Alan W. Mitchell and Michele Skuza, *Biological Oceanography Group, AIMS,* (edited by Jon Brodie, *GBRMPA*)

Rationale

Quantitative information on the inputs and outputs (fluxes) of nutrients and sediment to the Great Barrier Reef (GBR) is critical to our understanding of the present nutrient status of the GBR, changes in this status in recent times and our ability to predict future changes. Recent estimates suggest that four times as much sediment, nitrogen and phosphorus now enter the GBR coastal region from rivers than did before European settlement of the catchments. We need to know whether this is a significant increase in comparison to other sources (e.g. upwelling, rainfall, nitrogen-fixing cyanobacteria and sewage discharges) and in comparison with the stocks of nitrogen and phosphorus already stored in the shelf system. These stocks are held in the water column, sediments and biota. We also need to know whether reef waters already show elevated levels of nutrients and productivity as a result of nutrient input increases and the spatial patterns associated with this. The research project designed to gain this information was carried out over several years by the Biological Oceanography Group of the Australian Institute of Marine Science and this article is an edited version of the Executive Summary from the soon-to-be published Research Publication of their results.

Objectives

Shelf-scale budgets were developed for the nutrient elements nitrogen (N) and phosphorus (P) in the central Great Barrier Reef between Cape Tribulation (16°S) and Dunk Island (ca. 18°S). The intent was to quantify:

1) stocks of nutrients (N, P) naturally occurring in central GBR waters,
2) natural gradients and variability in water column nutrient concentrations, and
3) natural fluxes of nutrients into and out of shelf waters for comparison with anthropogenic or anthropogenically affected nutrient sources.

Study Area

Based upon features of shelf geometry and differing patterns of development on the adjoining coastal plain, the shelf was divided into two boxes (figure 1), a northern box between Cape Tribulation and Cape Grafton (the **Cairns Box**: area = 5940 km^2, volume = 197 km^3) and a southern box between Cape Grafton and Fahrquarson Reef (the **Tully Box**: area = 7830 km^2, volume = 312 km^3).

Methods

Stocks of dissolved and particulate nutrients in the two boxes were estimated from the results of extensive hydrographic sampling within and immediately adjacent to the boxes. The concentration data was partitioned by season

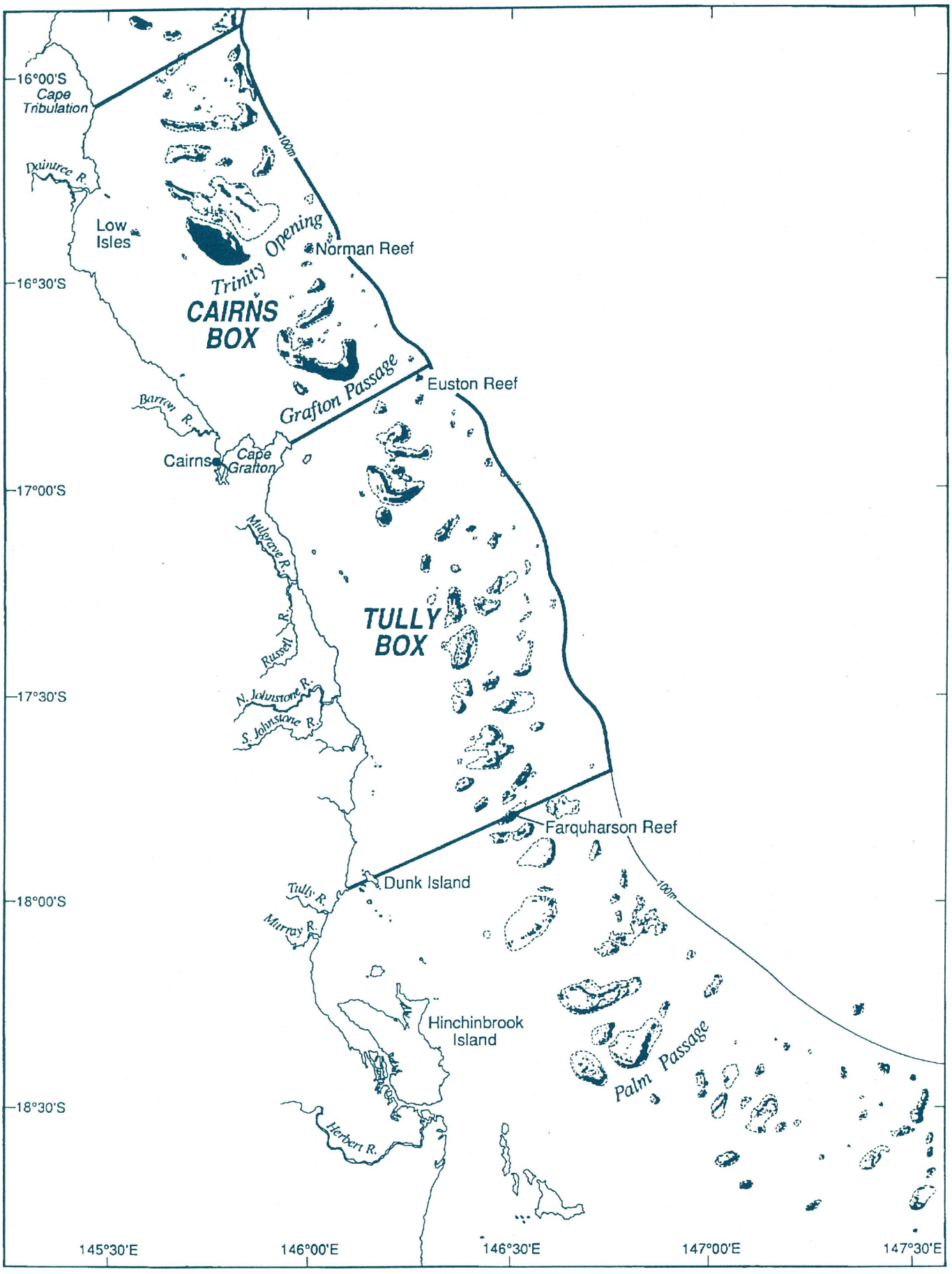


Figure 1. The central Great Barrier Reef and the shelf boxes covered for budgeting purposes.

(Summer: October - April, Winter: May - September) and cross-shelf (depth) location. Mean concentrations of a number of individual nutrient species varied significantly between seasons. Regardless of season, however, the highest concentrations of individual nutrient species generally occur near the coast (depth < 20 m), but these shallow waters contribute relatively little to total shelf nutrient stocks because of their relatively small volume (< 5 per cent of shelf volume). Most water column nutrients reside on the outer shelf (> 30 m depth) because of the greater volume of water.

Results

Dissolved organic nitrogen (DON = 50 100 metric tonnes in the study area) is, by far, the largest water column N pool (ca. 80 per cent of total water column N), followed by particulate N (PN = 10 300 m.t.) and ammonium (NH4 = 1400 m.t.). Nitrate (NO_3) and nitrite (NO_2) stocks are very small (<300 m.t.) in comparison. Phosphorus stocks are more evenly divided between phosphate (PO4 = 2200 m.t.), dissolved organic P (DOP = 5000 m.t.) and particulate P (PP = 1600 m.t.).

System-level inputs of N and P from rivers (7000 and 700 metric tonnes. p.a., respectively), rainfall (2700 and 160 m.t. p.a.) and shelfbreak upwelling (1200-4000 and 400-1000 m.t. p.a.) were quantified from the results of field sampling programs. Sedimentation, or resuspension fluxes of N and P (657 000 and 62 000 m.t. p.a.) were measured with sediment traps. N and P inputs from sewage (400 and 110 m.t. p.a.), benthic mineralisation (39 000 and 12 000 m.t. p.a.), atmospheric N fixation by coral reef cyanobacteria (1400 m.t. p.a.) and Trichodesmium (4600-213 000 m.t. p.a.), micro-zooplankton N and P excretion (21 000 and 2700 m.t. p.a.) and mineralisation of organic N by microbial communities (173 000 m.t. p.a.) were estimated using literature sources, locally collected data and appropriate regional studies. Phytoplankton N and P demand (277 000 and 38 000 m.t. p.a.) were estimated from regional measurements of primary production. Only indirect estimates could be made for removal of N and P through burial in sediments and sediment denitrification. No estimate could be made for cross-shelf mixing rates of water-borne nutrients. Indirect evidence suggests denitrification fluxes could be large relative to external N inputs. For a variety of reasons, there are very considerable uncertainties in estimates of the magnitude of atmospheric N fixation by Trichodesmium. Figure 2 shows the calculated annual inputs of N and P to the Cairns box.

Total external inputs of both N (17 000+ m.t. p.a.) and P (1400+ m.t. p.a.) are small relative to natural N and P recycling fluxes (>200 000 and >>15 000 m.t. pa) on the shelf. In particular, large vertical exchanges of detrital and/or inorganic C, N and P take place between the water column and benthos through resuspension and redeposition of particulate materials. Microbially mediated recycling in the water column and benthos supplies 80-90 per cent of phytoplankton demand for N, and likely a similar percentage of P, though at present no appropriate information is available for estimating local microbial P mineralisation. Overall, external inputs of N are likely to contribute less than 10 per cent of natural phytoplankton N demand. For P, external inputs contribute of the order of 2 per cent of estimated demand.

Discussion

Direct human inputs of N and P through sewage discharge are currently very small relative to natural nutrient inputs. River inputs of N and P comprise a large proportion of external inputs, but are still small relative to internal recycling fluxes. Data on riverine inputs of N and P are currently inadequate to reliably partition river nutrient inputs into natural and anthropogenic (e.g. fertiliser and land-use related) components. A very large percentage of annual nutrient inputs from rivers are delivered by flood events within relatively short intervals (less than two weeks). Sediment and nutrient delivery during these events are still poorly sampled in most north Queensland rivers.

Variability in measured water-column nutrient,

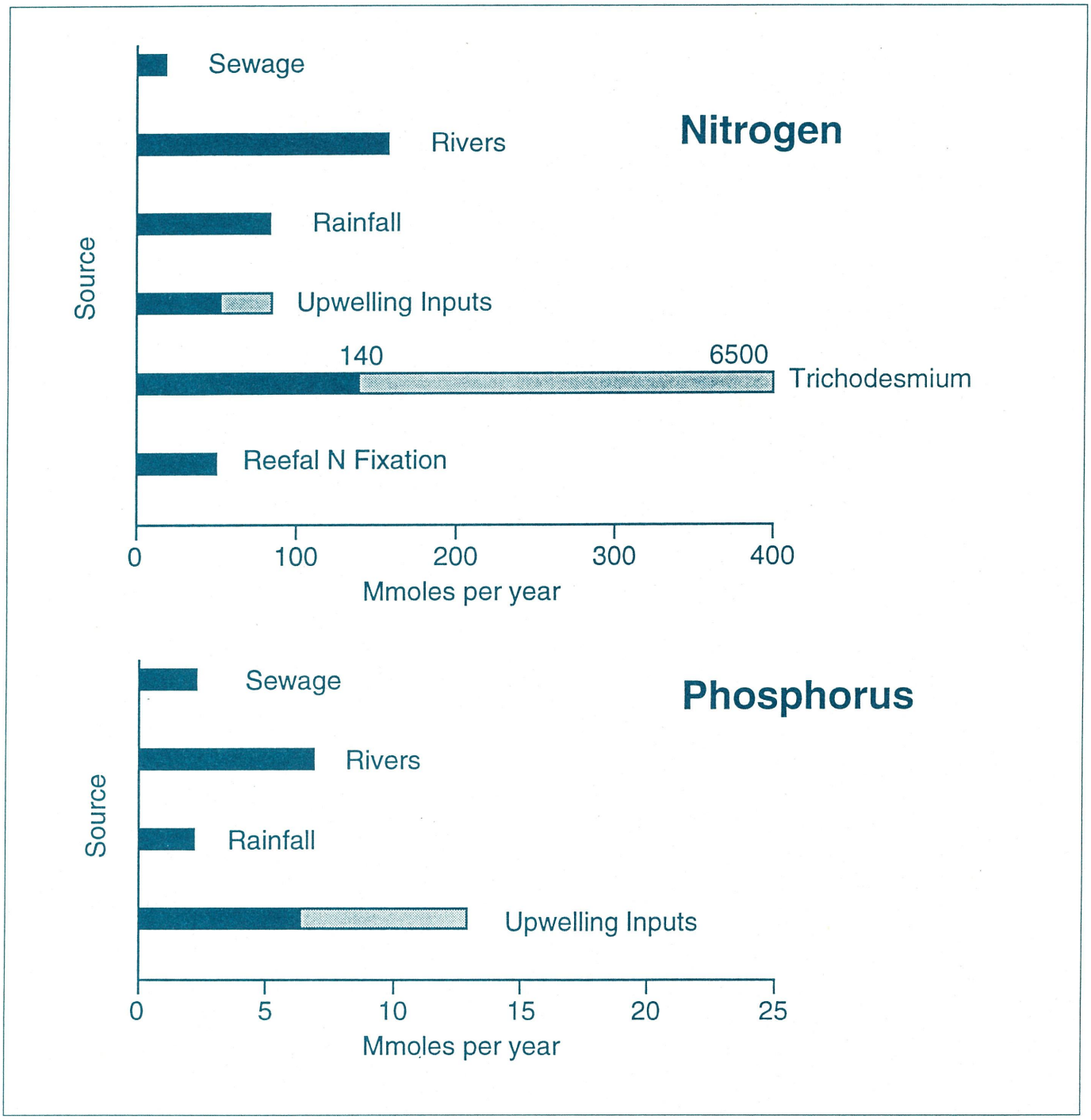


Figure 2. Calculated annual inputs of nitrogen and phosphorus to the Cairns box. Shaded portions of bars indicate the difference between the upper and lower end of a range where it could be estimated or was observed.

phytoplankton biomass and suspended solids concentrations is large relative to mean ambient concentrations. The detection of spatial and temporal trends will require a long-term commitment to the collection of data sets covering regional spatial scales.

Although nutrient levels are currently low in central GBR waters and external inputs are small relative to natural fluxes and stocks, our understanding of ecosystem behaviour is still not developed to the extent that the assimilative capacity of the central GBR for enhanced nutrient inputs can be predicted with any certainty. Caution is therefore advised in the management of nutrient inputs to GBR waters to ensure the conservation of the reef in perpetuity.

THE PEER REVIEW PROCESS:

The lighter and darker side.

Ray Berkelmans

Report and proposal reviews - you don't need me to tell you that all is not perfume and roses in this department! We are told reviews are there to raise standards and keep authors honest, but if you've been on the wrong end of a particularly bad review, you have to wonder if is all worth it. For those who have found themselves in this position, I have good news - someone's copped it worse than you! To illustrate this, I thought I'd do some digging through the files ...

GBRMPA has seen many a review come and go and to rummage through them is quite an eye-opener. At times I actually wondered why we haven't had any suicide cases among our consultants to date. I have seen some acid comments sitting in this job, but just when I thought they couldn't get any worse, along comes one which is pure unadulterated poison. Anyway, the point is that with passage of ample time and in the sober light of day, some of these comments are worthy of airing. If not for a laugh, perhaps to give the hint that you might like to be a touch more sensitive if you are a review**er** and if you are a review**ee**, you might like to grow some thicker skin.

So let's try some of those comments, shall we? Like this one for instance: *"Weasel words. For 'more quantitative', read 'unquantitative' or, more precisely, 'useless'..."*! Correct me if I'm wrong, but I think I can detect a mild dislike for this project from the reviewer. And surely, you'd be calling for stinger vinegar if you were on the wrong end of: *"... a colossally awful waste of effort. Neither exercise is worth funding."*! Ouch!

Cutting comment seems to be a favourite for many reviewers. I'm not sure why, but I guess it kind of gets the point across! *"The author displays a profound ignorance of modern ecology, which is masked by incomprehensible prose ..."*! To get good at reviewing, it obviously helps to be as subtle as a shark in a feeding frenzy.

Safety in numbers is a commonly held belief. But unfortunately, in the review process, there is no hiding from the machine gun approach which has on occasions been used to great effect on whole research teams: *"As a taxpayer, I resent the wastage of money on ... & co-workers, who were incompetent to survey (these animals) and unable to design a sampling program. They have been the most conspicuous spenders of money, the most willing to hide their results (or rather, the lack of them) ... and the best dissemblers yet"*. Who needs liaison skills when you have colleagues like this around?

The 'green theme' also seems to have become more prominent in recent times as illustrated by these gems: *"... I hope [the consultants] feel sufficiently guilty about the number of trees which have had to be cut down to generate this ostensibly simple proposal, and are planting trees in the near vicinity of their office to compensate"*. To add insult to injury, the same consultants copped this on a different report: *"... the report is excessively padded, a surprise when one is reminded on every page of its recycled origins"*. Wonder if the point got home the second time?

Denigration, it seems, is also a useful tool to get the message across. An adjective or two is all that it takes for classics like: *"... [this] is a rambling account of the problems in the field of numerical analysis ..."* And one must admire the direct brevity of the short, but pithy: *"... this is crap"*!

A mild dose of reviewer annoyance also seems to work wonders for bringing forth good quotes, like this one: *"The previous sampling should be ignored (i.e. used for its full worth)"*. And again, there's no question as to where you stand with a comment like: *"We can only conclude, based on the anomalous results and lack of explanation, that the analysis [of the data] is fundamentally wrong"*.

Reviewers' styles differ, but occasionally, there is a masterful demonstration of giving with one hand, while taking away with the other. *"The report is clearly written, but has little else to recommend its acceptance"*. One could go on the premise that every report has some redeeming features, but the silver lining on this cloud seems to be a bit on the thin side ...

While we've got our dirty underwear out for all to see, let's see some of the backhanders aimed at GBRMPA. Our monitoring objectives don't always inspire great confidence in our reviewers it seems: *"Finally, would you GBRMPA, please explain the intended use of the water quality data. Is it worth the expense or just window dressing ...? And please, flush this urination nonsense out of your monitoring programmes"* Or this: *"Why do 18 benthic line transects in such a small area. Are you intending to build a map?"*.

The ol' quotables don't just come from reviewers either. Sometimes you think your requests for further explanation from consultants are perfectly justified, but then you discover that you've tapped a deep well of pent-up frustration:

"... the point is really quite simple. Look at the columns on the extreme left and the columns on the extreme right. There are less (sic) *columns in each cluster and they are very short relative to the central cluster. This is showing simply and clearly that the abundance [is less]. There is a scale on the graph!".*

So, how does a project officer know when he has gone too far? It's not always difficult to tell! A plea like this from the author's superior kind of makes you feel like you're a bastard: *"... the analysis and interpretation of the results is proving to be a difficult and time-consuming activity for the author. I suspect such work would prove difficult for an experienced benthic community ecologist, let alone a fisheries biologist".* Two syllable words and a t-test is all we require from fisheries people from now on ...

And don't ever think you're home and hosed. Booby traps can be so beautifully disguised: *"The magnitude, quality and diversity of information provided in these 5 volumes are truly outstanding...".* Yet despite this glowing ego-stroke, this statement was followed by three pages of recommended improvements!

Subtlety and wit are pretty rare in a review, but every now and then you come across a goodie. I'm not sure if it was intentional or not, but I liked the title of a recent review: *"Review of G.B.R.M.P.A. Draught Report ...".* Cheers! It was even better when it came to light that one of the main gripes of the reviewer was the poor spelling in the report! Or a subtle hint by another reviewer: *"While the applicants may feel that the review process ... will take the form of a revue, this view may not find widespread acceptance within GBRMPA".*

When it comes to contenders for an award in this department however, then it must be a choice between: *"It looks quantitative, it feels quantitative, it smells quantitative - why not say quantitative! Qualitative is normally associated with poor data, bad karma and acne!"* and *"The author uses statistics as a drunken man uses a lamp post - for support, rather than illumination!".*

Anyway, why beat around the bush? When it is bad, make the most of it. Take this one for instance: *"This proposal suggests that (i) [the authors] are still being funded and (ii) a whole new research field has been invented. The growth industry of this new research field [must] end before it takes the country's entire remaining budget for scientific research".*

About now you will either be feeling rather smug in the knowledge that none of your reviews were ever this bad or ready to hurl yourself off a cliff because these comments really were directed at you and the embarrassment is just too much.

But, as I've mentioned, there is a message in all of the above for both authors and reviewers. Reviewers be warned that all good quotes will be entered into a database and yearly awards will be offered for the best character assassination and the worst attempt at humour. Researchers be warned that project officers are a pretty sadistic bunch and are keen spectators at the gallows. You have 2 choices: you can get tough and share with us some choice quotes directed at you (we'll pay good money for them). Or else, you are probably a candidate for the cliff anyway, in which case, spare us the trauma of your despair and make a good job of it!

COTS COMMS

Dr Brian Lassig and Udo Engelhardt

CURRENT COTS

Sightings of COTS continue to trickle in. Since the last issue of COTS COMMS we've had reports of small numbers of starfish (between 8 and 60). The reports cover a large area from Sherrard (59 starfish) and Chapman (47) Reefs off Lockhart River; Ingram Island (10) off Cape Melville; Paddy's Market (5) off Cooktown; Norman Reef (8) and Michaelmas Cay (48) off Cairns; Flora Reef (50-60) off Innisfail and even Flinders Reef (15) in the Coral Sea. To my knowledge, one of the COTS seen on Flinders Reef has set a new size record - it was measured at 1 metre in diameter!

Only time, continuing submission of sightings records and methodical surveys will tell us what these observations mean. None of the records qualify as outbreaks according to the established criteria (>0.22 starfish per 2 minute manta tow around the reef perimeter, or >40 starfish per 20 minute swim, or >15 per hectare), although the Sherrard and Chapman Reef observations by Frazer Muir of QDEH in Cairns come very close. Some of the reports didn't indicate the time spent diving or the area covered so it's impossible to judge the significance of the sightings. For some of the reefs we have no previous records of their status so we can't say whether the densities of starfish are increasing or not. In some cases (e.g. Michaelmas and Flinders Reefs) the survey respondents have indicated that the numbers are increasing or higher than in previous visits.

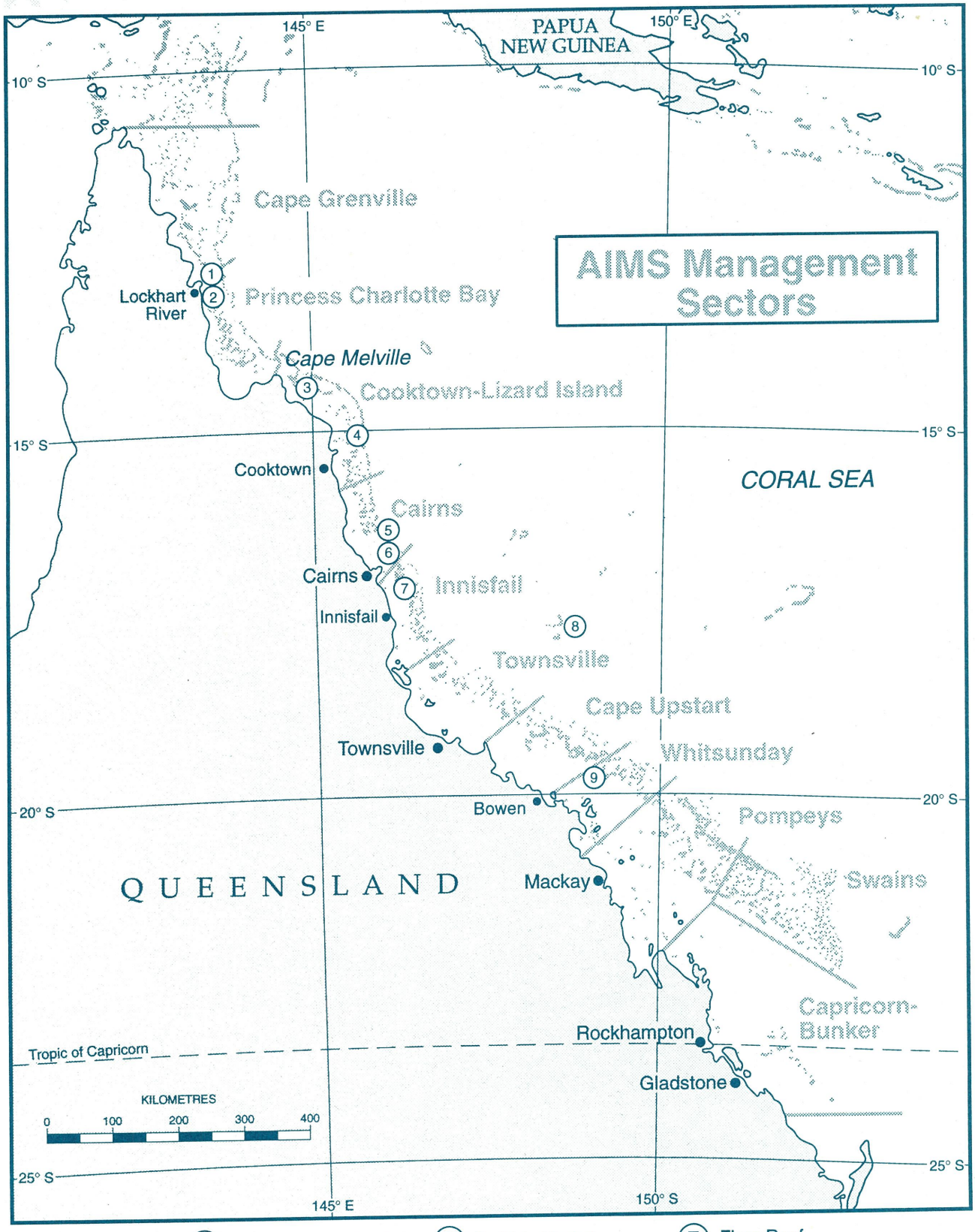
Obviously the starfish are causing localised damage in some places and conflicts between user groups (human viewers and starfish consumers) occur. In such cases we can provide technical assistance to help minimise the problem. We've prepared a *draft* manual on controlling COTS - please contact us if you'd like a copy.

CONTROLLING COTS

Our investigations into effective local-scale control methods for COTS are continuing at Bait Reef. This reef, located off the Whitsunday Islands in the Central Section of the Marine Park continues to support a population of starfish sufficiently large for experimental purposes. We recently repeated some of the earlier trials (see *Reef Research*, 3(1)) aimed at identifying a minimum dose of copper sulphate required to kill starfish. Another set of trials is assessing the effectiveness of mechanical (e.g. cutting up) rather than chemical methods to find the most environmentally friendly way of reducing COTS numbers.

The conduct of these trials has been greatly assisted by the help and expertise provided by Dale and Kate Westwood, the owner/operators of the now 'research vessel' *Banjora*. Their efforts have ensured that our work to date has been a total success. More than once, Dale dropped us directly over a group of COTS just waiting to be collected by a bunch of keen scientists. Local knowledge certainly is invaluable.

The operation at Bait Reef is set to continue for another couple of months, with the final experiments scheduled for early December this year to check on any seasonal effects.



1. Charles Island Reef
2. Sherrard Reef
3. Ingram Island Reef
4. Paddy's Market
5. Norman Reef
6. Michaelmas Cay
7. Flora Reef
8. Flinders Reef
9. Bait Reef

A more comprehensive account of this study and its results will appear in the next issue of *Reef Research*.

LATEST FINAL REPORTS

Modelling approach to hydrodynamics and the large-scale larval dispersal of *Acanthaster planci*: sensitivity analyses

by IJ Dight, MK James, L Bode and L Stewart

The Marine Modelling Unit (MMU) of James Cook University has been funded through the COTS Program for several projects investigating patterns of larval dispersal between reefs of the Great Barrier Reef. Results of the modelling are consistent with, and help to explain, a variety of observed features of the pattern of outbreaks on the GBR including:

identification of a source region from which COTS populations are proposed to have spread, primarily in a southerly direction;

the high incidence of outbreaks on mid-shelf reefs south from Green Island;

the susceptibility of particular reefs to repeated COTS recruitment; and

the cessation of outbreaks in the Central Section of the Marine Park.

This report examines the validity of the chief assumptions and approximations of the model as a precursor to its refinement.

Results of the sensitivity tests indicated that the cross-shelf and long-shelf patterns of connectivity between reefs derived from previous applications of the model and reported in the scientific literature are generally robust. Increasing the number of model runs, sampling density or the structure and size of the 'larval' cloud produced qualitatively similar patterns.

However, the tests also highlighted areas for improvement, especially if models capable of predicting the fate of larvae under specific sets of conditions are to be developed. In particular, the use of time-interpolated wind records and the incorporation of the inertia of the water mass into the model were identified as critical.

The issue of hydrodynamic models is currently being reviewed by the Authority.

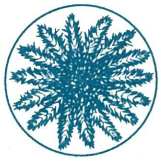
IN THE NEXT ISSUE

- **Highlights of at least 3 major research projects due to be finalised over the next couple of months;**
- **Outcomes of the Crown-of-thorns Starfish Research Committee (COTSREC) meeting in early November;**
- **The latest results of further manual control technique trials; and**
- **Survey results from the AIMS monitoring team's trips to the Far Northern, Cooktown-Lizard Island, Townsville and Cape Upstart Sectors of the GBR.**

Our aim is to establish a set of standards or guidelines for the development, testing and implementation of hydrodynamic models. Hopefully this will allow us to determine the confidence we can place in model results and use these potentially vital tools in management decision making.

THE CALM BEFORE THE STORM

This issue of COTS COMMS is a bit light-on, but don't complain to the editor (after all its free!). The next issue will more than compensate for the short-fall. As we mentioned in the last issue, reports of COTS sightings are critical to maintaining a current picture of starfish on the GBR. The next issue of COTS COMMS will describe a new promotion and incentive scheme that includes an improved, more user-friendly reporting form that we hope will encourage even greater responsiveness by Reef users.



NEW PUBLICATIONS FROM THE RESEARCH & MONITORING SECTION

RESEARCH PUBLICATIONS

Heron Island Spoil Dump.
M.R. Gourlay and J.S. Jell. Research Publication No.28 has now been published and is selling for $51.90 including postage and handling within Australia

Aboriginal and Torres Strait Islander Interests in the Great Barrier Reef Marine Park.
Dr Anthony Bergin. Research Publication No.31 has now been published and is selling for $16.50 including postage and handling within Australia.

WORKSHOP SERIES

Workshop on the use of Bioremediation for Oil Spill Response in the Great Barrier Reef Region.
Edited by Jennifer Lash and Steve Raaymakers. Workshop Series No 14 has now been published and is selling for $14.20 including postage and handling within Australia.

TECHNICAL MEMORANDUM

Sedimentation Resulting from Road Development, Cape Tribulation Area.
D. Hopley, R. van Woesik, D.C.J.D. Hoyal, C.E. Rassmussen and A.D.L. Steven. GBRMPA - TM - 24 has now been published and is selling for $21.10 including postage and handling within Australia.

For overseas orders please add $10 Aus for Cheques and $3 Aus for Sea Mail or $7 Aus for Economy Air.

The current status of the computerised Coastal Resource Atlas being developed for Queensland and a summary of latest oil spill incidents in the Great Barrier Reef region feature in this appearance of Slick Talk. Unfortunately no contributions from external authors have been received this time around.

UPDATE ON QUEENSLAND OIL SPILL COASTAL RESOURCE ATLAS

In 1989 the Great Barrier Reef Marine Park Authority (GBRMPA) funded the trial development of a computerised Coastal Resource Atlas (CRA) for use in oil spill planning and response in the Great Barrier Reef region. The trial development was undertaken by engineering and environmental consultants Sinclair Knight and Partners, using Hypercard software on Macintosh hardware. The pilot system developed by Sinclair Knight, for the area from Townsville to the Whitsundays, proved effective and extremely user friendly, dividing the coastline and reef areas into fixed size grid maps with overlays depicting sensitivity gradings, habitats, fisheries, infrastructure, bathymetry and tenure. The system also included a simple built-in oil spill trajectory model. The system was called 'A Strategic Atlas Program' (ASAP).

As a result of the pilot study by GBRMPA the Queensland State Oil Pollution Committee decided to adopt ASAP as the Coastal Resource Atlas for Queensland, and, in 1991, engaged Sinclair Knight to proceed with development of the system for the whole coast. This has proceeded using funds provided specifically for CRA development by the Australian Maritime Safety Authority (AMSA), under the National Plan to Combat Pollution of the Sea by Oil. While Sinclair Knight have been engaged to develop the computer program, the various government agencies in the State Oil Pollution Committee, especially the Queensland Departments of Transport (QDoT), Environment and Heritage (QDEH) and Primary Industries (QDPI), and GBRMPA, are responsible for providing, collecting, entering and maintaining the wide range of resource data in the CRA. The project has therefore required a high degree of inter-agency cooperation.

For development and management purposes ASAP has been divided into seven geographical sections (see figure 1). The east coast is divided into the Brisbane section which extends from the NSW border to Bundaberg, the Mackay section which extends from Bundaberg to Cape Bowling Green, the Cairns section which extends from Cape Bowling Green to Cape Flattery, and the Lockhart section which extends from Cape Flattery to the tip of Cape York. In addition there are the Torres section which covers Torres Strait, and the Weipa and Gulf sections which together cover the Queensland portion of the Gulf of Carpentaria.

ASAP is now in full operation for the four east coast sections (i.e. the whole east coast of Queensland from the NSW border to Cape York). The environmental and infrastructure data for the east coast is preliminary only and is now being updated. It is planned to conduct six-monthly to annual updates of data for all sections once in full operation. The modelling component for the east coast at this stage only includes tidal stream data for the area from Townsville to the Whitsundays. From Townsville north and from the Whitsundays south the model is wind-driven only, thereby severely limiting its accuracy. No plans exist at this stage for obtaining and entering additional

tidal stream data, as the CRA function currently has higher priority for funding than the modelling function.

Development of the program has now been completed for the Torres Strait, Weipa and Gulf sections, and the task remains for QDoT, QDEH and QDPI to enter data to the various overlays before these sections become fully operational. This is likely to be completed by mid-1994 for Torres section and by the end of 1994 for the Weipa and Gulf sections. GBRMPA is not involved with the Torres, Weipa and Gulf sections, nor the Brisbane section, as they are outside of the Great Barrier Reef Region.

ASAP can operate on a Macintosh Powerbook lap-top computer and is therefore highly portable and can be used in the field. At this time ASAP equipped Powerbooks have been established at the QDoT head office in Brisbane, several of the QDoT Regional Harbour Masters' offices along the coast, the GBRMPA head office in Townsville and the QDEH Southeastern Regional office in Brisbane. It has also been installed on office-bound Macintoshes at the Brisbane head offices of QDEH and QDPI. Eventually ASAP will be installed at all QDEH Regional and District offices along the coast, subject to availability of hardware.

ASAP will be an extremely useful oil spill response tool that will be widely available to all relevant agencies at all levels throughout Queensland.

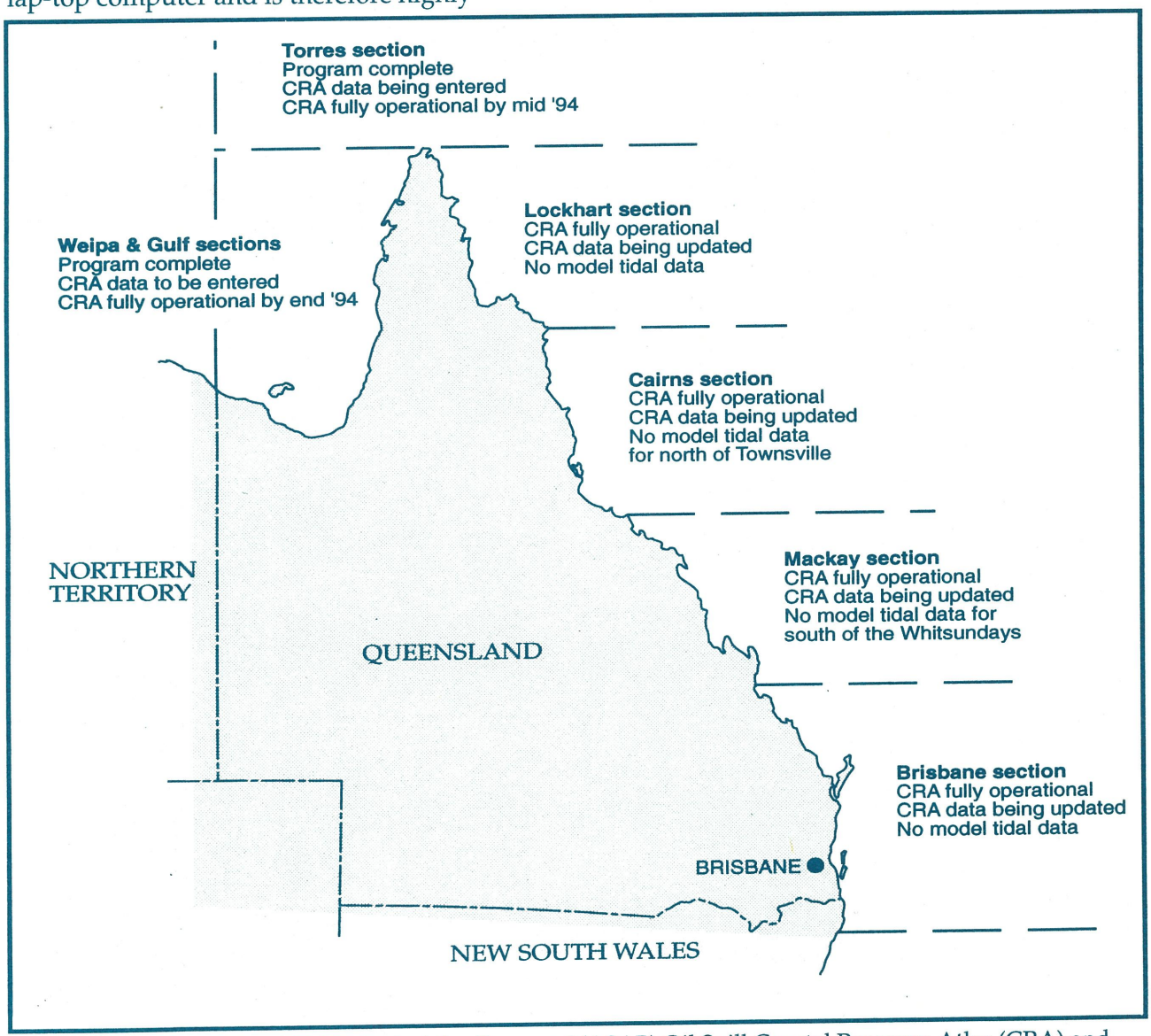


Figure 1. Development of 'A Strategic Atlas Program' (ASAP) Oil Spill Coastal Resource Atlas (CRA) and Spill Model in Queensland. Status as at October 1993.

RECENT OIL SPILLS - GREAT BARRIER REEF

At the time of writing GBRMPA has received fourteen separate reports of oil spills in the Great Barrier Reef region, bringing to around forty the number of such reports received since 1990. Below is a list of spills reported to GBRMPA from various sources from April to October 1993.

5 October 1993.

Port of Hay Point (central Great Barrier Reef)
Two 200 litre drums of lubricating oil being transported to a waiting ship by a helicopter burst on impact with the sea surface when the helicopter sling failed. The resulting slick threatened Mackay beaches and small areas of mangroves. A Pilot launch was dispatched by QDoT with dispersant, however after consultation with GBRMPA it was decided not to use dispersant and the launch spent an hour traversing through the slick to break it up. Only a small area of light sheen was observed by an overflight the following day.

22 September 1993.

Whitsunday Islands (central Great Barrier Reef)
Tar balls reported ashore on main resort beach at Hayman Island, on Steenes Beach at Hook Island and throughout water over approximately 4 nm^2 area. Believed to be from discharge by passing ship. Hayman Island resort staff effected beach clean-up.

19 September 1993.

Offshore Innisfail (northern Great Barrier Reef)
Merchant ship reported oil slick 1 nm long by 0.5 nm wide in shipping channel south of Innisfail. Believed to be discharge from passing ship. Marine Parks patrol boat obtained sample. Insufficient quantity for analysis, as slick dispersed/evaporated rapidly.

19 September 1993.

North of Hayman Island (central Great Barrier Reef)
Tourist vessel reported oil slick 3 nm long by 0.5 nm wide in shipping channel 2 to 3 nm north of Hayman Island. Believed to be discharge from passing ship. Possibility of oil coming ashore on Hayman and Hook Islands. QDoT Regional Harbour Master obtained sample. Slick monitored with aircraft for three days and eventually dispersed, evaporated etc. in open water.

17 September 1993.

Rattray Island (central Great Barrier Reef)
Private yacht reported oil on shoreline of Rattray Island. Marine Parks patrol boat inspected and obtained sample. Oil appeared to be aged and emulsified marine fuel oil, probably discharge from passing ship. Assessed as being of low environmental risk and no clean-up conducted.

10 September 1993.

Cairns Reef, Cooktown (northern Great Barrier Reef)
Civil aircraft reported 'substance' trailing merchant ship. No vessels available to respond. Coastwatch aircraft tasked to investigate and reported nil sighting of discoloured water or pollution.

6 September 1993.

Balgal Beach, Townsville (central Great Barrier Reef)
Residents reported 1m wide strip of oil along beach plus dead fish and birds. Inspection by Marine Parks officers found tar balls spread sparsely along beach and no dead fauna. No clean-up conducted. Residents advised oil had been on beach since 2 September 1993.

21 July 1993.

Turtle Islands (far northern Great Barrier Reef)
Civil aircraft reported large patch of discoloured water in vicinity of Turtle Islands and merchant ship in the area. Coastwatch aircraft tasked to investigate.

21 July 1993.

Hardy Reef (central Great Barrier Reef)
Tourist vessel reported leakage of hydraulic oil from split line whilst en route to Hardy Reef, creating 10 nm long slick. Estimated 20 litres lost. Considered negligible and left to disperse naturally.

5 July 1993.

Whitsunday Passage (central Great Barrier Reef)
Private yacht reported oil slick trailing merchant ship in Whitsunday Passage. No vessels or aircraft available to respond. Information passed to AMSA for follow-up.

4 July 1993.

Herald Island (central Great Barrier Reef)
Fishing trawler sank at Herald Island releasing several thousand litres of diesel. Marine Parks aircraft monitored slick which dispersed and evaporated rapidly in rough weather.

3 July 1993.

Off Townsville (central Great Barrier Reef)
Coastwatch surveillance flight observed discoloured water trailing merchant ship off Townsville. No vessels available to respond. Coastwatch obtained photographs and positive identification, passed to AMSA for follow-up.

2 July 1993.

Cairns Port (northern Great Barrier Reef)
Fishing trawler sank in approach to Cairns port, releasing several thousand litres of diesel. Cairns recreational/tourist beaches threatened however rough seas broke slick up rapidly with no oiling of beaches.

31 May 1993.

North of Hayman Island (central Great Barrier Reef)
Tourist vessel reported oil slick 4 nm long by 0.25 nm wide in shipping channel north of Hayman Island, believed to be discharge from passing ship. Marine Parks patrol boat obtained sample. Slick monitored with aircraft for several days and eventually dispersed, evaporated etc in open water. Several suspects investigated by AMSA and sample tentatively matched with foreign-flag vessel. Information sent to Flag State for their action.

The ongoing occurrence of such spills, the majority of which are caused by illegal discharges of waste oil by passing merchant ships, continues to be of significant concern to GBRMPA. Despite international Conventions and Australian legislation prohibiting all oil discharges in the Reef, with fines of up to $1 million, a section of the shipping community continues to blatantly flaunt the law. Of the forty oil spill reports in the Reef region since 1990, only two successful prosecutions have been effected, both by foreign governments against their own flag ships. These are:

- Successful prosecution by Greek authorities of the Master of the Greek vessel *Anangel Progress* for discharge in the southern Great Barrier Reef in February 1992. Fine unknown.

- Successful prosecution by Cypriot authorities of the Master of the Cypriot vessel *Ocean Regent* for discharge off Cape Upstart, central Great Barrier Reef in January 1990. Fine was approximately $A2300.

From such a dismal record it would appear that the 1990 Canadian Public Review on Tanker Safety and Marine Spills Response Capability hit the nail right on the head when they reported '. . . the chances of polluters being caught are small, of being caught and prosecuted even smaller. If polluters are prosecuted, the chances of being found guilty are minuscule and, if found guilty, fines are paltry.' Obviously, Australian authorities responsible for oil pollution need to seriously, imaginatively and energetically explore ways of improving surveillance and enforcement if they are serious about protecting the Great Barrier Reef from these low-level but ongoing, insidious and chronic, intentional discharges.

COOPERATIVE RESEARCH CENTRE for the ECOLOGICALLY SUSTAINABLE DEVELOPMENT of the GREAT BARRIER REEF

Professor Chris Crossland

The Centre was established on 1 July 1993 as part of the Commonwealth Cooperative Research Centre Program, being an unincorporated joint venture between the Australian Institute of Marine Science (AIMS), the Association of Marine Park Tourism Operators (AMPTO), the Great Barrier Reef Marine Park Authority (GBRMPA), the James Cook University of North Queensland (JCU) and the Department of Primary Industries, Queensland (DPI). The Centre is located at James Cook University in Townsville.

The National CRC Program is a recent initiative of the Australian Commonwealth Government and brings together key industries and scientific institutes to carry out research and development, training and extension activities which will benefit Australia. Some 52 CRC's have been established under the Program since May 1990.

This CRC - known as 'CRC: Reef Research Centre' - is undertaking an integrated program of applied research and development, training and extension, aimed at

enhancing the viability of and expanding sustainable Reef-based industries and economic activity, with particular emphasis on tourism, and providing an improved scientific basis for Reef management and regulatory decision making.

The Centre is managed by a Board chaired by Sir Sydney Williams and comprised of 6 representatives of industry - AMPTO (4), Queensland Commercial Fisherman's Organisation (1) and Queensland Sport and Recreational Fishing Council (1) - and 1 representative each from the Australian Institute of Marine Science, the Department of Primary Industries, the Great Barrier Reef Marine Park Authority and the James Cook University.

To achieve its goals, the Centre has developed three research programs, an education program and an extension program. The research programs include:

A Regional environmental status of the Reef; looking at the 'health' of the Reef through further studies of physics and chemistry of waters, sediments and nutrients and their effects on organisms.

To ensure the ecologically sustainable development of the Great Barrier Reef region, it is essential that enhanced sustainable user benefits and improved management policies and practices are based on an integrated framework of scientific knowledge which is powerful, predictive and accessible. This program seeks to develop such a framework through new research and through links with a considerable body of ongoing related basic research activities being carried out by other research agencies and institutions. While some of those research activities are related to ecologically sustainable development, there is a general lack of security for long-term financial support, cohesive integration and focus for addressing pertinent strategic issues, particularly at the regional scale.

The Program is designed to address the broader strategic questions of the current and likely future status of the Great Barrier Reef (including long-term monitoring), the coastal environment, and the stress and damage regimes applying. The strategy is to develop systems models, and to collate and extend information about the Great Barrier Reef ecosystem at a regional scale, recognising the particular need to know and understand: the location, rates and character of inputs into, and impacts upon the Great Barrier Reef; the relative degrees of dispersal and immobilisation of input materials (including biological material) through hydrodynamic, biological, sedimentary and geochemical processes; and the response of living systems to individual and cumulative impacts, and their removal or mitigation.

Activities include:

Biological Oceanography;
Long-Term Monitoring;
Cyclone Hind Casting;
Regional Circulation Models;
Circulation and Fish Dispersal;
Sediment Accumulation and Dynamics;
History of Sediment Accumulation;
Bio-markers - Corals and Clams;
Living Systems Response (Coral Reefs and Seagrasses);
and
Systems Models.

B Operations; which involve tactical research solving problems associated with the use of reef resources and addressing social issues, tourist activities and needs.

The Great Barrier Reef Marine Park is managed as a multi user environment. It is a major destination for tourists and regional residents which places increasing demands

on access and use while contributing to the economic development and opportunity of the region. The ecologically and socially sustainable levels of tourism, recreational use and reef fishing are examples of the issues that both managers and the tourist industry continue to address while ensuring that development and use of the region is optimised within the global responsibilities for stewardship of the Marine Park.

The Operations Program involves tactical scientific research addressing questions which will provide management agencies and user groups with fundamental operational knowledge to maximise opportunities for use of the Great Barrier Reef region within a framework of ecologically sustainable development. To gain this knowledge, sociological research will be conducted on aspects of the environment which are valued by users, together with ecological research on biota of interest to users such as corals, fish, island vegetation and seabirds.

In dealing with tactical issues, the program will work closely with industry to find positive solutions to problems associated with the increasing use of the Great Barrier Reef Marine Park at scales relevant to tourist operators and recreational fisherfolk. Cost-effective and sensitive techniques need to be developed to monitor changes in ecological communities of significance to visitors and in visitor behaviour and experience. Knowledge is needed about the key elements of Great Barrier Reef Marine Park settings which are important to tourists and other recreational users.

The enhanced economic viability of the tourist industry requires sociological techniques to monitor the destination image of the Great Barrier Reef and ecological techniques to rehabilitate reef sites damaged by cyclones and crown-of-thorns starfish.

Activities include:

Review of Environmental Impact Monitoring of Pontoons;

Review of Visitor Use Patterns;

An Annotated Bibliography of Monitoring Programs in the GBRMPA;

Development of Preliminary Social Impact Assessment Guidelines for the GBRMPA;

Effect of Anchoring and Diving Activities on Reef Benthos;

Spatial Allocation of Resource Use on the GBR;

Impact of Pontoons on Fish Assemblages on the GBR;

Socially and Ecologically Acceptable Levels of Use;

Evaluation of Time-lapse Video Techniques to Monitor Site Use in the GBRMP;

Analysis of GBR Visitors: their Attitudes;

Motivations, Socio-demographic Profiles and Activity Preferences;

Ecotourism: Developing Quality Tourism in the Special Interest Tourism Sector in the GBR;

Evaluation and Design of GBR Interpretation;

Restoration of Coral Reef Habitats: Pilot Study;

Evaluation of Methods for Effective Sampling of Reef Fish Populations;

Reproductive Strategies of the Common Coral Trout on the Northern GBR;

Monitoring the Replenishment of Coral Trout Populations in the Cairns Section of the GBRMP;

Long-term Studies of Size, Age and Sex Structure of Coral Trout Populations on Coral reefs Closed and Open to Fishing in the Central GBR;

Use of Otolith Weight for Age Determination of Fish Populations;

Design of Experimental Investigations of the Effects of Line and Spear Fishing on the GBR;

Review of the Information Needs from Recreational Fishing and Boating Activities and the Design of Sampling Strategies to Collect Appropriate Data;

and

Effects of Zoning Changes on the Fish Populations of Unexploited Reefs: Monitoring by Commercial Handline Fishers.

C Engineering research; aimed at better information and guidelines for structures on the reef and infrastructural developments in reefal environments.

In considering the sustainable development of the Great Barrier Reef and the needs of users and managers, five key categories of engineering research and development can be recognised as needing urgent attention. *Hydrodynamic design* inputs are difficult to determine accurately. The *geotechnical properties* of coral reef areas are complex and research is needed to improve anchoring systems and to predict reliably the stability of structure foundations on reef flats. *Structural designs* must provide for the safety and comfort of tourists and resist severe cyclonic conditions. *Construction techniques* such as marina excavation and de-watering, dredging and disposal of dredge spoils must account for the proximity of coral reefs. *Facilities* are isolated from mainland systems and require special techniques and infrastructure for water, power, sewage treatment and solid waste handling.

The program addresses questions of site limitation such as vulnerability to excessive storm and surge exposure and suitability for secure mooring systems for large, semi-permanent infrastructure. There is also research to address matters of groundwater management on islands. Engineering guidelines will be produced to help industry and managers to maximise sustainable use of the region while minimising environmental impacts. A wide range of engineering design issues will be addressed through a series of prestigious postgraduate research scholarships.

Activities include:

Evaluation of Cyclone Waves and Water Levels in the Great Barrier Reef;

Water Resources and Environmental Pollution;

Engineering Guidelines: Design, Construction and Operation;

and

Engineering Design for the GBR.

The education program will provide for a maximum of 23 postgraduate students per year within the three research programs, establish a teaching program within the CRC and promote the goals of the CRC through education.

A detailed strategic plan is being developed for the extension program.

The research activities are integrated and, fundamental to the Centre's operation, are all issues-driven with the tasks directly addressing issues and problems identified by industry users (especially tourism) and environmental managers of the Great Barrier Reef. Research activities interlink and involve researchers, managers and industry personnel. Major efforts are being made to ensure that research outputs are comprehensible and of direct value to the user.

Like other CRCs, the Centre activities are funded by all parties, plus Commonwealth funding over 7 years in the first instance. The Centre budget totals $45 million over 7 years; $13 million from the Commonwealth and about $6.5 million from industry, of which $6 million is expected to be provided through the environmental management charge on tourists using the Great Barrier Reef. The remainder of the budget is made up of $5 million from some of the parties and $21million 'in kind' from all parties.

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