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REEF ENCOUNTER

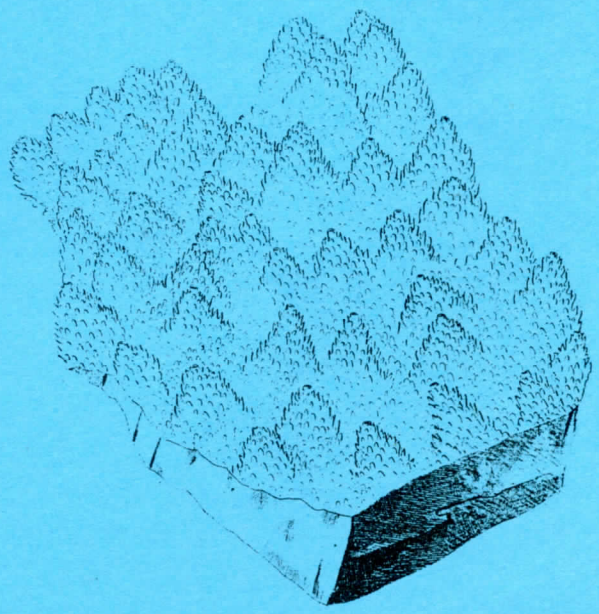
Newsletter of the International Society for Reef Studies

Number 9

July 1991

Leptoseris fragilis Edwards & Haime, 1849

Robust or Fragile Reefs ?



Acropora robusta (Dana,1846)

REEF ENCOUNTER No. 9 July 1991

NEWSLETTER OF THE INTERNATIONAL SOCIETY FOR REEF STUDIES

Edited by Sue Wells and Callum Roberts

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The **International Society for Reef Studies** was founded at a meeting in Churchill College, Cambridge, UK in December 1980.

Its aim under the constitution is to "promote for the benefit of the public, the production and dissemination of scientific knowledge and understanding concerning coral reefs, both living and fossil."

In order to achieve its aim, the Society has the following powers:

i. To hold meetings, symposia, conferences and other gatherings to disseminate this scientific knowledge and understanding of coral reefs, both living and fossil.

ii. To print, publish and sell, lend and distribute any papers, treatise or communications relating to coral reefs, living and fossil, and any Reports of the Proceedings or the Accounts of the Society.

iii To raise funds and invite and receive contributions from any persons whatsoever by way of subscription, donation or otherwise providing that the Society shall not undertake any permanent trading activities in raising funds for its primary objects.

The Society collaborates with Springer-Verlag in producing the quarterly journal *Coral Reefs*. This large-format journal is issued free of charge to all members of the Society, and concentrates on quantitative and theoretical reef studies, including experimental and laboratory work and modelling.

Membership

The annual subscription for membership of ISRS is currently US$60 or £35 sterling. Spouse membership is US$70 or £41 sterling. Under the constitution, subscriptions are due by January 31st each year. Members receive the journal *Coral Reefs*, the newsletter *Reef Encounter*, abstracts of papers of Annual Meetings and other periodic mailings.

Student membership costs US$10 or £6 sterling and benefits include all of the above except the journal *Coral Reefs*.

Institutional subscriptions to *Coral Reefs* must be placed directly with Springer-Verlag.

Subscriptions to the Society should be addressed to the Treasurer (address given above).

EDITORIAL

The coral reef session at the Pacific Science Congress in Honolulu in May/June resulted in some constructive discussion on long-term monitoring of reefs. In the next issue of *Reef Encounter* we would therefore like to briefly review some of the monitoring projects underway or being developed. We hope to have information on CARICOMP, the proposed PACICOMP, the ASEAN project, a proposal outlined by Bernard Salvat for a network of marine laboratories carrying out monitoring work, and some of the projects that use or intend to use amateur divers. If you are involved in any such programmes, or have strong feelings about methodology, parameters to be measured, use of amateurs etc., please get in touch or send in a brief contribution. We will stick fairly rigidly to the deadline of 1st October, with the intention of having the next issue available for the ISRS meeting in Berkeley in December.

Thank you all very much for your contributions for this issue, which is hopefully getting closer to the ideal of a newsletter as a vehicle for debate. And thank you again to Margaret Roberts for the cartoons and Brian Rosen for additional entertaining material.

Sue Wells

DEADLINE FOR THE NEXT ISSUE OF *REEF ENCOUNTER* IS OCTOBER 1ST 1991.

Cartoon by Margaret Roberts

We must increase our membership. Please persuade your friends and colleagues to join.

Reef Encounter could print the names of reef scientists who are *not* ISRS members. We might start with eminent figures, move on to those aspiring to eminence, and so on - no one would be spared. Tell your colleagues to take action now, to avoid this ultimate embarrassment!!

ISRS COMMENT

From the President:

Peter Sale

This is being drafted in Honolulu, while I await my flight home. The Pacific Science Congress (27 May - 1 June) included two very busy days for those of us interested in coral reefs (report in next issue of *Reef Encounter*), and provided a good opportunity for an ISRS Council meeting. We focused on several topics that I have mentioned before in *Reef Encounter*: membership, our financial resources, communication and the relationship of ISRS with the quadrennial international coral reef symposia.

Membership and Finance

ISRS membership remains static at just over 300 full members, with gains of new members only just balancing losses. We also have about 25 student members. Clearly, membership needs to have more value if we are to grow. By growing, we could slightly reduce the per member cost of this newsletter and *Coral Reefs* and thus strengthen our financial position. The value of membership will get a boost next year as ISRS members will be offered a reduced membership fee for the Guam conference. Registration for our own December '91 Conference in Berkeley is also lower for members. We must all encourage our friends to join. To this end, I have supplied all Council members with up-to-date membership lists.

More Effective Communication

At present, our Constitution requires an annual meeting at which election results are announced, financial accounts approved and so on. As an international organization, we cannot expect to all gather annually for a small meeting. At the Council meeting, two alternative futures were discussed. The first is a more federal structure with European, North American and Australasian subgroups. Each subgroup would operate independently, with annual meetings and elections and would provide representatives to the full society council. The second is to eliminate our constitutional need for meetings, to concentrate on mail communication, and to meet only in conjunction with the quadrennial symposia.

There is a middle way: to encourage, but not require, regional meetings, while ensuring that society business is done primarily in the pages of *Reef Encounter*. Several of us see the merit in having as simple a structure as possible. We need to discuss these proposals further, with the aim of reaching decisions in December. I welcome your input.

ISRS and the Quadrennial Symposia

At present, ISRS has no official responsibility for the organization of the international coral reef symposium every four years. Yet, as the only democratically-constituted international association of coral reef scientists, we should have a major responsibility to ensure the continuation of these meetings into the future. The current process, in which IABO appoints a new chairman, who creates a new IABO Coral Reef Committee, which then organizes a conference, totally lacks continuity. At the end of the conference, the IABO Coral Reef Committee is dissolved after recommending a new chairman. That it has worked satisfactorily seven times is no guarantee for the future.

Of course, many ISRS Council members are members of the IABO Committee, and others have been members of some or all of the previous IABO Committees. There is therefore considerable support within the Council for formalizing ISRS involvement. At present, there may be advantages in retaining the link to IABO, but I am exploring with Council the merit in having the ISRS Council responsible for nominating a proportion of IABO members. Again, your views and comments are welcome. My own view is that, in the long term, ISRS should select locations and assist the local organizing committee as necessary in planning and running each international symposium.

The above words may seem irrelevant to some of you. But I believe ISRS needs the quadrennial conferences as much as they may need it. I also believe that we need structures that will last past the current generation of reef scientists. And finally, I believe we should get these matters of membership and structure settled so that we can get on with the real job of learning about, managing and protecting coral reefs. The sooner, the better.

JOTTINGS FROM THE TREASURER

Would any members of the Society receiving multiple copies of any part of a volume of *Coral Reefs* please notify me A.S.A.P. and if possible keep the mailing wrappers with address attached. I am trying to minimise costs and it appears that some members are receiving 2 copies of every part and the Society is being charged double.

Secondly, when you move please notify the Treasurer a.s.a.p. so that parts of the volume do not go astray, for again the Society has to pay for replacement copies.

If members do find that they have not received parts of a volume please DO NOT wait 2-3 years to notify the Treasurer that you are missing parts.

Finally, as the job of Treasurer is an honorary position, it would be very helpful if dues were paid when you receive the first announcement. Recently I had to mail out over 180 reminders to members who had failed to take notice of the first call for dues. Not only is this a waste of time but is a waste of the Society's funds in terms of postage and loss of interest on our bank account.

Currently your membership fees barely cover the cost of the journal *Coral Reefs* and the newsletter, and many institutions are picking up the cost of Society mailings. Springer-Verlag has indicated that they wish to increase the price of *Coral Reefs* for Volume 11 so it looks as if we shall have to increase the dues yet again, but this will have to be voted on at the AGM in December 1991. However, late payment of dues is not helping our financially struggling Society so please pay your dues on time in future.

Pat Hutchings, The Australian Museum, P.O. Box A285, Sydney South, NSW, Australia 2000.

THE COMPLEAT REEF ENCOUNTER No. 9

"[For Arabian fishermen] there are below the waters charming genii who are eager to marry human beings, though to be sure, only when the latter have mortified themselves for months previously with unsalted bread and water, so as to give their flesh and blood a half-ethereal character.

The naturalist, however, cannot allow himself to be allured ....."

From: *Upper Egypt: Its People and Products* by C.B. Klunzinger, 1878. Blackie and Sons, Glasgow.

"... The Donohoes were married underwater last month because they wanted something different. .... 'They did just great,' said Lee, the Public Notary who officiated at the wedding. 'Some people write their own vows. People hire glass-bottomed boats to watch the service from above. .... I've had brides who have forgotten to wear waterproof make-up which tends to make the reef more colourful than usual! One turned up in full bridal outfit complete with weights sewn into the train but she got snagged up on the reef and we had to cut her free. It's the only wedding service in the world which I know of that insists that the groom and vicar have six-inch knives strapped to their legs. I even had a wooden organ down there and have been bitten in mid-service by a sergeant major. That's a fish. Not a marine.' Anything is, of course, possible in Florida. ...."

From: 'Do you take this frogman .....?' by K. Pilley, *The Weekend Guardian*, 4-5 May, 1991.

ISRS NEWS

1991 ANNUAL MEETING OF ISRS

Reefs Beyond the Golden Gate

The meeting will take place at the Berkeley Marina Marriott Hotel, Berkeley, California, from Friday 13 December to Monday 16 December, following the meeting of the American Geophysical Union. There will be a social event on Friday evening, following registration, and the scientific sessions will take place on Saturday and Sunday. There will be several thematic sessions, topics still under discussion. Deadline for receipt of abstracts is October 1st. The ISRS Annual General Meeting will be held on Sunday before the closing banquet.

Registration fees for ISRS members are $75 before September 1st, $85 after this date; and for non-members $110 before September 1st, $120 after this date. Please come and take part, and register as soon as possible.

Further details from: *ISRS Office, Dept Geography, University of California at Berkeley, Berkeley, California 94720, USA. Fax: 415-642-3370*

NEW ISRS T-SHIRTS

ISRS has a new 'official' T-shirt, printed in the mid-Pacific, with the society logo on the sleeve and *Chaetodon reticulatus*, an obligate corallivore, feeding on *Pocillopora meandrina* on the front. Available in grey, green or blue, in all adult sizes at US$17.50 including postage, or US$15.00 at the Berkeley Annual Meeting.

Place orders with: *Peter Sale, Dept Zoology, Univ. New Hampshire, Durham NH 03824, USA.*

CURRENTS

THE DEBATE CONTINUES – ROBUST VERSUS FRAGILE REEFS

The issue of whether or not reefs are 'deteriorating worldwide' or undergoing 'natural, fluctuating changes' has become a hot topic. In fact, the gap between the two sides narrows markedly as soon as one gets down to discussing what needs to be done to resolve the problem. Terry Done has sent the following contribution:

Those of us lucky enough to be at the 6th International Coral Reef Symposium in Townsville will surely remember being entertained by the plenary addresses of Peter Davies and Peter Sale. I was so impressed that when I was asked to give a plenary address on coral reefs at the 1990 International Symposium on the Ecology of Mangroves and Related Ecosystems in Mombasa, I looked to these two for inspiration. One of my colleagues read the draft of the address, soon to be published in *Hydrobiologia*, and was appalled that I seemed to be less enchanted with Peter Davies' published word than I was with the spoken word. "Poor Peter Davies" he said. And so, being a gentle soul, I returned to the word processor and barely gave Peter's paper a passing mention. But now I've decided that Peter was stirring, and would be happy if his comments drew some response. So I resurrected the penultimate draft of the *Hydrobiologia* paper, and include some bits of the Introduction and Discussion as a contribution to *Reef Encounter*.

Here are some extracts from this draft, on the issue of reef degradation. He begins .....

Coral reefs are frequently described as oases of high diversity and productivity in oceanic deserts; builders of their own habitat; objects of great beauty. However many of today's reefs do not fit these stereotypes, though they clearly have in the recent past. Degradation of coral reefs is the single most important issue confronting coral reef scientists and managers today. In this presentation, I discuss what degradation means in ecological and geological terms. I looked for inspiration to the plenary addresses given by the ecologist Peter F. Sale and the geologist Peter J. Davies at the 6th International Coral Reef Symposium held in Australia in 1988. Sale provided a historical sketch of the advances in ecological understanding of coral reefs. His reminiscences of how he and his colleagues recognised and discarded inappropriate ecological models and built new ones are an object lesson for all reef scientists.

Davies made a plea to coral reef scientists to adopt a multi-disciplinary applied approach to the study of coral reefs, and he will be gratified that the organisers of this symposium on mangroves and related ecosystems have adopted a similar position. He also made two statements that I quote *verbatim*:

> "With few exceptions, reef biologists focus on the diversity and processes operating on 'today's reef'. In most cases they are either unable or reluctant to come to terms with the concept of time in reef studies and I believe that this is leading to very dangerous, far reaching and incorrect assertions."

Despite the fact that I, as a biologist, can agree with some of the sentiments of this passage, I would maintain that the study of processes operating on 'today's reef', a structure built by biological processes, are fundamental to an in depth geological understanding of the coral reef phenomenon. As to the 'dangerous, far reaching and incorrect assertions', first he accuses 'many biologists' of adopting a particularly sentimental view of reefs in order to prop up their research programs; second, he makes one of his own. Referring to the Great Barrier Reef, he claims:

> "Its uniqueness is more logically related to its robustness and its ability *always* to regenerate after catastrophes " (my italics).

This statement is particularly dangerous, far reaching and incorrect if applied to individual reefs. Unfortunately, it is an attitude which is prevalent in coral reef environmental work in Australia. It is true that coral reefs around the world have developed as and where they are, not despite, but because of, what Davies refers to as catastrophes: i.e. continental drift, subsidence and sea-level change. It is impossible not to be impressed with these facts, and hard even for a biologist to believe that there will not still be coral reefs forever after, despite anything humankind may do to tropical seas. However, it is also hard not to wonder about the quality and amenity of the totality of reefs which today share the planet with an exponentially growing human population. Do we dismiss the monotonously regular reports in refereed ecological literature of yet another degraded reef as simply the result of more people looking at more reefs over a longer time period? The literature (e.g. Brown, 1987; Salvat, 1987) leaves no doubt that the answer to that is 'no'. Causes of reef degradation come from a long list which includes both episodic disturbances of short duration (e.g. storms, outbreaks of coral predators, brief exposure to toxic pollutants, siltation caused by dredging) and chronic disturbances of long duration, frequently anthropogenic. Hatcher *et al.* (1989) reviewed anthropogenic effects on coral reefs under nine categories: sedimentation, sewage pollution, thermal pollution, radioactive pollution, hydrodynamic influences, physical disturbance, extractive activities, introductions, tourism.

Before we make the *non-sequitur* – 'reefs (in general) have regenerated from much worse before, therefore this one (in particular) will again', let's try to understand the ecological manifestations of degradation, and the processes affecting the reef's subsequent ecological trajectory. The time scales we need to consider – years to decades and centuries – are long in terms of individual research careers, but crucial in the context of a reef's ability to maintain it's structural and biological integrity over geological time scales.

Terry's paper then goes on to review some examples of shifts from coral to algal dominance, and the poorly understood influences of nutrients, grazers, small-scale oceanography, chance recruitment events, coral population dynamics and overfishing in determining coral/algal structure and dynamics on coral reefs. He concludes:

The issues of reef degradation and recovery are complex and poorly understood. The few examples in this presentation indicate just some of the variety of ecological manifestations of disturbance, and factors affecting recovery.

It is commonly true that while the symptoms of widespread coral death and algal invasion are clear, the causes are frequently more a matter for conjecture than direct observation. Even where a cause is definitely identified – say overfishing, siltation caused by dredging or land clearance, sewage pollution, toxic wastes – it is not always in a country's best *immediate* economic interests to prevent that impact (*cf* Hodgson and Dixon, 1988). This statement is true for wealthy and poor countries alike. For example, the costs of treating or diverting sewage may be greater than the benefits of protecting a reef from degradation.

A scientist offering advice to a government on the best course of action in relation to coral reef management walks a precarious path. Knowledge of general reef character, history, structure and processes – as can be gleaned from personal experience and from the literature – is just the beginning. The uncertainties associated with interpreting what has happened to a specific reef in the past, and predicting how it will behave in the future, must also be confronted. On the time and space scales relevant to coral reef management, it is not appropriate to make decisions based on a presumption that a specific reef or system of reefs has 'ability *always* to regenerate after catastrophes' (Davies, 1988) – the 'she'll be right, mate' *dictum*. Neither is it correct to assume that a degraded reef will remain so forever, or that those reefs which do regenerate will do so in time scales which are convenient to human users of the reef.

This presentation has touched lightly on the many issues – physical, chemical and biological – which must be addressed in trying to understand the causes and consequences of coral to algal phase shifts in coral reefs. Clearly, a multidisciplinary approach is desirable for in-depth understanding of all complex natural systems. The initiatives of Unesco-COMARAF in creating 'The Regional Project for Training and Research on African Coastal Systems', and the University of Nairobi in organizing this Symposium are both welcome and timely.

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Terry Done, AIMS, PMB 3 Townsville, Qld 4810, Australia.

We are sorry that we have not had time to organise a response from Peter Davies in this issue. However, Rick Grigg has sent a further contribution on this subject (see also *Reef Encounter* 5).

In the current scientific literature on coral reefs, a controversy exists over the question of whether coral reefs are *fragile* ecosystems undergoing a worldwide decline due to increased human interference, or whether they are not more appropriately considered robust ecosystems remarkably resilient in the face of both natural and man-induced disturbance. In my view, this polarization in thinking is unfortunate. This should not be a question on which coral scientists take sides and proceed to gather data and defend respective views, but rather, the charge should be to go out and collect information that allows one to separate natural impacts from those which are man-induced and to compare the scale and magnitude of one with the other. Only then can we begin to place impacts due to man in a larger perspective.

In a review on this subject that recently appeared in the new book on reefs edited by Dubinsky (see p. 17), Steve Dollar and I argue for a balanced approach to the problem. In our view, we consider coral reefs over the short term to be rather fragile with respect to both natural and man-induced impact. However, given 'time and tide', we recognise that coral reefs do recover from both small and large perturbations alike and in this sense they can be considered robust ecosystems. Most humankind, if not most coral reef scientists, often view coral reefs relative to their own longevity, but if these same scientists were to place coral reefs in a larger context of space and time, they too might consider coral ecosystems to be robust. In other words, both schools of thought are needed. The 'fragilists' may well contribute the most to saving coral reefs in our lifetime, while the 'robustards' may be successful in best elucidating an evolutionary view of coral reef ecology.

Rick Grigg, Dept Oceanography, University of Hawaii at Manoa, 1000 Pope Road, Honolulu, Hawaii 96822, USA.

From an idea in Punch

UPWELLINGS

REEF ENCOUNTER BY E-MAIL

We have received two letters raising the question of how to speed up communication between reef scientists, given the widespread availability of electronic information networks. Bob Buddemeier raises the issues:

Peter Sale's remarks and editorials in the last two issues of *Reef Encounter* (Nos 7 and 8) have had much to say about communication, particularly in the context of the rapidly-moving world of global change. I'd like to reiterate a point I tried to make in my foray into the world of newsletters – mailed and published correspondence is becoming archaic, especially in dealing with rapidly developing situations. All of the organizational correspondence and about half of the participant contacts for the 'Coral Reef Ecosystems and Global Change' workshop (see p. 10) are being handled by electronic mail over the OMNET network. OMNET subscribers include a substantial fraction of the US marine and atmospheric science community, many agencies and institutions, and exotic remote subscribers such as AIMS, ORSTOM and the University of New Hampshire. Interestingly, it is the mainline coral reef biologists and geologists who are least likely to be found on e-mail networks – climate studies, oceanography and geochemistry are well represented.

This leads me to suggest that coral reef research has gone in the space of about two decades from a truly forward-looking interdisciplinary area to a rather parochial backwater. Peter asked in *Reef Encounter* 7 why coral

reefs were being left behind in the current environmental debate. I submit a two-part answer: first, that there are relatively few people in the field who are providing synthesis and conceptual leadership of the sort that can effectively relate reef studies to larger issues and other disciplines, and second that those who are or could be doing so are hampered by lack of internal communication (to sharpen their ideas and build momentum) and external communication (to convince and recruit people from outside the narrowly defined 'reef community') – their successes are seen as individual achievements, not as part of a larger relevance of reef-related studies.

What would happen if ISRS devoted a significant fraction of its present postage and travel budget to ensuring that there was at least one e-mail node in every country or geographic area with significant membership, plus a Coral Reefs (or think big – Tropical Marine Systems) electronic bulletin board? The bulletin board could serve not only the membership, but also as an information and recruiting tool for anyone who could be enticed to browse – arguably a much more effective means of scientific bootstrapping than making prettier T-shirts or relying on a too-small membership to twist the arms of colleagues in that ever-diminishing group of associates who have not already not decided to join ISRS. Let's think big, or at least think.

Bob Buddemeier, Kansas Geological Survey, 1930 Constant Ave – Campus West, The University of Kansas, Lawrence, KS 66047, USA.

Walt Jaap has written to describe the OMNET system:

We felt it would be beneficial to those studying coral reefs to have an exclusive network to foster rapid communication and used OMNET, a service-oriented electronic information network, to establish a bulletin board with the address 'CORAL.REEF'. This is open to all Science Net users for posting and reading information. The Florida Marine Research Institute, St Petersburg, will pay for its maintenance. We set up the board to hold postings for 90 days, after which they are purged by OMNET. We recommend that you set up your electronic mailbox to receive automatic notice of new postings to the CORAL.REEF bulletin board. OMNET currently has subscribers in 30 countries and has the potential to reach 44 more; new countries are added each year. It may never be possible to reach Bangladesh, but Fiji and Tahiti are as close as a modem. If you do not have access to electronic mail, the cost of subscribing in the USA is $75.00 for the first mailbox. People on BITNET and INTERNET electronics networks can communicate to OMNET with the proper protocol.

We hope the bulletin board will be a beneficial tool for exchanging information, making colleagues aware of episodic or complex phenomena, mass mortalities, and coral bleaching events, and for announcing meetings and symposia, sharing environmental data, job openings, etc. Please make your coral reef colleagues aware that the CORAL.REEF bulletin board is a modem away and that we encourage all researchers studying coral reefs to participate.

Walter C. Jaap, Florida Marine Research Institute, Division of Marine Resources, Florida Dept of Natural Resources, 100 Eighth Avenue S.E., St Petersburg, Florida 33701-5095, USA.

Walt sent print-outs of some of the communications on the bulletin board and there is no doubt that the system is efficient. He also suggested putting *Reef Encounter* copy on the bulletin board. This would obviously be a good way of disseminating the information in the newsletter, but ISRS would suffer financially as there would be even less incentive to join the Society if *Reef Encounter* is available free through OMNET. Obviously, we need to move into the 1990s along with all those like Bob and Walt who are already there, but many of us, for reasons beyond our control are still stuck in the Dark Ages and for the foreseeable future will have to depend on the printed word. It is also worth noting that money spent by ISRS on postage and travel is a comparatively small amount, and much of it is for activities that could not be covered by a coral reef bulletin board. Further comments welcome!

NEWS

THE GULF WAR AND THE GULF REEFS

The Gulf War was notable for many things, not the least the unprecedented amount of attention that the media bestowed on the potential impact of the conflict on the environment, and of course the use of oil spills and burning wells as 'weapons'. The conservation movement itself did not come out entirely blameless; several environmental organisations took advantage of the publicity opportunities, and wild and unsubstantiated facts and predictions circulated for weeks.

Now that media interest has died down, there is an opportunity for some saner thought, and some attempt can be made to find out exactly what has happened. In fact, as far as the reefs are concerned, hard facts are remarkably hard to come by (mines still abound, making access to many areas impossible). ROPME, the Gulf's Regional Organisation for Protection of the Marine Environment, estimates that a total of 7-8 million barrels of oil were discharged in the course of the various spills. By June, the oil spill had stabilised to the north-west of Abu 'Ali on the Saudi Arabian coast (WCMC, 1991). The general consensus is that 50-60% of the Saudi Arabian coastline and the north-west coasts of Bahrain and Qatar have been badly oiled. Beaches on the offshore Saudi Arabian islands were also badly affected but it seems that the reefs have not been seriously affected. The situation with the Kuwaiti reefs is still unknown. Major clean-up operations are underway in Saudi Arabia and large quantities of oil have been removed.

Of equal concern is the extent to which smoke from the burning oil wells in Kuwait will lower temperatures. According to WCMC (1991), water temperatures of the inner Gulf are already 1-2°C cooler than average. Recent theoretical predictions (Browning *et al.*, 1991; Bakan *et al.*, 1991) supported by ground observations, suggest that daily maximum air temperatures will be depressed by some 10°C over an area within 200 km of Kuwait, including the eastern seaboard of the Gulf, the region where most of the reefs lie, and by about 4°C throughout the whole Gulf. Coles and Fadlallah (1990) have recently shown that Gulf corals are subjected under natural circumstances to even greater extremes of temperature than was previously thought. The additional cooling could therefore have serious consequences for coral survival, particularly since this is expected to be relatively long-term. Reduced light levels and heavy inputs of hydrocarbons and toxins produced by burning oil, coupled with the lower water temperatures, are likely to further stress Gulf marine life.

A UN Interagency Action Plan has been set up to assess the situation and advise on management, with the involvement of organisations such as IUCN – The World Conservation Union, the World Wide Fund for Nature (WWF), the Intergovernmental Oceanographic Commission (IOC), and the International Atomic Energy Authority (IAEA). The focus and secretariat for this will be ROPME in Kuwait. IUCN is developing a project to re-survey some 50 coastal and island sites originally surveyed in 1986 (IUCN, 1987; Price, 1990) and will be monitoring fishery catch statistics to see if the oil has an impact on this industry. Several research institutes will be involved in reef work. The Research Institute of King Fahd University of Petroleum and Minerals in Dhahran is extending its research programme on reef stress to cover responses of Gulf ecosystems to the impacts of the war. The marine laboratory of the University of Nice is developing a research proposal, with the aim of looking at the ability of Gulf corals to withstand various stresses.

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For further information on current activities in relation to coastal resources in the Gulf contact: *Dr Andrew Price or Dr Charles Sheppard, Centre for Tropical Coastal Management Studies, Dept Biology, The University, Newcastle upon Tyne NE1 7RU, UK.*

Copies of the briefing documents produced by the World Conservation Monitoring Centre are available from: *Jo Taylor, Information Officer, World Conservation Monitoring Centre, 219c Huntingdon Rd, Cambridge CB3 ODL, Fax: 0223 277136.*

Marine biologists and oceanographers are needed for two-year, one-year and 3-6 month contracts to assist with the work of the Research Institute of King Fahd University of Petroleum and Minerals. For further information contact: *Dr Abdallah E. Dabbagh, Director, Research Institute, King Fahd University of Petroleum and Minerals, Dahran, Saudi Arabia.*

A Noah's Ark Won't Save The Persian Gulf Reefs

By David J. Fishman

IN LATE JANUARY, I tuned in to CNN to catch the latest installment of "War in the Gulf." I watched as Dr. Abdul Aziz Abu Zinada, secretary general of the Saudi National Commission for Wildlife Conservation and Development, explained what his government was doing to protect the Persian Gulf from the largest oil spill in history.

As a journalist covering the marine environment, I was especially curious to hear about the delicate ribbon of coral reef that hugs many of the tiny islands in the northern gulf and fringes its vast western shore.

'Coral reefs are the gulf's most biologically diverse habitat, bestowing food and shelter.'

To my astonishment, Zinada explained that his agency was considering moving the coral reefs 750 miles west to the Red Sea for safe keeping. He explained that the process would be relatively simple; the reefs could be transported in airplanes. Bewildered, I waited for one of the reporters packed into the briefing room to grill Zinada about his wild scheme. But incredibly, none did.

Can you imagine if when fire swept through Yellowstone National Park, the Park Service had announced, "Some trees are on fire, so we're going to move the rest of the forest to California," and the press just nodded and took notes? For those familiar with the grandeur of a coral reef, the Saudi briefing scene was no less stupifying.

Perhaps the reporters covering the briefing could be forgiven for their oversight. After all, these were political and military correspondents. We couldn't expect them to know that hundreds of miles of coral reef weighing millions, if not billions, of tons flourish in the Persian Gulf's shallow waters, or that coral reefs are the gulf's most biologically diverse habitat, bestowing food and shelter to hundreds of species of plants and animals and supporting a fishery that feeds thousands. The reporters' beats require knowledge of Scuds and sorties, not sponges and sea turtles.

If the reporters were curious enough to check the viability of the Saudi scheme with coral reef researchers, however, they would have discovered that the plan is neither technologically feasible nor biologically desirable. They would have learned that researchers have successfully transplanted only small, isolated coral heads — never an entire reef community with its tangled layers of distinct species.

David J. Fishman is a science and nature writer based in New York.

Extract from an article in Newsday (Long Island), 20 February 1991

Cartoon by Geoff Thompson in The Independent Magazine, 13 April 1991

"Apparently this slick isn't as bad as we first thought"

GLOBAL CHANGE

A workshop on Coral Reef Ecosystems and Global Change was held in June as a scientific community activity with joint support by the National Science Foundation, National Oceanic and Atmospheric Administration and the Environmental Protection Agency for three reasons: to examine recent evidence about the phenomenon of coral bleaching, to understand and predict the responses of coral reefs to global climate change, and to suggest priorities for future research needs in these agencies for long-range planning. Participation was by invitation, owing to limited space, funding and the need to have representation from a wide variety of disciplines.

The goal of the workshop was to produce a working document that assesses our state of knowledge about the phenomenon of coral bleaching and the sensitivity of coral reef systems to environmental change. The report(s) produced by the workshop will be published and distributed so as to achieve the widest possible circulation in the scientific community.

The workshop organisers were Christopher F. D'Elia, University of Maryland, Robert W. Buddemeier, Kansas Geological Survey, and Stephen V. Smith, University of Hawaii. The Federal co-ordinator was Phillip R. Taylor, National Science Foundation.

The results of the workshop will be summarised in the next issue of *Reef Encounter*.

STOP PRESS!! Bleaching in Thailand and Tahiti

In Thailand, bleaching has been observed on reefs throughout a recently surveyed 3600 km² area of the Andaman Sea, and has also been reported from the Gulf of Thailand. Around Phuket, at least 50% of the reef front has been bleached, from the reef flat to a depth of 8 m. Sea water temperatures in this area have been 2°C higher than normal since December.

Further information from: *Dr Hansa Chansang, Phuket Marine Biological Centre, Dept of Fisheries, P O Box 60, Phuket, Thailand.*

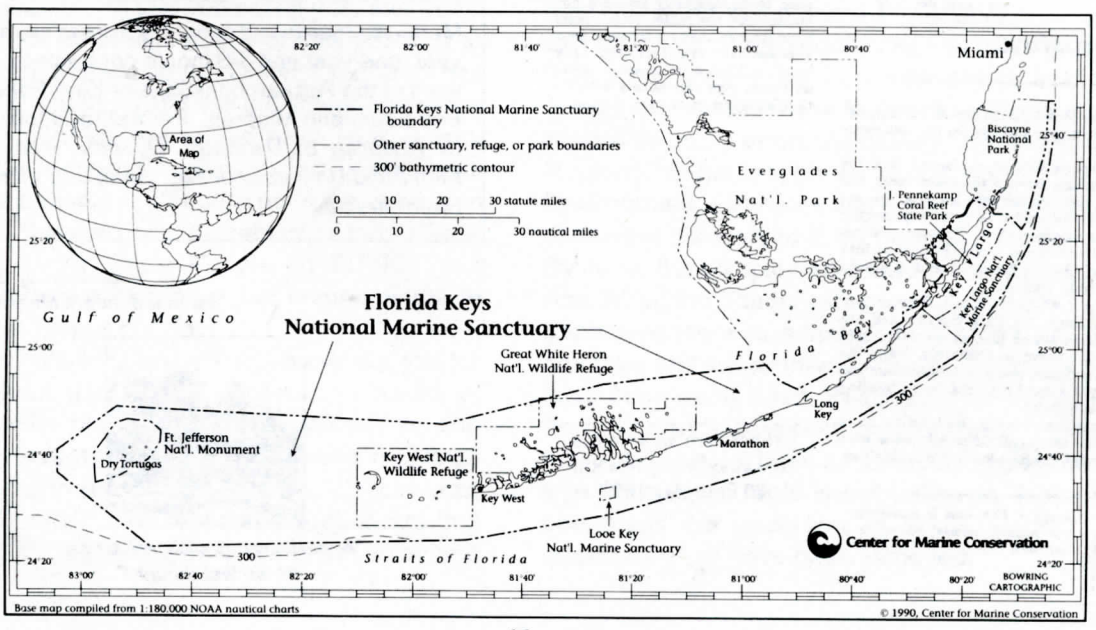
In French Polynesia, bleaching has occurred on reefs around Tahiti and Moorea, but further details were not available by the time of going to press. A team of scientists is currently investigating the situation.

Further information from: *Dr Bernard Salvat, Centre de Biologique et d'Ecologie Tropicale et Mediterranéen, Univ. Perpignan, Av. de Villeneuve, 66025 Perpignan Cedex, France.*

TOTAL PROTECTION FOR FLORIDA REEFS

Waters on both sides of the Florida Keys, from Miami to Dry Tortugas, were finally designated a national marine sanctuary on November 16th 1990 (see article by John Ogden in *Reef Encounter 8*). Covering 9000 sq km, this is the largest US national marine sanctuary and the first to be created through an Act of Congress. It includes two existing national marine sanctuaries, Looe Key and Key Largo, and will provide for multiple uses as does the Great Barrier Reef Marine Park. The National Oceanic and Atmospheric Administration is currently developing a management plan that should be completed by the middle of 1993. In the meantime, oil and gas development have been prohibited and commercial shipping restrictions imposed. A key component to the plan is the development of a water quality protection program with the State of Florida and the Environmental Protection Agency in order to tackle current pollution problems.

Further information from: *NOAA, Marine and Estuarine Division, 1825 Connecticut Ave, N.W., 7th Floor, Washington D.C. 20235* or *Center for Marine Conservation, 1725 DeSales St, N.W., Washington D.C. 20036.*



MOVING A RESEARCH CENTRE (WELL ALMOST!)

When I heard the news it had already been an unusual day. A southerly storm had ripped our floating jetty loose and it took ten of us the last two hours of daylight to secure the twisted remains to the beach. Later that night we contacted the local branch of the government building contractors to help salvage the remains. They casually told us "We were just coming to see you – we have to begin moving your Research Centre this week!"

The story has its origins two years before in a visit to Egypt by Sheikh Zayed al Nayyan, the President of UAE. President Mubarak brought him to Sharm-el-Sheikh to see the new hotel development there – a government showpiece. The good Sheikh expressed an interest in building his own hotel, and a deal was struck to give him a prime site on the north shore of Na'ama Bay where the President had a small villa. This act of generosity was marred only by one small problem: the site came complete with marine research centre! This was viewed as a minor inconvenience since the university which occupied the site was believed to have only a handful of people there. Unfortunately this was far from the truth.

Two years prior to this, in 1986, a project was initiated between Liverpool and Suez Canal Universities, funded by the European Community (see *Reef Encounter 7*). Since then work had progressed rapidly to establish an active research centre in Sharm-el-Sheikh on the site of a former Israeli facility. Ironically, only two weeks prior to the deal between Mubarak and Sheikh Zayed, the buildings had been formally transferred to Suez Canal University by another government department! Such poor communication is a major problem in Egypt. University staff only learned of the sale of their Research Centre from the newspapers six months later. By this time renovation was almost complete following six years of neglect after the Israeli withdrawal from Sinai.

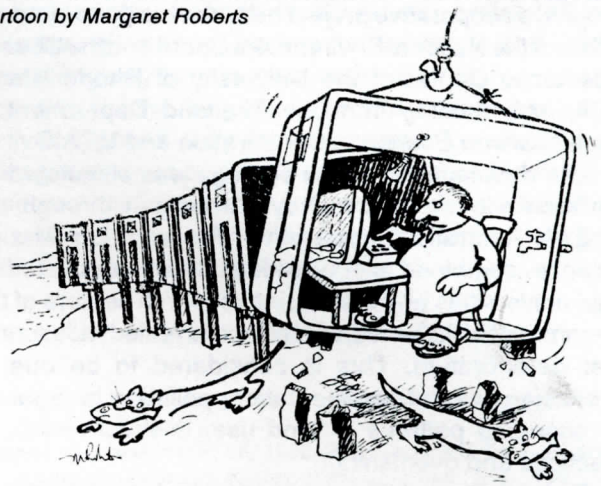
After hearing the news the university continued its programme of investment in the Centre in the belief that a firm presence on the site would reverse the decision to build a hotel. This belief was founded more on optimism than reality, and early in 1990 Sheikh Zayed reminded Mubarak of his promise. The order to move us was immediate. Since the Centre was constructed of prefabricated units it was considered cheap and expedient to simply move it to a new site 12km away.

Having spent many hours struggling with elusive contractors during construction and renovation, I found it hard to believe the rapidity of events. Over the next week we watched with a mixture of horror and amazement as the Research Centre gradually dwindled and unit after unit was trucked off. The last building moved was my house; my cats searched for it for days!

Unfortunately, the speed and efficiency with which we were evicted was due more to 'Presidential persuasion' than anything else. As the dust settled on the old site, the dust on the new had barely been stirred. Since then, the university has struggled with government and contractors to try to get the buildings finished (or at least started again!). Fourteen months on, there has still been no further activity. It can only be hoped that the Egyptian government will eventually see the importance of maintaining this facility. Reef science must not be allowed to expire in a country which has so great a need for it!

Callum M. Roberts, Centre for Tropical Coastal Management Studies, Department of Biology, The University, Newcastle upon Tyne, NE1 7RU, UK.

Cartoon by Margaret Roberts



REEF RESOLUTIONS AT IUCN GENERAL ASSEMBLY

At the 18th General Assembly of IUCN – The World Conservation Union in Perth, Australia in December 1990, two of the numerous resolutions passed related directly to coral reefs.

Resolution 18.73 called on the Governments of Queensland and Australia to move towards prohibiting all coastal tanker traffic by improving rail transport so that transport by sea is no longer necessary and the risk of oil pollution is reduced. All merchant vessels over 70m in length and all oil and chemical tankers and gas carriers will shortly require pilotage when navigating the northern section of the inner route of Great Barrier Reef and Hydrographers Passage. This legislation is being drawn up in response to the designation of the Great Barrier Reef as a 'particularly sensitive area' by the International Maritime Organisation.

Resolution 18.58 recommends that the Japanese government and other relevant agencies and NGOs look further into alternatives to building the now infamous airport on Shiraho Reef, Ishigaki Island, and review agricultural and development policies in relation to soil erosion and threats to coastal ecosystems. Opposition to the proposed airport had led to an alternative site being designated, but further studies have suggested that this will also result in significant reef damage.

IUCN hopes that concerned individuals or organisations will make use of General Assembly resolutions to bring about necessary changes. Copies can be obtained from IUCN, Ave du Mont Blanc, Gland, CH-1196, Switzerland.

NATIONAL CORAL REEF STRATEGY FOR THAILAND

The dramatic growth of tourism in Thailand in the 1980s, much of which is centred in important reef areas, and growing concern about the impact of this and other human activities on reefs has led to production of the first 'coral reef strategy' for a country. This has been produced through the Thailand Coastal Resources Management Project, a cooperative project between the government's Office of the National Environment Board and the Coastal Resources Center of the University of Rhode Island, USA, with funding from the Thailand Department of Technical and Economic Cooperation and USAID.

The development of the strategy was stimulated by the results of a 1988 survey carried out through the ASEAN-Australia Cooperative Program on Marine Science, combined with decades of work conducted by Thai universities and the marine research centers of the Department of Fisheries, which have revealed widespread reef deterioration. This is considered to be due to increasing coastal sedimentation, pollution brought on by changing patterns of land use, destructive fishing practices and overfishing.

Formulation of the national strategy has been undertaken in three phases. The results of the first, the preparation and distribution of findings on the status and significance of reefs in Thailand, have now been published in the project's first document *Vol. 1: Statement of Need*. Phase 2, currently underway, is a consultative exercise in which policies and actions are being formulated by interested agencies. It will culminate late in 1991 in the publication of *Vol.2: Policies and Action Plan*. The final phase will be obtaining Cabinet and agency approval.

Initial work at Phuket suggests that, as in the Philippines, management may be most effective when there is community participation. The strategy will emphasise the various ways that this can be achieved, as well as outline the various measures that need to be implemented by government agencies.

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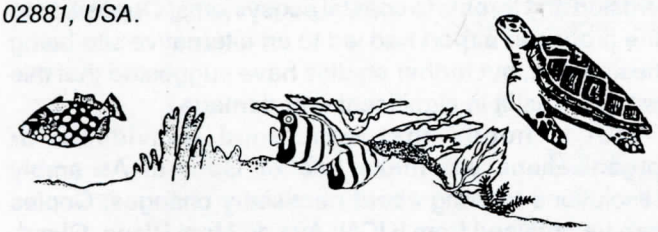
Further information from: *Lynne Hale, Coastal Resources Management Center, University of Rhode Island, Kingston, RI 02881, USA.*



FEATURES

CONSERVATION OF TROPICAL MARINE MOLLUSCS

Tim McClanahan

There is worldwide concern among marine conservationists over the impacts of shell collecting on mollusc populations and subsequent changes in marine communities. Unfortunately, this has rarely developed into thorough scientific analyses to support or refute such opinions. This may have led to the introduction of regulations, based not on scientific data, but on political concerns or the emotional beliefs of conservationists. They may well be in conflict with ecological realities.

'Over-collection' of molluscs is variously postulated to result in a) local or global species extinctions and b) an ecological imbalance in marine communities. I had the opportunity to study the potential impacts of shell collecting along the Kenyan coast, as a result of financial support from the East African Wildlife Society and the presence of three marine parks that exclude all forms of fishing and shell collecting. My survey, carried out periodically (usually weekends and academic breaks) over a two and a half year period, included the entire coastline from Somalia to Tanzania (McClanahan, 1989 and 1990). The results were somewhat surprising. I found that within reef lagoons, prosobranch gastropod densities were three times higher on reefs where shell collecting took place, than on those with no shell collecting. Further, in these same lagoons, prosobranch species richness was somewhat higher on reefs with shell collecting. A comparison of the population densities of 30 commercially collected molluscs between these two reef categories failed to find significant differences, apart from two large strombids (*Lambis truncata* and *L. chiragra*) which were more abundant on the uncollected reefs.

These results seem curious until one considers that the shelled reefs were also heavily fished. Two additional results of the survey were that unprotected reef lagoons had lower predation rates on tethered drupes (*Morula granulata*) and that prosobranch population densities were negatively correlated with total fish and particularly triggerfish (Balistidae) abundance. Consequently, I concluded that most of the smaller prosobranch species were being controlled to a greater extent by reef predators, such as triggerfish, than by human collectors. Larger species that are exposed on the reef, such as strombids, may be affected by human collectors. Thus, in Kenya at least, there was little evidence to suggest that local extinctions are likely to occur with the exception of the larger strombids which are fortunately protected by marine parks. However, this may not be the case where predators of invertebrates such as triggerfish are not harvested.

The impact of molluscs on the ecological state of reefs is also questionable in most tropical environments.

Previous concern about the effect of giant triton *Charonia tritonis* removal on Crown-of-thorn outbreaks in the central Pacific has been largely unsubstantiated. In Kenya, the high population densities of sea urchins on heavily fished and shelled reefs have been attributed to removal of molluscs such as helmet shells (Cassidae), but we have found that triggerfish were by far the most important predators of sea urchins (McClanahan and Muthiga, 1989; McClanahan and Shafir, 1990). In general, I suspect that predatory molluscs feed at lower rates than finfish with similar diets, and that, in the tropics where finfish are abundant, their role in controlling reef community structure and ecological processes has been largely overstated. Instead, I agree with Vermeij (1987) and Aronson (1990) who see molluscs as an evolutionarily older lineage which has been forced to find refuge from predation by occupying habitats and niches not used or under-utilised by bony fish (i.e. stressful environments, deep water and nocturnal habits). Bony fish have diversified and dominated high productivity niches since the Mesozoic era. If molluscs are to have an important role in ecological control of marine ecosystems, this is more likely to occur in stressful (i.e. temperate latitudes, high wave intensity, and fluctuating environments) or low productivity environments. There may be some notable exceptions, but these have yet to be studied.

Despite the results of my study and criticisms of certain conservation concerns, I believe that a number of important management issues need to be addressed. The harvest of molluscs needs to be considered as a 'fishery' – whether or not the molluscs are used for edible purposes or for their ornamental shells. Management strategies may include stock enhancement, aquaculture, harvesting quotas, limited entry restrictions and other techniques to provide a high long-term harvest. The distinction between ornamental and edible molluscs (or any animal) is not a good distinction for fisheries regulations. Many conservationists take exception to the shell trade, but overlook the problems caused by fishing, because they consider harvesting animals for ornamental purposes as of less value than harvesting for food. I consider that this Isocratian philosophy is counterproductive to conservation. Ornaments can play a role in conservation, through their educational value and aesthetic appeal. Ornamental shells can be kept for years, and only a few are needed to achieve their decorative function. Edible molluscs are consumed rapidly and must be harvested continuously to satisfy demand.

Regulation may need to be specific to species, ecosystem or region, depending on the mollusc's life history, local fishing habits and preferences, or regional differences in marine communities and species interactions. Catteral and Poiner (1988) have drawn up some useful criteria for estimating the impact of collection on mollusc populations. They suggest that molluscs that take a long time to mature, do not bury themselves, lack subtidal populations and pelagic larvae, and have low vagility (or a combination of these characteristics) will be susceptible to over-collection. I have suggested that over-collection is unlikely for many species if their predators are being harvested simultaneously.

Additional studies in different regions are required which focus on life history, growth, recruitment, predator-prey interactions and habitat suitability, prior to developing management programmes for molluscs. It should also be appreciated that habitat and large-scale oceanographic or meteorological changes of either natural or anthropogenic origin are likely to be a greater threat to mollusc populations compared to human harvesting. Consequently, habitat preservation, protection and monitoring, marine park establishment and global monitoring may be among the most important conservation activities for the long-term survival of molluscs. Such activities would also provide information on changes taking place in unprotected areas, and thus feedback for resource managers. Without such feedback, our efforts to manage reef resources may be strong on good intentions, but weak on usefulness.

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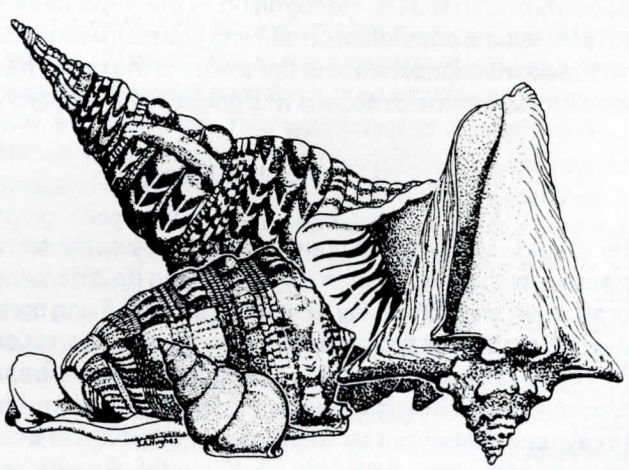


Drawing by Sally Hughes

COUNTRY PROFILE

CORAL REEF RESEARCH AND MANAGEMENT IN THE PHILIPPINES

Helen T. Yap and Porfirio M. Aliño, with Alan White

Introduction

Early reef research in the Philippines was confined mainly to the taxonomic work of Professor Francisco Nemenzo, Sr (J.E. Veron and G. Hodgson provided an updated review of Philippine coral taxonomy in 1989). In the mid-1970s, coral reef work took off on a much larger scale with the initiation of a survey of the country's reefs – 'Investigation of the Coral Reef Resources of the Philippines' – by the then Marine Sciences Center (now the Marine Science Institute), under the direction of Dr Edgardo Gomez. This project, which terminated in 1982, provided the first comprehensive picture, in semi-quantitative terms, of the status of the reefs at representative sites nationwide and provided a framework for the development of management strategies. Reef work started around the same time at Silliman University, Dumaguete, under Dr Angel Alcala, the focus being on Sumilon Island which was designated a fish sanctuary in 1974. Several government agencies were also involved over this period, such as the Natural Resources Management Center and the Bureau of Fisheries and Aquatic Resources (BFAR), which carried out the first reef surveys for management purposes.

Most reef research is currently carried out by the Marine Science Institute on the main island of Luzon and by Silliman University in the south, in both cases frequently in collaboration with agencies such as BFAR. Additional survey work is being carried out through BFAR itself, the Protected Areas and Wildlife Bureau (PAWB), and the growing number of marine park projects and community-based reserves, some of which are being set up in association with NGOs. Recognition of the dependence of the Philippine population on all living coastal resources, combined with concern about the status of the reefs, has helped to determine directions and priorities for research.

Status of Philippine Reefs

The great majority of the country's reefs are considered stressed, with about 32% in poor condition (0-25% living coral cover) and 38% in fair condition (25-50% living coral cover). Only 5% are considered to be in excellent condition (75-100% living coral cover). These figures have been calculated from data obtained during the early nationwide survey, supplemented by more recent information from two projects: the ASEAN-US 'Coastal Resources Management Project' and the ASEAN-Australia 'Living Resources in Coastal Areas' Project.

The main problems are siltation, fishing with explosives and over-exploitation of many reef resources. Siltation is largely due to poor land management, particularly deforestation. Dynamite fishing has increased alarmingly in recent years, encouraged by the widespread and deep-seated poverty in coastal areas which means that fishermen often feel they have no other alternative. Fishermen take increasingly small sizes of catch per unit effort, which in turn is leading to even greater exploitation. A new method, Pa-aling, based on muro-ami has recently been licensed, in which bubbles created with compressed air are used instead of rocks to scare fish into nets. BFAR is monitoring its impact, but there is concern that once BFAR stops watching the fishing boats they will revert to rocks, as these are cheaper than compressed air. At some sites, a primary concern is the daily dumping of thousands of tons of mine tailings into coastal waters. There are a variety of other major impacts, many of which are common to other South-east Asian countries.

Coral Reef Monitoring

More detailed studies of fish, corals and other benthic organisms are now underway. Coral community structure has been documented for many of the existing and proposed marine parks or reserves e.g. around Sumilon, Balicasag, Pamilacan, San Salvador, Mactan, Apo Reef, Sombrero and Tubbataha Reefs. Fish species diversity and abundance per unit area have been measured over time at sites in Batangas. Under the ASEAN-Australia project, sites have been set up for long-term monitoring; a further description of this programme will be given in the next issue of *Reef Encounter*.

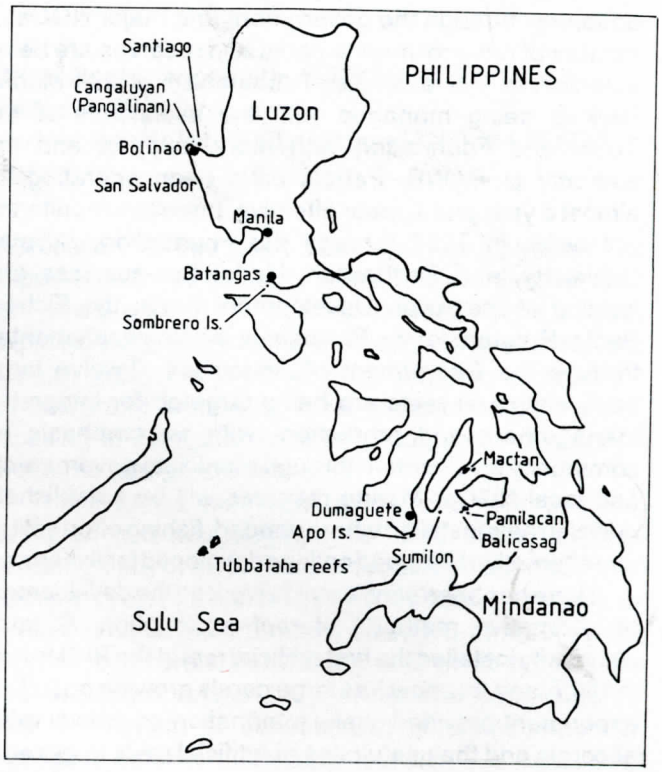
Extensive monitoring of the intense fishing activity by subsistence fishing communities near the field station of the Marine Science Institute in Bolinao is underway, through a USAID-funded Fisheries Stock Assessment/ Collaborative Research Support Program (FSA/CRSP). In this project, University of Rhode Island's visiting associate scientist Dr John W. McManus and his local collaborators are employing new ways of looking at multi-species/multi-gear fisheries stock assessment and the possible application of Pope's multi-species virtual population analysis. The evaluation and modification of destructive fishing gears (i.e. muro-ami and dynamite) to minimise their deleterious impact is another focus of the project.

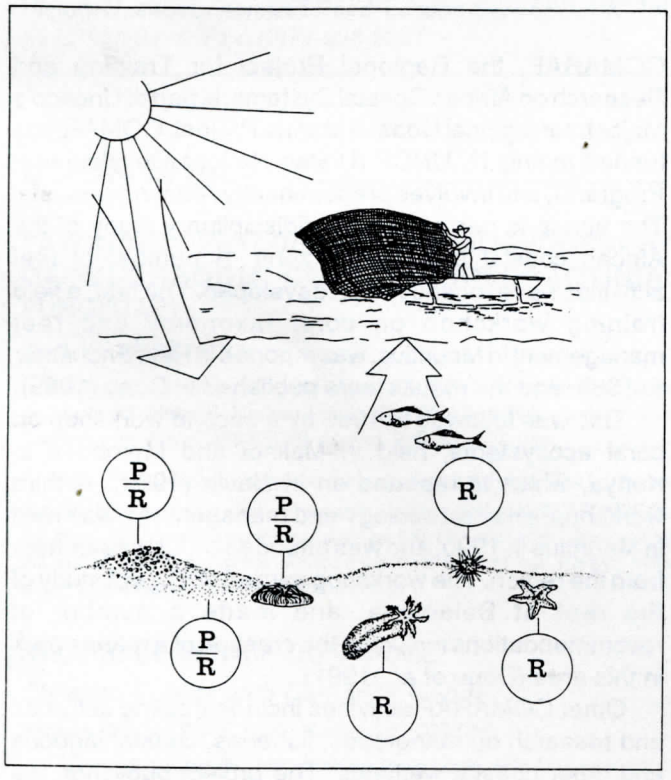
Dynamics of stressed versus unstressed areas

The Marine Sciences Institute has initiated studies on recolonisation of reefs damaged by blasting in order to gain an understanding of processes involved in their recovery, and factors that may hinder this. To simulate the effects of severe blasting, a site identified by local fishermen as already damaged by dynamiting, on a reef flat at Cangaluyan Island (Pangasinan), was cleared of

all living coral cover. A control site was set up about 1 km north-east of the experimental site in a healthy part of the reef. Limestone tiles placed at both sites were collected each month for examination of settling organisms. Over the 27 months following the disturbance, succession patterns for fleshy algae and sessile invertebrates were found to be similar at both sites. Coralline algae were more abundant at the damaged site, where coral settlement occurred earlier and more rapidly; coralline algae may thus play a role in reef recovery. However, four and a half years after the disturbance there was still no significant increase in coral cover at the damaged site.

The Marine Science Institute also began studies on the energy fluxes in reefs and other nearshore habitats in 1989. Initial investigations focused on gathering data on production and respiration of the major ecological components of a reef flat on Santiago in Bolinao. The metabolism of sand-rubble patches (about 60% of the total area), fungiids and selected invertebrates (starfish, sea urchins and sea cucumbers) are being studied, and it is hoped that further work will indicate the extent to which the system is stressed. Work has begun on the trophic relationships of the dominant fish species harvested on some reefs, particularly *Siganus fuscescens*, *Gymnothorax pictus*, *Choerodon anchorago* and *Scarus ghobban*.





Major reef flat components involved in energy flow. The long-term measurement of production (P) and respiration (R) rates will contribute to an understanding of how the system is maintained.

Many of the studies carried out in marine parks and fish sanctuaries have also provided valuable information for the comparison of stressed and unstressed reefs. Work at Sumilon, in particular, has provided useful data on reefs under fishing pressure, and rates of recovery of fish communities once this has ceased.

Coral Reef Management

Management of Philippine coral reefs is being tackled in a variety of ways. One of the most successful has been the establishment of community-based projects to manage small areas of reef. This was initiated through work at Silliman University and led to a number of small marine parks and reserves being set up and managed by local fishing villages. These projects involve encouragement of non-damaging fishing methods (e.g. prohibition of dynamite fishing within reserves, re-training of aquarium fishermen using sodium cyanide to use nets – see below), development of low-level ecologically sound tourism, and in some cases re-introduction of hatchery reared over-exploited species such as Giant Clams. San Salvador Island, for example, has been managed for two years in this way through the support of the Haribon Foundation, WWF, the Jaime Ongpin Foundation and the Dutch Government.

Reefs are also a focus of protected areas programmes underway through the government and major NGOs. A number of national marine parks and reserves are being established. For example, Tubbataha National Marine Park is being managed with the assistance of the Tubbataha Foundation with moral support and the authority of PAWB. Patrols have been operating for almost a year and appear effective. Intensive monitoring will begin in 1992 through the Foundation, Silliman University, and Earthwatch. Under the auspices and funding of the Asian Development Bank, the Fishery Sector Program for the Philippines is being implemented through the Department of Agriculture. Twelve large bays with coral reefs are being targeted for integrated management and protection, with an emphasis on community involvement through municipal governments and local NGOs. Marine reserves will be established, artificial reefs installed where needed, fishing effort limited and alternative livelihood options developed for fishermen.

There has been considerable work on the development of alternative methods of reef exploitation. Silliman University installed the first artificial reef in the Philippines in 1977, and this now has large corals growing on it. This experiment provided useful information on growth rates of corals and the usefulness of artificial reefs in general, and several such projects are now underway with the assistance of BFAR, in combination with education on coral reef protection in general and the value of marine reserves and sanctuaries. Mariculture research is underway for many species including giant clams. Fishermen are being trained in seaweed culture and small farms are being set up on many reefs throughout the country.

A number of studies on coral growth and transplantation have been carried out by the Marine Science Institute, in efforts to accelerate reef recovery. *Acropora pulchra*, *A. hyacinthus*, *Pavona frondifera* and *Pocillopora damicornis* have been studied in most detail. *Pavona frondifera* has shown the best response to transplantation, but further research is required. The Philippines is the main source of coral for the marine curio trade, and this has stimulated research into coral population biology. Although optimum harvesting levels were calculated for one species in 1984, these have yet to be tried and tested. At present the coral trade continues illegally.

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Editors note: Since the 1970s, an enormous amount of reef work has been carried out in the Philippines, which this brief review has been unable to do full justice to. We have also been forced to omit the extensive reference list provided by the authors. Please write to them direct for further information.

EFFORTS TO STOP CYANIDE FISHING ON PHILIPPINE REEFS

Sodium cyanide is widely used in the Philippines for catching reef fishes for the aquarium trade. This technique, although efficient, leads to fish of low quality, many of which die in transit. Moreover, cyanide is a broad spectrum poison and has widespread effects on other reef organisms. The International Marinelife Alliance Canada (now renamed Ocean Voice), estimating that over 1000 tonnes of sodium cyanide had been released onto Philippine reefs over the past 20 years, initiated the Netsman project to tackle the problem. This project has so far succeeded in training 10% of the 1500 fish collectors in the Philippines in non-destructive harvesting, using small-mesh nets into which fish are chased and selected species plucked off with a small dip net. The project has also taught fish collectors basic reef ecology and conservation. Ocean Realm now hope to raise sufficient funds to complete the training of all Philippine fish collectors.

For further information on this and other activities contact: *Dr Don E. McAllister, Ocean Voice, 2883 Otterson Drive, Ottawa, Ontario, K1V 7B2, Canada.*

WHO'S WHO?

COMARAF

COMARAF, the Regional Project for Training and Research on African Coastal Systems, is part of Unesco's Major Interregional Coastal Marine Project: COMAR. It is funded mainly by UNDP (United Nations Development Program), and involves predominantly African scientists. The aim is to carry out a multidisciplinary study of the African coastal and marine zone. A number of reef activities have recently been developed. The first, a field training workshop on coral taxonomy and reef management in Mauritius, was reported in *Reef Encounter* 5, 1989, and the results were published in Done (1989).

This was followed in 1989 by a second workshop on coral ecosystems, held in Malindi and Mombasa in Kenya, which is reported on in Navin (1990). A third workshop, on coral ecology and management, was held in Mauritius in 1990, and was attended by 13 researchers from the region. The workshop carried out a pilot study of the reef at Balaclava, and made a number of recommendations including the creation of a marine park in this area (Done *et al.*, 1991).

Other COMARAF activities include training activities and research on mangroves, fisheries, coastal lagoons and other coastal wetlands. The project publishes the *COMARAF Newsletter*, as well as reports and studies.

Done, T.J. 1989. Classification and Assessment of Some Coral Reefs in Mauritius. *COMARAF Series Documentaire* **2**. Regional Project RAF/87/038.

Done, T.J. et al. 1991. The coral reef at Balaclava, Mauritius: a pilot study and a comparison of methods. *COMARAF Series Documentaire* **6**. Regional Project RAF/87/038.

Navin, K.F. 1990. Coral Ecosystems Workshop. *COMARAF Rapport Technique* **2**. Regional Project RAF/87/038.

Further information from: *COMAR Major Project, Division of Marine Sciences, Unesco, 1 rue Miollis, 75015 Paris, France* or *Dr E.S. Diop, COMARAF Regional Coordinator, Unesco/UNDP, c/o Breda, B.P. 3311 Avenue Roume, Dakar, Senegal.*

REEF-RAFF!

Brian Rosen organises an occasional one-day discussion meeting for active researchers on the general theme of Evolution and Environments in the Marine Tropics. The aim is to generate discussion between biologists and geologists covering both modern environments and their ancient counterparts. These are not mini-conferences. Morning sessions are devoted to a subject suggested beforehand, while in the afternoon participants are encouraged to suggest other topics, bring along specimens, slides, work in progress, and research problems. Research students and post-docs are especially welcome.

The inaugural REEF-RAFF meeting was held in the Natural History Museum on 8 February 1991, when Jeremy Young spoke on 'Nutrient Flux: the key to low latitude carbonate deposition?'. A second meeting was held on 21 June 1991, with a theme of 'Miocene reefs and associated environments'.

Contact: *Brian Rosen, Dept of Palaeontology, Natural History Museum, Cromwell Road, London SW7 5BD, UK. Tel: (0)71-938-9316; Fax: (0)71-938-9277.*

BOOK SHELF

TAXONOMY, PHYLOGENY AND BIOGEOGRAPHY OF MUSHROOM CORALS (SCLERACTINIA: FUNGIIDAE)

Bert W. Hoeksema

In: *Zoologische Verhandelingen Leiden* 254, 1989?. Order from: National Museum of Natural History, P.O. Box 9517, 2300 Leiden, The Netherlands. Price US$30/£20 sterling. 295 pp., 678 figs.

This monograph is part of the author's doctoral thesis. The full thesis is available from the author at the same address, price US$37.50/£25.00 per copy. (Information on this publication has only just been received by the editor; apologies to the author if the date is incorrect. Please write direct to the author for further information.).

RECIFS: LE MONDE DU CORAIL

Christian Petron, with Catherine Gabrie

Editions Denoel, Paris, 1990. ISBN 2-207-23779-6.

This is a lavishly illustrated coffee table book, with some beautiful close-up photography. The four-page introduction to coral reefs is followed by nearly 100 pages of colour photos. The final 15 page section by Catherine Gabrie provides a concise but extremely comprehensive overview of the biology and ecology of reefs, threats from human activities, and conservation initiatives underway. The text is, of course, in French!

BOOK REVIEW

Coral Reefs – Ecosystems of the World 25

Edited by Zvy Dubinsky

Elsevier, Amsterdam, 1991. 562 pp. ISBN 0-444-87392-9. US$220.00.

Publication of this book has been long awaited; its impressive list of contents was first advertised at least two years ago. In his editorial preface, Zvy Dubinsky explains the primary aim of the book which is to address the key problems underlying the understanding of the structure and function of coral reefs as an ecosystem, focusing in particular on interrelationships of different problems and processes.

There follow nineteen review chapters covering evolution and zoogeography of coral reefs; physical oceanography of coral-reef ecosystems; biogeochemical nutrient cycles in coral-reef ecosystems; the role of symbiotic algae in carbon and energy flux in reef corals; irradiance in corals; calcification and photosynthesis in reef-building corals and algae; reproduction, dispersal and recruitment of scleractinian corals; competition between scleractinian reef corals – a review of mechanisms and effects; coral reef algae; the biomass, production and fate of bacteria in coral reefs; plankton in the reef ecosystem; zoogeography, behaviour and ecology of coral-reef fishes; feeding ecology of selected coral-reef macroconsumers: patterns and effects on coral community structure; aspects of trophic relations, productivity and energy balance in coral reef ecosystems; *Acanthaster plancii* population outbreaks; natural and anthropogenic disturbance on coral reefs; coral reef management; trends and new perspectives in coral-reef ecology and finally a systematic list of genera found on coral reefs.

Faced with the enormous task of compiling such a volume of contributions, the editor should be congratulated. As might be expected from the inclusion of such a wide variety of authors and subject areas, the standard of review is variable – most are very good and will be valuable sources of information for those not familiar with specific fields of research. In particular those reviews covering ecophysiology of reef organisms, coral reproduction, physical and chemical processes on reefs, biomass and fate of bacteria, and competition and ecology of fish, macroconsumers and predators are very comprehensive and well written.

All suffer, however, from being written over four years ago with the most recent references cited being 1988 and some even earlier. This is certainly no fault of the authors and indeed may be no fault of the editor either, but the value of any review is much diminished if recent developments and trends are not included. Such must be the case for a number of topics covered in this book, namely *Acanthaster* outbreaks which have been the subject of a *Coral Reefs* theme issue in recent years and natural and anthropogenic disturbances – for which the

authors will have had no opportunity to review the extensive literature that has accumulated over the last five years on coral bleaching, hurricane and storm damage and predictions for coral reefs as a result of predicted future climatic changes. For a number of topics covered in this book, special mini-symposia were held at the Sixth International Coral Reef Symposium in Townsville, Australia in 1988. Such sessions generally provide new information and insights to problems but the inclusion of relevant references from this source by authors in the present volume is very restricted.

In terms of coverage of topics there are major omissions in the book. One is any detailed account of the distribution and zoogeography of reef corals and another is the absence of any reference to relevant geological processes on reefs which may cast light on the structure and function of coral reefs, namely measurement of the growth and erosion of reefs and the value of interpretation of changes in the modern reef by reference to past reef environment histories. The value of the final appendix of coral reef genera is questionable – the sources of material used in its compilation are not acknowledged nor is it apparent to which area of the world it applies. Certainly the list is not comprehensive for currently recorded representatives of most groups shown, even for reef areas of low faunistic and floristic diversity.

While the book constitutes a valuable source material for all reef scientists, including post-graduate and post-doctoral students, the price of the text will likely place it outside the reach of this market. I suspect that even the limited budgets of libraries in developed countries may not be able to afford this volume. Most disappointing of all, libraries in developing tropical countries, where access to the primary literature is most limited and where the benefits of such a volume would be most felt, will certainly find the cost beyond their means.

Barbara Brown, Centre for Tropical Coastal Management Studies, Dept Biology, The University, Newcastle-upon-Tyne NE1 7RU, UK.

Coral-eating sea weed

The Great Barrier Reef is under threat from a coral consuming sea weed, which is being spread around the area by divers and tourists boats.

The sea weed, called *Chrysophaem taylori*, was found on the reef three years ago and is thought to have come from the Caribbean.

In 12 months it has spread from covering 0.26 hectares of the reef to covering 3.7 hectares. It usually grows in areas protected from the waves, but it is believed colonies are being broken up by the actions of diver's fins and that the sea weed is sticking to equipment and being carried to new areas.

Item found in diving magazine

ANNOUNCEMENTS

BIOGEOGRAPHY OF THE CORAL GENUS *ACROPORA* WORLDWIDE

This is a project to examine the evolution and patterns of distribution of the large coral genus *Acropora*, of which there are approximately 100-150 species worldwide. The study aims to combine a cladistic biogeographic analysis with a study of phylogenetic relationships so that relationships among areas may be examined in the light of the relationships among species which occupy them. We hope the project will provide an understanding of the origins of the world's coral fauna. It will also explore the boundaries of "endemic" marine fauna, the ranges of species and species groups, and the potential sources of propagules for replenishment of damaged or degraded reefs. We hope that we may be able to assist interested countries to document their natural resources, by providing species lists of the *Acropora* corals present on their reefs. We can also help by providing durable printed labels for duplicate specimens, thus leading to a reference collection in the country of origin, if this is desired.

To achieve these aims it is necessary to know patterns of occurrence of the species. With very little published information available, site collections are required. What we seek from interested persons are specimens of *Acropora* (about 10cm long is a good size), and some information about locality. It is necessary to have a collecting permit and, because corals are protected by CITES legislation, permission from a CITES authority or equivalent to export the specimens and bring or send them to Australia, is required. Our museum is registered by CITES to accept specimens for scientific research. Depending on the collector and her/his ease of contacting the local authority, we would either request that you obtain the permit or we would write away for the permit ourselves. We can sort these things out with you when we correspond with you about collecting; we can also give you letters of explanation to hand to the local authority or customs official. We can cover costs in sending the specimens to us.

Wallace, C.C., Pandolfi, J.M., Young, A. and Wolstenholme, J. 1990. Indo-Pacific coral biogeography: a case study from the *Acropora selago* group. *Australian Systematic Botany* **4(1)**.

Further information from: *Carden Wallace, Curator in Charge, Museum of Tropical Queensland, 70-84 Flinders Street, Townsville, QLD 4810, Australia..*

A JOURNAL FOR INVERTEBRATE TAXONOMY

Carden Wallace wishes to inform members about *Invertebrate Taxonomy*, an international journal for publication of original contributions on taxonomy and systematics of invertebrates, with special reference to

the Indo-Pacific region. It has been published by CSIRO Editorial Services for the last five years. The editors would welcome contributions on marine fauna. Turn around time for papers is 6 months to one year. This journal is highly recommended for reef scientists seeking a vehicle for fast, quality publication of taxonomic research.

Further information and notes to authors may be obtained from Carden at the address above.

NEW FISH JOURNAL

Reviews in Fish Biology and Fisheries will be a quarterly international journal devoted to publishing important review articles on any aspect of fish and fisheries biology. Subject matter will include physiology, evolutionary biology, taxonomy, zoogeography, behaviour, ecology and exploitation. First issue due out September 1991.

Sample copies from: *Journals Promotion Dept, Chapman and Hall, 11 New Fetter Lane, London, EC4P 4EE, UK.* Instructions for authors from the Editor: *Tony Pitcher, RRAG, Imperial College, 8 Princes Gardens, London SW7 1NA, UK.*

TRIP TO KAPINGAMARINGI

There may be some places still available (at late bargain prices) on a diving/fish watching/research visit to Kapingamaringi, the south-easternmost island of the Federated States of Micronesia, accompanied by C. Lavett Smith and Jim Tyler. The trip will be from August 23-Sept 6th 1991, starting from Truk. Original cost US$4000 excluding air fare.

Contact: *Naomi Stern, Different Drummer Divers, 100 W 81 Street 5C, New York, NY 10024. Tel: (212) 873-4059.*

QANTAS/LIZARD ISLAND TRAVEL FELLOWSHIPS

The Australian Museum and the Lizard Island Research Station in cooperation with Qantas Airways, are able to offer two economy class return air tickets to Cairns from any city served by Qantas. These tickets are available to people who will conduct significant research at the Station within the next year. The successful applicants should spend a minimum of four weeks at Lizard Island.

There were two recipients in 1991. Dr Ken Sebens of the Marine Science Center, Northeastern University, Nahant, Massachusetts, USA, investigated the effects of small water movements on the feeding and growth of corals. Vincent Dufour of the University of Perpignan, France studied recruitment of larval fish as part of his PhD, carrying out intensive night-time sampling to establish temporal and spatial variability in recruitment.

It is anticipated that a travel fellowship will be available for 1992, and the closing date for this will be 1st October 1991. Applicants should submit a three page research proposal clearly setting out: (1) aims, (2) methodology, (3) a personal CV and (4) significance of research to the Great Barrier Reef. Bench fees and other costs are not included in the fellowship. Visa arrangements are the responsibility of the successful applicants. A condition of the award is a report on the project, including photographs if possible, within two months of the visit which will be used for publicity by both Qantas and the Research Station.

Applications to: *Pat Hutchings, Australian Museum, 6-8 College Street, Sydney, NSW 2000, Australia.*

LIZARD ISLAND RESEARCH STATION DOCTORAL FELLOWSHIP 1992

Applications for the 1992 Fellowship close on 1st October 1991. This is worth A$13,000 over 3 years towards the cost of bench fees, travel and a small amount of equipment. The award is open to students enrolled for PhDs either in Australia or overseas. The 1991 fellowship went to Alison Green of James Cook University, Townsville for studies of the population biology of wrasses (Labridae).

Further information from: *The Director, LIRS Fellowships, The Australian Museum, PO Box 285, Sydney South, NSW 2000, Australia.*

DIARY

Please send contributions for the **Diary** section as soon as possible for the next issue.

Conferences

9-14 September, 1991, Munster, Germany

FOSSIL VI CNIDARIA – 6TH INTERNATIONAL SYMPOSIUM ON FOSSIL CNIDARIA INCLUDING ARCHAEOCYATHA AND PORIFERA

Organised by the International Association for the Study of Fossil Cnidaria and Porifera, in collaboration with the Westfalische- Wilhelms-Universitat, Munster. The planned scientific programme includes Evolution of Corals, Intraspecific Variability and Fossil Races, Diagenesis and Microstructure of Fossil Cnidaria and Porifera, Evolution of Reefs, Porifera, Coral Research History and Computer Supported Palaeontology. Further information from: *Fossil VI Cnidaria, Westfalische-Wilhelms-Universitat, Forschungsstelle fur Korallenpalaeozoologie, Pferdegasse 3, D-4400, Munster FRG.*

25-27 September, 30 September – 2 October 1991, Brisbane, Queensland, Australia.

ECO-TOURISM and THE GLOBAL CLASSROOM

These two workshops are being held consecutively at the University of Queensland to explore tourism and the environment. Each will consist of a series of symposia on themes such as the effects of eco-tourism on economic, environmental and cultural issues, and the integration of tourism, conservation and development. There will be a series of excursions during the two days between workshops that will demonstrate high quality environmental tourism programmes. Further information from: *Conference Convener, TraveLearn, The University of Queensland, Queensland 4072, Australia. Fax: (07) 870-5080.*

4 October, 1991, Honolulu, Hawaii
WILD OCEAN RESERVES WORKSHOP

This workshop, to be held in conjunction with Oceans '91 and the Events of the Oceans, Hawaii, will discuss a proposal to establish a system of Wild Ocean Reserves to protect valued resources in international waters. It will be chaired by Sylvia Earle. Further information from: *Mary Leach, NOAA/National Ocean Service, International Affairs, Fax 202-673-3957.*

3-8 November 1991, Honolulu, Hawaii
JOINING HANDS FOR QUALITY TOURISM: INTERPRETATION, PRESERVATION AND THE TOURISM INDUSTRY

This is the Third Global Congress of Heritage Interpretation International, and is sponsored by the East-West Center, Eastern Michigan University and the University of Hawaii. It is aimed at those involved in tourism and its management. Further information from: *Ray Tabata, Congress Co-chairman, Sea Grant Extension Service, 1000 Pope Road, Room 205, Honolulu, Hawaii 96822. Fax: (808) 956-2858.*

17-22 November, 1991, Jerusalem, Israel
INTERNATIONAL SYMBIOSIS CONGRESS

The programme will be arranged to encourage comparative discussions on different symbiotic systems and will be planned according to topics rather than types of symbiosis. There will be plenary lectures, parallel symposia, workshops, poster sessions and commercial exhibits. Further information from: *Prof. M. Galun, Dept of Botany, The George S. Wise Faculty of Life Sciences, Tel Aviv University, Ramat Aviv, Tel Aviv 69978, Israel. Fax 972-8-5413752.*

19-21 November, 1991, Smithsonian Institution, Washington DC, USA.
NATIONAL FORUM ON OCEAN CONSERVATION

This forum will highlight marine-based environmental issues and the interactions between land and sea. There will be two days of talks with around 50 speakers who will outline present knowledge, frame the critical issues and discuss research needs and policy options. The meeting will be open to the public. Further information from: *Office of Environmental Awareness, Ripley Center 3123, Smithsonian Institution, Washington, D.C. 20560, USA.*

Courses

7-12 September, 1991, Dyffryn House, St Nicholas, Nr. Cardiff, UK.
PROCESSES IN CARBONATE ENVIRONMENTS

A course for professional geologists concerned with the genesis and distribution of carbonate rocks in all their aspects. It will open with a field demonstration of a classic locality with a well-developed literature. Course fee: industrial and government £900, academic staff £400, full time research students £300. Applications, accompanied by a brief CV and statement of geological interests to: *Dr J.A.E.B. Hubbard, c/o The Director, The Mace Centre, Dept of Civil Engineering, Imperial College, London, SW7 2BU. Fax: 071-584 4220.*

NOTES FOR CONTRIBUTORS

The aim of *Reef Encounter* is to provide a magazine-style newsletter on any aspect of reefs, the livelier the better. In addition to news, meeting and expedition reports and announcements, we aim to have discussions and debates about particular issues concerning ISRS or the broader field of reef science in general. *Reef Encounter* does **not** publish original scientific data, so please do not submit such papers. The newsletter aims to complement the journal which carries scientific papers only, in that it provides an outlet for book reviews, discussion of papers in the journal and a correspondence column (**Upwellings**). It also carries short reviews of recent trends and developments in reef research or events that bear on reef studies. In the tradition established by the first editor, *Reef Encounter* will continue to be cheerfully illustrated, with cartoons, newspaper cuttings and other entertaining material.

Please note that *Reef Encounter* is an entirely voluntary effort. We do not have funds to pay authors, and the editors are also unpaid. Please help ISRS by submitting material on a regular basis and in a form that does not require too much editing.

To save time and postage, we shall not normally acknowledge submitted material and material will not normally be refereed or returned for corrections. Opinions expressed and errors of fact will have to remain largely the authors' responsibility. No published item should be taken as ISRS opinion unless indicated.

Please help by sending items of not more than 2,000 words in length and in double-spaced typescript, or on diskette using the Multimate, Microsoft Works, Lotus 1-2-3, or Word Perfect word-processing packages, or ASCII text files. You can expect some gentle editing for flow and sense and to address our readership as appropriately as possible. Illustrations should be of a size compatible with our format. Black line drawings are preferable at present, although we hope eventually to be able to afford photographs. Diagrams should have legends and/or captions to explain all symbols, abbreviations and shading patterns etc. Maps should have a scale and indication of orientation. Use *World List* abbreviations in references. Please use metric, or imperial-with-metric units, but not imperial units on their own. Do not forget to give your name and full address, or any other contact address where applicable.

We have no regular reprint system, but contributors will receive a free copy of the relevant issue.

DEADLINE FOR COPY FOR REEF ENCOUNTER 10 (due out December 1991) IS OCTOBER 1ST 1991.

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APPLICATION FORM FOR MEMBERSHIP

Name:.....

Address:.....

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Title:.....

Fields of interest:.....

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I/we enclose a cheque (in US$ or £ sterling ONLY please) of:

.....US$60 or £35 for FULL membership
.....US$10 or £6 for STUDENT membership
.....US$70 or £41 for SPOUSE membership

Cheques to be made payable to:

INTERNATIONAL SOCIETY FOR REEF STUDIES

Send completed application form and your cheque to:

Dr Pat Hutchings, Australian Museum, P.O. Box A285, Sydney South, New South Wales, Australia 2000.