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REEF ENCOUNTER

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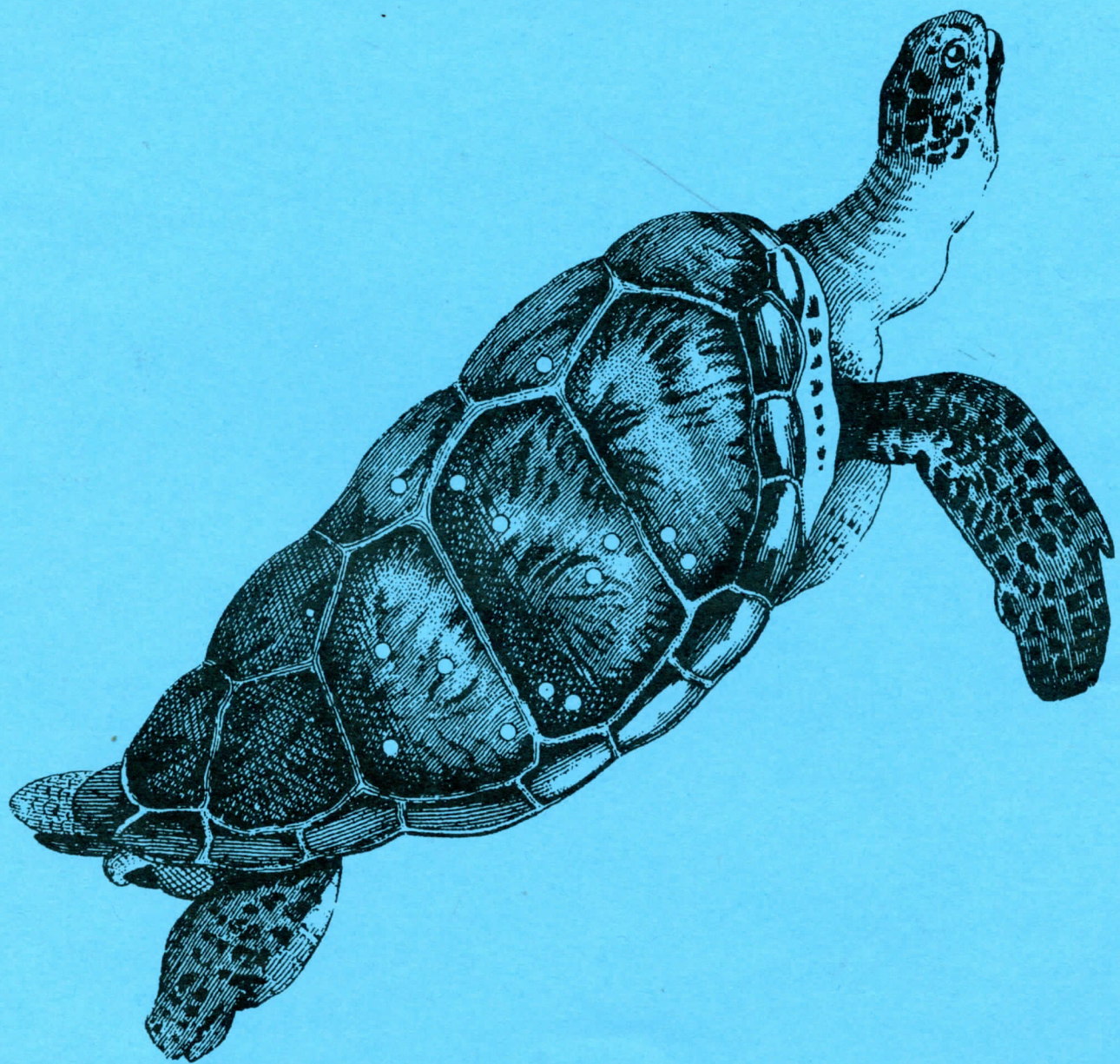

REEF ENCOUNTER No. 20 March 1997

NEWSLETTER OF THE INTERNATIONAL SOCIETY FOR REEF STUDIES

Editor Sue Wells
Associate Editors Maggie Watson and David Obura

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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.

COPY DEADLINE FOR REEF ENCOUNTER 21 (due out July 1997) IS MAY 1st 1997

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EDITORIAL

We promised we would never be late again with *Reef Encounter*, but this seems to be a difficult promise to keep. Apologies once again – the delay this time was entirely due to Sue, not to the newer members of the editorial team. Maggie Watson has done a great job keeping things moving in this change-over period and we are hoping that she will be able to stay involved from her new post in the British Virgin Islands. David Obura is also an invaluable addition to the *Reef Encounter* team and from his base in Kenya will be ensuring that the newsletter gets much better regional coverage. Once again thank you to all our contributors, who have patiently put up with alternately being chased for copy and then subjected to delays at our end – we are sorry if any of the news items now seem slightly out of date.

Sue found herself on January 1st of IYOR, the International Year of the Reef, watching four aquarium fish collectors scooping up the remaining damsel fish from a reef on which a group of tourists were about to dive, in Pulau Seribu Marine Park in Indonesia. The collectors came from a nearby village, where the houses were packed together on a tiny island and the community scratched a living from any marine resource at hand, including damsel fish. This episode seemed a very appropriate 'Compleat Reef Encounter' for 1997 and spoke volumes about the issues at hand. We hope you all have some good reef encounters this year and a busy International Year of the Reef – keep the newsletter informed of your research, news and opinions!

Sue Wells
Maggie Watson
David Obura

ISRS COMMENT

FROM THE PRESIDENT

John Ogden

The 8th International Coral Reef Symposium in 1996 was the largest since the first was held in India in 1969. This potentially unwieldy number of participants was transformed into an asset through superb planning and organization. The 15 plenary talks, which will be published in a 1997 supplement of *Coral Reefs*, were a novel centerpiece of the meeting, bringing the participants and the disciplines of coral reef science together into one hall three times each day. After six days of sessions and workshops, it is a testament to the skill and attention of the large team from the University of Panama and the Smithsonian Tropical Research Institute as well as the interest and energy of the participants that the last sessions were as well attended as the first. The ISRS booth at the meeting was also a very busy place. We signed up over 100 new members, sold 150 T-shirts and many books and journals, and answered myriad questions. On behalf of the Society I extend our deepest thanks to all for a stimulating and wonderful time!

The IABO (International Association of Biological Oceanographers) Coral Reef Committee (CRC) accepted by majority vote the proposal of Indonesia to host the next symposium in the year 2000. Malaysia was the runner-up and alternate. At the ISRS General Meeting members suggested that the CRC, whose only function has been to meet once every four years to select the next venue, had served its purpose. With our expanding membership and influence in international coral reef science, such as the International Coral Reef Initiative (ICRI) and International Year of the Reef (IYOR), it was agreed that the ISRS should take over and expand the functions of the CRC, particularly by providing scientific input into the design of the sessions and plenary talks and direct financial assistance. We are ready for this challenge and look forward to working closely with our colleagues in Indonesia to make the next Symposium as stimulating and well-organized as Panama.

In September, I accompanied ISRS Treasurer, Daphne Fautin, to negotiate our publication agreement with Springer Verlag in Berlin. Springer has developed a colorful new poster advertising ISRS and *Coral Reefs* and will work with us on a brochure which it will display in their booth at international meetings to help recruit new members. They will work closely with the new managing editor Dr. Terry Hughes to expand the size of our journal in 1998, improving our present problems with backlog of accepted papers and high rejection rate. I was grateful for the careful groundwork laid in two previous visits by Daphne and former ISRS President Bernard Salvat, particularly their 1995 re-negotiation of the profit-sharing agreement with Springer. More than any single other factor, this is responsible for our currently sound financial position and our ability to actively plan projects to foster coral reef science and management. Voting for the ISRS officers and council members is taking place while this issue goes to press. ISRS needs people who will be active participants in its growing involvement and influence in bringing the highest quality science to bear on the conservation and management of global coral reefs. Your voice and your vote are important.

Very best wishes to all.

THE COMPLEAT REEF ENCOUNTER

No. 20

Port Douglas, Australia: "With Secret Service counter assault teams poised to stave off stray sharks, President Bill Clinton plunged in the sparkling blue-green waters of the Great Barrier Reef... snorkeling his way past legions of iridescent fish, marveling at a giant clam and emerging unscathed ... to pronounce the experience an 'unforgettable day'."

Todd S. Purdum, International Herald Tribune, 23–24 November 1996.

ISRS NEWS

REPORT OF 8TH INTERNATIONAL CORAL REEF SYMPOSIUM

Some 1400 reef scientists, managers, students and others whose work involves coral reefs, attended the 8th International Coral Reef Symposium in Panama, 24–29 June 1996. Traditionally a discussion forum for scientists, presentations and debates at these symposia have increasingly focused not only on advances in reef science but also on the health and status of reefs. This reflects the growing emphasis on management science within the reef science community, itself a response to escalating human pressures on reefs. The 1981 meeting in Manila, the Philippines, had as its theme 'Reef and Man', and this theme has continued to dominate the proceedings.

The Panama symposium was remarkable, not only for its large size, but also for the sense of agreement that only a united effort, with scientists and managers helping each other, will produce solutions to the manifold problems facing coral reefs. A central theme throughout the meeting was the application of increased scientific understanding to reef management. Many Symposia and Workshops had management themes and for several an explicit goal was to bring scientists and managers face to face. The International Coral Reef Initiative (ICRI) convened a special session on 'The Role of Science in Coral Reef Governance' and numerous other workshops, sessions and presentations also touched on this topic.

Those concerned about reef health have long considered that the primary anthropogenic threats are overfishing, sedimentation and nutrient enrichment, which can be compounded by events such as coral bleaching and a range of other human activities that lead to direct damage on reefs such as recreational activities and boat groundings. Papers presented at the Congress provided a firm scientific foundation for these conclusions, and there is now good data and evidence for managers and policy makers to use in their efforts to influence public opinions and governments. Scientists are never fully satisfied with the adequacy of their data and, as for previous meetings, several sessions and workshops attempted to review the state of knowledge in their fields and define future research needs.

Historically, coral reef management has tended to be directed towards the establishment of marine parks (often 'multiple-use' as these tend to be more acceptable to local users), and the regulation of tourism activities. Reefs have been managed and protected in many countries for at least two decades, but with surprisingly few outright success stories. The science presented in Panama sent clear messages to managers that a much broader approach is needed. Several case studies illustrated that many reef managers have already taken this to heart and the principles of integrated coastal management are now providing the framework for their activities. Many presentations also documented the enormous amount of work that is underway to develop methods for surveying, assessing and monitoring reef conditions, that are appropriately rigorous and yet simple enough that they can be carried out on a time- and space-scale that is meaningful in this era of rapid change. They must also be available to reef managers and scientists with few financial or technical resources.

The symposium also offered glimpses of many exciting new advances in reef science, although the greatest challenges facing those attending were picking which of the 11 concurrent sessions to go to and then squeezing into the room after they had arrived. Molecular biology is forcing the pace in evolutionary and biogeographic studies on reefs. Cryptic species seemed to be popping up all over the place and models of speciation in the Indo-Pacific were shown to be long-overdue for an overhaul. The first direct measure of larval fish recruitment to their natal reef confirmed what commonsense and circumstantial evidence have long led us to suspect: that quite a large proportion of larvae (18–20%) recruit locally. This finding will bolster arguments for setting up marine fishery reserves as it suggests that local users can expect local benefits rather than just producing recruits for areas far downstream.

Several presentations showed clearly how fishing is changing the structure of reef ecosystems, yet in parallel sessions it was surprising how few of those studying reef fish community structure had even considered the possibility that fishing might have an influence on what they had measured. Cautionary words came from Jeremy Jackson in his plenary talk on 'Reefs since Columbus'. He documented the descriptions of the Caribbean marine environment made by early explorers, when large species, such as turtles, dominated the marine fauna in huge abundance. Changes in the Caribbean environment may well have occurred much earlier than we believe. The reefs we work on now are probably very different from those of 400 years ago.

One of the most positive outcomes of the symposium was the widespread feeling that the future of coral reefs lies in effective stewardship, and that everyone scientist, manager, fisher, tourist, coastal and inland resident has a role to play and a responsibility to take action. There is little doubt that future symposia will continue to provide a major forum for reef management science. It can only be hoped that the findings presented in Panama will continue to help improve the practice of reef management.

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SEE YOU IN BALI, 2000

From a process resembling an Olympic Games bid, Bali, Indonesia, was selected to host the 9th International Coral Reef Symposium (ICRS) which is planned to be held in Nusa Dua in October 2000.

Invitations to bid were sent out in March 1996 to more than 90 people in over 30 countries. Expressions of interest were received from 13 countries and these condensed down to six actual bids advanced in Panama at the 8ICRS: Bahamas;

Bali, Indonesia; Eilat or Jerusalem, Israel; Kota Kinabalu, Malaysia; Taiwan; Miami, USA. Countries displayed posters during the conference and prepared a summary document for the selection committee so that all participants at the 8ICRS were exposed to the bids and able to influence the Committee.

At the end of the symposium, all bidding countries presented their cases to the committee (representing 15 countries or territories) which comprised 12 council members from ISRS and 13 members selected by the Coral Reef Sub-Committee of the International Association of Biological Oceanographers. The committee had a very difficult choice as the standard of the bids was excellent, presenting in graphic detail all aspects from conference facilities and budgets, to quality of food and local cultures. All bidders had obtained government support, indicating the global significance of these Symposia.

After a complex selection process, voting came down to two countries and, in a close vote, Indonesia just beat Malaysia. In a unique spirit of cooperation these two countries will combine many of their resources to stage the Symposium. Members from Malaysia are invited onto the Indonesian Organising Committee and if for any reason the latter cannot proceed with the Symposium in 2000, Malaysia will be invited to take over.

The Indonesian representatives reassured the committee that invitations will be extended to individuals of all countries who wish to attend, irrespective of their race, religion and political beliefs. Although host countries have the right to refuse entry, the Committee stressed that every effort should be made to ensure that delegates from countries without diplomatic relations with Indonesia (or where Embassies are difficult to contact) are assisted in obtaining the necessary visas and travel documents.

These Symposia are very large events (Panama had over 1300) and require considerable organisation. We ask all intending participants to assist the Indonesian Organising Committee. The Panama Committee experienced considerable problems with slow responses and delegates signing up for the Symposium at the last minute. The international coral reef scientific and management community welcomes Indonesia as host for the next symposium and we stand ready to assist.

Clive R Wilkinson and Jeremy Jackson
Co-Chairs, ISRS-IABO Selection Committee

RESULTS OF THE ISRS COUNCIL ELECTIONS

The ISRS council elections had a modest turn out of votes 242 (against a membership of approximately 800). Thanks to everyone who voted and/or stood. Daphne Fautin and Steven Miller received a very strong vote of approval to continue in their present roles as Treasurer and Recording Secretary respectively. The new Councillors of the Society are: Rolf Bak, Gregor Hodgson, Michel Pichon, Donald C. Potts, Paul Sammarco, Bernard Thomassin.

Callum Roberts, Corresponding Secretary

TREASURER'S REPORT

1996 Membership Statement

As of 15 September, ISRS had 805 memberships:

650	individual memberships
109	student memberships
40	family memberships
6	honorary memberships

103 people joined the Society or renewed their membership at the International Coral Reef Symposium in Panama. Welcome to all new members, and welcome back to those renewing!

1997 BUDGET

Income	US$
Dues	48,000.00
Subsidy for editorial expenses from Springer	4,000.00
Page charges	1,000.00
Interest	1,500.00
Other (e.g. proceeds from sale of NGBR)	400.00
Donations from members	100.00
Total	55,000.00
Outgoings	
Coral Reefs	
printing 4 normal issues	10,000.00
printing supplemental issue of ICRS plenaries	5,000.00
shipping and postage	10,000.00
editorial expenses	4,000.00
Reef Encounter	
printing	4,000.00
shipping and postage	1,500.00
Membership directory	3,500.00
Membership administration	
fee	5,000.00
postage and supplies	3,000.00
Communications expenses (postage, fax, etc.)	2,000.00
Office supplies	150.00
Bank and card charges	1,300.00
Audit and tax return preparation	3,000.00
Total	52,450.00

Daphne Fautin, Treasurer

1997 ANNUAL MEETING OF ISRS, FIJI

A joint symposium of the Pacific Science Association's Scientific Committee on Coral Reefs (PSA-SCCR) and the 1997 Annual Meeting of ISRS is planned as a major scientific event in the International Year of the Reef (IYOR) during the VIII Pacific Science Inter-Congress, 13–19 July 1997 in Suva, Fiji.

Contributed papers on all aspects of coral reef science are welcome, but we are extending a special invitation to papers providing examples of successful management. We feel the most effective way to promote wise management is

not by telling people what to do or giving alarming news about the state of reefs; rather, we urge the demonstration of methods proven to be successful through case studies. For comparative observations, dive excursions are planned on one-day field trips in or near Suva Bay and Beqa Reef.

Among IYOR projects which are already scheduled for presentation at the Fiji meeting are the results of the PSA-SCCR assessment of the state of coral reefs in the Pacific, a project funded by the U.S. Department of State's International Coral Reef Initiative (ICRI). Ten representatives of regions in the Pacific will present papers to be published in a book on the status of reefs in the Pacific, funded by Sea Grant at the University of Hawaii, and made available at the Fiji symposium. A complementary project called GLOCOR (Global Coral Reef Assessment), funded by a Winslow Foundation grant, will also be presented at the symposium. This project involves the quantative resurvey of transects surveyed decades ago in order to assess changes in Pacific reefs.

Participants intending to present a paper or poster are required to submit abstract(s) to the Secretariat by January 1997. In order that we may organize the symposium, please also send a copy of the abstract to:

Dr. Charles Birkeland, UOG Marine Laboratory, University of Guam, Mangilao, Guam 96923. FAX (671) 734-6767, e-mail: birkelan@uog9.uog.edu
Dr. Richard W. Grigg, Department of Oceanography, 1000 Pope Road, Honolulu, Hawaii 96822. FAX (1) 808-956-9225, e-mail: rgrigg@soest.hawaii.edu

Second Circulars for the VIII Pacific Science Inter-Congress, including registration forms, abstract forms, information on accommodation, due dates, and field trips, are available from: *VIII Pacific Science Inter-Congress Secretariat, School of Pure and Applied Sciences, The University of the South Pacific, P.O. Box 1168, Suva, Fiji. FAX: (679) 314-007, e-mail: psa@usp.ac.fj [best means of communication]; Web site for the Inter-Congress is: http://www.usp.ac.fj/~psa*

ISRS 1998 ANNUAL MEETING AND CORAL REEF SYMPOSIUM, BOSTON

A major symposium on the subject of "Coral Reefs and Environmental Change Adaptation, Acclimation, or Extinction" will be held at the joint meeting of the Society for Integrative and Comparative Biology (SICB, formerly the American Zoological Society), the Ecological Society of America (ESA), and ISRS in Boston, USA, January 4–7, 1998.

The Symposium at this precedent-setting multisociety meeting will consist of two days of invited talks centred around, but not limited to, the output of Working Group 104 ("Coral Reef Responses to Global Change: The Role of Adaptation") of the Scientific Committee on Oceanic Research (SCOR). Coordinated sessions of topically-related contributed papers and posters will also be offered.

All ISRS members will receive meeting notices, abstract submission information, etc. An update announcement will appear in the next *Reef Encounter*; additional information may be obtained from the organizers: Robert W. Buddemeier (buddrw@kgs.ukans.edu) and Howard Lasker (hlasker@acsu.buffalo.edu).

1998 ISRS EUROPEAN MEETING

This will be held jointly with the Ecole Pratique des Hautes Etudes, URA 1453 CNRS, and ACOR (the French Association for Coral Reefs), 1-5 September 1998, in Perpignan, France. It is broadly aimed at encouraging collaboration in Europe, and students will be welcome. Further details to come in future issues of Reef Encounter or contact: *Rene Galzin and Michel Pichon, Ecole Pratique des Hautes Etudes, URA 1435 CN^RS, Universite de Perpignan, 66860 Perpignan Cedex, France. Tel: (33) 4 68 66 20 55; Fax: (33) 4 68 50 36 86; e-mail: pol@univ-perp.fr*

FIRST ISRS-SOLLINS GRADUATE FELLOWSHIP AWARDED

Melanie Dotherow-McField, a graduate student in the Department of Marine Science at the University of South Florida, has been awarded the first ISRS-Sollins Fellowship in Coral Reef Ecosystem Science. The fellowship, worth approximately $13,000, was established last year by Professor Phillip Sollins of Oregon State University with a donation to the Society in partnership with the Center for Marine Conservation in Washington, DC. Ms. McField's application was selected by a committee of the ISRS and the CMC from a total of 29 applicants from all over the world.

Ms. McField has worked in Belize since 1990, as a biologist with the Hol Chan Marine Reserve, as the Belize Representative of the International Tropical Conservation Foundation, and as a consultant with the Coastal Zone Management Project. She also served on the Board of Directors of the Belize Audubon Society. Ms. McField will use this Fellowship to support her graduate research on a survey of coral reef community structure and the investigation of their relationship to existing reef management efforts at various locations along the barrier reef complex. The information collected will also represent the baseline data for a long-term coral reef monitoring program conducted with the assistance of the Belize Fisheries Department and Coastal Zone Management Project. As a citizen of Belize, she will assist in the continuation of these conservation efforts in Belize upon completion of her PhD.

NEW TRADITIONS

A growing, evolving entity, such as the coral reef science community, develops new traditions. This is healthy. Dr. R.N. Ginsburg initiated a new tradition at the final night banquet for 8ICRS in Panama this June. He invited members of the organising committees of the 7 previous International

Symposia to reminisce briefly and reflect on how times have changed. He then read a poem about the coral polyp and coerced them into performing an impromptu dance in its honor.

As one of the dancers, I think we should now initiate an additional new tradition in the form of a Song in Honor of Bob. This should be sung whenever a group of four or more are gathered in his presence, and particularly after he has presented a paper, officiated at a ceremony, or participated in other similar scholarly events. It could become the official anthem of IYOR. The song is to the tune of "Her majesty's a pretty nice girl", a short ditty hidden on the innermost tracks of side two of the vinyl version of the Beatles' Abbey Road, and remembered in a strangely smoky haze by all coral reef scientists of the right vintage. If you don't know the tune, hum along anyway. Bob will enjoy it. Here it is.

A Song In Honor Of Bob

Bob Ginsburg is a crafty old man, getting craftier from day to day,
Bob Ginsburg is a cagey old man, but we sorta love him anyway,
He always tells us corals matter a lot,
Gees, Bob, we all kinda know that line,
Bob Ginsburg, he's a Coral Reef Man, and we really hope he stays that way,
Oh, yeah! We really hope he stays that way.

(With apologies to the Beatles, the Queen, and lots of other people)

Peter Sale

ISRS MYSTERY PHOTO COMPETITION!

Who is this well known reef scientist haunting the ISRS booth at the 8th ICRS, and photographed by Gray Multer? (Hint, if you add more teeth and reduce his nose, you should recognise him). The first correct entry wins an ISRS teeshirt. Send your answer (clearly dated) to Sue Wells at swells@wwfnet.org or Fax: (41) 22 364 5829.

UPWELLINGS

ETHICAL CONSIDERATIONS IN EXPERIMENTATION

I was surprised by the lack of critical assessment of animal treatment at the recent International Coral Reef Symposium in Panama. Perhaps ISRS members should spend some time discussing ethical issues involved with animal experimentation?

Coming from a background in animal behaviour, and previously based at a British institution (where Home Office licensing rules for animal experimentation are strict), I had long been imbued with the ideas (a) that one's methodology must minimise animal suffering and pain and (b) that animal sacrifice should be rigorously evaluated to ensure that it was absolutely necessary, scientifically valid, and humanely executed. Some of the research I heard at the ICRS would not have met these criteria.

Consider two examples from the symposium. First, I listened to work that involved electric shocking of larval fishes in experimental races to keep them swimming (the next paper reported similar findings, but this time obtained by swimming beside larval fish in the sea). Second, I learned of an experiment that involved taking crabs that were normally reclusive and camouflaged among algae and tethering them in exposed positions on bare ground to see whether they would be eaten more quickly than the hidden controls: they were. That both the aforementioned presentations were by excellent scientists only depressed me further. I heard no discussion of whether these and other manipulations were justifiable.

Why, I wonder, were ethical issues tacitly ignored by presenters and audiences? If we do not take responsibility for evaluating our own work and that of our peers, we expose ourselves to attacks from animal-rights activists. We have probably escaped censure to date because our work deals primarily with fishes and invertebrates, both groups that are seldom thought of as wildlife. However, the current long-overdue increase in conservation assessment of marine species may well focus greater attention on all threats to these animals, including scientific collection and experimentation. We might do well to re-consider our approaches to the use of animals in science.

Despite increased regulation of animal use in many countries, researchers still need to take final responsibility for their actions and those of their peers. Guidelines are often sufficiently general to allow for considerable variation in local interpretation, depending on the rigour of the committee or researcher; procedures are often amended after approval; and coral reefs are commonly located in developing countries with few restrictions on animal work. Community opinion essentially determines the level of adherence to animal care guidelines.

The Association for the Study of Animal Behaviour (ASAB) has specific guidelines to promote and ensure ethical treatment of animals, including considerations relating to:

- Choice of species, life history stage and non-animal alternatives;

- Number of individuals needed;
- Justification for pain and suffering;
- Endangered species;
- Procurement of animals;
- Housing and animal care;
- Final disposition of animals.

Referees for papers submitted to *Animal Behaviour* are asked to indicate whether any ethical concerns are raised by the work, and these can provide grounds on which to refuse a manuscript. Perhaps these principles should be examined for their applicability for work submitted to *Coral Reefs* and presented at the ICRS? Or can we come up with another set of guidelines that also recognise ethical issues associated with habitat disruption?

Amanda C.J. Vincent, Department of Biology, McGill University, 1205 Ave Dr Penfield, Montreal, Quebec H3A 1B1, Canada. Email: avincent@bio1.lan.mcgill.ca

IS CORAL VITALITY A GOOD MEASURE OF REEF HEALTH?

I read with great interest the article by Ginsburg, *et al.* (*Reef Encounter* 19) entitled "Rapid Assessment of Reef Condition Using Coral Vitality". While I applaud the authors' efforts, I am concerned that, in its present form, their approach misses the mark. The article emphasizes coral health as an indicator for the reef system as a whole, when in fact corals are only one group among a suite of organisms that contribute significant amounts of $CaCO_3$ to reefs. The fraction contributed by corals can vary significantly from one reef to another. For example, the deep drilling expedition on Funafuti Atoll (Sollas, 1904) reported coralline red algae to be the most significant contributor overall. Green algae *(Halimeda)* and foraminifers were second and third, respectively, and corals actually ranked fourth behind these other three in their contribution of $CaCO_3$ to the atoll.

In his study of variation in diagenetc sequences, Dullo (1986) reports only 16.8% contribution of calcium carbonate by scleractinians and 19.0% by calcareous algae in Recent reefs at Sharm al Harr in the Red Sea. The balance was made up by other biota including foraminifers, molluscs, etc. and abiotic processes.

The point is that not all reefs, and indeed perhaps few, rely on corals for the bulk of their constituent $CaCO_3$ makeup. Thus, even when destruction of significant coral cover has occurred, the reef as a whole may still be considered alive and healthy if overall net deposition of $CaCO_3$ remains positive. Even in reefs with a high composition of corals, this is possible where corals are stressed by crustose coralline algae, in particular, quickly colonizing the surface area once covered by live coral and continuing to lay down $CaCO_3$ in their stead. In addition, crustose coralline algae thrive in the high energy environment of the reef crest where few corals can survive, and are absolutely essential in binding unconsolidated $CaCO_3$ material to the reef. Without them, the $CaCO_3$ deposited by most corals would be lost due to erosive forces both biotic and hydrodynamic. There is even some evidence to suggest that crustose coralline algae may play a role in the settlement of new coral recruitment (Morse and Morse, 1991).

I personally have seen reefs on which the live coral cover had been reduced to perhaps 10% or15% due to storm damage (in the Marshall Is.), and bleaching (in the Cooks), and there was a very active and healthy growth of corallines and *Halimeda* covering much of the erstwhile corals. My subjective impression was not that these reefs were dead, but rather, they were very much alive, only changed.

Storms are a natural component of reef ecology, as may be *Acanthaster* blooms and some bleaching events. I would suggest that some reefs undergoing such stresses may simply be at a different point in the cycle of reef succession. Thus, even if we think of corals as a climax community within the reef ecosystem, it would be erroneous to assume that a reef is in true crisis just because the coral community is stressed. Any technique we devise for assessing reef health must go beyond the immediate and obvious impression of loss of coral cover, and consider the health of all the major $CaCO_3$ producers, especially the algae, to be genuinely useful. Perhaps we could begin that process by finding a more appropriate term than "Coral Reefs."

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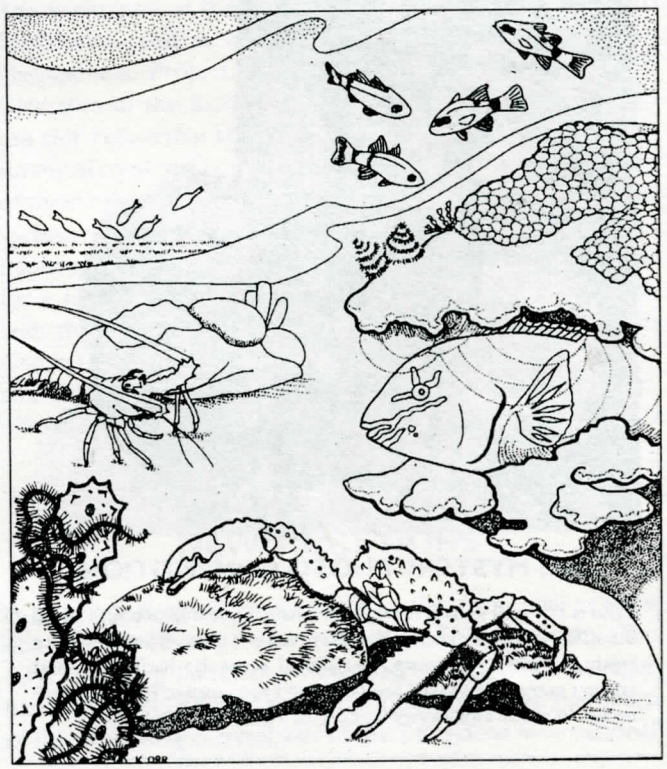
Philip S. Ely, 3388 Haynie Road, Blaine, WA 98230



From The Coral Reef Coloring Book by Katherine Orr (1992, Stemmer House Publishers Inc., Maryland, USA).

FEATURES

CORAL REEF MONITORING – THE STATE OF OUR ART.

A well established ecological monitoring program which collects relevant data and makes it available to decision makers is an essential component of a successful resource management program. A poorly developed monitoring program can simply drain already scarce resources. Denise McCorry (currently at the Swire Marine Laboratory, Hong Kong) recently completed a world-wide survey of coral reef monitoring programs underway in 1994 as part of her MSc requirement at the University of Newcastle's Coastal Management Program (McCorry 1996). Her study surveyed the status of 49 programmes of which over half were classified as being implemented by individual scientists and the rest by government departments, nongovernmental organisations, and marine protected areas. The majority of respondents were either from the Caribbean and involved in CARICOMP, or from the Indo-Pacific, and associated with the ASEAN programme. A few respondents were carrying out independent programmes. The report highlights some of the problems and successes of monitoring programs and provides a good opportunity for reflection and constructive criticism. Below, I summarise some of McCorry's findings, and my thoughts and own experiences in order to provide some constructive criticism, future direction and improvements for coral reef monitoring.

1) Adaptive management, costs and labour

About 50% of the responses named science as the major objective for monitoring with only 16% mentioning management. About 30% of the respondents thought it was too early to know the primary objective or relevance of their monitoring. Most of the studies were collecting 'baseline data', and there were only a few examples where monitoring had led to management plan development or changes in management practices. McCorry concludes that management objectives are failing because coral reefs are complex systems not easily understood from monitoring records, moreover monitoring programs and objectives are not targeted and information is often available too late for use by managers in mitigating impacts. Perhaps not surprisingly, financial and labour costs were the two most constraining factors in coral reef monitoring.

I believe many of these problems can be solved if we agree that *adaptive* management (Walters 1986, Walters and Holling 1990, Hilborn et al 1993) is one of the main objectives of monitoring. Adaptive management scientifically evaluates the outcome of management decisions so recommended adaptations can guide managers towards their stated objectives. Monitoring plays an important role in determining the results of management actions which are substitutes for scientific treatments or experiments. In complex ecosystems such as coral reefs cause and effect are hard to distinguish, so adaptive management programs also require modelling and smaller scale experimentation to further test scientific predictions. Commercially important resources are only part of a larger ecosystem, and many species without direct commercial value also need to be monitored or studied if the system is to be understood. Monitoring, modelling and experiments form the three lynch-pins of adaptive management.

If management is to be changed, the reasons must be understood by decision makers, managers and resource users. Most ecosystems have many user groups with a stake in the health of the ecosystem and coral reefs are no exception. This diversity of stakeholders is often a political problem but it is also a way to spread costs and improve communication. Given the labour and costs involved in monitoring, spreading the cost among interested parties is likely to improve the sustainability of the programme and insure different communities are represented in the data collection and communication process. For example a monitoring programme in Kenya led by an international conservation organisation (The Wildlife Conservation Society) involves personnel from the Fisheries Research Institute, Park Service, and Fisheries Department. Whilst the extent of annual monitoring often depends on the labour available, a basic minimum is achieved even in lean years.

2) The need for controls and comparison of existing management treatments

Over 80% of the respondents to McCorry's questionnaire reported that they were monitoring to collect 'baseline data' and over 75% are studying 'coral reef dynamics'. Less than 40% of the respondents were studying the effects of pollution while about 55% were studying marine protected area activities. Given the complexity of reef dynamics, I believe the primary focus of these monitoring studies must be the study of coral dynamics and collection of baseline data under different management treatments. These treatments should include a suite of environmental or habitat factors but should be focused on human resource use issues in order to gain support from interested communities.

In the Kenyan monitoring program various levels of fisheries management, including full protection from fishing, gear regulations and no gear regulations, represent experimental treatments. To ensure statistical rigor in the findings and maintain confidence in the results of monitoring, treatments should be replicated. Most monitoring studies are pseudoreplicated because replicates are only established with one control area and often no more than one impacted site. Given the ecological complexity and spatial variability in coral reefs, conclusions from such site-specific studies may not be generally applicable. In Kenya, we monitor three old marine parks (created before 1974), one new marine park (created in 1991), two reserves (restricted gear use) and four reefs with no gear restrictions. This replication of treatments ensures conclusions about fisheries management are robust. Inadequate replication of controls is often a problem in large-scale field studies. However fully protected parks can provide important controls for all extractive human resource use. Therefore, measurements in fully protected parks should be a priority for monitoring programs.

3) The importance of spatial variation in determining temporal variation

Over 60% of McCorry's respondents used ANOVA statistics to analyse their field data and therefore good estimates of variation are critical to the conclusions of monitoring programs. The purpose of most monitoring programs is to quantify temporal variation under different treatments in order to distinguish long term cause and effects. However such analysis is often complicated by the unintentional inclusion of spatial variation (Steward-Oaten *et al.* 1995). For example, organisms and even monitoring structures (such as transect lines) may move, introducing spatial variation and confounding analysis of temporal trends within sites. Where only one site per reef is studied no measures of spatial variation are available to correct calculations and estimates of temporal variation are probably biased.

Temporal and spatial variation often appear to be strongly and positively correlated, but this is frequently an artefact of incorrect monitoring. A recent study of sea urchin population dynamics in Kenya supports this point (Fig. 1). In this study, predation levels on the sea urchins varied among reefs by a factor of eight. Higher predation increased the spatial variation of the sea urchin populations, and consequently good estimates of temporal variation were not possible until spatial variation was subtracted from the total variation. Clearly, someone monitoring these populations over time without considering spatial variation caused by varying predation would conclude that temporal variation was very different among the reefs when in fact it is nearly constant.

Therefore, in order to distinguish temporal variation from confounding factors, good estimates of spatial variation must be made at each site, i.e. samples must be replicated. Temporal variation is then best calculated as the difference between the total and the spatial variation. If coefficients of variation are used (i.e. COV = S.D./mean * 100) then COVtime=COVtotal – COVspace. Studies that do not replicate sites within reefs will also have a difficult time distinguishing within reef spatial and between-reef variation since various ecological processes can be influencing spatial variation differently in each reef. Thus overall values will produce poor estimates for individual reefs – as shown in Fig. 1.

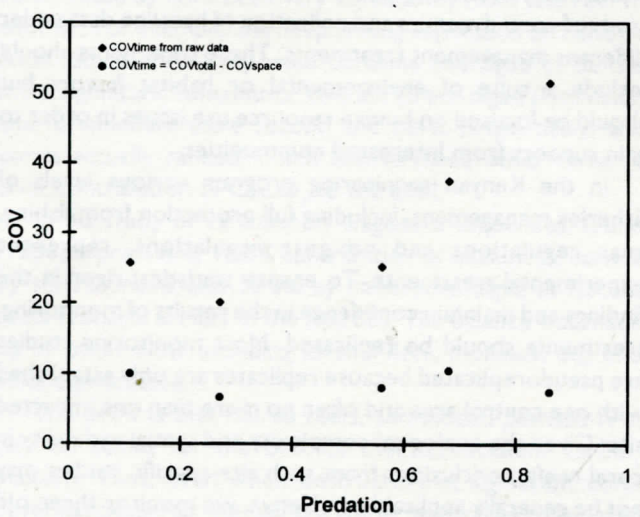


Fig. 1. Graph presents the calculation of temporal and spatial variability of sea urchin populations on 5 Kenyan reefs studied over a 7 year period as a function of the intensity of predation. One method (Temporal COV-direct) calculates temporal variation (COV = S.D/mean x 100) for each reef directly from the annual site averages; overestimating temporal variation under high predation conditions by compounding the effect of high spatial variation amongst reefs. The second method (Temporal COV-indirect) calculates temporal variation as the difference between total variation and an average spatial variation estimate for each reef . This method produces much lower, and very similar, estimates of temporal variation for each reef.

4) Ecological state variables versus processes

Monitoring programmes often investigate the status of reefs by focusing on quantities or state variables such as coral cover of fish abundance. For example, over 95% of McCorry's respondents recorded percentage coral cover and over 70% measured the relative abundance and species diversity of corals. These state variables are often used to measure the ecological health of a reef in order to focus management goals on achieving certain ecological states. Unfortunately monitoring by itself rarely identifies causative relationships between measured variables and processes (Hughes 1992). This can seriously stifle effective management, as managers resort to guessing at causes or accepting the most vocal or influential opinions. This is especially likely when only ecological states are monitored and the rest of the scientific trinity of adaptive management are not included. Since ecosystems are the dynamic outcome of states and processes, monitoring can determine causative factors if these processes or rates are also monitored. However McCorry's study records less than 5% of the respondents were studying predation, competition, physiological parameters or recruitment and none are listed as monitoring the calcium carbonate balance. This is worrying – particularly as the calcium carbonate balance is probably the universal currency of reef health and value.

The results of monitoring will be better understood if important ecological processes such as herbivory, carnivory, primary production, calcium carbonate deposition, and biological or physical erosion are monitored. Previously, field work and discussion among coral reef biologists has centred around estimating state variables. This may be less important than discussions that help expand the scope, efficiency and power of measurements in understanding ecological structure. The challenge to coral reef ecologists is to develop simple assays that determine processes in ways that are easily incorporated by monitoring programs. Some methods for herbivory, carnivory, calcium carbonate deposition and bioerosion already exist (Hay 1981, McClanahan et al 1994, McClanahan & Muthiga 1989, Glynn 1988, Eakin 1992) but more work is necessary to compare ecological assays with real rates and processes in coral reefs.

5) Combining monitoring with experiments and modelling

An objective of monitoring and adaptive management should be to develop conceptual and simulation models of

ecosystems. Using management regimes as scientific treatments as discussed above is one way to experiment, but because treatment areas are large and loosely controlled, coincident smaller and more closely controlled experiments are often needed.

Many ecologists regard simulation models as the end product of field and monitoring studies. Nevertheless, only one study surveyed by McCorry (1996) listed the production and testing of ecological models as an objective of their monitoring program. Including modellers in the scientific process is often an afterthought left until late in the project. This is a disastrous approach that will produce an unfortunate surprise for many ecological or resource based management programmes. I believe the information required by modellers should drive much of the field data collection and not vice versa.

A good example of this problem is exposed by my own modelling studies of predation and coral reef organisation, based on Lotka-Volterra equations (McClanahan, 1992; 1995). These models demonstrate that data on the processes of consumption and production are the principle information required to create energy based ecological models, although the level to which species can reduce resources is also critical (Tilman 1982, McClanahan 1992). State variables are cancelled out in the calculation of most model coefficients and are therefore largely irrelevant to model creation. Since most monitoring programs focus on state variables rather than processes, they will be largely ineffective in creating simulation models that consider species interactions. Such models need ecological process data, such as consumption, production, disturbance frequency and intensity, and recruitment data, rather than increasingly precise estimates of state variables. From the process data one can create and simulate ecological models in order to compare outputs with state variable data collected during monitoring programs. However this is not the state of our art and is unlikely to happen with the present financial and labour constraints. Nonetheless by fully realising the purpose of monitoring activities we can make greater efforts to build modelling, experimentation, and monitoring into a single circular and iterative process of scientific and adaptive resource management. The hope for understanding ecosystems and managing the resources they provide lies in this adaptive circularity and not in the continuation of a rigid and single minded programme of study.

The majority of programmes reported by McCorry have not passed their first decade and yet many are troubled by a lack of finances, labour and relevance. If these programmes are to survive the next decade, cost sharing and increased relevance to resource-use problems is needed. Monitoring, in conjunction with adaptive management, could create ecological and financial successes. Consideration and inclusion of the above factors into monitoring programmes should improve our chances of success.

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Denise McCorry thanks respondents from all participating monitoring programmes (detailed of which can be found in ICLARM'S REEFBASE). She would welcome feed back on the value of further surveys and suggestions for widening the scope of such investigations. Denise can be contacted at *The Swire Institute of Marine Science, Cape D'Aguilar Road, Shek'O, Hong Kong, Hong Kong. Fax 852-2809-2197, Tel. 852-2809-2197, Email: mdenise@hkucc.hku.hk*

NEWS

NEW PORT AND FREE ZONE FOR SÃO TOMÉ AND PRÍNCIPE

A new threat to corals in the Gulf of Guinea has arisen since the report of mining in the last issue of *Reef Encounter*. A deepwater port is now planned as part of a much larger development. On 14th April 1996 the government of São Tomé e Príncipe signed a Memorandum of Understanding with a South African company WADCO (Pty) Ltd. for the creation of an offshore Free Zone in Príncipe. WADCO (West African Development Corporation) is acting on behalf of ABC-PROMO (Agulhas Bay Concession Promotion Company), a multinational company that will coordinate the development in the Baia des Agulhas area of western Príncipe. The main business activities of the zone will provide services to the various oil rich countries around the Gulf of Guinea and may include marine and aviation engineering, educational and training services and banking. A deepwater port has been proposed for the Baia des Agulhas, one of the most stunning areas of the islands.

The free trade zone overlaps significantly with proposed terrestrial and coastal protected areas which have recently been delimited by the European Union financed ECOFAC project. The construction of a port and the consequent problems resulting from increased shipping could threaten the marine ecosystem around the whole of Príncipe. WADCO/ABC-PROMO have asked the World Bank to finance an independent environmental impact assessment.

Alternative locations are also under consideration, including the northwestern area of São Tomé which boasts better communications and proximity to the country's capital. Whichever location is chosen, the country's unique marine environment is at risk. Little is known about the country's marine ecosystems but they are rich in endemic species. *Montastrea cavernosa guineense* (which is known only from São Tomé, Príncipe and Annobon), the West African endemic *Porites bernardi*, and *Siderastrea radians* are amongst nine coral species known from the islands which are already threatened by coral mining in northwest São Tomé. The only marine survey was conducted in 1956 by the *Calypso* and discovered endemic crustaceans and sponges. Recent work on the marine molluscs has also turned up a high number of endemics. A baseline survey of marine habitats and biodiversity around the islands is clearly important if environmental impact assessments are to have any validity.

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TAKING ACTION ON THE LIVE FISH TRADE

The use of sodium cyanide to catch fish for the rapidly growing restaurant and aquarium trades in live reef fish has been widely publicized following the release of the report by Johannes and Riepen (1995). Insatiable demand in Hong Kong, China and Taiwan drives widespread cyanide use for the lucrative restaurant trade. It is also used almost exclusively as the most cost-effective method to harvest ornamental fish for worldwide distribution, of which the US accounts for nearly half. The Nature Conservancy (TNC) and others are now developing a strategy to protect the vital marine resources endangered by this practice. The goal is not to eliminate the live reef fish trade, but to develop sustainable fisheries through regulating the industry, providing fishers with alternative livelihoods, increasing local empowerment and incentives to protect marine resources, and encouraging research and development of mariculture alternatives. An analysis of the laws addressing destructive fishing practices has been produced by TNC (Kim and Case, 1996).

TNC and others, are also working through APEC (Asia-Pacific Economic Cooperation) to encourage regional policies and enforcement to halt destructive fishing practices. APEC is an 18 member trade liberalization and economic and technical cooperation forum, whose member economies recognize the linkages between trade and economic development, and the natural environment that supports these activities. Two APEC working groups, the Fisheries Working Group and the Marine Resources Conservation Working Group, are addressing the live fish trade problem. A one-day, technical workshop on reef-destructive fishing will be convened at the Eighth APEC Fisheries Working Group meeting in Mazatlan, Mexico in spring 1997 and will focus on the 'upstream' causes of reef destruction in the fisheries sector, and potential solutions. A four-day workshop on the 'downstream', marine environmental impacts of reef destructive fishing was endorsed during the Ninth APEC Marine Resources Conservation Working Group meeting, and will be convened in Hong Kong in October 1997.

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CORAL REEF S.O.S. MORROCOY NATIONAL PARK, VENEZUELA

Jose Ramon Delgado

In January 1996 a massive coral reef death occurred in the Morrocoy National Park, located on the western coast of Venezuela. The event occurred between the 20th and 25th of January, killing corals, octocorals, sponges, shells, sea-urchins, sea-worms, anemones, octopus, small and big crustaceans (including lobsters), and fishes. Morrocoy National Park (32,090 hectares), created in 1974, comprises the most impressive range of coral reefs, mangroves and sea-grass beds along the Venezuelan coast. Lying at the westernmost end of the Golfo Triste, it serves as a major recreation area to inhabitants of the central-west region of Venezuela, and has been submitted to constant use and development impacts ever since.

About 90 % to 95 % of the coral reef died. Only those communities in some small cays seem to have survived in a rather good shape. Strange burnt-like scars can still be seen in many coral heads, sponges and other living substrata. The causes of this event are still not clear. Researchers and experts have outlined 2 major hypotheses:

1. Natural causes; a climatic and oceanographic anomaly where an inversion of the normal wind patterns, including dead winds conditions, and heavy rainfall, were observed during the preceding days. This sudden change of winds and surface currents could have allowed conditions for a phytoplankton bloom that caused the mass mortality, by obstructing filter-feeding mechanisms and reducing dissolved oxygen levels in the water column. However, it is not certain if the low oxygen levels were a cause of the mass mortality, or a consequence.

2. Toxic substance spill; the Golfo Triste area is crossed by many navigational routes where ships transport all kinds of chemical products that are potentially dangerous. There is also a high level of industrial activity within a 25 mile radius of the park, including a petrochemical plant, an oil refinery, a thermoelectrical plant and a paper pulp plant. Puerto Cabello, Venezuela's third seaport, is located 50 miles to the east.

The toxic chemical spill hypothesis is considered the most probable cause. However chemical analyses of samples taken by researchers from three national universities have proved inconclusive. So far, it is not yet possible to identify the cause of the massive die-offs.

The potential for chemical pollution in the park has been considered a ticking time bomb by many scientists, environmental groups and concerned citizens. The name Golfo Triste means "sad gulf", a name given by early navigators sailing along the Venezuelan coast, perhaps referring to the poor coastal environment around the gulf. For two decades (1957 to 1976), the gulf suffered mercury discharges from an old chlorine-sodium plant. Recently, public awareness of the problem has grown, through newspaper articles warning of the dangers of new sources of mercurial and other heavy metal pollution in the gulf.

However no serious concern has been demonstrated either by the government or by public enterprises. A contingency plan that would facilitate future actions in dealing with similar situations of massive mortalities has been proposed by the Universidad Simon Bolivar. Funds for some of the proposed research, such as a post-event evaluation of the coral reef community, are being sought. I am also trying to encourage local people to organize an NGO for dealing with such emergencies, but so far with little success.

A message was posted on the NOAA coral reef list-server, asking several questions to help guide us in our response to the die-off: 1) has a massive disappearance of this magnitude (approx. 10 to 12kms of coral reef barrier) ever happened on the planet and has it been recorded in any way? 2) what could be expected to happen with the surrounding ecosystems, mangroves and sea grass beds? and 3) what could be expected to happen with human activities such as tourism and fisheries?

However, we received few responses other than some condolences! Gregor Hodgson wrote of an extensive coral kill that took place in Hong Kong in 1994, killing more than 200 sq. km of reef. But since Morrocoy does not experience upwelling there does not seem to be a common causal link, although the effects and consequences may be similar. So far, only Audubon has stated concern for the bird population of Morrocoy, and is starting to address the question. The low response rate was disappointing, bearing in mind the current fashion for international concern with coral reefs.

None of the existing Venezuelan environmental NGOs is fully concerned with the marine environment, hindering action in coastal and marine areas. We are therefore focusing our efforts on creating a local NGO, founded on the interest, support and participation of local people – as without them little success can be expected. We are also trying to move away from past types of hand-to-mouth environmental projects that have predominated in the Caribbean and Latin America.

We are therefore seeking a private sponsor to assist with starting up the local NGO, and to support the study to gain deeper insight into what really happened. Among the primary needs are a suitable lap-top computer and printer with fax-modem capacity in order to access world-wide communications, and some funds for printing materials and traveling expenses. Additionally, assistance from agencies with access to Landsat or other remote sensing images of the area during the days concerned is needed, in order to identify sea surface conditions at the time.

Any ideas and/or contributions are welcome. Please pass the word to your colleagues and keep your fingers crossed! Please help us raise awareness and take concrete steps to protect the beautiful scenery and natural bounty contained in this jewel of the Venezuelan national park system.

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THE GERMAN PRIORITY PROGRAMME ON THE EVOLUTION OF REEFS

The German Research Foundation 's Priority Programme entitled 'Global and Regional Controls of Biogenic Sedimentation – Reef Evolution and Cretaceous Sedimentation' held it's closing colloquium at the University of Göttingen, 8–12 October 1996. The results of six years of joint reef research carried out under the umbrella programme were presented. There was also a poster session, review talks by invited speakers, an excursion to Permian reefs in Germany, and a presentation on the German International Year of the Reef Initiative (see p.xx).

The Priority Programme comprised a Reef Group and a Cretaceous Group, which worked together collaboratively. The Reef Group, coordinated by Erik Flügel, concentrated on the biogenic and abiogenic factors controlling modern and ancient reef growth. The results from the work of this group were presented at the colloquium in several process-oriented thematic talks, going beyond the confines of individual projects. Over the last six years the reef programme has focused mainly on the following:

1. Interdisciplinary research by biologists, geologists, paleontologists, bio/geochemists and oceanographers on factors controlling Holocene reef growth and carbonate production. Key targets were quantitative assessments of growth rates and bioerosion, carbonate budgets, the role of nutrients in productivity, the influence of non-preservable or under-studied organisms on reef growth (e.g. soft corals, grazing fishes, bryozoans), microbial control of reef growth (calcification of biofilms, automicrite formation), microborers, ocean water chemistry, sea-level control, and comparisons with temperate and polar carbonate factories.
2. The use of these modern reef examples and controlling processes as partial keys to the past, for example the use of microborers as paleobathymetric indicators, environmental demands of modern siliceous sponges as a model for Ancient counterparts, biofilm calcification and automicrite formation in fossil mudmounds, soda lake chemistry as a partial analogue for Ancient oceans, distribution of Ancient cold water carbonates as mirrors for paleocurrent systems.
3. Anactualistic reefs: it became even more obvious during the Priority Program that many Ancient reef examples do not have modern counterparts. This holds true not only for sponge mudmounds, rudist or richthofenid reefs, but also for many types of microbolite reefs and even coral reefs, which include a great variety of subtypes. The analysis of the controlling mechanisms of these reefs was consequently based on a comparative analysis of reef associations, functional morphology of reef organisms, embedding of reefs in their structural, sedimentological, paleoceanographic and paleoclimatic framework, and control of reef occurrence, composition and distribution through sea level fluctuations. Fossil reefs (in the broad sense) that were studied spanned the Devonian to the Pleistocene. Most work groups focused on reefs and carbonate platforms from the Devonian (mounds and stromatoporoid reefs from central Europe, stromatolite reefs from Australia), Permian (differentiation of youngest Capitan reef types, Oman and northern Africa sponge and coral reefs, German stromatolite reefs, Richthofenia reefs – for the first time studied in detail), Triassic (Alpine, Oman, Iran; evolution of Triassic reefs through time), Jurassic (all major occurrences, particularly on the Northern Tethys seas and in the Lusitanian Basin: comparative ecology of coral, siliceous sponge and microbolite reef) and Cretaceous (rudist reefs from Europe and Oman, comparison with coral reefs, development of the coral-coralline-reef type). Comparative analysis of mudmounds through time was another key topic, and this revealed the importance of ultraconservative microbial-sponge associations for the growth of this type.
4. Reefs as paleomonitors: Once studied in detail and calibrated with the regional setting, fossil reefs often turn out to represent good paleo-indicators for Ancient shelf structure, climate, current and nutrient systems, and sea-level development (e.g. the Triassic, Jurassic and Cretaceous examples). This approach was accompanied and refined by reef modelling, the production of global paleoreef maps, and the analysis of differences and similarities with modern examples from comparable environmental and structural settings. Some of the results from the fossil examples might even allow a better understanding of modern reef growth (e.g. structural control of reef growth, importance of microbial activity for reef growth, temporal dynamics of reefs).
5. Reefs through time: In order to better understand the evolution of reefs through time, focus was put on the Frasnian-Fammenian, Permian/Triassic and Cretaceous/Tertiary boundaries as well as on more continuous temporal changes in faunal composition, frequency and distribution from Triassic to Cretaceous reefs.

The success of the programme was largely due to its interdisciplinary approach, its strong focus on both biological-paleontological and geological data, and to the comparative analyses of:

- 'classical' modern tropical reef settings and modern cold water carbonate factories;
- modern and Ancient reefs;
- Ancient reefs within time-slices and through time.

In a final discussion on future research needs, the following topics emerged:

- enlargement of the paleontological data base (e.g. taxonomy, functional morphology, quantitative paleoecology);
- the study of modern reef organisms under 'paleontological aspects' (functional morphology, preservability of associations, skeletal rigidity, carbonate productivity);
- biogeochemical and diagenetic studies;
- the improvement of embedding reefs in
- paleogeographic/-oceanographic models;
- the comparison of reefal and non-reefal benthic communities;
- the study of modern 'non-classical' or 'marginal' reef-type
- environments (reefs under sedimentation, deepwater, coldwater or

- nutrient-'stress', ramp-type configurations);
- the importance of the time factor at various scales

A report has been published containing 65 overview papers by 118 authors and a bibliography of all published Priority Programme papers: *Global and Regional Controls on Biogenic Sedimentation.* I. Reef Evolution (ed. by Reitner, J., Neuweiler, F & Gunkel, F). - Göttinger Arbeiten zur Geologie und Paläontologie, Sb 2, 428 pp, Gottingen (ISSN 0534-0403). Available from: Institut und Museum für Geologie und Paläontologie (c/o Fritz Neuweiler), Universitat Gottingen, Goldschmidt-Str. 3, D-37077 Göttingen, Germany.

Other results will be published in a book on the Evolution of Reefs being prepared by the reef group as well as in forthcoming papers.

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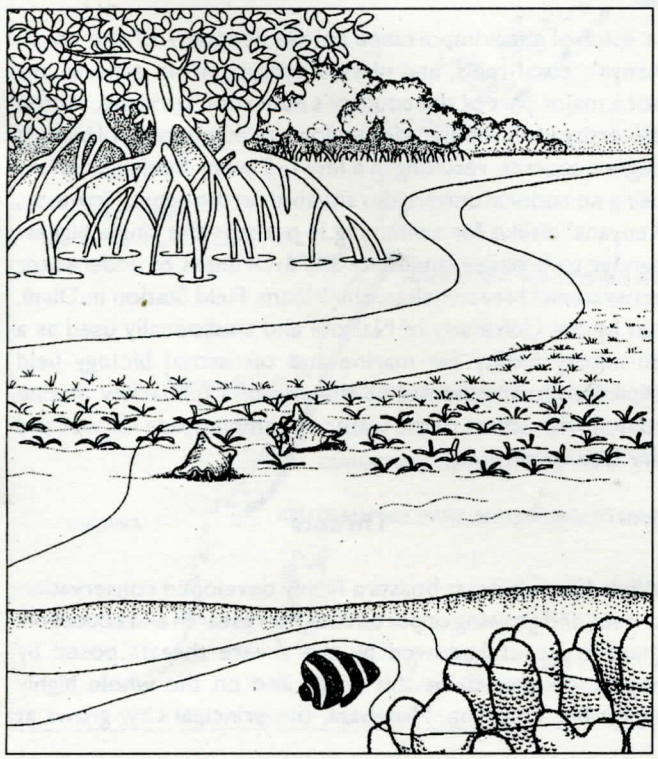
Reefgroup Stuttgart (modern and Ancient Reefs):
http://www.uni-stuttgart.de/UNIuser/igps/reefgroup

Jurassic Reef Park: educational article giving an overview of modern reefs and reef organisms and comparison with fossil examples:
http://www.uni-stuttgart.de/UNIuser/igps/Jurassic_Reef_Park

This can also be accessed through the reef group pages:
Institut fur Paläontologie:
http://xray.geol.uni-erlangen.de/pal



From The Coral Reef Coloring Book *by Katherine Orr (1992, Stemmer House Publishers Inc., Maryland, USA).*

COUNTRY PROFILE

THE REEFS OF KENYA

David Obura

Geography and history

Kenya's 500 km coastline on the Indian Ocean boasts a rich and diverse coral reef system. Well developed reefs extend from the Kenya/Somali border in the north, limited by seasonal upwelling of the Somali current, to patch reefs at the Mozambique/South Africa border in the south. East African reefs are a mixture of fringing and near-shore platform and patch reefs, with their greatest development in the continuous fringing reef of southern Kenya, and the island reef systems of Tanzania. Kenya's fringing reef, from Malindi in the north to Shimoni in the south, is approximately 200 km long, and mostly 1–2 km wide. Faunistically, Kenyan reefs form the western-most extent of the Indo-Pacific region, with similarities to the Red Sea. Low levels of zoological sampling has resulted in low estimates of species diversity, with more recent assessments progressively elevating diversity of the Western Indian Ocean/East African region closer to those in the center of diversity of the Western Pacific Ocean (e.g. for corals, Veron 1995).

Kenyan reefs have been useful to man for thousands of years, from providing protected, deep harbours for Arab seafaring traders, to food and recreational facilities for today's growing resident and tourist populations. While the width and accessibility of Kenya's fringing reefs is a boon for research and tourism, it also makes reef resources exceedingly vulnerable to exploitation, where fishers can walk or swim, at low tide, over the entire reef area. The mix of biodiversity and abundant resources, and the growing population pressures of a developing country, provide a microcosm of the coral reef conservation issues found around the world. While this mixture is potentially devastating, the small size of the Kenya coast enables a coherent approach at a national scale, and the potential for collaboration and contact among projects and stakeholder groups.

Research

Modern coral reef ecological research started in Kenya in the 1970s, with documentation of coral community structure and diversity (Hamilton and Brakel 1984) and an early study of elevated sea urchin abundances on an overfished fringing reef (Khamala 1971). The principal government institution mandated with carrying out research on marine and freshwater environments is the Kenya Marine and Fisheries Research Institute (KMFRI), headquartered in Mombasa. KMFRI scientists work on a variety of topics, including coastal geology, zooplankton studies, algal culture, and coral diversity and ecology, and have established links with local fishing villages to study and promote aquaculture of oysters and other shellfish.

The most active research group studying coral reefs in Kenya is the Coral Reef Conservation Project (CRCP, Wildlife

Conservation Society), directed by Dr. Tim McClanahan. Since the mid-80s, the CRCP has studied the most pressing problem facing Kenya's coral reefs, that of overfishing by local, artisanal fishers. This case study of overfishing is one of the best documented for any coral reef area, showing the interactions between fishing intensity, predation by finfish on sea urchins, competition between herbivorous fish and sea urchins, and the impact of sea urchin grazing on benthic community structure. On Kenya's overfished fringing reefs, sea urchin abundances have increased, through predation release, to the point that they competitively exclude herbivorous fish, preventing recovery of fish populations. The potential for reef restoration through manipulation of fishing effort and sea urchin abundances is now under investigation. Other projects have included a study of the effects of river-sediment on coral reefs in the Malindi Marine Park, of sea urchin reproductive and recruitment dynamics, and of fisher community culture and prospects for community-based reef restoration efforts. The CRCP also runs an internship program for students and trainee scientists from countries along the East African coast, through which they gain research experience.

University expeditions have contributed to the state of knowledge of Kenyan coral reefs, the most prominent ones being by Durham University, UK (Leopard Reef Expedition, 1979) to Malindi, the Catholic University, Netherlands expedition to Malindi/Watamu in 1985, and York University, UK expeditions to Kisite/Mpunguti 1992, Diani 1993 and Malindi/Watamu 1994.

Conservation

Kenya has a long history of conserving its natural environment, and established the first marine protected areas in Africa, the Malindi and Watamu Marine National Parks, in 1968. The Kenya Wildlife Service (KWS) is the government agency charged with management of all protected areas, with a recently established coast division headquarters in Mombasa to manage the marine parks system semi-autonomously from the terrestrial parks. There are now four areas with protected status along the Kenya coast: Kisite Marine Park and Mpunguti Reserve in the south; Mombasa Marine Park and Reserve; Malindi/Watamu Parks and Reserve; and Kiunga Marine Reserve in the north. Two of these areas (the Malindi/Watamu Parks, and Kiunga Reserve) are designated UNESCO Biosphere Reserves.

A fifth area, the Diani/Chale Marine Reserve illustrates the difficulties of managing multiple stakeholders and conflicting pressures on coral reefs. In an attempt to maintain artisanal fisher access to resources, and promote conservation for tourist and recreation purposes, KWS is following a participatory approach to involve all stakeholders in establishing the protected area. While the eventual management structure will hopefully avoid many of the conflicts plaguing other marine protected areas, the participatory approach has led to many delays caused by conflicting interests in the area.

The protected areas under KWS' management have enabled the unplanned 'controlled' experiments that have characterized almost all studies carried out in Kenya, where protected sites have been used as reference comparisons for change due to anthropogenic influences in unprotected sites. Thus conservation of Kenya's coral reefs has benefited from past research activities, and now the Kenya Wildlife Service has established an in-house marine research group with assistance from the Dutch government.

Kenya Wildlife Service has promoted cooperation with other institutions to assist in management of its protected areas, and the coast in general. The Mombasa Marine Park is the focus of an Integrated Coastal Zone Management Project, involving the Coast Development Authority, based in Mombasa, and assisted by the Coastal Resources Center of the University of Rhode Island. The project is the first of its type in Kenya, attempting to integrate urban services and planning, tourism and development interests, and environmental and biodiversity protection. The Kiunga Marine Reserve in the north faces very different problems, primarily because of its isolation. The East Africa office of the World Wide Fund for Nature (WWF) is assisting KWS to protect the biodiversity of this area – important for its coral reefs and isolated islands that serve as breeding and resting grounds for migratory birds – through integrating local fishing communities in the management of the reserve.

The coast also benefits from Kenya being the host of several international and conservation organizations, most notably the UNEP Regional Seas Program, and the IUCN East Africa Regional Office, both in Nairobi. While the regional mandate of these organizations diverts their focus to other countries, their presence fosters other conservation efforts, and many of their trial projects are sited in Kenya. For example, the UNEP Atlas Project, a regional effort to map coastal resources, started with Kenya as its first country of implementation.

Education

In spite of their importance to the economy of the coast, Kenya's coral reefs, and marine ecosystems in general, are not a major part of the country's education curricula. At the university level, marine ecology forms a component of biology degree courses, resulting in a few 1–2 week field trips, there being no national universities situated on the coast. However, Kenyans' dislike for swimming is perhaps the single biggest barrier to broader familiarity and awareness of underwater ecosystems! Nevertheless, the Moana Field Station in Diani, run by the University of Nairobi and traditionally used as a dormitory facility for marine and terrestrial biology field trips, has great potential as the site of a full-facility marine station with access to the water and ample space for wet and dry laboratories.

Threats

While Kenya's coast boasts a highly developed conservation system, and growing opportunities for research and education, these are overshadowed by the severe threats posed by population growth to this small, and on the whole highly accessible, coastline. Mombasa, the principal city, grows at

over 7% per year, fed by opportunities in the burgeoning tourism industry and migration from inland, already densely-populated, areas. The principal threat to Kenya's coral reefs is fishing and other extractive uses (McClanahan and Obura 1994), to feed the growing local and tourism food markets. Sedimentation from rivers draining upland areas is limited to parts of the northern coast and eutrophication of reef lagoon waters is a growing, though largely unquantified, problem. Similarly, the extent of pollution, largely from coastal industry, urban development and tourism, is unquantified.

The future

Kenya has reaped both the benefits and the problems form its colonial and newly-independent history. The infrastructure of transport and communication, and the centralized administrative system, have enabled a strong and consistent approach to dealing with environmental and conservation-related issues. The growing body of organizations working in coral reef research, conservation, and education, in government, private, and international sectors, continues to build on the pre-existing infrastructure, adapting to current pressures and funding realities. However the down-side of Kenya's inheritance is the dis-enfranchisement of local communities, alienated by the centralized administrative system. This legacy is evident today in the severe distrust local people have for centralized authority and management, and the misuse of this suspicion in the political arena. To overcome this barrier, the principal need is for all parties to bridge this societal gap, to build community-based projects combining conservation with sustainable resource development, and empowering users in the control and conservation of their renewable resources.

On the international and regional scale, Kenyan coral reef research and conservation stand as models for neighbouring countries. We hope to build better contacts with other Indian Ocean countries to foster integration and more efficient research on, and conservation of, coral reefs (see Indian Ocean Conservation Workshop report, *Reef Encounter* 18). New global initiatives for coral reef conservation and research, such as the International Coral Reef Initiative, International Year of the Reef, Global Coral Reef Monitoring Network, will both benefit from, and feed further growth in, Kenyan initiatives.

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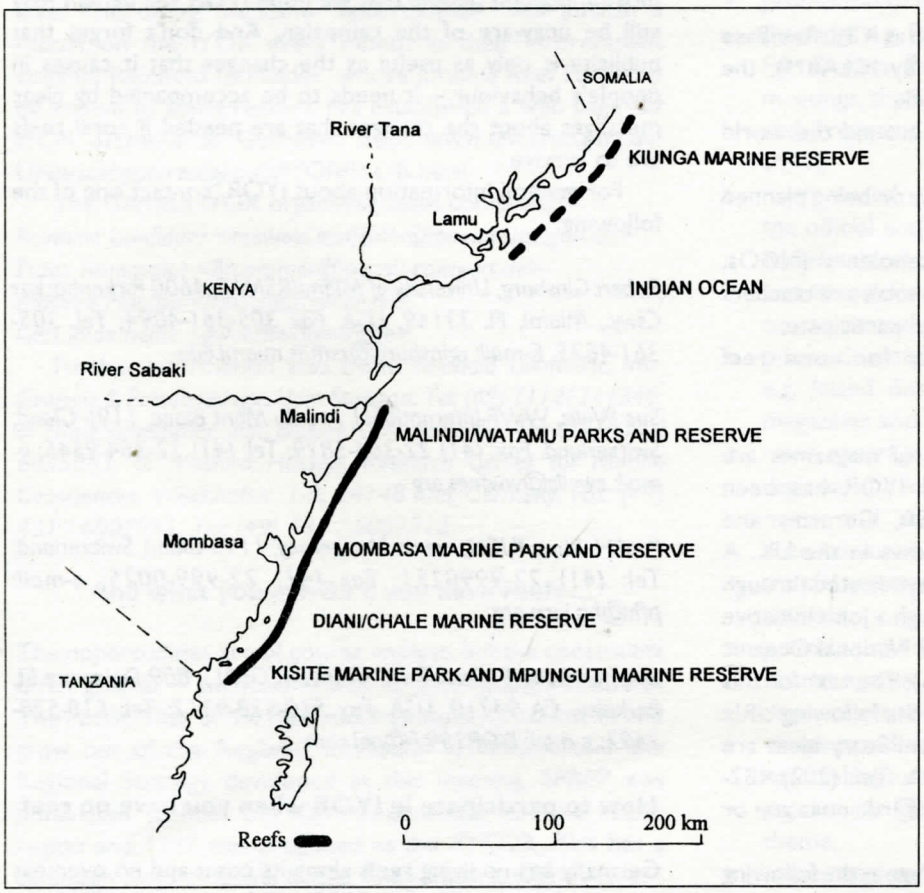
Further information from: David Obura, Coral Reef Conservation Project, P.O. BOX 99470, Mombasa, Kenya, Tel: (0254-11) 485570, Fax: (0254-11) 472215.



Marine reserves and protected areas in Kenya.

INTERNATIONAL INITIATIVES

IYOR UPDATE

It is getting increasingly difficult to summarise all the IYOR activities underway without missing something out – each week sees a new country or organisation taking part. The time was clearly ripe for an International Year of the Reef, and there is no doubt that public awareness will have been raised and an enormous educational need fulfilled. Including the 17 countries of the Pacific who are jointly working on a Pacific Year of the Reef campaign (see below), there are now some 50 nations and territories taking part. The lack of a central secretariat to handle information requests and answer queries is an increasing obstacle, but Bob Ginsburg in Miami, Paul Holthus at IUCN, Sue Wells at WWF International and Stephen Colwell at the Coral Reef Alliance are keeping things moving, if slowly at times. We hope you will all bear with us if requests are not met instantly.

IYOR is now officially the publicity arm of ICRI for 1997, and there is a close linkage between the two initiatives. The next issue of *Reef Encounter* will provide an update of ICRI activities, the secretariat of which is now in Australia. Results of research and survey activities being carried out under the banner of IYOR will be summarised in the next issue of *Reef Encounter*, and will be a focus of the next ISRS meeting at Fiji. Reef Check, a major international IYOR activity, is described on p. xx . An IYOR coral reef pack has been prepared and limited numbers are available on demand from Paul Holthus at IUCN. These contain:

- information on global programmes such as ICRI, ReefBase (the coral reef database distributed by ICLARM), the Global Coral Reef Monitoring Network;
- a list of educational resources from around the world relevant to reef conservation;
- an update of IYOR activities underway or being planned (also sent out on the IYOR-listserver);
- Action Sheets for different reef 'stakeholders' (NGOs, diving industry, fishing communities, schools and teachers etc) with suggestions for how they can participate;
- a list of handbooks and guidelines for coral reef management.

Feature articles and special reef issues of magazines are appearing in numerous countries and IYOR has been promoted at major dive shows in USA, Germany and elsewhere and at travel and tourism shows in the UK. A series of 52 coral reef story ideas is being syndicated through major international media channels, through a joint initiative of IUCN and the US Dept of Commerce's National Oceanic and Atmospheric Administration (NOAA). The text for this Media Outreach Proposal can be found at the following URL: http://coral.aoml.noaa.gov/bulls/52final.html Story ideas are still needed. Contact: Matt Stout, NOAA, Tel. (202) 482-6090; Fax (202) 482-3154; e-mail: mstout@rdc.noaa.gov or Paul Holthus (see below).

IYOR has a World-Wide Web Home Page at the following URL: http://www.coral.org/IYOR/ and there are a number of national or NGO-specific IYOR web sites. An IYOR Listserver has been set up to publicize IYOR activities, share information or ask questions about IYOR. Please do not use the list for personal communications or promoting commercial ventures.

To Subscribe: send e-mail to majordomo@reef.aoml.noaa.gov with the following message (only!) in the body of the text:
subscribe iyor-list

To Un-Subscribe: send e-mail to majordomo@reef.aoml.noaa.gov with the following message (only!) in the body of the text:
unsubscribe iyor-list "Your Name" <your_address@your.domain>

To Post a Comment or Announcement: send e-mail to iyor-list@reef.aoml.noaa.gov. The message will be circulated to all members of the list. The members may respond to you directly, or post their comments to the list for all to read. Please carefully consider the purpose of iyor-list before posting a message: this is a forum comprised of conservation groups, scientists, aquariums, government agencies and others interested in sharing ideas about IYOR.

To see a list of the functions and services available from the list-server, send an e-mail message to majordomo@reef.aoml.noaa.gov, with the following message (only!) in the body of the text:
help

One word of caution – a great deal of IYOR activity is taking place in cyberspace. The cynical might be tempted to suggest that more is taking place there than on the reefs themselves! Please don't forget that some people are not fully linked up to the Internet (and do not have regular or easy access to the Web), and others do not even have e-mail. There is still a place for faxes and hard copy. If you know of people that may be missing out on IYOR information, please print-out and send them information as you receive it. Some of the most important people that we hope IYOR will benefit may still be unaware of the campaign. And don't forget that publicity is only as useful as the changes that it causes in people's behaviour – it needs to be accompanied by clear messages about the changes that are needed if coral reefs are to survive.

For general information about IYOR, contact one of the following:

Robert Ginsburg, University of Miami/RSMAS, 4600 Rickenbacker Cswy., Miami, FL 33149, USA. Fax 305-361-4094; Tel. 305-361-4875. E-mail: rginsburg@rsmas.miami.edu

Sue Wells, WWF-International, Ave du Mont Blanc, 1196 Gland, Switzerland. Fax: (41) 22-364-5829; Tel: (41) 22-364-9545; e-mail: swells@wwfnet.org

Paul Holthus, IUCN, rue de Mauverney, 1196 Gland, Switzerland. Tel: (41) 22-9990251; Fax (41) 22-999-0025; e-mail: pfh@hq.iucn.org

Stephen Colwell, Coral Reef Alliance (CORAL), 809 Delaware St, Berkeley, CA 94710, USA. Fax 510-528-9317; Tel: 510-528-2492; e-mail: IYOR1997@aol.com

How to participate in IYOR when you have no reef:

Germany has no living reefs along its coast and no overseas territories with reefs, but IYOR will be promoted there as

much as anywhere. The rationale of course is that (as well as its fine reef scientists!) it ranks near the top in terms of numbers of tourists that visit reefs on holiday. IYOR is therefore being used both to educate tourists themselves about how to behave on reefs while on holiday and support reef conservation at home, and the tourist industry about sustainable tourism in the reef environment.

Scientists, museums and the diving community are jointly organising IYOR activities in Germany. The Geomar Research Center in Kiel promoted IYOR at an Open Day in September 1996 and the German IYOR initiative was officially launched by the German Research Foundation at a conference in October (see p.xx). The Association of Research Diving Biologist (ARDB), the German Diving Association and PADI Europe are participating. In January 1997, an IYOR booth was set up at the biggest boating and diving fair in Europe, the BOOT in Dusseldorf, and media coverage was generated with Prof. Hans Hass, a number of reef scientists and the watersport industry holding talks and discussions. A programme of scientific talks on reefs has been initiated under the IYOR-umbrella in various places; articles on IYOR have been published in diving journals and short articles in other print media; and list of 31 colleagues willing to give talks at schools, teacher's seminars etc. compiled and many talks scheduled. An exhibition on the evolution of coral reefs opens in June at the Senckenberg Museum in Frankfurt. IYOR activity weekends are being planned. Geomar and the Baltic Dive Center plan "IYOR project weeks" with several high schools in North Germany, involving slide shows on coral reefs and comparisons with local rocky tidal shores, excursions to the Baltic Sea and even an introductory scuba dive. The diving magazine "Sporttaucher" will publish a report on the IYOR every month in their environment column. Reinhold Leinfelder, whose Jurassic Reef Park may be known to some readers has established a web page for IYOR activities in Germany: http://www.uni-stuttgart.de/UNIuser/igps/reefgroup/IYOR/IYOR.html

The German IYOR organizing team comprises:
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Franz Bruemmer <Bruemmer@po.uni-stuttgart.de>
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Gert Woerheide <gwoerhe@gwdg.de>

Further information also from: *Reinhold Leinfelder, Inst. Geologie & Palaeontologie, Univ. Stuttgart. Tel: (49) 711 /1211340; or Franz Bruemmer, Inst. Biology, Univ. Stuttgart. Tel: (49) 711 / 6855083; or Moshira Hassan, Research Center for Marine Geosciences, Wischhofstr. 1-3; 24148 Kiel; Germany. Fax: (49) 431 / 6002941, Tel: (49) 431 / 6002822.*

And what you can do if you have reefs ...

The opportunities are of course endless, but the constraints often greater – particularly lack of funding and personnel. The Pacific Year of the Reef involves some 17 countries and grew out of the Regional workshop in 1995. Under the Regional Strategy developed at this meeting, SPREP was nominated to host the ICRI Coordinator for the Pacific region and 1997 was proposed as the PYCOR. This has a campaign slogan: "Coral Reefs: Their Health, Our Future!". Key messages and audiences have been identified for the campaign. A Regional Campaign Plan has been prepared and national/NGO campaign plans will be prepared in each country according to its needs. The Regional Campaign Plan provides a good example of the many IYOR activities that can be undertaken. Funding is being sought, although many activities are underway through existing national organisations.

The Plan has six components:

1. Support to national and NGO campaign plans; SPREP will coordinate the PYOCR campaign network and:

- seek new and additional funding, technical assistance and in-kind support for PYOCR,
- disseminate information about level and availability of funding
- provide expert and timely advice for national/NGO campaign plan development.
- support local and national workshops
- act as a clearing house for information and contacts who can respond to specific issues
- encourage Heads of Government/Ministers to launch national campaigns.

2. Communication Initiatives

- regional media launch of the PYOCR on 11 February 1997
- launch of documentary video and companion advertisement and promotion of its use on TV, in schools, airlines and other media outlets.
- presentation of the PYOCR at Pacific Island News Association Conference.
- promotion of PYOCR at relevant regional/ international meetings e.g. Pacific Science Association Inter-Congress, Fiji Oceans Promotion, SPC, TCSP, SOPAC, Forum meetings, the Sixth Conference on Nature Conservation and Protected Areas (Federated Sates of Micronesia, 1997)
- media-based campaign wrap up (11 February 1998) at the official end of the PYOCR.
- promotion of PYOCR with TV, radio, newspaper, print.
- provision information to the Pacific Council of Churches on the campaign.
- promotion of PYOCR through magazine feature articles e.g. Island Business, Pacific Islands Monthly, women's magazines and other organisation's newsletters.
- news coverage of national campaign achievements at the regional and international levels.
- news and campaign coverage on airline in-flight entertainment programmes (TV and magazine) including translations into Japanese and other languages for incoming tourists.
- provision of information on PYOCR to travel agents and tourist agency networks.
- regional art competition to highlight PYOCR.
- village based theatre, including puppet groups, as part of national/ngo campaign plans.
- production of tourist items e.g. t shirts with PYOCR theme.
- encouragement of Philatelic Bureaus to produce PYOCR stamps in partnership with national/ngo campaigns,

- use of Internet to promote PYOCR within broader IYOR network and to obtain information relevant to the region to feed back to those who do not have access.
- regional workshop for national curriculum developers on coastal marine conservation.

3. Policy initiatives

- Seek endorsement for the PYOCR from the South Pacific Forum and South Pacific Commission; SPREP to brief the Forum and SPC governments on Integrated Coastal Management, the EIA process, international trade in live non-cultured coral, use of cyanide/poisons for the live coral reef fish trade, and lack of information, understanding and
- research.
- Promote implementation (and accession where necessary) of relevant conventions e.g. CITES (corals, turtles, giant clams etc.), Convention on Biological Diversity, Ramsar Wetlands Convention.
- Support Global Coral Reef Monitoring Network in its efforts to establish a regional node in the Pacific and help secure resources for this.
- Encourage and assist countries wishing to develop legislation for the management, conservation and wise use of coral reefs and related ecosystems, including Marine Protected Areas. Where appropriate promote community based management and customary laws in advice to government departments.
- Encourage scientific and technical organisations to provide resources and assistance to both regional and national campaigns and initiate programmes in response to identified management issues.
- Encourage and support management, research and capacity building proposals to address problems and issues identified in the ICRI Pacific Regional Strategy (e.g. USP, UPNG, UoG, SPC, FFA, GBRMPA, Unitech, SOPAC, Uinv. Hawaii, AIMS, SPREP).
- Collaborate with the relevant population agencies and programmes to highlight impacts of increasing population pressure on coastal resources for the purpose of strengthening policies and actions of these programmes.
- Encourage governments and ngos to use Environment Weeks or Days (or similar) to focus on the Year of the Reef campaign.

4. Resource Production

- SPREP to produce regional campaign with poster, video, T-shirt, fact sheets, sticker; if possible radio audio tape, calendar (based on art competition), children's colouring book/comic book; also slide show (use existing SPREP slide show as basis)
- SPREP to provide logo that may be use for national/NGO campaigns to produce t shirts, caps etc.
- Joint production of the Wan Smol Bag *On the Reef' video for schools,
- Production of school PYOCR campaign resource information kit which will include copies of campaign resources and specific teaching materials; encourage and help develop ongoing curriculum based lessons and material covering coral reef, mangrove etc.. conservation and wise use.
- Guam video to made available as a resource to other member countries.

5. Reporting, Monitoring and Evaluation. SPREP will undertake the following:

- Every two months provide fax/e-mail update on campaign progress and upcoming events
- Quarterly campaign update at PEACESAT session.
- Campaign report for a Review and Evaluation meeting early 1998

6. Interaction with IYOR

- SPREP to be the coordinating link between IYOR and PYOCR. This should include accessing and disseminating information from IYOR to the network, sending Pacific campaign information to IYOR, and helping PYOCR members access IYOR contacts and initiatives.

THE GLOBAL CORAL REEF MONITORING NETWORK (GCRMN)

Coral reef monitoring has been discussed seriously for some time, culminating in June 1992 in Guam, at the 7th International Coral Reef Symposium, when many reef scientists and managers reported their willingness to participate in a global programme. Lack of funding delayed further progress until the International Coral Reef Initiative (ICRI) was launched. In 1995 ICRI called on many nations to commit themselves towards increasing research and monitoring of reefs to provide data for effective management. IOC, UNEP, and IUCN have now joined forces to co-sponsor the GCRMN, which is hosted jointly by the Australian Institute of Marine Science (AIMS) and the International Center for Living Aquatic Resources Management (ICLARM). These bodies, with the ICRI Secretariat, form the GCRMN Management Group. Advice is provided by a widely representative Scientific and Technical Advisory Committee (GCRMN-STAC).

The GCRMN aims to provide people with the capacity to assess their own resources, within a global network, and to spread the word on reef status and trends. The core objectives are to:

- link existing organisations and people to monitor biophysical and social, cultural and economic aspects of coral reefs within interacting regional networks;
- strengthen existing capacity to identify trends in coral reef condition and discriminate between natural, anthropogenic, and climatic changes;
- disseminate results at local, regional, and global scales by providing annual reports on coral reef status and trends to assist environmental management agencies implement sustainable use and conservation of reefs. Data will also aid preparation of predictive global climate change models for the GOOS Coastal Zone Module.

The following guiding principles will be used in fulfilling these objectives:

- the involvement of local communities will be emphasised;
- there will be equal emphasis on biophysical and social, cultural and economic data;
- existing organisations, networks, and monitoring programmes will be used; new bodies will not be created unless essential;
- a standard methodology will be offered, but the GCMRN will be responsive to the wishes of participants;
- monitoring in current or planned Marine Protected Areas and adjacent unprotected areas will be promoted;
- data will be made accessible to all, in an understandable format.

The GCRMN will function through fifteen independent networks, or sub-nodes, in six regions around the world. These networks will contain many different groups of people, all collaborating to monitor coral reefs and share data. The regions are:

- Western Indian Ocean islands and East African States
- Middle East Gulfs (those countries bordering the Red Sea, Gulf and intervening areas)
- South Asia (India, Sri Lanka and Maldives)
- East Asian Seas (from Burma/Myanmar and Japan to Indonesia and the Philippines)
- Pacific Island states
- Caribbean and Intra-Americas, including countries with reefs bordering the Atlantic Ocean

The participating countries will establish a number of sub-nodes in each region, each of which will employ a team of trainers and database operators to assist a small group of countries. Funding for each of the sub-nodes will be requested from country, development bank and agency donors. The responsibility for funding monitoring will devolve to the participating countries after about five years. Donors are invited to assist in developing the networks and funding proposals where their interests are paramount. Each team of monitoring trainers will train similar trainers in participating countries throughout the region, with a focus on monitoring by local communities. Monitoring will continue at key national sites, to gather data and develop skills. Experienced marine institutes will assist in training, establishing databases and problem resolution.

A range of reef types will be monitored along line transects. Methods from the *Survey Manual for Tropical Marine Resources* (Eds. English, Wilkinson and Baker, published by AIMS) from the ASEAN-Australia Living Coastal Resources Project will form the basis for monitoring. These were chosen as the 'standards' by the UNEP-IOC-WMO-IUCN Meeting of Experts on a Long-Term Global Monitoring System of Coastal and Near-Shore Phenomena Related to Climate Change, Pilot Projects on Mangroves and Coral Reefs, December 1991, and approved by the UNEP-IOC-IUCN-ASPEI Global Task Team on the Implications of Climate Change on Coral Reefs in 1992. The methodology includes:

- manta tow (or equivalent for a broad perspective);
- line intercept transect with identification at a minimum of 'lifeform' level (or equivalent transect method to gather % cover data); and
- fish censuring, with emphasis on fisher target species and indicator species, such as butterfly fish (Chaetodontidae).

As people gain more experience, monitoring will be upgraded to species level, using the same methods. Reporting should also include specific events and activities e.g. bleaching, predators, dynamite damage, urchin populations etc. Data on these are being accumulated by several groups, coordinated by Bob Ginsburg in Miami, Gregor Hodgson in Hong Kong, and John McManus of ReefBase in Manila. A comparable set of socioeconomic parameters are being assembled and local communities will be questioned on their use and knowledge of reef resources and how management may be improved. Methods and protocols are being prepared.

Monitoring work in current or planned Marine Protected Areas and adjacent unprotected areas will be coordinated with the World Bank, IUCN/CNPPA and the GBRMPA Global Representative System of Marine Protected Areas project. Monitoring data will be accumulated in each sub-node for distribution within the region and to ReefBase (ICLARM, Manila). These will be combined, by the GCRMN Coordinator, into annual global reef status summaries and disseminated to international forums, organisations and the media.

Two special monitoring projects will be supported by the GCRMN: a pilot programme undertaken simultaneously by research institutes around the world to give a snapshot of reef status; and the development of a tourist monitoring programme coordinated through tourist operators.

The Pilot Monitoring Programme is being set up. Marine research groups, senior researchers and others who have experience in monitoring coral reefs, particularly in several different coral reef regions, have been asked to participate. The goals are to:

- establish a cooperative network;
- demonstrate to governments, donors and the science community that a network can function; and
- assist developing countries to get started in reef monitoring.

Participants will be asked to monitor at least one site in their country and a parallel one with developing country scientists. The standard method should be used where possible, but any comparable methods will be acceptable. The data will be pooled and a report giving a 'snapshot' view of reef status will be presented in June 1997 as part of the International Year of the Reef. It is probable that sites monitored in this programme will constitute the basis for a global system of regular long-term monitoring.

You can help in the following ways:

- Ensure that your organisation or country is informed of the GCRMN and its objectives.

- Inform the GCRMN Coordinator about organisations and individuals who wish to participate.
- Provide information on potential donors to fund sub-nodes or individual country programmes, or training workshops and publications.
- Assist in the provision of training or equipment to countries to monitor and operate their own databases.

The following Web site gives the GCMRN charter document: http://coral.aoml.noaa.gov/gcrmn/gcrmn.html

A listserver has been set up for members of the GCRMN, in order to foster information transfer among those actively engaged in recording data. All list members may contribute to discussions, which are intended to support the goals of the GCRMN. For general coral discussions, postings may be made to the coral-list open discussion group. To subscribe to the GCRMN listserver, send e-mail to majordomo@reef.aoml.noaa.gov, with the following message (only!) in the body of the text:
subscribe gcrmn

If you have any problems concerning the GCMRN listserver itself, contact *Jim Hendee at NOAA: hendee@aoml.noaa.gov*

For further information on GCMRN, contact: Dr Clive Wilkinson Coordinator, Global Coral Reef Monitoring Network, c/o Australian Institute of Marine Science, PMB No. 3, TOWNSVILLE MC 4810, AUSTRALIA. Tel: +61 77 534 372 or +61 77 724 314; Fax: +61 77 722 808 or +61 77 725 852; e-mail: c.wilkinson@aims.gov.au or Dr John McManus, ReefBase Project Leader, International Center for Living Aquatic Resources Management, MCPO Box 2631, 0718 MAKATI, Metro Manila, PHILIPPINES Tel: +63 2 818 0466 or +63 2 817 5255, Fax: +63 2 816 3183; e-mail: j.mcmanus@cgnet.com

REEF CHECK 1997 – an IYOR Activity

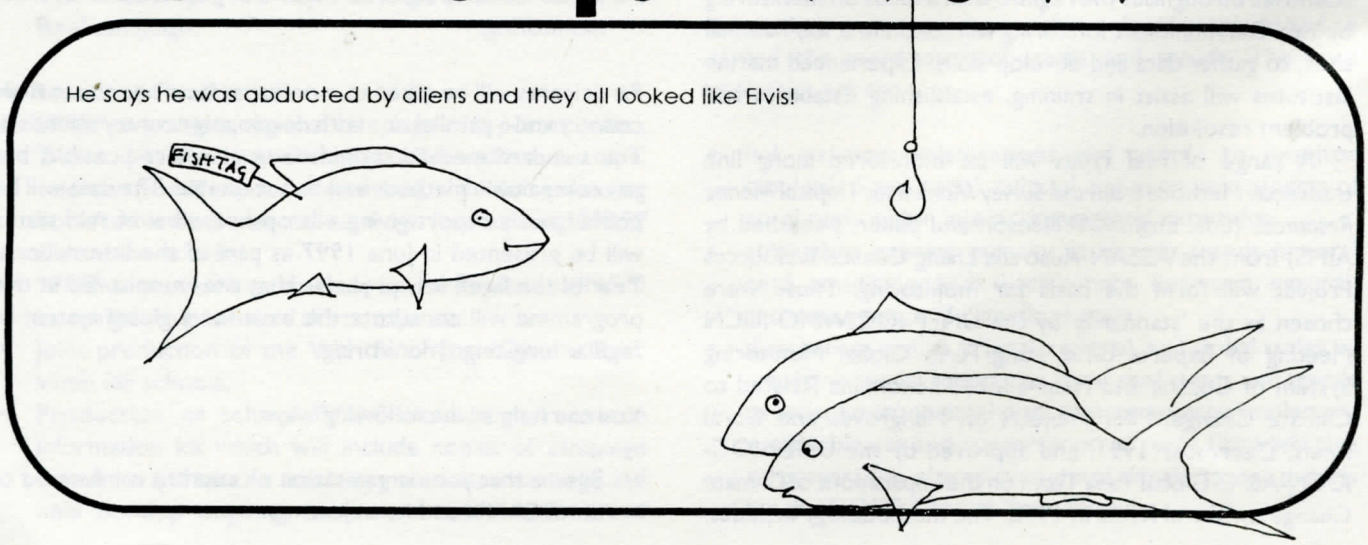
Reef Check 1997 will be an exciting international event involving collaboration between recreational divers and scientists. The concept of Reef Check is a one-day rapid survey of as many reef sites as possible throughout the world using very basic "tried-and-true" techniques such as counting indicator species such as grouper, sea urchins, measuring coral cover ratio live/dead etc. The work will be done in one day at each site by combined teams of recreational divers with a knowledge of marine biology and at least one professional marine scientist per team who will be responsible for ensuring the scientific quality of the work.

The objective will be to report on the basic "health" of a minimum of 100 reef sites from around the world. It is thought that this strategy will help achieve one of the major aims of IYOR – to build awareness of coral reefs and problems affecting them. The goal will be to disseminate the information gained from this snapshot "Reef Check" by having a live video satellite link among a number of representative sites throughout the world. In this way, we hope to focus the attention of the public, politicians and government leaders on the status of the world's coral reefs.

We are now looking for diver group/lead scientist combination teams to join our list of Reef Check 1997 participants.

Regional Coordination Centers have been established in: Europe (*Moshira Hassan <hassan@cerege.fr>*), United Kingdom (*Alastair Harborne <ccc@coralcay.demon.co.uk>*), and Hong Kong (*Marc Smith-Evans <marcse@asiaonline.net>*). If you are in those areas, please contact a Regional Center, otherwise contact *<reefchck@usthk.ust.hk>*, or: *Gregor Hodgson, Institute for Environmental Studies, Research Centre, Hong Kong University of Science and Technology, Clearwater Bay, Kowloon, HONG KONG; e-mail: rcgregor@usthk.ust.hk; fax: (852) 2358-1582; tel: (852) 2358-8568*

fish eye view



AN UPDATE ON REEFBASE

M.C. Ablan

The ReefBase 1.0 CD-ROM was first released at the 8th International Coral Reef Symposium in Panama last June. Since then, over 300 copies of the CD-ROM have been distributed to individuals and institutions. This has now been updated and revised and will be ready for its second distribution in June 1997.

To date, there are close to 7,000 reefs listed in ReefBase. Of these, 1,400 have information on benthic ecology. Management information is available for 492 reefs, harvest information for 1,500 reefs and stress data for 2,000 reefs. There are currently 2,390 entries in the ecology tables, 2,188 entries in the harvest tables and 3,225 records of stresses on reefs. ReefBase has 6,319 entries on dive locations, operators, sites, lodgings and tours for about 1,500 reefs. On each display form, we include the citation for the reference from which obtained each piece of information.

Much work is going into improving the query systems which allow users to arrive at summaries of the information found in the numerous tables. The report and query systems are being tied up more closely to the WinMap, the mini-GIS in ReefBase. In this way, users may obtain a display of the areas where reefs that fulfil criteria set through the query system.

We have added a 'Threats and Management Recommendations' table where information on the reported dangers to a reef and the recommended courses of action are listed. Data is continually added to the other tables on protected areas, socioeconomic indicators of reef use, as well as the list of institutions, experts and monitoring programs working on the various aspects of coral reefs.

Since ReefBase began in November 1993, our aim has been to come up with summary information on the reefs of the world by gathering information on various aspects of coral reef and reef resources. As we gather this information, we want to make it available to a wide range of audience. Thus, we have put the ReefBase 1.0 reef list and references tables on-line through the World Wide Web. These features may now be accessed through the ReefBase homepage at http://www.cgiar.org/iclarm/resprog/reefbase.html. Users may search the references list table by typing relevant phrases in the spaces provided or choose from drop down lists. These pages will be regularly updated as we cut new versions of ReefBase.

We have also added information on the Aquanaut Survey Method (ASM) onto the web page. The ASM is a means for volunteer divers to help gather information on the status of a reef during their dives. The data gathered through collaborative efforts with dive groups will be made available to others through this web site.

We appreciate the comments, suggestions and donations of both materials and pictures which we have been receiving. We look forward to receiving more of these from you. Please get in touch with us through: *ReefBase, ICLARM, M.C.P.O. Box 2631, 0718 Makati, City Philippines, Tel. 632-8180466 or 8175255, Fax. 631-8163183. E-mail:ReefBase@cgnet.com*

BOOK REVIEW

REEF FISHERIES

N.V.C. Polunin and C.M. Roberts (eds)

477pp. ISBN 0 412 60110 9. 1996. Chapman and Hall Fish and Fisheries Series 20. Chapman and Hall, London. Price £75.

Fisheries are under increasing pressure everywhere, and reef fisheries are no exception. The current global reef catch is estimated to be around six million tonnes per annum and comprises up to 25% of total landings in some countries, providing indispensable protein for coastal populations. In the Philippines for example an area of just 68 km^2 supports 17000 livelihoods. The lack of communication between fisheries scientists, ecologists and sociologists needed to understand such systems is a lament finally addressed in this book which discusses all aspects of fisheries from egg production to management institutions.

John Munro's initial overview defines reef fisheries as those conducted in areas where topography usually precludes the use of industrial gears. These fisheries are the domain of small scale artisanal fishers and often provide a last resort income in times of poverty. As such, they can be extremely difficult to manage, with little money available for the detailed biological research needed to apply conventional techniques. Munro highlights a dismal management record on the global scale despite the enormous socioeconomic importance of these resources. The need for effective fisheries regulation has often arisen relatively recently as coastal populations expanded rapidly over the last few decades. However increasing exploitation has coincided with the development of SCUBA and new underwater techniques for ecological investigation such as under water visual census. Munro identifies the understanding of larval processes as the emerging ecological challenge which will enable managers to design the growing number of protected areas to benefit fisheries as well as conservation.

A good understanding of reproductive potential, particularly in species with spawning aggregations or which are hermaphroditic, is essential for effective fisheries management. Yvonne Sadovy bravely reviews spawning (temporal and spatial patterns), egg output and size at maturity in the face of enormous variability and patchily available information. A strength of this book is that it draws together in one source disparate research previously buried deep in 'grey literature'. Sadovy guides us through the emerging field of reef fish reproduction, fraught with methodological difficulties, and debunks the often held belief that most reef fishes species show protracted spawning. For example *Epinephelus guttatus* is found to have yolked eggs for approximately four months but spawns over only 10 days.

George Boehlert discusses the importance of understanding larval dispersal and survival. He describes new sampling gears and techniques in this field and emphasizes the role of behaviour in determining composition of larval assemblages. Despite the difficulties of sampling larvae, especially of sparsely distributed commercial species, patterns are emerging in this last 'black box' of fisheries ecology.

Within the next few years this growing research area will doubtless generate enough information for a book in its own right.

Callum Roberts elaborates on the role of both larval and postsettlement processes on recruitment (defined in its fisheries sense as the stage after which fish can be captured) in a chapter on 'settlement and beyond'. The spectre of the lottery model versus recruitment limitation debate looms in several chapters and Roberts points again to the importance of scale. Nursery habitats such as seagrasses and mangroves can be important for juveniles of many reef fish but a further wide ranging and useful literature review finds the significance of such habitats varies geographically.

The trophodynamics of reef fisheries productivity are explained by Nicholas Polunin who considers inputs and flows of carbon and other nutrients through the ecosystem and discusses modelling with ECOPATH. Polunin highlights the need for an ecosystem approach to ensuring sustainable multispecies catches from spatially and temporally varying reef fish populations. Kenneth Ruddle picks up the introduction of the human element with a chapter on the geography and human ecology of reef fisheries. Ruddle combines an understanding of the complexity at the scale of local fisheries with the broader view of reefs as a globally threatened resource urgently in need of effective management. The by now almost traditional global review of reef fishery yields is provided by Paul Dalzell within a comprehensive summary of gear types, catch rates, and selectivity for different gears, much of which has been unavailable in previous reviews.

The multispecies and multigear nature of reef catches demands a new interdisciplinary approach, (as would have benefited many highly industrialized fisheries now in decline). The population and ecosystem effects of fishing are issues ecologists and fisheries managers should tackle together. Simon Jennings and John Lock bring a broad perspective to the discussion and draw the distinction between fishing effects and overfishing. They point to the potential for improved understanding of fishing effects to contribute to new monitoring, assessment and management schemes which may be more applicable to small scale fisheries than conventional approaches. However, for those who feel more at home with the familiar fisheries equations and models, Richard Appeldoorn provides a insightful discussion of stock assessment techniques and appropriate models for the dynamics of recruitment, growth, mortality and potential yield of small scale reef fisheries. This treatment is clearly written and will be accessible even to the most committed mathphobes!

Even good biological management often fails where economics and sociology have not been taken into account. John McManus shows how economics controls fishing effort and can lead to 'Malthusian Overfishing'. He suggests management solutions and draws on specific case studies for illustration. Remedial approaches such as changing fishing practices, hatchery releases, artificial reefs, restocking with exotic species, habitat restoration and protected areas are discussed by Jim Bohnsack whose cartoons of potential pitfalls emphasize the common sense conclusion that prevention is better than cure. Much can be learnt from traditional management regimes, and Ken Ruddle draws on the Asia-Pacific region to illustrate the benefits of established property rights and management controls vested in coastal societies. Where such systems have already broken down irretrievably a modern institutional approach to reef fisheries management such as those discussed by Timothy Adams may be more appropriate. Nicholas Polunin, Callum Roberts and Daniel Pauly draw the book to a close on an optimistic note focusing on developments in techniques such as under water visual census, fish aging using otoliths, and computer modeling and management practices including marine reserves.

This book provides a full treatment of the current understanding and management of reef fisheries, and has a broad geographical coverage. Its synthesis of data collection and management guidelines, restoration approaches, future research priorities and case studies will be invaluable to researchers, managers and students alike. Although publishers traditionally complain when reviewers carp (or should that be grunt!) about the price of specialist books, it is indisputable that the major drawback of this text is that the price will put it beyond the reach of many who need it most. It can only be hoped that the publishers will bring out a paperback version soon.

Maggie Watson

BOOK SHELF

ECONOMIC ANALYSIS OF INDONESIAN CORAL REEFS

Herman Cesar

World Bank Environmental Economics Series. Available from Ms. E. George, Agriculture Operations Division, Country Department III, East Asia and Pacific Region, The World Bank, 1818 H Street, NW, Washington, DC, U.S.A. 20433 Email Ebgeorge@worldbank.org@internet

The threats of poison fishing, blast fishing, sedimentation, overfishing and tourism development to Indonesian coral reefs are to be tackled by a new Coral Reef Rehabilitation and Management Program (COREMAP) established by the Indonesian Government. This World Bank study investigates the economic feasibility of such improved management and balances the perceived cost of reef conservation with an assessment of the long term costs of degradation.

Although Indonesia holds approximately one eighth of the world's coral reefs, only 29% are considered in good condition. Destruction is driven by large short term economic gains for a few individuals. However, this report estimates long term costs to society to be up to 50 times the short term benefits. Indonesia supplies more than 50% of the Asian live fish trade but at present catch rates the trade may collapse within a few years. Meanwhile Cesar estimates the net quantifiable cost may be US$ 46 million over four years whereas a sustainable hook and line fishery might provide net benefits of US$ 321.8 million (in present value terms). Similarly sustainable fishing outweighs the benefits of blast

fishing six times, with additional costs of coastal protection and lost tourism tipping the balance still further. Coral mining destroys natural coastal defenses and encourages logging of secondary forests (for lime burning). The external economic costs of logging may be US$ 67,000 per km^2 of mined reef, approximately equaling the gains from mining. Elsewhere hotels pay over US$ 100,000 per year to mitigate beach erosion, making total costs 7.5 times greater than benefits.

Cesar identifies the need for both local and national responses depending on the size of stakeholder's short term benefits and whether these individuals are locals or outsiders. Mining, overfishing and blast fishing may respond to local initiatives whereas cyanide fishing and logging induced sedimentation tempt outsiders with large short term profits and must be targeted at a national level. The report concludes that the divergence between private benefits and social costs reflects a highly inefficient use of reefs as natural resources and calls for decisive action to counter these threats.

TROPICAL CARBONATES

F.G. Bourrouilh-Le Jan (ed)
Proceedings of the Specialized Meeting of the Geological Society of France, 3rd and 4th May 1993. Mém. Soc. Géol. France 1995. 427pp.

The proceedings of this meeting held in memory of Professor Gabriel Lucas are available from Société géologique de France, 77 rue Claude Bernard, 75005 Paris, France. Price 350F + 25F postage. Further information from F. G. Bourrouilh-Le Jan, Université de Bordeaux I. Laboratoire CIBAMAR, Cinématique de Bassins et Marges, Bâtiment Géologie Recherche, Avenue des Facultés, 33405 Talence, FRANCE. Tel. (33) 56848823. Fax (33) 56848877.

CORAL FOREST TEACHER'S GUIDE

Available from Coral Forest, 400 Montgomery Street, Suite 400, San Francisco, CA 94104 USA, (415) 788-REEF (7333) Fax (415) 331-4064. Email coral@igc.apc.org Website http://www.blacktop.com/coralforest/

Coral Forest is a non profit-making organisation dedicated to educating and activating the public about the need to preserve coral reefs. An interdisciplinary, hands-on teacher's guide for grades K–5, 6–8 and 9–12 is now available describing the anatomy, reproduction and feeding behaviours of polyps as well as covering reef formation and location. Lessons on biodiversity investigate adaptations for predation and defence throughout the reef food chain. A further section emphasises the economic and ecological importance of reefs to people and ecosystems, identifies anthropogenic threats and suggests possible solutions. Each lesson establishes links to other subjects such as math, geography, and art. A resources guide provides teachers with a glossary, bibliography, references for students, a list of coral reef related organisations, educational merchandise and action programmes. Coral Forest is working the Smithsonian Tropical Research Institute to develop education programmes for use in Central and South America, and is currently translating the teachers guide into Spanish and Hindi. A sample lesson explaining how to make an edible reef from marshmallow (polyps) licorice (tentacles) and sprinklers (zooxanthellae) and then turn yourself into a parrotfish to eat your creation can be viewed at website http://www.blacktop.com/coralforest/tguide.html .

WHO'S WHO?

CEMRINO, PHILIPPINES

In 1994, the Center for Marine Tropical Ecology (University of Bremen), with funding from the European Union, initiated a two year programme to support the Resource Management Division (RMD) in Negros Oriental in their efforts to set up small community based reserves. In order to facilitate continuation of this work once the project ended, the Centre for the Establishment of Marine Reserves in Negros Oriental (CEMRINO Inc.) was officially registered as a Filipino NGO in September 1994.

The main goal of the project was to gather information on the distribution of reefs in the area and on their health and to use this in public hearings to gain support for new marine reserves which are being established to allow depleted fish stocks to recover. The success of the well-documented marine reserve at Apo Island, has raised awareness among coastal communities in the province of the value of marine protected areas. Reef benthos surveys and fish counts involving a variety of methods have been conducted to assess sites. Using a network of 'community organisers' established by RMD, and assistance from the German Development Service (GDS), workshops have been held in fishing villages to address the problems of overfishing and to gain the support of, and recommendations from, the fishermen for the establishment of marine reserves. In September 1996, 18 marine reserves were declared as fish sanctuaries under municipal ordinances; information gathering for five additional sites is expected to be complete by the end of the year.

The project has been granted a short extension of four months by the Commission of the European Union, but will terminate at the end of 1996. CEMRINO Inc. will continue to exist provided new funds can be found. Hope lies with a joint proposal being developed with the Rotarian "Ting Matiao Foundation" (TMF, Inc.), as TMF has extensive experience in community-based projects in the uplands of Negros Oriental. Both organisations could combine to address a wide range of environmental issues, with the local communities as the main beneficiaries, and negotiations for the first new project are underway. This approach, of establishing a locally based organisation through an externally-funded university programme, may provide a model for ensuring that such programmes have a long-term future.

For more information contact: H. Vogt, Centre for the Establishment of Marine Reserves in Negros Oriental, CEMRINO, Inc., 109 San Jose Ext., PO Box 187, 6200 Dumaguete, Philippines, T./Fax. + 63 35 225 5563. email: cemrino@klink.com.ph

DIARY

Conferences

6–9 June 1997, Victoria, B.C., Canada
1997 SOCIETY FOR CONSERVATION BIOLOGY ANNUAL MEETING
This will have a special emphasis on marine conservation biology. Further information from: *Conference Management, University of Victoria, BC, Canada. Tel. (250) 721–8746, Fax (250) 721–8776 Email SCB97@uvic.ca Webpage http://geography.geog.uvic.ca/dept/announce/scb_page.html*

13–19 July 1997, Suva, Fiji
MARINE/AQUATIC INTRODUCED SPECIES IN THE PACIFIC
This symposium will be held during the VIII Pacific Science Inter-Congress. Papers on the ecology, biology, biogeography, environmental and human impacts, and management of introduced species are welcome, as are papers documenting new invasions, transport mechanisms (such as ballast water), and intentional releases. The symposium is being co-sponsored by the CSIRO Centre for Research on Marine Pests (CRIMP) and the Pacific Science Association (PSA). Ronald Thresher (CRIMP) and L. G. Eldredge (PSA) will Co-Chair the session. James T. Carlton will be the keynote speaker. The date will be announced later. Contact L. G. Eldredge [psa@bishop.bishop.hawaii.org] for further information if you would like to present a contributed paper. Abstract should be submitted to the Inter-Congress Secretariat by January 31, 1997. To obtain the Inter-Congress Second Circular which includes general program of the Inter-Congress, along with information on paper submission, accommodation, excursions, etc. contact: *VIII Pacific Science Inter-Congress Secretariat, c/o School of Pure & Applied Sciences, P.O. Box 1168, The University of the South Pacific, Suva, Fiji FAX: (679) 314007, e-mail: psa@usp.ac.fj*

21–25 July 1997, San José, Costa Rica
28TH MEETING OF THE ASSOCIATION OF MARINE LABORATORIES OF THE CARIBBEAN (AMLC–97).
The Centro de Investigación en Ciencias del Mary Limnología (CIMAR) (Marine and Limnology Research Center), of the University of Costa Rica, is organizing this at the recently built Research City, University of Costa Rica, San Pedro. AMLC–97 will be a forum for the discussion of scientific advances in the region. The objectives of the meeting are to promote the discussion of the most relevant scientific problems of the region's marine ecosystems and to spread the knowledge generated in the region to a wide audience.

The meeting will be structured in such a way that it stimulates the exchange of ideas and information. There will be public lectures to make the information accessible to the general public. Accepted papers will be published in the proceedings of the meeting. AMLC was founded in 1956 by marine researchers with interests in the marine science of the tropical Atlantic and Caribbean. (The history of the Association was published by Ivan Goodbody, 1993, *Revista de Biología Tropical* Volume 41, Supplement 1, pp 1–7) Founded primarily as a scientific organization, the strength of the AMLC lies in the diversity of its member laboratories and the extensive expertise of its membership.
Further information from: *Jorge Cortés, President AMLC–97, CIMAR, Universidad de Costa Rica, San Pedro, Costa Rica. Fax. (506) 224-93-67 e-mail: jcortes@cariari.ucr.ac.cr*

3–8 November 1997, Nouméa, New Caledonia
5TH INDO-PACIFIC FISH CONFERENCE
This will be held at the ORSTOM Centre and South Pacific Commission Headquarters. The conference will present the latest developments in biodiversity of marine and freshwater fishes in the Indo-Pacific region. Symposia will cover systematics, evolution, biogeography, biology, ecology, ethology and genetics. Workshops will provide fora for debate on issues such as fish data bases, future research directions, ichthyotoxicity, parasitology and ethnology. The proceedings will be published in the journal *Cybium* and the deadline for abstracts is 15th August 1997. Further information from: *Michel Kulbicki, ORSTOM, Centre de Nouméa, BP AS, 98845 Nouméa Cedex, New Caledonia. Fax. (687) 264326 Email ipfc5@noumea.orstrom.nc*

12–17 April 1998, Cebu City, Philippines
16TH INTERNATIONAL SEAWEED SYMPOSIUM
The 16th ISS is hosted by the University of the Philippines, University of San Carlos, and the Seaweed Industry Association of the Philippines. Full paper and poster presentations are invited on all aspects of seaweed research and utilization, including. but not limited to: applications, molecular biology, chemical ecology, community ecology, taxonomy, chemistry, physiology, resource management, biogeography, pollution, diseases, microalgae, aquaculture. Those wishing to organize special sessions or topics, please contact the organisers immediately. The meeting will be followed by the 3rd International Seagrass Biology Workshop in Palawan 19–24th April 1998. Further information from: *Dr. Gavino Trono, Jr., Marine Science Institute, University of the Philippines, 1101 Diliman, Q.C., Philippines. fax (+63-2) 921-5967; 922-3958. Email: trono@msi.upd.edu.ph*

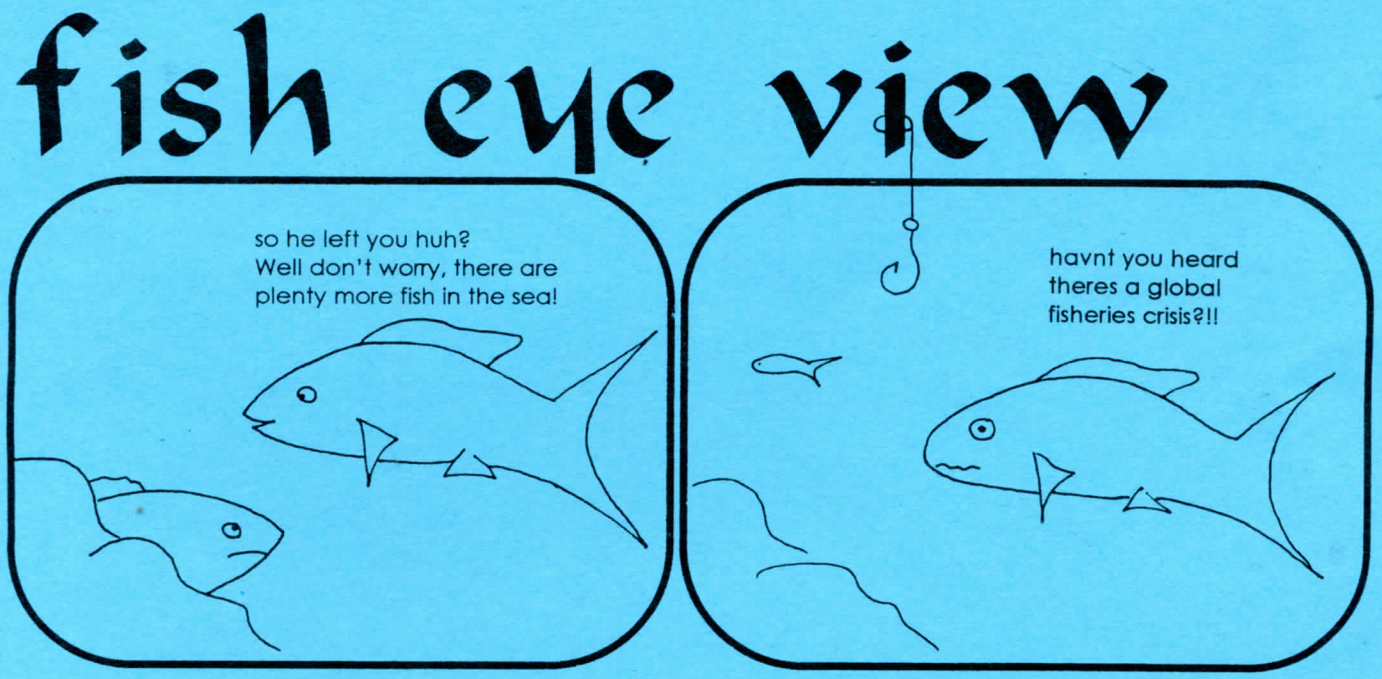
ANNOUNCEMENTS

WANTED: A Ph.D. STUDENT TO STUDY SEA ANEMONE SYSTEMATICS

The Actinodendronidae, commonly known as the Hell's Fire Anemones, occur on and around coral reefs of the Indo-Pacific. They live in the open in relatively shallow water and are zooxanthellate. Perhaps a dozen species in three genera constitute the family. A taxonomic revision will require both field and laboratory research to study features such as morphology, ecology, histology and molecular attributes. The precise design of the research will be determined by the student and advisors together. The principle objective is a modern taxonomic revision, including phylogenetic analysis, using a database that can be published in conventional (print) and electronic form.

This studentship is offered by the Department of Systematics and Ecology, University of Kansas. A stipend is available for the first two years after which help will be given to find additional funding. The minimum qualification is a Bachelor's degree and the position is open to any nationality provided the Universities entrance requirements (including English Language) are met. The length of the studentship (which will include coursework) will depend on the candidates initial qualifications. To start between 1 January and 15 August 1998.

For further information and application forms please contact: Dr. Daphne Fautin, Department of Systematics and Ecology, University of Kansas, Lawrence, KS 66045 USA. Tel. 913-864-3062. Email fautin@kuhub.cc.ukans.edu.



MEMBERSHIP

The annual subscription for individual membership of ISRS is currently US$70, provided renewal payments are made by 1st March each year. Individual and Family Members receive the journal *Coral Reefs*, the newsletter *Reef Encounter* and other periodic mailings. Family membership is US$80. Student membership costs US$20 and benefits include all of the above except the journal *Coral Reefs*.

A new category – Sustaining Member – has been added for those supporting the society with a subscription of $150. In addition to other benefits sustaining members will see their names printed in future issues of Reef Encounter.

Renewals received between 1 March and 30 April will cost US$30 for a student member, US$80 for a full member and US$90 for a family membership. Those received after 1 May will cost US$35, US$90 and US$100 respectively. New memberships will be at the base rate of US$20, US$70 and US$80 regardless of what time of year they join.

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

Subscriptions to ISRS should be addressed to: *International Society for Reef Studies, P.O. Box 1897, Lawrence, Kansas 66044-8897, USA.*

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, in that it provides an outlet for book reviews, discussion of issues of general interest 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* is cheerfully illustrated, with cartoons, newpaper 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 this 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, preferably, on diskette or by e-mail using Wordperfect or DOS-Text and in an IBM compatible format. 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. 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 21 (DUE OUT JUNE 1997) IS 1 MAY 1997; please send to one of these addresses:

Sue Wells, WWF-International, Ave du Mont Blanc, 1196 Gland, Switzerland.
Fax: (41) 22-364-5829; Tel: (41) 22-364-9545;
e-mail: swells@wwfnet.org

Maggie Watson, ICLARM Caribbean Marine Protected Areas Project, c/o Conservation and Fisheries Department, P.O. Box 3323, Road Town, Tortola, British Virgin Islands.
Fax: (1-809) 484 2670 Phone: (1-809) 494 5681
e-mail: iclarm@caribsurf.com

David Obura, The Wildlife Conservation Society, Coral Reef Conservation Project, P.O. Box 99470, Mombasa, Kenya.
Fax 254-11-472215 Phone: 254-11-485750
e-mail: crcp@users.africaonline.co.ke

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$ ONLY please) of *:

..... US$70 for FULL membership

..... US$20 for STUDENT membership

..... US$80 for FAMILY membership

..... US$150 for SUSTAINING membership

Credit Card Payment: Visa/Mastercard

No. ..... Expiry Date .....

Signature .....

Bank drafts and cheques to be made payable to: INTERNATIONAL SOCIETY FOR REEF STUDIES. If a receipt is required, please request it at the time of payment.

Send completed application form and your cheque to: *International Society for Reef Studies, P.O. Box 1897, Lawrence, Kansas 66044-8897, USA.*