

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*.

The category—Sustaining Member—is for those supporting the society with a subscription of \$150. In addition to other benefits sustaining members will see their names printed in each issue of *Reef Encounter*.

Renewals received between 1 March and 30 April will cost US\$320 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 the Society 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 paper, 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, newspaper cuttings and other entertaining material.

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

To save time and postage, we shall not normally acknowledge submitted material and 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, preferably by e-mail or diskette using Word or ASCII 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.

References are to be styled in the format as prescribed by *Coral Reefs*. 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 systems, but contributors will receive a free copy of the relevant issue.

COPY DEADLINE FOR REEF ENCOUNTER 25 (DUE OUT JUL. 1999) IS MAY 1st 1999;
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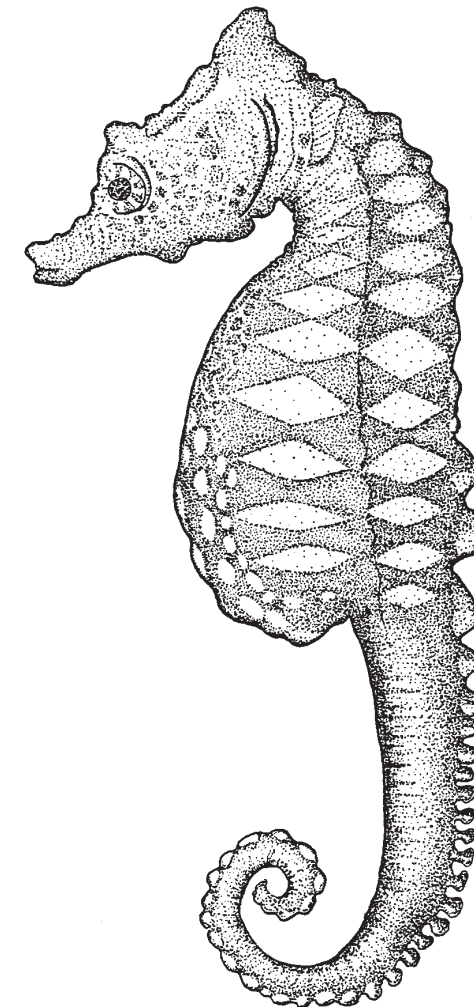
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REEF ENCOUNTER

Newsletter of the International Society for Reef Studies



REEF ENCOUNTER No. 24 December 1998

Newsletter of the International Society for Reef Studies



Editor Maggie Watson

Associate Editors Kristian Teleki 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:

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

Reef Encounter is produced by Allen Press, Inc., 1041 New Hampshire, Lawrence, KS 66044, USA. Printed on recycled paper.

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EDITORIAL

This issue of **Reef Encounter** takes the new look a step further. We also see a transition in ISRS Officers and Councilors. The new council takes office in January, so we've changed our cover to give the up to date contact addresses. See **ISRS News** for more details.

Bleaching was the topic of 1998, and our **Feature** has already received quite a bit of publicity. It draws together the ISRS statement on bleaching, an analysis of ocean HotSpots in the first half of the year from Al Strong and colleagues, and a comment on clam bleaching from the Philippines.

Spyhopper has contributed another opinionated tirade, this time on the miracle of economics. Money certainly distorts the world we live in. If you thought you'd heard it all,

check out **Compleat Reef Encounter**.

All the regular items are here, along with a Mozambique country profile and some more book reviews for those not lucky enough to have a year round field season. And if you do find yourself with a free moment, lets hear what you think about the issues raised in **Reef Encounter**. Is your topic or geographic region adequately represented? If not we look forward to receiving your articles for the next issue!

Special thanks to Cathleen Bester for the beautiful cover illustration, Simon Wilson and Dave Righton for many of the cartoons.

Maggie, Kristian and David



ISRS COMMENT

From the Out-Going President

I have had the great good fortune to be president of the ISRS after constitutional revision and business re-organization transformed our Society. I can only hope that all of you and my predecessors are pleased at the things that we have achieved in what now seems to be the very short period of four years. I am grateful to the officers, council members, and others who have helped me with their energy, ideas and constructive criticism and who made my tenure stimulating and fun.

I see two major challenges facing our Society in the immediate future. First, we must work to build our membership, particularly by finding creative ways to support developing country scientists and students. Second, we will face increasing demands for scientific input into the conserva-

tion and management of reefs in an era of global change. Our strategy to draw science, management, and policy-making more closely together must be considerably strengthened, our involvement in issues expanded, and our responsiveness improved.

A persistent irony is that just when one thinks that one is beginning to understand things, it is time to move along. I suppose that this is a secret of life as well as the strength of organizations.

Best wishes to the incoming officers and council and to all of you.

And Terry, good luck mate!

John Ogden

From the incoming President

It is a great honor for me to take over as President of ISRS. I congratulate the new office bearers and Councilors, and I thank John Ogden and those in his team whose terms are now coming to a close. Your hard work and impressive achievements have set a high standard for us who follow. In offering myself for the job, I pledged to work to maintain and enhance the Society's reputation as a vital and respected organization: 1) through which researchers disseminate their knowledge and insights about living and fossil reefs; and 2)

to which the wider community turns for advice on matters concerning coral reefs, their conservation, and sustainable use.

In **Coral Reefs** and **Reef Encounter**, we have two excellent avenues for disseminating the immense knowledge and insights of our membership. They are publications whose quality and breadth attract ever increasing numbers and diversity of good contributions. Through your support of these publications, and the skill, dedication and efforts of

their editorial and production teams, I see a bright future for the Society's role as a focal point for learned works on living and fossil reefs.

Far from being 'just' a society of researchers, our membership has a passion for reefs—especially living coral reefs. Just read back issues of **Reef Encounter**! However, as I write this in late 1998, there is greater concern than ever among our members for the future of coral reefs. Not only are there concerns about the widespread local impacts caused directly by humans, through destructive fishing, over-fishing, sedimentation, mining, and pollution. But also, as this decade has unfolded, there have been widespread coral diseases, predator outbreaks and bleaching leading to coral death on reefs in all tropical oceans. One of our major challenges as researchers is to understand the significance of these phenomena, both in the context of natural spatial and temporal variability, and in the context of human benefits and services diminished or forgone. But one of our chal-

lenges as advocates for coral reefs is to shake off such jargon and to engage with levels of the broader society, such as government, intergovernmental and non-government sponsored initiatives, foundations, and commercial users of coral reefs, in ways that will bring about good outcomes for reefs and for people who rely on them. I hope to be able to look back after four years in office satisfied that the Society has navigated these tricky waters successfully.

An exciting focal point for the Society is the 9th Coral Reef Symposium planned for Bali, Indonesia, in 2000. As a major sponsor, the Society looks forward to contributing towards the success of this meeting through a large attendance of its members, by providing competitive travel grants, and by assisting the organizing committee. Look out for updates in upcoming issues of **Reef Encounter**. On behalf of ISRS, I wish the organizers every success.

*With best wishes,
Terry Done*

ISRS NEWS

ISRS Elections

John Ogden formally announced the results of the ISRS elections at the ISRS European meeting in Perpignan last September. New officers and councilors will take up their posts from the 1st January 1999 and include: Terry Done, President; Barbara Brown, Vice President; Richard Aronson, Corresponding Secretary; Councilors: Loke-Ming Chou, Hector Guzman, Nicholas Polunin, Robert Richmond, Suharsono, and Carden Wallace. They replace the following council

members who will retire at the end of 1998: John Ogden, President; Rene Galzin, Vice President; Callum Roberts, Corresponding Secretary; Councilors: Jorge Cortes, Peter Glynn, Pat Hutchings, Ken Sebens, Juergen Paetzhold, and Clive Wilkinson. Grateful thanks are extended to all retiring officers and councilors for the many efforts they have made on behalf of ISRS. Thanks also to all the others who stood in the recent election but were not successful this time.

ISRS Awards

ISRS has established a number of ways to honor members and encourage the education of young reef scientists, including the Darwin Medal, Honorary Life Membership, the annual 'Best Paper' award for an article in Coral Reefs, The Sollins ISRS / CMC fellowship, and the Student Travel Award Program. Following a review by Peter Sale, Rene Galzin and Gray Multer, the following guidelines have been developed.

The Darwin Medal

This gold medal, the most prestigious award given by the ISRS, is an occasional award, usually presented every four years at the International Coral Reef Symposium. It goes to honor an ISRS member who has long been recognized as a

senior coral reef scientist responsible for major contributions throughout his/her career. Members send nominations with appropriate documentation to the ISRS Corresponding Secretary who brings them to the Council for selection of the medallist by a four-fifths majority vote (80%) in a secret ballot. Each nomination is judged on its individual merit and a four-fifths majority of Councilors voting must approve a nomination for an award to be made. At the occasion of the presentation of the award, the medallist is encouraged to give a thought provoking review of his/her particular scientific field with recommendations for future workers. This talk, following editorial review, is subsequently published as the "Darwin Lecture" in Coral Reefs.

Honorary Life Membership

The Honorary Life Membership is given periodically by the Council to honor retired senior scientists who have made outstanding contributions to their field and / or ISRS. Such individuals will receive all ISRS member privileges and publications at no cost for the term of their lives. The maximum number of Honorary Life Members at any one time is fixed by the Constitution and not all positions need be filled. The Corresponding Secretary of ISRS will solicit written nominations (with appropriate documentation) of potential Honorary Life Members from the Council, annually when vacant positions exist. By a secret ballot, Councilors will vote in favor of, or in opposition to, the award of Honorary Life Membership for each candidate so nominated. The vote in favor of any candidate must be unanimous for the award of this honor.

Annual Best Paper Award

The Best Paper Award plaque recognizes research excellence and is presented annually to the author or authors of what is judged to be the most outstanding paper published in the journal *Coral Reefs* in the past year. The decision on the winner is by majority vote of the Editorial Board of the Journal.

The Sollins / CMC Graduate Fellowship for Coral Reef Research.

The Sollins Fellowship is available to students, worldwide, who are already admitted to a graduate program at an ac-

credited university. Funds of approximately US\$ 13,000 are available to help Ph.D. students develop skills and address problems related to coral reef ecosystem research and management. Funds can be used to support salary, travel, fieldwork or laboratory analysis. The International Society for Reef Studies (ISRS) and the Center for Marine Conservation (CMC) support the Fellowship and review all applications. Interested persons should contact the ISRS Recording Secretary.

Student Travel Award Program

The ISRS Student Travel Award Program is designed to help graduate students from designated developing countries attend scientific meetings that would enhance their education. This is a Program that is co-sponsored by the ISRS and the host of a scientific meeting. Funds (up to US\$1200) are available from ISRS for round trip travel, with the student's food / lodging / fees covered by the meeting host. Applications accompanied by letters from at least two major professors regarding the graduate student's status and active current involvement with coral reef research are required. Applicants must also submit an abstract of an oral paper or poster that they would present if selected. Interested students should contact the ISRS Corresponding Secretary for names of Coordinators of upcoming meetings that will be co-sponsoring this Award. The meeting host will solicit and review all applications and select the award winner.

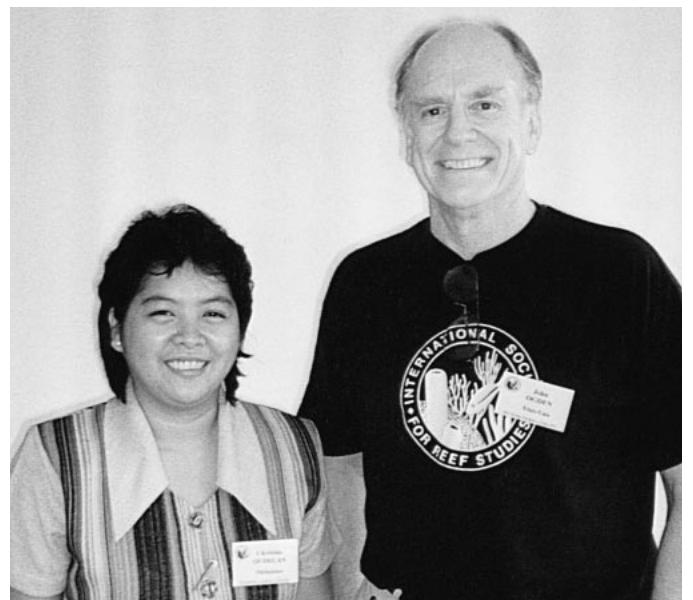
ISRS Student Travel Award is a Success

Ms. Christine Quibilan from the Marine Science Institute of the University of the Philippines was the winner of the first annual ISRS Student Travel Award. Her roundtrip airfare to the Perpignan meeting was paid for by ISRS, with student food, lodging and fees covered by the Conference host. Some 40 people attended her lecture, which was followed by congratulations from President John Odgen (see photos). Some personal comments and the abstract of her paper are given below.

Barbara Brown & Gray Multer, STAP Co-Coordinators

My Perpignan Experience

You can't imagine how honored and happy I was to be chosen as the first recipient of the Student Travel Award recently instituted by the International Society for Reef Studies. My Perpignan experience was a series of firsts for me. It was my first to visit France—a country known for its rich history, splendor and grandiosity. More importantly, it was my first time presenting a paper in an international forum and as a jet lagged student naturally I was nervous. But overall, I



John Odgen congratulates Christine Quibilan, winner of the first annual Student Travel Award.

can say that I was able to present my paper with confidence, and my work was well received.

What was most gratifying about the meeting was the wealth of information I gained from the four plenary lectures and very interesting paper and poster presentations. I wanted to attend all the presentations, but unfortunately three sessions ran simultaneously. However, I gained new friends and established good contacts for future research collaboration. One of the most thrilling experiences for me was to meet in person researchers whose work I have read and revered. I am now able to associate faces with the authors I've read back in the Philippines!

No conference is ever complete without its accompanying social events. The Mayor of Perpignan hosted a 'welcome cocktail' at Le Palais de Congrès. Field trips were also scheduled. Some went diving, while others went hiking and visited the Tautavel cave. I joined the field trip to Banyuls (the wine trip) and then walked along the Mediterranean coast. I can now proudly say that I have tasted one of southern France's most famous wines and was able to enjoy the sun, the cool breeze and the crystal blue waters of the Mediterranean Sea! The Conference dinner prepared by our host was a night to remember—a whole new experience. The wonderful candlelit dinner had a typical French ambiance. The food and wine were excellent. Traditional Catalan dances and songs were performed. It was an enjoyable and

nerve-wracking, intellectually
rewarding and memorable

lengthy evening where participants danced and drank to their hearts' content.

I hope that in the future, the Student Travel Award Program will remain one of the ISRS's priority programs so that it will continue to provide travel scholarships to budding coral reef scientists all over the world, most especially to students coming from economically poorer countries. Such a distinguished assembly of coral reef scientists is an appropriate and invaluable venue for sharing one's research as well as learning about current trends, interests and directions in various coral reef research topics.

My sincerest gratitude goes to the International Society for Reef Studies for the Student Travel Award, most especially to Dr. John Ogden, Dr. Rene Galzin and his staff at EPHE, Dr. Michel Pichon, Dr. Gray Multer and Dr. Barbara Brown. I also thank my family and colleagues at the Marine Science Institute of the University of the Philippines for all their support and encouragement. My Perpignan experience can be summed up in these words: nerve-wracking, intellectually rewarding and memorable. I fervently hope that this will not be my last adventure!

Miledel Christine C. Quibilan, Marine Science Institute, University of the Philippines, Diliman, Quezon City Philippines. Email: <mags@msi01.cs.upd.edu.ph>

Offshore Reefs in the South China Sea and the Sulu Sea: Comparison of coral community structure and recruitment processes.

Quibilan M.C.C. and Alino P.M.

Comparing the coral reef community structure of offshore reefs in the Kalayaan Island Group (KIG) of the South China Sea and the Sulu Sea basins provides valuable insights in deriving the biological, oceanographic and geological processes that affect reef formation and contribution to its present state. Community structure ordination together with coral population dynamics such as growth, recruitment and survivorship suggests possible "sources and sinks" among reefs situated in relatively pristine areas. A total of eight reef areas were surveyed in the KIG and also eight for the Tubbataha atolls in the Sulu Sea. Fixed transect locations were established for all of these sites using cement blocks laid at every 5 m interval for the 100m

length of the transect. To derive benthic life form information, three equally spaced 30m transects per site were read using the Lifeform Intercept Transect Technique (LITT). For specific sites, post-settlement recruits were counted, measured and identified from cement blocks after 6, 12 and 24 months of deployment. Results show that reefs in the Sulu Sea are in better condition in terms of live coral cover and abundance of recruits than reefs in the KIG. Differential diversity patterns of the life form-benthos implicates the interactive role of typhoons, monsoons and recruitment processes affecting the community dynamics at varying temporal and spatial scales.

ISRS European Meeting, Perpignan (France)

1-4 September 1998



The French organizing committee who put so much work into the meeting.

The ISRS European Meeting held in Perpignan was attended by 225 delegates from 27 countries, thus giving the event a worldwide dimension, rather than simply European. The excellent turn out led the organizing committee to arrange the scientific programme in three concurrent sessions throughout the two full days and two half days of the Symposium. During that period, 197 contributions organized into 14 themes were presented, including 127 oral papers and 70 posters. The abstracts have been published and are available by mail, see **BookShelf**. Plenary addresses were given at the beginning of each session. Authors and titles are as follows:

- Kleypas (Boulder, USA) : Defining a “coral reef” for the age of global change.
- W.Ch. Dullo (Kiel, Germany) : Coral growth, reef growth

and carbonate production.

- Dubinsky (Tel Aviv, Israel) : Environmental forcing and organismic control of the fluxes of material and energy between coral hosts and their algal symbionts.
- M.Harmelin-Vivien (Marseille, France) : Origin and maintenance of fish diversity on coral reefs: evolution and energetics.

A balance of approach amongst the contributions was obvious, with presentations ranging from the molecular level to the system level. In the latter category, strong interest for lagoon systems was noticed, with one full day session devoted to them.

An important and most appropriate emphasis was placed on presentation of data on the recent (1998) coral bleaching episode, and some stunning footage of bleached reefs from

the Great Barrier Reef and French Polynesia was shown, in addition to striking slides or pictures included in several oral and poster presentations.

It was most encouraging to note that a high proportion of contributions were presented by young scientists and graduate students. Among them was the first ISRS Student Travel Award winner, Ms. Quibilan from the University of the Philippines.

Overall, the ISRS meeting in Perpignan was a clear testimony of the vitality of reef research, not only in Europe, but in fact worldwide, including in a number of developing countries. W. Ch. Dullo from Germany offered to organize the next ISRS European meeting, which might take place in 2001 or 2002, i.e. after the 9th International Coral Reef Symposium to be held in Indonesia in the year 2000.

Michel Pichon

ISRS Council Honors Sue Wells for Exceptional Service

At the recent ISRS meeting in Perpignan, the council voted unanimously to honor Sue Wells with a special award for her exceptional service to the Society. Sue was editor of **Reef Encounter**, and a member of the ISRS Council, from 1989 (issue 5) until she retired as Newsletter Editor at the end of 1997 (issue 22). Brian Rosen produced the first three issues of the newsletter in the 1980s before handing over to the University of Newcastle for a transitional issue. It was at this point that Sue had her arm twisted (wrenched—she was later to suggest!) to give **Reef Encounter** a makeover. Sue's task was to transform an entertaining but highly sporadic newsletter into a regular mouthpiece for a growing Society. She immediately injected her professionalism and abundant enthusiasm into the task. I joined her in 1991 as co-editor, and by then the newsletter had begun to flourish. I quickly discovered that the apparently effortless appearance of the newsletter actually involved a huge amount of work! I also discovered that Sue required absolute dedication to spelling, punctuation and formatting. Within a couple of issues I was suitably cowed and triple checked edited text to make sure that I was not on the receiving end of one of Sue's wonderful withering looks! Editing **Reef Encounter** with Sue was a great deal of fun, but as we both moved around the globe in the early 1990s we found that

the copy deadlines invariably coincided with moments of peak crisis in our lives, such as moving house, starting a new job, finishing a job, or all of them at once. Despite these minor distractions, Sue always managed to find the time to produce better and fatter issues, and usually to get them out on time. When she didn't manage this, the editorials were always humble! Leaving **Reef Encounter** was hard as it became intimately entwined with our lives (if it's May, it must be **Reef Encounter** time...). But there comes a time when you feel that fresh blood is needed. I was the first to bolt leaving Sue to see through the transition to new Editors with the first issue of 1998. The Society will miss her superb editing skills but judging by the last issue Maggie, Kristian and David have met the challenge and have carried on the progression toward an ever better newsletter. The Society has also benefited greatly over the years from Sue's work on the council. At some point in the near future Sue will be presented with an engraved plate (when Barbara Brown next goes to Thailand and buys it!) expressing the Society's gratitude. Thanks for all your efforts Sue.

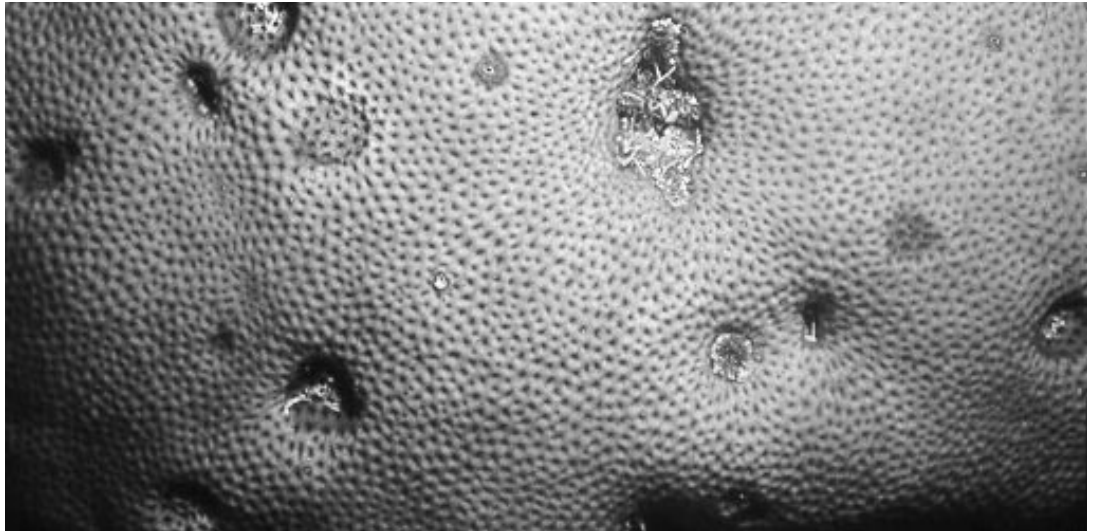
*Callum Roberts
Corresponding Secretary*

How to Order Copies of International Coral Reef Symposia Proceedings

Date	Venue	Reference	ISBN No.	Where to order	Cost
1969	Mandapam	Proc. Symp. on Coral and Coral Reefs, Mandapam Camp. 1969.	682031	The Marine Biological Assoc. of India, PB No. 2673, Dr Salim Ali Road, Ernakulam, COCHIN, Kerala, India. <i>At time of press we were unable to find out if copies were still available.</i>	
1973	GBR	Proc. 2nd Int. Coral Reef Symp. 1974. (Great Barrier Reef Committee: Brisbane)	0/909377/00/6 0/909377/01/4 0/909377/02/4	Out of print	
1977	Miami	Proc. 3rd Int. Coral Reef Symp., Miami. 1977. 2 Vols.		Comparative Sedimentology Lab, University of Miami, RSMAS/MGG, 4600 Rickenbacker Causeway, Miami, Florida 33149, USA	US\$44 plus 15% for surface mail and handling
1981	Manila	Proc. 4th Int. Coral Reef Symp., Manila, Philippines. 1981. 2 Vols.	971-03-0015-6	The Director, Marine Science Institute, University of the Philippines, Diliman, Quezon City 1101, Philippines.	US\$150 including airmail
1985	Tahiti	Proc. 5th Int. Coral Reef Cong. Tahiti. 1985. 6 Vols.	2.905.630.00.0 (01.9, 02.7, 03.5, 04.3, 05.1)	Salvat, B., EPHE, Universite de Perpignan, Avenue de Villeneuve, 66860 Perpignan, France	US \$ 300
1988	Townsville	Proc. 6th Int. Coral Reef Symp., Townsville, Australia. 1988	0731656032 (set) 0731656067 (vol. 1) 0731656035 (vol. 2) 0731656083 (vol. 3)	James Cook University Bookshop Post Office, James Cook University, Townsville 4811, Australia.	A\$150 + postage
1992	Guam	Proc. 7th Int. Coral Reef Symp., Guam. 1993. 2 Vols.		Marine Laboratory, University of Guam, UOG Station, Mangilao, Guam 96923 or Fax 671-734-6767. Email richmond@uog9.uog.edu P.O.'s are accepted, but not credit cards or foreign currencies.	Discount price of US\$85 for ISRS members + postage
1996	Panama	Proc. 8th Int. Coral Reef Symp., Panama, 1996. 2 Vols.	0-935868-90-9 set 0-935868-88-7 (v. 1) 0-935868-89-5 (v. 2)	Bookstore, Smithsonian Tropical Research Institute, Box 2072, Balboa, Panama	US\$300 + \$10 postage.

Another Unknown Caribbean Coral Phenomenon?

'Dark spots' have been observed extensively during the last decade at several reef areas of the Colombian Caribbean. The discolorations were first recorded as "medallones" in 1990 from the northern coast of Isla Grande (Rosario islands) during a bleaching event survey, and described as small round spots, brown to mustard in color, sometimes with partial mortality at the center, and occurring in



about 8-16% of the *Montastraea annularis* (*sensu lato*) colonies (Solano et al., 1993). Two years later, Diaz et al. (1995) frequently observed this discoloration and photographed it on *Siderastrea*, *Montastraea* and *Sptephanocoenia* from San Andres island (SW Caribbean). They named it "lunares oscuros" (dark spots).

We have been studying the incidence of this putative disease for several years on Colombian reefs. Dark Spots were observed during 1994-5 in about 3% of 2110 coral colonies of 30 species studied in four oceanic SW Caribbean atolls (Courtown, Albuquerque, Serrana and Roncador), but was present in only four species: *Siderastrea siderea* (12%), *Montastraea faveolata* (12%), *Colpophyllia natans* (5%) and *M. annularis* (3%). More recently (1997), in the Tayrona Natural Park (central Colombian continental coast), the discoloration was observed affecting about 16% of 9398 colonies of 21 species examined, principally on *Siderastrea* spp. (28%), *M. faveolata* (20%), *Stephanocoenia intersepta* (18%), *M. annularis* (17%), and *M. franksi* (6%). However, it was very rare at depths greater than 12 m and seems to increase in frequency during September-November when seawater temperatures are highest. Similar observations have been made across the Caribbean, and microbial cultures are being investigated from various places (J. Cervino & G. Smith, pers. com.).

Typically, Dark Spots appear as small, round, dark (usually brown on *Montastraea* and *Stephanocoenia* or purple on *Siderastrea*) spots that apparently grow in size over time. Some can be associated with a depression of the coral surface (suggesting a delay of skeletal growth) and others expand into a ring surrounding dead coral. The living coral surface at the spots is usually clean, without evident bacterial or fungal filaments or particles. In advanced stages, Dark Spots can be seen as a dark (not black) band bordering irregular dead coral patches. We would welcome comments and further observations from other scientists.

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Diaz JM, Garzón-Ferreira J, Zea S (1995). Los arrecifes coralinos de la Isla de San Andrés, Colombia: estado actual y perspectivas para su conservación. Academia Colombiana de Ciencias Exactas, Físicas y Naturales, Colección Jorge Alvarez Lleras 7, Bogotá, pp 1-150.

Solano OD, Navas G, Moreno-Forero SK (1993). Blanqueamiento coralino de 1990 en el Parque Nacional Natural Corales del Rosario (Caribe colombiano). An Inst. Invest. Mar. Punta Betín 22: 97-111.

J. Garzón-Ferreira & D.L. Gil, Instituto de Investigaciones Marinas y Costeras, INVEMAR, AA 1016, Santa Marta, Colombia.

Reefs at Risk

Reefs At Risk—a Map-based Indicator of Potential Threats to the World's Coral Reefs was released by the World Resources Institute (WRI) in June 1998. The project was a collaboration of WRI, The International Center for Living Aquatic Resources Management (ICLARM), and The World Conservation Monitoring Center (WCMC). Reefs At Risk is a first-of-its-kind, standardized, global assessment of anthropogenic threats to coral reefs. The map based analysis produced an indicator of potential threats to coral reefs in four broad categories: 1) Coastal Development, 2) Marine-based Pollution, 3) Overexploitation of Marine Resources, and 4) Inland Pollution and Erosion.

In order to describe the potential threats to coral reefs from sources in these categories, distance based 'threat surfaces' were developed from 12 representative stressors. These include cities, settlements, airports and military bases, population density, mines, tourist resorts, ports, oil

Reefs At Risk is a first-of-its-kind, standardized, global assessment of anthropogenic threats

tanks and wells, shipping routes, and areas where blast fishing or fishing using poisons is known to occur. Additionally, a watershed-based model was used to estimate potential erosion within the watershed. This was used to produce an estimate of areas potentially threatened by inland pollution and sedimentation. The 13 'threat surfaces' were integrated with data on coral reefs location, resulting in a global classification of potential threat to coral reefs. The full text of the report, technical notes and more detailed regional maps are available at <http://www.wri.org/wri/indictrs/reefrisk.htm>.

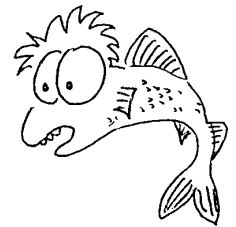
Key Findings

- 58% of the world's reefs are potentially threatened by human activity ranging from coastal development and destructive fishing practices to over-exploitation of resources, marine pollution and runoff from inland deforestation and farming.

Compleat Reef Encounter

The world's largest passenger liner, the P&O's Grand Princess, cost 250 million sterling. Its 3,300 passengers can enjoy a nine hole golf course, tennis courts and two theatres. The romantically inclined can get married in the Hearts and Minds chapel. That seems almost as many amenities as some of the coral reef destinations with struggling economies that these ships sail to! In fact, where's the need to dock at all? In March 1998, Carnival Cruise line effectively held Grenada to ransom by threatening to halt visits in protest at an environmental levy. But surely the lure of natural wonders, the magic of the underwater world will still count for something? Maybe not! The latest P&O leviathan actually has a coral reef in one of its five swimming pools! Does anyone fancy a microcosm study site for nutrient enrichment? Try justifying that exotic location to friends and family.

Information from the Times, 4th May 1998 and The Beacon, 3rd March 1998.



- Coral reefs of Southeast Asia, the most species-rich on earth, are the most threatened of any region. More than 80% are at risk (under medium and high potential threat), and over half are at high risk, primarily from coastal development and fishing related pressures.
- Overexploitation and coastal development pose the greatest potential threat of the four risk categories considered in this study. Individually, each affects a third of all reefs.
- The Pacific, which houses more reef area than any other region, is also the least threatened. About sixty percent of reefs here are at low risk.
- Outside of the Pacific, 70% of all reefs are at risk.
- At least 11% of the world's coral reefs contain high levels of reef fish biodiversity and are under high threat from human activities. These "hotspot" areas include almost all

Philippine reefs, and coral communities off the coasts of Indonesia, Tanzania, the Comoro Islands, and the Lesser Antilles in the Caribbean.

- Almost half a billion of the world's people, 8% of the total global population, live within 100 km of a coral reef.
- Globally, more than 400 marine parks, sanctuaries and reserves (marine protected areas) contain coral reefs. Most of these sites are very small. More than 150 are under 1 square kilometer in size.
- At least 40 countries lack any marine protected areas for conserving their coral reef systems.

*Lauretta Burke, World Resources Institute, 1709 New York Avenue, N. W., Washington, D. C. 20006 USA
Email: <lauretta@wri.org> website: www.wri.org*

Greenforce Coral Reef Project in Fiji

The Fijian archipelago comprises over 300 volcanic, coral and limestone islands. These islands are spread out over 1.3 million square kilometers of Pacific Ocean. Only 1.5% of the Fijian territorial area is dry land and of this land 83% is owned by local communities who still retain the fishing rights to their local waters. The increase in commercial fishing operators in these waters has given rise to fears of declining fish stocks. Damage from pollution, and some aspects of the tourism industry are also cause for concern.

As a signatory to the Rio Declaration and Convention on Biological Diversity (CBD) the Fijian Government needs to undertake a marine resource assessment in order to implement sustainable fishing practices. In order to meet the requirements of the marine resource assessment Greenforce, a UK based voluntary organization, has begun a three year coral reef survey on behalf of, and with, the National Trust for Fiji. The Trust recently initiated a scheme to establish five marine reserves with the uninhabited island of Yaduataba intended to be the first of these reserves.

In July of this year a formal agreement was made, and memorandum signed, between these two organizations detailing the survey to be conducted. The two organizations will collaborate on a comprehensive survey of the reefs surrounding the island of Yaduataba. The island is already a sanctuary of the crested iguana (*Brachylophus vitiensis*) and the Trust wish to extend the protected area to include the neighbor-

ing reef system, thereby creating one of Fiji's first marine reserves. The information and data gathered will allow the Trust to form a sustainable management plan for the region, and will also provide valuable support for their application to have Yaduataba recognized as a UNESCO World Heritage Site.

The scope of the survey will include the identification of fish, coral and other invertebrate species, and will determine and monitor the ambient environmental parameters which are perceived to be effecting the reef health. The assessment of reef fish communities will also include particular focus on commercially important fish species to provide information on the status of the Fijian fishery resources. Additionally, the survey findings will form part of the global Reef Check database to enable the Yaduataba reefs to be compared with others world-wide and to be included in this global reef assessment.

As is the case with most of Fiji, the island and the reefs are privately owned by local communities. This project has won the strong support of these local landowners and communities, and in particular their Chief, Ratu Alifereti Ramatai. Local participation and support is clearly essential to the success of this project.

At the end of the project, the organizers hope that monitoring methodology and data from these reserves will help establish a broader environmental policy for sustainable fishing practices, thereby fulfilling the requirements set out in the CBD. The partic-

Data will provide valuable support for an application to have Yaduataba recognized as a UNESCO World Heritage Site.

ipation and training of National Trust personnel through the survey will facilitate an ongoing programme of monitoring once the project is over. Greenforce will also donate much of the survey equipment to the National Trust to ensure the continued success of the program.

Further details of Greenforce and the Yaduataba Project from Jonathon Tully, Greenforce, 11-15 Betterton Street, London, WC2H 9BP Tel: (44) 171 470 8888; Fax: (44) 171 379 0801; Email: <greenforce@btinternet.com>; website: www.greenforce.org.

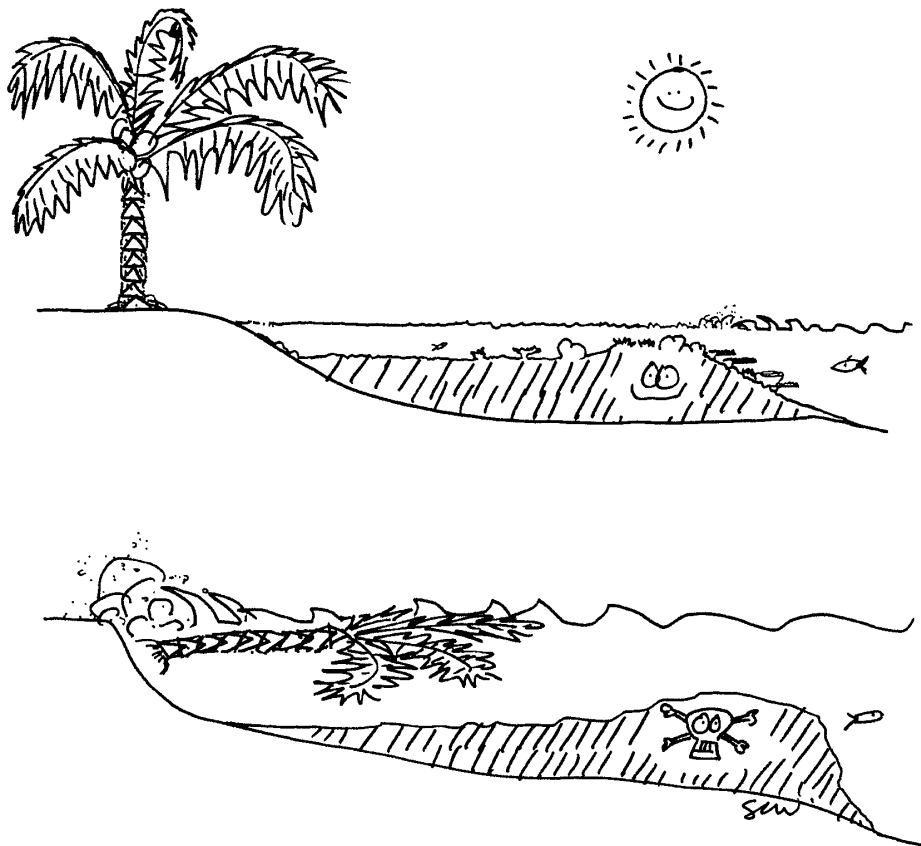
A Coral Nursery Project In The Florida Keys

The Ground Hog Day storm that hit South Florida on February 2, 1998, sustained winds in excess of 50 knots. These winds generated monstrous seas in the deep waters of the Gulf Stream that crashed into the offshore coral reefs in the Florida Keys. These shallow reefs absorbed the brunt of the storm, however massive amounts of coral were broken, tossed about and overturned. Such fragmentation can allow coral growth to recruit in new locations on the reef, however, this storm was very intense and was followed by a series of smaller storms that continued to toss the broken pieces about covering many in a layer of sand and sediment. Large areas of elkhorn coral (*Acropora palmata*) at Western Sambo reef were devastated. Reef Relief (a local NGO) has since developed a coral nursery at Western Sambo reef. Loose frag-

Rosettes will be moved to where vessels have run aground and scoured the bottom of coral

ments of *Acropora palmata* are cemented onto a concrete pad, creating a "Rosette" transplanting base that can be moved at a later date. Rosettes will ultimately be moved to areas of Western Sambo where vessels have run aground and scoured the bottom of coral. The plan is to photograph the corals on a regular basis as part of the Reef Relief Photo Monitoring Survey. However, storms later in 1998 slowed progress, themselves causing damage to the nursery. Financial support for this project is being provided by The Henry Foundation. Many supplies have been provided by the Florida Keys National Marine Sanctuary.

Michael Blades



Satellites at Sombrero

Sombrero is the northernmost islet in the Lesser Antilles. It lies 38 miles from Anguilla and is separated from the Puerto Rican / Virgin Islands bank by 40 miles of the Anegada passage. In rough weather, Atlantic swells can wash right over the tiny island (366m across) sitting atop a platform approximately 5.6 x 8 km wide and 16-30m deep. Fossil evidence suggests Pleistocene limestone may represent the floor of a pre-historic lagoon once protected by a barrier reef and possibly enclosed by an atoll (Julien, 1866). The island has a history of phosphate mining, and guano extraction, being the main source of 65,979 tons of 'unenumerated manures' exported from the West Indies to the UK between 1852 and 1891 (according to the Great Britain Parliamentary Session Papers, Trade and Navigation). Ogden et al. (1985) found corals common on other eastern Caribbean islands were well represented around Sombrero, although reefs were not seen. Some of the largest charter boats

Beal aerospace wants to perch a satellite launching facility on this isolated cay.

working out of the Virgin Islands visit Sombrero and have reported extensive coral communities. Fish communities are said to be generally rich and diverse.

Sombrero is in the limelight because Texas based Beal Aerospace wants to perch a satellite launching facility on this isolated cay. The company is currently negotiating to lease the island from the Anguillan government. The RSPB, American Bird Conservancy, BirdLife International and regional NGOs such as Island Resources Foundation are voicing strong opposition. An environmental impact assessment has been carried out by ICF Kaiser and is currently being reviewed by the British National Space Center. Meanwhile the Association of Reef Keepers, a British Virgin Islands environmental group, has asked PADI to sponsor an expedition to catalogue underwater life. By the time **Reef Encounter** is published, the EIS will have been released, but you can send comments or ask for

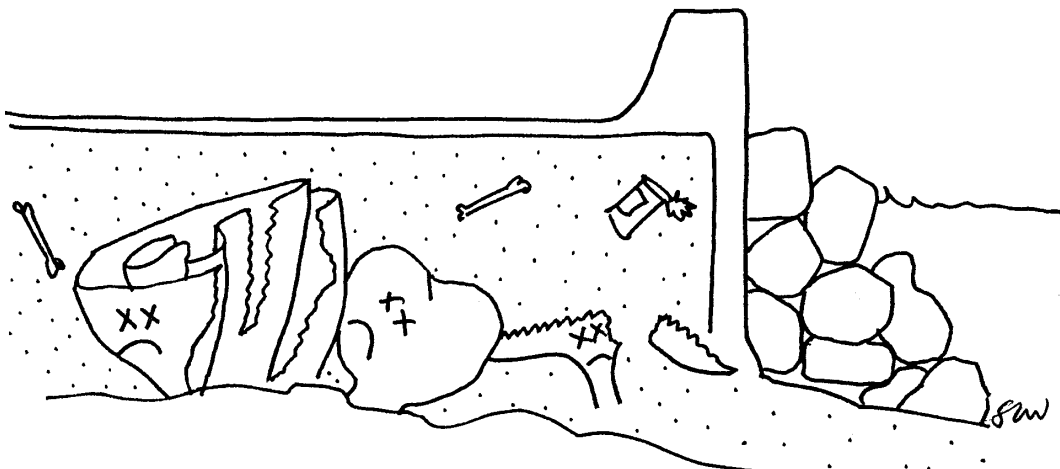
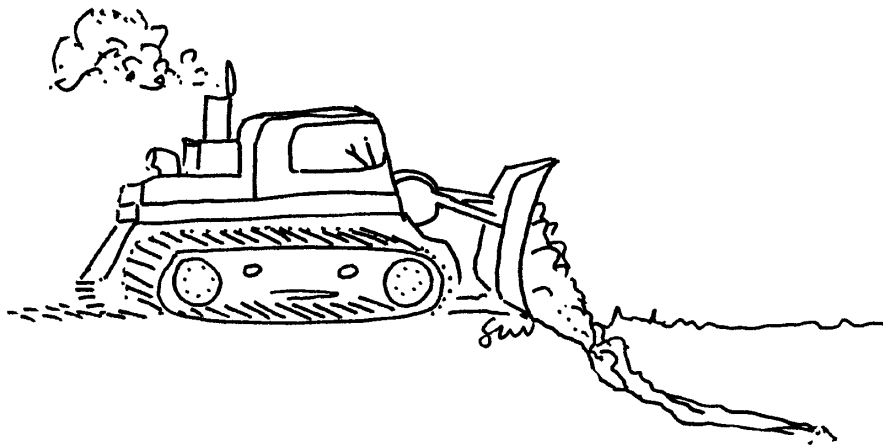
further information from Hon. Hubert Hughes, Chief Minister of Home Affairs, Tourism and Development, P.O. Box 60, The Valley, Anguilla. Tel: 264 497 2518 Fax: 264 497 3389.

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M. Watson



Ann Macaulay Cameron—an appreciation

Born near Hungerford, Queensland on 22 September 1939. Died in Brisbane on 17 October 1998

The last time I saw my dear friend, Ann Cameron, it was only a few weeks before her death. Her body was a battleground. The cancer, that had been thought to be in remission, had metastasized with great vigor and she was like a war refugee within her own body. She was still fierce, still valiant, still courageous, but she had retreated—been forced to retreat—to some redoubt deep within herself where she was preparing for the final assault by her renegade cells.

It was a sad, poignant meeting. She knew better than anyone that the end was near. It was also ironic that someone who had spent a lifetime pondering the deep evolutionary issues of individuality, coloniality and symbiosis should find her own individuality under attack. She knew that to understand cancer is to understand life itself.

Ann asked immediately that we not talk of commonplace things and daily niceties. She wanted, instead, to talk only about big, important things. And we did. The conversation moved to her life and her place in the world, and she asked me if I thought she had done enough. This lovely creature, my teacher, mentor and friend, suffered doubt. I was amazed. I was so confronted by her honesty and doubt that I could offer no coherent reply. I held her hand, now so weak and ravaged, and mumbled that, of course, she had, and made a poor attempt to hold back the tears.

In the weeks that followed, I thought a lot about Ann and her question, and even came up with some answers, but never got to say them to her. And now that she is dead, I have found some words.

She was a remarkable woman, and was, for many generations of emerging scientists in the Zoology Department at the University of Queensland, their first encounter with the 'meaning' of science, or perhaps, with what it means to be a scientist. She rejected the idea that, because science may be value free (and that is a debate for another day), scientists were somehow themselves excused from developing and exercising a sense of values. She insisted, demanded, that to be a scientist involved a moral dimension that was as important as the science itself. And of course, for Ann, that importance was transcendent.

Ann insisted, demanded, that to be a scientist involved a moral dimension as important as the science itself

Ann was, in the proper sense, a public intellectual at a time in Queensland when they were few and far between. Curiously, she was also perhaps a very private one. Never fully comfortable on the hustings, where her championing of burning issues should have taken her, she instead cultivated what can best be called a 'salon', in a clear and direct echo of those earlier remarkable women who also struggled to find authority and acceptance in a misogynous world. There she instructed, challenged and caajoled her 'babies' in a tradition at least as old as Socrates, in effect completing their education (and the Queensland education system left much to complete). She encouraged generations of young scientists to think for themselves.

And there was much for them to think about: huge conservation issues centered on the problems of coral reefs; monumental scientific issues centered on the way evolution is manifested in biodiverse regions such as rainforests and coral reefs; and great political and ethical issues such as the Vietnam war, the anti-apartheid struggle, and the struggle for civil rights in Queensland. Ann encouraged the critical analysis of all these issues, as well as the emergence of the view that such issues were the proper concern of scientists—that indeed, they were all part of the one issue, which is the proper role and responsibility of the educated person in civil society.

Ann's science contributed to, and was strongly influenced by, her time and place in a powerful interaction that enriched both her and those around her. She took First Class Honors in Zoology at the University of Queensland in 1962 (and her Ph.D. in 1969) at a time when a natural history approach was being challenged by a more evolutionary-based ecology. Of course, this succession was also occurring at that time throughout the English-speaking world, with Elton in Britain, Hutchinson in America and Andrewartha and Birch in Australia. But in Brisbane it resonated with great sonority with the local tradition of research on the iconic ecosystems of coral reef and rainforest. When the complexity of these phenomena was coupled with the new evolutionary perspectives in ecology, there was a great flowering of biology in Queensland in the sixties and seventies. People

like Jiro Kikkawa and Peter Dwyer joined the Zoology Department, others like Ray Specht joined the Botany Department, 'computer botanists' like Bill Williams and Len Webb worked in nearby CSIRO, and visitors like Joe Connell, Wendell Patton, Peter Frank and Fred Grassle were all drawn to the rich ecosystems and stimulating intellectual environment.

Many of the traditional marine biologists were swept up in this, and their science was changed forever. Ann's bibliography mirrors this history as first she challenged and was then won over by the new science. Her early works, particularly in toxicology, were in the best natural history tradition, while in her later works we can see her struggling with the evolutionary significance of venoms and toxicity in the context of coral reef ecosystems where diversity, longevity, stability and 'stationarity' (a favourite word of hers) are paramount.

Her love of science was bracketed by two other loves—for the Great Barrier Reef and for the English language. Both reflected her interest in communication, the one the message, the other the medium. She took the threats to the GBR personally, and worked scientifically and politically to counter them. She used her tremendous rhetorical powers to great effect, and was keen to see her 'babies' develop

their persuasive skills as well. Her scientific papers, particularly the later ones, always show these three elements intertwined—a golden braid of well chosen words, good science, and deep commitment to the GBR.

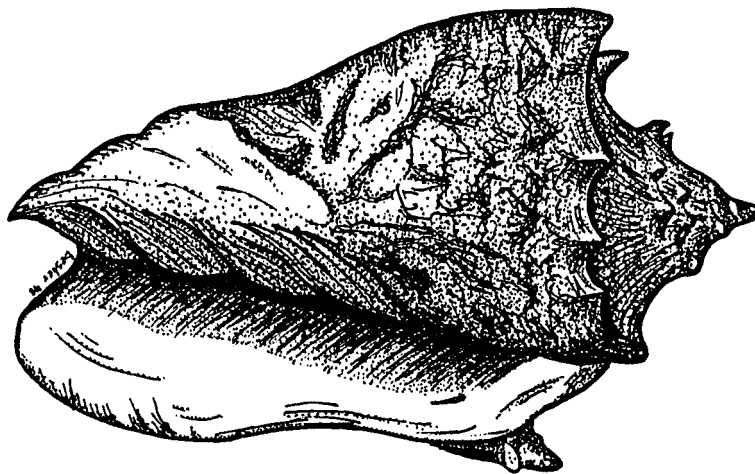
Ann's science and her salon were part and parcel of her larger struggle—the struggle of the unconventional, single-minded woman to establish herself, and to establish the right to be herself in a narrow-minded and misogynous culture. She chose career and partnership with the equally bohemian Bob Endean over marriage and family at a time when such a choice raised eyebrows.

She struggled to find her academic niche, and was considered 'prickly' by university administrators. For all that she suffered a thousand slights, but was adored by her 'babies', for all of whom she blazed a path. The landscape of coral reef science (and beyond) is now happily scattered with prickly, unconventional, thoughtful, educated women (and men) who owe all that to her.

Ann, your memes are secure inside the skulls of we who loved you. You did more than enough.

Roger Bradbury

She instructed, challenged and cajoled generations of young scientists to think for themselves.



Ladeez and gennelmen, boyz and gurlz...Roll up, roll up, roll up to the greatest show on earth. Well, the return of Spyhopper at least. First a big thank you to all those who entered the collective noun contest. In particular thanks for a 'pose of nudibranchs', which was very nearly topped by a 'posse of catfish' and a 'walletful of squid'. A case of Bordeaux's finest on its way to you Brad.

But to get back to this issue's tongue in cheek diatribe, Spyhopper has finally figured out a way to save coral reefs, mangroves, fish populations and the like. **ECONOMICS.** Yes that 20th century byword for progress. Many of our esteemed friends and colleagues have for the past few years been espousing the virtues of using economics to save the earth, and now Spyhopper is jumping on the bandwagon. The way it all works is quite simple and goes something like this. Natural resources are abused and overused because nobody owns the property rights, and therefore your average user tries to get the most out of the resource before anyone else. The tragedy of the commons, the race to fish etc. So, economists reckon that by assigning a proper value to a resource e.g. \$100 per m² per year of coral reef, people will take more notice of it and look after it in perpetuity. Spyhopper is sure they are right. But that isn't where it all ends surely? It's a time honored way of testing truth. Why not, once you have valued it, sell the resource to the highest bidder? This small step is a natural, perhaps inevitable progression from valuation, and has two benefits. First, the original 'owner' selling the 'property' generates some hard currency, always useful because of economic discounting AKA 'a bird in the hand is worth two in the bush'. Second, the new owner of the resource is at liberty to do with it as they wish, now having legally enforceable property rights, rather than the original and woolly sounding 'environmental inheritance and existence values'. Just for a moment, engage your willing suspension of disbelief, assume responsible actions in the world of commerce, and think of the possibilities for environmental improvement....

A soft drinks manufacturer could buy or 'sponsor' a piece of coral reef. They could then develop that reef for the purpose of advertising their product, perhaps by rearranging coral colonies to form patterns that spelt out the name of their top-selling beverage, thus encouraging thirsty divers to plunder the nearest bar for said drink. The reef is kept 'pristine' so that potential consumers are easily able to identify

I engage your willing suspension of disbelief, assume responsible actions in the world of commerce, and think of the possibilities for environmental improvement....

the thirst quenching beverage that they need, and the owner of the reef generates profits from the sales of the advertised products. Fish could be tattooed—the more glamorous and eye-catching fish would attract higher bids from market innovators, and thus generate more hard currency for the impoverished locals to spend on imported consumer products. Everyone is happy! The options are virtually unlimited. Reefs could be purchased and moved wholesale to more lucrative or attractive locations. They could even be attached to cruise ships and moved around the tropics! I jest not, take a look at **Compleat Reef Encounter.**

Furthermore, Spyhopper has an insight into the 'crisis' in reef health that we are always hearing about. An insight that means that coral reef health could improve without even addressing the fundamental problems of overfishing, pollution, destruction of habitat or coastal zone development. It is a case of simple economics. We know that coral reefs etc. are not being assigned their proper value and thus are not performing as well, economically, as they should be. But since values are directly related to quality (you get what you pay for), and it's the monetary value we are using as the new yard stick, we should surely see an improvement in coral reefs if and when the global market rallies from recession, and reaches yet another all time high. Think on that! The miracle of economics will increase the value of our precious natural resources simply by virtue of trade in global markets, without complex management plans and protected areas!! Why this hasn't been elucidated before is a mystery to Spyhopper, but surely the economists can spread their gospel, and ease the minds of all reef scientists and conservationists.

By now, Spyhopper is in need of a stiff drink and some light entertainment. Talking of which, does anyone out there have any 'tales from the field', so to speak? Spyhopper is considering a special article entitled 'And Another Time I Nearly Died', containing hilarious accounts of near misses, shark attacks and diving scrapes that chill the hearts but warm the cockles of adventurers everywhere. Spyhopper's personal favorite includes clam diving off the Tanzanian border, some irate Sudanese shark fishermen, a long swim and a tiger shark. But that's another story.

*Outraged by the audacious Spyhopper?
Reply care of the Editor, address on back cover.*

Mushroom Corals—Emerging Distribution Patterns in Arabia.

Aden, Yemen, Mushroom corals, *Fungia* sp., are for sale in the souq. But in Muscat, Oman there's not a mushroom coral in sight, even underwater. Somewhere between the Eastern and Western extremes of the southern Arabian seaboard lies a boundary in the distribution of certain *Fungia* species. The picture of where this boundary lies is slowly coming into focus as a result of recent surveys along the Gulf of Aden and Arabian Sea coasts. To date, observations have confirmed *Fungia* (*Fungia*) sp. occurring around the historic port of Mukallah (N14°31'.55 E 049° 08'.15) in the Yemeni Governorate of Hadramaut (DeVantier, pers. comm.), whilst none of this sub-genus has been seen to the east of this point. To the east of Mukallah lie the towering cliffs of Ra's Fartak, where the Summer upwelling which affects southern Arabia is said to be at its most intense and closest to shore. This factor may go some way to explaining why these corals are only found on the Africa/Red Sea side of this divide.

But what about other members of the Fungiidae? This is where the picture is only now starting to emerge. While *Fungia* (*Fungia*) species are commonly found as elements in coral reef communities, typical habitats of other Fungiids are in non-reef areas, in habitats where no other coral community occurs such as on coarse sediments in deeper water. Coral reef scientists rarely survey such areas and the lack of survey effort may account for the sparse data on Fungid distribution throughout much of Arabia, particularly outside the Red Sea.

Despite this, in the past three years some interesting observations have been made in Omani waters. Firstly, in March 1996, two species of Fungiids were observed among a coral community on a relatively deep rock reef in the south of the country (16°56'.21 N 054°47'.42 E, 22 m depth). These were tentatively identified as *Fungia* (*Diaseris*) *fragilis* and *Fungia* (*Cycloseris*) *curvata*, although confirmation of these reports is still needed. Secondly, in April 1998 a community of *Fungia* (*Cycloseris*) *curvata* was observed on a drowned fossil reef at a depth of approximately 20m in the Gulf of Oman (22° 39'.74 N 059° 24'.76 E). These latter specimens have been formally identified and lodged with the

Aden, Yemen, Mushroom corals, *Fungia* sp., are for sale in the souq. But in Muscat, Oman there's not a mushroom coral in sight, even underwater.

National Museum of Natural History Naturalis, Lieden, Holland. The only other reports of Fungiids from the Arabian Sea, Gulf of Oman or Arabian Gulf are *Fungia* (*Diaseris*) *fragilis* (Baldwin, pers. comm.) from Fahl Island, Gulf of Oman (N23° 40'.72 E058° 30'.00), and *Fungia* (*Cycloseris*) *tenuis* from Jana Island in Saudi waters of the Arabian Gulf (Vogt, pers. comm.).

The incompleteness of the records, and therefore the uncertainty of the status of Fungiids in the Arabian region, has obvious management implications. The *Fungia* (*Cycloseris*) community observed on the fossil reef in the Gulf of Oman was discovered during a baseline survey of an environmental impact assessment for a large industrial development. A liquid natural gas processing (LNG) plant and associated fertilizer plant (ammonia and urea) are currently under construction within 2km of the Fungid community, with the fertilizer plant loading jetty falling within the community. Available records indicate that *Fungia* (*Cycloseris*) *curvata* is a regionally rare coral species, and as a result the Government of Oman has insisted that those coralla falling in the footprint of the jetty be moved to mitigate their loss during construction and operation of the jetty.

A good deal remains to be learnt about the distribution of Fungiids in the Arabian region. From a biogeographic point of view, the effect of seasonal upwelling along the southern seaboard of the Arabian peninsular as a partial or complete barrier to the movement of coral larvae is particularly interesting. Differences in the composition of the Fungiid assemblage on each side of this divide raise some interesting questions. Until we know more, managers of natural marine resources should continue to take a precautionary approach when making management decisions. *Insh'allah*.

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CORAL BLEACHING — A GLOBAL CONCERN

Following widespread coral bleaching around the world in 1997-98, and considerable scientific and media interest, ISRS Council decided that it would be valuable if a statement was prepared which accurately summarised the present understanding of the nature and significance of bleaching

events witnessed over this period. The following statement has been prepared in consultation with scientists, active in this research area, and agreed by Officers and Council members of the Society:

ISRS Statement on Bleaching

During 1997-98, reports of coral bleaching from all the major tropical oceans of the world suggested that this time period had seen the most geographically widespread bleaching ever recorded, with some areas (e.g. Singapore, and the Andaman Islands) witnessing extensive bleaching for the first time in recent history. Coral bleaching has been described in at least 32 countries and island nations in 1997-98; with reports from sites in the Pacific, Indian Ocean, Red Sea, Persian Gulf, Mediterranean and Caribbean recording widespread bleaching. The bleaching response represents a loss of symbiotic algae and/or their pigments such that the coral may pale in color to a varying extent, or turn starkly white. Paling of some coral species is an observed seasonal phenomenon in the Pacific, Indian Ocean, and also the Caribbean. Where bleaching is seasonal, or less severe, the likelihood of full recovery of pigmentation is high. In the present bleaching episode the response has been exceptionally severe with a large number of corals turning completely white and subsequently dying.

Mass bleaching normally occurs when seasonally maximal sea-surface temperatures (SST) are exceeded. The likely triggers of bleaching are elevated SST and solar radiation. Research has indicated that these factors act in combination, rather than alone. Additional causes of bleaching such as extreme low tides and reduced salinities have also been implicated at some sites in 1998.

The occurrence of bleaching at many locations has been patchy with more severe bleaching recorded in shallow waters than at deeper offshore sites. Not only hard and soft corals, but also sea anemones, zoanthids, giant clams, foraminifera and many other zooxanthellate invertebrates are affected by the loss of their symbiotic algae. Corals can recover from bleaching but death may result if environmental stressors are extreme and/or prolonged. In the Indo-Pa-

..the most geographically
widespread bleaching ever
recorded

cific fast growing, branching corals are more susceptible to bleaching than slow growing boulder corals, leading to a high mortality in the former. Recovery of boulder corals has been frequently recorded in 1998, often within 1-2 months of initial bleaching. In the Caribbean, however, greater bleaching-related mortality has been shown in boulder and plate-like corals rather than in branching species, which had already suffered extensive mortality from storms, diseases and terrestrial run-off. In the Indo-Pacific the susceptibility of different corals to bleaching can significantly affect coral community structure and diversity, depress the rate at which the reef builds up, and reduce habitat availability for other reef species. Previous cases of bleaching-induced mortality from 1993 in the Pulau Seribu (Java Sea) and from 1996 in the Similan Islands (eastern Indian Ocean) have provided examples of community change. At both sites shallow parts of the reef have been temporarily transformed from being a mixture of branching and boulder corals to areas in which virtually only the boulder corals survive. During the current 1998 bleaching, one reef on the Australian Great Barrier Reef has been so severely affected that even many of the robust boulder corals (one of them dated as over 700 years of age) were badly damaged or died. Complete recovery of reefs following severe bleaching is dependent on growth and fragmentation of remaining corals, and on recruitment from stocks in the area. Evidence shows that restoration of the reef to its former state may be slow or, if interrupted by man-made change, may even be halted altogether.

Links have been made between the widespread incidence of coral bleaching in 1997/98 with one of the strongest El Ninos of this century. While past and present coral bleaching events in many parts of the Pacific appear to be closely matched to El Nino-induced seawater warming, the connec-

tions are not clear-cut for all locations in the Pacific. Nor can bleaching in Indian and Atlantic waters be directly linked to only El Niño phenomena. Factors responsible for elevated SSTs in the Indian Ocean, for example, are likely to be the result of a complex product of El Niño-related, monsoonal and local oceanographic factors which are superimposed on interdecadal patterns in climate variability.

Links between the apparent changing nature and frequency of the El Niño phenomena and global climate change have also been made but are the subject of controversial debate among climatologists with many suggesting that present patterns reflect the natural variability of the system rather than the effects of greenhouse gas-induced warming. For some of the tropical oceans significant increases in SST have been observed over the last 50 years. Concerns about the potential effect of global change on future frequencies of severe bleaching events are based on the narrow upper margin of

environmental tolerance in corals. While corals display impressive acclimation processes to changes in some environmental parameters, it is not known whether they are able to adapt or acclimatize at rates which match the projected rates of background seawater temperature increase. Should seawater temperatures rise, either as a result of greenhouse gas emissions or natural variability in the ocean/atmosphere system, then we might expect the incidence and severity of coral bleaching to increase yet further in the future with the possibility of substantial changes to the coral reef community structure.

The 1997-98 episode of worldwide bleaching is a major cause for concern. Although sea temperatures have returned to normal in many tropical areas of the world the full extent of bleaching-induced mortality may not be fully apparent for several months yet.

Ocean Hotspots and Coral Reef Bleaching. January—July 1998

E. Strong, T. J. Goreau, and R. L. Hayes

Since 1990 we have been able to predict virtually all known large scale coral reef bleaching events in real time using the "HotSpot" criterion (Goreau et al., 1990; Goreau and Hayes, 1994; Goreau, Hayes and Strong, 1997; Strong, 1998). We identify regions of the tropical ocean where satellite-derived sea surface temperatures (SST) exceed 1.0 °C above the monthly average value in the warm season (Strong, 1992; Strong et al., 1997). Maps showing monthly distributions of HotSpots are available on the world wide web at:

- <<http://psbgsi1.nesdis.noaa.gov:8080/PSB/EPS/SST/climohot.html>>
- <<http://manati.wwb.noaa.gov/orad>>

Maps showing the annual distribution of bleaching from 1969 through 1997 are posted at:

- <<http://www.fas.harvard.edu/~goreau>>.

Although coral bleaching can be found at low levels for anomalous temperatures below this value, a one degree anomaly for one month results in a major fraction of all corals being bleached and is readily identified by divers. Anomalies twice this magnitude for one month, or of this magnitude for two months, begin to cause appreciable coral mortality, while most corals appear to recover if anomalous

temperatures are less severe or less prolonged.

Following the January 1998 SST data we alerted researchers across the South Indian Ocean, Brazil, and Australia, and unusually early and complete field studies were conducted by researchers and divers in all affected areas. The most severely affected region was the Indian Ocean. Many reefs all across the Indian Ocean were several degrees above the critical threshold temperatures for up to four months, and coral mortality was devastating and unprecedented (reports are listed in Table 1).

The global extent of HotSpots from January to July 1998, the time period which covers the warm season in the Southern Hemisphere, is shown in Figure 1. Anomalously hot water, coral bleaching, and coral mortality taking place within these regions are both positively and negatively correlated with the El Niño/Southern Oscillation Index. The geographic extent and duration of HotSpots and coral bleaching during the first half of 1998 have exceeded all previous levels since 1982 (Strong, 1998). The previous year high was in 1997. The HotSpot area exceeding 2.0 °C in the first half of 1998 is already over double the total HotSpot area for 1997. Similarly, the area of HotSpots exceeding the yearly maximum of SST's by 3.0 °C has surpassed five times the area of any full year since 1984. The extent of and ecological impacts from additional SST anomalies have spread into regions of the Northern Hemisphere since July.

Based upon the very strong correlation between the distribution in space and time of oceanic HotSpots and the thermal thresholds for coral reef bleaching during the warmest season of the year, we have developed the prototype of an early alert system of coral bleaching warnings and coral bleaching watches. We envision that a coral bleaching “warning” would indicate that SST anomaly conditions over a specific reef tract are already sufficient for coral bleaching to appear. Similarly, a coral bleaching “watch” would indicate that SST anomalies are approaching or developing in a coastal area and that monitoring for coral reef bleaching should begin. These proposed NOAA notices of watches/warnings will be communicated to potential observers at sites expected to show coral reef bleaching as predicted by the distribution and degree of thermal anomalies.

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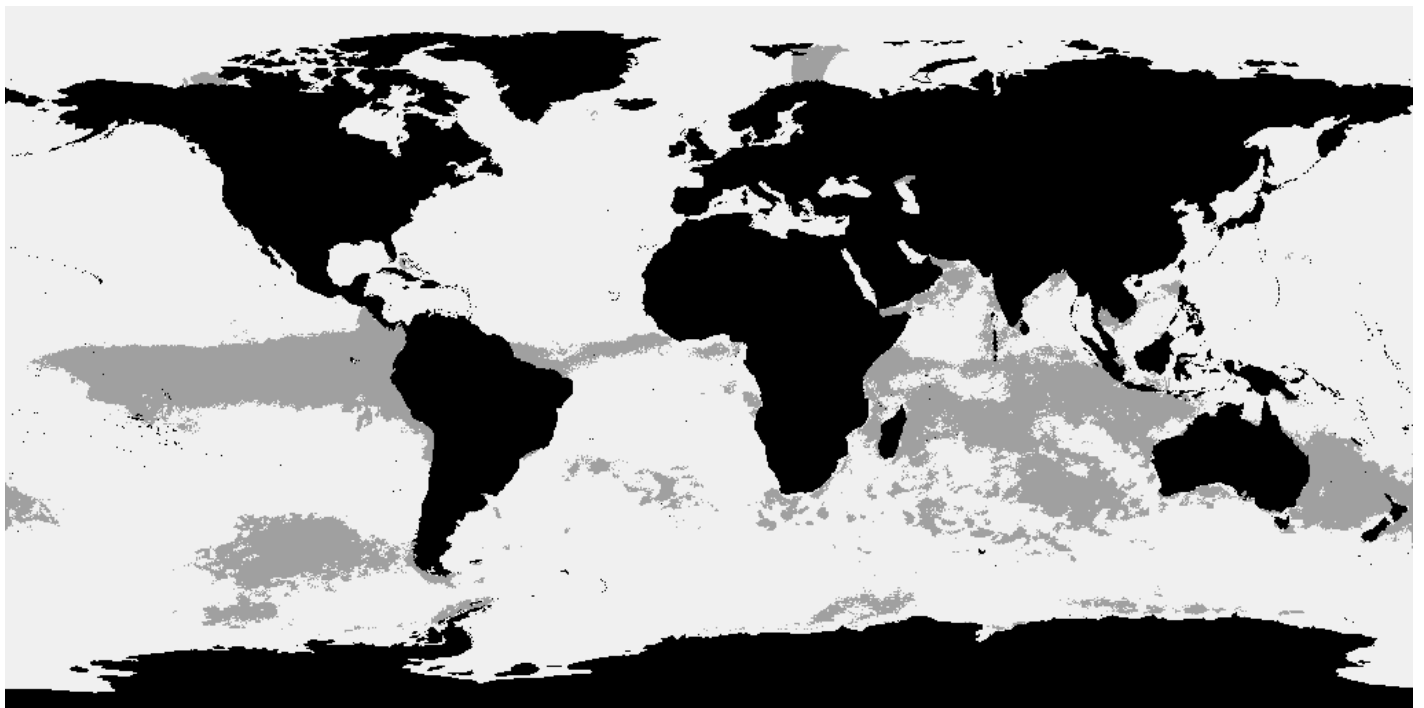


Figure 1. Global map showing the six month composite of satellite-derived sea surface temperature anomalies (“HotSpots”) in the Southern Hemisphere for January through June of 1998. The anomaly zones [in gray tone] indicate positive SST anomalies of 1.0 Celsius or greater over the maximum monthly climatology. Reports received from coral reef observers within these zones confirm that bleaching has occurred in all reported reef tracts encompassing these thermal anomalies. Large scale bleaching of corals has not been reported from reefs spared exposure to these HotSpots for this same period.

Table 1. Summary of bleaching reports in month received between January and June, 1998, from the regions corresponding to oceanic “HotSpot” distribution. Several days/weeks may have elapsed between onset of bleaching and when report was issued.

SITE	MONTH	REPORTER
Seychelles (Mahe, St. Anne, Praslin, La Digue)	January	Souyaye, Shepperd, Goreau
Galapagos	January	Wellington, Merlen
Indonesia (Bali)	January	Courtois, Goreau
Australia	February	Oliver, Berkelmans, Huber, Wellington, Salih, Bucher
Brazil	February	Migotto, Kikuchi
Mauritius	February	Pichon
Reunion	February	Pichon
Western Samoa	February	King, Daschbach
Comoros	February	Local Newspaper
Madagascar	February	McClanahan, Obura
South Africa	February	Schleyer, Korrubel
Tanzania	March	McClanahan, Obura
Panama (Pacific)	March	Eakin
Kenya	March	McClanahan, Obura
Mozambique	March	Thomassin
Somalia	March	McClanahan, Obura
Maldives (South Male, Felidu)	March	Batchelor
(Addu)	March	Naseer
(North Male Atoll)	April	Hakeem, Naseer, Allison
Sri Lanka (Galle)	April	Weerakkody
(Kikkaduwa)	April	Ekaratne, Rajasuriya
Muscat	May	Wilson
India (Lakshadweep)	May	Koya, Raghukumar
(Andamans)	May	Ravindran
(Kutch)	May	Arthur
(Tuticorin)	May	Arthur
Indonesia (Lombok)	May	Haq
(Taka Bone Rate)	May	Bettencourt, Tomascik, Elam, Turley
Malaysia (Kota Kinabalu)	May	Baker
(Sabah, Pulau Gaya)	May	Baker
Seychelles (Aldabra, Amirantes)	May	Teleki
Cambodia	May	Nelson
Thailand	June	Chandler
Oman	June	Wilson
Florida (Keys)	June	Hendee, Causey, Barimo

Mortalities of Giant Clams Associated With Unusually High Temperatures and Coral Bleaching.

High mortalities of cultured giant clams (Tridacnidae) were observed last July in the Philippines at the same time as unusually high water temperatures and coral bleaching. The Bolinao Marine Laboratory (part of the Marine Science Institute, University of the Philippines) runs a landbased nursery culturing giant clams for conservation, restocking and farming. Clam juveniles are reared up to 3 cm shell length, before they are transferred to ocean nurseries for further rearing. At the ocean nurseries, broodstock of seven species (*Tridacna gigas*, *T. derasa*, *T. squamosa*, *T. maxima*, *T. crocea*, *Hippopus hippopus*, and *H. porcellanus*) are held, as well as different cohorts of juveniles and sub-adults of these species. Nurseries are situated around Silaqui Island (16°25'43"N, 119°55'22"E) in Bolinao, and at Quezon Island (16°13'26"N, 12°00'2'46"E), Hundred Islands National Park, Alaminos, both in Pangasinan.

On 21st July, mortalities among giant clams were observed at the Bolinao ocean nurseries. Submerged thermometer measurements at the landbased nursery showed very high temperatures for the months of June and July, at 34.9° and 34.1°C, respectively. Giant clams that were previously bleached may have succumbed to the increasing seawater temperatures. However, mortalities among unbleached clams were also reported, in addition to fish kills observed in the vicinity of Silaqui Island, and observations of other moribund and dead marine organisms such as sea urchins, sponges, and seaweeds.

Percentage mortality among giant clams was 40% among broodstock *T. gigas* at 45 - 70 cm shell length (SL), and between 11 - 31% for combined counts of *T. derasa*, *T. squamosa*, *T. maxima*, *T. crocea*, *H. hippopus* and *H. porcellanus*, from 8 to 60 cm SL. Less than 5% mortality was observed for subadult *T. gigas* at 20 - 30 cm SL. The effect of the high seawater temperature anomaly on juveniles being reared at the landbased nursery at the Bolinao Marine Lab. was less apparent, since most of the raceways contained post-metamorphic juveniles. No seawater temperature-related mortality was reported for clams at the ocean nursery at the Hundred Islands.

The presence of dead, unbleached clams was puzzling. A contributing cause of all the deaths may have been lack of oxygen as the area was becalmed for much of the period, with no significant winds to drive the water across the reef

flat. The usual white breakers at the reef crest were absent.

Interestingly, the largest numbers or percentages of deaths were at two sites without seagrass. By contrast, a site between these two that had significant stands of *Enhalus acoroides* had lower numbers of deaths. This is a striking parallel with the observation of Jompa and McCook (1998) on the inshore reefs of the Great Barrier Reef, where stands of *Sargassum* seemed to have reduced the incidence of bleaching among corals. They attributed this mainly to the shading effect of the seaweeds and possibly the reduction of mixing of low-salinity waters. In the Bolinao ocean nurseries, there are no freshwater influences.

We posit the contribution of the *Enhalus* to the dissolved oxygen in the water as an added explanation for the reduced mortalities at the seagrass site. While these observations are preliminary, they suggest further research topics in the debate on coral bleaching and mortalities.

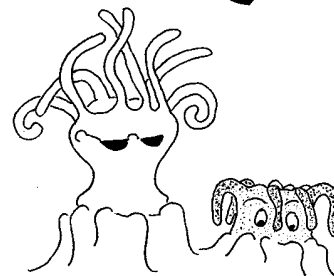
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Fashion can damage your health...

fish eye view



Darling!

That tan look is just tooo passe.

It's chic to look pale and interesting this year!

The Reefs of Mozambique

Fiona Gell and Maria Joao Rodrigues

Geography

Mozambique has over 2,700 km of beautiful coastline, with coastal habitats ranging from sandy beaches to mangroves. On the Mozambique-South African border lie some of the southernmost reefs on the African coast, generally dominated by soft corals in shallow waters, with reef-building corals only occurring at greater depth (Riegl et. al. 1995). Some coral reefs are found at Inhaca Island and around the Bazaruto Archipelago. A few are scattered elsewhere, but the major reef systems occur in the north. Between the Rovuma River on the Mozambique-Tanzania border and the Primeiras and Segundas Archipelago there are over 700 km of coral coast (Tinley 1971). The Quirimba Archipelago, the most northerly group of islands in Mozambique, has particularly well developed coral reefs. Shallow coral gardens cover large areas of sheltered water between the islands, and spectacular fringing reefs are seen on the exposed seaward coasts. Coral communities vary from dense stands of staghorn fringing the sandy spits of the islands, to huge plated *Montipora*. In just one hour-long dive you can see 55 coral genera (out of 60 or so known from East Africa, Schleyer (1997)). Coral cover and diversity is thought to be amongst the highest in East Africa (C. Sheppard pers. comm. in Whittington et. al. 1998).

Research

Following independence from Portugal, the devastating civil war (1975-1992) brought active biological research to a virtual halt. In the capital Maputo, the Biology faculty at Eduardo Mondlane University closed down completely between 1980 and 1985, while educational effort was concentrated at the school level. But in 1990 the first new students of marine biology graduated from their five-year course, marking a new era for marine research in Mozambique (Macia & Hernroth 1995). The main marine biological station at Inhaca Island had been maintained throughout the difficult years and is

now once more an active research base (Hernroth & Gove 1995). Even in 1990, the security situation in the provinces was unstable, so the majority of marine biological research has been carried out in the immediate vicinity of Maputo and Inhaca. In the last few years research has become practical in the provinces, but the lack of SCUBA equipment and training in-country has meant that very little subtidal research has been possible outside Inhaca.

The most extensive subtidal coral reef surveys and studies have been carried out in the Quirimba Archipelago. A French-Mozambican expedition to Ibo surveyed reefs and found diverse coral habitats (Rodrigues 1996).

Two years of marine biological research by teams of Mozambican and British scientists and volunteers followed as part of the Darwin/Frontier-Mozambique Quirimba Archipelago Marine Research Programme. This program, which was run in collaboration with the Mozambican Ministry for the Co-ordination of Environmental Affairs (MICOA), aimed to map marine habitat distributions, assess resource use and to identify high biodiversity and threatened areas (Whittington et. al. 1997 & 1998). Many Mozambican marine scientists and fisheries officers from Maputo and Pemba have received diver training through participation in the project, thereby helping to promote reef research throughout the country.

More than two thirds of the Mozambican population live in coastal areas. During the long years of civil conflict, people fleeing fighting in the interior found refuge on the coast and nearby islands. Many of these refugees have now settled permanently and rely on fishing and other marine resources for their livelihood. In rural areas fishing is often the only employment available, so the pressure on fish resources is intense and overfishing is a countrywide problem. In many areas nearshore shallow reefs and seagrasses are particularly under pressure because fishers lack the capital to finance

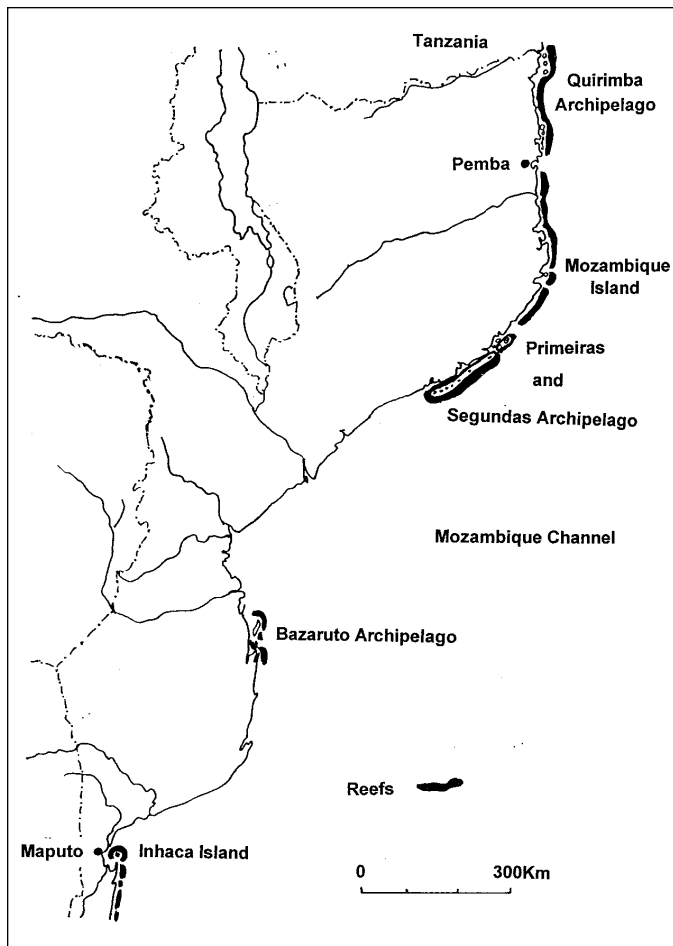
In just one hour-long dive you can see 55 coral genera out of 60 or so known from East Africa

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Threats

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fishing further afield (Massinga and Hatton 1996). In the north, large numbers of fishermen from Nampula province have exhausted nearshore fish resources in their area, and are moving further afield. Their presence is an escalating problem on the islands of the Quirimba Archipelago where they not only deplete local fish and invertebrate stocks, but also put pressure on even more basic resources such as scarce drinking water supplies.

Reefs also suffer pollution from industry and sewage in urban areas, and siltation from land-use changes inland. In the north, forestry has recently become commercially viable, but is still virtually unregulated, making siltation a potentially major problem. Silt and chemicals in agricultural run-off are increasing and impacting nearby coastal reefs throughout the coast (Massinga and Hatton 1996). Two of the main threats to reefs just over the border in southern Tanzania are dynamite fishing and coral extraction for house building and lime. Surprisingly, neither are a problem in the nearby Quirimba Archipelago at present, but coral extraction is increasing at an alarming rate further south in Nampula province.

A great deal of the Mozambican coast is beautiful and as yet unspoilt and is therefore a target for foreign tourist developers. Many areas are developing very quickly. Rapid,

poorly planned tourist development without enforcement of regulations or active state involvement has already done more harm than good in some places. Typically local people lose land and resources without receiving any of the benefits promised.

Conservation

Conservation of Mozambique's coastline and marine habitats through integrated coastal zone management has become increasingly high profile, receiving national and regional attention. Conservation projects have been established for some time in the Inhaca and Portuguese Island Marine Reserves and at the Bazaruto National Park. Numerous other coastal zone projects are underway for example at Inhaca Island, Xai-Xai, Mozambique Island and Mecufi, whilst still more are planned for the Primeiras and Segundos Archipelago and the cities of Nacala and Beira (Chonguiça 1997). The Frontier-Mozambique project in the Quirimbas was an important step forward for marine conservation and coastal management in the north. The Archipelago had previously been recommended as a marine protected area, and the two year project was the first practical step towards this goal. However, this remote area has yet to receive any active protection or management.

The will to establish conservation and research projects exists, but unfortunately, dramatic illustrations of effective management resulting from scientific research and community involvement are few and far between. However, many projects are still in their early stages. It remains a challenge to ensure the step between collecting information to identify problems and taking action does not become a stumbling block. Remote areas such as the Quirimbas are often in the most threatened, but isolation, lack of basic infrastructure and communication networks combined with the vast distance geographically and culturally from Maputo makes progression difficult.

Education

Community education projects promoting marine conservation and sustainable resource use have almost exclusively been confined to large management projects in the southern half of Mozambique, for example Inhaca Island (Gove 1997), the Bazaruto Archipelago (Elder 1994) and Xai-Xai (Motta and Truta 1997). In many rural areas there is a real need for raising awareness of ecological issues. Many people do not speak Portuguese, isolating them from the national media. Other problems arise through the mixture of cultures and backgrounds of the people, many of whom come from inland agricultural backgrounds. For example, in the Quirimbas many local fishermen do not have the benefit of traditional knowledge of fishing practices and resource management. Traditional management ideas are being lost,

and not replaced by any form of environmental education promoting the sustainable use of resources. The prevailing attitude is that fish and shellfish are an infinite resource that will always be available. This is not an isolated problem and there is a real need for a nation-wide programme of coastal environmental education designed to benefit those most dependent on marine resources. Such a programme must use local languages, take into account the low level of basic education in many of the small villages, and incorporate traditional knowledge and cultural focus points.

The Future

Reefs and other marine habitats of Mozambique are in a good condition compared to those elsewhere in the region and indeed world-wide. In the recent "Reefs at Risk" report (Bryant et. al. 1998) the reefs of Northern Mozambique were identified as at "low risk", and only a handful of small "high risk" areas were identified for the whole country. But whilst the extensive reefs of the Quirimba Archipelago currently exhibit very few signs of damage or deterioration as a result of human activities (Whittington et. al. 1997 and 1998), there is no room for complacency in this rapidly changing nation. The reefs, seagrass beds and mangroves of Mozambique must be acknowledged as the valuable resource that they are and their conservation must be actively promoted. Much of Mozambique's development potential lies in the country's rich coastal resources for tourism, fisheries and other developing industries. Sustainable development is paramount. A paper calling for work to specifically address coral reef conservation issues in Mozambique was produced at the beginning of 1998 by the Ministry for the Co-ordination of Environmental Affairs, and is a very positive step forward (Rodrigues et. al. in press). The political and scientific groundwork has been laid and, if good intentions are followed through, and with support for realistic long term integrated coastal zone management projects, the future for the reefs of Mozambique may well be bright.

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...no room for complacency in this rapidly changing nation...

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INTERNATIONAL INITIATIVES

Looking Back at the International Year of the Reef

During 1997, the International Year of the Reef (IYOR), more information about coral reefs was distributed to the public than ever before in history. Through an extraordinary collaborative effort involving scientists, conservationists, educators, government agencies and others, IYOR generated reports, articles, public service announcements, exhibitions, videos, and even rap songs about coral reefs that reached as many as one billion people.

IYOR was the brainchild of Bob Ginsburg of the University of Miami who started organizing it at the 1993 ISRS Colloquium in Miami. In 1995, the IYOR Public Awareness Campaign was launched by a committee of scientists and conservationists with a goal of reaching the broader public with messages about coral reefs. The result? By the end of 1997 more than 225 organizations in 45 countries had sponsored IYOR activities, and thousands of schools, aquariums and museums had participated in IYOR events.

One high profile IYOR activity was the production of two short movie trailers about coral reefs entitled *Hidden City* which used celebrity narrators to describe coral reefs and highlight the reefs' importance to people even if they lived thousands of miles from the nearest reef. The trailers were translated into all five official U.N. languages, and the producers estimate that nearly one billion people in more than 50 countries viewed *Hidden City* during 1997. Even if this estimate is off by a factor of five, it would still be one of the

most widely viewed environmental public awareness messages ever.

Another public awareness program was sending weekly briefings about coral reefs to more than 5,000 journalists throughout the world. The idea was to use the popular media to reach new audiences that might not know much about coral reefs. In the United States alone, this resulted in the publishing of over 700 more articles on coral reefs in 1997 than had been published in 1996. Articles that focused on the International Year of the Reef appeared in major U.S. newspapers such as *The New York Times*, *The Washington Post* and *USA Today* as well as popular magazines such as *TIME* and *National Geographic*, and radio and television broadcasts. Similar positive results in the mainstream media were reported around the world.

Whether the International Year of the Reef public awareness campaign achieved its ultimate goal of inspiring the public to support coral reef research and conservation is hard to prove, but there are a number of signs—from the USA's President Clinton signing of an Executive Order on coral reef protection to the number of school children preparing reports on coral reefs—that IYOR helped to awaken an interest in coral reefs in large segments of the general public. Several public speakers, such as Jean-Michel Cousteau, have noted that the type of questions about coral reefs that they are now

nearly one billion people
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viewed *Hidden City*
during 1997

asked by their audiences are much more sophisticated than those asked a couple of years ago. While this is all anecdotal evidence, there seems to be substantial support for the conclusion reached in a recent report on the impact of IYOR: "Based on the truly global response to IYOR both in terms of initiatives and media attention, the campaign has to be labeled a huge success." (Saxton, 1998)

IYOR also had another salutary effect: it built communication and trust between the many scientists and conservationists who worked on IYOR. ISRS members around the world, working side by side with environmental groups, marine resource managers, divers, environmental educators and countless others, played critical roles in making the IYOR a success. The IYOR organizers hope that the cooperation developed during the International Year of the Reef will lead to more long-term collaborative efforts between scientists, conservationists and others. This type of cooper-



ation will be critical if we are going to have continued success in building public interest and support for coral reefs.

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Stephen Colwell, Executive Director, CORAL-The Coral Reef Alliance. A complete catalogue of IYOR activities is still being prepared, if any ISRS members participated in IYOR and have not reported their activities, they are encouraged to send a summary of their work to Stephen at 64 Shattuck Square, Suite 220, Berkeley, CA 94704, Fax: 510-848-3720, Email: <coralreefa@aol.com>, web site: www.coral.org

Monitoring and the Global Coral Reef Monitoring Network (GCRMN)

Until recently, coral reef monitoring was the territory of coral reef scientists. It was assumed that an in depth knowledge of statistics and sampling design was essential to gather data for reliable reef conservation and management. But not all sciences are so exclusive. Many thousands of amateur bird watchers monitor bird distributions and migrations. Most people who gather weather information are not meteorologists, but people given instructions on how to read a few instruments and make careful observations of the sky. The data analysed by trained meteorologists would be very meagre without the thousands of observations received from volunteers and part-time employees. The need is just as great in reef studies. In resource management the need for swift action often means that decisions are already made before the appropriate monitoring program can be designed. We have to work together to bridge the gap between what research scientists offer and what management really wants.

Why are coral reef scientists so territorial? Now come to think of it, not so long ago many scientists belittled those doing long-term monitoring, regarding their activities as a waste of time, semi-scientific stuff, and not real research. Now, we know that long term monitoring programs such as those on Jamaica and the

Great Barrier Reef have added enormously to our understanding of how coral reefs function. Those reviled scientists have been given hero status.

Any who doubt the need for a lot more rapid assessment / data-less management should read the paper by Bob (R.E.) Johannes in Trends in Ecology and Evolution, Vol. 13, p. 243-246, 1998 (The case for data-less marine resource management: examples from tropical nearshore finfisheries). And some recent innovations are proving that volunteers can gather valuable data; just read the Reef Check reports released in November 1998. The GCRMN and Reef Check have combined forces to expand the network of monitoring of coral reefs throughout the world. We recognise 3 overlapping levels of monitoring—scientific which provides statistically rigorous data on reefs; government level monitoring that covers larger areas in less detail; and finally community or volunteer monitoring that can cover enormous areas with observations on percent coral cover and the occurrence of key indicator animals. For the government level monitoring we recommend line transect and manta tow methods like those developed in the ASEAN countries between 1984 and 1994; whereas we recommend Reef Check methods for community level monitoring. 1999 will

Why are coral reef scientists so territorial?

see massive expansion in reef monitoring, building on the increased effort of both GCRMN and Reef Check. We will be asking many coral reef scientists to assist as we expand.

What has the GCRMN done so far?

One node is up and running in South Asia, funded by the UK with strong support from the governments of India, Maldives and Sri Lanka. Ongoing training allows participants to gather data on the status of reefs, particularly after the severe bleaching event that started in April 1998. Training in socioeconomic assessments of communities using reefs was held in the Laccadives in September.

Another node is functioning in the south Indian Ocean with assistance from the Indian Ocean Commission and the European Union. Training has been provided for people in Comores, Madagascar, Mauritius, Reunion and Seychelles, and reef monitoring at designated national sites has been underway since January 1998. The countries of the east African coast have agreed to cooperate in reef monitoring and a funding proposal has been submitted by the Kenyan government to Sweden.

In the Pacific, SPREP (Cook Islands, Tonga, Saipan, Palau, Papua New Guinea) has co-ordinated training. Initially trainers came from the Australian Institute of Marine Science, but now the trainees are themselves trainers. The countries of the Pacific are enthusiastic in their support, largely because of a successful Pacific Year of the Coral Reef campaign conducted by SPREP, and six nodes are agreed for the future. The government of Hawaii is formulating plans for monitoring involving both scientific and community level participants.

A GCRMN training workshop to be held in Vietnam for

A firm partnership has been formed with Reef Check and ReefBase

Burma/Myanmar, Cambodia and Vietnam (funded by Japan) is now scheduled for early 1999. Progress in the Caribbean is slow but steady, with CARICOMP marshalling its forces to expand monitoring to islands not involved in previous reef monitoring. The UNEP offices in Jamaica are actively encouraging reef monitoring in the region, and there is a ready made database set up by CARICOMP in Jamaica.

Some of the biggest progress has been in the management of the GCRMN. A firm partnership has been formed with Reef Check (Gregor Hodgson) and ReefBase (John McManus). This covers three major themes; monitoring by governments, by communities and volunteers, and consolidating the database structure. Closer links are also being formed with the UNEP Regional Seas coordinators, and the World Bank has signed on as a GCRMN co-sponsor.

All this provides a good launching base for activities in 1999. Has progress been rapid enough? On some fronts, yes, but on others no. But starting from scratch in many countries is not easy. For example, at a recent training exercise to teach people to monitor reefs on scuba, some had to be taught basic swimming and snorkelling skills before training could commence. Moreover, the GCRMN has to deal with a number of agencies—4 co-sponsors, 2 hosts and a few others with strong influence; this has distinct advantages, but does slow things down a bit compared with narrower, more streamlined efforts such as Reef Check.

*Clive Wilkinson
Coordinator GCRMN*

Reef Check 1998, the Second Global Survey of Coral Reef Health

Reef Check is finishing its second annual global survey. Against the odds, the volunteer survey has continued to gain momentum and increase, with 10 more countries joining this year. The preliminary results were released at a press conference in Hong Kong on 19 November followed by individual country press conferences around the world. Based on preliminary results, El Nino-related bleaching and mortality is the story of the year, with corals many centuries old having succumbed.

The program is a community based project and we thank all our colleagues who have taken transect lines to far corners of the world to get vital data. We are also grateful for a



grant from the Rockefeller Bros. Fund which allowed the Reef Check program to grow in Asia, especially in Vietnam, Malaysia, Indonesia, Thailand and the Philippines, and from UNEP which gave the program a big boost in the Caribbean. We expect that additional funding will allow more countries and surveys to be added next year in other parts of the world.

In 1998, Reef Check was formally chosen as a partner in the Global Coral Reef Monitoring Network (GCRMN) which operates within the International Coral Reef Initiative (ICRI) as the government level program. Reef Check serves as the community-based monitoring protocol for GCRMN.

This allows us to share co-ordinators, training and survey data. In another collaboration, the 1997 data set has been passed to ReefBase in Manila and will be incorporated as a special unit so that everyone can have access to this invaluable resource. We thank John McManus and his ICLARM team for working to make this possible.

Reef Check has accomplished a number of goals. First, it has gathered a comparable two-year data set of a snapshot of reef health from around the world. The data set from 1997 held many surprises and no doubt 1998 will produce more. In 1997, the biggest surprise was how bad overfishing of high-value organisms was and how reefs far from human population centres were just as badly affected as other reefs. It was also surprising that based on numbers of these organisms, marine parks do not seem to be working to conserve them. There were many other interesting results described in the summary report available from our FTP site (see instructions at <http://www.ust.hk/~webrc/ReefCheck/reef.html>).

Beyond the science, the program has involved hundreds of individual scuba divers, from school children to government ministers, in an educational process wherein they learn about the value of coral reefs, and threats to reef health. Stories based on Reef Check community involvement have now appeared in many of the major publications in the world and have been featured on radio and television in dozens of languages. Slowly but surely, we are raising public awareness about coral reef conservation among the general public. Together with GCRMN operating at the government level and the dozens of other smaller reef conservation programs operating around the world, we have stimulated a demand for coral reef monitoring in most countries with coral reefs. NGOs and research institutes in countries like Iran and Bangladesh, with little previous histo-

the volunteer survey
has continued to gain
momentum

In 1999 we have an unprecedented
opportunity to generate public and
government support following global
bleaching in 1998

ry of concern for reefs, are now asking for help.

We need the public awareness so that the public will request their governments to do more for coral reefs and to support programs aimed at conservation and management. Eventually, we hope that an annual (or more frequent) coral reef status report will be commonplace in countries with coral reefs, a bit like a weather report.

Of course monitoring and raising public awareness are the two easiest steps up the high staircase towards sustainable management of coral reefs. The results of monitoring enable an evaluation of reef status, so that management decisions can be made. To reach the ultimate goal will require far more resources devoted to creating larger and more marine parks with better enforcement of regulations, more funds for aquaculture/stock enhancement, research on high-value organisms, better control of fishing, continued public education, and all this within a government framework of Integrated Coastal Management.

In 1999, we will have an unprecedented opportunity to generate public and government support for coral reef research and conservation following the extensive global bleaching and mortality event in 1998. Let's make the most of it. If you have not already become part of the program, we ask for your help to volunteer time (two Saturdays will do it) to help with Reef Check 1999. See our website or contact: <reefchck@ust.hk> for information on how to register.

Gregor Hodgson, Institute for Environment and Sustainable Development, Hong Kong University of Science and Technology, Clearwater Bay, Hong Kong, Tel: (852) 2358-8568, Fax: (852) 2358-1582 Email <rcgregor@ust.hk>

Reefbase 3.0. Forging on Towards Informed Management of the World's Coral Reefs

ReefBase plays a central, unifying role in efforts to manage the world's coral reefs. It is a relational database that documents coral reefs around the world, identifies related resources, describes marine protected areas and their features, and provides information on reef stresses, threats, management initiatives, reef-related socioeconomic vari-

ables and tourism. It features several types of maps, photographs, satellite pictures, related databases, information on the Aquanaut monitoring method and a comprehensive query system.

ReefBase 3.0 was released in November 1998 at the International Tropical Marine Ecosystems Management Sym-

posium (ITMEMS) in Townsville, Australia. The ReefBase package consists of a CD-ROM and a user's manual. New features in ReefBase 3.0 include NASA satellite photos, *Reefs at Risk: A Map-Based Indicator of Threats to the World's Coral Reefs*, Charles Darwin's book on coral reefs, *The Structure and Distribution of Coral Reefs*, and the ARMDDES database of the Australian Institute of Marine Science. Also included are a wide range of summary graphs, an improved query system and a large amount of data from the 1997 Reef Check Program.

ReefBase 3.0 is an update of two earlier versions of ReefBase: *a Global Database on Coral Reefs and their Resources*. It contains:

- selected information on over 8 000 reefs;
- ecological information on corals and fish communities for 3 000 reefs;
- stress data for over 2 000 reefs;
- coral reef fisheries and mariculture production information;
- dive sites, dive operators and tourist lodging information for 1 000 reefs;
- management practices and legislation information for 500 marine protected areas;
- 196 maps covering known coral reefs in 118 countries and island states;
- 883 aerial, underwater and terrestrial pictures of coral reefs, their use and misuse;
- 188 low-orbit earth photographs;
- indexes of some 1 500 experts, monitoring programs and institutions involved in coral reef research, and a dictionary of common terms in the study of coral reefs;
- over 7 000 references on coral reefs from published papers, conference proceedings, technical reports and news articles;
- the Ecopath 3.0 ecosystem modeling software;
- the REEFHAB diagnostic model for predicting coral reef distribution;
- the Rapid Assessment of Management Parameters (RAMP) subdatabase.

ReefBase 3.0 is easy to use. Strategic links help get at information from different starting points and allow you to summarise data for management initiatives or reports. The data entered in ReefBase come from published and unpublished reports on specific reefs, from surveys conducted by governmental and nongovernmental organizations and indi-

ReefBase is aimed at environmental and coastal managers, scientists, tourists, divers and students

ReefBase data has been used in recent predictions of the effects of climate change on coral reefs

viduals, as well as from a wide array of other data sources. Citation information on all data sources is included in the database so you can cite any piece of information directly. ReefBase is aimed at environmental and coastal managers, scientists, tourists, divers and students. The database has been designed with a wide range of activities in mind, including managing coastal areas, setting up systems of protected areas, planning diving trips, generating research strategies and conducting comparative analyses of reef ecology and management approaches.

Under the International Coral Reef Initiative (ICRI), the Global Coral Reef Monitoring Network (GCRMN) is being set up around the world, with ReefBase as its repository. Data from a variety of previous and ongoing monitoring programs have also been released for public dissemination through ReefBase. ReefBase provided much empirical information on the status of reefs for the Reefs at Risk study, which represents the first major attempt to quantify and map coral reef degradation on a global scale. Both the Reefs at Risk study and much of the 1997 Reef Check data are included ReefBase 3.0.

ReefBase also has a great deal to offer the general public. For example, ReefBase 3.0 contains a very comprehensive dive trip planning guide, often including data on accommodation, dive operators and contact addresses. Teachers and students can find nearly 1 000 photographs of coral reefs, their uses and misuses. Researchers can use the bibliography of over 7 000 references to improve the coverage of their studies.

The new ReefBase Aquanaut Survey Manual describes a sampling approach to enable nonspecialists, such as sport divers, marine park rangers and others, to set up ecological monitoring programs for divers. An international certification program is underway in which scuba instructors are trained to teach courses to certify divers as data-gathering "aquanauts". At a more technical level, ReefBase data has been used in recent predictions of the effects of climate change on coral reefs, including the determination that a warmer sea surface might lead to reductions in reef-building activity.

ReefBase: a Global Database on Coral Reefs and their Resources, is produced by ICLARM in collaboration with World Conservation Monitoring Center, World Resources Institute, the National Atmospheric and Space Administration (NASA), the National Center for Atmospheric Research (NCAR), and the Reef Check Program at the University of Science and Technology in Hong Kong. The Rapid Assess-

ment of Management Parameters (RAMP) portion was created in collaboration with the University of Rhode Island (URI). ReefBase was funded initially by the European Commission, and subsequently by the Government of the Netherlands, the Swedish International Development Cooperation Agency (Sida), the United States Agency for International Development (USAID) and ICLARM. The ReefBase 3.0

CD-ROM and User's Guide is available at US\$30 plus the cost of airmail or courier service to the country of destination.

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Atlantic and Gulf of Mexico Reef Assessment (AGRA)

The Atlantic-Gulf of Mexico Reef Assessment (AGRA) is an international collaboration of reef scientists and managers, their students and trained volunteers. The primary goal is to make rapid assessments of the condition of reefs throughout the Western Atlantic and Gulf. AGRA grew from the realization that the condition of corals, algae and fish in this region are not well documented (with the exception of Jamaica, Colombian atolls, and south Florida). Information on some of the largest reef areas in the region: Belize, the Bahamas, parts of Central America, and some areas of Cuba is notably lacking.

AGRA is not another monitoring effort. Instead, its aim is to identify quickly those reefs that have seriously declined and those reefs so luxurious that they deserve special protection efforts. Examples of reefs that have seriously declined are those on the north coast of Jamaica (Hughes, 1994) and some of the Colombian atolls off Central America (documented by Diaz, 1995). Assessing the condition of a large number of reefs will disclose any spatial patterns of decline. For example, the condition of reefs near centers of population can be compared with those that are remote. These comparisons can help to distinguish anthropogenic from natural impacts.

Over the past four years, a Rapid Assessment Protocol (RAP) for benthos and fish has been developed. Benthic assessments include the coral mortality by species and colony size and the relative proportions of turf algae, macroalgae, and crustose coralline algae. For reef fish, the rapid assessment addresses the abundance and size distribution of key fish species and overall diversity.

June 2-6, 1998 AGRA—RAP Workshop

To review and field test the RAP, the Organizing Commit-

tee convened a Workshop at the University of Miami from June 2-6, 1998. Some 85 participants from 21 countries attended. RAP results were presented and plans for assessing other specific areas were outlined. Several participants displayed maps of reef distribution; others reviewed what is known about reefs of Brazil, Central American coast, Colombian atolls and Cuba. Abstracts of presentations are available on the AGRA website, (<http://coral.aoml.noaa.gov/agra/>).

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Field trials of the RAP protocol for benthos (corals and algae) and fish were organized. For the benthos, visual surveys were made on shallow patch reefs. A second group focused on reef fish and compared techniques of assessment. Using the presentations and field trial as background, the discussions led to several additions and revisions of the protocol for benthos.

The group concerned with fish prepared a new and more practicable protocol for fish assessment. The revised RAP is posted on the AGRA website or is available by mail.

AGRA—Next Steps

The revised RAP has now been applied in a large-scale assessment of the extensive and relatively remote reefs off Andros Island, Bahamas. It is also being used in Belize and Mexico and it will be tested on Brazilian reefs later this year. To standardize RAP techniques, at least two training Workshops have been offered: one for the southernmost part of the region (Bonaire Nov 2-6, 1998) and a second for the Central Caribbean to be held in Belize or Yucatan in 1999.

To help cover field expenses of AGRA-RAP assessments, the AGRA Organizing Committee welcomes research proposals or inquires from scientists who would like either to participate in or lead assessments (write for details or see the web site).

The results of assessments made during the next nine months together with those already completed or in progress will be assembled and reviewed for a special publication to appear in 1999 either as an issue of the Atoll Research Bulletin or the first of an AGRA Series. Beginning in the summer of 1999, assessments will be expanded to larger areas of the region. The target date for completion of the assessment of reefs throughout the Western Atlantic and Gulf of Mexico is the end of the year 2000.

The AGRA website has full information on AGRA-RAP. It also includes a list of the participants in the Workshop as well as brief abstracts of their presentations. Comments on AGRA and RAP are welcome. If there is sufficient interest, a summary of comments will be prepared and posted on the AGRA website.

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Philip Kramer, Miami, Florida
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Peter Sale, Windsor, Canada
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BOOK REVIEW

A Guide To The Seashores of Eastern Africa and the Western Indian Ocean Islands.

Matthew Richmond (editor)

448pp., 154 color plates, 70 line drawings, 165x242mm, paperback. ISBN 91-630-4594-X. 1997. Swedish International Development Co-operation Agency (SIDA) / Department for Research Cooperation, SAREC. Distributed by Tyler's Academic Books, 154 High Street, Bangor, Gwynedd, LL57 1NU, UK. Email <Tyler@Tyler-Books.co.uk>, Tel: ++44 1248 372057, Fax: ++44 1248 372283. Price: £20, US\$35, 55DM, 220 FFr (Subject to sterling exchange).

As a consequence of a small mishap *en route* I arrived in the Quirimba Archipelago, Mozambique for my first Ph.D. field trip armed only with a damp set of "Creatures of the Red Sea" playing cards and what was left of a copy of the *Collins Guide to Coral Reef Fishes*. The Collins guide could be opened at just three different pages: Caribbean blennies, Pacific damselfishes and "restricted distribution parrotfishes", the rest of the pages having been fused together in an unfortunate Indian Ocean submersion in which I had also participated. This was obviously not the ideal way to begin ecological research on the East African coast, and was followed by a few months of fieldwork in which my notebooks became full of descriptions of animals that were christened things like "pointy-nosed seagrass-carrying spider crab 2a", "emperor

X (*sololo*)" and "brown hairy starfish". Eventually replacement field guides arrived at base camp, visiting researchers brought identification guides for their particular specialty and my ability to put names to mystery creatures improved. However, this precious reference collection was not portable and each individual book and paper was kept in a plastic bag, inside a trunk, underneath a tarpaulin at base camp, in case of tropical storm or other watery disaster: not exactly the most user-friendly set-up. In those first months in the Quirimbas Matthew Richmond's *A Guide to the Seashores of Eastern Africa and the Western Indian Ocean Islands* would have been the answer to all my prayers.

This really is the most wonderful book. The result of six years work and involving hundreds of people within the re-

gion and beyond, *A Guide to the Seashores of Eastern Africa* is more than a field guide—it is an incredible introduction to all aspects of life on the east African coast. It covers fish and phytoplankton, meiofauna and mangroves, worms and whales and everything else in between. The book provides an introduction to all the major taxonomic groups likely to be encountered on the shore and in the sea of the western Indian Ocean. A regional expert introduces each major group of animals or plants, describing the basic biology, distribution and status as a resource for human use. Obviously, in a book that you could conveniently fit into a small daypack, the number of species described and illustrated is necessarily limited, but there is still an impressive attempt to include the majority of those occurring commonly. For more details on study families or species it will always be necessary to consult the primary literature, but this book will be invaluable for putting people on the right track with its descriptions of over 1600 species. The bibliography provides a comprehensive and up to date list of the literature for those who need more specific information.

Aside from the biological content, this book is the ideal

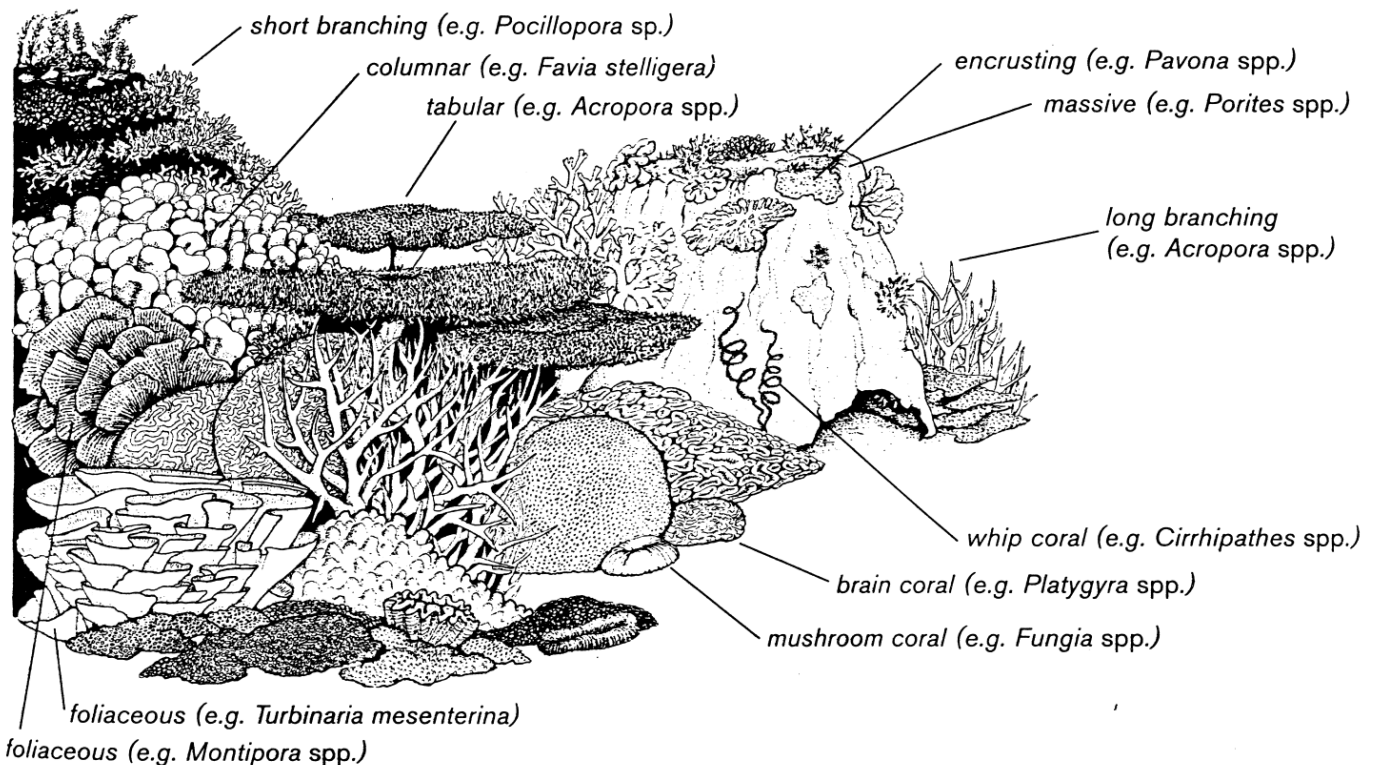
it covers fish and phytoplankton, meiofauna and mangroves, worms and whales and everything else in between.

companion for any outsider living or working in the region. The introduction is a condensed guide to the East African coast covering everything from the origin of the people and cultures and a description of traditional fishing methods, to the treatment of chiggers and sea-urchin injuries. There is an illustrated guide to traditional boats of the area, a lunar calendar and contact addresses for organizations active in marine and coastal issues in the region. Some of the common species are named in Kiswahili, Portuguese, French, Seychelles Creole and other languages of the area. A list of useful marine and everyday terms in Kiswahili, Portuguese and French is also included.

There will be so many groups of people for whom this book will be an invaluable resource. It is portable and affordable and so is ideal for use in the field. Ann Alexander's watercolour illustrations are realistic and attractive, and there is also a good glossary and clear diagrams so the book is accessible to those unfamiliar with marine biology, making it ideal for use in schools and universities. It is well laid out with a good index of common and scientific names, vital for the rapid access of information that is often necessary in the field. The accurate illustrations and wide variety of topics

DIAGRAMMATIC REPRESENTATION OF A SHALLOW WATER CORAL REEF

showing many of the common colony shapes and forms, with examples of species or genera



from *Guide to the seashores of Eastern Africa*

covered also make it an excellent aid in discussions with local people about the resources of the area and the local names provided will also be useful for this.

Olof Lindén (coordinator of the Marine Science Programme of the Swedish International Development Agency, Sida, who financed the book) wrote the forward. As he emphasizes, one of the most important roles of such a book (apart from its use in higher education, research and coastal management), is to educate and inspire the young people in East Africa and the islands who are growing up surrounded by the incredible biological diversity of the Indian Ocean coast. This book can not fail to achieve this. At the same time the guide will entertain and inform anyone with an interest in marine science or natural history, even if they have never even been to East Africa. The reader is drawn in by the beautiful illustrations, the informative maps, the snippets of social, historical and geographical information and the wonderful representation of the diversity life on that coast. From

an excellent aid in discussions with local people about the resources of the area

a child in a fishing village or a ship-wrecked Ph.D. student, to the coordinator of a regional project or a top government official, this book has something to offer everyone.

Matthew Richmond and his team must be congratulated for producing what I would consider the perfect field guide. The Swedish International Development Agency deserve credit for funding such a worthwhile project which is sure to benefit the people and ecosystems of the coast well into the future. I would recommend this book to anyone, and as an added incentive to buy it, proceeds go to the Seashores of Eastern Africa (SEA) Trust which funds marine education and sustainable resource use projects throughout the western Indian Ocean.

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The Enchanted Braid

Osha Gray Davidson

ISBN 047117727X Wiley. 1998. 282 pp.

Free copies of books for review arrive on my Cambridge doormat infrequently enough for the occasion to be both memorable and exciting. So I started reading in a state of pleasurable anticipation. But unfortunately I immediately encountered what, in hindsight, I feel to be the book's biggest distraction—the emphasis of the first few pages. I was not interested in personal reflections on the demise of the Florida Keys (the Preface) and the start to Chapter 1 was kitsch enough to make me question what the rest of the text would hold. These may well not prove obstacles to others, and in any case once into the flow I soon realised I was in for a treat. Davidson writes in an engaging style, almost conversational in its nature. For example he illustrates parrotfish nutrition with a quote—'they'd eat a McDonald's parking lot to get the grease out of it'—symptomatic of the interpersonal approach to describing coral reef ecology and conservation which he adopts. I found myself smiling as the tour through coral growth, reproduction, fish behaviour and turtle migration unravelled in Part I. Osha Davidson has succeeded in writing a book which fills a void in the spectrum of coral reef literature, a large gap between the text books on one hand and beautiful but rapid coffee-table books on the other. In essence a

Your friends will read it, and there lies the book's success

book that entertains and informs in equal measure. Part II is devoted to the interactions between humans and reefs, presenting what I believe to be a measured assessment of problems, reality, and possible solutions. I particularly appreciated the emphasis given to population growth as a driving force for the issues being described. The personalities of those people who assisted Osha in his research are brought vividly to life (John McManus was obviously a major hit!) and this helps to carry the reader through familiar topics. At the same time the content is rich enough to inform where the subject or case study is new. If you are looking for a balanced and readable overview of coral reef issues then I would recommend this. If you are continually feeling the need to explain the importance of a job which to many seems impossibly esoteric, or simply have to justify a series of trips to exotic destinations to friends and family (appropriately enough I read it on the way to Mauritius) then use 'The Enchanted Braid'. Your friends will read it, and there lies the book's success.

Ed Green, Head of Marine and Coastal Programme, World Conservation Monitoring Centre, 219 Huntingdon Road, Cambridge CB3 0DL, UK Email: <edg@wcmc.org.uk>

Giant Clams: A Comprehensive Guide to the Identification and Care of Tridacnid Clams

Daniel Knop

ISBN 3921684234 Ricordea Publishing. 1996. 255pp.

The giant clams of the Indo-Pacific evoke different things to different people. Some of the general public may picture huge bivalves in tropical seas, perhaps sporting a dead diver caught by the leg in the maw of these "killer clams". To a Pacific Islander, tridacnid clams may be a snack, food banked for rough weather, a raw material for making axes in the old days, souvenirs today, or catch to sell in the market. Whilst to an aquarium owner, admiring the fluorescent colors of a captive clam is an aesthetic experience. The book *Giant Clams: A Comprehensive Guide to the Identification and Care of Tridacnid Clams* by Daniel Knop partially succeeds in presenting a well-rounded view of giant clam biology, culture and utilization.

However, the uneven quality of information presented in the book may bother some readers. Selection and caring for giant clams in aquaria are well covered, although some will disagree with Knop's advocacy of supplemental feeding. Information on hatchery and nursery production, clam anatomy and diseases will be interesting to readers unfamiliar with these topics. The ample color photography in the book

is excellent (albeit dealing with a very photogenic subject). However, some biologists and conservationists may have problems with *Giant Clams*. The text is occasionally rough with incorrect terminology, incomplete translations and typographical errors. Throughout the book (including the portion of the book dealing with CITES) tridacnid clams are labeled "endangered" rather than "threatened" as listed on CITES Appendix 2. In addition, Knop hypothesizes and generalizes on many subjects, sometimes without substantial evidence or adequate research (e.g. "[Tridacnid clams] only chance to survive, if there is any, is by captive propagation.")

Despite its weaknesses, this book may be welcomed on the bookshelves of aquarium owners and the general public for its accessible information and beautiful photographs of giant clams.

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BOOKSHELF

International Society for Reef Studies European Meeting Perpignan (France) 1-4 September 1998

Copies of the Abstract volume of the ISRS European Meeting, held in Perpignan can be purchased from the Organizing Committee. The price is FRF 100,00 (including postage), re-

duced to FRF 80,00 for ISRS members. Contact: R. Galzin, Fax: (33) 4 68 50 36 86; Email: <galzin@univ-perp.fr>.

Fisheries Biology, Assessment and Management.

M. King, Fishing News Books, Blackwell Science Ltd. Osney Mead, Oxford UK. 176 illustrations, 352 pages. £25.99. ISBN 0-85238-223-5

This is a clear and accessible all round introductory text for fisheries biology and management. Although not specifically aimed at reef or even tropical fisheries, it provides a broad based introduction to fishing world wide. There is plenty of background information on fishery resources and

life histories, from echinoderms to pelagics. The chapter on fishing gear ranges from trawls to a FAO sponsored Western Samoan handreel. Population biology gets due emphasis along with data collection and assessment techniques. It's the standard fare, but presented with enough clarity to en-

gave even a confirmed mathspobe. I particularly liked the quote at the beginning of the chapter on yield—'You never know what is enough unless you know what is more than enough' (William Blake). The text includes worked examples and there are discussion questions at the end of chap-

ters, making it a valuable teaching aid. Alternatively, if you need a working background in fisheries management but don't have access to taught courses, you can start from scratch with this book.

WHO'S WHO

Reef Care Curaçao

In 1991 Dr. Manfred van Veghel wanted to pinpoint the spawning of *Montastrea annularis*. He organized a large group of volunteer divers to swim transects at night for a week and note whether any spawning was occurring (from this research we now know that the spawning occurs every year 5, 6 and 7 days after the full moon of September and October, mostly from 10-11 pm.). During these nights spent on the island of Curaçao in the Netherlands Antilles, Southern Caribbean, van Veghel and marine biologist Paul Hoetjes expressed dismay at the death of a green turtle after the animal had lain on its back in the scorching sun for a whole day. No one had been able to stop this from happening due to lack of regulations protecting sea turtles, or the coral reef as a whole for that matter. "Perhaps, with all these enthusiastic volunteer divers something could be done", they mused. Six months later, during the ISRS meeting in Guam, researchers from around the world raised the alarm about the coral reefs in general, and Wilkinson predicted the loss of many reefs within the next 20-40 years unless something was done. Returning from this meeting, van Veghel published an article in the local newspapers relating the dire straits the coral reefs were in, and the idea to form a volunteer organization to do something to preserve the Curaçao reefs was born. A board was formed, and the foundation's objectives were formulated, stating that it would try to protect and preserve the reef through monitoring programs, raising of public awareness, education and direct protective action—legal or via publicity campaigns.

Now, Reef Care Curaçao has become a household name in the Curaçao community. For five years Reef Care has

been organizing snorkel courses for groups of deprived children. Regular underwater clean-ups have drawn people's attention to the problem of marine debris. Through its turtle nesting monitoring program, Reef Care (together with CARMABI, a local biological institute, and the management of the Curaçao Underwater Park) has been instrumental in finally getting legal protection for sea-turtles. Spearfishing, officially prohibited on the island since the seventies, but going on uncontrolled anyway, was attacked through a publicity campaign. The ban is finally being enforced much more stringently. Reef Care helped stop development of a coastal area adjoining a 10 mile stretch of pristine coral reef. A quarterly volunteer reef

monitoring program was started, and Reef Care participated in the worldwide 'Reef Check' effort. Since 1997 Reef Care has developed a legal task force consisting of volunteer lawyers. The task force is intended to protect coral reefs through lawsuits, and to set legal precedents for environmental protection.

Meanwhile yellow-band/blotch disease has been heavily impacting our reefs, signs of nutrient pollution are apparent and in the 0-2 m depth range the coral reef has all but disappeared from our island. It's enough to make one despair, however we consider it the more reason to continue our fight.

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9th International Coral Reef Symposium, Bali, Indonesia 2000

The next ISRS sponsored International Coral Reef Symposium will be in Bali, Indonesia in October of 2000. The exact date and venue, hotel information, registration fees, etc. will be announced in later circulars.

Indonesia is blessed with some of the most extensive and diverse coral reefs in the world, and it is considered to be a center of dispersal for tropical marine species in Indo-Pacific coastal waters. Indonesia considers it a great honor to be entrusted to organize such a prestigious international scientific gathering. The government, with the support of the Indonesian scientific community, unhesitatingly endorses the proposal.

The 9th International Coral Reef Symposium, apart from evaluating the current state of knowledge in coral reef studies, provides a forum for exchange of experiences and ideas. It is also expected to serve as a vehicle for evaluating ICRI's Framework of Action and the extent of its implementation so far. **The symposium is organized and sponsored by the Ministry of Environment, the Indonesian Institute of Sciences, the International Society for Reef Studies, and the Indonesian Association for Coral Reef Studies.**

The theme is 'World coral reefs in the new millenium: Bridging Research and Management for sustainable development.'

Scope of Discussion

Papers are welcomed on any of the following topics

1. *State of knowledge*: status of reef resources, community structure, productivity, biodiversity, life history, biology, taxonomy, bioactive substances, reef geology, recruitment, larval dispersal, geological history, etc.

2. *Resource management*: sustainable utilization, conservation, degradation, rehabilitation, recovery processes, artificial reefs, etc.

3. *Socioeconomic values*: capture fisheries, mariculture, resource valuation, carbon sinks, environmental protection, genetic resources, awareness and public education, legal aspects and law enforcement.

4. *Research and monitoring*: management strategies, impact assessment, methodology, database development.

The symposium aims to encourage cooperation among coastal states in the tropical and sub tropical region in order to meet regional needs for sustainable coral reef development and management. It also aims to meet the global needs of interdisciplinary and interstate monitoring of natural phenomena that have negative impacts on coral reefs, such as global warming, sea level rise and global biodiversity loss.

Correspondence

Correspondence should be directed to either of the following addresses:

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Soedaryono
The State Ministry of State for Environment
Jalan D.I. Panjaitan, Kebon Nanas, Jakarta 13410, Indonesia
Tel: 62-21-8580111, Fax: 62-21-8580110
Email: <dalaph@cbn.net.id> or <sjwadana@indo.net.id>

Preliminary registrations can be made by going to the following web site and clicking on 'Seminar'.

[Http://www.oseanologi.lipi.go.id/english.htm](http://www.oseanologi.lipi.go.id/english.htm)

Paleoceanology of Reefs and Carbonate Platforms: Miocene to Modern

An international Symposium entitled Paleoceanology of Reefs and Carbonate Platforms: "Miocene to Modern" will be held in Aix-en-Provence, France, in 27-30 September 1999.

The meeting is sponsored by the International Association of Sedimentologists and the International Society for Reef Studies

Aix-en-Provence has a long university tradition and now hosts the new CEREGE, (Centre Européen de Recherche et d'Enseignement de Géosciences de l'Environnement, Université Aix-Marseille III, CNRS, ORSTOM).

The Scientific committee comprises :

G.F. CAMOIN, CEREGE, Aix-en-Provence, France.

A. DROXLER, Rice University, USA.

W.-Chr. DULLO, GEOMAR, Kiel, Germany.

P. FLOOD, University of New England, Australia.

W. HANTORO, RDCG, Indonesia.

M. PICHON, EPHE—Perpignan, France.

A. STRASSER, Université de Fribourg, Switzerland

The style of the meeting will follow the tradition of paleoceanography conferences. To avoid parallel sessions and provide enough time for debates, 2 scientific themes per day will both include 1 keynote and 3 to 4 invited talks. All other scientific contributions will be presented in Poster format followed by a summary presented by the members of the Scientific Committee. Contributions will be published in special issues of international journals. More information will appear in the Third Circular.

Scientific themes include:

Effects of paleoceanographic and climatic changes in the evolution of reef and carbonate platform biota.

Paleoceanographic boundary conditions of reefs and carbonate platform formation: tropical vs. cool water carbonate systems.

Causes and effects of rapid sea level changes on reefs and carbonate platforms.

Paleoclimatic and paleoceanographic signals in reef organisms.

Cyclicity and sequence stratigraphy in carbonate systems and quantitative modeling.

Impact of recent environmental changes on reefs.

The carbon budget in reefs and carbonate platforms: sinks and sources.

Hydrocarbon potential of cenozoic reefs and carbonate platforms.

Deadlines :

May 15, 1999 deadline for receipt of abstracts and hotel reservation. Deadline for receipt of registrations for field trips.

June 15, 1999 : deadline for payment of fees and student residence reservation.

July 1, 1999 : final program.

Information and registration forms are available at <http://www.cerege.fr>. Further information from G.F. Camoin, E-mail <camoin@cerege.fr> or <prcp@cerege.fr>

Benthic Ecology Meeting

The 1999 Benthic Ecology Meeting will be held March 25-28, 1999 in Baton Rouge, Los Angeles, USA. Host institutions are Louisiana State University, University of Southwestern Louisiana, and LUMCON. Presentations concerning coral-reef ecology have contributed significantly to meetings in the past, and the organizers hope there will be a strong repre-

sentation at this meeting. The meeting web site can be viewed at: <http://www.lsu.edu/guests/be99>. Further information from Kevin Carman, <bem99@unix1.sncc.lsu.edu>. The deadline for registration and abstract submission is Jan. 31, 1999.

Scientific Aspects of Coral Reef Assessment, Monitoring, and Restoration

14-16 April 1999 Ft. Lauderdale, Radisson Bahia Mar Beach Resort, Ft. Lauderdale, Florida USA.
Organized by the National Coral Reef Institute (NCRI)

The purpose of the meeting is to develop a scientific synthesis of assessment, monitoring, and restoration designed for enhanced understanding and management of all aspects of coral reefs. This conference also seeks to identify emerging concepts and to describe new and innovative scientific and technological approaches.

The conference will include invited keynote and plenary talks, contributed papers in three concurrent sessions, a poster session, and workshops. Abstract submission information is available on the web or will be mailed upon request. A special peer-reviewed publication of Plenary Talks and selected Contributed Papers is planned.

Early registration fees apply before 1 January 1999.

There is a significant student discount. Registration includes the Conference program of invited Keynote, Plenary Talks, Contributed Papers, Poster Session, Abstract Book, opening reception, closing banquet, poster reception, continental breakfast and break refreshments for each of the three days.

For more information on the conference and for registration please check the web at: http://www.nova.edu/ocean/ncri/confinfo_1.htm or contact the National Coral Reef Institute, Nova Southeastern University Oceanographic Center, 8000 N. Ocean Dr., Dania, FL 33004 USA Tel: 954-920-1909 Fax: 954-921-7764 Email <ncriconfinfo@ocean.nova.edu>

Quaternary Marine (Palaeo) Biography of SE Asia

This is one of the 15 planned sessions of the International Symposium on the Biogeography of SE Asia 2000 to be held 4-9 June, in Leiden, The Netherlands. The meeting is organized by the National Museum of Natural History, the Rijksherbarium/Hortus Botanicus (both in Leiden) and the Netherlands Research School of Sedimentary Geology (NSG), Amsterdam.

Southeast Asia has received much attention in recent years, both from earth scientists and biologists. It is a region where several lithospheric plates are colliding and this process of ongoing mountain building has resulted in a very complicated biotic history. It comprises major hotspots of global biodiversity. However, the natural environment is much under threat and increased attempts are being made to study and to preserve what is left. It has become clear in recent years that the abiotic and biotic developments can only be understood if they are studied in an integrated way. Therefore both earth scientists and biologists are invited to share their knowledge of specific aspects concerning Southeast Asia. Those who have suggestions for topics relevant to this session or would like to participate, should contact the convenor.

The main aim of the symposium is to give a comprehensive and integrated summary of the knowledge at the start of the new millennium. Although there will be ample room for short communications and posters, the accent is on re-

view papers covering all aspects of historical biogeography of the area, including geological developments, palaeoclimatology, marine and terrestrial life, plants as well as animals. In addition, attention will be paid to methodology, and to "applied biogeography" and conservation. Special themes may include monitoring of Global Climatic Change and Biodiversity assessments. The meeting will consist of invited presentations, contributed lectures and posters, and workshops on topics such as computer applications and multidisciplinary research themes. It is intended to publish the review papers as a book that reflects the main aim of the symposium: a comprehensive and integrated summary of the knowledge at the start of the new millennium. The other contributions will either be published separately or as part of the book.

The Scientific program is proposed to consist of five sections, each with several sessions. For each section several people have been approached to act as convenor. Since the coverage is not yet complete, we invite you to suggest additional names, with particular emphasis on names of people from SE Asia. Convenors for a session will be put in contact with other convenors in the same section, enabling them to act in concert.

1. Methodology: 3 sessions: Geology; Palaeontology; Biogeography

2. Mesozoic: 2 sessions: Geology & Palaeontology; Gondwana distribution patterns in recent organisms
3. Tertiary: 3 sessions: Geology/Plate tectonics; Palaeontology; Tertiary distribution patterns in recent organisms
4. Quaternary: 4 sessions: Geology & Climatic Change; Terrestrial (palaeo)biogeography; Marine (palaeo)biogeography; Human Impact
5. Applied Biogeography: 3 sessions: Biodiversity Informatics; Global Change; Societal Needs & Conservation

Researchers and students from the Southeast Asian region are especially invited to attend the symposium and to contribute with lectures and/or posters. The Steering Committee and the International Organizing Committee will do their utmost to improve funding possibilities for participation by people from SE Asia.

Convenor for this session: Dr. Bert W. Hoeksema, National Museum of Natural History "Naturalis", P.O. Box 9517, 2300 RA Leiden, The Netherlands. <Hoeksema@Naturalis.nnm.nl>.

ANNOUNCEMENTS

Institute for Tropical Marine Ecology (ITME)

The Institute for Tropical Marine Ecology is a new educational / research organization. Founded in 1998 by Dr. Sascha C.C. Steiner, ITME is currently based in the U.S.A. and preparations for the establishment of a permanent office and field station in Dominica are under way. Dominica's spectacular volcanic topography, and the paucity of research stations in the Lesser Antilles, put ITME in a prime geographic location for marine research. In June 1999 ITME's academic program will be launched with a six-week summer course in marine resource conservation, followed by a three-month semester in September 1999. The semester program includes courses in tropical marine ecology, biology and identification of marine organisms, and marine re-

source economics. All courses are issue-driven with hands on experience. Courses are aimed at advanced undergraduate biology majors, however graduate students are welcome. The inter-disciplinary curricula will incorporate ongoing research projects on coastal habitats, allowing students to explore Dominica's marine life. When courses are not in session, ITME will operate as a regular research station, available to visiting scientists.

For further information please contact Dr. Sascha C.C. Steiner, Institute for Tropical Marine Ecology, Worcester, NY 12197 - 0430, U.S.A. Tell/Fax: (607) 397 9796 Email <scs@ccpc.net> or visit ITME's web pages at <http://www.ccpc.net/~scs>

MEETING REPORTS

Essential Fish Habitat and Marine Reserves

Second International Mote Symposium in Fisheries Ecology.
November 4-6 1998.

In November, approximately 200 scientists and managers gathered in Sarasota, Florida to discuss Essential Fish Habitat and Marine Reserves. The impetus for this meeting was largely the United States' reauthorization of the Magnuson-Stevens Fisheries Act, which mandates the protection of 'Essential Fish Habitat'. But what exactly is that, and can it be found or preserved in marine reserves?

Three days of presentations from the Georges Bank scallop fishery to Caribbean reefs gave an interdisciplinary

overview and drew out common threads. Some of the presentations will be published in a special issue of the Bulletin of Marine Science.

David Covonor was the first of many to identify a paradigm shift in thinking. Whilst a decade ago we thought cracking the recruitment problem would be the answer to managers' prayers, marine reserves now inspire an almost religious fervor. But it's no good preaching to the choir. For marine reserves to work you need public 'buy in', and to

maintain support, reserves must be successful. As Tundi Agardy emphasized, managers must not promise more than reserves will deliver.

Population modelers to conservation advocates agreed that marine protected areas are not a silver bullet, and are no substitute for controlling fishing capacity. However, all allowed that reserves are an essential tool. Paul Dayton and Tony Pitcher

both provided shocking statistics on trawling. An area equivalent to the continental shelves is trawled every two years. Fishing leaves hardly any ecosystems undisturbed. We have no baselines from which to measure regime shifts, anthropological impacts or ecosystem functions. Callum Roberts summarized for the 'biodiversity corner': we are looking for a relatively small difference between disturbed and very disturbed environments. We simply don't know what a pristine ecosystem looks like. Meantime, overexploitation leading to phase shifts doesn't necessarily make fishing unprofitable. Many fishers are quite willing to switch to a new (usually lower) level in the food chain.

The main dissention was not over what to do, but when to do it. Many called for more marine reserves now rather than waiting for the slow grinding mill of science to provide meticulously validated selection criteria. Others such as Larry Crowder advocated caution, suggesting that unless 'sources' and 'sinks' were evenly distributed, random placement of reserves might do more harm than good. Alternatively, careful siting might reap large rewards. Ken Lindeman presented data identifying spawning sites used sequentially by several species of snappers around Cuba, which would surely benefit from protection.

So how should reserves be designed for fisheries management? Josh Nowlis, summing up for the modeling contingent, admitted the answer is 'it depends'. The size and number of reserves needed will differ with varying situations and goals. Modelers emphasized the need for more data in order to understand processes such as movement rates of adults and juveniles. Emerging techniques should help with this. Several researchers spoke on otolith microchemistry and microtags.

Whilst a decade ago we thought cracking the recruitment problem would be the answer to managers' prayers, marine reserves now inspire an almost religious fervor.

Marine protected areas are not a silver bullet, and are no substitute for controlling fishing capacity. But they are an essential tool.

But what's best for fishing industries may not provide conservation benefits. Time area closures can protect mobile species when they are particularly vulnerable (eg. spawning aggregations), but rotating reserves are not good for habitat conservation. Clearly, although marine reserves have potential to bring fishing and conservation interests together, interests will often conflict.

Clear goal statements will be important in defining what or who reserves are designed to help.

And when is a reserve not a reserve? Most of the time! Dayton showed a map of numerous protected areas in California, but challenged the conference to pick out the 'no take' zones marked in red. Even when closed for one species, extraction of others is often allowed.

Once designed a reserve must be enforced, or it becomes a paper park. On Friday the afternoon coffee break was cancelled in favor of a talk by three US enforcement officials. They marched briskly up to the podium. A special agent turned the overheads. The Major stood at the bottom of the steps and confirmed contentious points. The speaker leaned over the lectern and told the cookie munching audience that protection of the proposed Tortugas Ecological Reserve in the Florida Keys would take more than three million dollars in set up costs, followed by 1.1 million a year running costs. Without these resources policing would fail. Depressing news, and as one researcher was later heard to mutter, 'if the last super power can't do it, what do we say to developing countries?'

One thing is certain, and Crowder voiced it for the conference as a whole. We must not look back in ten years time and see marine reserves as yet another fisheries management mistake. On the last evening, a few of us went to a downtown restaurant. At the table the waiter smiled apologetically and explained that although Atlantic Swordfish was the chef's 'special', there was only one left. Two hundred researchers could hardly have put it better.

Maggie Watson Email <iclarm@caribsurf.com>