

# REEF ENCOUNTER

Newsletter of the International Society for Reef Studies

Number 12

December 1992





# REEF ENCOUNTER No. 12 December 1992

## NEWSLETTER OF THE INTERNATIONAL SOCIETY FOR REEF STUDIES

Editor Sue Wells

Associate Editor Callum Roberts



### CONTENTS

- 3 Editorial**  
S. Wells and C. Roberts
- 4 ISRS Comment**  
From the President  
B. Salvat  
A Note from the Treasurer  
D. Fautin  
A Broader Journal and a More Active Society?  
R. Grigg
- 5 ISRS News**
- 6 Upwellings**
- 7 Currents**  
Musings on Monitoring  
M. J. Risk
- 9 Features**  
Threats to Scarborough Reef in the South China Sea  
M. and T. Collard
- 10 News**  
Cyclones Blast United States Coral Reefs  
C. Birkeland, R. Grigg and J. Ogden  
New Test for Ciguatoxic Fish  
Survey in Palau
- 13 Meeting Reports**  
US-French Co-operative Research on Coral Reef Systems  
M. Eakin  
7th International Coral Reef Symposium, Guam
- 14 Country Profile**  
US Virgin Islands: Small Islands Big in Science  
J. Battey, E. Gladfelter, C. Grippaldi, R. Hayes, N. Quinn,  
M. Taylor
- 16 Book Review**  
The Greenpeace Book of Coral Reefs  
P. Holthus
- 16 Book Shelf**
- 17 Announcements**
- 20 Diary**

#### President

Bernard Salvat  
Centre Biol. Ecologie  
Tropicale Méditerranée,  
E.P.H.E.,  
Université de Perpignan  
66860 Perpignan Cedex  
France

Tel. (33) 68-66-20-55

Fax. (33) 68-50-36-86

#### President Elect:

C. Birkeland (Guam)  
B. Brown (UK)

T. Hughes (Austr.)  
H.G. Multer (USA)

J. Patzold (Germany)  
K. Sebens (USA)  
C. Wilkinson (Austr.)

#### Managing Editor:

**Geological Editor:**

**Biological Editor:**

**Environmental Editor:**

#### Secretary

Rene Galzin  
Centre Biol. Ecologie  
Tropicale Méditerranée,  
E.P.H.E.,  
Université de Perpignan  
66860 Perpignan Cedex  
France

Tel. (33) 68-66-20-55

Fax. (33) 68-50-36-86

P. Hutchings (Austr.)

#### Council

F. Bourrouilh-le Jan (France)

J. Cortes (Costa Rica)

Y. Loya (Israel)

L. Muscatine (USA)

V. Paul (Guam)

P. Spencer Davies (UK)

R. Grigg (USA)

I. Macintyre (USA)

T. Hughes (Austr.)

B. Brown (UK)

#### Treasurer

Daphne Fautin  
Kansas Geological  
Survey,  
Univ. of Kansas  
Lawrence,  
Kansas 66045-2106  
USA

Tel. (913) 864-3965

Fax. (913) 864-5317

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

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

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

- i. To hold meetings, symposia, conferences and other gatherings to disseminate this scientific knowledge and understanding of coral reefs, both living and fossil.
- ii. To print, publish and sell, lend and distribute any papers, treatise or communications relating to coral reefs, living and fossil, and any Reports of the Proceedings or the Accounts of the Society.
- iii. To raise funds and invite and receive contributions from any persons whatsoever by way of subscription, donation or otherwise providing that the Society shall not undertake any permanent trading activities in raising funds for its primary objects.

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

#### Membership

The annual subscription for full membership of ISRS is currently US\$60, provided renewal payments are made by 1st March each year. Full Members receive the journal *Coral Reefs*, the newsletter *Reef Encounter*, and other periodic mailings.

Spouse membership is US\$70.

Student membership costs US\$10 and benefits include all of the above except the journal *Coral Reefs*.

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

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



## EDITORIAL

We apologise if this issue has taken a little longer than usual to reach you. Both of us have recently moved to other institutions and have been getting to grips with the problem of putting together *Reef Encounter* separated by half the world. Thanks therefore to all contributors who answered our pleas to meet unrealistically short deadlines and special thanks to Jun Espiritu of ICLARM (International Center for Living Aquatic Resources Management) for providing the cartoons.

*Reef Encounter* has recently been providing a forum for debate on the extent to which the reef research community should become actively involved in environmental issues, a topic that also generated fervent discussion at both the 1991 Berkeley meeting of ISRS and the 7th International Coral Reef Congress in Guam in 1992. Many people have remarkably strong feelings about this, as indicated by Mike Risk's article in this issue.

We should perhaps therefore look at how scientists in other disciplines are tackling this issue - after all, reefs are not the only natural ecosystems with problems. UNCED (the United Nations Conference on Environment and Development) which took place in June 1992, may have disappointed many with its lack of resolve over key issues, but it may have had a significant impact on how scientists think about their work, as indicated by the following examples.

An international conference on tropical forests held in April 1992 at the Oxford Forestry Institute (see *Trends in Ecology and Evolution* 7: 249-250, 1992) debated the role of scientists and foresters in working with a resource that is being rapidly depleted. One conclusion was that major advances in the quality of tropical forest management will come, not from more research, but from altering management practices to take better account of existing knowledge and of social and economic aspects. The term 'scientific extractivism' was coined to describe those who conduct research in developing countries, contribute nothing to their development, and publish data in developed countries in journals whose excessive price prevents subscriptions in the country where the research was carried out. Clearly this approach is now firmly outdated. The role of outside experts was identified as one of contributing knowledge from experience gained elsewhere, skill at observing local conditions in a target area, and an understanding of the ecological, social and economic mechanisms underlying management systems. Needless to say, there was no consensus, with some arguing strongly for the rights of tropical forest scientists to engage in purely 'curiosity-driven' research. Does this sound familiar?

The Ecological Society of America and the British Ecological Society have been debating the issue for slightly longer (see Lubchenko *et al.* (1991) *Ecology* 72: 371-412, and Grubb and May (1991) *Conservation Biology* 5: 548-549). Both societies have identified priorities for research, which provided the basis for an international meeting held in Mexico in 1991 at which the establishment of a co-operative programme - the International Sustainable Biosphere Initiative (ISBI) - was recommended (Huntley *et al.* (1991) *Ecol. Int.* 20: 1-14, and Sala (1992) *Trends in Ecology and Evolution* 7: 324-326). This defines three priority areas for research:

1. Diversity and sustainability: ecosystem response to disturbance; the consequences of simplification through the loss of diversity; the nature and maintenance of diverse systems.
2. Sustainability in a changing biosphere: the state of the biosphere; the responses and feedbacks of biotic systems to change; and innovative approaches to synthesised information and modelling processes.
3. Human dimensions of sustainability through co-operative work between natural and social scientists: human populations and perceived resource availability; human values and resource degradation; and the ecological impacts of different cultural styles.

At the risk of sending everyone to sleep, we should also mention one other meeting. 'ASCEND-21' was convened by the International Council of Scientific Unions (ICSU) in November 1991 to discuss the contribution of science to development and environmental issues and to develop an 'Agenda of Science for Environment and Development into the 21st Century' (Marton-Lefevre (1992) *Environ. Sci. Technol.* 26: 1085-1088; proceedings edited by Dooge *et al.* and published by Cambridge University Press). The 'classical responsibility of all scholars to undertake research, to publish the results and to explain the implications for society' was strongly emphasised. The coastal zone was specifically mentioned as an area where environmental issues are approaching a crisis point. Taking these points together, ISRS should perhaps take some responsibility for following up the recommendations, which included more research into global change (natural and anthropogenic), special efforts in education and the establishment of scientific institutions, and the setting up of a forum to link scientists with development agencies.

This issue of *Reef Encounter* reflects many of these points and hopefully will stimulate some of you to write in with your views. Some ISRS members are genuinely concerned that the new trends will undermine good science. If this is true, what should ISRS be doing about it? Several ideas came out of the questionnaire circulated at Guam and reported on by Rick Grigg on p. 4; some are already being acted upon, others still need attention. *Reef Encounter*, for example, could be one vehicle for giving the Society a more multidisciplinary outlook - where are the contributions from geologists, chemists, social scientists and others? If you know these people are not reading the newsletter, show them a copy and get them to put pen to paper, even if it is in criticism.

The next issue should come out on time. Contributors are asked to send material in the first instance to Callum Roberts as Sue Wells will almost certainly be on the move again.

Sue Wells  
Callum Roberts

**COPY DEADLINE FOR REEF ENCOUNTER 13**  
**(due out July 1993) IS MAY 1ST 1993**  
**Please send copy to Callum Roberts - see back page**



## ISRS COMMENT

---

### FROM THE PRESIDENT

Bernard Salvat

#### Progress and Change: the way forward for ISRS

Twelve years old! It is twelve years since David Stoddart brought reef scientists together to form ISRS, and to launch our international journal *Coral Reefs*, in an arrangement with Springer Verlag. Our society is now at a critical stage and we must reconsider its structure and the means of communication between reef scientists. We need to think about the potential for ISRS-sponsored meetings at different levels: local, regional and international, and about their form: symposia with contributions (presentations and posters), seminars and forums. We must expand our horizons and take the results of our research into the broader field of current human issues and concerns: applying our knowledge to management, and setting it in a better time-scale, from past to present to future, using the full range of technology and communication now at our disposal (for example, sclerochronology, networks of observatories and laboratories, global programmes). The challenge is to remain a cohesive community and yet to contribute to the widely disparate needs of our changing world.

We have to progress and adapt. If we do not, ISRS risks floundering, and coral reef research will be the weaker. Our future will depend on four steps:

- developing a willingness to progress and change;
- using our imagination to select the correct priorities;
- focusing our attention, time and energy on these priorities; and
- building a strong Society with true international representation

What have we achieved since the beginning of 1992? In June, at the 7th International Coral Reef Symposium, I was given the opportunity by Chuck Birkeland to address over 600 reef scientists, and to explain how ISRS and our journal are of interest to the whole reef community. Over 100 new members joined the Society.

The constitution is now under review and a new one is to be adopted by the end of 1993. The bye laws will be re-written to facilitate action by Council members and officers both inside and outside the Society. A regional approach will probably be considered.

We are making a real effort to develop a higher profile for the Society. The number of reef meetings that are held under the auspices of ISRS (with other institutions) is to be increased (see below). *Coral Reefs* will contain a Society page twice a year, and we will maintain regular production of *Reef Encounter*.

So, we are on our way. The team you elected is doing its best, so please help us: good papers for *Coral Reefs*, contributions for *Reef Encounter*, and recruitment of new members. And don't forget to pay your 1993 dues as early as possible, in order not to be penalised by the higher rates that we are introducing for late payers!

## A NOTE FROM THE TREASURER

Bernard Salvat is certainly a persuasive fellow! Since his addresses in Guam, to the plenary session of the 7th International Coral Reef Symposium and to the general membership of ISRS, we have gained 160 new members – a 51% increase. As of October 1st, ISRS had 70 student members, 382 regular members and 22 spouse members – an all-time high in all categories!!!

Of course, Bernard did not do it all by himself. Many of you have been urging colleagues to join ISRS (you can tell who was not a member as of 15th May by checking your membership list). For example, despite Hurricane Andrew, we have lots of new members in the Miami area, thanks to Peter Glynn. I'm sure that each of us knows at least one interested person who is not a member – what an easy way to double our membership.

An important part of the increase is due to renewals. Thanks to each of you who supported ISRS by continuing your membership – each renewal is a vote of confidence. Notices for 1993 were sent in November and you will have been pleased to see that the amount of dues remain unchanged. In response to your concerns, we have also instituted Deputy Treasurers to collect dues in the currency of their countries. They will then forward the total to me in US\$. Since bank charges will be distributed over many memberships, we expect them to be small enough to be born by ISRS. That, of course, is yet to be demonstrated, and this experiment will be continued only as long as it is not excessively costly to the Society. Of course, you may still send your dues directly to me in US\$. Along with your dues notice, those of you whose mailing address is outside the US will receive a list of Deputy Treasurers.

Actually, the amount of dues will be unchanged only for those who renew promptly. In Guam, the Council endorsed increasing dues through the year as a means of encouraging prompt payment, because delayed receipt of dues costs ISRS in several ways. Your dues notice contained the schedule of payment. Of course, new members will pay at the base rate throughout the year. I look forward to hearing from you early in 1993!

Daphne Fautin, Treasurer

---

## A BROADER JOURNAL AND A MORE ACTIVE SOCIETY?

At the 7th International Coral Reef Symposium in Guam (June 22–26 1992), the council of ISRS circulated a questionnaire to participants seeking their views on improving the society and increasing membership. The questionnaire also sought views on how the journal, *Coral Reefs*, might be improved.

Regarding the Society, the most often expressed concern was the need for a mechanism whereby members could provide more input. This could be achieved if new or younger members become more active, for example contributing to *Reef Encounter*, publishing in the journal and expressing an interest in running for office within the Society. Several of the concerns about membership are already being addressed as described above: the Society is endeavouring to double its membership in the







back onto PACON 94, a scientific meeting being held under the auspices of the Australian Marine Science Association and other agencies (see Diary). Further information from: Dr T. Done, Australian Institute of Marine Sciences, PMB 3, MC, Townsville, Queensland 4810, Australia. Fax (077) 725-852.

September 1994. Luxembourg.

ANNUAL MEETING OF THE EUROPEAN SECTION OF ISRS  
This will be open to all and will be held in the Grand Duchy Of Luxembourg in the first week of September 1994. It is being organised by: Dr Jorn Geister, Universitat Bern, Geologisches Institut, Saltzerstrasse 1, CH-3013, Bern, Switzerland. Fax (41) 31 654 843.

8TH INTERNATIONAL CORAL REEF SYMPOSIUM

This will be held in Panama in 1996. Further information will be published in Reef Encounter as it becomes available.

### Proceedings of the 7th International Coral Reef Symposium

Readers will be pleased to know that the recent typhoons in Guam (see p. 10) have not affected production of the Proceedings of the 7th International Coral Reef Symposium. According to the General Editor, Bob Richmond, the final copy should have been sent to the printer in December.

### CITES PERMITS FOR CORALS

A number of reef scientists have been complaining about CITES regulations for the import and export of coral specimens. The general regulations were published in Reef Encounter 11, 1992 and it would be a major task to give details of how and where permits are obtained in each country. Scientists should encourage their academic institutions to obtain the necessary information and become aware of the requirements; institutions that have adopted this approach have rarely had problems. The following extract, concerning scientific activities in general, is from a letter to one of the editors from the CITES Management Authorities Co-ordinator at the CITES Secretariat in Switzerland: "The important point for scientists to remember is that they are not exempt from the provisions of CITES. In fact, since we are aware of a number of scientists being involved in illegal and harmful trade, there is good reason for CITES authorities to be vigilant in applying the provisions. .... What scientists should certainly do is to consult the CITES Management Authorities of their own countries before importing specimens, since these are the agencies responsible for authorising imports.

It might go without saying, although perhaps it has done for too long, that any scientist who collects specimens of CITES species from the wild with the intention of exporting them should ensure that the CITES Management Authority of the country is fully informed about his or her work, and its scientific value. At the same time the scientist should ask the Authority what are the procedures for export".

## UPWELLINGS

### QUANTITATIVE ASSESSMENT OF SEWAGE AND SILTATION

On p.22 of Reef Encounter 11, Sorensen and Pendleton ask for information to help set up a marine park in Honduras. In particular, they want guidelines for the quantitative assessment of the effects of sewage and siltation on reefs. The answers are pretty simple, and have been known for about 20 years. In areas of heavy siltation, the corals will trap sediment in their skeletons, thereby recording the rate and type of sediment input (Barnard et al., 1974). Necessary laboratory equipment amounts to an analytical balance, a vacuum filtration apparatus, and some acids. The same equipment can be used to assess suspended particulate matter loads, with an eye to the seemingly-critical 10 mg/l value (Cortes and Risk, 1985). For the high-tech continuation, the trapped sediments can be analysed by x-ray diffraction, and the source identified. Similarly, the effect of sewage is well-known. Filterfeeders (including bioeroders) and benthic algae explode at the expense of corals (Banner, 1974; Rose and Risk, 1985). Scoring this sort of change in the benthic community can be done with nontechnical personnel, using virtually no equipment beyond snorkelling gear. For the high-tech continuation, changes in  $\delta^{15}N$  in coral tissue indicate changes in the trophic status associated with sewage input (Allison et al., 1991).

Allison, W.R., Risk M.J., Zahir, H. and Shakeel, H. 1991. Reef monitoring in Maldives: a combination of high-tech and low-tech science. *Program plus abstracts, ISRS meeting, Berkeley, Calif.*: 13.

Banner, A.H. 1974. Kaneohe Bay, Hawaii: urban pollution and a coral reef ecosystem. *Proc. 2nd. Int. Coral Reef Symp., Brisbane* 2: 685-702.

Barnard, L.A., Macintyre, I.G., and Pierce, J.W. 1974. Possible environmental index in tropical reef corals. *Nature* 252: 219-220.

Cortes, J. and Risk, M.J. 1985. A reef under siltation stress: Cahuita, Costa Rica. *Bull. Mar. Sci.* 36: 339-356.

Rose, C.S. and Risk, M.J. 1985. Increase in *Cliona delitrix* infestation of *Montastrea cavernosa* heads on an organically polluted portion of the Grand Cayman fringing reef. *Marine Ecology* 6: 345-363.

Michael J. Risk, Dept of Geology, McMaster University, 1280 Main St. West, Hamilton, Ontario, Canada L8S 4M1. Fax: (416) 522 3141.

### THE COMPLETE REEF ENCOUNTER No. 12

"As humming-birds sport around the plants of the tropics, so also small fishes, scarcely an inch in length and never growing larger, but resplendent with gold, silver, purple and azure, sport around the flower-like corals".

C. G. Ehrenberg, 1832 (full reference not available)

Why can't scientific papers be as pleasant to read these days?!



## CURRENTS

### MUSINGS ON MONITORING

Michael J. Risk

#### Reef relevance?

Returning to Canada late in August, having cancelled out of the 7th International Coral Reef Congress because of a once-in-a-lifetime opportunity to visit an uninhabited, untouched Maldivian atoll, I was delighted to see, in the Everestian pile on my desk, both the June *Reef Encounter*, and the *Abstracts* from Guam. I sat down to go through them with anticipation, but finished full of a foreboding sense that what most of us would call "our" science was in deep trouble and that we are collectively in danger of not being able to see the coral for the polyps.

I had spent most of my time away visiting developing countries faced with a staggering array of environmental problems: the Maldives, Indonesia, and Zanzibar, off the coast of Tanzania. Each of these taught me lessons which I hope are universal.

The Republic of Maldives is a chain of atolls stretching south into the Indian Ocean from near the Indian subcontinent. The Maldivians live on coral and derive their incomes from fishing and tourism. Perhaps as many as 70-100,000 people live on the capital island, Male, which has an area of about two square kilometers. All the sewage is discharged, untreated, onto or near the reef and coral mining for construction is a major impact (see 'Country Profile' in *Reef Encounter* 8, Dec. 1990). Evidence that the reefs of Male have suffered serious damage has been presented by several authors.

Reading between the lines of Tom Tomascik's article on Indonesia in *Reef Encounter* 11, one senses the importance of bureaucracy in that country, of the immensity of the resources and the problems in their management, and the difficulty of accomplishing anything in a less-than-Holocene time frame. To be blunt, Indonesia probably has the highest proportion of the world's reefs, with one of the highest ratios of dependence on marine resources, and Tom and his colleagues are almost on their own out there.

My last, and longest, stop was on Zanzibar, where the entire population obtains 90% of its protein from fish, mostly reef-associated species. The coastal reefs of Zanzibar are already over-fished, and dynamite fishing is common on the adjacent Tanzanian coast. The hunger of the local people for knowledge about their coastal resources stood in haunting contrast to the more basic, and far more tragic, hunger of their neighbours to the north: will the Zanzibaris be that far behind, should their reef fisheries fail?

#### Reflections on *Reef Encounter*

So I returned, jetlagged and humble, to pick up my copy of *Reef Encounter*. I read through, digested, and then became depressed. I feel we are failing society's needs.

First of all (p.4), we read that, like every other professional society, ours is feeling the financial crunch. Yet look at the membership figures, and reflect on the name of our Society,

and you will quickly realize that we are unlike other such groups. We attempt to study, with ever-more-sophisticated techniques, an ecosystem which is the virtual monopoly of the developing world, and which is of infinitely more importance to Them than it is to Us. A glance at the membership figures (p.5) suggests that, at most, 10% of our membership comes from those parts of the world most affected by what we do. I spent some time looking at the list of Best Paper awards in *Coral Reefs* (p.6). Notwithstanding that they are all excellent pieces of research, I wondered whether any of them would ever be of the slightest use to the people with whom I had just been working.

Our executive is, quite properly, concerned with the budget and with membership in the Society but again, if we stand back and look at the situation, it seems bizarre. We work with the most complex, fragile, fascinating and beautiful ecosystems that have ever existed, and that are also the livelihood of millions. If ISRS has a small membership, then we have collectively failed to communicate the message or, more likely, been quite complacent to see our numbers restricted to those who know the rules and can play (and afford) the game. Membership in ISRS is currently US\$60. If developed nation members were willing to raise that to, say, US\$100, we could then probably (assuming the costs of membership remain constant) donate subscriptions of *Coral Reefs* and *Reef Encounter* to every marine station in the tropical developing world.

Pages 6 & 7 give us Mark Eakin's view of the Berkeley meeting, and his discussion of the dichotomy between "radicals" and "conservatives" (my phrasing and quotation marks) in the ranks of reef scientists. The radicals, who frequently are not, generally state that there is no time to lose, that we must take advocacy positions if we are to save the ecosystem on which we work; the conservatives, individuals who frequently hold very liberal views on other subjects, feel that we owe it to our rigorous training not to fly off half-cocked. This latter view was crystallized by Rick Grigg's admonition to us, not to become False Cassandra's: i.e., we run the danger of losing credibility if we cry wolf (to mix fables) too often.

We should never lose sight of the fact that Cassandra was right. As a child, she was given the power of prophecy by Apollo. When she later spurned his advances, he took from her the power to convince, and so it was that the Trojans did not heed her warnings about the funny-looking horse with the big belly. If we really wish to draw parallels with this story, we should remember that the villain was Apollo, an external influence who blinded the public's ability to absorb an urgent warning. If we reef scientists represent Cassandra in this analogy, then Apollo is torpid governments, venal industries, or even those of us who have sold out.

The general picture seems pretty clear. I invite someone to perform a simple experiment: total all the monitoring and assessment studies published over the past 20 years, and contrast the % of reefs showing decline with the % showing improvement. My largely geological background perhaps accounts for my lack of patience with those who maintain that we cannot prove deterioration until the fluctuations we see have exceeded normal variation. That point of view is futile. For example, at the end of the Permian, 90% of all marine species died out, the largest mass extinction event in world



history. Are we then to allow 90% of reef-associated organisms to die off before we take positions? Or worse yet, work always with the figleaf of  $p < 0.05$ , which armours us from having opinions until it's too late?

On pages 8 and 9, we have articles by Thomason and Roberts, on "What is a healthy reef", and Hughes on "Monitoring of coral reefs: a bandwagon?". Both of these are useful in themselves, but they emphasize that, as a group, we tend to see monitoring in *biological* terms only. Techniques for and understanding of environmental monitoring of other ecosystems is in several instances far in advance of that for reefs. Thomason and Roberts, for example, mention *Musselwatch*, a programme designed by a chemist. Such programmes illustrate that a "monitoring" programme that does not include sedimentologists, chemists, and oceanographers as well as biologists is in danger of being useless; without an integrated approach, biological monitoring is a sterile exercise incapable of identifying causes. Ecology is not, and should not be, the sole preserve of biologists. Properly done, it is a unifying, integrating marriage of all relevant disciplines.

Howard Latin announced on p.20 his survey on reef degradation, which is designed to give us the opportunity "to provide more support for reef conservation initiatives and to provide better information on reef conditions to environmental policymakers." This is exactly the sort of effort which we, as a group, should support wholeheartedly. We are neither politicians nor policymakers, and we need people who can translate our research into legislation. I hope Howard's success at Guam was greater than he experienced at Berkeley, where he tried to get this started.

### Guam glimmerings

The Abstracts volume made me feel like the kid who got to the candy store after it closed: so much good science! I was delighted with the increasing representation from tropical countries and the focus in several papers on the interfaces between science, politics and the media. Continuing their tradition of taking the lead in reef studies, several of the papers by French authors integrated the chemical with the physical and biological, an approach used in few of the many other papers on monitoring.

I was also happy to see the excellent efforts orientated towards assessing past productivity levels by measuring bioerosion rates. I don't envy the poor souls attempting this, because the data sets required will be huge! (Sammarco and Risk (1990) sawed, scanned, digitized and summarized 300 coral slabs, to get one simple relationship with high variance.) When combined with chemical records in the coral skeletons, however, this approach can lead to an important historical record of the effect of eutrophication on reefs. Taphonomic overprinting has to be assessed and the bioeroding groups chosen very carefully. Some can yield confusing or misleading results, not only because their modern distribution with respect to productivity is unclear, but also because the preserved records are ambiguous.

For instance, one might be tempted to score boring bivalves but, for example, the distribution of *Lithophaga* is not simply related to productivity (Scott et al., 1988; Scott and Risk,

1988). In addition, some species of *Lithophaga* bore into dead coral and others are obligate live-coral borers. As the shells are rarely preserved, one must then deal with treatment of the boreholes. For dead coral borers, this is simple: amount removed equals skeleton destroyed. Some of the borers into live coral, however, dissolve only enough skeleton to accommodate their shell, and then simply keep pace with the coral as it grows. Skeleton denied is not skeleton destroyed. We will be able to extract some important data from such work, but the best results will come from the worst critters to work with: sponges, worms, and microborers.

### Chronicle of concern

I will try to tread very carefully here, to avoid being counterproductive by giving unnecessary offense. I recently received letters from two highly-respected reef scientists with developing world experience, knowledgeable in biology, chemistry and geology, and who would be likely to appear on most people's list of "People To Be Consulted On Reef Health". The following quotes come from these:

"Went to Guam for the coral reef bash. What a disappointment. Everyone's on this global monitoring bandwagon, trying to develop "new" sampling or monitoring techniques. Guess they're doing that so that, in 50 or so years, they'll have good data for the post-mortem. Everyone's focused on global change and sea level rise. When you've worked the places I have, you realize that sea level rise is the last thing to worry about at the moment: it's the shit and the plastic bags that'll wipe the reefs out before anything else."

"Today's reef biologists (especially if they want to publish in Coral Reefs) can never come up with an idea, let alone an hypothesis. If it looks like a duck, walks like a duck, and quacks like a duck, all a biologist is allowed to conclude is that it looks like a duck, walks like



Illustration by Ovidio (Jun) F. Espiritu Jr.



a duck, and quacks like a duck. A geologist is allowed to conclude that it is a duck-like creature."

There may be grains of truth in both of these cynical quotes. With respect to the latter, the contrasting histories of the disciplines may be important. Biological research has traditionally been supported by governments and foundations, environments in which economic impetus is subordinate to intellectual scrutiny. In North America, geology grew as an extractive industry-based science. Ideas were encouraged because they could lead to more oil or gold. On the other hand, if the Chief Geologist felt your idea hadn't worked out, she could fire you on the spot.

The adversarial system we have developed and fostered over the past few decades has served us well, and been a key factor in maintaining rigour. When I view the present concern about reef monitoring, however, I am reminded of the furor in the 1970s over "species diversity". It seemed as though everyone had a new, different, improved Index, which superceded and was immeasurably superior to all others. No one seemed to take note of the fact that all the indices were autocorrelated, and that they measured something really important. In reef science, we still see papers on "better" monitoring techniques, while the important issues pass us by. After all, with a large enough sample size, all the monitoring methods give you the same answers. I feel it is time to put down the critical cudgels which we so reflexively take up, and to collaborate on management frameworks.

#### Impactical, and perhaps practical, suggestions

Perhaps it would be most useful if the majority of us stopped doing science. Most of the critical questions concerning the health of reefs have been answered, and our time could be better spent elsewhere. We could at least opt out of the 'Mega-Monitoring' projects that are being bruited about. Certainly, some monitoring or assessment is needed, especially in little-studied parts of the world. However, measuring the rate of decline of one of the most beautiful ecosystems on earth pales into insignificance beside the need to identify causes and to educate others.

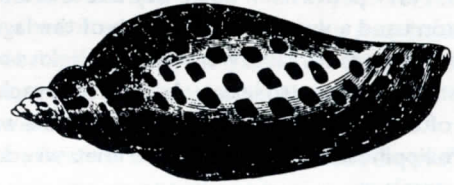
More practically, and given that enough work has probably been done on the tolerance limits of reefs, we could do as workers in other aquatic ecosystems have done and develop expert systems for reef assessment that could be taken anywhere and used by relatively unsophisticated people. There are some powerful forces out there that don't give a stuff about reefs if they can make a buck or a rupee. All they need to do at the moment is hire one "expert", because if the defense puts six of us on the stand, we will give twelve conflicting opinions.

Finally, given that the monitoring momentum is unstoppable and that, in the near future, vast sums of money are likely to be allocated for this purpose, it sure would be nice if these projects had a scholarship component built into them, designed to train those citizens of the developing world who depend so intimately on those ecosystems which we merely love.

My work in the developing world has been supported by the International Centre for Ocean Development, Canadian International Development Agency, International Development Research Centre, and Natural Sciences and Engineering Research Council of Canada. The Zanzibar project is held jointly with the University of Guelph.

#### REFERENCES

- Sammarco, P.W. and Risk, M.J. 1990. Large-scale patterns in internal bioerosion of *Porites*: cross continental shelf trends on the Great Barrier Reef. *Mar. Ecol. Prog. Ser.* 59: 145-156.
- Scott, P.J., Moser, K. and Risk, M.J. 1988. Bioerosion of concrete and limestone by marine organisms: a 13-year study from Jamaica. *Mar. Poll. Bull.* 19: 219-222.
- Scott, P.J. and Risk, M.J. 1988. The effect of *Lithophaga* (Bivalvia: Mytilidae) on the strength of the coral *Porites lobata*. *Coral Reefs* 7: 145-151.
- Michael J. Risk, Dept of Geology, McMaster University, 1280 Main St. West, Hamilton, Ontario, Canada L8S 4M1. Fax: (416) 522 3141.



## FEATURE

### THREATS TO SCARBOROUGH REEF IN THE SOUTH CHINA SEA

Martha and Tim Collard

Over the last ten years we have visited a number of offshore reefs in the South China Sea. On our most recent trip, we stopped at Scarborough Reef off the coast of Luzon in the Philippines and were appalled by the marked deterioration of the reef since our last visit two years ago. Scarborough Reef lies approximately 120 naut.mi. west of Manila at 15°03'N, 117°48'E, within the Philippines EEZ (it is just outside the 'historical' boundary line of this country but it is nevertheless considered to lie within the jurisdiction of Santa Cruz in the province of Zambales). Lying far offshore and with no protection, the reef is buffeted by storms all year round, in the summer by almost weekly typhoons from the south-east and in the winter by the north-east monsoon.

The reef is triangular in shape and is a classic atoll with a shallow sandy lagoon (1-10 fathoms deep) with numerous coral bommies surrounded by a reef platform margin which breaks the surface at low tide. A number of eroded channels through the reef permit a two-way flow of water between the lagoon and open ocean. It is not uncommon to find large tuna and other pelagic fish in the shallows. Outside the reef, the bottom slopes gradually into deeper water except at the south-west corner where the slope is gradual to a depth of about 20-30 ft and then drops vertically to 120 ft before shelving briefly and falling sharply to greater depths.

The shallow shelf is heavily scoured by wave action and hard corals, if present at all, tend to be stunted. On the edge of the shelf however and on the deeper slopes, coral has generally been in good condition up to this year (1992). The shelf also had plentiful triggerfish and surgeonfish and a scattering of wrasse. Larger fish in deeper waters included groupers, snapper and parrotfish with eagle and manta rays, turtles, jacks, barracuda, tuna and sharks.



On previous visits we have met fishing fleets from Taiwan, Hong Kong, China, and the Philippines. The Taiwanese are known to use dynamite placed by divers at depths of up to 100 ft and detonated with a remote charge. The Filipinos tend to use home-made bombs in the shallows. Hong Kong boats typically unload 8-15 sampans which fish with hook and line. Two years ago we spotted a traditional Chinese sailing junk nearly overflowing with pieces of hard coral, which we understood was destined for fertilizer or trinkets.

The fishermen are not alone on the reef. Up until 1992, US Airforce and Navy pilots from Subic Bay and Clark Airforce base on Luzon used a wreck at the mouth of the lagoon for target practice. Parachute flares were dropped before bombing started to warn fishermen to leave. Additionally, yachts from Hong Kong often stop overnight in the lagoon on the way to or from the Philippines, and we have also met wreck divers seeking new treasure.

Our trip in May 1992 proved a startling contrast. There were only two Hong Kong boats and two Filipino bancas working the reef and both complained of the lack of fish. A large barge was stationed inside the lagoon using dynamite charges to break apart the wreck to sell as scrap metal in Manila. We dived on the north-east section which had previously offered good diving. This time, the entire area (nearly 7 naut. mi. in length) was dead or dying. The coral appeared to have been blown apart, creating extensive rubble fields from the shallows to depths of over 120 ft. Lying between the broken coral were clumps of red algae, and fish life was limited to juveniles, with a noticeable absence of predators especially sharks. On the south-west, we also saw widespread coral destruction with large intact *Acropora* colonies only at depths of 100 ft or more; again pelagic fish and sharks were very few. The north-west section presented a similar appearance and only the lagoon seemed relatively intact, with coral bommies and juvenile reef fish, although again very few large fish. The Marine Science Institute of the University of the Philippines have carried out two surveys of the reef in recent years and in 1991 also found large quantities of rubble on the reef, and both detonated and undetonated bombs littering the lagoon floor.

Scarborough Reef epitomizes the problems of protecting and managing reefs that lie along way offshore. Few countries have the time, resources and money to properly police these areas and the lack of a resident community means that local management, as carried out elsewhere in the Philippines, is out of the question. Even with rapid intervention now, it will take many years for Scarborough Reef to return to some semblance of its former days. The reef is being considered as a candidate site for protection under the Philippines Integrated Protected Areas System (IPAS) programme (hence the Marine Science Institute surveys) and the Department of Environment and Natural Resources (DENR) now headed by Dr Angel Alcalá, a foremost Philippine reef biologist is discussing potential collaboration with the defence forces for protection of such areas. Clearly, action is urgently needed to protect this and other reefs like it, particularly in the South China Sea.

*Martha and Tim Collard, 30 Stanley Village Road, 2nd Floor, Hong Kong. Tel. 8131242.*

Staff of the Marine Science Institute at the University of the Philippines kindly provided additional information for this article.

## NEWS

### CYCLONES BLAST UNITED STATES CORAL REEFS

*Cyclonic storms ripped through Guam, Hawaii and Florida during the summer. Three ISRS members have emerged from the hurricane shelters to describe their effects.*

#### Hurricane Andrew: a shock to the system in Florida

Hurricane Andrew struck the east coast of Florida just south of Miami in the early morning of 24th August 1992. The rapidly moving storm was strong and compact, behaving like a 25 mile wide tornado in its turbulent passage across the state. While wind speeds and storm tides were high and damage to structures and vegetation was extreme in the path of the storm, there was only 4-6 inches of rainfall and wave heights were not extraordinary. Florida Institute of Oceanography (FIO) automated meteorological and oceanographic instrumentation on Fowey Rocks Lighthouse at the storm center was knocked out at 04.00 EDT after recording sustained wind speeds of 140 mph and gusts to 167 mph. A wave-measuring buoy 40 miles south of the storm recorded maximum wave heights of less than 2 m.

The major environmental impact of the storm was concentrated within Biscayne National Park, Everglades National Park, the Big Cypress Reserve and several small state parks. In the days immediately following the storm, numerous aerial surveys were done and investigators hurried to return to their study sites. The Florida Department of Natural Resources coordinated a major effort in aerial surveys and satellite photography which was entered in a GIS database. The National Park Service, operating under the Incident Command System protocol which is set into place following natural disasters, assembled three Resource Damage Assessment Teams within two weeks of the storm. The Teams will do a rapid reconnaissance of the storm impact on marine, freshwater and upland areas which will guide a longer term research response to damage, recovery and restoration.

The most evident impact of the hurricane on marine ecosystems was uprooted and defoliated mangrove forests. The vast seagrass beds off the mangrove regions appeared to be undisturbed although there were anecdotal reports of masses of seagrass leaves and rhizomes in the Gulf Stream off Cape Hatteras several weeks after the storm.

Reef damage seems to have been concentrated in Biscayne National Park, where there are excellent long-term studies of reef structure. Initial surveys have shown that delicate branching corals were broken and some massive coral heads were toppled. Other delicate reef organisms such as sea fans and sponges were ripped loose and there was evidence of scouring by wave-suspended sediment (W. Jaap, J. Porter, A. Szmant, *pers. comm.*). While shallow reefs (less than 5m depth) were most damaged, there are reports of damage to reefs as deep as 20 m, and dramatic shifting of shipwrecks more than 30 m deep popular as dive sites. These may be a result of turbidity currents from shallow water or large oceanographic disturbances associated with the storm. On the whole, however, coral reef



damage is not as extreme as that reported in the literature for other regions such as the well-documented impact of Hurricane Allen in 1980 on the reef at Discovery Bay Marine Laboratory in Jamaica (Woodley *et al.*, 1981).

Hurricane Andrew will be one of the best documented hurricanes in history, due to the many automated meteorological and oceanographic instruments that were in place. Integrated records from all available sources will provide a dynamic picture of the storm as it moved across the seascape of South Florida and will permit comparison with earlier and subsequent storms. For investigators with on-going long-term studies, the hurricane was a large natural experiment of great value providing an accurate, quantitative assessment of the impact of the storm and the recovery of damaged ecosystems.

The passage of such a violent atmospheric and oceanographic disturbance through the fragile environment of South Florida has likely left subtle marks on the region that will be discovered only by careful study. Superimposed on these concerns are the long-term human impacts associated with storm recovery including illegal dumping, toxic spills and seepage into the water table and coastal regions, and damaged sewage treatment plants. While periodic hurricanes are a normal part of the environment of South Florida, there is concern that declining water quality may affect the recovery process or significantly change the character of the impacted ecosystems.

Prior to Hurricane Andrew, the management plan for the Florida Keys National Marine Sanctuary had identified the major regional interdependencies and was bringing the various agencies together on an integrated research plan. For example, Florida Bay in the Everglades National Park is identified as the key to water quality downstream in the marine sanctuary. The post-storm research will further document interdependencies and foster an integrated regional approach to marine resource management in South Florida.

#### REFERENCES

Woodley, J.D. *et al.* 1981. Hurricane Allen's impact on Jamaican coral reefs. *Science* 214: 749-755.

Adapted from an article submitted to *Conservation Biology* by: John Ogden, Florida Institute of Oceanography, 830 First Street South, St Petersburg, Florida 33701, USA

#### Typhoons Omar and Brian: business as usual for Guam

Guam is frequently hit by intense typhoons, lying as it does in the centre of the monsoon trough in the Northwest Pacific Basin. It has been seriously hit by four major typhoons in the

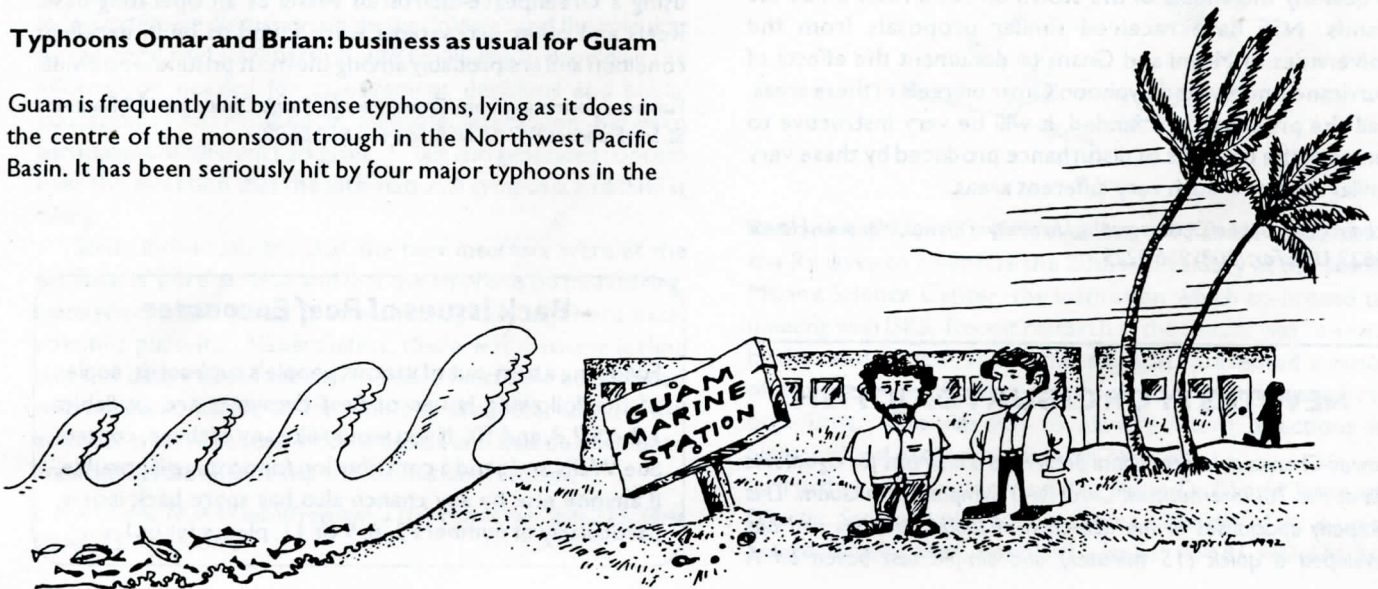
last 22 months (a record beaten only in 1968 when we had four major typhoons in 8 months!), the most recent being Omar and Brian. This is the only region in the world where there is no off-season. More than two thirds of all tropical storms here mature into typhoons which can strike at any time. In the last 27 years we have averaged 26 tropical storms a year with a maximum of 35 in 1967 and minimum of 17 in 1975 (John Spiers, *Pacific Daily News*).

The damage to coral communities from storms over the last 22 months is obvious, with extensive direct damage in the form of broken branching corals and toppled coral mounds. Landslides of gravel and boulders from the shore have caused what are probably long-term changes, and the plumes of sediment deposited by rivers and coastal development activities may cause delays in recruitment.

However, Guam's reefs have recovered in the past. When hit by more than one major typhoon per year, reef communities tend to take "two steps back and one step forward", but they eventually rebound. This is in major contrast to the Caribbean where major hurricanes are less frequent and where Knowlton *et al.* (1981) have documented reef organism mortality from secondary factors an order of magnitude greater than the direct effects of the hurricane. Stoddart (1974) also reported recovery to take decades. The reef communities of Guam generally seem to recover more rapidly, although the 'climax' community that we consider normal in Guam may be less topographically complex. Guam is surrounded by open-coast fringing reefs and the coral communities are normally exposed to heavy wave action. Although there are 267 species of scleractinians in the shallow waters, the general morphology of the community on the open coast is a flat pavement, a multispecies quilt that recovers fairly rapidly.

The same can be said for the human population on Guam. Our rather unattractive cement-block architecture is an adaptation to frequent typhoons and earthquakes. Our marine laboratory looks capable of withstanding a war, and has no large

Typhoon-adapted reefs, architecture and human population of Guam  
Illustration by Ovidio (Jun) F. Espiritu Jr.





picture windows, despite its position overlooking beautiful Pago Bay. It has withstood many typhoons and a 6.5 earthquake with no significant damage, except to the seawater system and from the secondary effects of power cuts. Our seawater pump and intake are down at sealevel and are affected by wave action even though not all of the typhoons in the region hit Guam. We are planning to get an inland well as a backup to our open coast seawater intake. The problem of power cuts has been solved by the acquisition of a 175KW generator that automatically clicks on at the start of a power cut, and served us well during typhoon Brian.

#### REFERENCES

- Knowlton et al. (1981). *Nature* 294:251-252.  
Stoddart (1974). *Proc. 2nd Int. Coral Reef Symp.* 2: 473-483.  
Charles Birkeland, Marine Laboratory, University of Guam, UOG Station, Mangilao, Guam 96923. Fax: (671) 734 6767.

### Hurricane Iniki: Kauai takes the blows again

The Hawaiian Islands were struck by Hurricane Iniki on September 11th 1992. Iniki was a force 4 storm packing sustained winds up to 145 mph (232 kph) with gusts to 175 mph (280 kph). Fortunately, only one island, Kauai, was in the direct path of the storm. Damage to the coral reefs on the south and west facing shores of Kauai was almost complete. Living reefs in these areas were virtually reduced to carbonate rubble except in small refugia that were afforded protection from storm waves by virtue of bottom topography, shoreline geography (such as points or bays), or offshore shoal areas that buffered waves. In areas fully exposed to storm waves, the successional process was virtually returned to time zero. The scale and magnitude of the disturbance was very similar to that produced by Hurricane Eva in 1982, also on Kauai.

Damage to coral reefs from Iniki on the other main islands in the Hawaiian Archipelago was much less than on Kauai. On exposed southwesterly-facing shores the magnitude of the disturbance became progressively less moving south-east down the chain away from Kauai. Richard Grigg and Steven Dollar have submitted a proposal to the US National Science Foundation to quantify the effects of the storm on coral reefs on all the islands. NSF have received similar proposals from the Universities of Miami and Guam to document the effects of Hurricane Andrew and Typhoon Omar on reefs of these areas. If all the proposals are funded, it will be very instructive to compare the patterns of disturbance produced by these very similar storms in such very different areas.

Richard Grigg, Dept of Oceanography, University of Hawaii, Honolulu, Hawaii 96822, USA. Fax: (808) 956 9225.

### NEW TEST FOR CIGUATOXIC FISH

Hawaii-Chemtect International presented a new test for ciguatoxic fish at the 7th International Coral Reef Symposium in Guam. This company specialises in the detection of food impurities and has developed a quick (15 minutes) and simple test based on a

immunoassay to identify the presence of lipid polyethers. The tests are expected to cost about US\$1 per sample. The following interesting morsels of information have been abstracted from their publicity.

There are around 27 different ciguatoxins, all of which are lipid soluble, acid-stable and heat-resistant. This means they cannot be destroyed by boiling, salting, drying, marinating or baking. Repeated exposure to toxins does not result in immunity but rather to greater susceptibility to them. Ecological disturbances on the reef cause the toxic organism, a dinoflagellate *Gambierdiscus toxicus* which normally lives under sand, to spread rapidly. Outbreaks of ciguatera often follow such disturbances and its incidence increased greatly in the South Pacific after World War II.

The availability of the test raises new liability issues for restaurants and other places serving seafood to the public. There are currently moves underway to develop testing protocols and standards for ciguatera in the United States.

Further information from: Catherine Goldsmith, Hawaii-Chemtect International, Pacific Center, P.O. Box 92015, Pasadena, California, 91109, USA. Fax: (818) 795 6032.

### SURVEY IN PALAU

A survey of the biological and cultural resources of the south-west islands of Palau took place in June 1992, as part of a series called the 'Rapid Ecological Assessment of Palau' which will ultimately cover the entire archipelago. Sponsors included the Republic of Palau, Greenpeace, The Nature Conservancy and the South Pacific Regional Environment Programme. The information will be used by the Republic of Palau as resource management and long-term development plans are devised.

The south-west islands are 200-400 miles southwest of the main Palau Islands and include six islands - Helen Reef, Tobi, Merir, Pulo Ana, Sonsoral and Fana. Documentation of the abundance, distribution and status of the natural and cultural resources of the islands and reefs was carried out by a team using a Greenpeace-chartered vessel as an operating-base. Reefs and other ecosystems were found to be in excellent condition and are probably among the most pristine worldwide.

Further information from: Greenpeace US Pacific Campaign, 139 Townsend St, San Francisco 94107, USA. Fax 415 512 8699.

### Back issues of Reef Encounter

Following a turn-out of various people's cupboards, copies of the following issues of *Reef Encounter* are available: 1,3,4,5,7,8, and 10. If you would like any of these, contact Sue Wells and send a contribution for postage if possible. If anyone else by any chance also has spare back issues, particularly of numbers 2, 6, 9 or 11, please let us know.



## MEETING REPORTS

### 7th INTERNATIONAL CORAL REEF SYMPOSIUM, GUAM

The 7th International Coral Reef Symposium was held in Guam 22–26 June 1992, hosted by the University of Guam Marine Laboratory and successfully organised by Chuck Birkeland and his committee, and attracted some 550 participants.

The meeting facilities were spacious but allowed easy movement between sessions, and the many social events were well planned, providing a festive atmosphere for casual interaction. The pre- and post-symposium excursions were enjoyable, despite (for many) typhoon-influenced weather that illustrated all too clearly the natural stresses that reefs and reef researchers often suffer! A minor complaint was the lack of interpretive guides or field manuals for these trips; perhaps the organizers of the 8th ICRS can take note of this and come up with something a little more educational for their excursions.

The symposium however was highly stimulating. Plenary talks set the stage for the central foci of the symposium. Bob Buddemeier kicked off thoughts on a global scale with his talk on 'Corals, climate and conservation', and Clive Wilkinson followed with 'Whether widespread extinction can be prevented through management practises'. Both pointed out the rapid changes that reef ecosystems have undergone in recent years and the role of coral reef science in dealing with the problem.

These talks led into early sessions on coral reef monitoring. Data from existing programmes paint a depressing picture of declining reefs worldwide. Equally depressing was the lack of basic environmental data to explain these trends and test hypotheses. For this reason, much time was spent discussing the design and implementation of coral reef monitoring programmes.

Sessions varied widely. First order scientific topics included reproduction, recruitment, genetics, bioerosion, behaviour, ecology and geology. More comprehensive approaches such as whole reef metabolism, reef responses to climate change, reefs as recorders of climate and the effects of disturbance brought together individuals of broader backgrounds.

The emphasis on monitoring, management and conservation led to extensive discussion on methodologies and the role that we, as coral reef scientists, should be playing in providing the information needed for management decisions and public education. This resulted in valuable interaction between participants of different backgrounds, but also generated concern over the direction that the international symposia and ISRS is taking.

Some individuals felt that the new interests were at the expense of 'pure' science and that the emphasis on monitoring, management and policy is in some way tainting more basic scientific pursuits. Nevertheless, there was a strong feeling that our desire to pursue basic science must now be balanced with our responsibility to contribute to the preservation of the ecosystem on which our work is based, and that our work has implications far outside our offices and laboratories.

*C. Mark Eakin, NOAA/Global Programs, 1100 Wayne Ave, Suite 225, Silver Spring, MS 20910, USA.*

### US-FRENCH CO-OPERATIVE RESEARCH ON CORAL REEF ECOSYSTEMS

An informal workshop was held on 24–25 September 1992 in Baltimore, Maryland, to discuss US-French collaboration in coral reef research that would complement current programmes.

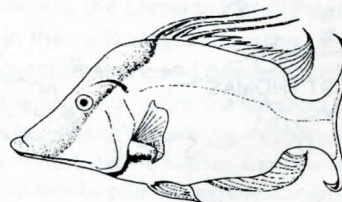
Six scientists and some administrators from each country discussed specific areas of scientific co-operation that will be conducted under an existing US-French bilateral agreement and agenda for scientific research.

The conclusions of the workshop will be used to develop proposals for submission to science planning and funding agencies in the two countries. From a 'menu' of potential activities, the group selected a subset of greatest mutual interest, importance and feasibility. These were:

1. The exchange of information, samples and scientific data to further systematic work on biodiversity;
2. A field programme to observe the impacts of natural and human-induced environmental stress by examining reefs with stress gradients;
3. A field study on calcium carbonate cycling and whole island budgets;
4. The exchange of data from existing monitoring programmes;
5. The development of protocols and systems for monitoring physical and biological parameters of coral reef ecosystems.

For more information, or copies of the report, please contact: *C. Mark Eakin, NOAA/Global Programs, 1100 Wayne Ave, Suite 1225, Silver Spring, MD 20902, USA. Tel (1) 301-427-2089, ext 291. Fax (1) 301-427-2073, OMNET: M. Eakin.*

### INTERNATIONAL SYMPOSIUM ON BIODIVERSITY AND ADAPTIVE STRATEGIES OF CORAL REEF ORGANISMS



This was held from 22–24 November 1992 at the University of the Ryukyus to celebrate the 20th anniversary of the Sesoko Marine Science Center, the institution which co-hosted the meeting with ISRS. Recent research at the Center was reviewed by the resident staff, and visiting scientists presented a variety of papers on biodiversity and adaptive strategies of reef organisms. The aim was to identify future directions for biological and ecological research on reefs.

Further information available from: *Dr Kiyoshi Yamazato, Director, Sesoko Marine Science Center, University of the Ryukyus, Sesoko, Motobu, Okinawa 905-02, Japan. Fax 81 980 474 919.*



## COUNTRY PROFILE

### US VIRGIN ISLANDS: SMALL ISLANDS BIG IN SCIENCE

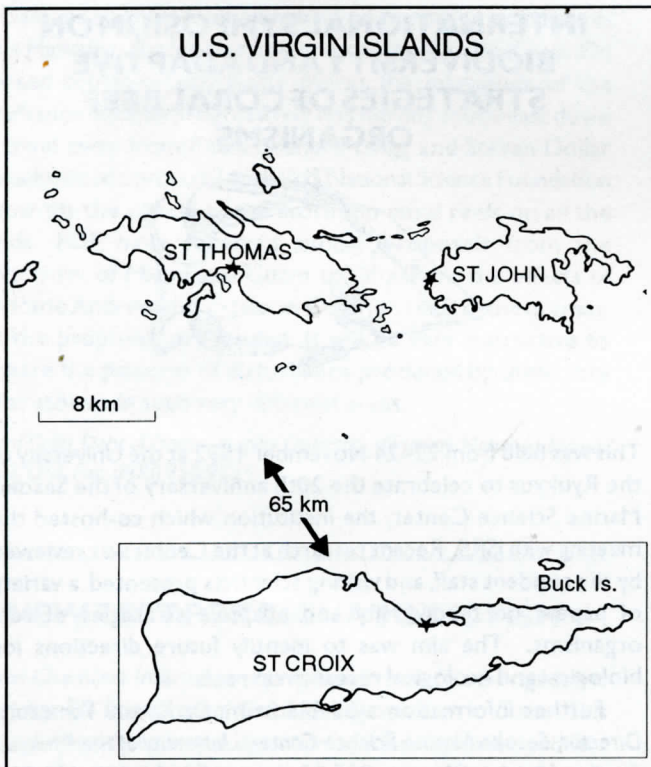
**James Battey, Elizabeth Gladfelter, Cynthia Grippaldi, Raymond Hayes, Norman Quinn and Marcia Taylor**

The US Virgin Islands is a United States territory and so not strictly a country in its own right. However, the islands warrant a separate country profile because of the importance and quantity of reef research being undertaken there. Although small, they are a veritable hotbed of activity, and all three main islands, St Thomas, St Croix and St John have groups of active reef scientists and managers.

With such a volume of activity, this profile cannot document all ongoing projects or do justice to past achievements. However, it is hoped that it will at least provide some of the flavour of what is going on. Since the territory is so small, the reef fraternity are close knit. None of the projects exist in complete isolation from others and collaborative activity has been the key to productivity.

#### St John – where it all began

Studies in the US Virgin Islands have been at the cutting edge of reef research since the 1960s. Early work centred on the Virgin Islands Ecological Research Station (VIERS) at Lameshur Bay on St John, deep within the Virgin Islands National Park and Biosphere Reserve (described below). VIERS was set up by the College of the Virgin Islands (now the University of the Virgin



Islands (UVI)) on a shoestring budget. Jack Randall's studies of artificial reefs pioneered experimental manipulation of reef communities. VIERS was later chosen by NOAA for its Tektite I and II 'Man in the Sea' programmes in the late 1960s and early 1970s. Aquanauts spent a month in an underwater habitat extending the limits of endurance diving and knowledge of how reef communities were put together.

VIERS has played host to marine scientists ever since, including a spell in the 1980s as the site for the School for Field Studies. However, in collaboration with the National Park, the University has recently redefined the emphasis of the station from research to environmental education, renaming it the Virgin Islands Environmental Resource Station. Marine research will continue though and interested scientists should contact Cynthia Grippaldi at the address below about using the facility.

#### St Croix - a phoenix from the ashes?

The West Indies Lab on St Croix was probably one of the most important facilities for reef research in the Caribbean from its opening in 1971 until its untimely and much lamented closure in 1990, a casualty of Hurricane Hugo. In addition to a strong staff, the lab supported research by many scientists of international repute throughout its existence.

Although the West Indies Lab has been officially closed for two years and access denied to its buildings and equipment, a glance at research underway in St Croix will show that it still lives on very much in spirit if not in structure. Current projects include detailed studies of fish behaviour and recruitment by Bob Warner, Peter Sale, Chris Petersen, Ray Clarke and others. Josh Nowliss is just finishing a study of gorgonian defences to mollusc predation and Dennis Hubbard continues work on sedimentation and reef geology. Hurricane Hugo's spanner in the works produced some good study topics: Heine Zankl is looking at Hugo's effects on reef diagenesis, and Betsy Gladfelter, and John and Mary Bythell are taking advantage of this major disturbance in their monitoring study of coral population dynamics at Buck Island. The latter forms part of a US National Park Service coral reef assessment project being undertaken jointly with Caroline Rogers (research scientist with the National Park) in St John and others in Florida.

Gone but not forgotten, the West Indies Lab may be set for a revival. In a series of events not far removed from Shakespearean farce, the lab was sold by Fairleigh Dickinson University to a European countess building her castle on a hill close by in St Croix. The contract was signed in an air of secrecy days before the University of South Carolina expressed interest in taking the lab over. Persistence and perseverance have prospered and USC now has plans for a new lab at either of two possible sites within striking distance of the old lab, if only potential donors can be wooed. Fingers crossed!

#### St Thomas - a new centre for research

St Thomas is home to the University of the Virgin Islands Department of Marine Science and Eastern Caribbean Center, the government departments of Planning and Natural Resources



and Division of Fish and Wildlife (also present on St Croix), and the independent Island Resources Foundation. Perhaps one of the most notable recent events on the research scene here has been the opening of the UVI MacLean Marine Science Center in February 1992. The centre forms not only a focus for undergraduate training in marine science for the eastern Caribbean but also hosts visiting faculty and research students. Mark Hixon from Oregon State University has brought his research group to St Thomas since the mid 1980s to work on fish inhabiting artificial reefs, a collaborative study with Jim Beets, formerly of the Division of Fish and Wildlife. The center has extensive lab and boat facilities and anybody interested in using them should write to Ray Hayes at the address below. Plans are now underway to turn this facility into a center of excellence within the Caribbean region.

### Reef disturbances - a natural laboratory

The Virgin Islands have suffered their share of environmental crises, but full advantage has been taken to research these and develop a better understanding of them. In addition to the studies described above, Hurricane Hugo spawned other projects. Pete Edmunds, formerly of the School for Field Studies at VIERS, and Caroline Rogers are still studying a Hugo interruption in a long-term study of coral populations on St John. Bill Gladfelter has been doing a long-term study of gorgonian communities on St John, while in St Thomas, Teresa Turner of the Marine Science Center has begun a study of Hugo effects on seagrass and conch populations with Norm Quinn.

Aside from Hugo there have been mass die offs of *Diadema* sea urchins and coral from disease. Even several years after the coral die off, research by Barbara Kojis and Norm Quinn reveals no significant recolonisation.

The Virgin Islands have not been slow to realise the importance of studying global warming and climate change. Ray Hayes, the new Acting Director of the Marine Science Center, is studying ocean thermal anomalies and coral bleaching. Jim Battey, from the same department, is investigating lipid storage by corals and plans to extend the study soon to look at the effects of bleaching on energy reserves.

### Conservation and management

The Virgin Islands, termed 'America's Paradise' on license plates, is suffering the same problems in microcosm facing regions with coral reefs elsewhere. Fortunately, the resources available for research are greater and qualified scientists are more numerous than in many other countries. The strong basis of fundamental research that has been established has been used to advantage in the more practical problem-solving studies. Limited facilities in other regions often constrain such partnerships, and the work underway here can perhaps help to provide an understanding of similar problems elsewhere.

Environmental problems in the Virgin Islands owe much to the rapid development taking place. This has been the main cause of increasing sediment levels and elevated nutrient concentrations in the surrounding ocean. No one is sure how much this has contributed to the decline of reefs in the area,

but it is certainly not helping them to recover from recent natural disturbances.

A number of groups are charged with tackling questions of environmental management. The Island Resources Foundation, under the direction of Ed Towle, has been undertaking studies of the territory's natural environment for the past 20 years. Its most recent major project has been an ongoing study of 18 'Areas of Particular Concern' (APCs), many of which are under threat of development, carried out jointly with the Virgin Islands Marine Advisory Service of the university. The APC study is a critical element of the territory's coastal zone management program, and seeks to develop management plans for these areas of great ecological significance.

The Virgin Islands National Park on St John has been a recognised leader in initiating studies of environmental deterioration. Aside from numerous studies taking place within the park's waters, they were instrumental in setting up the Virgin Islands Resource Management Cooperative in 1982 with a grant of \$600,000. This grouping of governmental and non-governmental organisations produced an important series of research reports between 1986 and 1988 when the original funding dried up. The Island Resources Foundation is currently seeking to resurrect this grouping.

Fisheries have been undergoing serious declines in the Virgin Islands, partly from overfishing and partly from the gradual deterioration of the reefs. This has spurred the Division of Fish and Wildlife, in collaboration with the National Park, to undertake an assessment of their current status within park waters; a similar effort is badly needed outside the park. A project based at the Eastern Caribbean Center of the university is currently experimenting with restocking Nassau groupers using hatchery-reared fish.

Jim Beets, while chief fishery officer at the Fish and Wildlife Service, was instrumental in getting legislation tabled to set up a series of over twenty marine fishery reserves in St Thomas and St John. Unfortunately, this ambitious plan has been stalled for a year on the governor's desk awaiting the inclusion of St Croix. Crucian fishermen remain to be convinced that it is a good idea but are said to be coming round to it. Don't hold your breath though. Meanwhile, the Department of Planning and Natural Resources is in the early stages of setting up a territory-wide system of protected areas and hopes to start with the Salt River Canyon in St Croix, once the location of Hydrolab.

The people who have helped compile this are too numerous to mention individually. However, LaVerne Ragster, Caroline Rogers and Barbara Kojis were particularly helpful. We extend our apologies to the many people and groups who have not been mentioned. Space limitations would not allow us to expound on many of the other important activities taking place in the US Virgin Islands.

*Jim Battey, Norman Quinn (Eastern Caribbean Center) and Raymond Hayes, Marine Science Center, University of the Virgin Islands, St Thomas, US Virgin Islands 00802, USA. Fax: (809) 779 6104.*

*Marcia Taylor, Eastern Caribbean Center, Univ. of the Virgin Islands, Kingshill, St Croix. Fax: (809) 777 8701.*

*Cynthia Grippaldi, VIERS, P.O. Box 250, Cruz Bay, St John, US Virgin Islands, 00831, USA. Fax: (809) 776 6645.*

*Elizabeth Gladfelter, P.O. Box 26472 GBS, St Croix, US Virgin Islands 00824, USA.*



## BOOK REVIEW

### The GREENPEACE Book of Coral Reefs

Sue Wells and Nick Hanna

Available in USA, Canada, Australia, New Zealand, Mexico, Philippines, and associated dependencies from: Sterling Publishing Company Inc., 387 Park Ave South, New York, NY 10016-8810, USA (Fax 212-213-2495), price US\$29.95; and in other parts of the world from: Cassell plc, Stanley House, 3 Fleets Lane, Poole, Dorset BH15 3AJ, UK, price £16.99. ISBN 0-7137-2347-5

For further information contact: Greenpeace Pacific Campaign, 139 Townsend St, San Francisco, CA 94116, USA. Fax 415 512 8699.

From the opening chapter, 'The Life of the Reef', through to its closing section, appropriately entitled 'Hope for the Future', the *Greenpeace Book of Coral Reefs* provides a thorough, comprehensive and balanced review of what is happening to coral reefs around the world. The 160 pages are a collection of information, images and examples of what concerned reef scientists would like the rest of the world to be aware of. All this is written and presented in a manner to be interesting, readable and comprehensible for the general public, which is the audience for which the book appears to be primarily targeted, and rightly so. Nevertheless, even hard core 'coral heads' will appreciate this first ever reef book dedicated to exploring what modern man is doing to the natural systems we so love to study, why this is happening and what needs to be done.

The initial chapter is a concise overview of what reefs are all about, with a good collection of verbal and photographic images, leaving the reader impressed with the diversity and vitality of reefs and reef organisms. A few appropriate diagrams would have aided the description of coral anatomy, reproduction, coral types and reef structure, particularly given the target audience. Nonetheless, what is important is that this is only the beginning of a much more important task – describing the interaction of humans with coral reefs. This is taken up in the next chapter, 'People and Reefs', which outlines our involvement with reefs, stressing the importance of coral reefs to those communities living adjacent to them and dependent on them and the use and values of reefs for science and medicine.

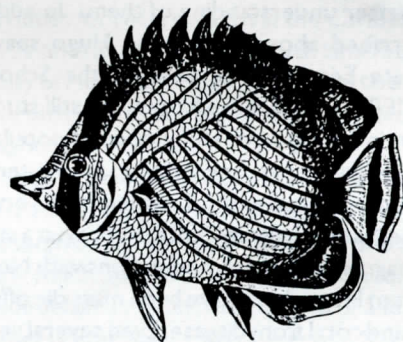
The forces of change on coral reefs are reviewed in 'Vulnerability and Resistance', which includes a balanced treatment of complex topics such as bleaching, sea level rise, climate change, ciguatera and COTS. The critical issue of human use of reefs and adjacent ecosystems and the effects of such use on reef health, resiliency and recovery is highlighted. This theme is dealt with in more detail in the chapters 'Development and Pollution', 'Harvesting the Reefs' and 'Reefs and Tourism'. These chapters continue to provide a thorough and balanced overview of complex issues, as is to be expected from the knowledgeable authors, with well-chosen examples and illustrations. Although detailed recommendations on how to tackle the problems cannot really be treated in an 'awareness raising' book of this sort, the importance of considering the environmental effects of development on or adjacent to reefs and the critical role of local communities and reef users is stressed.

The final chapter does indeed present 'Hope for the Future' with success stories from around the world to indicate how increasing population, development, resource harvesting and tourism can be compatible with sustained use of and healthy reefs. This is followed by brief, practical tips for snorkelers, divers, boaters, tourists and consumers on 'How You Can Help'. Overall, the book is highly recommended to inform and educate anyone and everyone, from uninformed citizen to hyper-busy reef scientist, about what is happening to the world's coral reefs and what needs to happen if 'healthy' reefs are to continue to be a part of our world.

Paul Holthus, East West Center Environmental Programme, Honolulu, Hawaii.

## BOOK SHELF

### MALDIVIAN FISH BONANZA!



For those wanting to identify the fish of the Maldives, there has been little available until the last five years or so, since when Allen and Steene's *Reef Fishes of the Indian Ocean* and Anderson and Hafiz's *Common Reef Fishes of the Maldives* (Volume 1) have been published. Most earlier works skirted the periphery of the region with varying degrees of overlap (and quality of presentation). Three more books have recently hit the shelves: the two reviewed here and the second volume of Anderson and Hafiz's book. The Maldives can now be considered as well and truly on the ichthyological map!

### DIVER'S GUIDE TO FISHES OF MALDIVES

John E. Randall

Immel Publishing, UK. 1992. 193 pp. ISBN 0-90-151-53-1. £23.95 (paperback).

Randall's book is aimed primarily at divers and laymen as the title suggests. In deference to this audience he has pruned species' descriptions to a minimum and omitted almost all of the meristic data to be found in his other books. This slightly reduces the value of the book to scientists (although these days such data are rarely needed as few people actually catch fish to identify them). However, the quality of the photographs is as excellent as ever: 400 species likely to be seen by divers are covered in 475 colour plates. The book should serve its stated purpose admirably, is handy in size and well-produced in the tradition of Immel's high quality publications. The only substantive criticism is that within families, species have been arranged



alphabetically. This separates some which are morphologically very similar and could be confused (such as *Chaetodon auriga* and *C. vagabundus*).

#### GUIDE TO SELECTED FISHES OF THE MALDIVES

*Don E. McAllister, Charles Anderson and Noel Alfonso*  
International Centre for Ocean Development, Halifax, Canada.  
1992. 92 pp. ISBN 0 662 19309 1. Available from Marine  
Research Section, Ministry of Fisheries and Agriculture, Republic  
of Maldives.

The scope of this book is much more modest than Randall's, covering fifty species from seven families (Carangidae, Holocentridae, Lethrinidae, Mullidae, Serranidae and Sphyrnidae), but the authors note that in the future they hope to add further species to the book. Its wipe-clean loose-leaf plastic binding will make this especially easy and is a nice idea. The binder itself has space for about another 100 species.

The book is aimed to be used by people collecting fisheries statistics in the Maldives and should serve this purpose well as it includes the most commercially important reef fishes. There are some very fine diagrams illustrating the salient features of each family, and each species is illustrated with a colour photograph. The photographs are unlikely to appeal to the diving fraternity as many rather accurately depict the gaping death throes of the various species. This will, however, make life easier for those faced with a deck full of fish. A lot of useful information is presented on the species including commercial use and catching methods. However, the authors will have to tighten up the identification notes for future sheets. In this edition no less than eight species of emperor can be 'distinguished from other Maldivian emperors by cheek without scales'. This doesn't count as much of a distinguishing feature!

#### FIELD GUIDE TO ANEMONEFISHES AND THEIR HOST SEA ANEMONES

*Daphne G. Fautin and Gerald R. Allen*  
Western Australian Museum, Francis St, Perth, WA 6000,  
Australia. 1992, 160pp. ISBN 0-7309-5216-9. Available from  
the above address at A\$30 + A\$7.50 postage and handling  
(Australia) A\$15 (overseas).

Anemonefishes must be one of the most written-about reef fish families and much of the writing has been done by Gerry Allen, whose lifelong fascination with these beautiful creatures is very evident in this latest publication. He has produced two previous books on anemonefishes, and one on damselfishes (see last issue *Reef Encounter*) which also covers them. This book is somewhat different in that it emphasises the anemone side of the symbiosis (a welcome change), combining Allen's talents with those of Daphne Fautin, the senior author. The book is beautifully designed and provides simple keys for identifying both anemones and anemonefishes and information on the geographic distribution of each species. The anemone section has a nice pictorial guide for each species, showing which anemonefish inhabit them. There are also photographs illustrating all the species, most of which are very good and some truly stunning. The book includes sections on the behaviour and ecology of anemonefishes and anemones, and on their aquarium care. It is very handy in size (16.5 x 24cm) and will no doubt appeal equally to divers and scientists alike.

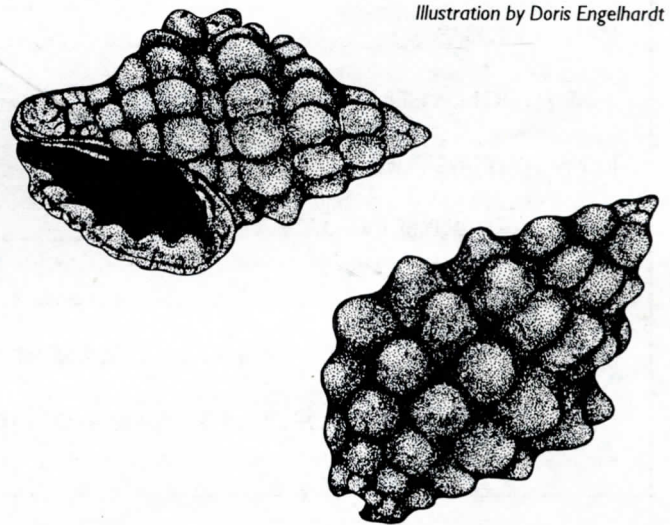
## ANNOUNCEMENTS

### DRUPELLA: HAVE YOU SEEN THEM?

*Drupella* spp. are small corallivorous snails. Populations are so well hidden among corals that they are rarely noticed. Consequently, although they are thought to be widespread around the Indo-Pacific, reports are scarce and their distribution is not known. *Drupella* potentially play a major role on Indo-Pacific coral reefs because, like Crown-of-Thorns starfish, they occasionally form feeding aggregations that kill large parts of coral reefs. Several aggregations have been observed around the Indo-Pacific, and reports from Western Australia and Japan have shown that these can be extremely destructive.

There are several species, all similar in appearance. The illustration shows *Drupella rugosa*. Adults are 2-3 cm long, knobbly and usually covered in the pink calcareous alga that grows on dead coral branches. This makes them more irregular in appearance than in the drawing. The pink alga provides good camouflage among coral branches and the shells can be very hard to detect.

Illustration by Doris Engelhardt



The best way to find *Drupella* is by their feeding scars on corals, which are patches of bright white skeleton. After a few days, these become dull and less obvious as algae start to grow over them. Large scars, the result of many days feeding, are often banded in appearance with a gradation of algal growth from one side to the other. *Drupella* do not like crawling on live coral tissue so they are found attached to dead skeleton, often on or near feeding scars, or in reef crevices or rubble. They feed at night and are much easier to see during a night dive.

To determine the distribution of *Drupella* in the Indo-Pacific I need your help. If you have seen any at all (not just big aggregations) or would like more information about them, please contact me:

*Ms Robyn Cumming, Associate Lecturer, Department of Marine Biology, James Cook University of North Queensland, Douglas 4811, Townsville, Queensland, Australia. Tel (61)-77-81-4626/4345; Fax (61)-77-25-1570. E-Mail: mbrlc@marlin.jcu.edu.au*



## DO YOU TEACH A COURSE ON CORAL REEFS?

While numerous courses on coral reefs exist, there is no medium through which prospective students can search for them. Additionally, people teaching coral reef courses have expressed an interest in corresponding with colleagues to exchange course materials and ideas.

The Flower Gardens National Marine Sanctuary, in conjunction with the Texas Sea Grant Program, has therefore taken the initiative of compiling a list of courses specifically

aimed at coral reefs. Copies of the resulting booklet will be available through the sponsoring institutions. Please note that for this first edition, we will be unable to list related general courses such as those aimed at carbonate geochemistry and tropical marine biology.

The survey forms (please photocopy the form below) should be completed and sent to: *Randy Runnels, c/o Flower Garden Banks National Marine Sanctuary, 1716 Briarcrest Drive, Suite 702, Bryan, Texas 77802, USA.*

Please respond promptly to ensure that your information is included.

### CORAL REEF COURSE SURVEY

COURSE TITLE: \_\_\_\_\_

INSTRUCTOR(S): \_\_\_\_\_

UNDERGRADUATE, GRADUATE, BOTH OR OTHER LEVEL: \_\_\_\_\_

CREDIT HOURS: \_\_\_\_\_

INSTITUTION WHERE OFFERED: \_\_\_\_\_

HOW OFTEN IS THE COURSE OFFERED: \_\_\_\_\_

DOES THE COURSE INCLUDE A LAB? \_\_\_\_\_

FIELD WORK? \_\_\_\_\_

INSTRUCTOR WILLING TO EXCHANGE COURSE MATERIALS? (YES/NO) \_\_\_\_\_

DESCRIPTIVE ABSTRACT OF COURSE (not to exceed 100 words):

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

CONTACT (name and address) FOR COURSE INFORMATION:



## A 'SCIENTIFIC CODE OF ETHICS'

The University of California Research Expeditions Program, a public research participation programme providing exchange opportunities between scientists, educators, the public and counterparts in host countries, has drawn up a code of ethics for scientists working in developing countries. It was described in **Conservation Biology** (Vol.6, 1992, pp.310-311) and is reproduced here as, although not applicable to all situations, its aims may have general validity for many reef scientists working in the tropics.

1. Hire local people as field assistants. With their knowledge of the area, they have the potential of being the best long term monitors and managers of protected areas. Include students and teachers as they are important links to the community.
2. Contact appropriate local authorities if research is in an area with an indigenous organization. Even if such permission is not required at a national level, making this contact will help avoid local resentment and worse.
3. Find out what local people know about the subject. Indigenous knowledge is a valuable resource too often ignored. Acknowledge this resource and, where appropriate, ensure compensation.
4. Be aware of and respect local customs.
5. Help develop educational outreach programs and interpretative centers that include your research results and reflect the knowledge and values of indigenous cultures; they can be used both by visitors and the local community.
6. Write up results in the local language and make copies or at least summaries available to relevant national and local agencies, including environmental organisations.
7. Visit the local school – often the best link to the community in rural areas - to describe the work so that people know what you are doing in their area. Lack of communication often leads to wildly (and sometimes dangerously) distorted views of what is really being done.
8. Lecture at the local university.
9. Offer to do a public presentation to other visitors and colleagues if working at a reserve or national park. Such presentations often help raise much needed funds for reserve or park maintenance.
10. Include graduate students from national and regional universities in the research.
11. Share the results of the research with and help train local guides.
12. Provide duplicates of specimens to national institutions as well as local educational centers, interpretative centers at reserves, etc.
13. Take copies of pertinent journals or recent publications as gifts for libraries and colleagues abroad. Subscription and purchase costs may be prohibitive for those in developing countries.

14. Make a video or slide collection on the research to be left for the local community, other scientists or visitors to the area. These resources are especially useful in describing areas which may be off limits to visitors in certain reserves.
15. Suggest economic activities that use natural resources in a sustainable way.
16. Represent local interests to national governments and ensure that local people are an integral part of the development of any management plan.
17. Observe standard wilderness conduct. Take out what you take in; minimise your disturbance of the area.

Further information from: *Jean G. Colvin, University Research Expeditions Program, University of California, Berkeley, CA 94720, USA.*

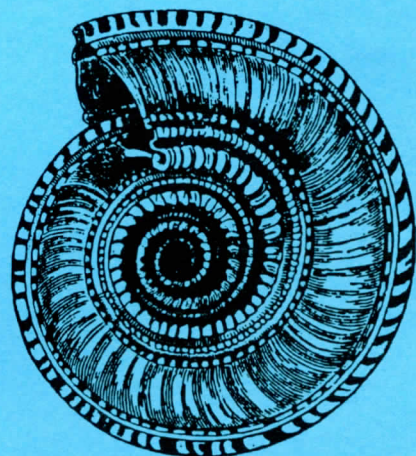
---

## NEW WORKING GROUP ON THE IMPACT OF COASTAL DEVELOPMENT ON CORAL REEFS

At the 7th International Coral Reef Symposium in Guam, a meeting was organised by Jim Maragos, Paul Holthus and Michel Porcher for those interested in the issue of coastal development in reef areas and how its impact might be mitigated. Those present agreed that the establishment of a working group, to operate within the framework of ISRS, would be a useful start. The main objectives of such a group would be to:

1. Improve communication among reef scientists working on the impact of development on coral reefs,
2. Improve communication between reef scientists, planners and engineers, and
3. Improve the availability and dissemination of information on methods to reduce the impact of coastal development on coral reefs.

Suggestions and proposals for topics to be addressed are being sought. If you can contribute and would like to join the group, please contact: *Michel Porcher, CETE Mediterranee, B.P. 37000, 13791 Aix en Provence Cedex 3, France. Tel (33) 42 24 76 76 – Fax (33) 42 24 77 98 or Jim Maragos, East-West Center, Program on Environment, 1777 East-West Road, Honolulu, Hawaii, 96848. Fax: (808) 944 7298.*





# DIARY

See ISRS News section (p.5) for forthcoming meetings co-sponsored by ISRS.

### 3-7 April, 1993, Guangzhou, China

#### THE SECOND INTERNATIONAL CONFERENCE ON THE MARINE BIOLOGY OF THE SOUTH CHINA SEA

Sponsored by the Marine Biology Research Station at Dayawan, the South China Sea Institute of Oceanology, the Chinese Academy of Sciences and the Guangdong Society of Oceanology and Limnology. Themes for the meeting include marine resources and fisheries, marine fouling, estuary and bay ecosystems and human impact, and marine environmental monitoring, pollution and conservation. Further information from: Mr Cai Guoxing, South China Sea Institute of Oceanology (SCSIO), 164, West Xin Gang Road, Guangzhou 510301, People's Republic of China; or The Marine Biological Association of Hong Kong, c/o Department of Zoology, University of Hong Kong, Hong Kong.

### 19-23 July 1993, New Orleans, Louisiana

#### COASTAL ZONE 1993: 8TH SYMPOSIUM ON COASTAL AND OCEAN MANAGEMENT

In addition to the permanent theme of these symposia: 'A Spotlight on Solutions', there is a specific theme in 1993 of 'Healing the Coast' which will provide a focus on existing and new scientific and management tools designed to improve the health of coastal and ocean resources. A number of topical sessions will be of interest to reef researchers and managers, such as maritime marine/coastal parks, museums and aquariums, coral reef processes, and coastal management. Further information from: Orville Magoon/Gail Oakley, Coastal Zone Conference Headquarters, P.O. Box 279, Middletown, CA 95461, USA. Fax (707) 987-9351

### 4-8 July 1994, James Cook University, Townsville, Australia.

#### PACON '94. 6TH PACIFIC CONGRESS ON MARINE SCIENCE AND TECHNOLOGY

The biennial PACON congresses bring together scholars and resource people to discuss key issues concerning marine technology related to the economic potential of the ocean in the region from a multi-disciplinary perspective. The 1994 meeting will be held under the auspices of the Australian Marine Sciences Association and other organisations. Technical papers will be presented on a number of themes, and there will be workshops on topics such as global positioning systems, mapping and Pacific Basin Marine Science Organisations. The registration circular will be mailed in mid 1993 to those completing a pre-registration form. It is planned to hold a joint ISRS/Australian Coral Reef Society meeting following the Congress (see Society News). Further details are available from: PACON '94 Organising Committee, c/o Sir George Fisher Centre for Tropical Marine Studies, James Cook University, Townsville, Qld 4811, Australia. Fax: 61 77 755429.

# NOTES FOR CONTRIBUTORS

The aim of Reef Encounter is to provide a magazine-style newsletter on any aspect of reefs, the livelier the better. In addition to news, meeting and expedition reports and announcements, we aim to have discussions and debates about particular issues concerning ISRS or the broader field of reef science in general. Reef Encounter does not publish original scientific data, so please do not submit such papers. The newsletter aims to complement the journal which carries scientific papers only, in that it provides an outlet for book reviews, discussion of papers in the journal and a correspondence column (Upwellings). It also carries short reviews of recent trends and developments in reef research or events that bear on reef studies. In the tradition established by the first editor, Reef Encounter 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 material will not normally be refereed or returned for corrections. Opinions expressed and errors of fact will have to remain largely the authors' responsibility. No published item should be taken as ISRS opinion unless indicated.

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

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

### DEADLINE FOR COPY FOR REEF ENCOUNTER 13 (due out July 1993) IS MAY 1ST 1993.

Please send copy to Callum Roberts at Eastern Caribbean Center University of the Virgin Islands St Thomas US Virgin Islands 00802 USA

Phone: +809 779 6103 Fax: +809 779 6104

Sue Wells  
56 Oxford Road  
Cambridge CB4 3PW  
UK

Produced by: The Nature Conservation Bureau, 36 Kingfisher Court, Hambridge Road, Newbury RG14 5SJ, UK.

Printed on recycled paper.

## APPLICATION FORM FOR MEMBERSHIP

Name:.....

I/we enclose a cheque (in US\$ ONLY please) of:

Address:.....

- ..... US\$60 for FULL membership
- ..... US\$10 for STUDENT membership
- ..... US\$70 for SPOUSE membership

.....

.....

Title:.....

Cheques to be made payable to:  
INTERNATIONAL SOCIETY FOR REEF STUDIES

Fields of interest:.....

Send completed application form and your cheque to:  
Dr Daphne Fautin, Treasurer, Kansas Geological Survey,  
University of Kansas, Lawrence, Kansas 66045-2106, USA.