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REEF ENCOUNTER

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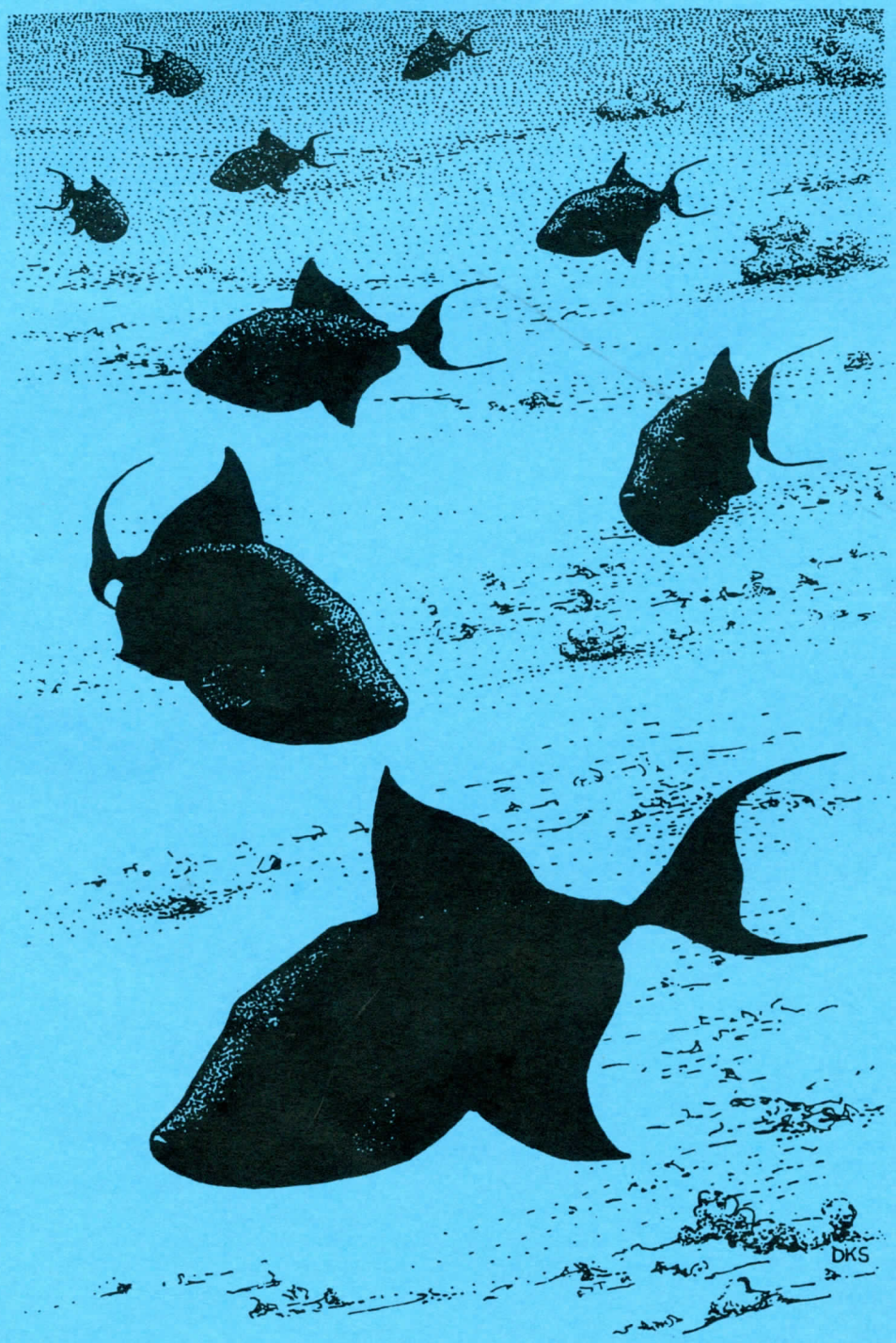

REEF ENCOUNTER No. 17 April 1995

NEWSLETTER OF THE INTERNATIONAL SOCIETY FOR REEF STUDIES

Editor Sue Wells
Associate Editor Callum Roberts

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*Cover: Nesting triggerfishes. Female triggerfish (*Odonus niger*) care for eggs within the territory of a single male. Though females are responsible for all care they compete for the attention of territorial male during periods of highly synchronised breeding activity. Illustration by Dafila Scott and used with her permission.*

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.

EDITORIAL

We apologise for the late arrival of this issue of *Reef Encounter*, but are pleased that it has at least come out in what is still 'spring' in many parts of the world. The delay was partly because we wanted to be able to announce the results of the ISRS election and welcome the new officers to the Society. Our new President leapt into action immediately as the contents of this issue will show.

The delay was also due to our dogged insistence on providing information to the readership on the plethora of meetings and coral reef 'initiatives' that are being planned for the next year or two. Many (perhaps even the majority) are being organised by or with the assistance of ISRS members. However, it has been very difficult to obtain updates on several of these activities. *Reef Encounter* is produced to keep the reef science, and increasingly management, community informed of such developments. The editors often receive enquiries of this nature, particularly if a topic has been previously mentioned in the newsletter. So, to our regular contributors who do seem to bear these points in mind, thank you. To others, a plea - if you are planning a meeting or activity of interest to a wide audience (and if your meeting is prefaced with the word 'International' it has to be!), please send the details for inclusion in the newsletter, even if it is only a preliminary notification. Similarly, once the meeting has taken place, please send a short report on what took place and share what was achieved with those who were unable to participate.

There is another important reason for sharing information about meetings and initiatives at an early stage in their planning: avoiding duplication. Many of the activities reported in this issue superficially look rather similar. Whether they turn out to be duplicating each other will depend on close collaboration between the organisers to ensure that each one has its own clearly defined objectives.

Finally, a point of concern that has been raised by a number of people - are meetings, 'anecdotal' status reports, and initiatives really the best way to spend scarce financial and human resources on coral reefs? On the positive side, this rash of activity denotes a genuine concern on the part of international agencies and national institutions to 'do' something about the state of the world's reefs. But for anyone involved in trying to raise money to carry out research and monitoring or to implement even simple management procedures, it can be depressing to see so much money and time tied up in this way. Belize is a case in point: for at least six sites on the Barrier Reef, the groundwork has been done to create new marine protected areas, but unless funding is found to set up management structures for them, their implementation will remain as theoretical as it seems now. Similarly, major efforts have been expended in bringing in consultants to advise on monitoring programmes, but unless funding is made available to train people to carry out the monitoring, this too will remain a distant goal. International meetings on management and monitoring will be of little use to Belize, if the problems of too little money and too few trained people are not resolved at the same time. If the forthcoming initiatives can start to tackle these fundamental problems, they will have been worthwhile. What is critical is that organisers and participants press hard for 'new' money to be made available to follow up on recommendations. Without that commitment, our efforts may turn out to be counterproductive in the end.

Sue Wells
Callum Roberts

COPY DEADLINE FOR REEF ENCOUNTER 18 (due out October 1995) IS AUGUST 31st 1995

ISRS COMMENT

FROM THE PRESIDENT

John Ogden

On behalf of the new officers, I am honoured to make my first report to you as ISRS President. I am pleased to say that, thanks to the outstanding leadership of our departing President, Bernard Salvat, assisted by Rene Galzin, Secretary, and Daphne Fautin, Treasurer, our Society is in great shape. Our membership, at over 600, stands at its highest point since our founding. We have professional management of our mailing list and dues collection permitting improved mailing of bills and notices, dues payment by credit card, and tax exempt status in the US. *Coral Reefs* is the most cited of 52 marine and freshwater biology journals in the Science Journal Citation Reports. We have a new contract with Springer Verlag, including a financial arrangement which permits greater latitude in financial planning. Finally, we have a substantial cash reserve. We are fortunate that two key members of the team that directed this progress will be returning.

It is well to review the events which led to this transformation. In early 1992, we were very loosely organised under an outdated Constitution. The election of that year was challenged on several grounds, creating a constitutional crisis which was resolved by our leadership, who directed the drafting of a new Constitution. We now operate in a much more professional way which will serve us well as we grow into the future. I am particularly grateful to my opponent in this election, Patricia Hutchings, who was president-elect in 1992 and who unselfishly and graciously stepped aside to stand for new elections under the new Constitution. Another major transition will be the election for 50% of the Council in December 1996.

The next two years will be exciting and important for reef science. The ISRS is an internationally recognized focal point for excellence in research and will be called upon for leadership in the application of science to resources management and in the education of managers and policy-makers, two critical steps leading to the sustainable use of reef resources. Important milestones ahead are the Reef Symposium in Panama in June 1996 and potential actions

arising out of the International Coral Reef Initiative (ICRI) after the upcoming meeting in the Philippines this May. We must sustain and enhance our unique internationality by promoting regional meetings, such as the September meeting in Newcastle and others in Australia, Asia, and the US. We must concentrate on attracting young scientists as members, particularly those from developing nations, to build the ISRS leadership of tomorrow. We will examine alliances with other scientific societies and non- governmental organizations engaged in mutually compatible research and conservation efforts.

I am humbled by the trust which you have put in me and I pledge to work hard to sustain the momentum, enthusiasm, and progress of the past few years. With the able assistance of Callum Roberts, Corresponding Secretary, Steven Miller, Recording Secretary, our indefatigable *Reef Encounter* editor, Sue Wells, and the growing global connections of the Internet, I look forward to frequent and close communications and guidance from my fellow officers, the Council, and the membership.

ISRS NEWS

ISRS ELECTION RESULTS

There was an enthusiastic response to the recent vote for new officers of ISRS and support was spread broadly across the candidates. A total of 264 votes were received; 6 were from members not paid up, 5 had no name and could not be checked and 7 people submitted two votes in error. The results of the voting were as follows:

PRESIDENT	Patricia Hutchings	102
	John Ogden	142
	Spoiled ballots	2
VICE PRESIDENT	Rene Galzin	103
	Ken Sebens	65
	Charlie Veron	75
	Spoiled ballots	3

CORRESPONDING SECRETARY	Callum Roberts	213
RECORDING SECRETARY	Steven Miller	212
TREASURER	Daphne Fautin	229

Clive Wilkinson, Returning Officer
Bernard Salvat, Immediate Past President ISRS

TREASURER'S REPORT

The 1994 budget (*Reef Encounter* 15, p.5) anticipated expenses of US$32,000 and income of US$36,000. Total expenses were as budgeted, although the categories were not precisely as anticipated (the audit cost less and we did not pay for *Reef Encounter* 16 in 1994). The subsidy from Springer was less than in previous years due to the exchange rate, but since this is dispersed among the four editors of *Coral Reefs*, there was no net effect. Income was higher than anticipated for three major reasons:

i. Profits were not expected from *Coral Reefs* because the new agreement with Springer-Verlag calls for lower prices and no profit-sharing, but we received profits in 1993, before the agreement took effect.
ii. Interest was about twice that anticipated because funds banked by ISRS as a service to the 7th International Coral Reef Symposium (which were used to pay for the proceedings) generated interest while being held.
iii. Contrary to expectations, membership continued to grow (see below).

Financial and Membership Statement for 1994

Income

	US$
Dues	35,853.81
Profit from *Coral Reefs*	6,204.19
Subsidy for editorial expenses from Springer	1,710.67
Interest	1,532.24
Page Charges	1,030.00
Donations from members	50.00
Total	46,380.91

Outgoings

Springer-Verlag for *Coral Reefs*	26,000.00
Editorial expenses	1,712.00
Reef Encounter	1,650.00
Audit (and preparation of tax return)	1,500.00
Postage	670.00
Application fee for tax exemption	465.00
Bank charges	140.97
Labour	151.25
Office supplies	15.84
Total	$32,305.85

Comparison with previous years (US$):

	Income	Outgoings	Cash assets
1992	32,922.39	31,287.47	9,500.00
1993	44,512.51	35,577.04	15,911.08
1994	45,725.91	32,365.85	24,845.55
Jan 1995			38,920.61*

* there is also an additional US$10,000 to be returned by Springer-Verlag due to an overcharge.

Membership	mid '92	end '92	end '93	end '94
Honorary	4	7	6	6
Family	15	24	23	23
Student	39	78	77	74
Individual	251	399	451	506
Total	309	508	557	609

Last year, as in 1993, we gained about 50 members, thereby exceeding 600 for the first time in ISRS history! 1995 has begun very well, with many new members and a high rate of renewals, prompted perhaps by the new payment method. Please keep the momentum up by renewing promptly and recruiting more members for ISRS. 1996 should see another surge in membership with the 8th International Coral Reef Symposium.

1995 Budget

Income

	US$
Dues	36,000.00
Subsidy for editorial expenses from Springer	2,000.00
Page charges	1,000.00
Interest	700.00
Other (proceeds from sale of T-shirts etc)	500.00
Donations from members	100.00
Total	40,300.00

Outgoings

Coral Reefs (printing and postage)	20,000.00
Reef Encounter (printing)	4,000.00
Reef Encounter (postage)	2,000.00
Editorial expenses	2,000.00
Membership administration	
Fee	3,500.00
Postage and supplies	1,500.00
Communications expenses (postage, fax etc)	1,500.00
Office supplies	150.00
Miscellaneous (bank charges etc)	250.00
Expenditures approved by Council in Luxembourg	
Printing of T-shirts	500.00
Best paper plaques (10)	400.00
Advertising display	200.00
Total	36,000.00

ISRS GAINS TAX-EXEMPT STATUS

The ISRS has been approved by the US Internal Revenue Service as a tax-exempt organisation, retroactive to the formation of the Society in 1980. US citizens please note: because the ISRS is an international organisation with non-American officers, donations to the ISRS are not tax-deductible.

Copies of the THE NORTHERN GREAT BARRIER REEF: a Royal Society discussion organized by Dr Stoddart and Sir Maurice Yonge FRS, 28-29 January 1976, published in 1978, are available from the ISRS Treasurer. Prices: US$20.00 (surface mail), US$30.00 (airmail). Payment must be by US$ money order or cheque drawn on a US bank. Contact: Daphne Fautin, Kansas Geological Survey, 1930 Constant Avenure, University of Kansas, Lawrence KS 66047, USA.

Gray Multer has organised the making of Best Paper plaques and a display stand to advertise the ISRS desk at meetings. He has also had society T-shirts made. These will be available at the Newcastle meeting (see below) and the next issue of *Reef Encounter* will contain details for mail ordering.

In Luxembourg, Don Kinsey was voted an honorary member of the ISRS, Sept. 9, 1994.

FUTURE ISRS MEETINGS

5-9 September 1995
EUROPEAN MEETING: 'BIOLOGY AND GEOLOGY OF CORAL REEFS'
University of Newcastle, UK
This will be held jointly with the British Ecological Society and is being hosted by the Department of Marine Sciences and Coastal Management at Newcastle University. The meeting is broadly aimed at encouraging collaboration in Europe and between other members of the reef science and management community. The programme will consist of two full days of oral presentations plus a full day of four workshop sessions.

Oral presentations will be divided into eight topics: biogeography and biodiversity - patterns and processes; fossil reefs; isotopic signatures and the coral skeletal record; reef taphonomy; community structure and dynamics; coral reef fish biology and fisheries production; reef degradation, rehabilitation and management; and remote sensing and GIS in reef ecosystem management. Workshop 1 is intended to promote ideas on future European research collaboration. The use of the latest technologies for monitoring the physical and chemical environment of coral reefs will be demonstrated by a selection of European and US-based research groups in Workshop 2 and opportunities for environmentally relevant research discussed. Workshop 3 will cover the action and impact of toxins derived from reef organisms and Workshop 4 is a meeting of the European reef fish network.

Three field trips are planned for the final day to: the Permian bryozoan-algal reef and associated sediments in the Sunderland area; the Northumberland coastline; and Hadrian's Wall. There will be a banquet and ceilidh (traditional folk dance) on the final evening at medieval Langley Castle.

Deadline for registration and receipt of abstracts is 1 May 1995. The registration fee is £120 for ISRS and BES members and £140 for non-members and includes all scientific sessions and social events; £65.00 for students (or £110 including conference dinner). Further information and registration forms from: *Dr N. Polunin, Department of Marine Sciences and Coastal Management, Ridley Building, University of Newcastle, Newcastle-upon-Tyne NE1 7RU, UK. Fax (44) 191 222 7891; e-mail: n.polunin@ncl.ac.uk*

24-29 June 1996
8th INTERNATIONAL CORAL REEF SYMPOSIUM
ATLAPA International Convention Centre, Panama City, Panama
This is being organised by the University of Panama and the Smithsonian Tropical Research Institute. It is the first ICRS to take place within the neotropics since 1978 and is within easy reach of two oceans. The scientific programme will consist of 5 days of plenary talks, symposia, contributed talks and poster sessions, broken mid-week by one day for short field trips and workshops. There will be 14 plenary speakers covering a range of topics; during the times of their talks there will be no other scheduled activities. Most symposia will be either full day or half day in length and all will have organisers responsible for inviting speakers and reviewing/ editing manuscripts prior to submission for publication in

the Proceedings. The full list of symposia is still being finalised. An attempt will be made to organise contributed papers into coherent sessions and co-ordinate their scheduling to follow related symposia. Space for posters will be provided; abstracts will not be required for posters. The workshops will provide a forum for discussion and planning for small groups sharing an interest in specific research areas; the full list for these is still being finalised.

During the Symposium, there will be three evening public lectures covering scientific, technical and management issues, and two public forums in which topics relevant to the region will be discussed: policies for the management of coral reefs, and the role of Central American indigenous cultures in reef conservation. An educational exhibition on coral reefs will be displayed at ATLAPA during the Symposium and display space will be provided for publishers and local organisations. The scientific sessions will be in English but all public events will be in Spanish.

Pre- and post-symposium field trips are being organised to Mexico (Cozumel), Belize (Carrie Bowe Caye area), Honduras (Roatan and Cayos Cochinos), Colombia (San Andres and Providencia Islands), Costa Rica (Caribbean coast), Panama (several trips), Ecuador (Galapagos), Curacao and Bonaire, Brazil (Recife coast and offshore islands). For those who wish to SCUBA dive on trips that offer it, a special application must be made to the 8th ICRS.

Registration fees cover attendance at several social events and (without the late penalty) are $400 for ISRS members, $200 for ISRS student members, $450 for non-members and $225 for non member students. Participants from developing countries can apply for financial support from 8thICRS.

Please note the following dates:

30 June 1995
Receipt of: Symposium registration (US$100/US$50 deposit); hotel registration (one night deposit); field trip application (US$100 deposit/trip); SCUBA certification application.

31 August 1995
SCUBA certification applicants notified of results

1 November 1995
Receipt of abstracts of all oral and poster contributions; receipt of financial assistance request form.

1 December 1995
Receipt of registration fees without late penalty; full payment for field trips

15 February 1996
Financial assistance applicants notified of awards

13-23 June 1996
Pre-Symposium field trips

24-29 June 1996
8th ICRS Symposium. Receipt of revised manuscripts of papers submitted for publication

29 June-8 July 1996
Post-Symposium field trips

Further information from: *Convention Manager, 8th International Coral Reef Symposium, STRI Unit 0948, APO AA 34002-0948, USA. In Panama: Tel: (507) 28-4022; Fax (507) 28-0970; e-mail: stri01.naos.brenesm@ic.si.edu*

CURRENTS

DEGRADATION AND RECOVERY OF MALDIVIAN REEFS

William R. Allison

Re-occupation in 1992 of sites surveyed over thirty years ago in the Maldives showed a dramatic reduction in the percentage cover of acroporid and pocilloporid corals. Reefs displaying similar damage have been observed in many locations throughout the archipelago, implicating a large scale natural cause(s). Elevated sea surface temperature (SST) in 1983 or more likely 1987 is suspected as the primary cause. This probably contributed substantially to degradation attributed to other causes, and to the widespread shoreline erosion in the Maldives. Recent surveys at other locations indicate that the reefs are recovering, which will presumably ameliorate the shoreline erosion, other things being equal.

I recently conducted qualitative (swims and manta tows) and quantitative (line intercept transects) surveys on reefs throughout the Maldives. Intensive quantitative surveys were carried out on sites surveyed in 1958 at Veligandu in Rasdhu Atoll (Scheer, 1974) and in 1964 at Addu Atoll (Stoddart, 1966; Davies *et al.*, 1971). Shoreline erosion has recently occurred at Gan, Veligandu and many other islands in the archipelago and has received considerable attention in the local media.

Similar changes were apparent at all sites surveyed and these were representative of the reefs throughout the Maldives. Species belonging to the families Acroporidae and Pocilloporidae had been killed in growth position. Skeletons of robust forms such as *A. palifera* and *A. robusta* growing in sheltered water were largely intact, whereas colonies of more fragile forms had collapsed. At Gan, the *A. formosa* and all similar growth forms had been eliminated, while the percentage cover of massive *Goniastrea retiformis* colonies had increased (Figure 1). The only *Acropora* species present in 1992 were relatively young colonies of forms such as *A. hyacinthus* and *A. humilis* growing on the dead remains of the branching *Acropora* colonies.

The general pattern at Veligandu is summarised in Figure 2, and here too, acroporids and pocilloporids were hard hit. The extensive spur of *Acropora palifera* which dominated the reef off the south-east extreme of the island was all dead in growth position and beginning to collapse in some areas. The wave-swept area inshore of this area, which in 1958 was dominated by *Acropora irregularis*, displayed nothing but fragments of dead *A. irregularis* in 1992. Only one large live *Acropora cytherea* was observed in 1992 along the entire eastern edge of the reef. All of the other *Acropora* colonies were small and judged to be approximately five or six years old. The percentage cover of massive corals had also declined at Veligandu, especially on the outer side where they were apparently removed by wave action. The massives remaining were generally alive, in contrast to the acroporas.

A number of factors, such as sediment loading, eutrophication, *Acanthaster planci* and stress associated with

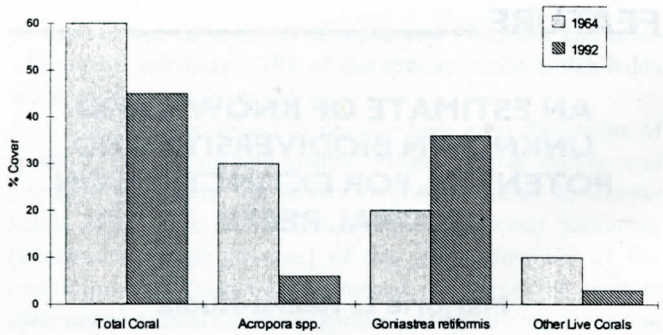

Figure 1. Mean coral cover in the Acropora formosa *zone, Gan lagoon: 1964 and 1992.* A. formosa *has been eradicated and all existing Acropora colonies are recent growth.* G. retiformis *cover has increased.*

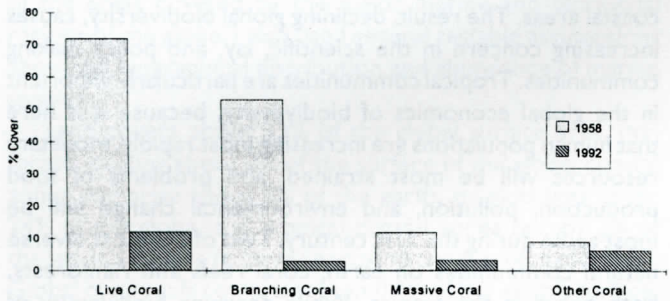

Figure 2. Mean coral cover for all sites at Veligandu, 1958 and 1992. Live coral cover for all types has decreased. Branching corals have declined the most, and virtually all existing branching coral is recent growth.

elevated sea temperature are known to selectively kill acroporids in growth position. Of these factors, sediment loading and eutrophication seem unlikely to have operated on the scale observed in Maldives. *Acanthaster* infestations are a possibility, although the divers, fishermen and coral miners interviewed had not observed *Acanthaster* on the scale required nor at most of the sites surveyed. There is more support for a bleaching event of the sort generally associated with elevated sea temperature than for these alternatives. Qualitative observations of a bleaching event were made in North and South Male Atolls in 1987 (Sanders & Wood, 1987) and COADS ship reports show prolonged periods of elevated SST in the area in question in both 1983 and 1987. This does not prove that elevated SST associated bleaching caused the mortality, but the necessary conditions were present to suggest it as a contributing cause and there is more reason to suspect it as the main cause than the other possibilities.

The coral colonies killed by this event were commonly robust branching *Acropora* types which form natural breakwaters in shallow water. Although in many instances these were still standing, biological and physical degradation had reduced their height and often colonies crumbled under slight hand pressure, suggesting that the protective function will be further reduced and erosion will increase. On the other hand the many new coral colony recruits present on these reefs, and rapid increase in coral cover at sites in North Male Atoll (up from 20% in 1991 to 40% in 1994, Allison, work in progress) suggest that barring additional interference, recovery will be rapid.

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William R. Allison, Institute for Environmental Studies, University of Toronto, Toronto, Ontario, Canada, M5S 1A4.

THE COMPLEAT REEF ENCOUNTER

No.17

"The three-times Open champion was 15 under par and six shots ahead of the Canadian Jack Kay at Nusa Dua [Indonesia].... Faldo confirmed to the official that during Saturday's third round he had lifted a piece of coral from behind his ball in a greenside bunker at the 2nd hole, and he was expelled for contravening rule 13.4(c) which forbids the touching or removal of loose impediments in a hazard."

The Guardian, UK. 7 November 1994

UPWELLINGS

TAKING A CRITICAL LOOK AT REMOTE SENSING

Ever since Elliott Smith first examined Landsat data of the Great Barrier Reef in 1975, the search for both management and scientific applications of satellite imagery has been exhaustive (see reviews by Jupp, 1986 and McCracken & Kingwell, 1988). Twenty years on, the newcomer to reef research and management might be forgiven for expecting to find a simple advisory text that segregates the routinely successful applications of remote sensing from those that are best labelled as potential or experimental. Surprisingly, such a quest would be fairly fruitless.

In 1986, UNESCO published guidelines on the application of remote sensing to coral reef environments. These were aimed at both scientists and coastal managers. Since then, new sensors have become available, analytical software has become more sophisticated and of course, "applications research" has battled onward. The need for a re-evaluation of remote sensing is long overdue.

However, given the harsh realities of today's economic climate, it is necessary to extend this evaluation beyond simple questions such as, "which habitats can we map using Landsat imagery?". We need to address the operational usage of remote sensing in both technical and economic terms. We need to ask, "how cost-effective is each sensor for assessing marine and wetland habitats for various levels of desired accuracy, ground-truthing requirements, capital investment, analyst skills and so on?". Only then can a scientist, planner or decision maker truly assess whether their objectives may be realised using remote sensing.

A joint project between the universities of Newcastle and Sheffield (UK) seeks to critically evaluate these issues in collaboration with the Turks and Caicos Islands Ministry of Natural Resources, Coral Cay Conservation and the Belize Coastal Zone Management Unit. The UK Overseas Development Administration has granted 3 years of funding, at the end of which, practical guidelines to the use of remote sensing for tropical coastal resources assessment will be published. These will be disseminated free to coastal managers in less developed countries. Training materials will also be produced for Unesco's WinBilko remote sensing distance-learning package.

We would be interested to hear readers' views on the role of remote sensing in both resource management and academic research. In particular, we would like to hear of specific cases in which the products of remote sensing have been adopted in a management context. Documentation of routine and unsuccessful attempts to use such techniques rarely appears in the published literature but is of considerable importance in making a balanced assessment of the utilisation of remote sensing.

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Note: A session entitled Remote Sensing and GIS in reef ecosystem management is being held at the next European Meeting of the ISRS at Newcastle on 5-9 September 1995. For further details contact: *Alasdair Edwards, Centre for Tropical Coastal Management Studies, Dept. of Marine Sciences & Coastal Management, Ridley Building, University of Newcastle, Newcastle upon Tyne, NE1 7RU. E-mail:a.j.edwards@ncl.ac.uk*

FEATURE

AN ESTIMATE OF KNOWN AND UNKNOWN BIODIVERSITY AND POTENTIAL FOR EXTINCTION ON CORAL REEFS

Marjorie L. Reaka-Kudla

Humans now consume 20-40% of the global net terrestrial primary productivity (Ehrlich and Wilson 1991, Ehrlich and Ehrlich 1992, Wilson 1992). Associated with this has been intensive habitat modification on land and deterioration of coastal areas. The result, declining global biodiversity, causes increasing concern in the scientific, lay, and policy making communities. Tropical communities are particularly important in the global economics of biodiversity, because it is here that human populations are increasing most rapidly, monetary resources will be most strained, and problems of food production, pollution, and environmental change will be most acute during the 21st century. Two of the most diverse natural communities on earth, coral reefs and rainforests, both occur in the tropics. While declining biodiversity of tropical rainforest has received considerable (and well deserved) attention over the last decade or two, the status of coral reefs has received little international attention until recently.

Despite the known and potential value of reef communities and the threats to their health and vigour widely documented over the last decade, it is astonishing that we still do not even know the total biotic diversity of coral reefs (e.g. how that diversity compares to that of rain forests), or the fraction of their diversity that is described versus undiscovered. I recently have estimated global species diversity (Reaka-Kudla 1994, 1995), and briefly describe the results here.

There currently are about 1.8 million *described* species on earth, although various authors have estimated that 5-120 million exist (Erwin 1982, 1988; May 1988, 1990, 1992; Stork 1988; Wilson 1988, 1992; Black *et al.* 1989; Ehrlich and Wilson 1991; Gaston 1991; Grassle and Maciolek 1992). Compared to terrestrial environments, total marine biodiversity has been little studied. It is widely recognised that marine environments have more *higher-level* taxonomic diversity than terrestrial. Among all macroscopic organisms, there are 43 marine phyla and 28 terrestrial phyla (of the 33 animal phyla, 32 live in the sea and only 12 inhabit terrestrial environments), and 90% of all known classes are marine (Ray 1985, 1988, 1991; Pearse 1987; Angel 1992; May 1994).

Some marine environments also contain high species diversity. For example, based on their and others' samples of 1,597 species of soft bottom marine macro-fauna off the east coast of North America (255 to 3,494 m depths), Grassle and Maciolek (1992) calculate that the global deep sea fauna, because of the huge area it occupies, may include 10 million species (mostly polychaete worms, crustaceans, and molluscs; but see lower estimates in May 1992, 1994; Poore and Wilson 1993). Most of these deep sea species are rare (90%

of the species sampled by Grassle and Maciolek comprise <1% of the individuals; 28% of the species in the entire fauna were collected only once).

Coral reef communities contain high local diversities of species (e.g. corals and plants, fishes; sessile, motile and boring cryptofauna; discussed in greater detail in Reaka-Kudla 1995), but there have been no previous estimates (except for rough guesses) of the global diversity of the community. I calculated the known and expected species diversity of coastal marine organisms, tropical coastal marine organisms, and coral reef organisms using compilations and estimates of the total number of marine species (from prokaryotes to fungi, plants, and animals) in combination with (i) concepts of island biogeography, and (ii) calculations of the areas covered by the major marine and terrestrial regions of the globe. I also used several testable assumptions about the biographical distribution and abundance of marine species.

Land covers about 33% of the global surface area, rain forests occupy about 2% of the surface of the globe, coastal zones comprise about 8% of the earth, tropical seas cover 24% of the globe, and tropical coastal zones occupy 2% of the world's surface (an area approximating that of rainforests). Global coral reefs comprise about 0.1% of the earth's surface, 6% of tropical coastal zones, and 5% of the area of global rainforests.

There are approximately 1,450,000 described terrestrial species (about 5% of the total), and 318,000 described aquatic species (17% of the global total). My calculations from a variety of sources (Ray 1988, Pennak 1989, John 1994, May 1994) indicated that the global proportion of marine vs. fresh water species was about 90% vs 10%. Thus there is a total of about 274,000 described marine species (including approximately 180,000 macroscopic marine invertebrates, 36,000 species of algae, and 58,000 species of other marine groups such as vertebrates, protistans, viruses and bacteria). Therefore, about 15% of global described species are marine (an astonishingly small figure also obtained independently by May 1994). If only macroscopic marine species are included, due to uncertainties in the taxonomy of micro-organisms, there would be about 200,000 described species of marine macro-algae, macro-invertebrates, and chordates, or only about 11% of the total described global species.

From these total numbers of described species of marine organisms, one can calculate the number of species in global coastal zones by assuming that about 80% of all marine species occur in the coastal zones (Ray 1988, 1991; Black *et al.* 1991; further analyses of all of these assumptions, including those below, are underway in my laboratory). This figure probably is probably conservative since over 90% of all marine species are benthic rather than pelagic (May 1988, 1994). Oceanic phytoplankton comprise only 9-11% of all algal species (Sournia and Richard 1991), and almost all marine macroalgae live in benthic (John 1994 and pers. comm.) sunlit environments. With this basis I then went on to calculate the number of described marine species that *should* occur in tropical coastal and coral reef environments based on the global area of these regions and current knowledge of biogeographic patterns.

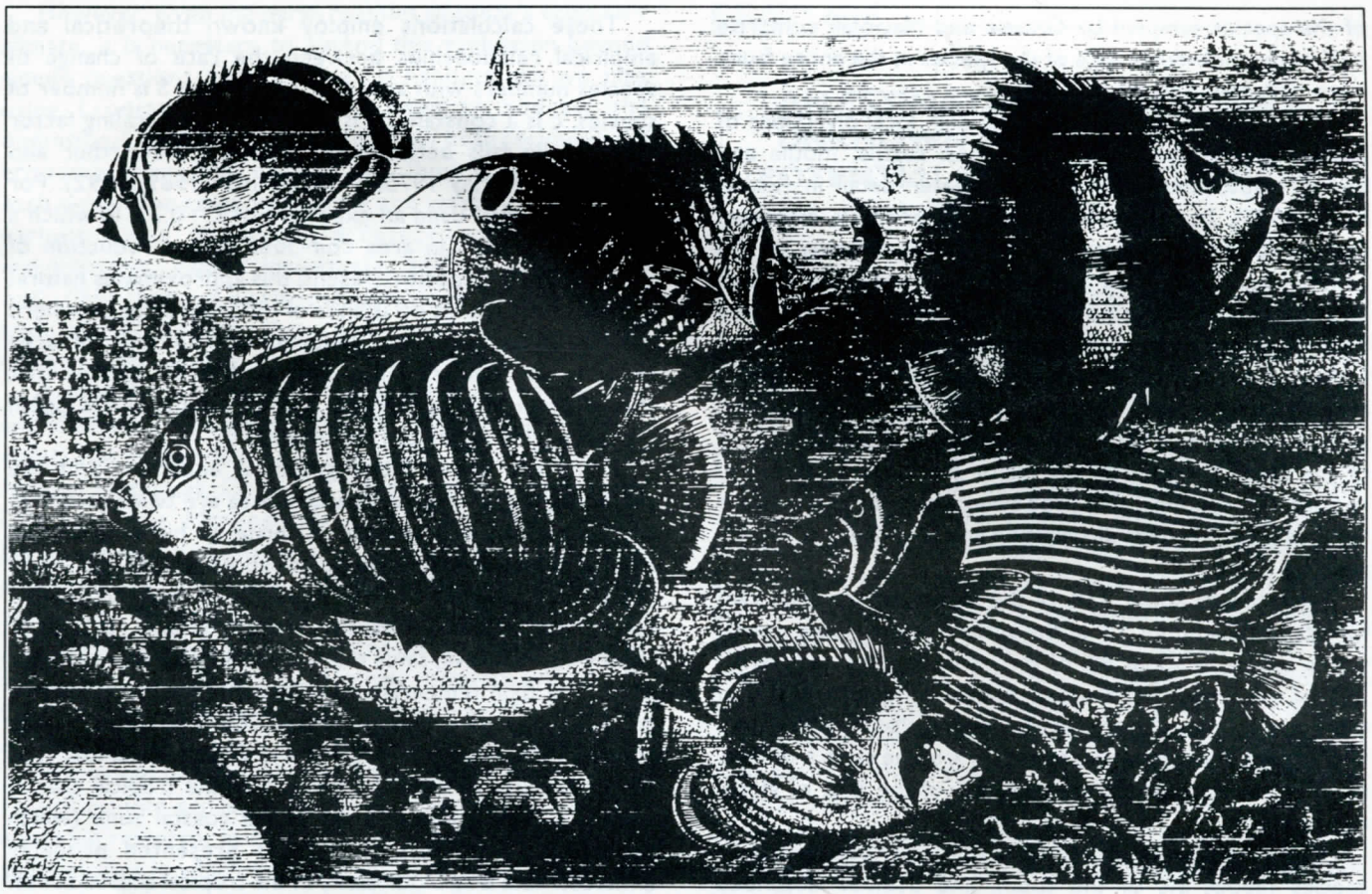
These calculations employ known theoretical and empirical relationships between the rate of change of species numbers with area ($S = cA^z$, where S is number of species, c is a constant, A is area, and z is a scaling factor that usually falls between 0.2 and 0.3; MacArthur and Wilson 1967; May 1975, 1994; Wilson 1989, 1992). For my calculations I used an exponent of $z = 0.25$, in which a reduction of 90% in area coincides with a reduction of about half of the species present; this approximates natural situations for faunas on islands of different sizes or where habitat destruction has reduced the amount of area available to species. Thus, the number of species that should occur in progressively smaller realms of the global marine environment can be calculated.

Using the above biogeographical equations and the assumptions that tropical coastal zones are twice as rich in species and as well studied as those at higher latitudes, tropical coastal zones should include about 182,000 described species and 133,000 described species of macrobiota. The assumption of double diversity in the tropics is realistic or slightly conservative, since there are 2-3 times more species in tropical than temperate environments for most (though not all) groups of organisms (May 1986, 1988; Stork 1988; Stevens 1989; Angel 1992; Raven and Wilson 1992; Rex *et al.* 1993). Because of the assumption that the tropical coastal zone is as well studied as the global coastal zone (which probably is not met), the values presented probably underestimate true biodiversity in the tropical coastal zones.

Similarly, using the above area relationships and assuming that the complex coral reef substrate contains twice as may species and is as well studied as level bottom (sand, mud) habitats in the same biographical region that are not associated with reefs, there are about 91,000 described species of all coral reef taxa and 66,000 species of described coral reef macrobiota on earth. Abele (1976) reports that 53 species of crustaceans inhabit coral habitat (*Pocillopora damicornis*) compared to 16 species in sandy beach habitats on the Pacific coast of Panama. Thus calculated, the total described coral reef biota represents only about 4-5% of the described global biota.

In contrast, rainforests account for 70-80% of the described global biota. If 90% of currently described terrestrial species occurred in rainforests (as do primates, Mittermeier 1988) and if all groups were as well known as primates, then rainforests would include about 1,305,000 described species. However, several estimates in the literature suggest that there are at least 2 million described species in rainforests. Although rainforests cover 20 times more global surface area than coral reefs, and thus one would expect smaller numbers of species on global coral reefs than rainforests, the numbers of described coral species are still unusually small.

Based upon the area of the globe that they occupy compared to that of rainforest, coral reefs should be comprised of about 950,000 total species (about 35-50% of global species), assuming that the two environments are equally studied and that similar ecological and evolutionary processes operate on coral reefs as in rainforests, i.e., that coral reefs have the same area-specific diversity as rainforests.



The difference between the figures for described global reef species (91,000 species overall and 66,000 of macrobiota) vs. total expected species (at least 950,000) on global coral reefs suggests two hypotheses. (a) More than 90% of all reef species (about 93% of the macrobiota) remain undiscovered. Note that these calculations are based on conservative figures for the number of species in rainforests, so that the expected number of coral reef species may be larger and the proportion of described species on coral reefs lower (especially for micro-organisms) than here represented. (b) Alternatively, the assumption that similar ecological and evolutionary processes generate and maintain diversity in coral reef and rainforest communities may be incorrect, and coral reefs indeed may have lower area-specific diversity than rainforests due to biological or historical constraints that affect diversification or extinction.

Several lines of evidence suggest that the first rather the second hypothesis is correct. High numbers of undocumented species are likely in coral reef environments because, being far from the location of most systematists and biologists, tropical environments are less studied, and systematists for these groups are fewer than those in temperate latitudes (see Wilson 1985, 1988: Erwin 1988; Diamond 1989; Gaston and May 1992; May 1994). Tropical marine environments provide even further barriers to study because they require SCUBA diving and fairly extensive logistic support for investigation. Further, systematic analyses indicate that concealed sibling species (morphologically similar and previously classified within one species) are more common in marine taxa than previously thought (e.g. Grassle and Grapple 1976, Bowen *et al.* 1991, Feldmann and Manning 1992, Knowlton *et al.* 1992). Additionally, although we tend to think of coral reef communities in terms of large sessile organisms such as corals, flamboyant fishes, and large colourful benthic invertebrates such as lobsters, most coral reef species are small in body size (e.g., Reaka 1986, Reaka-Kudla 1995). Indeed most cryptic coral reef species are *constrained* to small body sizes by the sizes of bioeroded holes in the reef, whose refuge they must obtain in order to survive intense fish predation (Wolf *et al.* 1983; Reaka 1985, 1986, 1987, 1991; Moran and Reaka 1988). Hutchinson and MacArthur (1957), Morse *et al.* (1985), May (1988) and others have documented this skewed size distribution, with vastly more small than large species, for almost all groups of animals (but see Fenchel 1993 and May 1994 for micro-organisms). Small organisms almost always are poorly observed and known (May 1969, May 1978, Gaston 1991), since they often live in cryptic or interstitial environments. This is true in coral reefs as well, where we have recorded several hundred thousand small macroscopic motile reef organisms of 12 or more phyla living within holes and crevices in the upper 10 cm of 1 m^2 of reef substrate (Reaka 1985, 1987, 1991; Moran and Reaka 1988, 1991). In addition to their cyptic habits, these motile organisms are often crepuscular or nocturnal (and thus often are unobserved even by field biologists; Dominguez and Reaka 1988). Collection of organisms from these three-dimensional calcareous crypts

is difficult and labour intensive, leading to their strong under representation in many ecological and systematic studies. Cryptic invertebrates, comprising the greatest proportion of species on reefs, are the ecological equivalents of insects in the rainforest, and they usually are overlooked when the diversity of a coral reef is considered.

In addition to inadequate study of these species on local scales, the number of small species is likely to be underestimated on a global scale because of their restricted geographic distributions. One of the strongest correlations in marine biology is the association between small body size of macroscopic marine animals and the production of only a few relatively large larvae that have abbreviated developmental times (brooded young emerge from the parent's protection as relatively large juveniles, or parents produce large larvae with short planktonic stages; both are characterised by short dispersal and restricted geographic distributions; Hansen 1978; Reaka 1980; Reaka and Manning 1981, 1987; Strathmann and Strathmann 1982; Jablonski and Lutz 1983; Jablonski 1986a). In contrast, species that attain large body sizes within their lineage commonly produce large numbers of small swimming larvae that feed in the plankton for extended periods, resulting in broad geographic distributions. The body size of species of reef-dwelling mantis shrimps are significantly correlated with the size of their geographic ranges (Reaka 1980). Therefore, because most species are small on coral reefs, and most small species have relatively small geographic ranges, poorly sampled areas (e.g., some areas of the Indo-West Pacific) are very likely to contain undocumented species with endemic distributions that do not extend into better sampled areas.

Paleontological and evolutionary studies show that, at background levels of extinction, species with restricted geographic ranges are significantly more susceptible to extinction than those with broader ranges (Hansen 1978; Jablonski 1986a, 1986b, 1991; see also Reaka 1980, Reaka and Manning 1981, 1987). Also, tropical species are particularly susceptible to extinction, as evidenced by the striking demise of reef communities at each of the major mass extinctions (Jablonski 1991). The background rates of extinction for marine invertebrates (1-10% of species per million years, Jablonski 1991) are vastly lower than the extinctions that potentially could result from present day environmental alterations (Diamond 1989, Ehrlich and Wilson 1991, Smith *et al.* 1993), and the long narrow coastlines of coral reefs are especially vulnerable to habitat degradation and fragmentation.

Therefore, this study suggests that undocumented diversity and - of particular importance at the present time - undocumented contemporary extinctions are likely to be higher than we realise in coral reef communities because there are many more relatively small, cryptic, and unstudied macroscopic species than generally recognised. Not only is it likely that undocumented extinctions already have taken place but the potential for future extinction in macroscopic coral reef species is higher than generally realised because of the preponderance of diminutive species in these environments.

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NEWS

TESTREEF PROGRAMME

The Commission of European Communities (Science, Research and Development), under its Environment Programme, has awarded a joint research group, representing four countries, a grant of about US$400,000 to study the Temporal and SpaTial variability of Indian Ocean REEFs. The following institutes are involved:

France: laboratories belonging to the Universities of Marseilles, the Centre National de la Recherche Scientifique at Gif-sur-Yvette and the Bureau de Recherches Géologiques et Minières at Orléans. General and National Co-ordinator: L. Montaggioni.
Germany: laboratories at Christian-Albrechts University at Kiel and the University of Heidelberg. National Co-ordinator: D.W. Dullo.
Britain: Glasgow University. National Co-ordinator: C.J.R. Braithwaite.
Italy: Institute of Marine Geology and the University of Bologna; National Co-ordinator: M. Taviani.

Field investigations started in the Seychelles in October 1994.

The main objectives of the project are:

i. To produce a high quality database covering the last 20,000 years and defining the environmental changes in the tropical part of the western Indian Ocean (of special interest is the spatial evolution of the southern limit of the intertropical belt).

ii. To reconstruct changes in sea level on a regional scale, and thus to integrate the results in a global palaeoceanographic framework.

The data set will be based on the record of the main sea surface parameters (temperature, salinity) at various time scales from the study of coral reefs and will provide information on certain aspects of climate dynamics (e.g. patterns of short-term palaeoclimatic variations, monsoon variability, relationships between monsoon intensity and El Niño-Southern Oscillation)

The programme will focus on three reef sites located at different latitudes along the Mozambique Channel: Seychelles (4°S); Mayotte, Comoro Islands (14°S) and Tulear, Madagascar (23°30'S). Two different time scales are involved (1-1000 years, and 1000-20,000 years) at different levels of spatial and temporal resolution involving high-frequency (seasonal or pluri-annual) and low-frequency (century to millennium) forcing trends.

The 1-1000 year time scale will be investigated by drilling individual massive coral heads (*Porites*). In each of the three study sites, coral heads with overlapping chronologies will be selected to produce a composite record that may cover a millennium at a resolution of up to seasonal frequency. The

methods used will be principally geochemical, including stable isotopes (^{18}O, ^{13}C), and trace elements (Sr/Ca), coupled with measurements of growth and production rates of coral skeletons (sclerochronology). Isotope analyses will be performed on each seasonal band of the skeletons in order to get a high-resolution record. Trace element analyses will be made for periods characterised by sharp fluctuations of sea surface temperatures demonstrated by ^{18}O excursions. Accurate ages will be provided by AMS ^{14}C dating.

The 1000-20,000 years time scale will be investigated from cores made through reef sequences about 25 m thick and from material provided by previous sampling of submerged reef slopes using a submersible. This study seeks to see how far the high-resolution in coral growth bands may be applied to key periods within a longer time scale (e.g. 10 years proxy variations over 8000 years). The minimal resolution will be 100 years. Climate variability will be defined using oxygen and carbon isotope data obtained from cored coral colonies (massive *Porites* and branching *Acropora*). Since a continuous record cannot be expected on this time scale, high resolution measurements will be performed only at various well-dated levels.

In addition, sea level curves will be reconstructed through U/Th radiometric dates (alpha-counting methods; Thermal Ionization Mass Spectrometry) obtained from corals *in situ*, coupled with palaeobathymetry information deduced from biological assemblages that are good sea level indicators.

Further information from: *L. Montaggioni, General Co-ordinator, Centre de Sedimentologie-Paléontologie, Université de Provence, Place Victor Hugo, Case 67, 13331 Marseille Cedex 03, France. Fax 91-10-60-06.*

TUNA CANNERY THREATENS CORAL REEF IN PAPUA NEW GUINEA

The World Bank has a long record of financing development projects which have resulted in environmental degradation. In the last ten years or so the Bank, being more sensitive to environmental concerns, has made a real attempt to invest in projects with less damaging effects. However, recent plans to construct a tuna cannery at Madang Lagoon, Papua New Guinea (PNG), suggests a return to their previous, less conscientious habits. While other groups, including the American fishing company Zee Enterprises Incorporated, are also investing in the project, it is World Bank money, disseminated through the Global Environmental Facility (UNDP and UNEP), that is providing a major portion of the support.

The cannery will be located at the north end of Madang Lagoon. Initially, cannery wastes were to be dumped into the lagoon, but recent plans are for the effluent pipes to discharge at about 40 m depth at the mouth of Ottilien Passage. While this is an improvement over the initial plan, much discharge would still enter the lagoon during incoming tides. An environmental assessment conducted by the PNG Department of Environment and Conservation has recommended that the effluent pipes be located outside the reef where off-shore currents will disperse wastes. Though construction of the cannery has begun, its location would allow for repositioning of discharge pipes to off-shore locations with minimal alterations.

Research carried out through the Christensen Research Institute (CRI), a biological station located adjacent to Madang Lagoon, has shown this region to be extremely diverse biologically (e.g. *Proc. 7th Int. Coral Reef Symp.* 1992, 2: 697-717, 729-735, 736). It has therefore been designated as an important biodiversity area by Conservation International and the PNG Government. Given the apparent concern for biodiversity conservation in PNG, it is ironic that the lagoon at Madang should be selected as a location for a cannery. In addition to the biological diversity issue, the lagoon serves the local needs of the community through its fishery resources and as a direct source of revenue through ecotourism operations such as SCUBA diving.

While the proposed cannery will certainly provide jobs and needed revenue for PNG in the short term, this development should take into account the needs of the local community. These resources must be managed in a sustainable fashion in order to safe-guard them for use by future generations. Inappropriate discharge of cannery wastes can only jeopardise the lagoon. Appropriate planning for the Madang cannery is within easy reach of the World Bank and other proponents of this project. Conservation International have been lobbying for the preparation of more environmentally sound plans. It remains to be seen if the Bank will develop this cannery in a responsible fashion or return to their old ways of investing in environmentally unsound projects.

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INTERNATIONAL CORAL REEF INITIATIVE

The International Coral Reef Initiative (ICRI) is a development of the US Coral Reef Initiative (see *Reef Encounter* 16) and is a partnership of several nations (USA, Japan, Australia, UK, France, Sweden, the Philippines and Jamaica), development banks, aid agencies and other international and regional organisations (UNDP, UNEP, UNESCO, World Bank, Inter-American Development Bank, IUCN, Alliance of Small Island States, South Pacific Regional Environment Programme, Co-ordinating Body for the Seas of East Asia). Announced at the UN Global Conference on the Sustainable Development of Small Island Developing States in Barbados, May 1994, the ICRI exists to promote a partnership between policy makers, managers and the science and research community involved in coral reef and related ecosystem issues.

The objectives of the ICRI are:

For governments and international organisations to expand the implementation of local, national, regional and international activities to conserve, restore and sustainably use coral reefs and associated environments.

For each country and region to incorporate into existing local, regional and national development plans management provisions for protection, restoration and sustainable use of the structure, processes and biodiversity of coral reefs and associated environments.

To strengthen capacity for development and implementation of policies, management, research and monitoring of coral reefs and associated environments.

To establish and maintain co-ordination of international, regional and national research and monitoring programmes to ensure efficient use of scarce resources and a flow of information relevant to the management of coral reefs and associated environments.

An ICRI Executive Planning Committee (comprising representatives from the principal partners and including both scientists and government personnel) is developing a number of activities:

Development and agreement on an ICRI Call to Action and an ICRI Framework for Action.

Agreement on a strategy, including financial support, for ICRI Regional Meetings to determine regional priorities and strategies to implement the Framework for Action.

Agreement on mechanisms for matching, through the products of the regional meetings, the interests and capacities of the donor agencies with the priorities of recipient countries.

The principal event will be a meeting of the ICRI partners and other governments in Dumaguete City, Philippines, May 29-June 2, 1995. This will not be a scientific meeting (there will be about seven invited scientists and a further 10 people with scientific backgrounds but now involved in management) and the 100 invitees will comprise mainly government (about 36 countries will be represented) and aid agencies representatives, senior policy makers, non-governmental organisations, industry/private sector (dive groups, tourist agencies) and programme planners. The aim of the meeting is to promote and strengthen partnerships and to set the stage for regional follow-on meetings where the 'framework for action' will be further defined and adopted and national coral reef initiatives will be created or strengthened. It is not expected that new international funds will be made available but rather that there should be a better allocation of existing funds.

A report on 'The Status of Reefs' is being produced through NOAA for the meeting, with input from the ReefBase team at ICLARM. This will be a concise summary of status and trends in world coral reef ecosystems. A number of regional reports on issues and activities associated with coral reefs and related ecosystems will also be presented at the Dumaguete meeting. The South Pacific Regional Environment Programme (SPREP) is preparing the Pacific report; reports are also being prepared for the Caribbean, East Asia, Red Sea, Middle East and other regions. These will assist in the development of an integrated global programme and its compatibility and incorporation with regional issues and needs. ReefBase, under the direction of John McManus, will be an important component of the ICRI, as will the IOC/GOOS/LOICZ initiative described on p. 22.

Following the Dumaguete meeting, it is expected that a number of regional meetings will be held. A meeting entitled 'Consultation on Coral Reef Management in the Inter-Tropical Americas' is already being planned to take place in Jamaica, July 5-8 (postponed from the previously advertised dates in April). The Steering Committee for this includes representatives of the Government of Jamaica, the University of the West Indies, UNEP's Caribbean Environmental Programme, US-AID and CARICOMP. Participation is by invitation only. The meeting will aim to share experiences in management, to identify the road-blocks and various national needs and to help delegates organise National Coral Reef Initiatives at home. Particular attention will be paid to the role of local communities in co-management of reefs. Delegates will also have the opportunity to discuss their country's proposed projects with representatives of regional funding agencies.

Further information on the Jamaica meeting from: *Dr Jeremy Woodley, Centre for Marine Sciences, University of the West Indies, Mona, Kingston 7, Jamaica. Fax 809-977-1033; e-mail: woodley@uwimona.edu.jm*

Further information on the ICRI from: *Susan F. Drake, Co-ordinator of the International Coral Reef Initiative, OES/ETC, Room 4325, 2201 C Street, NW, Department of State, Washington, DC 20520, USA. Phone 202-647-0658; Fax 202-647-5247; e-mail sdrake@state.gov*

US INVOLVEMENT IN THE ICRI

The ICRI started as a predominately U.S. initiative, and the U.S.A. is continuing to play a major role. The U.S. State Department is coordinating the effort which is an interagency effort involving The National Oceanic and Atmospheric Administration, the U.S. Department of Interior, the National Science Foundation, the U.S. Agency for International Development, the Environmental Protection Agency, and the U.S. Department of Agriculture.

Initially, it is envisioned that the U.S. CRI will offer assistance to coastal governments in assessing and managing resources that will ensure the protection, conservation and sustainable use of coral reefs and associated ecosystems. The initiative will also develop education and outreach programs to raise public awareness of the importance of protection, conservation and sustainable development of reefs. Regional Coral Reef Monitoring and Assessment Programs in the Caribbean and Pacific will be established, building on existing activities through new partnerships. Another item on the table for the CRI is a global effort to build capacity for effective management of coral reef ecosystems, including a USAID program to foster integrated coastal zone management and collaborative community-based management.

Perhaps the most important element for the success of this initiative is support for community involvement in the development and implementation of local and regional coral reef initiatives. For the national and international CRI to

succeed in effectively conserving and managing coral reef ecosystems, it is essential that we base our programs on local community development.

U.S. plans for Research, Assessment and Monitoring (R&M) are still maturing. For 1996, NOAA is the only U.S. Agency with a specific budget request for activities. Of the $3m overall NOAA request, approximately $1m is currently planned for (R&M). Again, these are not yet defined, but if funded will likely include some of the following items:

Support for the Coordination of the IOC/GOOS Global Coral Reef Monitoring Network

Support for the development of Caribbean/western Atlantic and Pacific monitoring networks, expanding upon the existing CARICOMP and developing PACICOMP networks and improving U.S. involvement through enhanced monitoring in the Florida Keys National Marine Sanctuary.

Support for research directed at essential problems in the management of coral reef resources in the Caribbean (including the Florida Keys) and Pacific basins. Problems of regional to global significance are considered highest priority.

Further information on the research and monitoring activities can be obtained from: *C. Mark Eakin, Ph.D., NOAA/Global Programs, 1100 Wayne Ave., Suite 1225, Silver Spring, MD USA 20910-5603; Tel: 301-427-2089 ext. 19; Fax: 301-427-2073; Internet: eakin@ogp.noaa.gov*

BACKGROUND AND PROPOSED ACTIVITIES FOR THE INTERNATIONAL YEAR OF THE REEF, 1996-1997

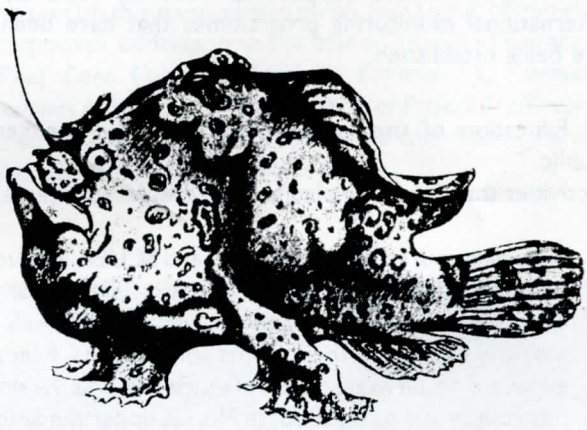
The International Year of the Reef (IYOR) is to be a major effort to assess the condition of reefs worldwide, to document patterns of degradation and seek their causes, to educate users and the public on the values of reef and to assist in the development of strategies to advance their recovery and promote their sustainable management. It will provide a global context for national and regional efforts and a handle for publicity and fund-raising activities, stimulating organizations and institutions with common interests and aims. It will be complementary to activities such as the International Coral Reef Initiative (ICRI) and other national, regional or international programmes.

At the 1993 colloquium in Miami on the Global Status of Coral Reefs, a clear consensus emerged among scientists that many reefs are in decline worldwide, notably in areas adjacent to human population centres. It was also clear from a region-by-region review of what is known of the world's reefs that basic information on their condition is inadequate. 1996 was therefore declared as the Year of the Reef and has since been renamed the International Year of the Reef. During this year, a number of activities will be initiated, with the likely extension into an international decade of reef studies. The programme will be launched at the 8th International Coral Reef Symposium to be held in Panama, 24-29 June 1996.

A number of activities that are being seen as contributions to the IYOR have already taken place or are underway through a variety of organisations. These include:

i. The formation of an international Organizing Committee.
ii. The initiation of several pilot projects of rapid assessment of reefs.
iii. A workshop, sponsored by UNESCO, in Indonesia in November 1994, on coral reef assessment and status evaluation*.
iv. The development of ReefBase, the global database on coral reefs.
v. Production of a Directory of NGOs involved in coral reef management, for distribution in April 1995.
vi. Preparation of guidelines for the development of participatory and volunteer programs involved with reef assessment.

* We hope to have a report on this meeting in the next issue of *Reef Encounter*. (Eds).



Programme of proposed activities

The list of proposed activities in assessment, education and outreach is still being finalised and the following ideas are preliminary and open to modifications and additions as the programme develops. The composition of the Organising Committee is also still being worked on, but positive responses have been received from many of the people that have been approached.

1) Assessment

Specific activities to be encouraged during IYOR are:

i. Development and application of Rapid Assessment Progammes (RAP) for both reefs known or suspected to be degraded and for those considered to be pristine. Pilot projects are underway in several parts of the world and funds have recently become available from a private foundation for pilot assessments in the Western Atlantic and the Pacific. A grant from the US State Department as part of the ICRI will be used to compile existing information on the status of reefs in the Western Pacific

and prepare a report for the Panama Symposium. This activity will be a joint effort with the Pacific Science Association's Committee on Coral Reefs.

ii. Re-surveys (re-visits) of reef areas that were studied earlier this century to assess long-term changes. Funds are available to initiate two re-visits in the Atlantic during 1995: Puerto Rico, and Abaco Island in the Bahamas. Other candidate areas in the Pacific and Indian oceans are under consideration.

iii. Re-surveys of reefs that have become damaged through known causes to evaluate impacts and recovery. Among the sites that should be considered are Florida (ship groundings), Panama (oil spill), Caribbean (over-fishing).

iv. Research into tolerances of reef organisms to particular impacts through study of examples and/or laboratory experiments.

2) Monitoring
Encouragement and support of national, regional, and international monitoring programmes that have been and are being established.

3) Education of user groups, students, and the general public.
Activities that are being planned or considered include:

i. A training course for dive masters and SCUBA instructors designed to provide them with basic information and concepts on the biology and geology of coral reefs that they can pass on to their clients and students. Funds are expected to be available to prepare the first version of this course and to try it out in Florida under the auspices of the Atlantic Reef Committee, headquartered at the University of Miami's Rosenstiel School of Marine and Atmospheric Science.

ii. Involvement of SCUBA divers and snorklers in providing early warnings of damaged or degraded reefs and in assisting in rapid assessments.

iii. Field trips to reefs for students and the public led by reef scientists.

iv. Promoting the development of curriculum materials on reefs for primary and secondary schools.

4) Outreach and collaboration.
Outreach to and collaboration with managers and administrators of reef protected areas, the ICRI and the community of non- governmental organizations.

i. Organizing dialogues with all three groups to develop lines of communication and uncover needs for information.
ii. Establishment of a coral reef information network and distribution of a newsletter focussing on management and NGO activities.

Implementation

The emphasis during implementation of IYOR plans will be on promoting collaboration and co-ordination between existing organizations and programmes involved in reef research and management, especially NGOs and university groups. The problems on reefs, both natural and anthropogenic, are region-specific as are socio-economic factors; all these are best addressed by those intimately involved with them. In a few regions, it may be appropriate to establish new groups to effect IYOR activities.

IYOR will have a two pronged approach, one through the scientific community, and one through the NGO community. The former will be responsible for research relevant to the mission and the latter will lead the education and publicity activities, as well as many of the management initiatives. Both approaches will complement each other however: methods developed for reef assessment can be used by the NGO community; and publicity and education campaigns carried out by NGOs will lead to wider support for scientific work and to the release of funds necessary for research.

Funding

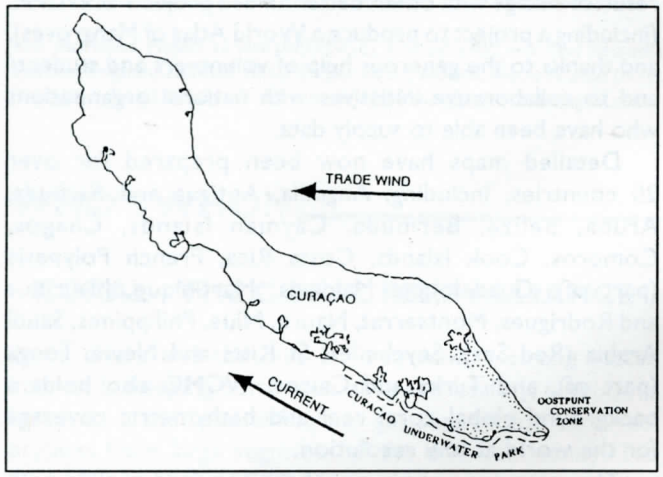
An encouraging start has been made on funding initial activities of the IYOR. The US State Department is providing start-up funds that can help to initiate activities of assessment and education. The contribution of a private foundation will seed efforts on rapid assessment in the Atlantic and Pacific oceans. A fund-raising event sponsored by Showboats International has raised funds for the assessment of Florida reefs and for matching support to develop the diver-master training course. It is increasingly clear that the most effective fund-raising is regionally based. The pool of prospective donors with regional or local interests is large and responsive to concerns that are in their neighborhoods. The Organizing Committee is ready to provide background information and suggestions to regional groups on fund- raising ideas.

Further information from: *Dr R. Ginsburg, University of Miami/RSMAS, 4600 Rickenbacker Cswy, Miami FL 33149. Fax: (305) 361-4094/4632. e-mail: rginsburg@rsmas.miami.edu*

MEETINGS IN BELIZE

Although not strictly part of the major initiatives, two invitation-only meetings are being planned to take place in Belize this year that cover similar topics. In July, sponsored by USAID and the Wildlife Conservation Society, there will be a meeting of representatives from the Central American countries which will aim to develop a common coral reef monitoring protocol for these countries. Existing recommended methods will be used as a basis for this project. In October, IUCN will be organising a meeting with funding from the European Union which will allow delegates from a selection of the Africa-Caribbean-Pacific countries that are part of the Lome Convention, to share their experiences in coastal zone management with particular reference to coral reefs.

THREATS TO CURAÇAO'S REEFS



The best fringing reefs in Curaçao lie around the south-east point of the island and fall within the 20 km stretch of coastline and adjacent marine water that was declared as the Curaçao Underwater Park in 1983. These reefs are thought to be particularly important in terms of the overall health of the Curaçao reefs as they lie upstream of other reef areas and thus may be the main source of larvae for recolonisation. The adjacent land area, known as Oostpunt, is privately owned, but was designated in 1991 by the government as the Oostpunt Conservation Zone in order to protect the nearby marine resources and because it is of conservation interest in its own right. The area has also been proposed as the site of Curaçao 's second national park.

Recently however, there has been a change in policy and the government has agreed that the owner, and a developer who wishes to urbanise the area, may go ahead and develop 20% of the area provided an Environmental Impact Assessment is undertaken. There are fears that, were such development to go ahead, it would inevitably present a major threat to the reefs, particularly as they lie only about 200 ft off shore and in about 20 ft of water. Elsewhere on Curaçao, the reefs are thought to be declining as a result of extensive coastal development.

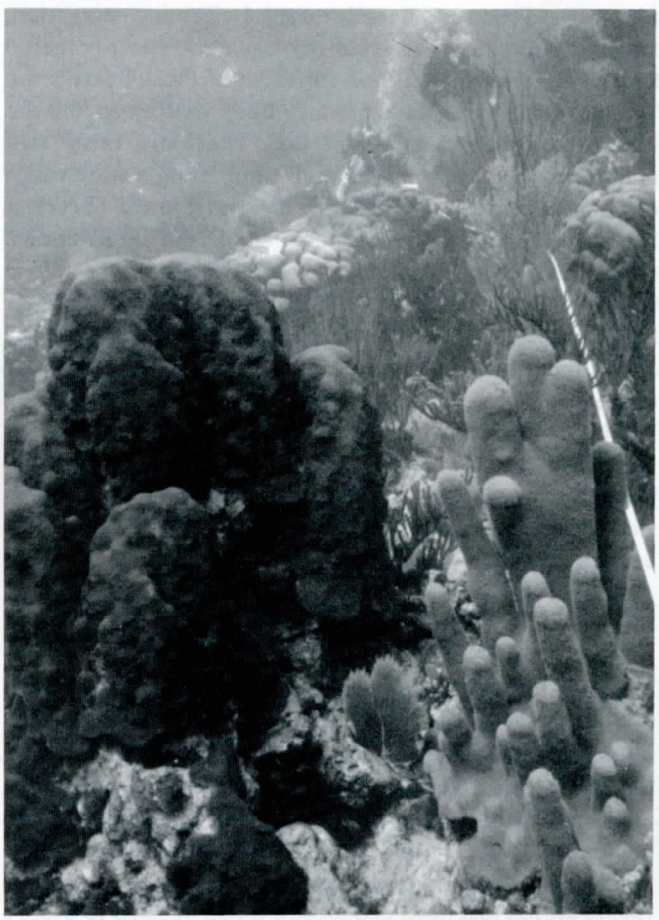
CARMABI (the Netherlands Antilles Ecological Institute), STINAPA (the Netherlands Antilles National Parks Foundation) and a local NGO, Reef Care Curaçao, have therefore been lobbying for support to oppose the development at all costs. Support has been obtained from around 50 local, regional and international organisations and individuals. Rolf Bak, Council Member of ISRS, brought the issue to the attention of the Society at the AGM held in September 1994 at the Luxembourg meeting and the following resolution was passed:

> "In view of the degradation of coral reefs in all parts of the world and in consideration of the value of the reefs of Oostpunt Curaçao as an unspoilt Caribbean fringing reef, we urge the Government of Curaçao to preserve the reef of Oostpunt in its original, untouched condition for future generations."

General Assembly of the ISRS at the Annual Meeting Luxembourg, 9 September 1994.

The Florida-based NGO, Project ReefKeeper, was invited to carry out a habitat survey and environmental assessment of the marine area in December 1994. Transects were run at a number of sites, including a control location near the Avila Beach Hotel outide the Park which has been heavily affected by development, run-off from coastal roads and the construction of artificial beaches. The survey showed that the Oostpunt reefs averaged 58% coral cover whereas the Avila site had only 32% coral cover and substantial algal cover; 24 coral species were found on the Oostpunt reefs, but only 15 at the Avila site. This suggests that the Oostpunt reefs may indeed be the most pristine reefs left in Curaçao.

Expert opinions on Project ReefKeeper's report are now being solicited and this review, with the report, will be submitted to the Curaçao Island Council this month. The Council will make a final decision on whether to open part of the Oostpunt Conservation Zone to development by the end of August 1995. If you would like to make a submission on this issue, please do so. Send your comments and responses, addressed to the Island Council of Curaçao, to: *Reef Care Curaçao, Kaminda Yakima 14, Curaçao, Netherlands Antilles, Fax 599-9-368120, or Project ReefKeeper, Operations Center, Suite 162, 2809 Nird Ave, Miami, Florida 33133, USA. Fax: 305-358-3030.*



REEFBASE

GLOBAL REEF DATABASE - AN UPDATE

By the time you read this it will be nearly two years since ReefBase was announced and about a year-and-a-half since work really began in earnest (see *Reef Encounter* 15). The database will be the first global review of coral reefs since the publication of the UNEP/IUCN *Coral Reefs of the World* volumes in 1988, and in its early stages it is being funded by the European Union.

Work began at the International Center for Living Aquatic Resources Management (ICLARM) in Manila in October 1993. By January 1994, preliminary ideas for the design of the database had been drawn up, core staff had been appointed and the World Conservation Monitoring Centre (WCMC) in the UK, who were developing a coral reef geographic information system (GIS) under the WCMC Coral Reef Mapping Initiative, had been brought in as collaborators. A small international workshop, with 20 scientists from ten different countries, was held in January 1994 in Cambridge to review the database structure.

THE DATABASE

John McManus and his team in Manila have now developed a highly detailed database, written in Access, which contains about 90 tables and several hundred fields. The database will hold simple descriptive data and statistics for an extremely broad range of issues including ecological, physical and chemical descriptors, fisheries and recreation, socio-economic issues, reef management and protected areas. The fundamental unit for most of these fields is the "reef-by-year". Software has also been written to link the data to the maps in a simple GIS. There are three staff members now inputting data full-time, using a wide range of published and grey literature drawn from the library at ICLARM, including the proceedings of the International Coral Reef Symposia and the *Coral Reefs of the World* volumes. Reports have also been submitted by scientists from around the world. Some data are being directly added from other databases, as is the case for coral reef protected areas, data on which have been supplied by WCMC. Work has focused mainly on a limited subset of the tables to date, notably those relating to ecology (and benthic cover) and reef management. As with all such work, the data-inputting process is integral with the further development of the database.

THE MAPS

The aim of WCMC's contribution is to prepare a digital map of the world's coral reefs at a base scale of 1:250,000, showing reefs as polygons, and including bathymetric contours for 20, 50, and 100m, as well as related ecosystems where available. The funding through ReefBase was for only about 6 man-months but, given the WCMC's interest in global biodiversity mapping (the first global coverage of tropical rainforest has just been produced), it was decided to make a start on the project and raise further funds along the way. A considerable amount has already been achieved partly as a result of linkage with other, better funded projects at WCMC (including a project to produce a World Atlas of Mangroves), and thanks to the generous help of volunteers and students and to collaborative initiatives with national organisations who have been able to supply data.

Detailed maps have now been prepared for over 20 countries, including: Anguilla, Antigua and Barbuda, Aruba, Belize, Bermuda, Cayman Islands, Chagos, Comoros, Cook Islands, Costa Rica, French Polynesia (part of), Guadeloupe, Maldives, Martinique, Mauritius and Rodrigues, Montserrat, Nauru, Niue, Philippines, Saudi Arabia (Red Sea), Seychelles, St Kitts and Nevis, Tonga (part of), and Turks and Caicos. WCMC also holds a background global coral reef and bathymetric coverage for the world at low resolution.

The maps are not always of the required quality, with some failing to show all the desired features (such as bathymetry), or based on relatively old data. However, most of the small islands have been prepared at resolutions greater than 1:250,000 and several maps show a wide range of features, including mangroves, seagrass, shoreline-type and protected areas. Because of budget constraints, it has not been possible to do a big mail-out to all relevant persons, but attempts have been made to consult with scientists and cartographers for each country, to ensure that the best readily-available data (digital where possible) is used. Groups consulted have included UNEP, NAMRIA (the Philippines), MEPA (Saudi Arabia), the Island Resources Foundation (Caribbean states), Corial and the East-West Center (Pacific Islands), WWF, Bangor and Warwick Universities (Indian Ocean), and numerous individuals.

We are still looking for other good maps, preferably in digital form, at a scale of about 1:250,000 (with higher resolution for small countries). We are in effect offering a free digitising service in cases where digital data are not available. Furthermore, most of the data held at WCMC are freely available (subject to copyright etc.), although small charges are usually made to cover the cost of formatting and preparing special outputs, unless data are given under data exchange agreements. If you can help, please do not hesitate to get in touch.

THE "FINAL" PRODUCT

Many of the tables in the database have automatic links to maps and work is currently underway to refine this software. It is planned to start importing the maps from WCMC towards the end of 1995. The database and the GIS will be linked on a CD-ROM output which will have its first release at the Panama ICRS next year. At this stage, ReefBase will not be complete, but it will set a format and structure for future work. Many of the tables will contain data and there will be maps, at some scale, for every country.

This is a new regular page in *Reef Encounter* to provide information on ReefBase and the WCMC Reef Mapping Initiative. Any comments, criticisms and advice would be most welcome.

Mark Spalding, Marine Research Officer, World Conservation Monitoring Centre, 219 Huntingdon Road, Cambridge CB3 0DL, United Kingdom. Tel: +44 (0)1223 277314; Fax: +44 (0)1223 277136. e-mail: Mark.Spalding@wcmc.org.uk

John McManus, Project Leader (REEFBASE), Coastal and Coral Reef Resource Systems Program, ICLARM, M.C.P.O. Box 2631, Makati, Metro Manila 0718, Philippines. Fax (63-2) 816 3183. e-mail: JMcManus@iclarm.msm.cgnet.com

WHO'S WHO?

CORAL - THE CORAL REEF ALLIANCE

Scuba divers and the dive industry have a strong vested interest in keeping coral reefs alive and healthy. Until now, however, it has been difficult to get support for coral reef projects from large segments of the dive community. The Coral Reef Alliance (CORAL) has been created to address this problem by building a large new constituency of divers concerned about threats to coral reefs, and by raising funds to support coral reef conservation and research.

Scuba divers constitute an active, affluent demographic group. There are over five million certified scuba divers in the United States alone, and over six hundred thousand new scuba divers certified each year. Demographic studies show that the majority of divers match the profile of people who support conservation efforts. Most divers in North America are college educated with annual incomes exceeding US$70,000, and a growing percentage of new divers are women (*Skin Diver*, 1993). These divers spend over one billion dollars annually in order to dive at coral reef destinations (*Tour & Travel News*, 1993).

By soliciting funds from a narrow target market of recreational users to conserve a particular type of natural resource, CORAL is following the successful model of organizations such as Ducks Unlimited, which now raises US$50 million annually from its 500,000 members to support wetlands conservation. One of CORAL's long-term goals is to build a multi-million dollar Coral Reef Conservation Fund that will serve as a permanent source of financial support for reef conservation and research.

Divers, the dive industry and numerous private foundations have donated generously to helped launch CORAL. Major funders include: The Wallace Alexander Gerbode Foundation, The Richard & Rhoda Goldman Fund, The Hahn Family Foundation, The Henry Foundation, The Ittleson Foundation, The Curtis and Edith Munson Foundation, and The David and Lucile Packard Foundation.

CORAL and the ISRS

CORAL is working in cooperation with a number of ISRS members to increase the public's awareness of threats to coral reef ecosystems. In particular, CORAL is promoting the initiative to designate 1996 as The Year of the Reef through articles in the popular press and diving publications. Further, CORAL is providing support for ISRS scientists to identify reefs in the Western Atlantic that show signs of recent decline. CORAL distributed a "Call to Divers" at its booth in this year's Dive Equipment and Marketing (DEMA) show, asking divers to phone, fax or e-mail information on reef condition to Bob Ginsburg at the University of Miami.

Two other CORAL initiatives may be of interest to ISRS members. First, CORAL's Volunteer Service matches individual CORAL members with reef research and conservation projects that need help. If you need skilled volunteer divers for an upcoming project, the CORAL Volunteer Service may be useful. Second, through the CORAL Diver Network on the Internet, CORAL members can go on-line and report on coral reef conditions they have observed during recent dives anywhere in the world. The CORAL Diver Network allows members to report instantly on the condition of reefs and helps CORAL mobilize concerned divers quickly to address threats to particular reefs. There are plans to coordinate this information with the reef databases being developed to track reef conditions around the world (see *Reef Encounter* 15:15).

CORAL is interested in ideas from ISRS members about how to increase cooperation between reef scientists and reef conservation organizations, and we encourage your questions and comments.

CORAL Membership Activities

CORAL's newsletter and other publications keep members up to date on what the dive community is doing to help protect coral reefs. CORAL's publications, seminars, dive trips and educational programmes distribute information about threats to coral reefs and what can be done to combat these threats. CORAL also distributes information to divers, dive stores and tour operators that explains what individual divers can do to dive responsibly and respect coral reefs.

ISRS members are encouraged to become members of CORAL. CORAL members have access to CORAL's newsletters and on-line information, as well as many other membership benefits. Annual membership starts at only US$20. If you join CORAL in 1995, you will also receive a free one-year subscription to Rodale's Scuba Diving Magazine.

For more information on CORAL's activities or to become a member of CORAL, please contact: *CORAL - The Coral Reef Alliance, 809 Delaware St., Berkeley, CA, USA 94710, Tel: (510) 528-2492 / Fax: (510) 528-9317 / E-Mail: CoralReefA@aol.com.*

MEETING REPORTS

CORAL REEF RESPONSES TO GLOBAL CHANGE: THE ROLE OF ADAPTATION: SCOR Working Group 104

At its most recent meeting, the Scientific Committee on Oceanic Research (SCOR) approved the formation of SCOR Working Group 104: CORAL REEF RESPONSES TO GLOBAL CHANGE: THE ROLE OF ADAPTATION. The Terms of Reference of the group are:

A. To review, classify, and summarize present evidence for adaptation to climate/environmental change at the

organism and community levels, with attention to the issues of rates and limitations.

B. To present available evidence and theories and to solicit scientific input from the broader community by organizing one or more special sessions at the 8th International Coral Reef Symposium (Panama, June 1996), based on initial review and issue formulation by working group members. The Symposium programme organizers have agreed in principle to support this activity, which is seen as providing an important avenue of communication with the larger community of coral reef scientists.

C. To work with the broader input obtained from these symposia to produce by mid-1998 an authoritative report or compilation of reports to SCOR addressing the following issues:

1. The evidence for adaptive responses to environmental change at both the organism and the coral reef community level. Issues of community structure as well as function (metabolism and carbon budgets) will be specifically addressed, as will time scales relevant to climatic cycles as well as the biological processes of existing reefs.

2. Hypotheses concerning the mechanisms for these adaptive responses and for their interactions or propagation across time and space scales relevant to global change. This will explicitly include identification of critical research needs and opportunities.

3. Rate dependence and critical thresholds for reef survival, adaptation, or re-establishment, with specific reference to the relationship between past and present environmental change and the scenarios for Greenhouse-enhanced future change.

Members of the working group are expected to be (pending formal invitation and acceptance): R. W. Buddemeier (Chair), R. Bak, R. Gates, J.-P. Gattuso, T. Done, J. Pandolfi, B. Hatcher, and A. B. Pittock. Corresponding members will be: S. V. Smith, C. B. Castro, R. Rowan, B. Opdyke, J. Patzold, and D.Yellowlees.

The origins of this working group lie in efforts over the past five years (D'Elia *et al.*, 1991; Smith and Buddemeier, 1992; Buddemeier and Fautin, 1993; Wilkinson and Buddemeier, 1994) to assess and predict responses of corals and coral reef communities to various kinds of environmental change, and more particularly in the frustrations resulting from those efforts. In the interests of space the comments that follow do not include citations contained in the reviews cited above, and I emphasize that the opinions expressed do not necessarily represent those of other members of the Working Group.

One basic frustration centers on the issues underlying the "fragile vs. robust" debate that has been discussed in these pages before (*Reef Encounter* 9). Viewed from a present-day biological perspective, reef ecosystems are seen as highly diverse, complex, interdependent communities. They are acknowledged to be disturbance-adapted, but the disturbances considered typically have time constants short compared to coral life-times, and spatial dimensions not much larger than a modest suite of individual reefs. Reefs are seen as vulnerable to chronic (often anthropogenic) stress, and experiments on individual organisms commonly demonstrate that there is a fairly narrow (although not necessarily invariant!) range of environmental conditions over which physiological responses are "optimal." This overall image points to the "fragile" classification, which is often reinforced in non-technical literature by analogies to the "underwater rainforest" – analogies that I consider misleading because of their fallacious implications about the locational stability, levels of endemism, and mechanisms of reproduction of reef organisms and communities.

From a more geological or paleobiological perspective, reefs almost inevitably appear more "robust." Reefs and their constituent organisms have persisted through the climate oscillations of the Quaternary – oscillations that appear to be more extreme and more rapid the more closely they are examined. Evidence is accumulating that tropical oceans may have been as much as 4-6 degrees cooler at and well after the Last Glacial Maximum (LGM) (Science, 1994; Beck *et al.*, 1992). A preliminary review of bathymetry (Archer and Buddemeier, unpubl.) indicates that a LGM eustatic sea level drop of 105 m (Peltier, 1994) would reduce the shallow benthic surface area available for coral reefs to less than 15% of the modern value, and would also affect the distribution and diversity of shallow-water habitat types. A recent interpretation of coral-derived data on the Holocene Transgression (Blanchon and Shaw, 1995) indicates that there were sustained periods of sea level rise so rapid that shallow-water reef community structures could not persist. Yet, in spite of complete relocation of the communities themselves, probable major changes in biogeographic ranges, and environmental disruption of community structure as we currently envision it, Indo-Pacific coral taxa have survived the last 3 Ma without substantial extinctions (the comparable number in the Caribbean is probably 1 Ma (Budd *et al.*, 1994), which still encompasses multiple glacial cycles), and, in addition, the distributions and community composition and structure of preserved reefs appear to be reproduced at successive interglacials.

I have been unable to reconcile these seemingly self-consistent yet contradictory views into any kind of coherent prediction or generalizable advice potentially useful to policy makers or managers. It seems clear to me that unless the "geological" observations are grossly biased or inaccurate, there must be unrecognized or uncharacterized mechanisms of adaptation (a term that I use in its immediate, physiological sense rather than as an attribute defined on evolutionary time scales) embedded in the physiology, symbiotic interactions, and life histories and reproductive strategies of reef organisms and assemblages. If so, elucidation of these mechanisms is likely to alter fundamentally our understanding of reef communities and their constituent organisms.

A third aspect of the overall puzzle is not on the axis of the "fragile-robust" or "biological-geological" dichotomies, but provides both further incentives for addressing the issues and a possible approach to their understanding. This is

the community metabolism aspect of coral reefs, and its role in carbon (and other nutrient) budgets both at the community level and on global scales. Various formulations of the "Coral Reef Hypothesis" (Opdyke and Walker, 1992) have suggested that the oscillations in net coral reef calcification as sea level changes may provide critical climatic feed-back through their effect on the air-sea CO_2 system. Although such a role may be unlikely for reefs alone, it is definitely a reasonable consideration in terms of total neritic carbonate production, of which reefs are a significant component. This global consideration relates to the investigations of reef calcification rates that suggest broad consistency in modal values over a rather wide range of environments and community compositions. This hint of functional consistency across structurally and compositionally diverse communities suggests some avenues for approaching the dilemma of understanding communities that seem tightly integrated on some scales but ephemeral on others. In particular, the interactions between photosynthesis and calcification at a variety of scales, between community function and structure, and between those interactions and variations in the environment are all subjects that may help unify the "bioreef" and "georeef" concepts, establishing both in a truly global context.

After a third of a century of coral reef research, we find that many key questions have not been asked, and that the answers to those that have been asked repeatedly often lack useful levels of insight or generality. My personal view is that reductionist, disciplinary research is a necessary but not sufficient condition for scientific advance, and that we are overdue for some serious integration and intercalibration of our present research approaches and disciplinary conventional wisdom. It is my hope, and intention, that SCOR Working Group 104 will make a major contribution to this. However, such a goal reaches beyond the grasp of even the finest of committees. We will succeed to the extent that we can catalyze, document, and perhaps to a limited extent coordinate, a much wider set of discussions and collaborations. I am looking forward to providing more details on activities and opportunities for interaction in the next *Reef Encounter*; in the meantime, anyone with ideas or contributions relevant to the terms of reference should feel free to contact me (or other members of the Working Group).

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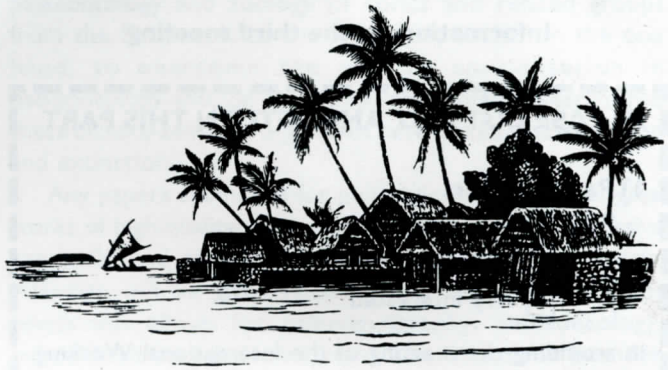


INTERNATIONAL WORKING GROUP ON SCLERACTINIAN CORALS

The second meeting of the International Working Group on Scleractinian Corals was held as a workshop during the Second European Regional Meeting of the International Society for Reef Studies in Luxembourg (September, 6-9, 1994). The main purpose of the meeting was to discuss the next steps in the systematic revision of the post-palaeozoic corals (Scleractinia). Because of a concurrent session on sclerochronology during the workshop, participation was rather low, with only 16 of the 40 people who had hoped to attend, being present.

The following topics were discussed:

1. Development of the List of Morphological Terms by L.Beauvais, C.Chaix, B.Lathuiliére and H.Loeser

The List of Morphological Terms has been translated into German by R. Baron-Szabo, M. Bertling, U. Lauxman and W. Werner and into Spanish by G. Alvarez. Copies are available from H.Loeser. Following the sudden death of Louise Beauvais, no one has been found to complete the list. It was agreed that the list in its present form is nevertheless useful, and it may be possible to complete it later. Comments on this are being collected by H.Loeser.

2. Systematic revision of genera

For the systematic revision of genera, a list of about 1500 Scleractinian generic names (Triassic to Recent) was compiled and distributed at the workshop. Interested colleagues were asked to mark the genera on the list which they could revise and to return the lists before Dec, 31, 1994 to H.Loeser. However, only three lists have been returned. The list is still available from H.Loeser by mail or, preferably, email (packed

ZIP-file). Lists should be returned as quickly as possible.

3. Further work

There are already many ideas for further work to be presented at the next meeting. The next steps in the revision, and any technical and organisational questions should be discussed in detail. The VII International Symposium on Fossil Cnidaria and Porifera in Madrid has been envisaged as the venue. The status of the Working Group and its coordinating role still have to be discussed, and there are urgent decisions to be taken.

Information on the third meeting

PLEASE CUT OUT AND RETURN THIS PART

1) Participation.

I'm ☐ not interested
☐ perhaps interested
☐ very interested

in attending the meeting of the International Working Group on Scleractinian Corals

2) Systematical revision of the genera

☐ I'm not interested
☐ I've got the list already and I enclose it here
☐ I have not received the list but I want to have it

by ☐ postal mail
☐ email (as PKZIP-file) and I will send it back as fast as I can

3) Propositions

I would like to make the following propositions to the next meeting:

_____

_____

_____

4) I would ask you to inform me whether the meeting will be held or not in Madrid.

☐ yes
☐ no

Name: _____

Phone: _____

FAX: _____

email: _____

To be mailed to: H.Loeser, PF 192409, D-01282 Dresden, Germany. FAX : +49 (0) 351 30951, +49 (0) 351 335203, email: h.loeser@link-dd.cl.sub.de

On September 12th, a session on "Paleobiology of Scleractinian Corals" will be held during the VII Symposium on Fossil Cnidaria and Porifera in Madrid (September, 12-15, 1995) as a concurrent sessions with those on the Palaeobiology of Palaeozoic Corals and the Palaeobiology of Sponges. Sergio Rodriguez, the Chairman of the Symposium, was so kind as to ask me to organize the third meeting of the International Working Group on Scleractinian Corals as a workshop in this session.

However, a meeting of the working group is only useful under the following conditions:

1. If a high number of participants express interest in the meeting as well as in active cooperation within the Working Group.

2. And if more information is provided by colleagues as a contribution to the systematic revision before the meeting. Please return the lists that you have received in Luxembourg or ask me for copies, and send all replies to me as soon as possible. It is absolutely necessary to have a firm base before proposing the next steps.

If there are too few people, or if insufficient contributions are returned, the meeting will be not held in Madrid, and a decision will be taken later about a meeting in the next or following year.

The intention of this circular is to determine the interest in the next meeting and in assisting with the revision. Please return the questionnaire on the left. It will then be decided whether the meeting will take place in Madrid. Assuming that the meeting will be held, contributions can be submitted, but they should cover only the topics relating to the revision. Contributions to the session on "Palaeobiology of Scleractinian Corals" should be sent as usual to Sergio Rodriguez.

GLOBAL REEF RESEARCH AND MONITORING MEETING

On 23-27 October 1994 a meeting, sponsored by the IGBP Project Land-Ocean Interactions in the Coastal Zone (LOICZ), the Intergovernmental Oceanographic Commission (IOC), and the World Conservation Union (IUCN) was held at Bermuda Biological Station for Research. The invitees divided into two groups to take up two major areas of concern. The first group (Buddemeier, Chair, Elder, Hendry, Pernetta, Woodroffe, and Yap) reviewed the science plan of the LOICZ Core Project, which contains broad considerations of the impact of global climate change and land-use practices on coastal ecosystem dynamics, and considered whether this design was appropriate for implementation on coral reefs. The second group (Rogers and Ogden, Co-Chairs, Cortes, Eakin, Gomez, Scherer, and Knap) drafted a work plan for a Global Coral Reef Monitoring Network (GCRMN) as a part of the Global Ocean Observing System (GOOS). The

GCRMN, which grew out of the notorious "alphabet soup" workshop in Guam in 1992 (UNEP/IOC/IUCN/WMO Pilot Activity on Global Reef Monitoring), has been funded by several of the partners of the International Coral Reef Initiative (ICRI). The first step will be to hire a GCRMN Coordinator and to establish an office at a suitable venue to begin the development of a regionally-based global coral reef assessment, monitoring, and research program. A report of the meeting (LOICZ Report No. 4) is available from: *LOICZ Core Project Office, NIOZ, Texel, The Netherlands.*

COMMUNITY INVOLVEMENT IN THE MANAGEMENT AND PROTECTION OF CORAL REEF ECOSYSTEMS IN HAWAII

This workshop was held on November 10th, 1994, at the Honolulu Campus of Tokai University, and was sponsored by the Sierra Club Legal Defense Fund, Life of the Land and the Greenpeace Pacific Campaign. Participants included scientists, students, government personnel, environmentalists and reef users such as fishermen. Following the key-note speakers, four discussion groups were formed to review issues such as community management, legislative and policy initiatives, local outreach and education strategies, and monitoring and research. Of particular interest was the new community-based subsistence fishing area set up on Molokai by a group of Hawaiians, the Hui Malama O Mo'omi, when they realised that their fish stocks were declining. The area has official designation under state legislature, and the group is formulating their own management plan.

The strategies developed in the four discussion groups have been compiled into an action agenda and a working group is being established to follow through the recommendations. Further information from: *Sierra Club Legal Defense Fund, 223 South King St, Austin Building, 4th Floor, Honolulu, Hawaii 96813. Fax 808 521-6841.*

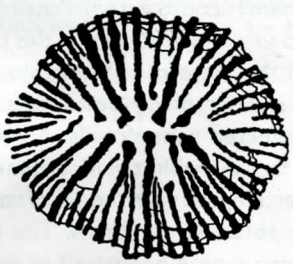
ANNOUNCEMENTS

NEW RESEARCH FACILITIES

Mote Marine Laboratory's Florida Keys Marine Research Center is available for use by researchers interested in the marine habitats of the Florida Keys and Florida Bay. The Center is located on Pigeon Key approximately in the centre of the Florida Keys National Marine Sanctuary. Housing and lab facilities, including a flow-through seawater system, are available on the island. Boats are also available.

For further information please contact: *Dr. Michael J. Marshall, Research Coordinator, Florida Keys Marine Research Center, 1600 Thompson Parkway, Sarasota, Florida 34236, USA. Tel. 813-388- 4441; Fax 813-388-4312; e-mail, KeysSci@aol.com.*

NEW JOURNAL - Coral Research Bulletin



The Coral Research Bulletin (CRB) is a new journal on the palaeontology and zoology of corals and related groups from the Palaeozoic to the Recent. It seeks, on the one hand, to overcome the existing specialization in palaeontology and, on the other, to further research into these climate-sensitive organisms between faunist explosion and extinction.

Any papers submitted for publication should be original works of high quality, show an unorthodox and progressive approach, and serve to advance coral research. Special attention will be given to taxonomy and the inferences which this allows for palaeogeography, palaeoecology, palaeoclimatology and stratigraphy. The CRB is also intended as a forum for authors from East European countries and the C.I.S. states. It will primarily carry articles of some length, but issues containing a collection of smaller papers are also conceivable.

Three or four volumes a year are planned, beginning in 1994. The publisher Hannes Loeser will be cooperating with a number of colleagues who have indicated their willingness to examine and edit articles. Manuscripts will be accepted in English, French and German (preferably in English). Results which have already been - or are being - published elsewhere cannot be published in the CRB, although this does not apply to strongly condensed abstracts, which we could publish in full.

Volume 1 (published May 1994): The Mesozoic Corals. Bibliography 1758-1993. (in English) By a team of authors. 97 pages, diskette, boards (DM 40)

This bibliography contains almost 2,000 references to the taxonomy, palaeoecology and palaeogeography of Mesozoic corals (Triassic-Cretaceous; Scleractinia, Octocorallia). All entries have been very carefully checked and supplemented with information on topics such as age, country of origin of the material reviewed, and taxonomic aspects (new taxa, description/illustration). An index of the countries of origin facilitates access to the literature on specific geographical regions. The accompanying diskette contains the bibliography in the form of a database as well as a menu-driven search programme for IBM-compatible computers. Updating will be provided as an optional service.

Volume 2 (July 1994). Hannes Loeser & Ulrike Kienel. Die Korallenfauna des Kassenberges in Muelheim/Ruhr (Westfalen; Deutschland). 1: Geologie und Paloekologie. (in German) 23 pages, 5 text illustrations, 9 coloured plates, paperbound (DM 40)

Part 1 of the monograph outlines the geological exploration of the Kassenberg quarry in Muelheim-Broich, access to

which has become difficult, and shows the site in several profiles (some of them reconstructed). Possible sedimentation cycles from the Lower Cenomanian to the Upper Turonian are described and the state of palaeontological research is documented. The stratigraphic results are supplemented by an evaluation of selected nannofossils. A reconstruction of the Cenomanian facies, habitat and sedimentation of the Kassenberg site is attempted with the aid of studies conducted on Mediterranean abrasion platforms. The highly coloured plates include photos (some historical) of the fossil site and illustrate a striking similarity with Mediterranean abrasion coasts.

Volume 3 (September 1994). Hannes Loeser. La faune corallienne du mont Kassenberg a Muelheim/Ruhr (Westphalie; Allemagne). 2: Paleontologie. (in French). 93 pages, 65 text illustrations, 14 plates, boards (DM 48).

Part 2 of the monograph deals with the corals found at the Kassenberg site. The relatively small fauna of a pronounced Jurassic character comprises about 40 species of hermatypic corals belonging to 29 genera of both Hexacorallia and Octocorallia. A comparison with type material from the Cretaceous in France, Saxony (Germany), Austria, Slovenia, Serbia, the Czech Republic and from the Jurassic in Poland and Romania augments the existing knowledge of some species and genera. The families Stylinidae and Haplaraeidae and the genera Acrosmilia, Adelocoenia, Epistreptophyllum and Mixastraea are dealt with in detail. In the concluding chapter, the coral fauna is compared - both geographically and stratigraphically - with other coral faunas of the Lower to Middle Cretaceous.

The CRB is published at irregular intervals. Each volume is priced individually and can be ordered separately. Subscriptions are also available and the price for 1994 is DM 110. A special 50% discount is granted for Eastern Europe and the C.I.S. countries. All prices in DM, V.A.T. (EU), postage and package included (overseas air surcharge DM 10.00, each volume if mailed separately). Payment of separate volumes on a pro forma basis only; the annual subscription is payable on receipt of the first volume. Payment either by credit card (EuroCard/MasterCard), Eurocheque/cheque payable on a German bank or by remittance (+ DM 20.00 bank charges). Prices are subject to change without notice. *Coral Research Bulletin. c/o CPress Verlag, PF 192409, D-01282 Dresden, Germany*

REEFDATA: A DATABASE FOR REEF SURVEY DATA

An easy-to-use database program is available for data collected using variations of the line transect method such as intercepted distance (whether measured with a tape measure or a chain) and point intercepts. The program runs on IBM compatible computers (286 up) under DBase or FoxPro and uses little disk space. It could be adusted to run on Mac (almost runs now) but that will be up to the user to do. The database files created may be adapted for integration into databases currently under development. Although the program has been extensively tested, the manual is new and may not be as transparent to a new user as it is to us, so feedback would be useful.

What does the program do? (1) It uses the general categories (e.g. Algae, Hard Coral, etc.) and object names (e.g. Turf Algae, Massive Corals, or more specific names if desired) to produce percentage summaries by category and object name. (2) For corals, in addition to percentage cover for each type, it produces summaries of colony count and number of species. (3) It can do this for intercept and point data. (4) Outputs include: a) a record of all data stored in "transent.dbf" and "samples.dbf" files, from which raw data can be abstracted; b) a printout with the above information and a list of survey items and measurements; and c) a summary spreadsheet file. d) a plot of cumulative species vs distance is optional. e) misc. other options. (5). Code names can be up to seven letters long and can be easily adapted to match those proposed for databases under developement (e.g. ASEAN or CARICOMP). (6) Mutant code names are rejected, ensuring standardization and reducing error checking time. (7) New code names can be introduced by adding them to the "objects.dbf" file via a start-up menu choice. This allows the list to evolve with user knowledge and needs, while allowing generalization to higher taxonomic or functional levels (e.g. lump all branching corals or all algal types) either using the summary printout, the flat database summary file or the relevant data records from the transent.dbf file. The same end can also be accomplished by writing a database program subroutine. (8) There is a code line which if activated, ensures that the program cannot be shut down without a backup copy being taken to a floppy disk.

Program and instructions are available free, but there is a US$ 5 charge for disk, packaging and air postage from: *William R. Allison, Maadheli, Majeedhee Magu, Male 20-03, REPUBLIC OF MALDIVES (Via Singapore).*

GLOBAL ASPECTS OF CORAL REEFS - STILL AVAILABLE

Copies are still available of the Proceedings of the Colloquium on Global Aspects of Coral Reefs: Health, Hazards and History, that was held at the University of Miami in June 1993. This collection of 62 case histories from 28 countries is edited by Bob Ginsburg and covers a range of topical issues. Price $30.00, plus 15% handling charge and postage; 10% discount on orders of 10 copies or more. All orders will be sent library rate domestically and surface mail internationally. Cashier's checks and money orders made payable to the University of Miami must accompany the order, which should be sent to: *Comparative Sedimentology Laboratory, c/o Robert Ginsburg, University of Miami, RSMAS/MGG, 4600 Rickenbacker Causeway, Miami FL 33149, USA.*

NEW JOURNAL - Fisheries Research Bulletin of Tonga

This new journal aims to publish the findings of fisheries research underway in the Kingdom of Tonga. It is also the intention that it will facilitate exchange of information with other interested parties undertaking similar work elsewhere in the world. For details of the journal and correspondence on South Pacific fisheries please write to: *Tadashi Kimura, Aquaculture Research and Development Project, JICA, Minsitry of Fisheries, P.O. Box 2480, Nuku'Alofa, Kingdom of Tonga. Tel/Fax: 676 23 891.*

BOOK REVIEWS

THE PACIFIC REEFS: A PARADISE LOST?

Pat Hutchings (Guest Editor)

Special Issue of *Marine Pollution Bulletin* Vol. 29, 1994. 140 pp. ISSN 0025-326X. Available from: Anne Vindenes Allen, Elsevier Science Ltd, The Boulevard, Langford Lane, Kidlington, Oxford OX5 1GB, UK. Fax (44) 865 843954. Price £40 per copy (for orders of 1-9 copies) inc. surface mail.

This compilation of 19 papers covers a broad range of issues relating to reefs of the Pacific island nations and several of the Pacific rim countries. The aim is to draw attention to the many problems facing this region and the apparent lack of reef management.

Current threats to the reefs in the South-western Pacific islands (Fiji, Tonga and Western Samoa), French Polynesia, Hainan in China and Papua New Guinea are described. The Papua New Guinea paper gives some information on reef status at localised sites, but the contents of these contributions reflect the fact that few data are available to describe reef health or condition in this region, although it is comparatively easy to identify potential threats. Papers on the Philippines (summarising the results of survey work since 1979) and Hong Kong (comparing early studies with recent ones) are rather more successful in providing a picture of current reef status, but they make depressing reading - as is well known, in both countries, reefs have undergone substantial deterioration. A paper by Peter Glynn reviews the work carried out in the Galapagos which revealed the link between bleaching and coral mortality and ENSO events, and also makes the point that current human activities in this formerly pristine environment now provide an additional threat to reefs already stressed by natural events.

Several papers describe localised studies into particular threats that could negatively affect reefs on a broader scale: the 1994 coral bleaching event at a site in Tahiti, French Polynesia; contamination of sediments and shellfish in Suva Harbour from a battery manufacturing plant and a rubbish dump; the Torres Strait baseline study, in which concentration levels of various metals within the sediment and biota of the area were investigated in response to concern about the impact of effluent from copper and gold mines along the Fly River; the ENCORE experiment on the Great Barrier Reef which is investigating the response of reefs to nutrient enrichment; and a study carried out on Mataiva Atoll, French Polynesia, to determine the potential impacts of underwater mining of phosphate deposits in the lagoon.

Management-oriented papers range from the general to the specific. An IUCN project to identify priorities for marine protected areas in the South Pacific region is described, and provides a good overview of management issues but does not go as far as identifying priority sites for management, again reflecting the lack of good data. The potential for developing integrated coastal zone management programmes in the Pacific nations is discussed in another paper. This approach is apparently being used in Western Samoa and the Cook Islands and it would have been useful to have had more information on the successes and failures of these programmes. However, a paper on general environmental management issues in Yap provides such a case study and points out the pitfalls. The author is involved in the production of the country's twelfth marine resource management plan, the first eleven plans never having never been implemented, and he comes down heavily on the international donor agencies that fund such activities without any thought to the follow-up.

A review of management in French Polynesia suggests that little management is in progress. Fisheries and their management in the Solomon Islands are described. On a more positive note, a new approach to trochus management in Yap is described, which will involve the establishment of a State Trochus Marketing Authority whose functions will be to manage the biological and marketing aspects of the fishery, sell trochus on the international market and cover the costs of management from sale of the product. At the time of writing, the Bill for the establishment of the Authority had been accepted in principle by the Governor and both councils of traditional Chiefs.

The theme issue suffers from the fact that the papers have not been grouped together very obviously in terms of topics, although a wide range of subjects are covered. And the question arises as to whether the rather gloomy tone of the compilation, reflected in the subtitle 'A Paradise Lost', is perhaps a result of a bias in the selection of papers. The work of the South Pacific Regional Environment Programme, The Nature Conservancy, the East-West Center and several other major institutions and organisations is barely touched upon, and overall the issue probably underestimates the extent of management efforts underway in the region. For example, none of the many studies on the potential role of customary marine tenure and traditional rights in modern reef management are described.

However, any new information on the Pacific reefs, particularly in a peer-reviewed journal, is a welcome addition to the literature of this comparatively poorly studied region.

Sue Wells

REEF

Romesh Gunesekera

Granta Books, London in association with Penguin Books. 1994. ISBN 0-14-014217-7. 190 pp. Available from: Granta Books, 2/3 Hanover Yard, Noel Road, Islington, London N1 8BE, UK. Price stlg 9.99.

We felt that a review of a book with the title *Reef* was essential, although readers may be a little surprised to hear that this is a novel. But it will make a delightful addition to your fiction collection and, with the underwater photo on the cover, could easily pass for a slim text book and be read without suspicion in the lab or college library. *Reef* is the gentle, romantic, funny and often sad story of Triton, the houseboy of the eccentric Mister Salgado who lives in Colombo and is obsessed both by Sri Lanka's disappearing reefs and the beautiful Miss Nili who becomes his lover.

The foreground, and detail, of the book is taken up with engaging descriptions of Mister Salgado's courtship, ably assisted by Triton who becomes an accomplished cook through his own infatuation for Miss Nili: " 'He makes a lovely cake', she said, endearing herself to me for the rest of my life. I had used ten eggs instead of the regulation seven that day, because of her. And real yellow butter creamed to perfection."

The reefs, like the tense political situation in the country, provide the backdrop and create the sense of tragedy against which the comic scenes are played. Unlike the men in the Ministry, Mister Salgado understands the complexity of the relationships between the sea, the reefs and the lives of the people who depend on them. But he is powerless to help. Triton simply observes it all, amazed and even terrified by his first experience of the sea, but quickly taking refuge in the new challenge that it presents for his culinary skills: a brilliant blue parrotfish.

Not surprisingly, *Reef* has been shortlisted for at least one prize. Read it for its evocative descriptions of tropical gardens, its mouth-watering cookery details, and its sad ruminations on the reefs' decline - many of us will empathise with Mister Salgado's despair at the apparent inability of a single individual to make change happen.

Sue Wells

COLLABORATIVE AND COMMUNITY-BASED MANAGEMENT OF CORAL REEFS: LESSONS FROM EXPERIENCE

Edited by A.T. White, L.Z. Hale, Y. Renard and L. Cortesi

Kumarian Press Inc., 1994. 130 pp. ISBN 1-56549-032-0. Available from: Kumarian Press Inc., 630 Oakwood Avenue, Suite 119, West Hartford, CT 06110-1529, USA. Tel: 800-289-2664; Fax: 203-953-8579. Price US$21.95 (shipping and handling costs vary according to zone).

This book of case studies, sponsored by Greenpeace and the Coastal Resources Center of the University of Rhode Island, is a timely addition to the literature on community-based management of natural resources. Although this concept is not new - marine and coastal resources having been managed by local communities for centuries in some parts of the world - the idea that this might be a valid modern approach has taken some time to become accepted. Empowering people to take a part in managing their resources and to be actors, rather than passive subjects, is an idea that is being promoted in many aspects of sustainable management and development.

Following an introductory section outlining the need for community-based management and the failure of earlier management approaches, the book provides six case studies that were presented at a special session on community-based management at the 7th International Coral Reef Symposium in Guam in 1992. The third part includes a table with many other examples of community-based reef management from around the world, and the book concludes with a section on the lessons to be learned from the case studies presented.

The first case study tends towards a criticism of the community-based management approach, and describes the traditional management system *sasi* in the Moluccas in Indonesia. The system was upset by the emergence

of a commercial trochus market which led to competition between local government personnel and commercial exporters. However, if the idealistic 'pure' *sasi* concept failed to work, there is still hope that it can be revised and integrated into contemporary management programmes.

Community-based management appears to be particularly successful in the Philippines and there are two case studies from this country. The success may reflect something in Philippine society which makes it culturally and politically attuned to such an approach, but it is probably also due to the fact that people here are highly motivated to improve the management of their marine resources as their livelihoods having been so drastically affected by reef deterioration.

A St Lucia case study describes the conflict between fishing and diving user groups. Involving these groups in the monitoring of resources resulted in the formation of new user organisations to address the root problems. The Thailand case study provides a useful breakdown of the steps involved in setting up a community-based management project, and the case study from the Florida Keys illustrates how this approach is of equal value in a developed nation such as the USA where, in theory, government resources for management are so much greater.

There is a good discussion of the need to find ways of measuring management success, an aspect of monitoring that urgently needs to be introduced if effective strategies are to be developed with any rapidity. But the suggestion that levels of community awareness and the existence of management tools are themselves good measures is questionable; a marine protected area with a larger budget or more wardens is not automatically more successful than one with fewer funds or personnel - many other factors are of course involved.

If fault is to be found, it is perhaps that the concluding sections do not take a sufficiently critical look at the approach. The statement that the case studies all led, among other things, to a 'reversal in reef degradation' is not borne out by the information presented. The obstacles to and limits of community-based management are briefly covered at the end, and it is clear from the case studies themselves that co-management is probably the most appropriate strategy in many cases: increasing community responsibility but not in opposition to centralised or governmental management arrangements which are often essential to ensure long-term viability of a programme.

If further inducement to buying the book is needed, it should be noted that all royalties will be used to support coral reef management efforts where community and collaborative approaches are used.

Sue Wells

THE BIO-PHYSICS OF MARINE LARVAL DISPERSAL

Edited by Paul W. Sammarco and Mal L. Heron

American Geophysical Union, Coastal and Estuarine Studies, Volume 45, 1994. 356 pp. ISBN 0-87589-259-6. Available from American Geophysical Union - Orders, 2000 Florida Avenue, NW, Washington, DC 20009, USA. Fax : 1-202-328-0566. Price : US$42 (USA and Overseas) - AGU member price : US$29.40.

What are the larval dispersal capabilities of marine vertebrates and invertebrates is one of the most important questions arising in present marine research and still has no clear answer. The approach proposed in this book is very interesting because it joins biological and physical processes and suggests that questions on larval dispersal should be addressed using a multi-disciplinary approach. This book groups a series of authors who describe examples of studies conducted mainly on coral reef organisms. The book lacks information from non tropical research developed in the north Atlantic concerning the bio-physics of larval dispersal. However, it does describe larval dispersal on a large range of organisms and contains a very interesting concluding remarks section. This book gives an excellent overview of connections between biology and physics when related to larval dispersal in coral reef organisms.

Serges Planes, Centre Biologie Ecologie Tropicale, E.P.H.E., Université de Perpignan, 66860, Perpignan Cedex, France.

A CORAL REEF HANDBOOK

Australian Coral Reef Society

264 pp. Price A$29.95, plus $4.50. Available from Surrey Beatty and Sons, 43 Richmond Road, Chipping Norton, NSW, Australia 2170.

When we advertised this in *Reef Encounter* 14 (October 1993), we failed to mention that this is not the original version, but a completely new and re-written version. It is considerably larger and more comprehensive than the old edition which covered Heron Island only, and now covers the entire Great Barrier Reef. The new edition is already being re-printed as the first print-run is almost exhausted.

DIARY

Conferences

5-12 June 1995, International Convention Center, Beijing, China

XVIII PACIFIC SCIENCE CONGRESS

Sponsored by a number of Chinese scientific institutions, this will have 'Population, Resources and Environment: Prospects and Initiatives' as its central theme. There will be six general symposia as well as scientific sessions organized by the Scientific Committee of the Pacific Science Association, including one on coral reefs. The first circular is available from: *XVIII Pacific Science Congress Secretariat, c/o Institute of Atmospheric Physics, Chinese Academy of Sciences, P.O. Box 2718, Beijing 100080, P.R. China; Fax: 86-1-2562458.*

26 June - 2 July, University of Sydney, Sydney, Australia.

INTERNATIONAL LARVAL FISH CONFERENCE

This is a joint meeting between the Early Life History Section of the American Fisheries Society and the Australian Society for Fish Biology and is being held back to back with the annual meeting of the latter society. The first four days of the conference are organised into seven symposia covering the following topics: (1) Contrasting larval biology, (2) Population dynamics and oceanography, (3) Development and behaviour, (4) Condition and growth, (5) Aquaculture, (6) Larval systematics, (7) Biology of Pomatomus saltatrix, and (8) Fisheries independent measures and (9) Coral reef fish larvae. The fifth day will be devoted to local excursions. Further information from: *M.J. Kingsford, University of Sydney AO8, NSW 2006, Australia. Fax: (02) 692 4119; email: mikek@extro.ucc.su.oz.au*

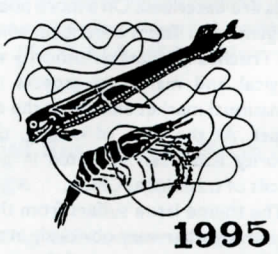
10- 14 July 1995, University of Sydney, Sydney, Australia.

REEFS AND CARBONATE PLATFORMS IN THE PACIFIC AND INDIAN OCEANS: AN INTERNATIONAL WORKSHOP.

The program for this meeting, convened by Peter Davies, Douglas Bergerson and Gilbert Camoin, will cover numerous current topics in reef growth including Turn on/turn off - unconformities, survival, and demise of carbonate platforms, Growth in response to 3rd to 5th-order sea level fluctuations, Fluid movements through carbonate platforms, Latitudinal gradients in accretion, Tectonic and environmental controls, Climate and reef growth and Integrated approaches to defining geometry and architecture of reefs. Registration forms from: *Douglas Bergerson, Dept of Geology and Geophysics, University of Sydney, Sydney, NSW 2006, Australia. Fax: (02) 692 0184; Email: dougb@es.su.oz.au*

10-14 July 1995, Amsterdam, Netherlands

2ND INTERNATIONAL CONFERENCE ON PELAGIC BIOGEOGRAPHY (ICoPB)



Following several meetings of the SCOR Working Group on Pelagic Biogeography, this conference will be held to discuss new developments in biogeography of plankton and nekton, its relation to climate, hydrography and history and the results of the 1993 Working Group meeting. The meeting will be held in the Amsterdam area. The conference language will be English. The programme will probably include lectures, poster sessions and working groups, and proceedings will be produced. Further information from: *S. van der Spoel, Institute of Taxonomic Zoology, P.O. Box 94766, 1090GT Amsterdam, Netherlands. Fax: 20-5255402.*

17-21 July 1995, Amsterdam, Netherlands
6TH INTERNATIONAL CONFERENCE ON COELENTERATE BIOLOGY (ICCB)

This will present new developments in ecology, synbiosis, morphology, taxonomy, biogeography, evolution, reproduction, population biology, behaviour, physiology, cellular biology, growth, genetics, natural products, biodiversity, palaeontology, conservation and pollution in relation to coelenterates. The conference language will be English. Visits to laboratories and museum collections will be organised. Further information from: *S. van der Spoel, Institute of Taxonomic Zoology, P.O. Box 94766, 1090GT Amsterdam, Netherlands. Fax: 20-5255402.*

10-17 August 1995, University of Hawaii, USA.
XXIV INTERNATIONAL ETHOLOGICAL CONFERENCE

This conference will be of interest to coral reef scientists because, aside from its location, many studies of marine organisms are expected. Further details are available from: *Prof. George Losey, Co-Chair XXIV IEC, Zoology Department, University of Hawaii, Hawaii, 96822, USA. Fax: 808 236 7443. E-mail: IEC@ZOOGATE.ZOO.HAWAII.EDU.*

Courses

1995 Summer Program in Marine and Environmental Science
J.Seward Johnson Marine Education and Conference Center

The Center is the educational arm of the Harbor Branch Oceanographic Institution and offers formal academic coursework in the summer at the undergraduate and graduate level, summer research internships and facilities for visiting field course throughout the year. 1995 courses include Tropical Fish Ecology, Marine Invertebrate Zoology, Global Environmental Problems and Solutions among others. Further information from: *Harbor Branch Oceanographic Institution, 5600 U.S. 1 North, Fort Pierce, FL 34946, USA. Tel. 407-465- 2400; Fax: 407-465-5743.*

1995. Summer program in tropical marine ecology and biology.
Mote Marine Laboratory, Florida Keys Marine Research Center, Pigeon Key, Florida

Three short courses are being held on topics such as Florida Bay and Florida Keys Ecosystems, the Biology and Ecology of Sharks and Rays, and Coral Reef Ecology. A limited number of Summer Research Internships may also be available at the FKMRC. Pigeon Key facilities are also available year-round for research and education workshops. For further information please contact: *Dr. Michael J. Marshall, Research Coordinator, Florida Keys Marine Research Center, 1600 Thompson Parkway, Sarasota, Florida 34236, USA. Tel. 813-388-4441; Fax 813-388- 4312; e-mail, KeysSci@aol.com*

June 12-23, 1995. Integrated Coastal Zone Management
International Institute for Infrastructure, Hydraulic and Environmental Engineering (IHE), Delft, The Netherlands

This course aims to provide postgraduate training for key-job holders and physical planners in coastal areas. Participants are normally aged between 35 and 45 years, and are drawn from the level of section heads and prospective directors of coastal agencies, including national and provincial governments, large municipalities and special task forces. This range of backgrounds is intended to enhance interdisciplinary communication and improve the understanding of the priorities and approaches of the different government bodies involved.

The goals of the course are associated with the introduction and implementation of Coastal Zone Management and include, for example, the expressed need to examine key issues in decision making on urban and recreational development in vulnerable coastal sections and integration of sectoral activities in coastal development. It also takes into account the objectives of a sound Coastal Zone Policy which emphasizes local participation in decision making.

The programme comprises lectures, workshops and some site-visits in the Netherlands and Belgium and is organised jointly between Delft University of Technology and Delft Hydraulics. The course fee is Dfl. 4,000, excluding meals and accommodation. Further information from: *IHE, P.O. Box 3015, 2601 DA Delft, The Netherlands. Tel: (31) 15 151700/ 151715; Fax (31) 15 122921.*

11-22 September, 1995 Manejo Integrado de Zonas Costeras
Escuela Superior Politécnica del Litoral, Guayaquil, Ecuador

The purpose of this course is to provide participants with practical skills to design and implement integrated management plans for coastal areas and environments. It is directed at resource management professionals and environmental planners in government agencies, universities and non-governmental organisations in the Latin America and Caribbean Region. The course will draw on global experience in integrated management planning for coastal environments and how it can be applied to critical coastal resources management issues for nations in the region (such as coral reef and mangrove loss, water quality degradation, declining fish production, and rapid tourism development).The is being run jointly by the Coastal Resources Center of the University of Rhode Island and the Escuela Superior Politécnica del Litoral in Ecuador. The course will be in Spanish and is open to all applicants; however, participation will be limited to 25 individuals. Course fee is US$2500 and covers all costs including food and lodging. Further information from: *Director de Capacitación, Centro de Recursos Costeros, Escuela Superior Politécnica del Litoral, email: ecervan@espol.edu.ec, Fax: 5934 854629; or The Training Coordinator, Coastal Resources Center, University of Rhode Island, email: markd@gsosun1.gso.uri.edu, Fax: +1 401 792 5436.*

23 October - 3 November, 1995 International training course on integrated coastal management
Silliman University, Dumaguete City, Philippines

This course is very similar to the one described above but a special emphasis is being placed on coral reef management. The course includes practicals on rapid appraisal and techniques of assessment of coral reefs. It responds to Chapter 17 of Agenda 21, the action plan resulting from the 1992 "Earth Summit", which calls for the sustainable use and conservation of marine resources and identifies coral reefs as a high priority for management and protection. It is being planned in concert with international initiatives to catalyse international and national action to sustain the world's coral reefs and associated coastal ecosystems. Course costs and numbers of participants as above. Further details from: *The Training Coordinator, Coastal Resources Center, University of Rhode Island, email: markd@gsosun1.gso.uri.edu, Fax: +1 401 792 5436.*

MEMBERSHIP

The annual subscription for individual membership of ISRS is currently US$60, provided renewal payments are made by 1st March each year. Individual and Family Members receive the journal *Coral Reefs*, the newsletter *Reef Encounter* and other periodic mailings. Family membership is US$70. Student membership costs US$10 and benefits include all of the above except the journal Coral Reefs.

Members outside Europe should add US$10 for airmail delivery of *Coral Reefs* (copies will otherwise be sent surface mail).

Renewals received between 1 March and 30 April will cost US$20 for a student member, US$70 for a full member and US$80 for a family membership. Those received after 1 May will cost US$25, US$80 and US$90 respectively. New memberships will be at the base rate of US$10, US$60 and US$70 throughout the year.

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

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

NOTES FOR CONTRIBUTORS

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

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

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

Please help by sending items of not more than 2,000 words in length and in double-spaced typescript or, preferably, on diskette using Wordperfect or DOS-Text and in an IBM compatible format. You can expect some gentle editing for flow and sense and to address our readership as appropriately as possible. Illustrations should be of a size compatible with our format. Black line drawings are preferable 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.

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