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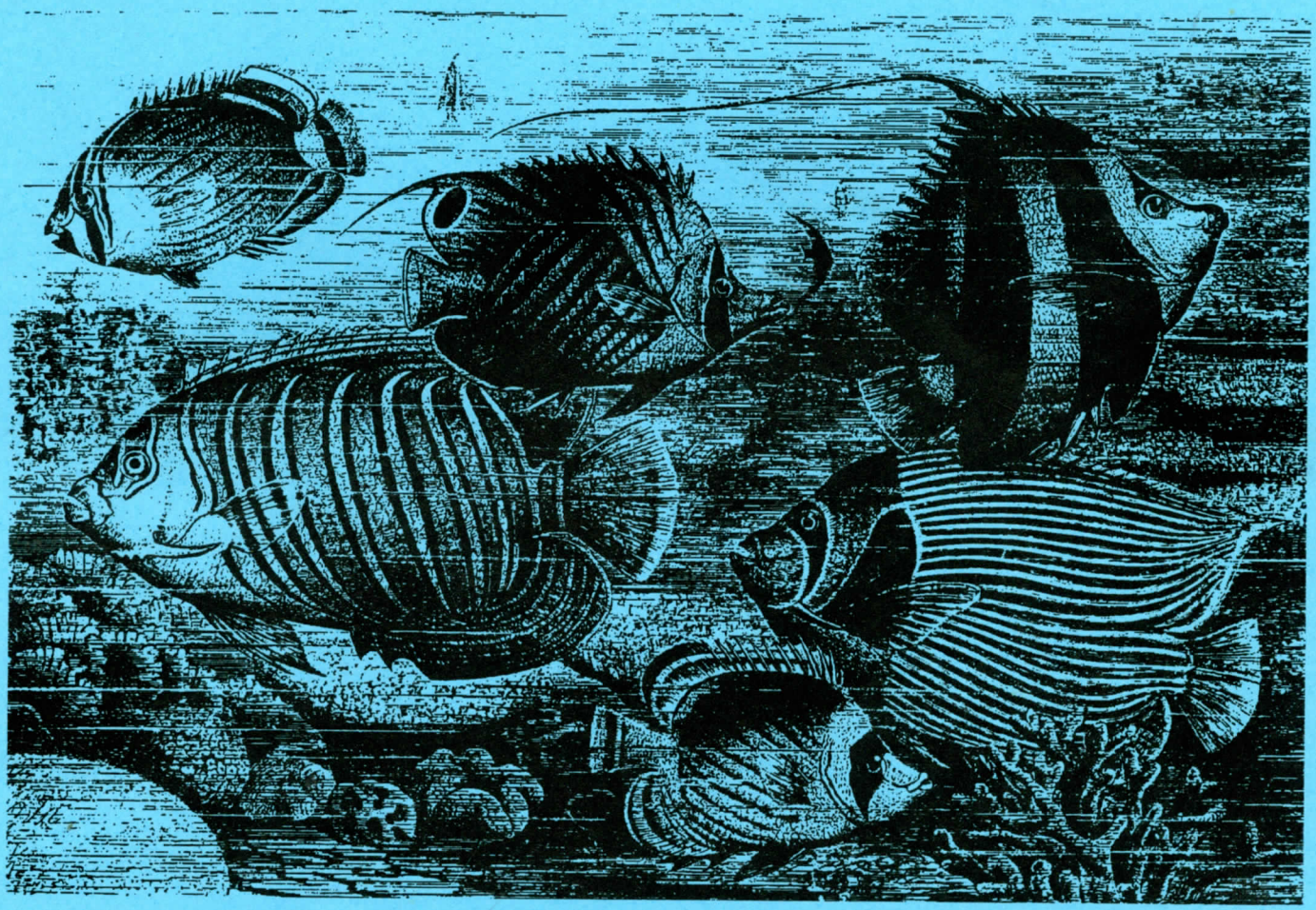
REEF ENCOUNTER

Newsletter of the International Society for Reef Studies

Number 6

December 1989



Reef Biodiversity

REEF ENCOUNTER No. 6 December 1989

NEWSLETTER OF THE INTERNATIONAL SOCIETY FOR REEF STUDIES

Edited by Sue Wells assisted by Barbara Brown

CONTENTS

Page

3 **Editorial**
S. Wells/B. Brown

4 **ISRS Comment**
How can coral reef scientists be most effective?
C. Birkeland

5 **Currents**
Marine biological diversity: a strategy for action.
J. C. Ogden

6 **Upwellings**
Meeting reports -- Global warming & sea-level rise

7 **News**
The havoc of Hurricane Hugo
Hurricane Gilbert in Jamaica, September 1988

10 **Features**
Extinction risk of coral reef fishes
C. Roberts
Trading away the coral reefs
S. Wells and E. Wood
Pacific precautions
P. Holhus

14 **Who's Who**
Cancer on the reef -- The Registry of Tumors in Lower Animals
More sick corals -- bleaching survey

16 **Book Review**
Corals of Australia and the Indo-Pacific
by J. E. N. Vernon

17 **Book Shelf**

18 **Announcements**

19 **Diary**

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

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

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

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

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

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

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

Membership

The annual subscription for membership of ISRS is currently US$50 or £35. Under the constitution, subscriptions are due by January 31st each year. Members receive the journal *Coral Reefs*, the newsletter *Reef Encounter*, abstracts of papers of Annual Meetings and other periodic mailings.

Student membership costs US$8 or £6 and benefits include all of the above except the journal *Coral Reefs*.

Spouse membership costs US$58 or £41 (i.e. one full + one student membership) and entitles the couple to one copy of each issue of the journal and other mailings.

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

Subscriptions to the Society should be addressed to the Membership and Development Officer (address given above).

EDITORIAL

Many thanks to those who took the trouble to write in and comment on the last issue. The suggestion that *Reef Encounter* should be double the length and come out monthly was most flattering, but we regret that ISRS's financial circumstances make this impossible at the moment! There is some concern about the overlap (existing or potential) between *Reef Encounter* and the Pacific Science Association Coral Reef Newsletter; any suggestions as to how we might overcome this would be very welcome. Thanks also to all those who provided contributions, again at rather short notice.

The theme which dominates this issue of *Reef Encounter* is once more an environmental one -- the damage sustained by coral reefs during violent storms and during 'coral bleaching' events, and the potential loss of marine biological diversity if reef degradation and exploitation continue at current rates.

Storm damage and bleaching are both issues which, during an era of global warming, could be critical in determining how coral reefs respond to increasing sea-level over the next 50 years. Coral bleaching will shortly be addressed in a theme issue of the Society's journal *Coral Reefs*.

The question of whether or not we can expect to see a loss of biological diversity in the marine environment in the future is currently being discussed (see *Conservation Biology* September 1989; and a theme issue of *Coastal Management* due out Summer 1990). Species extinctions in the marine environment are rare, and mainly restricted to warm-blooded vertebrates, but with the current pressures on coasts and seas there is a strong feeling that the situation needs careful documentation.

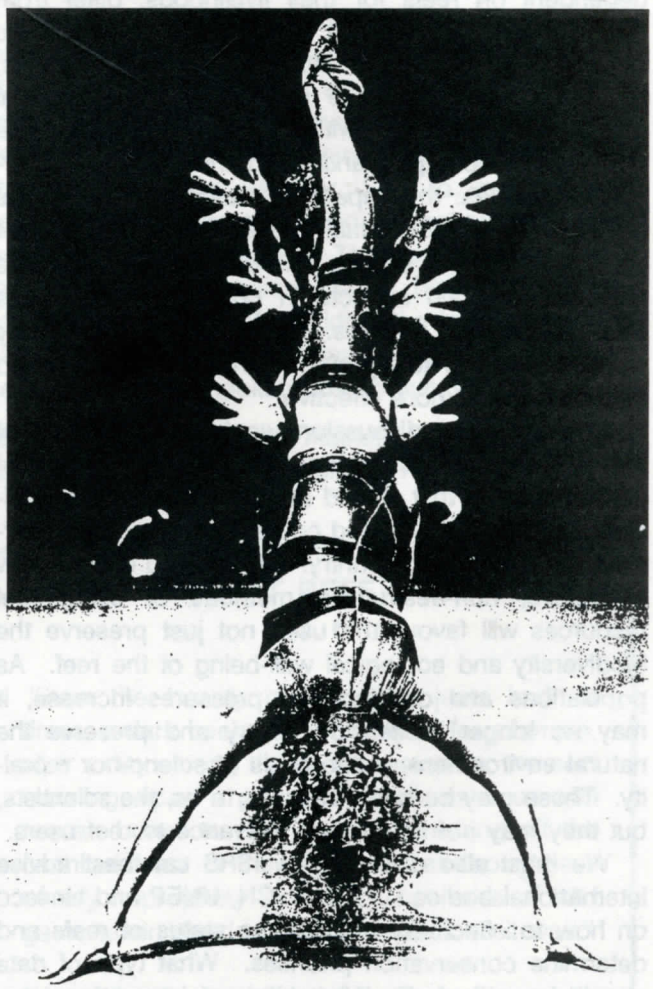
The general demise of tropical marine systems is highlighted in a recent review by Hatcher, Johannes and Robertson in *Oceanogr. Mar. Biol.* **27**, p.337-414. These authors urge us not to be complacent for they suspect that the destruction of tropical marine systems will closely follow the pattern of tropical rain forests, though the time-scale may be somewhat longer. Quoting from their text: "If they are to remain employed, scientists studying the marine ecosystems of the tropics must take a more active role in contributing to the formulation of conservation policy".

This sentiment is being increasingly expressed. In the June issue of *Conservation Biology* **3**: 202-203, Noss, in an article entitled 'Who will speak for biodiversity?', cites Aldo Leopold: *To keep every cog and wheel is the first precaution of intelligent tinkering.* Noss writes:

"Humans are great at tinkering, but not so good at saving cogs and wheels. Science specializes in the analysis of tinkering. Conservation biologists justify their existence by pointing out environmental problems, which, we say, cannot be solved without objective scientific data..... Our role is different from the typical activist; it is to pose and answer scientific questions, and to provide information that is relevant not only to policy-makers, but ultimately to anyone who is concerned about the environment. There is a fine line to walk between science and policy-making, but we have a duty to communicate with the public..... We need to stop arguing over esoteric details, stop declining to comment when we do not have all the data, and pull together to offer strong guidance on how to save the Earth."

Ways in which ISRS and the coral reef scientific community might meet this challenge will be discussed in a special workshop at the Society's meeting in Marseille in December and fully reported in the next issue of *Reef Encounter* -- which we hope will provide an ideal forum for debate, discussion and most of all -- co-ordinated action.

Sue Wells
Barbara Brown



"REEF" - a ballet choreographed and performed by Dance North, Townsville, Australia

ISRS COMMENT

From the President:

HOW CAN CORAL REEF SCIENTISTS BE MOST EFFECTIVE?

Chuck Birkeland

Bernard Thomassin and the organizing committee for the ISRS meeting in Marseille are kindly incorporating into the programme a workshop on "What should scientists be doing to effectively preserve biodiversity and improve the management of coral reef resources? How can ISRS be involved to facilitate the efforts of scientists?" This open meeting will take place on the afternoon of December 16th, before the AGM of ISRS.

The US National Science Foundation, UNEP and UNESCO are providing travel support for certain of our colleagues from tropical Asia so that they can give their perspectives on present problems facing coral reefs and what scientists should be doing. Of course, the problems in developing countries with populations dependent on reefs for their livelihoods, differ from those in affluent countries where parks and reserves operate more effectively. But even in these countries, the effects of large-scale agricultural and industrial processes will be felt within protected areas. The problems are complex and are manifested over different time scales: the impact of sea-level rise on coral reefs will be more gradual and extensive than that of coral mining. But despite this diversity, these issues may have certain aspects in common that we, as scientists, should address. Let's use the opportunity of this workshop to try and clarify such problems so that we can be more effective.

One topic for discussion would be the value of expressing our ideas in terms of economics - a way of communication that should be as relevant to the decision maker in a developed country as to a local fisherman in a developing country. We need to explain how alternative, non-destructive methods of using reef resources will favour the user, not just preserve the biodiversity and ecological well-being of the reef. As populations and development pressures increase, it may no longer be feasible to try and preserve the natural environment on the basis of science or morality. These may be better reasons to us, the scientists, but they may not hold much relevance to reef users.

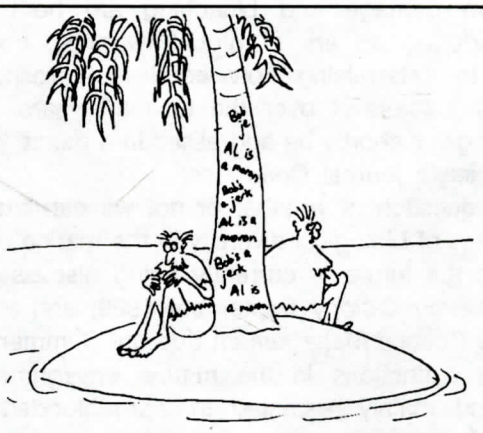
We must also discuss how ISRS can best advise international bodies such as IUCN, UNEP and Unesco on how to effectively monitor the status of reefs and determine conservation priorities. What type of data should be collected? What kinds of international co-operative efforts in data collecting and long-term studies are needed and are feasible?

Please bring your thoughts to the workshop, or write to us with your ideas if you are unable to come to Marseille. One objective of ISRS is for members to get together to discuss such matters.

STUDENT MEMBERS – WHERE ARE YOU?

Student membership of ISRS costs only US$8.00 or £6.00. For this you will receive *Reef Encounter* (two issues a year), abstracts of papers of the Annual Meetings and other periodic mailings. You will only miss out on the journal *Coral Reefs* (and it seems you don't have to prove you are a student!)

We want *Reef Encounter* to become a vehicle for student thoughts and ideas. As soon as we get some contributions, we will start a **Student's Voice** page. Surely you have something to say? Write with news of your projects, requests for help, and opinions on the way current reef research is going.



With apologies to Gary Larson, 'The Far Side'

DEADLINE FOR THE NEXT ISSUE OF *REEF ENCOUNTER* IS 1ST MAY 1990

The two recent issues of Reef Encounter have contained articles mainly from ISRS officers or invited contributors. We hope this will change. One of the main functions of the newsletter is to facilitate communication of thoughts and information between members of the Society. Do take advantage of this opportunity; it will be hard work if everyone is just a passive recipient.

We have not really resolved the problem of funding but it looks as if it will be feasible to produce two issues a year, coming out in July and December. Since it takes about 8 weeks to type up, edit, produce camera ready copy and print, deadlines for submission of copy will be 1st May and 1st October.

We have fairly large stocks of back issues of *Reef Encounter,* Nos. 1-4. If you have any suggestions for uses for these, let the editors know; we will be keeping some back numbers to use for display purposes at symposia etc.

CURRENTS

MARINE BIOLOGICAL DIVERSITY: A STRATEGY FOR ACTION

The wide political and scientific concern about global biological diversity has arisen from the dramatic and well-documented increase in loss of species associated with tropical deforestation. In the many recent workshops and discussions on this issue, the universally acknowledged high diversity marine environment, the coral reef, has received little attention. While contemporary species extinctions are rare or unreported on coral reefs, habitat damage and loss, a major component of biological diversity, is at crisis proportions all over the tropical world. Population extinctions and subsequent loss of genetic diversity may also be epidemic. Ironically, deforestation, the primary cause of loss of biological diversity on land, is also a leading cause of habitat destruction in shallow tropical seas through runoff of forest soils and nutrients.

There is disturbing evidence that habitat degradation in the tropical ocean may be more widespread than previously thought. Sublethal stresses may spread over wide areas, increasing susceptibility of populations to disease. Recent examples include the mass mortality of the sea urchin *Diadema antillarum* in the Caribbean in 1983-84, the worldwide loss of acroporid corals, and even the widespread bleaching of reef cnidarians in 1987. While the interconnectedness of the ocean may spread stresses widely, the dispersal capabilities of marine larvae may result in relatively rapid recovery following mitigation of stress. In the tropical coastal environment we may have the time to act before a crisis is reached.

As in tropical forests, the conservation of marine biological diversity lies at the uneasy and contentious meeting ground of society, politics and science. The preservation of biological diversity is not primarily a scientific issue, but rather a social one. Declines in species rich marine environments are the result of exploitation of resources, in most cases by an indigenous human society with immediate economic or food needs and **no** alternatives. Banning exploitation of marine resources from marine parks and preserves will not prove to be completely effective as, if little or no relief is provided for human needs, pressure on adjacent resources may simply increase, ultimately destroying the preserve.

Nevertheless, science has a pivotal role to play in this issue. Within scientifically defined sub-regions of the world's oceans, or 'large marine ecosystems', political and social action, scientific assessment and sustained monitoring of biological diversity must be combined in an overall strategy. As Birkeland has pointed out (*Reef Encounter* 5, 1989), **scientifically** documented demonstrations of the economic and social advantages of alternatives to exploitive practices are needed as well as the political will to invest in such alternatives. Once we have such successful examples, the strategy may be exported, with a greater chance of government acceptance, from one sensitive region to another.

Fortunately, a potential mechanism for implementation of such a strategy exists in the rapidly developing plans of the multilateral development banks (MDBs) - the World Bank and the three regional banks for Latin America, Africa and Asia. Together these banks provide funding of over US$25 billion for projects in developing countries. Following a series of environmentally disastrous projects, some of the voting country members of the MDBs are reviewing loan policies with respect to the preservation of biological diversity. For example, the US Treasury Department, with a voting share of 20% in the World Bank (US$17 billion in loans), has produced a memorandum entitled 'Tropical Forest and Wetland Voting Standards'. A similar document for projects affecting the marine environment is in preparation by the Oceanic Society with input from an *ad hoc* group of largely US experts.

ISRS can play an important role by ensuring that international concerns about coral reefs and associated tropical environments are included in these US guidelines and by urging the development of similar guidelines by other voting members of the MDBs. This strategy provides a way for ISRS to use its major assets - scientific expertise and internationality - on an issue of critical importance. The opportunity to sensitize the MDBs to tropical marine biological diversity has the best chance of providing the **immediate** alternatives to exploitive development that most agree are needed if tropical habitats are to survive.

John C. Ogden, Florida Institute of Oceanography, 830 First St, South, St Petersburg, Florida 33701, USA.

THE COMPLEAT REEF ENCOUNTER No. 6

"Even the beauty of natural objects had, at times, a dark back-ground. When, for example, after a day among the corals, we came, the next morning, upon a group of Feejee savages with human bones to their mouths, finishing off the cannibal feast of the night; and as thoughtless of any impropriety as if the roast were of wild game taken the day before. In fact, so it was."

From: *Corals and Coral Islands* by James D. Dana. 1872

UPWELLINGS

This column is for contributors who want to take issue with facts and views expressed in recent publications, including* Reef Encounter, *or to give vent to any other views on the subject of reefs, including ISRS.

Coral Reef Fishery Management at Discovery Bay

In the last *Reef Encounter,* Chuck Birkeland wrote a good article on the use of coral reef resources in developing countries. "Few of us" he wrote "are in a position to set up management systems in local villages of developing countries". As one of the few, I'd like to mention the Fisheries Improvement Project at the Discovery Bay Marine Laboratory. This is a joint project of Trent University and the University of the West Indies, funded by CIDA (Canadian International Development Agency) which started about a year ago. Our aim is to work with the fishermen of Discovery Bay to enable them to introduce their own fishery management measures, which might include sanctuaries or controls on gear. Sounds simple, doesn't it! One of the difficulties, as our field leader, Bill Allison, is finding, is that we are not dealing with a coherent group of traditional fishermen, such as might be found in a less westernized society. Rather, they are fragmented, competitive, suspicious of one another and include many part-timers who have other jobs. It is a major challenge to stimulate the formation of a viable fisherman's organisation in this environment.

Jeremy Woodley, Discovery Bay Marine Laboratory, P.O. Box 35, Discovery Bay, Jamaica, West Indies.

MEETING REPORTS

5th International Conference on Coelenterate Biology, 1989

This was held at the University of Southampton in July, 1989, and was attended by 250 participants from 31 countries. Over 179 papers and 63 posters were presented, with the biggest contribution from the USA. A wide variety of subjects were covered, and 37 papers and five posters were presented on corals and reefs. These included ecology of coral reefs, population growth of coral communities, symbiosis and ecological physiology, ultrastructure and analysis of skeletal composition and skeletogenesis, studies on palaeontology, biostratigraphy and paleogeography of scleractinian corals, conservation of reef corals, the effect of pollutants, predation and man-induced damage on reefs, coral reproduction including gametogenesis, spawning of the planulae and recruitment of juvenile coral. Although the papers on symbiosis provoked much lively discussion, the session on conservation drew by far the greatest audience participation.

Report provided by: *Suharsono, Centre for Tropical Coastal Management Studies, Dept of Biology, The University, Newcastle upon Tyne NE1 7RU, UK.*

Coastal Zone 89 -- 6th Symposium on Coastal and Ocean Management

This was held in Charleston, USA, in July 1989, and attracted over 1000 participants and 600 papers on every imaginable subject related to management of seas and coasts, from remote sensing, databases and coastal planning to beach erosion, coral reefs and floating hotels. The coral reef session included papers on reef management in the Florida Keys, reef restoration in the Caribbean, and community-based efforts in reef management in the Philippines and Thailand. The successes and failures of 'coastal zone management' over the last decade were extensively debated in a workshop and seminar (organised by John Clark of CAMPNET, the Coastal Area Management and Planning Network) held before the symposium. Projects carried out in Sri Lanka, Thailand, Ecuador and Brazil in collaboration with the University of Rhode Island (USA) and other examples from both tropical and temperate areas were analysed and discussed.

There was some despondency that little real progress was being made. Numerous coastal zone management **plans** have been produced, but action often seems to stop at the implementation stage. The need for good information showing trends in coastal degradation and their significance, for basic monitoring of key resources, and for case studies illustrating how the principles of CZM can work was stressed over and over again. It was felt that only when such information is available will it be possible to convince politicians that a plan is not enough in itself - a plan is only of value if implemented.

A short booklet on 'The Status of Integrated Coastal Management: a Global Assessment' was produced during the workshop. This, and further information, is available from: *John Clark, RSMAS, University of Miami, 4600 Rickenbacker Causeway, Miami, Florida 33149, USA.*

NEWS

THE HAVOC OF HURRICANE HUGO

Hurricane Hugo, the largest cyclonic storm of the season, swept into the Caribbean fully matured, smashing Guadeloupe and Montserrat before savaging St Croix in the night and early morning of September 17th and 18th. Such was the damage on land that no one has yet had time to assess the implications for the reefs. The West Indies Laboratory (WIL) of Fairleigh Dickinson University (FDU) on St Croix was severely damaged. John Ogden, ex-WIL Director, recently visited St Croix and has sent this account, pieced together from conversations with the current director Dr Elizabeth Gladfelter and the log of Dr John Bythall.

As it became clear that the storm would impact the island, the 45 students and scientists at WIL began preparations on September 15th and 16th according to a long-established plan. Hard decisions were made about which buildings were the safest for people and equipment and which were likely to be destroyed.

On Sunday September 17th, the wind began to blow from the north in the morning and strengthened all day. The west dormitory rooms were stocked with food, water and medical supplies. At sunset, power was cut and the group took cover, divided into four rooms. By early evening, with northerly winds at an estimated 80 mph, it was too dangerous to venture outside due to flying debris. Near midnight, with winds increasing, the roof cladding began to tear away and rain poured in from the north. Over the next few hours the wind veered to the south and rapidly increased to an unbelievable and fearsome strength as the eye of the storm passes slowly to the northwest over the west end of the island. At one point in the early morning the dormitory roof and upper walls lifted with a great noise and crashed back into place. Reinforced concrete block walls bowed inwards and cracked with the pressure of the wind; failing doors were reinforced with bed frames. The four groups consolidated as the rooms were deemed successively unsafe. Finally all 45 people crowded into one room preparing for the worst. Each person clutched a mattress or pillow and sat against the wall, or huddled under a bed or desk in awe and terror, feeling painful pressure changes in the ears. Before dawn the wind slowly decreased, rest was possible, and by sunrise the bleary survivors emerged to see to the safety of others in nearby houses.

Thankfully no one was injured, but the campus presented a shocking sight. The brand new, two-storey NSF research building was destroyed. The dormitory was extensively damaged as were roofs and the larger windows all over the campus. Surprisingly, there was little storm tide and the WIL dock and sea water pumps survived, although nearly every vessel in Tague Bay was blown ashore. On the island, over 75% of the houses had extensive damage, and nearly every power pole was blown down or broken. The island appeared burned by a flash fire as every leaf and small branch was stripped from trees and the leaf litter was blown away. The eye of the storm apparently spawned tornadoes which were fickle, destroying one home while sparing its neighbour. The anemometer at the airport recorded an incredible 220 mph.

Over the next few days the island contended with infrastructure collapse, looting and the more difficult problems of food, water and sanitation. By September 23rd students and scientists were evacuated and the staff began to put their lives back together, assess the damage and plan repairs which are expected to continue until next summer. Simply restoring island electrical power may take until next spring. The student group reassembled late in the month at FDU in New Jersey to finish the semester, the faculty flying up in rotation from St Croix.

As of this writing, only one brief visit had been made to reefs near Buck Island on the northeast coast. The reefs north of the island were in relatively good shape. Reefs facing south were smashed and scoured with berms of debris subaerially exposed on the reef flats. Lab staff were in the middle of a reef monitoring program sponsored by the National Park Service, so it is likely that a quantitative assessment of the damage and recovery can be made. The last storm of this size to hit St Croix was over 60 years ago. The long wait for the next 'big one' is over.

John Ogden is collecting letters of support and financial contributions to the WIL Hurricane Hugo Fund. Members of ISRS who are interested may send these addressed to WIL care of: J.C. Ogden, Florida Institute of Oceanography, 830 First St South, St Petersburg, Florida 33701, USA. An expression of international support will be critical as the University makes difficult decisions about the reconstruction of WIL and its future.

HURRICANE GILBERT IN JAMAICA, SEPTEMBER 1988

Well before Hurricane Hugo occurred, we had asked for news on the impact of Hurricane Gilbert on reefs in Jamaica. This piece, kindly provided by Jeremy Woodley, now has particular relevance in the light of recent events on St Croix.

A hurricane is a violent environmental disturbance, tightly constrained in space and time. Its 'footprint' of extreme impact may be only a few score miles across, so that its track can be represented by a line drawn on

a map of the Caribbean. Wherever it strikes, it passes on within a matter of hours. To a human observer, it seems like a very rare, extreme event, unpredictable in its occurrence and movements, highly localised and contrasting sharply with a background of more benign conditions. On a longer time-scale, however, hurricanes are common and almost ubiquitous; a map of Caribbean tropical storms and hurricanes for the last hundred years is black with their tracks (Neumann *et al.*, 1978).

Thus, despite their narrow track and brief duration, any coral reef within the hurricane belt is subject to their influence. The temporal structure of that influence depends upon the time-scale of the processes affected by storms. Thus, in relation to geological processes of reef growth or sedimentation, on a time-scale of hundreds or thousands of years, hurricanes can be regarded as a continuous force. On such a scale, it may be possible to distinguish different intensities of that force due to differences in hurricane frequency in space or time. On shorter time scales, the occurrence of hurricanes is irregular. Their influence on processes measured on a time scale of the same order as the interval between hurricanes, such as the growth of corals, is better understood in terms of the time elapsed since the previous storm (Kjerfve *et al.*, 1986).

After the hurricane of 1944, the north coast of Jamaica enjoyed thirty-six years free from the impact of large hurricane generated waves. All kinds of corals flourished, but fast growing species were especially successful. *Acropora palmata* (elkhorn) and *A. cervicornis* (staghorn) dominated large areas in extensive thickets. This was achieved by a slender branching morphology, strong enough to resist moderate wave energies but fragile under extreme conditions. In August 1980, Hurricane Allen passed close to the eastern and northern shores of Jamaica and wrought catastrophic damage. Branching corals were smashed and most of their fragments died (Knowlton *et al.*, 1981), some massive corals were toppled or shattered, softer organisms like sea-fans and sponges were ripped up and all were bombarded with fragments and scoured by resuspended sand (Woodley *et al.*, 1981). The reefs had still not recovered to their former luxuriance by September 1988, when Hurricane Gilbert struck. Thus, although the physical impact of its waves on the north coast was comparable to that of Hurricane Allen, the damage to reef organisms was not as spectacular, because the time elapsed since the previous hurricane was so short.

Nonetheless, the impact of Gilbert was severe. The eye of the storm passed along the length of Jamaica and about 50 km south of the Discovery Bay Marine Laboratory, where I made my observations. Hurricane force winds, at the leading edge of the storm, blew directly off the sea for several hours on an almost constant heading, despite the transverse movement of the storm. This was probably an 'island mass' effect, and resulted in huge waves scrubbing the reef terrace in the same direction for much longer than had those of Hurricane Allen. Linear scarification is still evident today. The *palmata* and *cervicornis* rubble created by Allen had become cemented and overgrown in the intervening eight years. Gilbert remobilised this material, scrubbed it clean and re-distributed it, to at least about -14m. Most of the sand and much of the lighter rubble was transported downslope. Shallow features, that we had known as sand plains or channels, were revealed as hardgrounds or rocky paths. Benthic algae that had proliferated after the *Diadema* mortality (Liddell and Ohlhorst, 1986) were stripped off. Sponge and sea-fan corpses accumulated in channels and sediment chutes on the fore-reef slope, down to the last drop-off at -55 m. Macerated tissues and fine silt had reduced visibility to a few metres after the storm, and it took about two weeks to return to normal. Unusual organic loading of reef sediments, revealed by superficial blackening with iron sulphide, persisted in deep water for many weeks.

Hurricane Gilbert undoubtedly generated huge waves; no direct observations of height were possible, but their mean period was estimated at about 15 sec! Such waves dig deep; recording thermographs, at -18 and -45m (generously provided by Bob Wicklund of the Caribbean Marine Research Center) revealed a dramatic incursion of cool water due to Gilbert and may shed light on biological processes consequent on this mixing. Meanwhile, other biological processes are at work on the reef terrace. Although Gilbert may not have had the spectacular impact of Allen, it has set back the clock of reef 'recovery' to where it was in 1981.

But reefs are always recovering from a hurricane (Kaufman, 1986). Analysis of the history of severe hurricane impacts, over 120 years, on the north coast of Jamaica, suggests that their median interval has been about seven years. The storm free period 1944-1980, when the *Acropora* spp. flourished and when the classic descriptions of those reefs were written (e.g. Goreau, 1959) seems to have been exceptional (Woodley, 1989).

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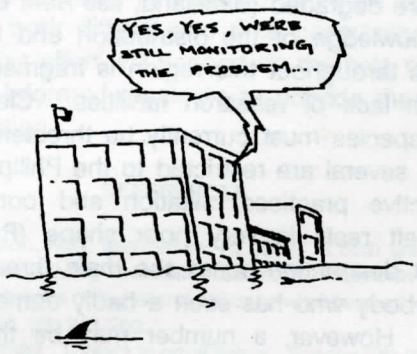
Jeremy Woodley, Discovery Bay Marine Laboratory, P.O. Box 35, Discovery Bay, St Ann, Jamaica, West Indies.

GLOBAL WARMING -- SEA LEVEL RISE



As far as we know, there has been no particular response to Bob Buddemeier's statement on 'Reefs in the Greenhouse' (see *Reef Encounter* 3). Meetings and activities relating to this issue are being initiated at an accelerating rate; a few are mentioned below:

4th South Pacific Conference on Nature Conservation and Protected Areas, Vanuatu, September 1989

During this conference, a resolution was passed on the importance of conservation in mitigating global warming. "The vital role of healthy marine ecosystems, particularly coral reefs, in absorbing carbon dioxide from the atmosphere and in maintaining the capacity of the coastal zone to adapt to sea level rise" was recognised. It was also acknowledged "that the establishment of nature conservation areas, and of implementation of ecologically sustainable land use practices, can make a major contribution to the conservation of both coral reefs and tropical forests in the South Pacific, thereby reducing global warming".

A resolution was passed "to afford high priority to the safeguarding of coral reefs and tropical rainforests and the implementation of wise land use practises, and to give these matters prominence when seeking national and international support for the conservation of nature in the South Pacific...." The South Pacific Forum was invited to convene meetings with Forum Dialogue Partners on assistance for establishing conservation areas and sustainable resource uses, especially in relation to coral reefs and tropical forests.

Further information from: *Paul Holthus, South Pacific Regional Environment Programme, South Pacific Commission, B.P. D5, Noumea Cedex, New Caledonia..*

International Workshop on Adaptive Options and Policy Implications of Sea Level Rise and Other Impacts of Global Climate Change, Miami, 1989

This will be sponsored by the Coastal Zone Management Subgroup of the Response Strategies Working Group of the Intergovernmental Panel on Climate Change. It will address the topic from the perspective of coastal states in Europe and the Mediterranean, West Africa and North and South America. The results of discussions at this and a similar workshop to be held in Australia in February addressing all other areas, will form the basis for the final report of the subgroup. The purpose of the Coastal Zone Management Subgroup is to provide information and recommendations to national and international policy centers, enabling decisions to be made concerning i) coastal zone management strategies for the next 10-20 years; and ii) long-term policies dealing with limitation and/or adaptation to climate change/sea level rise.

Further information from: *John J. Carey, Deputy Assistance Administrator, National Ocean Service, NOAA, 1825 Conn. Ave. N.W., Suite 611, Washington D.C. 20235 USA.*

A symposium on sea-level rise in relation to coral reefs, saltmarshes, mangroves, beaches etc. is being organised at the meeting of the American Association for the Advancement of Science (AAAS) in New Orleans in February 1990.

Further information from: *David Stoddart, Dept of Geography, Earth Sciences Building, University of California, Berkeley, California 94720, USA.*

Small Island States Conference on Sea Level Rise, Maldives, November 1989

This conference is jointly funded by the Commonwealth Secretariat and the Government of Maldives. We hope to have a report on it in the next issue of *Reef Encounter.*

FEATURES

EXTINCTION RISK OF CORAL REEF FISHES

Callum Roberts

Headlines such as "one species becomes extinct every day" and "60,000 species will go extinct in the lifetime of a child born today" do not fail to depress the reader. So far the great majority of extinctions have been terrestrial and most species, with some notable exceptions, have had small geographic ranges. Indeed, statistics on species loss (which make many assumptions) are at present mainly calculated from figures of rain forest loss, with rough estimates of the geographical ranges of rain forest organisms.

It is a comforting thought to those who work on marine organisms that few completely marine species have so far become extinct in recent history (extinctions seem to be restricted mainly to warm blooded animals: Steller's Sea Cow and the Caribbean Monk Seal for example). Two factors have been responsible for this. Firstly, Man's influence on the marine realm has historically been less than on land, although pressure on the seas is rapidly increasing. Secondly, marine organisms tend to be much more widely distributed than terrestrial ones. This stems largely from the existence of a pelagic dispersal phase in the majority of marine species, permitting wide dispersal of propagules, and reduced opportunities for genetic isolation and speciation. Barriers to dispersal are fewer than on land. Local extinctions of populations have thus rarely been significant to global populations.

Recent statistics on coral reef habitat loss and degradation show that there are no grounds for complacency (McManus, 1988) and that species may soon begin disappearing. Small geographic range sizes are not an entirely terrestrial phenomenon, and species with narrow distributions must be considered those most at risk. For example, amongst reef fishes there are a considerable number with small known ranges. The damselfish *Chromis pelloura* is found only from depths of 30-50 m at Eilat in the northern Red Sea. It could be argued that this species is widely distributed in deep water since for unknown reasons, several deep water species occur in shallower water in the northern Gulf of Aqaba than elsewhere. However, submersible exploration to depths of over 300 m failed to reveal it elsewhere on the Sinai coast. This species must therefore be considered 'at risk', particularly since the reefs at Eilat are under heavy pressure from urban expansion and pollution. A number of other species have very limited ranges in the Red Sea. For example, the dottyback *Pseudochromis pesi* is known only from the Gulf of Aqaba.

Elsewhere similar examples exist, particularly of species endemic to single islands or island groups. The angelfish *Holacanthus guezi* is so far known only from Reunion, and the anemonefish *Amphiprion chrysogaster* from Mauritius. Reefs of both islands have been reported to be becoming seriously degraded (IUCN/UNEP, 1988).

At lesser risk are species restricted to particular island groups or similarly small regions. One well-known example is that of the coelacanth which is limited to the Comoros Islands. Recent submersible exploration has suggested that populations are small and that fishing for scientific specimens could be seriously endangering the species, particularly given its low fecundity (Balon *et al.,* 1988). However, the region currently of most concern must be the Indo-Australasian archipelago, undisputedly richest in marine species diversity. Reefs there are under heavy pressure from man, and estimates suggest that 60-70% of them are degraded (Birkeland, see *Reef Encounter* 5). Our knowledge of the distribution and taxonomy of species throughout this region is fragmentary, largely through lack of research facilities. Clearly though, many species must currently be threatened. For example, several are restricted to the Philippines, where destructive practices, siltation and coral collecting have left reefs in very poor shape (Rubec, 1988). Habitat destruction poses the main threat to species as anybody who has seen a badly damaged reef will know. However, a number may be threatened by over-collecting, such as the easy-to-catch anemonefishes, and colourful but rare species like some angelfishes (McAllister, 1989). The very small home-ranges of many reef fishes make them vulnerable to overcollecting, since reductions in population density could translate into reduced reproductive success.

Theoretical consideration allows predictions of species most at risk to be further refined (Pimm *et al.,* 1988). Population size is of major importance; species which are rare throughout their ranges are, other things being equal, more at risk of extinction than common species. However, this effect is confounded with longevity. Longer- lived species tend to be larger and have lower intrinsic rates of increase than short-lived ones. Mathematical models predict that larger species will have a greater risk of extinction than small species at large population sizes, and a smaller risk in small populations (a prediction recently confirmed for island-nesting birds, Pimm *et al.,* 1988). Furthermore, more variable populations have a greater risk of extinction than relatively stable ones. This is of particular concern with reef fishes, populations of many species being characterised by wide recruitment variability. Here again longevity is important. Longer-lived species tend to smooth out recruitment variation more than short-lived ones, an observation which has become known as the 'storage effect' (Warner and

Hughes, in press).

Against this background of reefs in decline, the formation of the IUCN Species Survival Commission Coral Reef Fish Specialist Group is very timely. There can be few such groups in the enviable position of beginning work before extinctions occur. One of their main tasks will be to define priority regions for conservation: those supporting very rich assemblages and currently suffering extensive reef degradation. Part of the work will also involve identifying threatened species and this will rely heavily on pinpointing those with small geographic ranges, particularly in areas where habitats are under pressure. The group will also review the role of the aquarium fish industry with a view to recommending limits to trade which would safeguard wild populations.

The diversity of reef fishes is bewildering, with perhaps as many a 5000 known species (McAllister, 1989) and doubtless many more still to be described. This means that compiling information on their status is going to be both difficult and time consuming. The success of this effort will depend on the help of many experts and informed amateurs to provide the necessary information.

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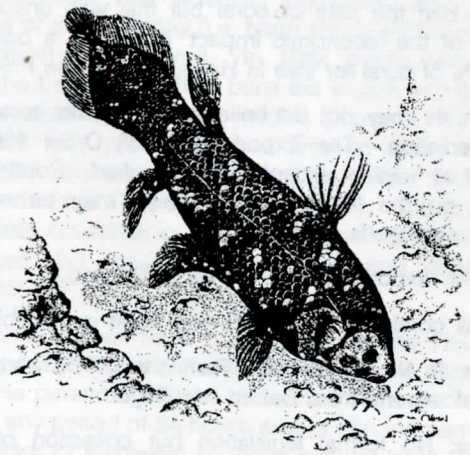
Callum Roberts, Marine Research Centre, Environmental Institute, Sharm-el-Sheikh, Egypt.



Coelacanth (courtesy WWF International)

TRADING AWAY THE CORAL REEFS
CITES Listing for Corals

Sue Wells and Elizabeth Wood

In October this year, at the meeting of the Parties of CITES -- the Convention on International Trade in Endangered Species of Wild Fauna and Flora -- the orders Scleractinia and Coenothecalia and the families Tubiporidae, Milleporidae and Stylasteridae were listed in Appendix II of the Convention. This means that the 103 countries that are party to CITES may only accept imports of reef corals if they are accompanied by a valid export permit from the country of origin, or a re-export certificate if not coming from the country of origin. CITES regulations apply to scientific as well as commercial specimens, unless the scientists or scientific institutions have been registered for such non-commercial exchange of specimens by the CITES Management Authority of the country in which they are situated. CITES export permits for corals should not be issued in countries where coral collection and export is prohibited, but many of these permit scientific collection and export under special licence.

Appendix II listing therefore permits international commercial trade where this is allowed in the country of origin (or re-export), but provides a means of monitoring it (through the permit system) and obliges importing countries to honour national legislation such as export bans in exporting countries. International commercial trade is prohibited for Appendix I-listed taxa, but no corals are listed on this and it is unlikely that they would be in the future.

The ornamental coral trade is only one of the many threats to reefs: siltation, sewage pollution, coastal development, tourism, damaging fishing methods etc. have a more long-term devastating impact. But in several areas the scale of the trade is giving cause for concern. Unlike many forms of reef exploitation, this industry services a purely luxury market. It exists because the demand is there. Many people who buy corals, either as cheap souvenirs bought on a whim and discarded as rapidly, or as expensive *objets d'art,* are unaware of its animal origin. Such is the concern that collection and export of reef corals is now prohibited or restricted in over 20 countries (Table 1).

USA coral imports in 1988 were a record 1456 tonnes (a small proportion possibly accounted for by coral sand), in contrast to an annual average of about 200 tonnes in the 1960s. The Philippines is the main supplier, despite legislation since 1977 banning collection and export of stony corals (apart from a seven-month period in 1986 when the ban was temporarily lifted). In 1988, the USA imported about 600 tonnes from the Philippines (Wells and Wood, 1989). Not only were these corals illegally exported, but their import into the USA was in contravention of the US Lacey Act,

domestic legislation which, for specified species (and these include corals), prohibits import of wildlife illegally collected or exported from its country of origin. Other significant coral importers are European countries and Japan.

Seventeen reef coral genera were listed in Appendix II of CITES in 1985 and, from the information provided in the annual reports of the Parties, it is possible to unravel some of the illegal Philippine trade. The Philippines, with its ban on coral exports, should not have been issuing CITES export permits. It is clear that much recent Philippine trade has been carried out under forged permits. The recent increase in the US trade is largely a result of increased exports from Indonesia. US imports from this country rose from a negligible amount in the early 1980s to nearly 480 tonnes in 1988. Indonesia has no legislation controlling reef coral exports, and we have no information on where the coral is coming from within this country. Other important suppliers include Malaysia, Taiwan and the Pacific (see below).

The listing of only 17 genera meant that enforcement of CITES regulations was virtually impossible - no customs officer can be expected to identify reef coral genera! It was clear that some rationalisation of the listing was required. The UK-based Marine Conservation Society, with financial assistance from TRAFFIC USA, prepared a proposal to list all reef coral on CITES, for presentation by Israel. The aim was to include all those affected by trade and any others which needed to be listed under the CITES 'look-alike principle', i.e taxa which might not themselves be threatened by trade but which are difficult to distinguish from those which are threatened.

There was some controversy over the proposal. A set of criteria (the Bern criteria) defining biological and trade status should be met by a taxon for its listing in the CITES Appendices. If these criteria were strictly applied, few if any marine invertebrates would qualify for inclusion on CITES. However, Giant Clams and black corals are listed, and many other marine and terrestial species are covered by CITES even though they do not strictly meet the criteria. The key points for corals are that international trade is large and increasing, and coral exploitation is known to contribute to the current widespread degradation of reefs.

The proposal received little enthusiasm from Australia and the USA, somewhat hypocritically as both countries have strict controls on coral collection. In the USA, coral collection on the Florida reefs is banned and yet the Keys are lined with shops piled high with coral imported from developing countries, including the Philippines which has an export ban. In the event however, the proposal was adopted with 59 parties in favour, 1 against, and some abstentions. The amendment comes into force 90 days from its acceptance i.e. on 18 January 1990.

Table 1. National legislation relevant to corals

[N.B. This table is probably not comprehensive.]

Australia: Coral collecting is regulated by both Commonwealth and State legislation, and on the Great Barrier Reef is restricted to licensed areas of the reef front. Additional permits are required from the Marine Park Authority if licensed areas fall within zoned sections of the park. Commercial collecting is permitted only within zones designated for general use. Export and import of coral is controlled under the Wildlife Protection (Regulation of Exports and Imports) Act 1982. Regulations to this Act, which came into effect in 1984, permit the export of coral specimens only in accordance with an approved management programme. As yet there are no approved management programmes and no permits have been issued for coral exports.

Bahamas: coral collection is prohibited under Fisheries Resources (Jurisdiction and Conservation) Regulations 1986.

Bermuda: stony corals are protected in territorial waters.

Cayman Islands: collection of corals is illegal.

Dominican Republic: the sale and collection of a number of stony coral genera is prohibited under a decree of 1986.

Egypt: taking of corals is prohibited along part of the Sinai coast.

Fiji: legislation drafted but not implemented; collection carried out according to guidelines produced by the Fisheries Division: use of SCUBA gear is prohibited; export permits are required; management requirements for particular areas to be determined by consultation between the collector and the Fisheries Division; traditional reef custodians to be involved to the maximum extent practicable in coral harvest. Guidelines for black coral exploitation limits harvesting and export to one operator; export permits issued only for worked products.

Guam: live coral may not be removed from depths of less than 10 fathoms and corals may be collected only with an appropriate permit.

Haiti: coral collection, sale and export banned under legislation that applies to all Haitian wildlife.

Hawaii: Under section 188.68 of the Hawaii Revised Statutes, taking live stony corals in the Order Madreporaria is prohibited except under permit. This year an attempt was made to ban the sale of coral but this was unsuccessful because of the 'economic impact' that such a ban would have; 80% of coral for sale in Hawaii is from the Philippines.

India: corals may not be collected in certain areas under local jurisdiction. The Exports (Control) Order 1988 bans export of all 'wildlife' except those specified. Corals are not included on the list of wildlife which may be exported, although sea shells are.

Indonesia: export of black corals prohibited.

Israel: all corals are protected and trade is prohibited.

Malaysia: In November 1986, Parties to CITES were notified that coral exports from Sabah are illegal.

Maldives: No formal legislation but collection of marine organisms around most resort islands is strongly discouraged by dive and tourist operators.

Netherlands Antilles: collection of corals is prohibited.

New Caledonia: coral collection was previously restricted to *Fungia* species and branches of *Acropora* weighing less than 300 gm. It is now authorised on a trial basis under Deliberation 509 of 16.12.82 and Arrete 85-321/CM of 19.6.85 on Tetembia reef only; 18 genera and the family Faviidae may be collected under permit.

Papua New Guinea: collection of corals (and other marine organisms) is prohibited within marine parks and protected areas under the Conservation Areas Act 1978, the Fauna (Protection and Control) Act 1966 and the National Parks Act 1982. Trade and exploitation are regulated under the Customs Regulation Act 1973 and the Fisheries Act 1977.

Philippines: Presidential Decree (P.D.) 1219 of 1977 banned all collection and export of ordinary or hermatypic corals except under special permit for scientific and educational purposes. In 1980, P.D. 1698 provided tighter controls by banning the transport and possession of ordinary corals. In 1986, under pressure from the coral traders who maintained that they needed to clear stocks of hard corals collected prior to the imposition of the ban, it was announced that exports would be permitted for one year, from May 1, 1986 to April 30, 1987. However, the ban was reimposed on 22 November 1986 after only seven months when it was discovered that freshly collected coral was being exported. The Secretariat notified all Parties in November 1988 of the re-imposition of the ban and urged them to help the Philippines implement this by rejecting any application for importation of corals from this country and to inform the CITES Secretariat of any attempt to circumvent the ban.

Puerto Rico: collection of corals has been prohibited since October 1979 except for scientific, educational and some commercial purposes. Although the laws are reportedly rarely enforced, since they came into force there has been a marked decrease in coral collecting. The penalty for extraction, possession, transport and sale of coral is not more than six months imprisonment and/or a fine of not more than $500.

Sudan: collecting of corals is prohibited.

South Africa: coral may be collected only under licence and only for scientific purposes.

USA: under Federal Law, collecting permits are issued only for educational and scientific purposes, and collection, damage or sale of stony (i.e. hard) corals (*Millepora* sp. and Scleractinia) is prohibited. In 1982 corals were included under the Lacey Act, which bans the import into the USA of illegally taken or exported wildlife products. Imports of Philippine raw, processed and finished stony corals are specifically prohibited, as of 10.2.89, under a notification published in the Federal Register 54 (27), 1989 (p.6455). In May 1989, collection of 'live rock' from Florida waters was prohibited; 2-3 tons were being exported daily through Miami for the aquarium trade.

Vanuatu: the coral trade is regulated by the Fisheries Act 1982 and subsequent Fisheries Regulations Order No.49 1983. No person shall take more than three pieces of living coral in any period of 24 hours except with the permission of the Director of Fisheries; no coral may be exported without written permission of the Minister of Fisheries.

Pacific Precautions

Information sent by Paul Holhus, of the South Pacific Regional Environment Programme (SPREP), on the rapid rise in coral harvesting proposals and activities in the South Pacific region forms the basis of the following account. It is supplemented by additional material gathered in the course of preparing the coral proposal for CITES.

Coral harvesting operations have been underway in New Caledonia and Fiji for some time. In New Caledonia, mainly faviids are collected which are shaped on a lathe as art objects or lamp bases. These are sold in Noumea and, at least until 1987, exported to the USA (32 tonnes in 1987). Harvesting is limited to a section of the back area of Tetembia reef which lies to the north of Noumea, and is operated under a permit system and monitored by Pascale Jouannot of the Aquarium at Noumea. Exploitation of massive species is likely to have a more long-term impact than of the faster growing branching species; she has calculated that harvest is ten times the sustainable rate (Jouannot and Bour, 1988). A French company is currently investigating setting up an operation in New Caledonia to harvest coral for bone graft use.

In Fiji, harvesting is operated under a licence system and is monitored closely by the Fisheries Division (Viala, 1988), in many ways providing a model for management that could be adopted elsewhere. There is only one licensed exporter and exports, mainly of branching species, go entirely to the USA; 133 tonnes were exported in 1988, and it is thought that 1989 exports may reach 200 tonnes. Exports are expected to stabilize at around 100,000 pieces a year and, if this figure is exceeded by much, legislation will be considered. Legislation was drafted in 1986 but it has not been felt necessary to implement it as the guidelines (see Table 1 above) seem to be keeping the situation under control. Collectors have been advised to move operations to fringing reefs and inner lagoons, away from inshore reefs which are likely to be slower to regenerate because of turbidity and freshwater runoff. Dr Tim Adams of the Fisheries Division writes that the reefs lie within customary fishing rights areas and the local custodians provide an additional control system. In 1987 collecting was reduced because of disputes between collectors from different villages in the same customary fishing rights area! Collecting is spread widely and baseline surveys are carried out by the Fisheries Division before any new areas are harvested. Follow up surveys have shown that less than 5% of available coral cover is harvested.

The main concern is the number of other countries that have shown an interest in exporting. Commercial harvesting started recently in Western Samoa but exports have now been stopped. Export of a con-

tainer-load a month has started from Pohnpei (Federal States of Micronesia). Kiribati has been approached to export *Heliopora*. Tonga was harvesting *Goniopora* and *Porites* in 1988 for export for medicinal purposes (bone grafts) until this was stopped pending a resource survey and management planning.

The South Pacific Commission, CCOP/SOPAC (Committee for Co-ordination of Offshore Prospecting), the SPREP and others are being approached to give advice. At the 4th South Pacific Conference on Nature Conservation and Protected Areas, held in Vanuatu in September this year, a resolution was passed recommending that: "SPREP liaise with organisations such as WCMC (World Conservation Monitoring Centre), CITES and the TRAFFIC Network, and prepare a report to countries in the SPREP region on the current status of commercial hard coral harvesting including: biological considerations, economic and legal aspects, and the capacity of different coral species to be sustainably harvested."

SPREP is planning to move quickly to prepare a set of 'Environmental Guidelines for Coral Harvesting Operations' for governments in collaboration with other organisations concerned with regulation of the coral trade. Paul Holthus would appreciate suggestions on content, information on coral harvesting experiences, legislation and regulation elsewhere. It would be very helpful if you could also copy anything you send to Paul to Sue Wells for the TRAFFIC Network.

Dr Paul Holthus, South Pacific Regional Environment Programme, South Pacific Commission. B.P. D5, Noumea Cedex, New Caledonia.

Information also available from: *Frank Antram, TRAFFIC Oceania, Suite E, 8/18 Whistler St, P.O. Box 799, Manly, N.S.W. 2095, Australia, Sue Wells, 56 Oxford Road, Cambridge CB4 3PW, UK; Liz Wood, Hollybush, Chequers Lane, Eversley, Basingstoke, Hants RG27 ONY, UK.*

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Drawing by Bob Foster-Smith

WHO'S WHO?

Cancer on the Reef -- the Registry of Tumors in Lower Animals

The diverse group of diseases known as neoplasia or cancer are commonly studied in humans and other mammals. These diseases have also been recognized in many aquatic organisms from various phyla. The Registry of Tumors in Lower Animals (RTLA) was established in 1966 as a cooperative project between the National Cancer Institute and the Smithsonian Institution to study tumors in invertebrate and poikilothermic vertebrate animals. Its primary mission is the collection, identification and preservation of specimens with neoplasms or related disorders from natural habitats, zoos, aquaria and laboratory experiments from around the world. Many cases represent published independent studies and were contributed by the investigators to be available for comparative study. The materials submitted with each case have been archived for easy retrieval and are available to qualified investigators for study.

Secondly, the Registry collaborates on experimental studies and surveys performed by colleagues to help clarify the nature, incidence and etiology of these diseases. Finally, the Registry analyzes, correlates and disseminates information and has assembled a fairly complete library of reprints relating to neoplasms in these organisms. The RTLA is preparing an atlas of the cases of invertebrate neoplasia and related disorders present in the Registry collections. This project will complement the atlas of neoplastic diseases of fishes being prepared by a team of collaborators from cases in the Registry and from other sources.

About one-half of the 5000 accessions currently in the Registry have neoplasms, and the remaining cases represent a variety of infectious diseases caused by micro-organisms, parasitic infections, injury and wound repair, nutritional disorders and developmental anomalies, as well as 'control' or normal specimens for comparison with diseased animals. Interestingly, most of the aquatic organisms (fish, bivalve molluscs, decapod crustaceans) come from temperate habitats, probably because most scientists studying the pathology of such animals are located in these regions. However, neoplasms have been reported in organisms from tropical environments. These include the calicoblastic epitheliomas in acroporid corals (Cheney, 1977; Bak, 1983; Peters *et al.* 1986) and neurofibromatosis in damselfish (e.g. Schmale *et al.* 1986; Schmale and Hensley, 1988). Cellular proliferative

disorders may be caused by exposure to radiation, certain chemicals and heavy metals, parasites, viral infections or oncogenes. With the continued degradation of environmental quality in tropical marine habitats, particularly chemical pollution, more aquatic organisms may be at risk for developing neoplasms like those in temperate polluted waters (Couch and Harshbarger, 1985; Mix, 1986; Overstreet, 1988).

The RTLA is interested in learning more about neoplasms in organisms from tropical environments, particularly coral reefs. The Registry can assist scientists who are studying such diseases in the histopathology and interpretation of possible neoplastic lesions. Materials submitted to the Registry may be either whole or dissected parts of specimens, paraffin- or plastic-embedded tissues or micro-slides (both stained and/or unstained).

Materials will be further processed if necessary to produce microslides, a set of which will be returned to the contributor when possible along with an evaluation. Each case will be accessioned into the Registry collections and be available for study by other investigators.

If you have any questions, suggestions or specimens please contact: *Dr John C. Harshbarger (Director) or Dr Esther C. Peters (Research Fellow), Registry of Tumors in Lower Animals, National Museum of Natural History, Smithsonian Institution, Washington D.C. 20560. Tel. (202) 357-2647.*

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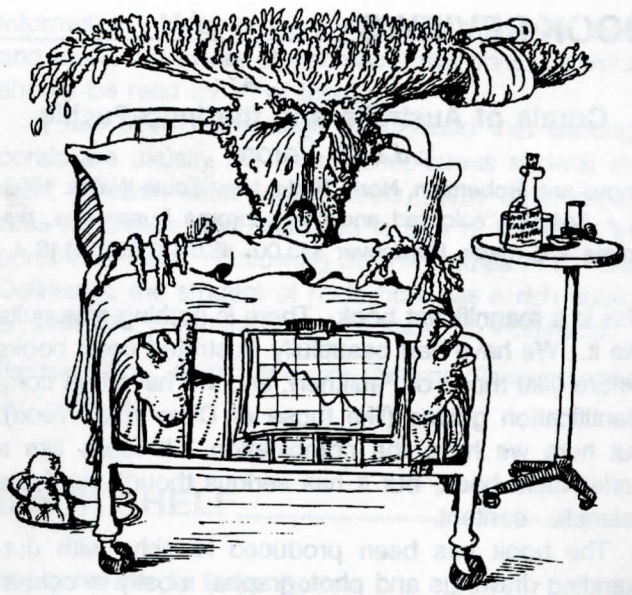

Drawing by Bob Foster-Smith

More sick corals -- bleaching survey

Many areas experienced new bouts of bleaching in the winter or late summer of 1988. In spring 1989, intense bleaching occured in the Gulf of California in the eastern Pacific, and widespread but less intense bleaching occurred around Mona Island, Puerto Rico, and the U.S. Virgin Islands, in the Caribbean.

We have now received 250 reports of bleaching from around the world, but information is still needed for many Pacific, and even some Caribbean, areas. There are some interesting records of occurrences in previous years, but we need more data to confirm possible patterns. We also need information on the rate of recovery and on the number of mortalities or amount of necrosis. We have some reports of formerly common reef species that have apparently disappeared from affected areas. Others have noticed increases in Black Band disease (BBD) and White Band disease following bleaching events; we are seeing what may be increased amounts of BBD around Puerto Rico and Mona Island. Similar records would be useful in attempts to understand the problems.

We have also received reports of separate mass mortalities and/or major marine ecological disturbances which may be related to or at least coincidental with coral reef bleaching, many having a similar complexity and lack of ready explanation. We would appreciate learning of other such mortalities that have occurred in the last few years.

Ernest H. Williams Jr., Project Leader, Caribbean Aquatic Animal Health Project, Dept of Marine Science, P.O. Box 908, Lajas, Puerto Rico 00667-0908, USA. Tel: (809) 899-2048/1078 ext. 211 (there is a 24 hour 'emergency message service'; a little Spanish may be necessary). Temporary Fax no: 809-265-2880. Telex: UPR MAY 3452024.

BOOK REVIEWS

Corals of Australia and the Indo-Pacific

J.E.N. Veron

Angus and Robertson, North Ryde, New South Wales. 1986. xi + 644 pp., coloured and monochrome illustrations, diagrams and maps. Hardcover $45.00. ISBN 0 20715116 4.

This is a magnificent book. There is nothing else quite like it. We have had beautifully illustrated coral books before (like those of Faulkner), and we have had coral identification guides (like those of Ditlev and Wood), but here we have the combination. It looks like a coffee-table book, but it has serious though readable scientific content.

The book has been produced lavishly, with outstanding drawings and photographs, mostly in colour. Almost every page bears one or more illustrations. Even the contents list is a double spread with seven coloured and two black-and-white photographs. Whether or not you would ever want to identify a coral, you would find that owning this book will genuinely give you and your friends and colleagues a great deal of interest and pleasure. (It's my favourite for putting in front of a visitor when I have to rush out of my office, or while I'm stuck on the phone!). It's not even expensive, because as Veron says in his acknowledgements, he and the contributing photographers forewent all their royalties. This generous gesture, which I think will be most especially appreciated by marine biologists, laboratories and libraries in all those less wealthy countries within whose territorial limits lie most of the world's coral reefs. For Veron's book is not intended to be merely ornamental. It is a working book that brings together in accessible form all the systematic and biological work that he and his co-workers have carried out over more than 15 years in numerous reef regions of the Indo-Pacific -- especially the Great Barrier Reef. (Most Indo-Pacific reef workers will already be familiar with Veron and his co-workers' 'green monographs' -- the foundation for this book.)

The outer parts of the book consist of several well-written and interesting chapters on subjects like coral ecology, biology and biogeography, coral reefs and geological history. These take up about an eighth of the total number of pages. Between these outer parts is the heart of the matter, consisting of four systematic sections. By far the largest of these deals with (over 500) Australian reef-building species. As most Indo-Pacific reef workers know, many of these occur well beyond Australia, so Veron's book amounts to a definitive state-of-the-art identification guide to many (most?) Indo-Pacific corals from a leading expert.

Ultimately however, whatever the author's credentials, or the lavishness of production, or price of the book, we have to judge it on its intentions. These are not clearly stated in the book itself, but the first thing mentioned in the dust jacket blurb is the 'fascination of the coral world'. Well, there is no doubting that Veron's book conveys this with regard to variety of coral forms. The second thing the blurb mentions is 'a ready means of identifying most species', and certainly, this would be the main reason why most coral reef workers would be interested in the book (presumably, they need no further persuasion about the fascination of reefs). Here, it is harder for me to judge because I already have pretensions to being able to identify corals, though it may be significant that I find myself using this book *in conjunction with* (rather than instead of) the AIMS monographs. This is for the simple reason that the monographs illustrate more of the skeletal details that are used to distinguish species. On the other hand, Veron's book is more suitable in style for the non-specialist, and gives a much better idea of the 'whole colony' appearance of different species underwater. The logical conclusion will be to produce a handy waterproof edition.

But one should also ask, how do non-specialists find the book as an identification guide? From my own small sample of 'beginners' working only with dry specimens, it seems that they find things far from straightforward. It is difficult to pinpoint reasons for this, as Veron usually provides keys to the taxa, and has explained relevant morphological terms in an introductory section, as well as giving further relevant information in the taxonomic parts themselves. Perhaps it is again a question of needing to work in conjunction with the monographs, or more simply, of needing patience in becoming familiar with all the morphological possibilities, especially in getting a feel for ranges of variation (which Veron does mention in places). So the message to coral novices is don't be dazzled into expecting quick results.

Of course there are also some niggles, though these are perhaps the prerogative of a fellow specialist. I was intrigued for example that Veron presents the coral genera in an unfamiliar order according to his apparently new revised scheme of family relationships (p. 61). He says that his scheme is based 'especially on details of the structure of the individual septo-costae'. If so, jolly good, as this is consistent with most modern scleractinian coral workers' approach. Having said that, however, why are the Fungiidae left in their traditional unrevised position as sister to a larger agaraciid- related group? Gabriel Gill (1980) has shown that fungiids have a septal structure like various faviids and the extinct montlivaltiids (see Gill and Lafuste, 1971). This point is not mere pedantry, because as Gill reasonably wrote on my reprint copy of his fungiid paper; "this (paper) is a lithophagus (sic) boring into the solid foundations of scleractinian systematics". His work is part of a much larger effort on the part of fossil coral workers in

France and Poland in particular to present new information on coral microstructure which now has fundamental implications for the whole classification of Scleractinia. All the more intriguing therefore that Veron says on p.3: "More importantly, the fossil record also gives us an understanding of the phylogeny of genera and families ..... that cannot be gained from the living organisms". Actually, extinct lineages, though included by Veron in his scheme, are left unlabelled, and we are given no supporting details for his scheme, nor reference to where we can find them.

Which brings me to a much more general point: it is a pity that the book provides no list of further reading especially for the more general sections on corals and reefs. Perhaps the literature has now become so vast that any bibliography would have been too much of an all-or-nothing task, but it would undoubtedly be widely appreciated if the problem of selection was tackled well. Never mind, don't let this stop you from buying the book, but don't drop it over the reef edge.

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Gill, G.A., 1980. The fulturae ("compound synapticulae"), their structure and reconsideration of their systematic value. *Acta Palaeontologica Polonica* **25**: 301-310.

Gill, G.A. and Lafuste, J.G., 1971. Madreporaires simples du Dogger d'Afghanistan: etude sur les structures de type "*Montlivaltia*". *Memoires de la Societe Geologique de France* (Nouvelle Serie): **50 (115)**: 1-40.

Brian Rosen, Dept Palaeontology, British Museum (Natural History), London.

Special issue: *Halimeda*.
Coral Reefs 6 (3/4): 121-279. 1988.
Edited by H.H. Roberts and I.G. Macintyre.

Halimeda is a familiar calcifying warm-water marine alga: a plant very characteristic of coral reef areas. In recent years, its astonishing abilities as a sediment-former (and ultimately, as a rock-former) have become apparent, and are the subject of numerous studies, from different disciplines and different points of view. Alot of praise is currently given to inter-disciplinary studies: this special issue of *Coral Reefs* is a welcome amd worthwhile effort in this direction.

It contains 16 papers, all studies of *Halimeda* from different angles: palaeontological, biological, sedimentological and ecological. It begins with E. Flugels' review of its geological history, a carefully balanced and impartial review of the fossil evidence, which explains the special difficulties involved in study of these remains. This is followed by a varied selection of papers, mostly on living *Halimeda* species and the sediments they build in different environments, but including aspects of reproduction and other biological information. Most workers who deal with reefs, living and fossil, are aware of *Halimeda*: this special number should be read by all of them.

It has been increasingly recognised that although corals are usually the most conspicuous skeletal element of warm-water marine reefs, many other organisms contribute and *Halimeda* is one of the most important of these. Following on the studies of L. Hillis-Colinvaux, the student of reefs now has a rich source of available comparative information on *Halimeda*.

Graham Elliott, British Museum (Natural History), London SW7 5BD, U.K.

BOOK SHELF

Many thanks to Brian Rosen for the mini-reviews.

MAP OF MODERN REEFS AND SEDIMENTS OF ANTIGUA, WEST INDIES

M.P. Weiss and H.G. Multer

Dept of Geology, Northern Illinois University, DeKalb, Illinois. 1988.

Full colour map, 27.5 x 40.5 ins, scale 1:40,000. Descriptions and colour illustrations of bottom sediments and communities on back side with record of changes over time; about 40 changes of the bottom sediments are recognisable between 1954 and 1981, the years of the earliest and latest aerial photos available during construction of the map. Available from M.P. Weiss, Dept Geology, Northern Illinois University, DeKalb, Illinois 60115, USA. US$11.

POETRY IN PICTURES. THE GREAT BARRIER REEF

Mark O'Connor and Neville Colman

Hale and Iremonger Pty Ltd, G.P.O Box 2552, Sydney, NSW, Australia. 80 pp. Hard cover: ISBN 0 86806 207 9. (UK price £5.95; available c/o J.M. Dent distributors).

An attractive little book mostly arranged with Mark O'Connor's poems on left hand pages and Neville Colman's photos on right hand pages. Some of the poems were reproduced in *Reef Encounter* 3; we may include some more in the future. He seems to be the only person to make reefs the subject of professional poetry writing. Recommended reading for jaded reef scientists.

THE CORAL SEAS OF MUSCAT

Frances Green and Richard Keech

Middle East Digest Ltd. (21 John St, London WC1N 2BP, UK). 106 pp., appendices, glossary, bibliography, index. Hard cover: ISBN 0-946510-28-8.

A compact, useful and professional little book to add to a growing list of local-on-the-reef guides. The main section is a field identification guide to the corals which is well illustrated. The corals of this region are not well known from previous records. More unusual in books of this kind are first aid tips, and an interesting chapter on the geological history of the region - reflecting the authors' occupations as professional geologists. With a Foreword by David Bellamy, an Introduction by Charles Sheppard and an epigraph from the Quran, what more could you ask of 106 pages?

Reef encounters

PASSENGERS disembarking at the airport at Manado, capital of one of Indonesia's remotest provinces, are greeted with a notice: "Welcome to North Sulawesi, the Land of the Smiling People".

But a smiling population is not the main reason for the gradual increase in foreign visitors to this highly scenic area — a ready smile and a wish to be friendly are general Indonesian characteristics.

The real lure appears on a large hoarding in the airport car park: a colourful impression of the coral reefs of Manado Bay. Ten years ago these were unknown, but since then divers from many countries have spread the word about their unspoiled splendour.

Alfred Russell Wallace, the Victorian naturalist and collaborator with Darwin, during his visit to Manado in the 1850s, called it "one of the prettiest towns in the East".

Another Victorian who knew that part of the world occasionally mentioned Manado in his work, but Joseph Conrad's characters were usually bound for more familiar East Indies ports. Even today it is still five days' sailing by scheduled passenger ship and three and a half hours' flying time by jet from Jakarta to Manado.

One of the best places to appreciate Wallace's compliment about Manado is from a *pelang*, a long, double-outrigger canoe, sailing from one of the diving centres just outside the city to the islands in the bay for a day's swimming and diving.

Manado and its bay are set against a background of mountains and active volcanoes, with a narrow plain packed with coconut plantations in between. Church towers and spires dominate the suburban hills, mosques present a lower profile, given away by a cupola glinting in the sunlight.

The city has breathing space and absorbs the population of over 200,000 without effort. The hills, churches, broad avenues and villas give it a southern Mediterranean feel. It is prosperous by national standards thanks to cloves, copra and nutmegs. "Even the side streets have sidewalks," as one visiting American observed.

The Chinese temples in the city centre and the upward-sweeping curves and roofs of some of the public buildings are the only real architectural reminders that you are in the Orient.

As the *pelang* nears Bunaken Island, where the best reefs lie, the sea changes colour dramatically. Blue turns to a luminous mixture of jade and turquoise above a reef that spreads out for several hundred metres from the palm-shaded beaches.

The drop-off is over the place where the reef plunges vertically and it is an awesome sight to gaze down from the *pelang* at the submerged cliff face, eerily distorted by the refraction of sunlight on the water: downward visibility can reach 30 metres.

Once you are in the sea, everything comes into focus. The water temperature (year-round average, 27°C) makes wet suits unnecessary even when nearly 50 metres down.

But the marine life is at its richest and most dazzling in the shallows. The reef has both an elegance and grotesqueness of its own; to describe the fish and the coral would exhaust every adjective in the lexicon of colour.

As if you were not spoiled enough already, there is still the lunch-break to look forward to on the white beaches, under the palms or in bamboo pavilions, where appetising local dishes are brought on the *pelangs* from the diving centre.

Afterwards, resting in the shade and looking out towards the other islands and the mainland, you find it difficult to quarrel with Wallace's description of Manado made well over a century ago.

David Weatherup

● The main diving centre is Nusantara Diving Centre, PO Box 15, Manado, North Sulawesi, Indonesia; recently opened is the Murex Diving Centre, Malayang, Manado. Both charge about £40 a day for beach-cottage accommodation, full-board, and two dives with equipment provided. Many visiting divers bring their own regulators and buoyancy compensation devices. Tuition is available, hire equipment adequate. PADI decompression tables are used and safe practices observed; some staff speak reasonable English. Mid-April to late October is best for a visit.

● Specialist Indonesian Express (non-ABTA, 01-491 4469) can package Manado with Bali: five nights' full-board at Nusantara, with all hire costs, plus six nights in Bali (room only), overnights in Jakarta, all flights and transfers, £1,270 per person, two sharing.

From the *Weekend Telegraph*, August 13 1988

.....but they need to be more careful encounters:

The following comments about the area mentioned in the above article are taken from the IUCN/UNEP publication *Coral Reefs of the World*, Vol. 2:

"KEPULAUAN BUNAKEN PROPOSED MARINE RECREATION PARK

"...The reefs are heavily fished and there is a noticeable lack of the most important food fish..... The anchors of diving boats and divers standing on corals are also damaging shallow reef areas."

"... The conservation value of the reefs is diminished by the extent of damage to shallow water corals (1-4 m depth), but the habitats and species are considered to be highly important at a provincial level. The area was declared as a marine park by Decree of the Provincial Governor in 1980, but has not yet been established; it is also proposed by PHPA as a Marine Recreational Park at the national level....."

"... There is a need for marine environmental education, as many of the fishermen apparently do not appreciate the economic value of the reefs in terms of tourism....."

ANNOUNCEMENTS

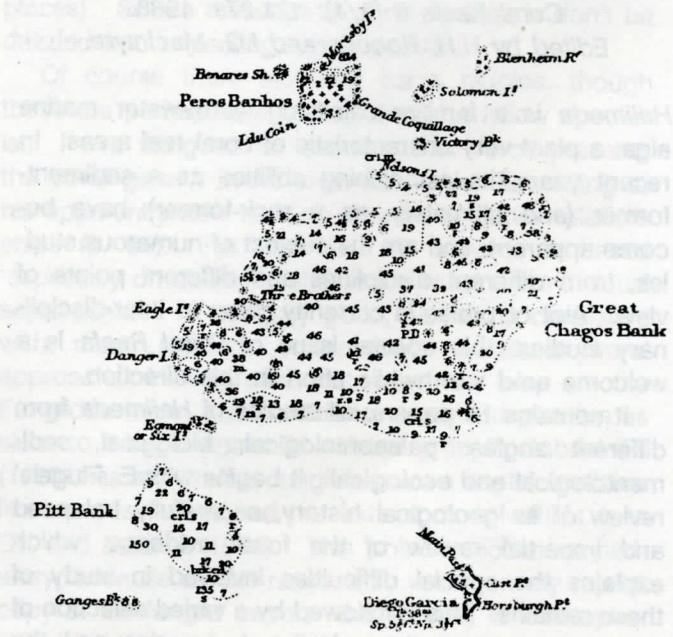
CHAGOS ARCHIPELAGO: REEF RESEARCH PROGRAMME

Could you face spending a month or so in the middle of the Indian Ocean working on some of the least disturbed and little known coral reefs in the world? The Marine Conservation Society (UK) is developing a survey and research programme in the Chagos Archipelago and would like to hear from you if you a) have a useful project in mind, b) feel intrepid and c) can raise the necessary funds.

The emphasis will be on projects that contribute towards the conservation and management of the Chagos reefs, but there is ample scope for all disciplines. Ecological studies of selected reefs were carried out in 1978/79 but a lot of work remains to be done. The area is under the jurisdiction of the British Government and is uninhabited save for a military base on Diego Garcia in the extreme south. At the centre of the Archipelago is the Great Chagos Bank, believed to be the largest atoll in the Indian Ocean.

The visit is planned for December 1990/March 1991 and is seen as the first in a series. The aim is to establish a co-ordinated programme of research incorporating both short and long-term projects. Two boats equipped with diving gear will be available, and a base will be set up on Peros Banhos. Costs will be kept to a minimum (this is not a profit-making venture) and logistics taken care of, but we will be relying on participants to secure their own funds - probably about £1,000 for a month's stay.

Contact, as soon as possible: *Dr Elizabeth Wood, MCS Coral Reef Conservation Team, Hollybush, Chequers Lane, Eversley, Basingstoke, Hants RG27 ONY, UK.*



The Chagos Archipelago, from J. Stanley Gardiner (1936)
The Reefs of the Indian Ocean

THE SEVEN UNDERWATER WONDERS OF THE WORLD

CEDAM International (an diving organisation dedicated to Conservation, Education, Diving, Archaeology and Museums with a marine biology/archaeology expedition programme) gathered together a number of marine scientists, conservationists and explorers in Washington D.C. in August this year to select the Seven Underwater Wonders of the World, in an effort to generate an increased global awareness of the world's fragile marine environment. The judges included Bob Johannes of CSIRO, Australia, Eugenie Clark (University of Maryland) and many others. The final selection was as follows:

Belau
Lake Baikal (USSR)
Ras Muhammad and the northern Red Sea
Belize Barrier Reef
Northern Great Barrier Reef
Galapagos
Deep Ocean Vents

Nominated sites not selected were the Kenya coast, Wakulla Springs (Florida), Nacimiento Mante (Mexico), Bismark Sea, Anegeda (British Virgin Islands), Roatan (Honduras), Aldabra (Seychelles), Sea Mount (San Salvador), Enewetak Atoll, Apo Island (Philippines), Truk Lagoon, California coast, Florida Keys, and the Andros Wall (Bahamas).

There are plans for a photo-exhibit, documentary and book on the seven sites. CEDAM International is also organizing expeditions to the Seven Underwater Wonders, which are open to all CEDAM members. Membership is $20 (plus a one time $20 initiation fee). Further information from: *CEDAM International, Fox Road, Croton-on-Hudson, NY 10520, USA.*

DIARY

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

Conferences

11-16 March, 1990, Elat, Israel
JOINT U.S. - ISRAEL WORKSHOP ON MARINE SYMBIOSES: MOLECULAR BIOLOGY TO ECOSYSTEM FUNCTION

Current work has demonstrated that in many cases symbiotic associations form the very physical and energetic foundation for the whole ecosystem of which they are a part, as in coral reefs and hydrothermal vent systems. The workshop aims to provide all specialists working in this field with an opportunity to share recent developments, discuss emerging concepts, and define future research fronts. Further information from: *Joint U.S. Israel Workshop - Marine Symbioses, c/o INTERNATIONAL Ltd, P.O.B. 29313, Tel Aviv 65121, Israel.*

23-29 May, 1990, Honolulu, Hawaii
CONGRESS ON MARINE TOURISM

Sponsored by the Sea Grant College Program, East-West Center and Pacific Basin Development Council, this includes sessions on policies for integrating tourism development and environmental protection and managing resources for economic development. Further information from: *Marine Tourism Congress, Sea Grant Extension Service, University of Hawaii at Manoa, Honolulu, Hawaii 96822, USA. Tel. (808) 948-8191; fax (808) 955-6950.*

16-20 July, 1990, Tokyo, Japan
PACON 90; PACIFIC CONGRESS ON MARINE SCIENCE AND TECHNOLOGY

This focuses mainly on marine technology: underwater remote sensing, submersibles, marine mining, marine recreation etc. Further information from: *PACON, c/o dept of Civil Engineering, University of Hawaii, 2540 Dole St, Holmes 383, Honolulu, Hawaii 96822, USA.*

18-21 June 1990, Havana, Cuba
II CONGRESS ON MARINE SCIENCES

This will cover a variety of topics and will be preceded byt an International Workshop on Lobster Ecology and Fisheries (12-16 June). Further information from: *Organizing Committee, 2nd Congress on Marine Sciences, Institute of Oceanology, Academy of Sciences of Cuba, 1ra No. 18406 e/184 y 186 Playa, Ciudad de La Habana, Cuba.*

23RD MEETING OF MARINE LABORATORIES OF THE CARIBBEAN

This will take place at the same time as the II Congress on Marine Sciences and will include a special session and panel discussion on coral reef bleaching. Further information from: *Dr. E.H. Williams, Dept of Marine Sciences, University of Puerto Rico, Mayaguez, Puerto Rico 00709-5000. Tel. (809) 899-2048/1078 ext.211).*

23-30 August 1990, Yokohama, Japan
V INTERNATIONAL CONGRESS OF ECOLOGY, 'INTECOL 1990'

The congress has the theme of 'Development of ecological Perspectives for the 21st century'; within the session on 'Resource use and man-made ecosystems', there are nine invited papers on coral reefs. Further information from: *Dr Makoto Kato, Biological Laboratory, Yoshida College, Kyoto University, Kyoto 606, Japan.*

3-6 October 1990, Kanagawa, Japan
INTERNATIONAL SYMPOSIUM ON THE COASTAL ZONE

Sponsored by the SURF '90 Association, and in collaboration with the American Shore and Beach Preservation Association and the Coastal Zone Foundation, this meeting will cover a wide variety of issues concerned with coastal zone management. It is being held concurrently with an 'international competition of proposals for better management of the coastal zone. Further information from: *SURF'90 Association, Isomi Samariya Bldg. 8th Floor, 1-12-17, Katase-Kaigan, Fujisawa, Kanagawa, 251 Japan.*

4-7 October 1990, St Petersburg, Florida
DIVING FOR SCIENCE, 1990

The 10th Annual Scientific Diving Symposium of the American Academy of Underwater Sciences will cover a wide range of topics with a focus on diving in temperate and tropical waters. There will be an opportunity to participate in workshops on diving technology, scientific methods and recreational adventures in the Florida Keys, Gulf of Mexico and Cayman Islands. Further information from: *Walter Jaap, Florida Marine Research Institute, 100 Eighth Avenue S.E., St Petersburg, Florida 33701-5095, USA.*

27 May - 2 June 1991, Honolulu, Hawaii
XVII PACIFIC SCIENCE CONGRESS

Entitled 'Towards the Pacific Century: the challenge of change', the 1991 congress of the Pacific Science Association will include symposia on 1) Global environmental change - Pacific aspects, 2) Population, Society and Health, 3) Science and Culture, 4) Biological diversity and 5) Emerging Technologies and development. There will be a meeting of the coral reef committee. Further information from: *XV11 Pacific Science Congress Secretariat, 2424 Maile Way, Fourth Floor, Honolulu, Hawaii 96822, USA.*

Diary cont.

9-14 September, 1991, Munster, FRG
FOSSIL VI CNIDARIA - 6TH INTERNATIONAL SYMPOSIUM ON FOSSIL CNIDARIA INCLUDING ARCHAEOCYATHA AND PORIFERA

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

4-8 November 1991, Honolulu, Hawaii
THIRD GLOBAL CONGRESS

Sponsored by Heritage Interpretation International, Eastern Michigan University and several University of Hawaii units, this is tentatively entitled 'Interpretation, Preservation and the Travel Industry'. Further information from: *Ray Tabata, Congress Co-chairman, Sea Grant Extension Service, 1000 Pope Road, Room 205, Honolulu, Hawaii 96822.*

Courses

1990, Hawaii Institute of Marine Biology, Coconut Island
1990 EDWIN W. PAULEY ADVANCED RESEARCH TRAINING PROGRAM

Each year at HIMB, a summer course in a specialised area of marine research is made possible through the generous support of the Edwin W. Pauley Foundation. Graduate students will be given preference. The course provides opportunities for students to conduct research with guidance from experts in the field. Information about future courses from: *Dr Paul Jokiel, Hawaii Institute of Marine Biology, PO Box 1346, Kaneohe, HI 96744, USA.*

July 1990, Discovery Bay Marine Laboratory, Jamaica
CORAL REEF ECOLOGY AND MANAGEMENT

A course on pure and applied reef ecology, suitable for advanced undergraduates, graduate students and persons involved in coral reef management who are certified SCUBA divers. For information contact: *Head, Discovery Bay Marine Laboratory, P.O. Box 35, Discovery Bay, St Ann, Jamaica, West Indies. Tel. (809) 973-2241.,*

15-27 January, 1990, Bermuda Biological Station for Research Inc.
DESIGN AND STATISTICAL METHODS FOR ENVIRONMENTAL STUDIES

This will cover the principles of study design and provide microcomputer-based experience in various aspects of modeling, data analysis and hypothesis-testing applicable to all kinds of environmetal studies. The course will be taught at advanced undergraduate and beginning graduate level. Further information from: *Dr Susan B. Cook, Education Director, Bermuda Biological Station for Research, Inc., Ferry Reach GE 01, Bermuda. Tel. 809-297-1880. Fax. 809-297-8143. Telex. BA 3246.*

NOTES FOR CONTRIBUTORS

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

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

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

DEADLINE FOR COPY FOR REEF ENCOUNTER 7 (due out July 1990) IS MAY 1st 1990.

Barbara Brown
Centre for Tropical Coastal Management Studies
Department of Biology
The University
Newcastle upon Tyne
NE1 7RU, UK

Fax: (091) 261 1182
Telex: 53654 (UNINEW G)
Phone: (091) 232 8511

Sue Wells
56 Oxford Road
Cambridge
CB4 3PW, UK

Fax: (0223) 277136
Telex: 817036 SCMU G
Phone: (0223) 350409

APPLICATION FORM FOR MEMBERSHIP

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Title:.....

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

.....US$50 or £35 for FULL membership
.....US$ 8 or £ 6 for STUDENT membership
.....US$58 or £41 for SPOUSE membership

Cheques to be made payable to:

INTERNATIONAL SOCIETY FOR REEF STUDIES

Send completed application form and your cheque to:

Dr David H. Montgomery, Biological Sciences Dept, California Polytechnic State University, San Luis Obispo, California 93407, USA.